Science and Technology

Grade 7

Government of Nepal

Ministry of Education, Science and Technology

Curriculum Development Centre

Contents

1 Scientific Learning

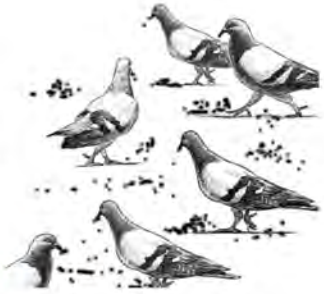


fig 1.1

You might be curious to know when you see the birds taking their foods in your surrounding:

What do birds eat? How does the way of taking food differ in the birds and human?

Is it easier to pick up the scattered food for birds with the beak?

Observe the event:

We use alarm if we have to get up on a fixed time early in the morning. We wake up by the sound of alarm clock. It is a regular event of our daily life. When we think deeply about it, a number of questions related to the event arise in our mind. For example:

fig 1.2

a. How is sound produced by alarm clock?

b. How does the sound reach to our ears?

c. How can we hear the sound?

Scientific learning begins with the curiosity that develops after observing an object or event. Questions such as what, why, and how raise in our mind after observing the events and the objects around us.The systematic study to find the answer of such questions is a scientific learning process.

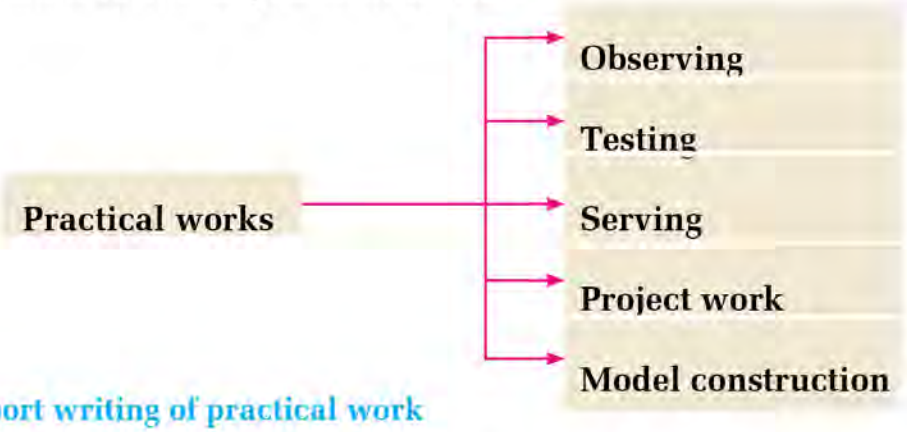
The scientific learning process involves deep thinking, searching the reason and finding the solution to the questions raised after the observation of the events. The steps involved in scientific learning process are as follows:

1. To study the objects or events around us.
2. To ask questions related to the objects or events.
3. To guess the probable answers of the questions.
4. To test by using suitable method.
5. To record the data obtained by the test.
6. To conclude by the analysis of data.
7. To prepare the report of the task.

The steps mentioned above are followed systematically in scientific learning process.

Practical work of science

Practical works have important roles in scientific learning process. The work done inside or outside a laboratory related with a definite subject matter is practical work. We can test any principle or fact by doing practical work. Following are the different forms of practical works:



Report writing of practical work

The detailed description of objective, materials required, method / procedure, result, conclusion etc. after doing a practical work is called report.

Why do we write report?

1. To submit the details of the practical work.
2. To share the finding of the scientific study and research clearly.
3. To compare the result of the experiment with the objective.
4. To record the conclusion and challenges of the experiment.

The format of writing report of practical work may be different. The major components of a report of practical work are given below:

1. **Title:** There should be a title at first while writing a report. The title indicates the type of practical work.
2. **Objective:** A practical work always has a definite objective. Objective should be write clearly in a report.
3. **Required materials:** Different types of materials are required for an experiment. A list of such materials should be included in the report. By seeing the list, other people can also perform the practical work by using the materials.
4. **Figure:** A neat and clear figure of the practical work should be sketched. The different parts of the figure should be labeled properly.
5. **Procedure:** The activities performed in the practical work should be written in a sequence. It is called the method or procedure of the practical work. Method or procedure is written in past perfect tense.
6. **Observation:** Observation is made to examine whether the result of the experiment are aligned with the objective or not. The data obtained by the observation are noted or filled in a table and often presented in a graph.
7. **Analysis:** The facts or data obtained from the practical work are analysed. The result of the practical work can be known from the analysis. The data obtained from the observation may need to be calculated.That's why analysis is mentioned in report of the practical work.
8. **Result:** The result of a practical work is written on the basis of the analysis. The result shows whether the objective of the practical work is fulfilled or not. For this reason, result is also written in the report.
9. **Conclusion:** On the basis of the result of the experiment, we obtain conclusion of the practical work. Conclusion is also a part of the report.

10. **Precaution:** The safety measures to be followed during the conduction of practical work is mentioned as precaution. It prevents from the probable accidents and helps to do the practical work in suitable way as well.

Sample report 1

fig 1.3

Title : Observation of volume of air

Objective: To test whether air has a definite volume or not.

Required materials : Empty mineral water bottle

Procedure:

1. The lid of a mineral water bottle was closed properly to make it airtight.
2. The bottle was squeezed from the bottom towards its mouth.
3. The lid was opened, when it was not possible to squeeze it any more.

Observation:

When the lid was opened after squeezing the bottle, air passed out forcibly.

Result : Air can be compressed.

Conclusion : Air does not have definite volume and it can be compressed.

Sample report 2

fig 1.4

Title: Properties of air

Objective: To prove that oxygen is present in air

Required materials: Match box/ lighter, candle, glass tumbler, bowl, water

Procedure:

1. A burning candle was kept in a bowl.
2. The bowl was filled with water partially.

3. The burning candle was covered with a glass tumbler.

Observation: The candle covered with the glass tumbler was extinguished after a moment.

Result: The oxygen present in air supports to glow the candle. After a moment when all the oxygen inside the glass tumbler finishes, the candle extinguishes. The amount of consumed oxygen is shown by the volume of the water raised in the glass tumbler.

Conclusion: Oxygen is presentin the air.

Question to think

Have you seen the use of a lantern as shown in the figure? A lantern has a glass covering around its wick. Why does a lantern have holes at its upper and lower parts? Would a lantern glow perfectly if it did not have the holes? Discuss.

fig 1.5

Sample report 3

Title: Distillation process

Objective: To separate salt and water from salt solution

Required materials: Round bottom flask, cork, conical flask, tripod stand, retort stand, burner, condenser, wire gauze

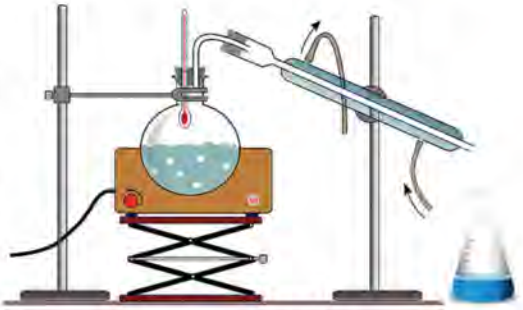


fig 1.6

Procedure:

1. A round bottom flask was filled half with salt solution.
2. The flask was kept on wire gauze over a tripod stand and it is fixed by using a retort stand.
3. A condenser was fitted at the mouth of the round bottom flask.
4. Cold water was managed to pass in the condenser as shown in the figure.

5. An empty conical flask was kept at the other end of the condenser to collect distillate in it.
6. The salt solution was heated using burner.
7. When the solution was heated, cold water was also passed in the condenser.

Observation: After heating salt solution for 10- 15 minutes, the solution was boiled and a part of it was changed into steam. It was seen that when the steam was passed through the condenser, it changed into water by cooling. The condensed water was collected in the conical flask by the help of inclined condenser. After continuous heating, the salt remained in the round bottom flask finally.

Result: Salt and water are separated from the solution.

Conclusion: Solid (solute)and liquid (solvent) of a solution can be separated from a solution by distillation process.

Project work

Visit any temple or any cultural heritage nearby your house. Prepare a report on the challenges and measures to solve the problem to keep the heritage clean and green. Present your report in the classroom.

Model construction

A collage model of photosynthesis process made by using papers is shown in the figure alongside. What are the other activities, principle or fact you have learnt in science and technology, which can be presented in the form of collage model? Discuss with friends in the classroom.

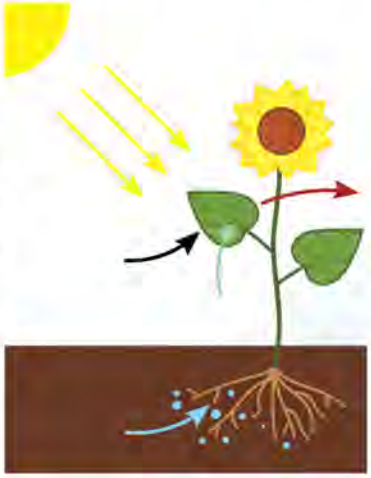


fig 1.7

Collage is a type of model that can be

constructed by pasting the collected small pieces of paper on a surface. Models of atom, food chain, different types of cloud, ecosystem etc. can be constructed by pasting paper and other materials available locally.

You have seen a globe, when studying about the earth in class. What similarities may be in between the earth and the globe? What facts related to earth can be understood by observing the globe? Discuss among the classmates in the class.

fig 1.8

A globe is model of the earth. The spherical shape of the earth and its inclination on the earth's axis are few facts that can be observed clearly on a globe.

Collage model of the Solar System can be made by pasting the printed or sketched figures of the sun and other planets.

Model construction is a process of constructing samples of scientific processes and methods, materials, parts of organisms, natural resources etc. by using locally available materials.By constructing models of solar system, eclipse, the internal organs of human body etc., we can study and demonstrate the parts which are not visible directly. A model helps to clear the principles and facts of science. Thus, model construction is an important task of scientific learning.

fig 1.9

Sample report of model construction

Topic: Model construction of lungs

Objective: To demonstrate human breathing by constructing a model

Required materials: Two small balloons and a big balloon, a pair of scissors or knife, a big plastic bottle, pipe, sticky tape, glue, a Y-shaped hose connecter.

Procedure:

1. The plastic tube was connected with the single tube side of the Y–shaped hose connecter. Then the connect s made airtight by using sticky tape or glue.
2. Each of the tubes of the two ends of Y- shaped hose connecter was fitted with a small balloon. The joints of the balloon and the tube were tied with rubber bands to airtight the joints.
3. A plastic bottle was cut carefully at little bit higher than the bottom of it using a pair of scissors or knife.

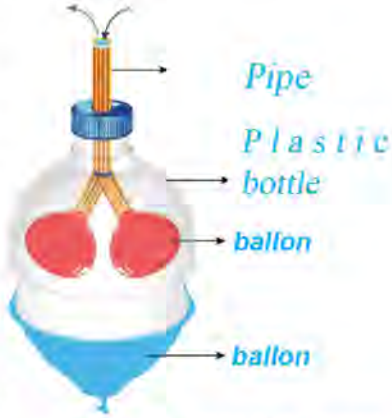


fig 1.10 model of lungs

4. A hole was made at the centre of the lid and the single tube end of the Y shaped hose connector was passed in it.
5. The lid was fitted tightly in the bottle and the joint was made airtight.
6. A small knot was made at the mouth of the big balloon. Then the balloon was cut at opposite region of the mouth and fitted at the cut end of the bottle as shown in the figure. Then the joint was tied tightly to make it airtight.
7. By gripping the knot of the big balloon, it was pulled and relaxed alternately.

Observation: When the knot of big balloon was pulled, the size of the small balloons fitted in hose connecter increased. When the big balloon was relaxed the size of the small balloons decreased.

Conclusion: In human body breathing occurs by the expansion and contraction of the lungs. The lungs are made expanded and contracted by the diaphragm. Diaphragm is a strong muscular layer that separates thorax and abdomen.

Exercise

1. Fill in the blanks with suitable words given below:

continuous	principle	demonstrate
precautions	pattern	paragraph

a. Practical work helps to clarify the learnt .....

b. To prevent probable accident in laboratories we should follow.....

c. We should write the report of practical work in a fixed .....

d. We can ..... by constructing different models of science.

e. Learning is a ..... process.

2. Tick (√) the correct alternative:

a. How does scientific learning process related with an object or event begin?

i. by doing practical work
ii. by analyzing the objects or events
iii. by curiosity raised by seeing the objects or events
iv. by collecting data related with the objects or events

b. Which of following is the practical work done in a laboratory?

i. to separate salt crystals from the salt solution
ii. to identify natural resources by field visit
iii. to know the function of parts of a flower by

observing them

iv. to produce static electricity by rubbing a comb on hair

c. Which of following is the first part of the report of a practical work?

i. objective ii. result

iii. observation iv. procedure

d. Why is title written at first in report writing?

i. It indicates the practical work.

ii. It tells the procedure of practical work.

iii. It tells the required materials for practical work.

iv. It helps to give correct result.

3. Answer the following questions:

a. What is scientific learning?

b. How does the scientific learning begin after seeing objects or events around us? Clarify with example.

c. 'Practical work plays an important role in science". Justify the statement.

d. What is report writing? Why should we write the report of practical works?

e. What things should be cared while writing a report?

f. What components should be introduced while writing a report of the practical work done inside a laboratory? Write in short.

4. Differentiate:

a. Practical work and model

b. Observation and result

2 Information and Communication Technology

This is the age of science and technology. The means of scientific invention and modern technology have brought a significant change in human lives. Communication means like computer, internet, digital camera, CCTV (Close Circuit camera television), radio, television, etc. have made our life simple and easy. Due to development and rapid change in technology, the field of information and technology has taken a new turn. Nepal has also made a remarkable development in the field of information and technology. It is possible to communicate with our relatives inside and outside the country through internet using computer and mobile.

Figure 2.1

Information and communicatio technology (ICT) is widely used in teaching learning process in the present day. The learning process has become effective due to use of ICT tools like computer, radio, television, etc. Therefore, it is important to have skills to use such tools for effective learning.

Figure 2.2

2.1 Tools of information and communication technology

Activity 2.1

The picture given below shows various ICT tools that are used in our daily life. Discuss the uses of these tools and complete the table below.

Figure 2.3

S.N	Name of ICT tools	Uses
1.	Radio	To listen to song, news or various programmes of entertainment and collect information
2.	Telephone	To communicate with people
3.	.....	.....
4.	.....	.....

Radio, television, newspaper, computer, projector, etc. are the tools of information technology. These tools perform various functions like creating, displaying, storing, transmitting, exchanging of information and so on. The above mentioned means of communication in the activity 2.1 can be divided into one-way and two-way means of communication.

1. The information or message transferred through tools like radio, television and newspaper is in one direction only and cannot be discussed or interacted. Such tools are one-way means of communication.

2. Any information obtained from ICT tools like telephone, mobile or computer can be dialogued or discussed. Such tools are two-way means of communication.

Facts or reality collected about any substance or thing is information. We can get information of any substance or events in the world by reading newspaper, listening to radio and watching television.

A method of exchange of information between two or more than two individuals through oral, written or any other means is called communication. In other words, expression of one's feelings or experience in written, oral or any other means is communication. The scientific working system, which is followed to invent objects, is called technology. The short form of Infromation and Communication Technology is called ICT.

The tools used in the area of information and communication technology for various purposes are the means of information and communication technology. Some of the tools used in information and communication are given in the chart below.

It is possible to exchange information of the whole world due to internet service. Necessary information is searched or exchanged from the computer throughthe internet network using wire or without using wire.

Sometimes a computer may have technical problem even though it is connected with the internet wire.The following figures illustrate whether a computer has internet access or not.

Computer with wireless internet access

Computer with wired internet access

Computer with problem of wireless internet access

Computer with problem of wired internet access

Fig 2.5

Internet is the present world's significant necessity. Internet connects various devices of information technology. One can easily get information of incidents of various countries in the world by the help of internet in short time. Access in internet allows one to read online news. The necessary knowledge and information can be acquired from social network in the present day. Today, whole world has become a small global village because of internet.

Fig 2.6

Browser

It is not sufficient to search required online materials even if a computer has internet access. It is necessary to install applications to run internet. These applications are browsers. Chrome, Mozila firefox, safari, etc. are widely used browsers.

According to the type of software used in computers, the browsers to be used in computer can be different. The software used in computer like windows, Linux, mac, android, ios may have different browsers.

Website

1. Website is one of the information systems or collections of data. In websites, information is kept in the form of photos, videos or documents. Different organizations have their own websites. Generally, website begins with 'www.' The full form of 'www' is 'world wide web'. A website does not resemble with any other websites in the world. Therefore, each organization has their own specific address. The address is called web address or called Universal Resource Locator (URL). For example: To know the information regarding Center for Education and Human Resource Development, Sanothimi Bhaktapur, the steps to search the information are given below;

2. Open browser, type www.cehrd.gov.np in the search bar and press 'enter' key.

3. Various link web pages are seen when it is opened as shown in the right diagram.

Figure 2.7

4. Click on downward arrow from info center page.

Different options appear. Select any one of them.

5. If 'Online Study' is selected as an option, the page as shown in the diagram will be opened. In this way, one can learn about necessary information or contents oneself selecting the required option.

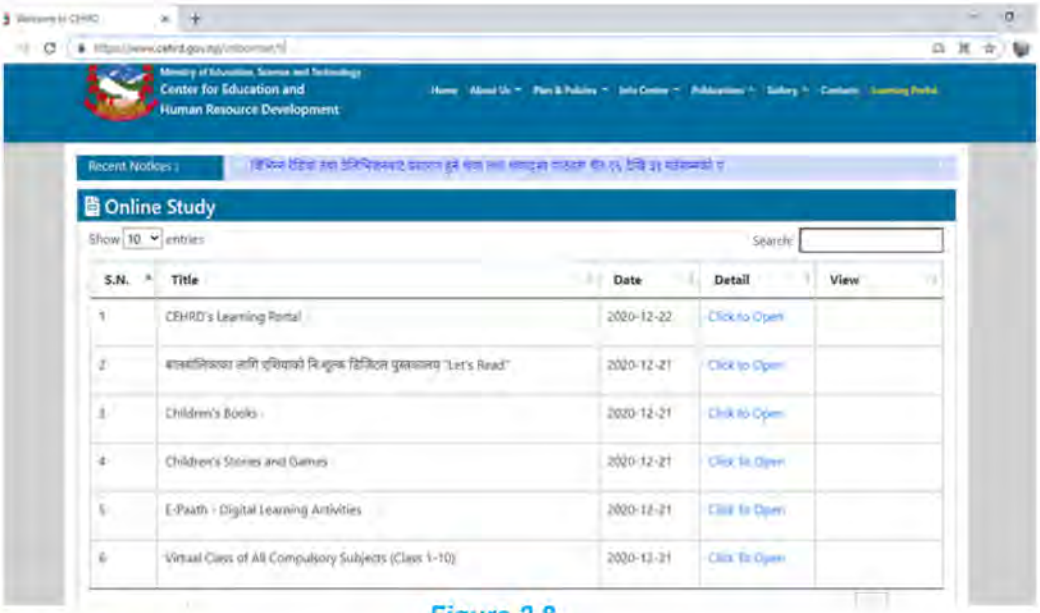


Figure 2.8

Project Work

Go to www.cehrd.gov.np of the Centre of Education and Human Resource Development. Click on info centre > online study link, select S.N 6 and choose 'virtual class of all compulsory subjects (Class 1-10)' then click 'open'. Now the YouTube page of virtual class opens. You can visit playlists page and select the videos prepared for grade seven. You can take help from your teacher if necessary.

Search engine

Search engine is necessary to search any information from browser. Search engines like google, Bing and yahoo can be found in browser. While installing browser one of the search engines may be selected as default. One can even select the required search engine as default from the setting of the browser.

An example for selecting default search engine in google chrome browser is given below.

1. Search on google chrome in your computer or mobile.
2. Click on --- symbol in right side of chrome.

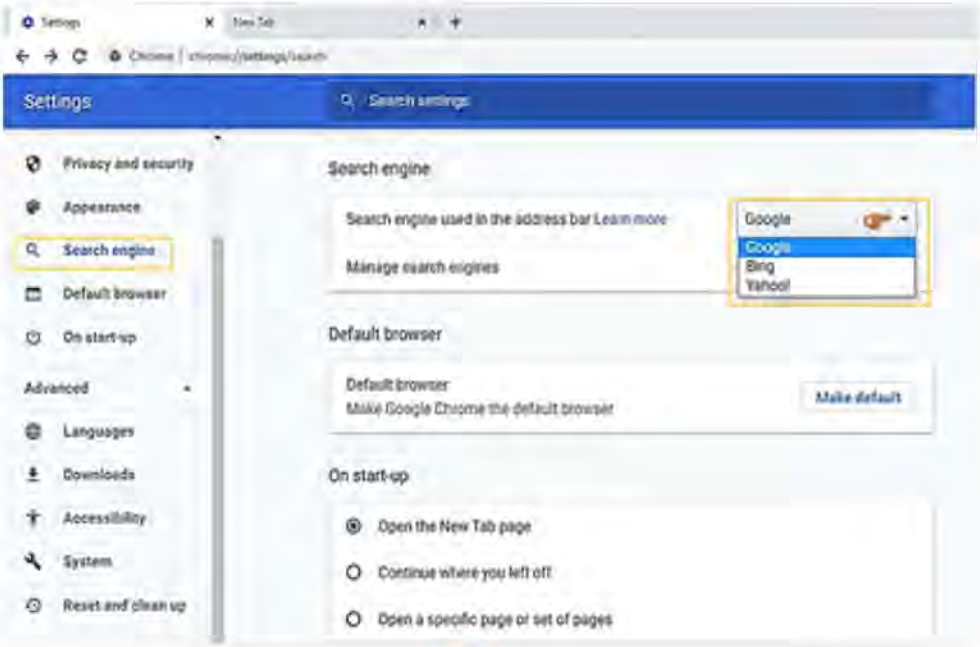


Fig 2.9

3. Click on setting and visit search engine on the left side of search engine.
4. Move the cursor to 'search engine used in address bar' in the right side and select the option, Google Bing or Yahoo to set as default search engine.
5. After selecting default search engine, one can visit google chrome and type the required word in the address bar. Thus, necessary information is displayed in the screen.

The steps mentioned above are the steps to make any of the search engine as default. Necessary information can be searched from default search engine of a browser.

Google search engine has been used widely. Even if one does not know the website, one can easily search information on any subject matter simply by typing key words in search engine. If you know the websites of school or university, government or non-government organization, ministry, etc. you can directly go to address bar and type web address of the related organization and visit main web page.

Project work

Go to search engine of a browser and type 'Ministry of Education' in the search bar. Various website links of ministry like Ministry of Education, Science and Technology appear on the right side as shown in the figure. Click on any one that you want to know about.

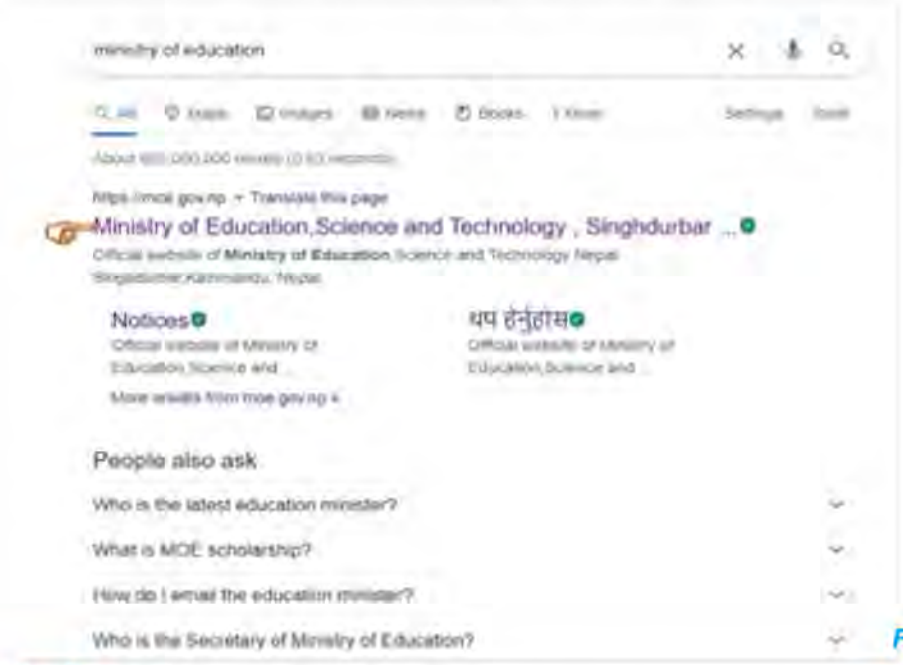


Figure 2.10

E-book

E-book or electronic book is the digitized form of a book. E-book can be read by using computer, smart phone or any E-book reader. Mostly E-books are in PDF (Portable file document) format and the computer needs to have adobe reader or any PDF file support application to read E-book. One can simply download E-book

from search engine. E-book occupies very less space in the computer. So a computer can contain thousands of books.**Steps to find e-book of your class from the website of the Curriculum Development Centre.**

Fig 2.11

1. Search the website of Curriculum Development Center, www.moecdc.gov.np
2. You can see the webpage as shown in the picture.
3. Click on 'textbook' of the web page on the right side.
4. Select 'grade seven' from class group (Grade six to eight).
5. Search the name of desired book and click on download link on the right side then click on 'download' bottom.
6. Now the desired e-book is downloaded. The downloaded file of the book is saved in downloads folder of the computer.
7. We can read the downloaded e-book in our mobile or computer.

If you have forgotten the website of e-book to be downloaded, then you can type the name of desired book in search bar. In order to search and download digital version of a book,

Science and Technology of grade seven, you can visit the website of Curriculum Development Centre (CDC) and type 'cdc science book class 7' in search engine. Various website links related to the subject matter are displayed on search engine after search.

Figure 2.12

Email

Email is a method of submission and exchanging digital information. It has reduced the traditional method of postal service for the exchange of messages. It is easier to send words, pictures, audios, videos, etc. from one place to another instantly by using email. Computer, internet and email services are necessary for sending and receiving email. Various companies are providing email services through Gmail, Hotmail, Yahoo, Outlook, etc. Using such services, one can send digital mails to the email addresses of other people.

Ways of opening email account

We can open our new email account in email services like Gmail, Hotmail, Yahoo, Outlook, etc. Many email services are used in our country for the exchange of email. We need email account not only to exchange email but also to use various services in Android smartphone.

Project work

1. Go into search engine of your browser; type 'Gmail account sign up' and search.
2. Among the various websites while searching, select the website as shown in the figure right side. Web page to open new account opens.

3. Fill all personal details correctly in the web page.

4. Use unique user name or use suggested user name by the computer. Computer doesn't accept the existing username.

5. Create a strong password using letter (a-z), number (0-9) and special character (#, @, %. &. *). The password that you created should be remembered or you can write in your note book.

Fig 2.13

6. After filling all the details click on 'next'.

7. Web page opens as shown in the figure and you can enter your mobile number, date of birth, gender, etc.

Fig 2.14

In 'recovery email address', write any email address you have been using previously. But if you don't have any email address created before, you can use the email address of your parents or relatives or any close ones in the recovery email address.

8. If you forget your email address or password, the cell number,

date of birth filled in the webpage, the recovery email filled in this web page helps you to recover your email.

9. After this, web page of 'privacy and terms' opens, then scroll down the page and click on "I agree'.

10. Then go into Gmail out of various services that are seen in the screen and web page as shown in the figure opens.

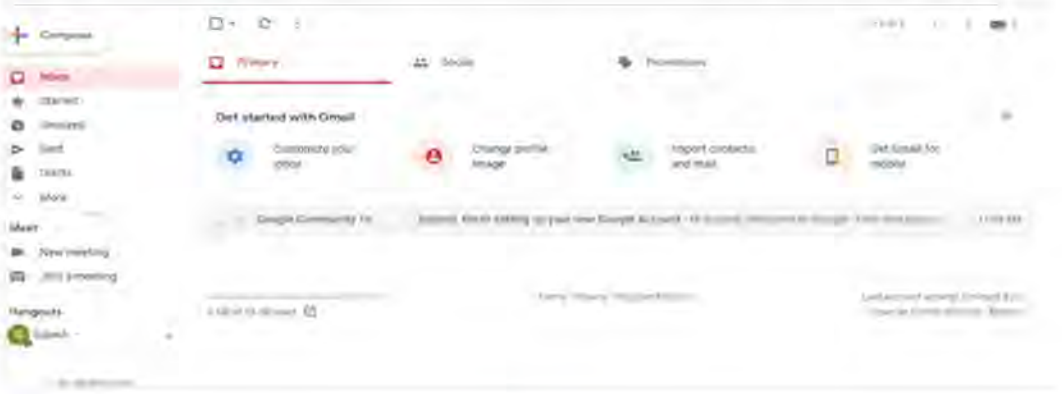


Fig 2.15

11. Now your new email account is ready. You can keep your profile picture and go to 'setting' for further

Project work

Create a new Google account in Gmail, Hotmail, Yahoomail or in any websites. Give all the correct personal details and exchange messages with your friends through email.

Sending email or reading received message in email

Email can be sent using different programmes like Gmail, Hotmail, Yahoomail, etc. but the method of sending email and steps to be followed through Gmail are given here.

1. Type 'www.gmail.com' in address bar and press 'enter' key.

2. Visit the web page, type email address and password and click on 'sign in' of the web page.

fig 2.16

3. Then click on '+' sign at the right side of the page.
4. Type the email address at 'To' icon in the row given in the email compose page. Type the email addresses serially if email is to be sent to many persons. One can even use CC or BCC to send the same email to many people at a time.
5. Below the address, write the suitable topic in 'Subject' so that the receiver gets information on related subject.
6. Then write the message in detail. Click on 'attach file' option at the bottom of the page to send file, photo or video. Select the required file, photo or video and click on 'attach'.
7. Now, click on 'send' icon of the page and your email is sent to inbox of the receiver immediately.

Click on 'inbox' at the right side in order to read the email received. If file, picture or video is attached, go to 'attach file' and click on 'download' below and get your file at the time of need.

Activity 2.2

Take a photo of your project work of grade seven with a mobile or ask your teacher to take photo and ask him/her to send the file in email. Now exchange email among your friends with the help of email address of your friends. If you have any problem

regarding opening of message or downloading the attached file, take help from your teacher.

The use of email is being increased day by day. It is easier, quick and more multi-useful medium for exchanging digital message. It has many advantages but serious problem may arise if one does not obey precautions. The advantages and disadvantages of email has been listed in points below:

Advantages

1. It is fast. So, information or message can be sent quickly.
2. Email can be sent and received at any time.
3. Besides text message, audio, video, photo or link of different files can also be sent.
4. Any computer or mobile with internet access can be used to send and receive email.
5. Except the cost of internet service, sending and receiving of email are free of cost.
6. Email can be sent to many people at a time.

Disadvantages

1. It is not effective to receive email by receiver if she/he is in the area without internet service.
2. Computer with internet service may receive virus through email and it may damage data and file of the computer.
3. If the user does not check email, the information may not be exchanged.
4. Unnecessary spam mail may irritate users. Important email may not be seen if we do not check email frequently.
5. The password of email should be kept secret and should be changed time to time. If anybody forgets the password and cannot recover, he/she may lose the account forever. In

order to be safe from the problem, one must provide mobile number or any other alternative account while creating new account. This may help us to recover account.

Though email has many disadvantages, one can get a lot of advantages if proper care and safety measures are taken while using email in this modern age. Therefore, safety measures have to be adopted in using email.

2.3 Spreadsheet

Spreadsheet is a computer programme used for calculation, preparation of graph, chart and so on. Large mathematical calculation can be done quickly in spreadsheet with a single command.The use of spreadsheet programme for personal, commercial and official purposes is increasing day by day.

Among various spreadsheet programme Microsoft Office and Microsoft Excel are more common. Spreadsheet is widely used in data entry, arranging data in alphabetic order, arranging data in ascending or descending order, adding, subtracting, multiplying, dividing and preparing chart or table.

Activity 2.3

The spreadsheet given below contains name, gender and age of family members. Study the spreadsheet and data carefully and find the answer of following questions.

1. Which column is filled with age of the family members?
2. Which row is filled with age and gender of Nabin?
3. Spreadsheet shows that the age of Kamala is 25. What is the name of the cell filled with her age?

	A	B	C	D
1	नाम	उमेर	लिङ्ग	
2	पदम	65	M	
3	लक्ष्मी	62	F	
4	मिना	42	F	
5	सिताराम	39	M	
6	पवित्रा	35	F	
7	नविन	30	M	
8	कमला	25	F	
9	सुमन	20	M	
10				
11				

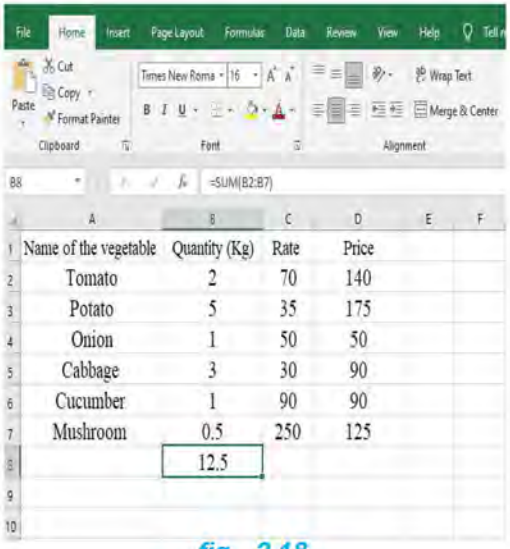
fig 2.17

4. If you fill your name at cell A10, to which cell is your age filled?

Ways of addition of data in spreadsheet

1. Type excel in search bar and open blank spreadsheet.

2. Enter different information such as 'Name of vegetable', 'quantity', 'rate' and 'price' in spreadsheet as shown in the figure.



	A	B	C	D
1	Name of the vegetable	Quantity (Kg)	Rate	Price
2	Tomato	2	70	140
3	Potato	5	35	175
4	Onion	1	50	50
5	Cabbage	3	30	90
6	Cucumber	1	90	90
7	Mushroom	0.5	250	125
8		12.5		
9				
10				

fig 2.18

3. Each number in the table is represented by certain row and column. The rate of tomato is Rs.70 which is denoted by column 'C' and row '2'. So the cell is represented by C2. Similarly, cell address of 0.5 Kg of mushroom is B7.

	A	B	C	D	E
1	Name of the vegetable	Quantity (Kg)	Rate	Price	
2	Tomato	2	70	140	
3	Potato	5	35	175	
4	Onion	1	50	50	
5	Cabbage	3	30	90	
6	Cucumber	1	90	90	
7	Mushroom	0.5	250	125	
8		12.5		=D2+D7	
9					
10					

fig 2.19

4. To add the quantity of all vegetables click on the first quantity, 2 having cell address B2 and drag it up to the last cell (B7). Now all the cells from B2 to B7 are selected.

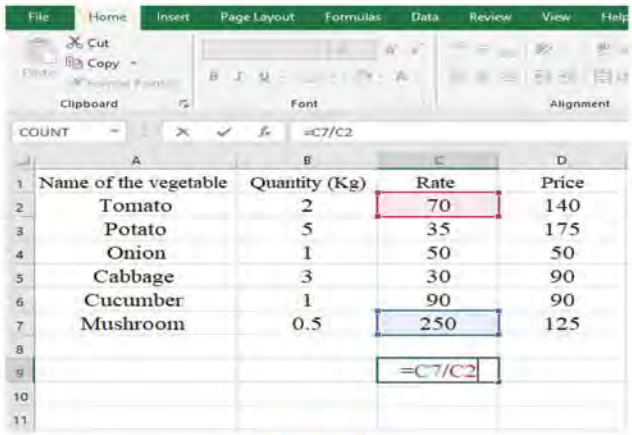


fig 2.20

5. Now click on the 'auto sum ∑' at the left side of spreadsheet. The sum of all the quantity appears just below the last cell of the quantity, i.e. B8.

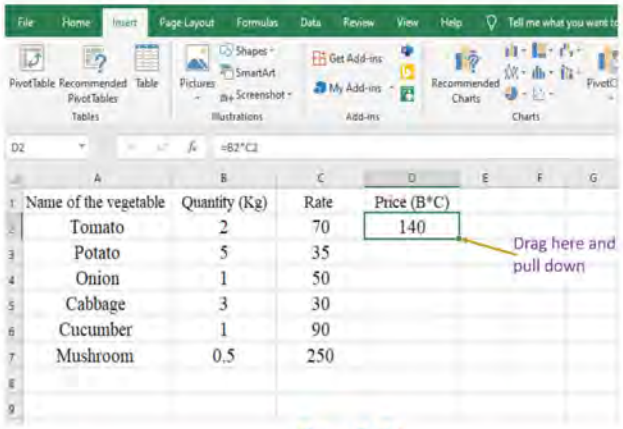


fig 2.21

6. If you have to add some certain quantity only, click on any cell on the result writing cell such as D8. If you want to add the price of potato, 140 and price of mushroom, 125 type D2+D7 and press enter key. The result is obtained in D8.

7. In this way you can use ' +' sign to add, '-' to subtract and '/' to divide. If you have to subtract price of

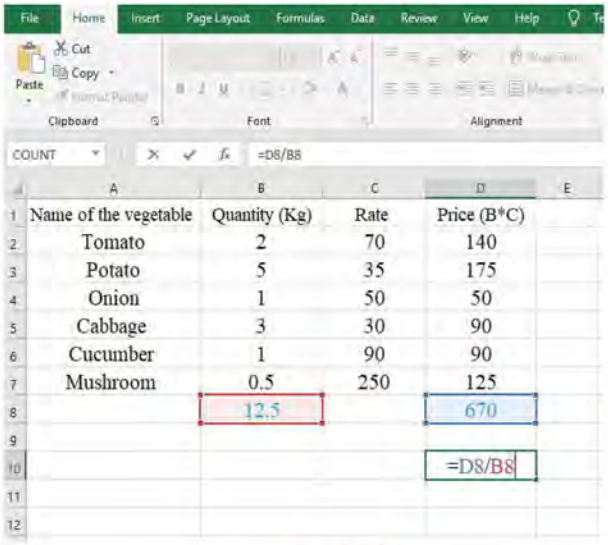
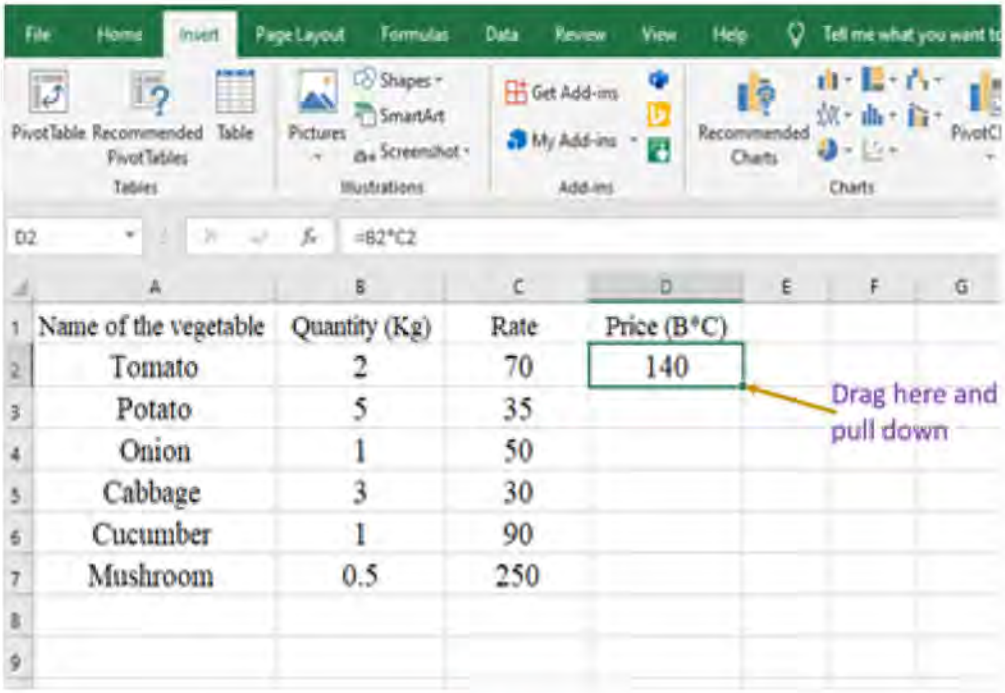


fig 2.22

onion from the price of potato, click on the cell on which the result is to be filled and type '=D3-D4' and press 'Enter' key. Similarly, if the rate of mushroom is to be divided by the rate of tomato then click on the cell on which the result is to be filled and type '=C7/C2' and press 'Enter' key.

Ways of multiplication in spreadsheet

1. To find the total amount of tomato, its quantity is multiplied with its rate.



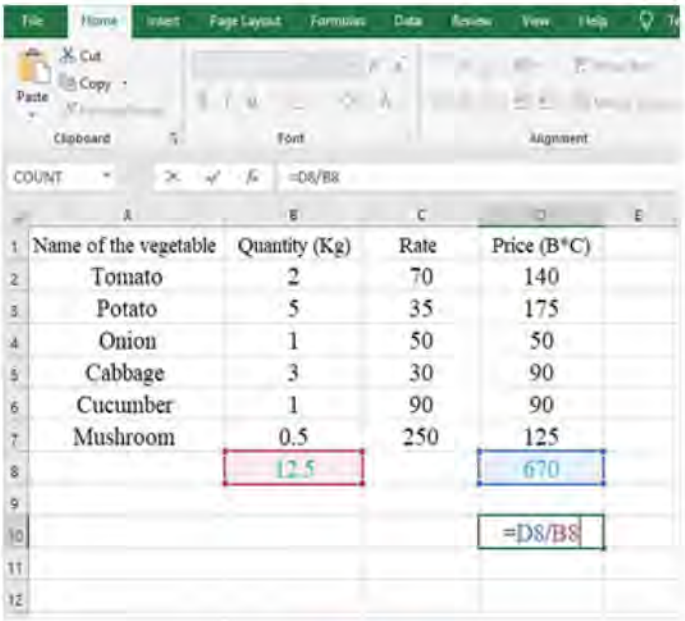
	A	B	C	D
1	Name of the vegetable	Quantity (Kg)	Rate	Price (B*C)
2	Tomato	2	70	140
3	Potato	5	35	
4	Onion	1	50	
5	Cabbage	3	30	
6	Cucumber	1	90	
7	Mushroom	0.5	250	
8				
9				

Fig 2.22

2. To calculate the total amount of tomato, click on D2 cell.
3. Type '=B2*C2' in D2 cell and press 'Enter' key. The total sum of tomato is obtained as 140 in D2 cell.
4. To find the total amount of each quantity, click on lower right corner of D2 cell and drag up to D7 and leave. Total amount of each vegetable is obtained in the respective cells.

5. Then the total sum of all the vegetable can be calculated on selecting the cells from D2 to D7. Then select 'autosum ∑' as above.

6. Here the average price of all vegetables can also be calculated by dividing the total price of all the vegetable (D8) by the sum of total quantity of vegetable (B8).



	A	B	C	D
1	Name of the vegetable	Quantity (Kg)	Rate	Price (B*C)
2	Tomato	2	70	140
3	Potato	5	35	175
4	Onion	1	50	50
5	Cabbage	3	30	90
6	Cucumber	1	90	90
7	Mushroom	0.5	250	125
8		12.5		670
9				
10				=D8/B8
11				
12				

Fig 2.23

Mathematical addition, subtraction, division, multiplication and average can easily be calculated by using spreadsheet.

Activity 2.4

Fill the marks of each subject of your final term examination in spreadsheet and take help of your teacher to calculate total mark and percentage of the total obtained mark in the spreadsheet.

Preparation of graph or chart in spreadsheet software

Spreadsheet programme is used to present various data in graph or chart which is more attractive. Presentation of data in graph, pie-chart, bar diagram makes learning easy. It makes clear about subject matter on presenting data in the form of chart.

1. First the given data is filled in a spreadsheet

2. The given figure shows the number of death in road accident due to different causes from Ashad to Poush in 2077 B.S.

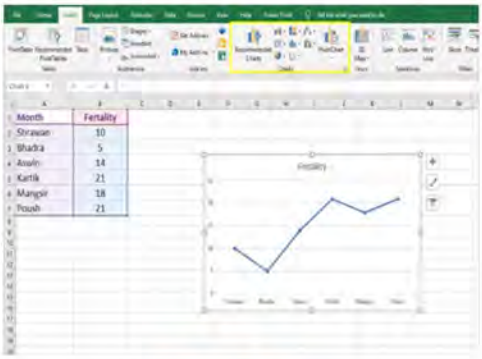
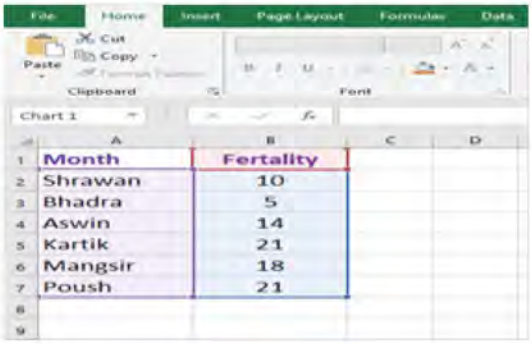


Fig 2.24

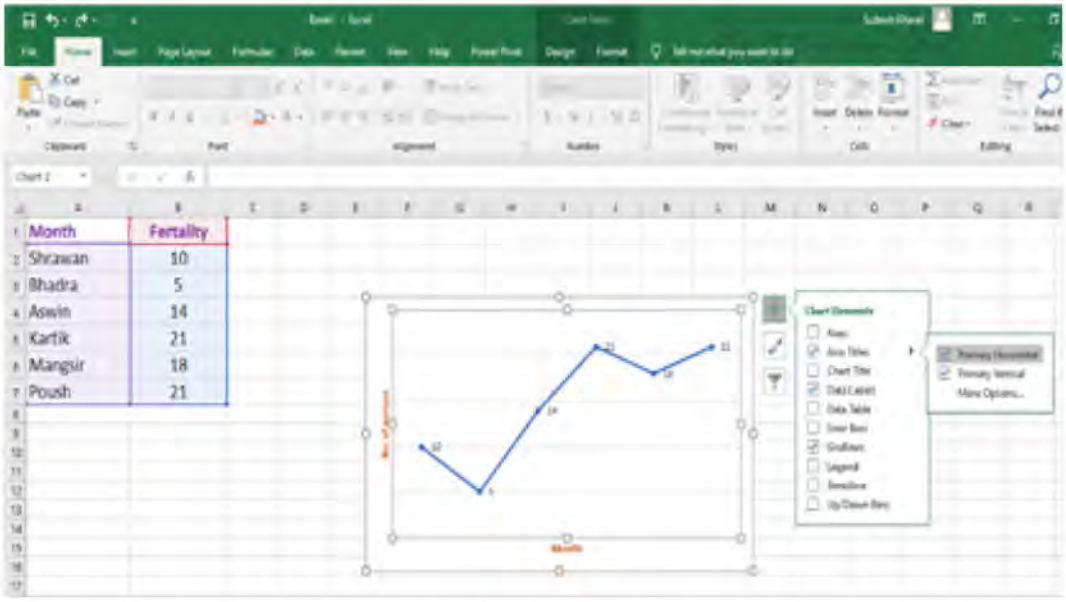


	A	B
1	Month	Fertality
2	Shrawan	10
3	Bhadra	5
4	Aswin	14
5	Kartik	21
6	Mangsir	18
7	Poush	21

Fig 2.25

3. Select all the given data and click on 'insert' to present the data in chart.

4. Then select some appropriate chart among different varieties of charts within the yellow boundary.



	Month	Fertality
2	Shrawan	10
3	Bhadra	5
4	Aswin	14
5	Kartik	21
6	Mangsir	18
7	Poush	21

Fig 2.26

5. Then the selected chart will be displayed in spreadsheet page.
6. Features can be added from right side on clicking '+' sign, then select check (√) option to add some feature and click on uncheck to remove unwanted data.
7. One can even add title in X-axis and Y-axis on clicking on axis titles.

Activity 2.5

Find out the number of students in each class in your school and fill the grade of class and number of students of each grade in spreadsheet. Present the data in pie-chart and graph.

2.4 Photo


Fig 2.27

What do you do if you visit a new place? Certainly, you will take photos in that place for the memory. We take photo in different ceremonies such as birthday, marriage, *brata banda, annaprasan* (weaning ceremony), and so on. Digital photo can be transferred quickly and easily from one place to another through various tools of communication and technology. Thus, digital photo and message can be sent or received using different computer software very fast.

High quality photos can be taken from mobile easily with the features present in the mobile. Various software of mobile is used to edit photo to make more attractive. The size of the photo can also be increased or decreased as per our desire.

Ways to transfer photos from mobile or camera to a computer

1. Switch on mobile or camera and connect it with the computer using data cable (USB).

2. Message of connection of the device with computer displays on computer screen. Select options to perform activity in the connected device permit appears on the screen for connection.
3. Click on 'File transfer'since we have to transfer photo or file.
4. Visit 'This PC'>'Devices and drives'. It shows the computer drives and the external device (camera or mobile) connected with computer.

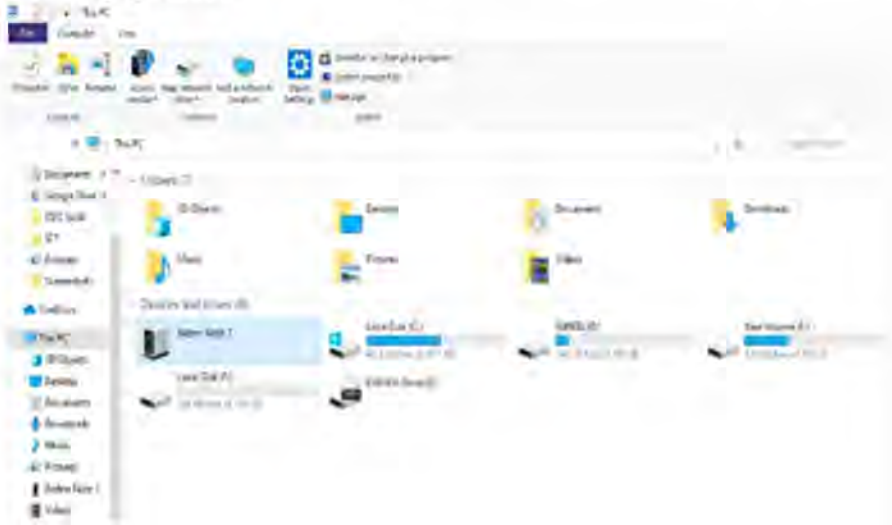


Fig 2.28

5. Click the name and go into folder.
6. Among various folders go into pictures or DCIM>camera.
7. Now photos are seen in the computer.
    i. Select photos or place mouse in somewhere in corner of the photo, right click and select copy (Ctrl +C).
    ii. If more photos are to be transferred, then click on 'shift or Ctrl' key and press and hold for selecting. At last, copy all as we did above.
    iii. If all photos of the folder have to be transferred, then just select the folder or open the folder and press Ctrl + A to select all the photos at a time.

8. To paste the copied photos, go to computer folder or drives and right click and paste (Ctrl + V). Now the photos are copied and can be seen in the computer.

Photo editing

We can make photos more attractive using photo tools. Digital photo can be made smaller or bigger in size by editing it. Online application is used at the time of hiring working staff, admission of students and so on. Before submitting online application, it is necessary to resize the document or photo and convert into prescribed file format (JPEG, PDF, etc). If the document is not according to the prescribed format or size, it may not be uploaded in the application. If we learn simple skills on photo editing, we can make a photo more attractive and can do a lot. Some of the photo tools related to photo editing are described below.

Crop

Sometimes the photo we capture or receive may not be in desired size. The process of keeping necessary parts and removing unnecessary parts of photo is called photo cropping.

Ways to crop photo

1. Open the photo to be cropped from any suitable photo programme.
2. Here, we are opening photo from Photos programme of Windows 2010.
3. Select photo, give right click from mouse and select any programme as default from options in 'Open with' section.
4. After opening the photo, click on 'Crop' icon at the right side of the top of the photo.
5. A bright lining appears around photo. Click on the lining and drag the bright portion for the selecting the desired portion.

6. On dragging mouse around the round part of corner, the brightness fluctuates in all parts. If any of the side (left, right, up and down) has to be increased or decreased, then, place the mouse at the center and drag accordingly.
7. After arranging bright lining of the photo, click on 'crop and rotate'.
8. Then click on 'Save as copy' down and right hand side.
9. Then select the folder in computer to save the edited photo at a desired folder. Thus, unnecessary part of photo can be removed and made more attractive.

Light and color adjustment

1. Open the photo to be edited using computer photo programme as above.
2. Visit edit and create>Edit at the right top. (on clicking Ctrl+E one can directly go to edit)
3. Click on adjustments at the right side. Then different options like light, color, brightness, contrast appears on screen.
4. To increase or decrease brightness of photo, drag on vertical line and move it left and right. Adjust the photo at which it looks better.
5. Adjust color in the same way. Go to adjustment if any additional features.
6. Click on 'spotfix' below adjustment and keep in clicking for several time to remove spots from photo.
7. After editing everything, click on 'save as' and save in the computer.

In this way we can make photo more attractive after editing and adjusting light, color, clarity and spot fix.

Ways of adjustment of image size

1. Open MS Paint in the computer.
2. Go to file>open from left top of Ms Paint and search photo in Ms Paint. (Photo can also be opened directly entering Ctrl+O).
3. Zoom in/out in screen to see the photo clearly in the screen.
4. Arrange horizontal or vertical pixels from 'Resize' icon as shown in the figure.
5. Pixels and size are found below the photo. In the given figure Pixels 4272×2848 and size 3.3 MB is shown.

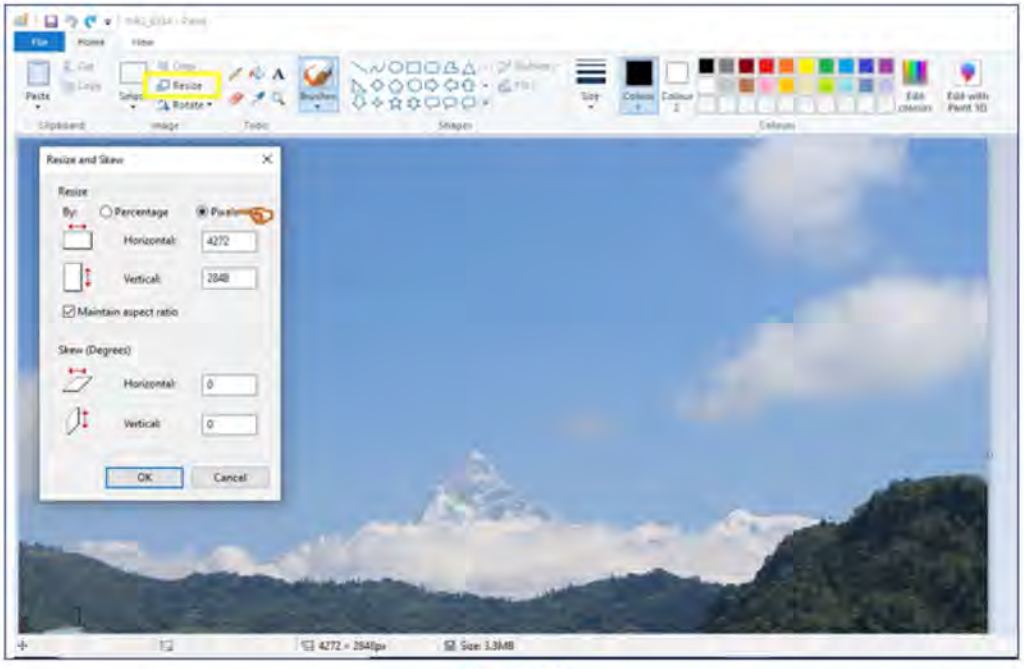


Fig 2.29

6. Below the photo, maintain aspect ratio has sign '◘' and on arranging horizontal or vertical pixels another is arranged itself.
7. If both pixels have to be arranged then click on maintain ratio and remove '◘' sign. After that both horizontal and vertical pixels can be arranged.

8. To increase size of photo, increase Pixels and to decrease size of photo, decrease pixels.
9. After increasing or decreasing pixels, click on OK or Enter key.
10. In the given figure when the photo has 3000×2000 Px, the size of photo has been decreased to 973KB only. In this way, size of photo can be adjusted to the desired size by increasing or decreasing pixels.
11. Now save the resized photo in MS Paint clicking ctrl+s.
12. Finally photo can be saved in image format in computer desktop or any folder.

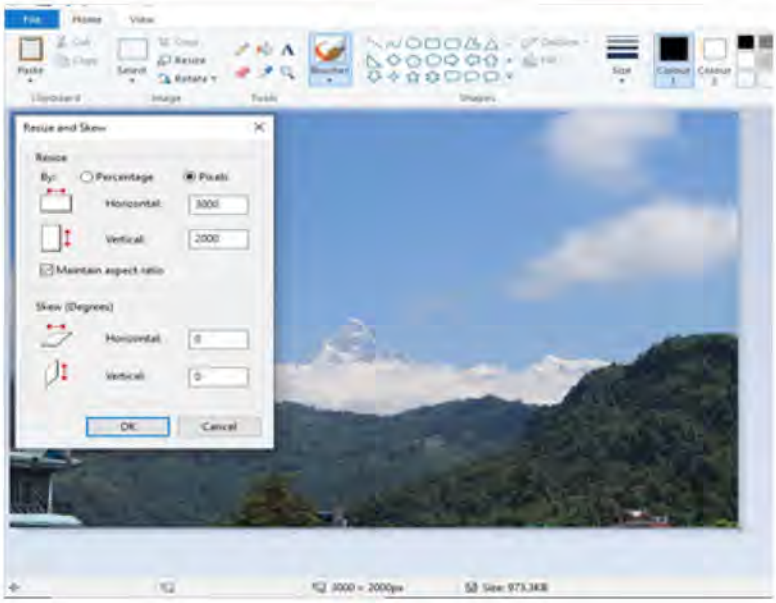


Fig 2.30

Note: Photo can also be resized from various websites that appears in online image resize in search engine when there is access of internet.

Activity 2.5

Take a group photo in your classroom with a mobile. Exchange the photo among each other through email. Then try to increase or decrease the size of the photo from MSPaint.

PowerPoint presentation

We use to present through PowerPoint to make the subject matter easy to understand. The photo used in presentation has more importance to make PowerPoint attractive. Captured photo or the photo obtained from any means has to be adjusted in a proper manner in slides. According to the necessity, we can add photo editing it. Photo editing skill has been mentioned below from which the photo can directly be added in the PowerPoint slide.

To crop photo:

1. Save the photo to be edited on desktop.
2. Open PowerPoint and go to insert>Picture>the device. Then insert the photo into a slide.
3. Select blank layout from home page of PowerPoint and go to Layout. After this, the lining at the back removes as shown in the figure.

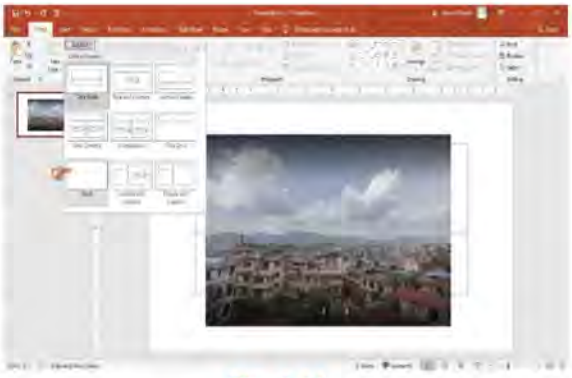


Fig 2.31

4. Select the photo of the slide and go to Picture Tools and click on Format below picture tool.

Fig 2.32

5. Click on 'crop' at the right top of the slide.
6. After clicking on Crop, black lining appears at the four corner and middle of the photo.
7. Drag (select and move) to crop to select the desired portion of the photo.
8. The part to be cropped appears brighter than other part. Then click on Crop at the right top.
9. Thus, the desired part of the photo can be kept in slide after cropping.

Activity 2.6

Search the pictures of heritages of Nepal enlisted in world heritage site and present them in PowerPoint.

Adjustment of Brightness/contrast, sharpen/soften

1. Select photo from slide and go to Picture Tools and click on Format. Then click on Correction at left top of the slide

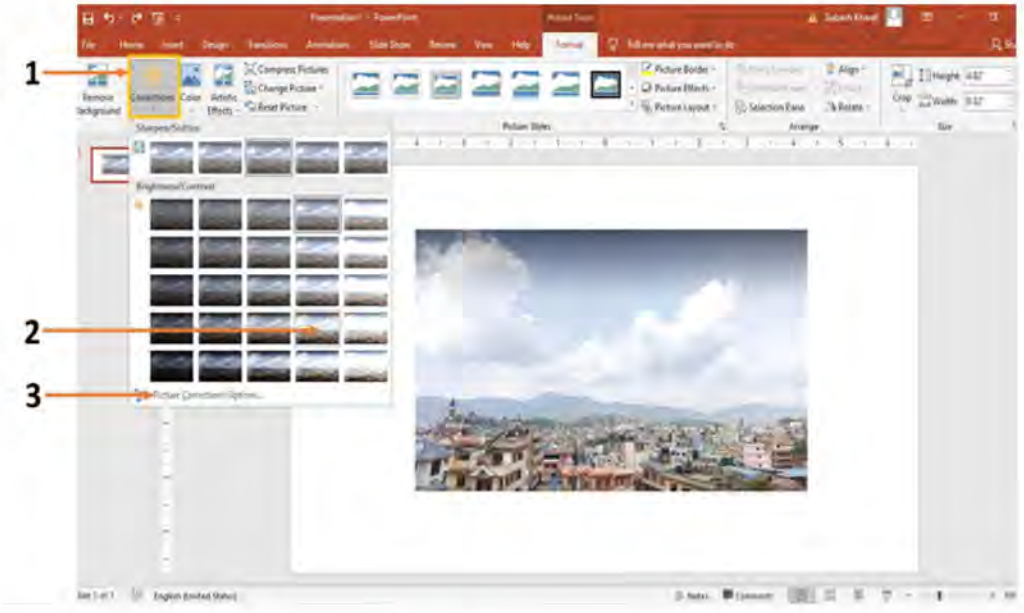


Fig 2.33

2. Go to 'sharpen/soften, brightness/contrast' present below the correction icon. Click and save the photo which appears clear where cursor is kept.

3. If the photo has to be further edited, then click on Picture correction options. Choose the options as per the requirement and make a correction.

4. If you want more correction click symbols 1 to 3 as shown in the figure and make necessary correction.

5. To add caption of photo, select 'insert' in text box.

6. You can adjust more than one photo in a slide. To avoid shifting of position of more number of photos in a slide,we should group photos.

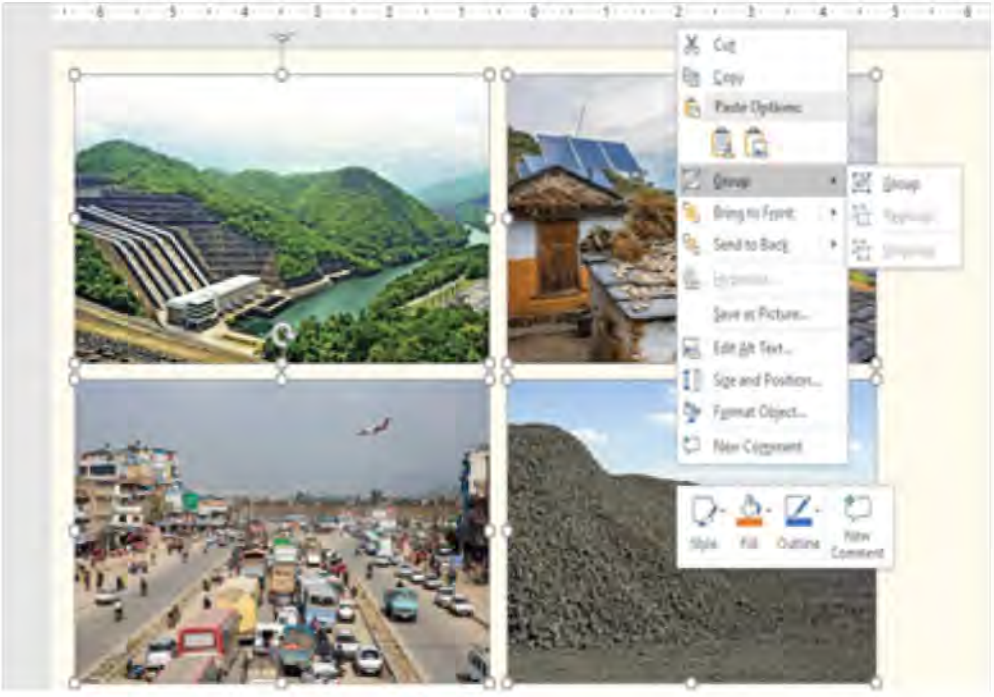


Fig *2.34*

7. Press Ctrl+A to select all the photos of a slide for grouping. For grouping one can even select any one photo from the group and keep pressing the Shift and select other photos.

8. After selecting all the photos for grouping, take the cursor of mouse at any edge of the photo and right click on mouse.
9. On right click of the mouse, different options appear and select group
10. On grouping picture and the caption written in text box below the picture, the picture and the caption moves as a single picture. Therefore, it is necessary to group pictures and the caption.

Computer virus

Computer virus is a type of computer software which obstructs function of a computer. It closes computer programme, shows some message frequently or even shuts down the computer automatically.

If some problem arises frequently in computer or the computer opens and shuts down itself, then one can estimate that the problem is due to virus. One can say a computer has virus if the file in the computer damages or cannot be opened, file cannot be deleted, formation of folder in pen drive, memory card, appearance of same message frequently while working in a computer. In such situation computer has to be checked. Virus usually damages files and programmes and gives wrong direction while using computer.

Ways of computer virus transmission

Internet is the main medium for the transfer of virus in computer. If virus is present in the file of some websites, it directly enters into the host computer. Virus enters into computer through devices used in computer like pen drive, memory card, CD, floppy disk, hard disk, etc. If file is copied from computer having virus through pen drive, CD, memory card, hard disk, floppy disk, etc. into another computer the same virus enters into the computer.

Similarly, virus enters into computer itself while installing any programme through autorun. Sometime virus enters unknowingly when some programmes are installed by computer user.

Prevention of computer from computer virus

There is some similarities in virus infection in human body and computer. Therefore, it is better to think about prevention from virus infection than treatment of virus in computer. Some of the ways to prevent computer virus are given below.

1. While downloading file from various websites by using internet, there is a chance of transmitting virus in the computer. Therefore, it is not good to visit unnecessary websites.
2. While opening email from unknown address, it is necessary to confirm received emails (spam mails) or files related to mail.
3. It is necessary to turn on firewall protection all the time in computer.
4. Easy password should not be used. Password containing different characters like alphabet (a-z), number (1-9) and special characters (!, @, #, $) are strong passwords. Such passwords should be used.
5. Downloading and installing free software programme has high chance of containing computer virus. So, such programmes should not be used as far as possible.
6. Antivirus software protects computer from virus.
7. Antivirus software should be updated time to time and devices used in computer such as drive folder, portable media (pen drive, floppy, hard disk, memory card, etc.) should be scanned.

Ways of removing computer virus from computer

Sometimes, virus may enter to computer even adopting several safety measures. A computer may have virus if the computer

operates very slowly or computer software or programme does not work well. We need antivirus software to delete virus from computer. The ways to remove computer virus is given below:

1. Install any suitable antivirus in computer.
2. Update the programme after installing antivirus clicking at database update.
3. After Programme update, go to full scan or quick scan from scan option.
4. After scanning, the information about any virus or any problem in the computer comes as notification.
5. Select delete option from option icon of select option in the left side of notification list.
6. Problems may arise in computer during scan if setting is not done properly. If so, go to setting as per the instruction.

Software

Programme is a set of instruction to execute in the computer or by the computer. The set of programmes is called software. Software is a set of specific type of instruction which gives direction to the computer. Software controls computer operation and solves the problem of the user. The mostly used softwares in market are MSDOS (Microsoft Disk Operating System), Windows XP, Paint Brush, Spreadsheet, Word, etc.

Software which can be used free of cost are available in internet. Free software can be installed and used easily but some software can be used after purchasing it. Software are divided into following categories:

System software

It is a type of software used to run or control computer system. It is designed to run different computer hardware. It is made to run hardware of the computer. It is taken as important part

of computer. System software is also called operating software (OS). Some of the system software (OS) are Windows, Mac OS, Anroid, LINUX, etc.

Application software

The software which is designed to control computer according to will of the user is called application software. Such programmes are designed as per the necessity of computer user. MS Office, Photoshop, PDF Reader, etc. are application software.

Utility software

Utility software creates better relation and environment between computer software and hardware. It helps to perform the taskin a fast, reliable, and proper way. Antivirus, disk cleaner, disk defragmenter, etc. are some of the utility softwares.

Activity 2.7

Make a list of computer software used in your computer lab. Prepare an article on any of the software used and present in your class.

2.7 Code of conduct for using computer and internet (terms and conditions)

Computer has made the work of human being easy and comfortable. Information can easily be exchanged because of internet access. We may face problem if we are not able to make right use of internet and computer. While using social media, we may make virtual friends. We may trust such friends and may share privacy of an individual and it may create a big problem in our personal life. It may cause economic loss. We have been hearing several cases of digital stealing or looting. Therefore, it is necessary to take proper care while using computer and internet. The rules we follow while using computer and internet is called terms and condition/internet ethics. Some of the computer ethics are mentioned below:

1. We should not provide personal information like name, date of birth, age, mobile number, etc. to any unknown people.
2. Personal details of any person should not be given without their permission. If one has to give personal details, make sure it will not be misused.
3. Password should not be shared.
4. Password should not be autosaved in the computer which is common for everybody in a school or any offices.
5. Individual or group photo should not be shared to anybody without their permission.
6. New account should not be created in social network in the name of other.
7. In case of account hacking or threatening of unknown person, or any problem, report to Nepal Police.
8. If any unknown person tries to be closer, asks to meet or sends unnecessary messages, you should report to your parents.
9. Do not open email in an unknown email address. Make sure the objectives for sending the email and decide to open.
10. Unnecessary spam mail should not be opened or replied.
11. Hackers try to get personal details through information of prize, opportunities or any advantages through email or social network. Therefore, stay alert in such cases.
12. Do not upload such photo which may provide hints for irrelevant person about your location while roaming outside your home. Be alert that other person may make plan and you may have to bear heavy loss of property or life.

Exercise

1. Fill in the blanks with suitable words given below.

Software, browser, connect, ICT, programme

a. Computer, smartphone, digital camera, etc. are the devices of ..... .

b. Internet ..... means of information and technology with each other.

c. We can search necessary information with the help of ..... from internet.

d. The series of instruction is called computer .....

e. Spreadsheet used in computer to prepare chart or graph is a .....

2. Tick (√) the correct statement and cross out (X) incorrect statement.

a. Devices related to computer are used to exchange information all around the world because of internet.

b. Email receiver does not need internet service to read the mail.

c. Photo can be made more attractive from photo editing.

d. Size of photo can be increased or decreased using MS paint.

e. The set of instructions used to operate a computer is called programme.

3. Use tick sign (√) for the correct option.

a. What type of software is windows used in computer?

i. System software ii. Application software

iii. Utility software iii. Driver software

b. What does CC written in email address denote?

i. Correct copy ii. Combine copy

iii. Carbon copy iv. Copy to copy

c. Which of the following is disadvantage of email?

i. Quick exchange of information

ii. Comparatively less expensive

iii. Need internet connection

iv. Exchange of mail and audio-visual material

d. What is drag in spreadsheet?

i. Select ii. Select and copy

iii. Select and copy iv. Select and copy

e. What does 'gov' denotes in www.moecdc.gov.np.

i. Educational website

iii. Government website

ii. Non-government website

iv. Information related website

4. Differentiate between:

a. System software and application software

b. Letter (mail)and email

5. Answer the following questions.

a. What is information and technology?

b. How does tools of information and technology change the lifestyle of human being? Clarify the statement.

c. What is internet? Make of list of tasks which has become possible today because of computer.

d. How can we use e-book? Write any two advantages of using e-book.

e. Write any two advantages and disadvantages of email.

f. What is spreadsheet programme? Make a list of tasks that can be performed in spreadsheet.

g. What is computer virus? What are the preventive measures for stopping the computers to be infected from virus?

h. Why is it necessary to follow computer ethics while using internet in computer?

i. What are the tools of information and technology?

j. How has human life become easy due to the developmentin information and technology?

6. Fill the given data in spreadsheet. Assuming 100 as total mark of each subject, calculate the total marks and the

S.N	Name	English	Nepali	Maths	Science	Social	Total	Percentage
1	Aarati	55	45	70	56	72	?	?
2	Dolma	53	54	43	62	45	?	?
3	Lakpa	64	67	56	34	53	?	?
4	Meena	53	75	76	45	76	?	?
5	Raman	65	52	65	32	32	?	?

3.2 Invertebrates

fig 3.16

a. What are the differences in structure of animals shown in the figure?

b. Do all the animals have backbone?

We see different types of animals around us. Some animals of them have backbone in their body. Some animals do not have backbone. The animals having backbone are called vertebrates. Cow, buffalo, dog, cat, bird etc. are some examples of vertebrates. Animals, which do not have backbone are called invertebrates. Earthworm, leech, cockroach, slug, snail etc. are some examples of invertebrates. There are very small animals around us which can not be seen by our naked eyes. They can be seen by the help of microscope. They are called microorganisms. Such microorganisms are made of single cell and they are called unicellular organism. Those animals which consist of number of cells are called multicellular.

Activity 3.8

Observe invertebrates found around your house/school/pond/ ground. Sort out them into different groups on the basis of their characteristics given in the table and discuss about them in class.

Animal's name and Characteristics	**Body shape**		**Segmented body**		**Habitat**		**Wings**		**Body surface**	
	round	flat	yes	no	water	land	yes	no	dry	

From the above activity, we find that invertebrates are of different types. On the basis of similarities and dissimilarities found in them, invertebrates are classified into nine phyla (singular-phylum). They are as given below:

1. Unicellular animals

Activity 3.9

Observe an Amoeba under microscope with the help of your teacher. Sketch the diagram observed and make a list of its characteristics.

Amoeba Euglena Paramecium

Fig 3.17

Characteristics of unicellular animals are as follows:

a. Body of unicellular animal is made of single cell.

b. Usually they are found in water and in the body of other animals as parasite.

c. They move from place to place by the help of pseudopodia, flagellum or cilia.

d. The processes like digestion and reproduction are conducted in the single cell. Asexual reproduction is done by them.

The group of single celled animals is called Protozoa. Examples of this phylum are Amoeba, Paramecium, Euglena and Plasmodium.

2. Porous animals

Activity 3.10

Observe a specimen of sponge with the support of your teacher. Sketch the diagram observed and make a list of characteristics of it.

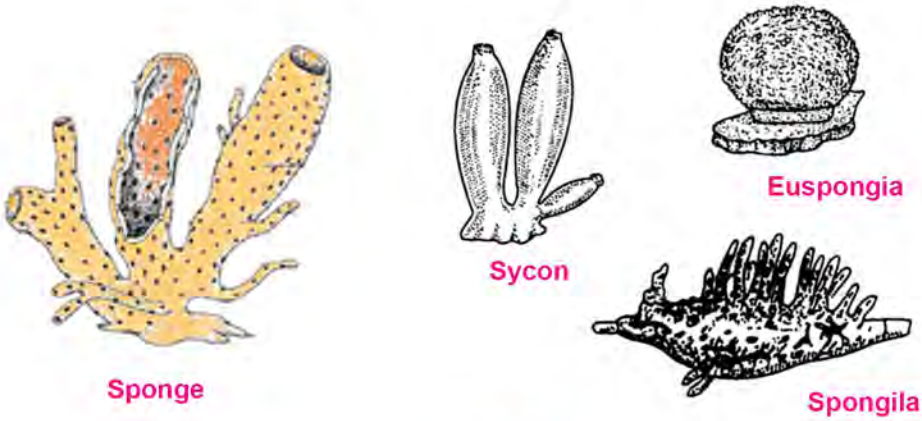


Fig 3.18

Characteristics of porous animals are as follows:

a. Body of these animals is made of two layers (diploblastic).

b. Fine pores called ostia are found on the body surface. They have a hole at anterior end of the body called osculum.

c. They are found attached on any substratum in water.

d. Water and foodstuff enter in their body through ostia. Unnecessary substances are expelled out from the body through osculum.

e. They reproduce by regeneration process. The process of making up new organism from fragmented part of the body is called regeneration.

The group of porous animals is called as Porifera. Examples of this phylum are spongila, sycon etc.

3. Hollow bodied animals

Activity 3.11

Observe a permanent slide of hydra. Sketch the diagram and make a list of its characteristics.

Hydra

Coral

Fig 3.19

Characteristics of hollow bodied animals are as follows:

a. Body of these animals is hollow like pipe.
b. They have thread like tentacles around their mouth.
c. Ingestion (intake food) and egestion (excretion) both the processes take place through mouth.
d. They use tentacles in locomotion and to take food in their mouth.
e. They reproduce by fragmentation and budding methods.

The group of hollow bodied animals is called as coelenterata. Examples of this phylum are hydra, coral, jellyfish etc.

4. Flat animals

Activity 3.12

Observe a specimen of tapeworm or liver fluke. Sketch the diagram observed and make a list of its characteristics.

Liver fluke

Tapeworm

Fig 3.20

Characteristics of flat animals are as follows:

a. Body of these animals is flat, wide and ribbon like shaped.

b. They are parasite.

c. They have sucker near their mouth. They take food by using sucker.

d. They have digestive system but anus is absent in them.

e. They are bisexual animals (hermaphrodite). Bisexual animals are those animals in which male and female both the reproductive organs are found in the same individual.

The group of flat animals is called as Platyhelminthes. Examples of this phylum are liverfluke, tape worm etc.

5. Unsegmented cylindrical animals

Activity 3.13

Observe a specimen of Ascaris. Sketch the diagram observed and make a list of characteristics of it.

Ascaris

Hookworm

Fig 3.21

Characteristics of unsegmented, cylindrical animals are as follows:

a. Body of these animals is cylindrical and unsegmented.

b. Body is covered with cuticle.

c. Usually they are parasite. Some of them are found in water and are free-living.

d. They are unisexual, i.e. male and female are separate in them.

e. They have complete digestive system with mouth and anus.

The group of cylindrical unsegmented animals is called as Nemathelminthes. Examples of this phylum are Ascaris, hookworm, etc.

6. Segmented cylindrical animals

Activity 3.14

Observe an earthworm collected from nearby field or ground. Sketch the diagram and make a list of characteristics of it.

Earthworm Fig 3.22 Leach

Characteristics of segmented, cylindrical animals are as follows:

a. Body of these animals is cylindrical and segmented.

b. Body has soft and moist skin and they respire through the skin.

c. Usually they are found in water and moist soil.

d. They are bisexual, i.e. both male and female reproductive organs are found in the same individual.

e. They locomote by the help of organs like setae (earthworm and sandworm) and sucker (leech).

The group of cylindrical segmented animals is called as Annelida. Examples of this phylum are earthworm, leech, etc.

7. Animals with jointed legs

Activity 3.15

Observe a cockroach and make a list of its characteristics.

mosquito butterfly prawn cockroach

Fig 3.23

Characteristics of animals with jointed legs are as follows:

a. Animals of this phylum have segmented legs. They have three pairs or more number of legs and have wings.

b. The outer surface of their body is made of hard cover called exoskeleton.

c. Sexes are separate in them.

d. Most of them have compound eyes that help them to see around them clearly without moving their head.

The group of the animals with jointed legs is called as Arthropoda. Examples of this phylum are mosquito, butterfly, crab, prawn, cockroach, etc.

8. Soft bodied animals

Activity 3.16

Observe a snail and make a list of its characteristics.

Snail Mussel (SIPI) Octopus

Fig 3.24

Characteristics of soft bodied animals are as follows:

a. They have soft and moist body and a single muscular foot. The foot helps them in locomotion.

b. They are found in both water and land.

c. They have tentacles on their head.

d. Usually they have hard shell that covers their body.

e. Male and female sexes are separate in them.

The group of soft bodied animals is called as Mollusca. Examples of this phylum are snail, mussel, octopus etc.

9. Spiny animals

Activity 3.17

Observe a specimen of starfish. Sketch it and make a list of its characteristics.

Star fish

Fig 3.25

Sea- urchin

Characteristics of spiny animals are as follows:

a. Their body is covered with spiny skin. The spines are made of calcium carbonate.

b. They are found in ocean.

c. They do not have clear head.

d. They have tube feet for swimming.

e. Usually they have capacity of regeneration.

The group of spiny animals is called as Echinodermata. Examples of this phylum are star fish, sea urchin, sea cucumber etc.

Exercise

1. Tick (√) the correct alternative given below.

a. In which phylum a snail lies?

i. Platyhelminthes ii. Annelida

iii. Nemathelminthes iv. Mollusca

b. Animals of which phylum of the following are found only in ocean?

i. Porifera ii. Protozoa

iii. Echinodermata iv. Mollusca

c. Which one is unicellular animal?

i. Sponge ii. Hydra

iii. Paramecium iv. Planaria

d. Which of following is character of cylindrical and unsegmented body?

i. Has developed digestive system

ii. Body is covered with cuticle

iii. Has no anus

iv. Move by using setae

e. Which of following is a unisexual parasite having cylindrical and unsegmented body?

i. Leech ii. Ascaris

iii. Tape worm iv. Slug

f. Which of the following is the main characteristic of the phylum of prawn?

i. Have wings ii. Aquatic

iii. Segmented body iv. Segmented legs

2. Fill in the blanks using the suitable words given below:

Tentacles bisexual Annelida Porifera Protozoa

a. The animals having cylindrical and segmented body are kept in the phylum..... .....

b. Flat animals are.....

c. Sponges are kept in phylum.....

d. All the single celled animals are grouped in phylum.....

3. Answer the following questions:

a. Write the name of the phylum of following animals.

Leech prawn starfish earthworm Euglena

b. Why is a butterfly grouped in phylum Arthropoda?

c. Write any three characteristics of phylum Protozoa.

d. What types of animal are grouped in phylum Porifera?

e. Name any two such phyla which have bisexual animals in them.

f. Write a similarity and a difference found in between flat worms and cylindrical worms.

g. Write any three characteristics of the animals found in phylum Mollusca.

h. Differentiate between

i. Protozoa and Porifera

ii. Arthropoda and Mollusca

iii. Earthworm and pinworm

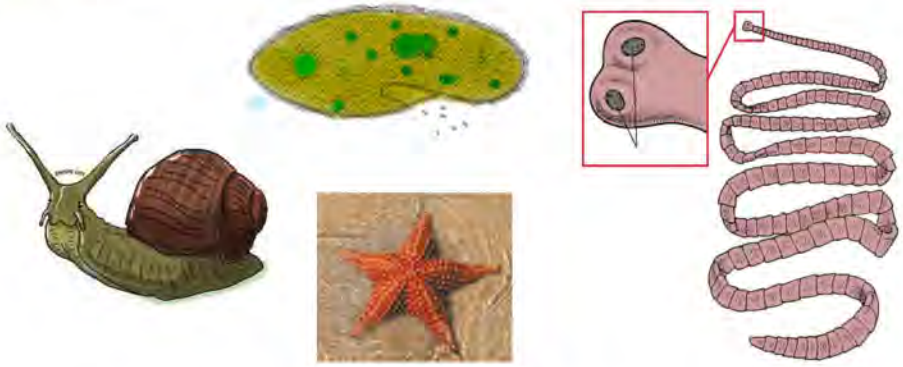
iv. Ascaris and leech

i. Sketch neat diagrams of the following.

Amoeba earthworm snail hydra

j. Ascaris and earthworm looks similar but they are grouped into two different phyla while classifying them. Explain.

4. Answer the following questions on the basis of given diagrams



a. Which of those animal has tentacles?

b. Which animal has no clear head?

c. Which animal conducts all the life processes in single cell?

d. Which of them is a parasite found in human abdomen?

3.3 The Cell

In the given figures, a brick wall and the cells of onion peel observed under the microscope are shown. Observe the figures. What are similarities and dissimilarities in these two figures? Discuss in class.

Fig 3.26

As the walls are made of bricks or stones, the body of organisms is also made of living cells. The difference is only that bricks or stones are nonliving things but the cells are living things. If bricks or stones are added the size of wall increases. In the same way the size of our body also increases when number of cells increase in it. These cells are the basis of own life. The cells are also called as structural and functional unit of life. What is its cause? Discuss in class.

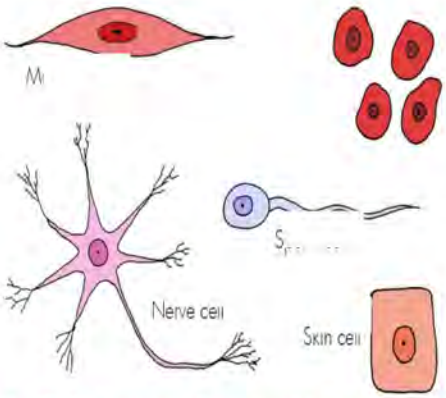


Fig 3.27 *Different shape and size of cells*

Body of all the living organisms is made of living cells. Cells are of different shapes and sizes, because the size and shape of the cells is according to their function. Body of some organisms is made of single cell which are called as unicellular organisms. The living beings which have number of cells in their body are called as multicellular organisms. In multicellular organisms, cells unite

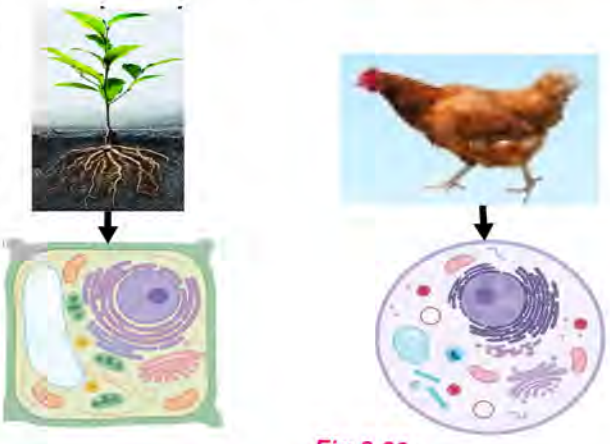


Fig 3.28

into tissues; tissues unite into organs; organs unite into body system and number of body systems form the body of a living being. In the same way plants are made of plant cells and body of animals are made of animal cells. Thus, body of all the organisms is made of cells.

Are the cells that form animal body and plant body similar? Sort out the differences between their shape and structure by seeing the picture

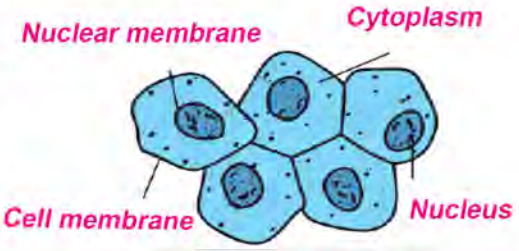


Fig 3.29 Human cheek's cells

Activity 3.18

Objective: To observe cheek cells

Required materials: Toothpick, slide, cover slip, methylene blue, microscope

Method: Scratch at the inner surface of cheek using the wider end of a toothpick and collect the material obtained on the toothpick, on a glass slide. Place a drop of methylene blue on it gently and cover it using a cover slip. Avoid the existence of air bubbles under the cover slip. Observe the slide under microscope and sketch the diagram of the structure observed.

Discussion and conclusion: What are the structures seen under the microscope? Discuss. Have you seen nucleus, cell membrane and cytoplasm like components in it?

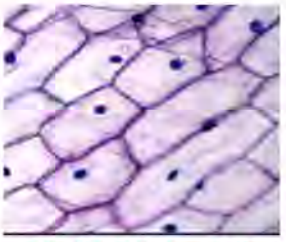


Fig 3.30 Onion cells

Activity 3.19

Objective: To observe onion cells

Required materials: onion, knife, forceps, slide, cover slip, safranin, glycerine, microscope

Method:

1. Cut an onion longitudinally in two equal halves.

2. Take out the fine membrane of the onion piece by using forceps.
3. Keep the membrane sunk in safranin for a while in a watch glass.
4. Keep the membrane in water kept in a watch glass.
5. Place a drop of glycerine on a slide. Place the piece of membrane in glycerine and cover it carefully with a cover slip.
6. Observe the prepared slide under microscope.

Discussion and conclusion: Sketch the diagram of the structure observed and label its different parts. Find the differences between plant and animal cells by comparing the cheek cells and onion cells. Present your work in class.

Structures of plant and animal cells

Observe the given diagrams of animal and plant cells and discuss about the following questions.

a. What are the components that are found in the animal cell but not in the plant cell?

b. What are the components that are found in the plant cell but not in the animal cell?

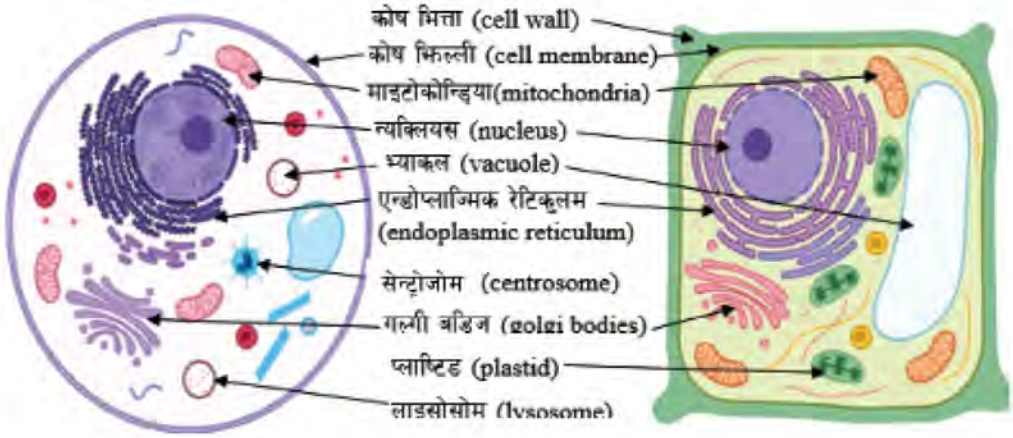


fig 3.31

c. Are the outer surfaces of both the cells of about same thickness? What effect does it cause on the shape of animal and plant cells?

Cell membrane, cytoplasm and nucleus are the main parts of a cell. Such parts of a cell are called as the components of a cell. The outermost layer of a cell is cell membrane that surrounds cytoplasm and nucleus. In plant cell, a thick layer of cell wall is also found over the cell membrane. There are many other components found in cytoplasm.

Mitochondria, vacuole, plastid, Golgi body, centrosome are some such components. A short description of those components is given below:

A. Cell wall

Cell wall is thick, rigid and of non-living nature. It is made of cellulose and found in plant cells only. Cell wall protects the cell from mechanical injury and provides fixed shape of the cell.

B. Cell membrane

Cell membrane is found in both plant and animal cells. It is thin, flexible and of living nature. It is mainly made of lipid and protein. It controls the passage of materials in and out of the cell. Required materials for cells enter and unnecessary materials are thrown-out from the cell through it. It is also called as semi-permeable membrane.

C. Cytoplasm

The semi-liquid found in between the cell membrane and nucleus of a cell is called cytoplasm. It consists of water, salt, vitamin, protein etc. Different components of a cell are found in it. The components are both living and nonliving. Living components are called as organelles and nonliving components are called as inclusions. The main organelles found in cytoplasm are as given below:

a. Mitochondria

Mitochondria are elongated structures found in both plant and animal cells. They conduct respiration in them and store energy. Mitochondrion is also called as powerhouse of a cell.

b. Plastids

Plastids are found in plant cells only and they help in preparation and storage of food. They are found in different shapes like ribbon, cup, plate, rod etc. They also provide attractive colours to flowers and fruits. There are three types of plastids found in plants; they are chloroplast, chromoplast and leucoplast. Chloroplast is found in stem and leaves of a plant and contains chlorophyll in it. Chromoplasts are of different colours and are found in flowers and fruits. Leucoplast is found in root of plants and it is colourless.

c. Vacuole

Vacuoles are sac like structures filled with transparent liquid in them. In some animal cells, vacuoles are absent. The vacuoles in animal cells are of smaller size than that of plant cells. They balance amount of water in cells.

d. Centrosome

Centrosome is found in animal cell only. It is found near nucleus and is cylindrical in shape. It plays an important role in cell division. Cell division is a process of forming new cells by the division of preexisting cells.

e. Endoplasmic reticulum

Endoplasmic reticulum is found in the form of network. It connects nuclear membrane with cell membrane. As bone supports to our body, it gives mechanical support to the cell.

f. Lysosome

Lysosome is a type of component of a cell that contains digestive

enzyme. It produces different types of juices that digest nutrients inside the cell.

g. Ribosome

Small granular structures found stuck with the surface of endoplasmic reticulum are called ribosome. They are also found in cytoplasm. Ribosomes synthesize protein in the cells.

h. Golgi body

Golgi body is found in both animal and plant cells. It transports, modifies and stores protein and lipid.

i. Nucleus

The spherical and oval structure found in a cell is called nucleus. It consists

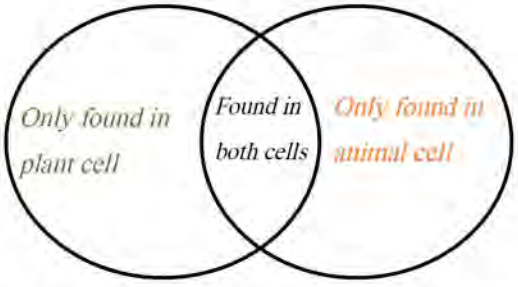
of nucleolus, nuclear body and chromatin. It controls different activities in a cell.

Project work

Take a plywood or cardboard piece of the size of a chart paper. Construct a model of animal and plant cells on it by using clay/thermocol or other suitable materials available in your surroundings. Apply suitable colours to the components of the cell and label them.

Activity 3.20

Observing diagrams of animal and plant cells, place the components given below at their suitable places in the Venn diagram given alongside.



Cell membrane, cell wall, cytoplasm, nucleus, mitochondria, vacuole, plastid, ribosome, lysosome, centrosome

Exercise

1. Tick (√) the correct alternative given below :

a. Which component is found only in animal cells?

i. Vacuole ii. Plastid

iii. Cell wall iv. Centrosome

b. Identify plant cell on the basis of the features given below.

i. It has cell wall, plastid, centrosome and vacuole.

ii. It has cell wall, cell membrane, plastid, and vacuole.

iii. It has cell membrane, centrosome, ribosome and cytoplasm.

iv. It has nucleus, plastid, lysosome and centrosome.

c. Which component of a cell is semi-permeable?

i. Cell membrane ii. Endoplasmic reticulum

iii. Cell wall iv. Vacuole

d. Which component is found in both plant and animal cells?

i. Centrosome ii. Plastid

iii. Cell membrane iv. Cell wall

e. What is the other name of ribosome?

i. Powerhouse of a cell

ii. Protein factory of a cell

iii. Suicidal bag of a cell

iv. Controlling centre of a cell

f. What is the feature of inclusion found in cytoplasm?

i. Nonliving nature ii. Living nature

iii. Solid nature iv. Liquid nature

2. Fill in the blanks suitable words given below:

plastid mitochondria nucleus vacuole cytoplasm

a. The organelle which controls all the activity of a cell is.....

b. Powerhouse of a cell is .....

c. The organelle that helps in preparation of food is .....

d. The liquid substance found in between nucleus and cell membrane is .....

3. Write differences between:

a. Cell membrane and cell wall

b. Animal cell and plant cell

c. Plastid and mitochondria

4. Answer the following questions:

a. Define cell.

b. Write the cause of considering cells as the basic unit of life.

c. Which component of a cell is called powerhouse of a cell?

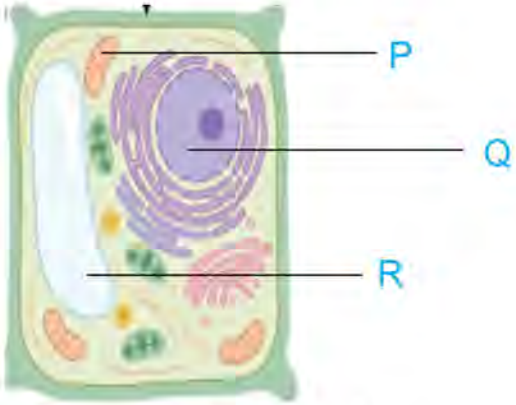
d. Sketch neat diagrams of animal and plant cells and label their different parts.

e. Mention the components found in an animal cell.

f. Write any four components found in cytoplasm

g. What is the cause of selecting plant cell for the study of the structure of a cell? Describe in short.

h. Answer the following questions on the basis of the given diagram.



i. Write names of P, Q and R.

ii. What is the function of P?

iii. Which part of it is known as powerhouseof a cell?

iv. What is the cause of being fixed shape of the cell?

v. Due to the presence of which part of a cell, plants can help to maintain the environmental balance? Explain.

4 Biodiversity and Environment

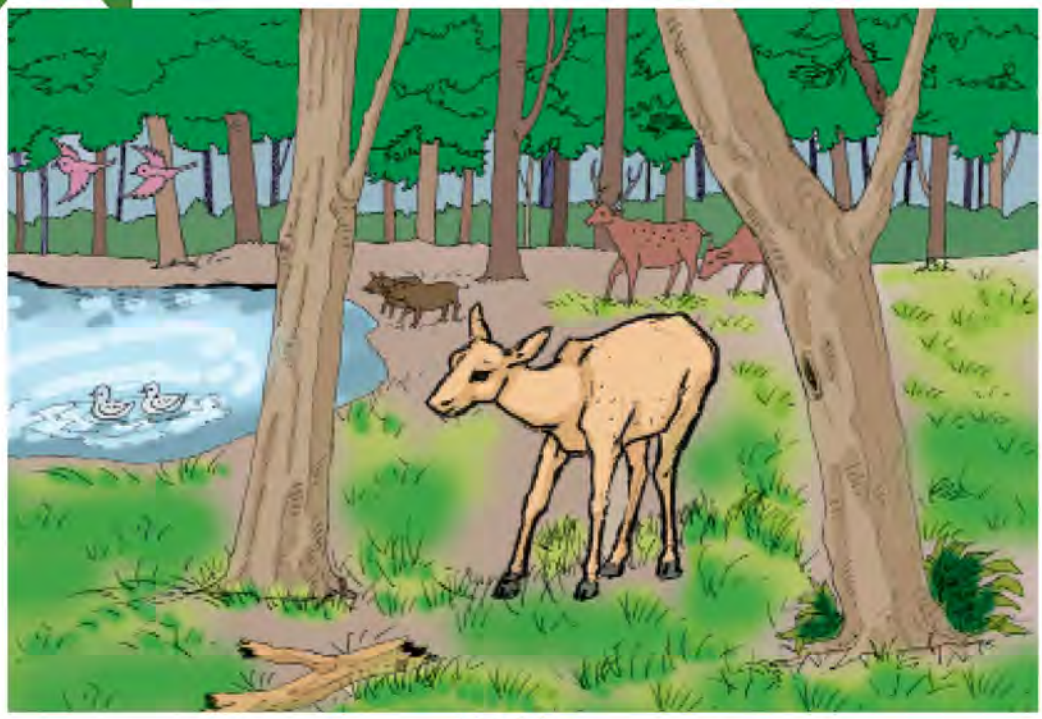


Fig. 4.1

Are yaks and rhododendron found in each terai, hills, and himalayan region of Nepal? Why is so ? Is there same environment in terai, hills and himalaya regions?

Various types of animals and plants are found in different environments. Various types of animal and plants found in the world are the components of environment. Due to variety of landscape and diversity in the environment of Nepal, various types of animals and plants are found here. The animals and plants found in hot region of Terai are different from the animals and plants found in Hilly and Himali regions. The presence of different kinds of plants and animals in a particular area is called as biodiversity. Biodiversity and environment are closely interrelated.

4.1 Natural Resources

Activity 4.1

What type of natural resources do you use in your locality? Fill the resources and their uses in the table given below;

Natural Resources	Uses
1. Water	1. To cook food, for irrigation, to drink
2.	2.

Fig 4.2

Natural resources are gift of the nature to the living organisms. We use natural resources in the form of fuel like coal, firewood, petroleum etc. The raw materials used in industries to manufacture various things are obtained from the nature. All the materials available in nature are natural resources. Water, air, soil, rocks and the minerals present in the rocks, wildlife (plants and animals), coal and petroleum fuels etc. are some main examples of natural resources. Presence of natural resources make human beings and other animals easy to survive. Natural resources are used in farming and to run industries.

Project work

Make a list of industries found in your (locality) province. What type of natural resources do the industries use? Write them in the table and present in your class.

Name of industries	Used raw materials	Natural source of the raw material	Use of the manufactured materials
1. Broom industry	Broomgrass	Forest	To clean
2.			
3.			

4.1.2 Classification of natural resources

Activity 4.2

What type of natural resources do you use in your locality? Write the uses of the natural resources in the table given below;

Obtained from living beings	Obtained from non-living things	Can be replaced immediately after they are finished	Cannot be replaced immediately after they are finished




Fig 4.3

Natural resources can be classified in various bases. They can be classified into living and non-living resources. Different types of animals and plants including forests are the examples of living resources. Air, water, minerals, soil, rocks etc. are examples of non-living resources. On the basis of their replacement, natural resources can be classified into two classes. They are renewable and non- renewable resources. Air, water, forest product and soil are examples of

renewable natural resources. These resources can be re-used and they do not finish even though they are used repeatedly. So, these resources are called renewable natural resources. Fuels like coal and petroleum has possibility to finish by their continuous use. They need millions of years to form in nature. In the same way, there is limited store of metals and rocks in the earth and they also cannot be replaced just after they are finished. Thus, coal, petroleum, metals, rocks etc. are examples of non-renewable natural resources.

Project work

What types of renewable and non-renewable natural resources are in your community? Investigate. For what purpose are the renewable natural resources being used there? Write in a table and present in the class.

4.1.3 Importance of water resources, water reservoirs and wetlands

Water is found at different places and in different forms in nature, which are called as water resources. Water resources are mainly found as surface water and underground water. Water resources like watersheds and wetlands are surface water. Answer the following questions on the basis of the observation of the given figure.

Fig 4.4

a. What type of water resource is shown in the figure?

b. What type of natural resources of water is available in your locality?

c. Do these resources contain water throughout the year?

d. How are such resources used and conserved in your locality?

Water reserves

Fig 4.5

Water reserves are sources of water. In such regions, rainfall is collected and it forms a big store of water. Water reserves are formed by the collection of water from various sources.They vary in size and may be in the form of pond/lake or river covering thousand kilometers of area. Jagadishpur lake, Ghodaghodi lake, Beeshajari lake, Gosaikund, Rara lake etc. and number of other rivers are the main water reserves of our country.

Wetlands

The water resources in which water is available throughout the year and have swamp lands around them are called wetlands. Wetlands have a large area of lands around them that is wet by absorbing water of the source. Koshi Tappu region is the main wetland of Nepal.

Fig 4.6

Wetlands play a very important role to maintain natural balance. Some importance of water reserve and watersheds are mentioned below.

1. The plants and animals found in watershed and wetlands are source of food of human beings and other animals.
2. Water reserves and wetlands are habitat of many plants and animals. Fish and other aquatic animals reproduce in such sources of water.
3. Many types of birds migrate to these regions for the temporary habitat in extreme seasons. They come to such places to escape from the extreme and to reproduce.
4. Such regions are considered as the container of rain water and function as the source of water used for different purposes.
5. These regions play a vital role to maintain the balance of environmental temperature and to conduct water cycle.

4.2 Depletion of natural resources

fig 4.7 fire, urbanization

Discuss the given questions on the basis of the observation to the following figures.

a. What other natural resources along with plants in the forest are destroyed by jungle-fire or Dadhelo?

b. What efforts can be made to protect forests from forest fire?

c. How does urbanization deplete natural resources?

d. What are the other causes of depletion of natural resources?

Project work

By asking with your parents, investigate the presence of natural resources, number of wild animals and forest nearby your house that were found in the past in your locality. Fill the information in the given chart and present in class.

Natural resource	Previous condition	Present condition	Probable cause of the change

What may be the cause of difference in the conditions told by the guardians and seen at present? Discuss in class.

Due to overpopulation, the use and demand of metals, petroleum, natural gases etc. are being increased day by day. Deforestation is also occurring at a high rate. People are suffering from the environmental pollution caused by Jungle-fire, which occurs every year by the human activities and other natural cause like lightning. It is destroying crop product too. Jungle fire and deforestation are also degrading bio-diversities. The practice of production of more crops in less cultivable land, with uncontrolled use of chemical fertilizers and insecticides decreases the fertility of soil. Due to increasing industrialization, the emitted waste is polluting natural resources like air, water and soil. People are deprived of getting fresh air to breathe. These activities are also decreasing the level of underground water. Overuse of the natural resources leads to their depletion. During volcanic eruption, fossil fuel and forest products are destroyed. On the basis of the fact mentioned above, the causes of depletion of natural resources can be summarized in following points.

1. Overpopulation and imbalanced migration

2. Unmanaged agriculture system
3. Deforestation and jungle-fire
4. Overconsumption of natural resources
5. Pollution
6. Industrial and technical developments
7. Natural disasters

Activity 4.3

How does depletion of natural resources affect our daily life? Mention affected areas, effects and measures to minimize effects in the table given below.

S. N.	Affected areas	Effects	Measures to minimize
1.	Water		
2.	Fuel		
3.	Forests		
4.	Mineral rocks and metals		
5.	Biodiversity		

4.3 Management of solid waste

Various types of waste come out from houses, industries and farming as well. Peel of fruits and vegetables, dust and other solid wastes come out from houses. Similarly different types of harmful gases and chemicals come out from the industries. Agricultural waste comes out when we harvest grains. All the unwanted substances are called waste or garbage. If the waste is not managed properly, it causes pollution that may harm us and other organisms seriously.

These wastes have negative impacts on our health and on

Fig 4.8

environmental balance as well. Thus, we must do their safe emission and proper management. The figure shows waste collected in the city of Nepal. Observe the figure and discuss about the following questions.

a. What effects will occur on human health, if solid waste is not disposed safely?

b. How can waste affect our domestic cattle?

c. How has domestic garbage managed in your house?

d. If there is an industry nearby your house or school, how is its waste emission affecting to our environment?

Garbage may be in any state like solid, liquid or gas. Some of them are biodegradable and some are non-biodegradable. We can maintain our environment balanced, clean and healthy by the proper management of the waste. We have to manage these different types of waste by different methods.

The pollution caused by waste also degrades the quality of soil. In present days, the proper management of the waste has become a big challenge for the government of many countries.

By the proper management of solid waste, we can solve the problem of waste in addition with the supporting the availability of raw materials and increment in economic source.

The 3R's model waste management is found effective for the solid waste management. The three components of 3R's model are as given below:

A. Reduction
B. Reuse
C. Recycle

A. Reduction

Wise use of natural resources and things, which reduce environmental pollution, is reduction. Use of reusable cotton/ cloth bags instead of disposable polythene bags is encouraged to use in shopping and not bringing unnecessary things of packing from market are some example of reduction. Our activities help to reduce the use and production of pollution causing materials. For example, if we decrease the use of polythene bag for shopping their production will also be minimized and it will support to manage solid waste. In the same way, use of chemical fertilizers and insecticides can be reduced. We can use organic fertilizers instead of chemical fertilizers and biological methods to control insects instead of using harmful insecticides.

B. Reuse

If the things used once are used for another purpose without disposing, it is called reuse. The clothes that are not useful for us can be given to the people who wants to use it. If same

Fig 4.9

thing is used again in this way, it helps to reduce the demand in the market and rate of production decreases. Consequently, the adverse effect on environment decreases. A single bag is reused time and again while purchasing things in the market. For example, cans or plastic containers or glass vessels of packed powder milk, chocolates and other products can be used to store grains, flour, tea leaves, sugar, salt etc. Such some bigger containers also can be used for plantation in them.Plastic bags used for packing of grains and flours, milk packets etc. can be used as vase. Plastic and glass bottles can be used to decorate our terrace, porch and gardens too.

C. Recycle

The old substances used once can be used as raw material for production of new articles. The old newspapers, books, an exercise book are used to prepare new paper in paper industries. Old utensils of iron, copper, brass, aluminiun metals wires, tools, vehicles, arms etc. are melted to make new metallic vessels and articles. Old plastic bags, pipes, utensils and containers are used to remold into new plastic articles by heating. The entire activities mentioned above are examples of recycling that supports in solid waste management.

Thus 3R model is very useful in solid waste management.

Activity 4.4

In what ways are reducing, reusing and recycling done in your house and in school for solid waste management? Complete in table given below and discuss in class.

Place	Reduce	Reuse	Recycle
House			
School			

Project work

Take a plastic bottle and make holes in it as shown in the figure. Insert twigs of some plants like mint twigs in the holes. Keep the bottle in shed for a week and supply water regularly. After that, keep the bottle in sunlight. In what aspects of solid waste management and environmental conservation has the activity supported? Discuss.

Project work

Make different articles and decorating materials by reusing waste paper and plastic in your house and school. Decorate your classroom by using them.

Exercise

1. Tick (√) the correct alternative of the following questions:

a. Which one is non-renewable natural resource?

i. Air ii. Coal

iii. Water iv. Soil

b. How does natural imbalance occur?

i. By the overuse of non-living things

ii. By the less use of non-living things

iii. By changing structure of non-living things

iv. By changing in structure and overuse of non-living things

c. How can we minimize the loss of life and property in the bank of rivers?

i. By conserving water

ii. By conserving wetland

iii. By conserving water reserves

iv. By conserving natural resources

d. What type of solid waste management is 'Remolding of used plastics' ?

i. Reuse

ii. Reduce

iii. Recycle

iv. Both A and C

e. What are the similarities among water resource, water reserve and wetland?

i. Interactive relation between water and land

ii. Being enough source and flow area of water

iii. Support to animals and plants

iv. Depend on water cycle as a source of water

f. Which statement defines biodiversity?

i. Existence of various types of organisms according to the environment

ii. Existence of same types of organisms in different places

iii. Existence of different climate at different places

iv. Existence of different natural resources in different environment

2. Fill in the blanks with suitable words given below:

environment balanced environment recycle
renewable non-renewable biodiversity
reduction

a. Availability of variety of animals and plants is .....

b. The maintenance of balance in the amount of living beings and nonliving things is called .....

c. The practice of not bringing the packaging materials of bought things to home is called.....

d. The natural resource that can be replaced shortly after it is finished at its origin place is called..... resource.

3. Answer the following questions:

a. Write the importance of biodiversity.

b. How can we maintain ecosystem balanced?

c. What is wetland?

d. Why are water reservor important?

e. Mention major methods of solid waste management.

f. How does the extensive use of chemical fertilizers and insecticides to produce more crops in less land deplete natural resources?

g. Explain the importance of wetlands.

h. "Nepal is rich in biodiversity", Justify the statement with your logic.

i. Write the differences between:

   i. Reuse and recycle

   ii. Water reserve and wetland

   iii. Renewable and nonrenewable resource

j. Explain the interrelationship between environment and biodiversity.

k. What are the precautions to be taken while using natural resources?

l. What are natural resources? On which basis they are classified?

m. Describe about any five causative factors of depletion of natural resources in short.

4. Answer the following questions on the basis of the given diagram:

i. What is the impact of this activity on agriculture?

ii. What are its effect on water resource and water reserves?

iii. How does the activity affect on the wildlife?

iv. Which natural resources are shown in the figure?

v. What may be your role to balance it?

5 Life Process

Some life processes are shown in the figure given below. Study them to discuss about the questions listed below:

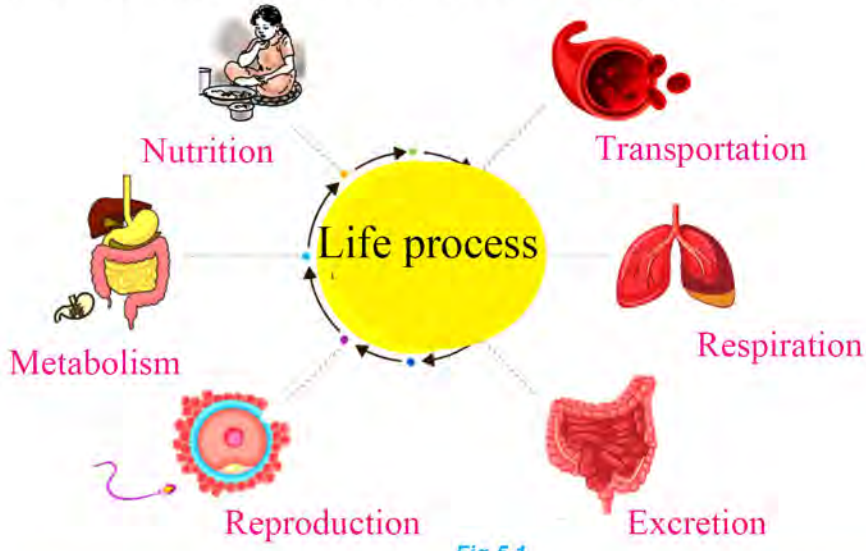


Fig 5.1

a. Which of these life processes occur in both animals and plants ?

b. What effect will be seen on the organisms if any one life process of them is imbalanced?

c. By which life process are nutrients transported to each cell of body?

The process by which living beings survive, grow and reproduce to continue their generation are called life process. For example, living beings eat food to get energy, digest, respire and reproduce to continue the generation. Life processes like nutrition, digestion, respiration and reproduction support the organisms to survive and to maintain the continuity of their generation. Respiration, digestion, transportation, excretion, reproduction, growth etc. are some major examples of life process occurred in plants and animals.

5.1 Transportation

Fig 5.2 Transportation in plants

We eat food to survive. After the digestion of food how do the nutrients reach to each cell of the body? How does the effect of medicine reach to finger to heal wound even the medicine reaches to stomach?

The living cells of all the organisms need oxygen, nutrients and other substances to survive and to remain healthier. In every cell, various types of substances are also formed which are not required for the body. The process of supplying required substances to the cells and transporting unnecessary substances from the cells to the related excretory organs is called transportation. Transportation is occurred in various methods in different types of animals and plants.

5.1.1 Transportation in plants

Fig 5.3

Activity 5.1

Objective: To observe transportation in plants

Required materials: twig of white rose with flower, beaker, coloured water

Method: Take coloured water in a beaker and place a twig of white rose with flower. Observe it at least after half an hour.

Discussion and conclusion: Did you see the change in the colour of rose petals? Why? Discuss about the cause.

Plants absorb water and salt from soil through their root and they transport such substances to leaves through a tissue called xylem. The food prepared in the leaves and other green parts of a plant is transported to different parts of it through another tissue called phloem. These mentioned events are few examples of transportation in plants. In plant, transportation of gases like

oxygen and carbon dioxide also occur. These gases enter through fine pores on leaves called stomata. Then they are transported by dissolving with the liquid transported by xylem.

5.1.2 Transportation in animals

Transportation method varies between one animal to another animal. Unicellular and simple animals do not have special organs for transportation. In developed animal, transportation system is found in their body. There are different methods of transportation in invertebrates and vertebrates.

Fig 5.4 ransporation in Sponge

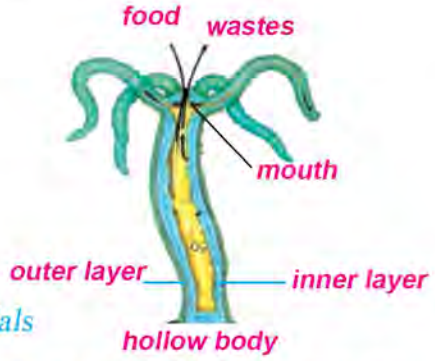


Fig 5.5 Transportation in Hydra

We know that body of unicellular organisms is made of single cell. In Amoeba, the required substances like food and oxygen enter through cell membrane. Unnecessary substances are also thrown out through cell membrane. These substances are transported from one point to other by the cytoplasm inside the cell.

Fig 5.6

In multicellular animals with simple structure like Jelly fish and hydra have some particular organs for transportation. They have pores and hole in their body to pass required substance in and unnecessary substances out of the body. In sponge, oxygen, food and water enter in their body through ostia (pores) and waste is thrown out through osculum (hole). In hydra, food and

undigested waste pass in and out through its mouth and gases are exchanged through the pores on its body. Their canal and tissue present in their body supports to distribute such things to different cells of the body.

Transportation system is developed in human and other developed animals. Blood circulatory system is the main system. Blood circulatory system consists of blood, blood vessels and heart. Oxygen, nutrients and other required substances for cells dissolve in blood. The blood carries them to different cells by flowing in blood vessels. The cells absorb required things from the blood and leave waste in the blood by the process of diffusion.

5.2 Excretion

Have you ever seen water droplets at the marginal region of leaves of a plant early in the morning? From where such droplets have come? Discuss in class.

Fig 5.7

During the conduction of life processes in living being, bodies produce such substances which are not required for the body of that organism. If such substances remain for longer time inside the body they may harm our body. Some substances may present in more than required amount in the body. The process of expelling out such waste and excess substances from the body is called excretion. Both animals and plants excrete such things in various extent.

5.2.1 Excretion in plants

Activity 5.2

Objective: To observe excretion in plants

Required materials: Potted plat, transparent polythene bag, string

Fig 5.8

Method: Take a potted plant and insert the tip of one of its branch in a dry polythene bag. Now tie the open end of the bag using a thread. Observe it after 5 to 6 hours.

Discussion and conclusion: What is seen at the inner surface of the polythene bag? Conclude by discussing in class.

Plants excrete oxygen, carbon dioxide and water. Green plants give out oxygen during photosynthesis, a part of this oxygen is used in respiration and the rest is expelled out from the body. During respiration, the plants expel carbon dioxide.

Fig 5.9

Carbon dioxide is expelled out through the stomata found on the surface of the leaves of plants during respiration. The plants throw excess amount of water in the form of vapour. The process is called transpiration. In addition to this, water is excreted through hydathodes. Hydathodes are the opening of fine tubes at the marginal region of leaves. Water is excreted in liquid form through them, the process is called guttation. Plants do not have special excretory organs like in animals. Plants excrete in the form of resin, latex and oily substances.

5.2.2 Excretion in animals

Animals have excretory system for excretion of waste from their body. Animals do not have similar excretory organs. Unicellular animals excrete the unnecessary substances through their cell membrane. Diffusion is the process by which the unnecessary substances are separated and expelled out from the body of unicellular animals. The insect like grasshopper have malphigian tubules for excretion.

Human beings and other developed animals have different types of excretory organs like skin, lungs and kidneys.

Fig 5.10

In developed animals, sweat is excreted by skin, lungs excrete carbon dioxide and kidney excretes urine. The sweat glands found in skin that excrete excess water, salt and urea as sweat.

Fig 5.11

Lungs help to excrete carbon dioxide obtained during respiration. The urinary system plays vital role in excretion in human body. Urinary system consists of two kidneys, two ureters, a urinary bladder and a urethra. Kidneys are the main organs of urinary system. The excess amount of salt and water, harmful chemicals like urea and uric acid are excreted from blood by the help of kidneys in the form of urine. A pair of ureters carry urine in to urinary

bladder. The urine stored in urinary bladder is thrown out through urethra.

Activity 5.3

Sketch a neat and well-labeled figure of human urinary system on a chart paper and colour it with suitable colour. Discuss in class about the working method of different parts of the urinary system using the chart.

5.2.3 Differences between excretion in animals and plants.

Activity 5.4

Complete the given table:

Animals	Basis of difference	Plants
	Excretory organs	
	Excretory substances	
	Reuse in body of the excretory substances	

Discuss in class and conclude the difference in excretion in animals and in plants on the basis mentioned above.

5.3 Respiration

Can we stay without breathing for a long time? Why? Discuss in class.

The food eaten by living beings can not gain energy by only digestion of food. To gain energy the nutritive substances obtained from food should be broken. This process is occurred inside the cells in the presence of oxygen gas. It is possible to do many types of physical work and to conduct life process due to energy obtained from respiration. The process of getting energy by the decomposition of food is called as respiration. The process can be expressed by the following method in short.

Nutrients (glucose) + oxygen ⟶ water+carbon dioxide + energy

Are respiration and breathing same process? In breathing, there is only exchange of gases occurs. In this process, air is inhaled to get oxygen and air is exhaled to throw out carbon dioxide. Respiration is complex chemical process. Do plants respire? Animals and plants both respire. Both of them use oxygen for respiration and give out carbon dioxide.

5.3.1 Respiration in plants

Activity 5.5

Objective: To demonstrate 'do plants give out carbon dioxide during respiration?

Required materials: Conical flask, beaker, one holed cork, U shaped glass tube, limewater.

Fig 5.12

Method: Take a conical flask and keep few germinating gram or pea seeds in it. Connect U shaped glass tube in that flask by the help of the cork. Insert theother end of the tube in the beaker containing lime water. Observe thechange occurred in the lime water after half an hour.

Discussion and conclusion: Why does the lime water turn into milky?

Fig 5.13

The germinating seeds kept in the conical flask give out carbon dioxide during respiration. When the carbon dioxide passes into lime water, then the water turns into milky. The experiment proves that plants give out carbon dioxide gas during respiration. Plants take in oxygen and give out carbon dioxide through stomata and lenticels.

5.3.2 Respiration in animals

Why do we feel weakness when we do not take food and water for a long time? Why do we feel hungry after 3-4 hours from

taking meal? Discuss in class.

Animals use various methods and different organs for respiration. Which part or organ do unicellular animals, sponge and hydra use to respire? Discuss in class.

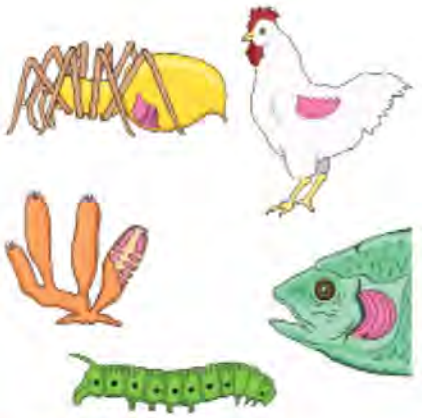
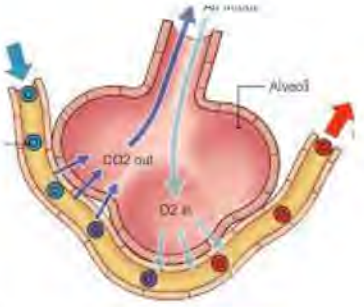


Fig 5.14 Respiration system

Unicellular to developed animals use the organs like cell membrane, pores, spiracle, skin, gills, nose, mouth and lungs for respiration.

We respire through lungs. Human respiratory system consists of nose, trachea and the lungs. Nose is connected with trachea. Trachea is connected with lungs. The lungs are the sac like structures found in thoracic cavity. There are millions of air-sacs in each lung, called alveoli. The air entered in nose during breathing reaches to the alveolus through trachea and bronchi. The blood present in the capillaries around the alveolus absorb oxygen from the air by diffusion process. In the same way, carbon dioxide is left in the air by the impure blood. In this process impure blood is purified. The pure blood supplies oxygen to each cell. In the cells the food is oxidized using the same oxygen to release energy for different purposes.



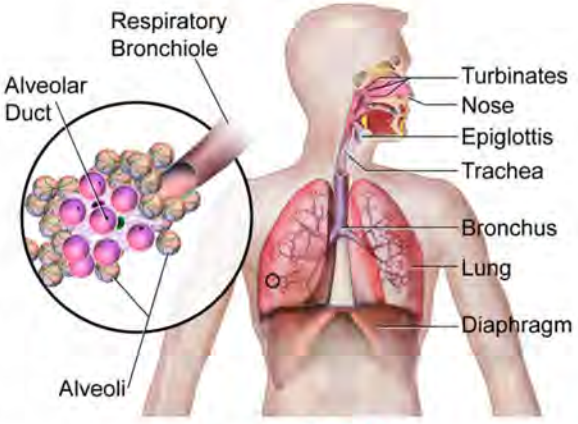


fig 5.15

Exercise

1. Tick (√) the correct alternative of the following questions :

a. In which process does the waste product of body reach to excretory organs?

i. Respiration ii. Transportation

iii. Excretion iv. Reproduction

b. In which part are oxygen and carbon dioxide exchanged?

i. Kidneys ii. Lenticels

iii. Xylem iv. Alveolus

c. Which of following is respiratory organ of insects?

i. Stomata ii. Spiracle

iii. Lenticels iv. Skin

d. Which statement is true about the excretion of excess water in plants?

i. Plants excrete excess water in the form of vapour.

ii. Plants excrete excess water in the form of droplets.

iii. Plants excrete excess water in the forms of gas and liquid.

iv. Plants excrete excess water in all the forms of water.

e. To which life process is the given chemical reaction related to?

Glucose + oxygen → water + carbon dioxide + energy

i. Digestion ii. Transportation

iii. Excretion iv. Respiration

f. How does transportation take place in multicellular animals like sycon and other sponges?

i. It is occurred through canal system.

ii. It is occurred through special tissues.

iii. It is occurred through cell membrane.

iv. It is occurred through coelenteron.

3. Fill in the blanks using suitable words given below:

life process carbon dioxide respiration excretion oxygen cell membrane

a. The production of energy by decomposition of food occurs in.....

b. Plants take .....during respiration.

c. Transportation in unicellular animals occurs through.....

d. The process, which occurs in living beings only is called.....

4. Answer the following questions:

a. Describe the excretion in human body in short.

b. How does transportation occur in plants?

c. Elucidate the importance of respiration.

d. How do unicellular animals excrete?

e. Describe the excretion process in plants in short.

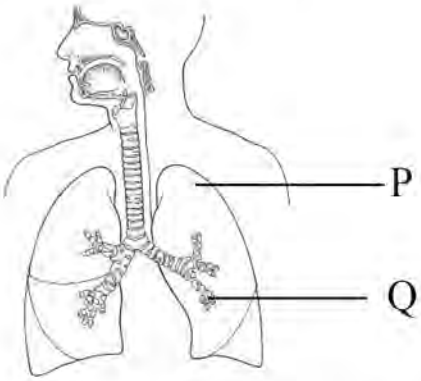
f. Explain the respiration process in human body in short.

g. Write differences between the respiration in insects and fish.

h. What are the differences between excretion in animals and plants?

i. Why does both the breathing rate and heart beat increase while running? Explain.

j. Answer the following questions on the basis of given diagram.



i. What is the function of this system?

ii. Name the part indicated by P.

iii. In which organ of body is alveolus present?

iv. What is the function of the part indicated by Q?

v. In which part does exchange of oxygen and carbon dioxide take place?

k. Sketch a neat figure of the human excretion system. Also label any four parts of it.

6 Force and Motion

We do different types of work in our daily life. We need to apply force to do such works. The force applied on a body affects on it. A moving body changes its position. Motion of a body may be in a straight line or curved path. In this unit we will study about distance, displacement, speed, velocity, gravity, weight, work and power.

6.1 Distance and displacement

Ramesh's house is at position A. There are two paths to go to the school at position B east from his house. Although the path X is curve, he goes to school using the path X because the bridge of the path Y has collapsed.

Fig 6.1 Distance and displacement

Does Ramesh walk in the same direction in path X?

Which path of them has the shortest distance between the house and the school?

The path X which is not in particular direction shows the distance between A and B. While the path Y shows displacement from A to B towards east. Thus, displacement is the distance in a straight line.

Activity 6.1

Take a measuring tape. Go to the field near your school with one

of your friends. Mark points A, B, C and D as shown in the diagram on the field. Then ask your friend to walk on the path A, B, C and D in the Z shaped path. Find the total distance covered by your friend by measuring and calculating in the following pattern.

Total distance= distance between A and B + distance between B and C + distance between C and D.

Now measure the distance between A and D to find displacement.

Are the magnitudes of distance and displacement same? Is the direction of distance and displacement similar? In which direction is the displacement?

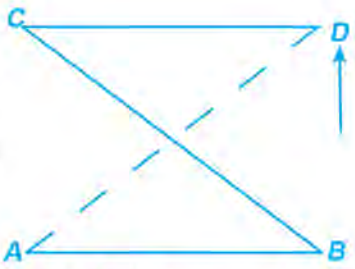


Fig 6.2 Distance and displacement

Distance is the total length of the path covered by a body when it travels from one place to other. It is denoted by 'd'. We need only magnitude for complete expression of distance. Those quantities which can be expressed by magnitude only are called as scalar quantities or scalars. Distance can be expressed as the product of speed and time. The SI unit of distance is metre (m).

Distance = speed x time

The shortest distance between two places is called displacement. It has a particular direction. It is denoted by 's'. We need both magnitude and direction for the complete expression of displacement. Those quantities which have both magnitude and direction are called vector quantities or vectors. Displacement can be expressed as the product of velocity and time. The SI unit of displacement is also metre (m).

Displacement) = velocity x time

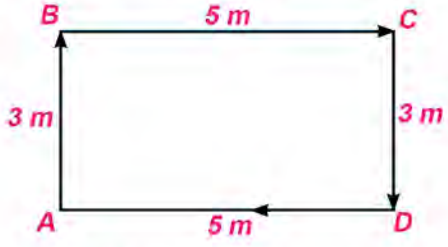


Fig 6.3 Rectangular path

Activity 6.2

Roshani walks in the path A, B, C and D as shown in given diagram. If she starts to walk from A and finally reaches at A again, answer the questions given below:

S. N.	Questions	Condition	Cause
1.	In which condition is the value of distance not zero but value of the displacement is zero?		
2.	In which condition is the value of speed and displacement equal?		
3.	In which condition is the value of displacement negative?		

If Roshani reaches at the point A by starting to walk from the same point, she has displacement zero but she covers a distance of 16 m (3+5+3+5). When she reaches at B her distance and displacement both are same (3 m) as she covers the distance in a straight line and in the same direction. When Roshani reaches at point C and turns right, she moves in the opposite direction of AB, now she has negative displacement.

Activity 6.3

Discuss and conclude the differences between distance and displacement as shown in the table.

Basis of difference	Distance	Displacement
1. Definition		
2. Direction		
3. Scalar or vector		
4. Relation with speed/velocity		

6.2 Speed and velocity

Dolma takes 30 minutes from her home to reach uncle's home by walking on the path A. If we have to find her speed, we have to divide the total distance covered by her by the time taken to cover the distance. When she walks on the path A, she covers total distance of 1800 m, in this condition,

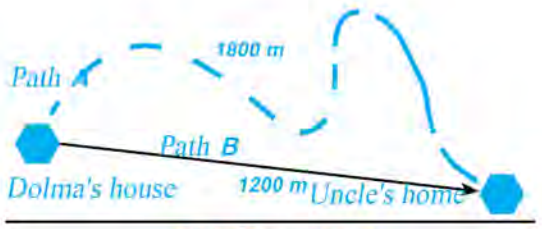


Fig 6.4 Distance and displacement

$$\text{speed} = \frac{distance}{time}$$

$$= \frac{1800}{1800} \text{ m/s} = 1\text{m/s}$$ (1minute = 60 sec, 30m= 60 x30 =1800 s)

Thus, the speed of Dolma is 1 m/s.

The distance covered by a body in a unit time is called speed of that body. It is a scalar quantity and its SI unit is m/s.

The shortest distance between the Dolma's house to her uncle's home is shown by the path B, that is 1200 m east. In this condition,

$$\text{Velocity} = \frac{displacement}{time}$$

$$= \frac{1200}{1800} \text{ m/s} = 0.67\text{m/s}$$

Thus, the displacement of Dolma is 0.67 m/s in east.

The rate of displacement of a body is velocity of that body. The displacement made by a body in unit time is called velocity of that body. It is a vector quantity and its SI unit is also m/s.

Activity 6.4

Discuss and write the differences between speed and velocity as shown in the given criteria.

Criteria of differences	Speed	Velocity
1. Definiton		
2. Direction		
3. Scalar or vector		
4. Relation with distance or displacement		

6.2.1 Numerical problems

Example 1

Rahima travels the path from P to R through Q. She takes 1 minute to cover the distance from P to Q and then 2.5 minutes from Q to R. Calculate her speed when she covered the distance between P and R. Calculate her velocity when she moves from P to R directly in 3.5 minute time.

Here,

Distance (d) =32 m + 78 m = 110 m

Displacement (s) = 100 m

Time (t) = 1 min + 2.5 min = 3.5 min = 3.5 x 60 s = 210 s

Speed = ?

Velocity = ?

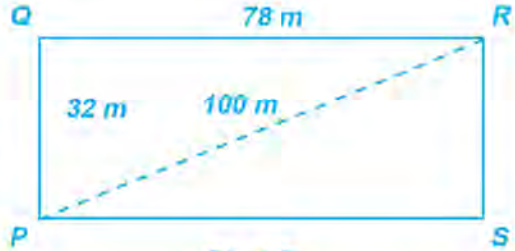


Fig 6.5

According to definition of speed,

$$\text{Speed} = \frac{d}{t}$$

$$= \frac{110}{210} \text{ m/s} = 0.52 \text{m/s}$$

Hence, speed of Rahima is 0.52 m/s.

According to definition of velocity,

velocity $= \frac{s}{t}$

$= \frac{100}{210}$ m/s = 0.48m/s

Hence, velocity of Rahima is 0.48 m/s from P to R.

Example 2

A car is travelling in the velocity of 20 m/s. How long does the car take to travel the distance of 80 m?

Here,

Distance (d) = 80 km = 80 x1000 m = 80000 m

velocity = 30 m/s

Time (t) = ?

According to definition of speed,

$\text{Speed} = \frac{d}{t}$

or, $30 = \frac{80000}{t}$

or, $t = \frac{80000}{30}$ = 2666.67s = 44.45 min.

Hence, the car travels the distance in 44.45 min.

6.3 Gravity

Fig 6.6 (a) Water fall (b) Dropped stone

Observe the given diagram. Is the direction of motion of the waterfall and the falling stone same? Why does it happen? Think just a moment. Newton searched the answer of this curiosity in the mid of 17th century when he saw a falling apple from a tree. He identified the attraction force of the earth as the cause of the falling object towards its surface. The force of attraction of the earth is called its gravity. Newton discovered

that all the heavenly bodies in this universe including the earth attract each other towards their centre by a force of attraction. The force of attraction is called gravitational force. Gravitational force between any two objects is acted towards their centre.

Due to the gravity of the earth the atmosphere is around it. Gravity causes rain, snow and hail fall towards the earth's surface. When a body is thrown up or dropped down vertically, gravity causes the change in the velocity of the body. The change in velocity of a body per unit time is called acceleration. The acceleration produced in a body due to force of gravity is called acceleration due to gravity (g). Average value of g on the earth surface is 9.8 m/s2. Gravity of the earth causes weight of a body.

If there is no gravity on the earth, what might be its effects in our daily life? Discuss and present the conclusion in your class.

6.4 Weight and its measurement

Activity 6.6

Objective: To find the relation between mass and weight.

Materials required: Two pieces of stone of different masses, string or thread, spring balance.

Procedure: Take a small and a big stone. Tie them with two separate threads. Hang the stones in spring balance and weigh them one by one. Record the weights in the following table.

Size of the stone	Weight
Small stone	
Big stone	

Discussion and conclusion:

What may be the cause of difference in weight of the stones? What can be concluded by the activity?

The force of attraction of the earth on a body towards its centre is called weight of that body. Numerically, the product of mass of a body and its acceleration due to gravity is called as weight of that body. More gravity is acted on the bodies having more mass. Less gravity is acted on the bodies having less mass. The more will be the gravity acted on a body, the more will be its weight. We use a spring balance to measure weight of a body. As the weight is a kind of force, its SI unit is Newton (N).

fig 6.7

The relation between mass and weight is shown by the following formula:

Weight = mass x acceleration due to gravity or $W = m \times g$

Numerical problems

Example 1

Calculate the weight of a body having mass of 50 kg. ($g = 9.8\ m/s^2$)

Here,

Mass (m) = 50 kg

Acceleration due to gravity (g) = 9.8 m/s^2

Weight (W) = ?

According to formula,

W = m x g

= 50 x 9.8

= 490 N

Thus, weight of the body is 490 N.

Example 2

Calculate the mass of a body having weight of 1200 N. (g= 9.8 m/s^2)

Here,

Weight (W) = 1200 N

Acceleration due to gravity (g) = 9.8 m/s^2

Mass (m) = ?

According to formula,

$$W = m \times g$$

$$m = \frac{W}{g}$$

$$= \frac{1200}{9.8} = 122.45 \text{ k}$$

Thus, mass of the body is 122. 45 kg.

6.5 Friction and its nature

Have you ever slipped while walking? Remember once the place where you have slipped. How was the surface of the place where you slipped? Was it dry or wet? Was it rough or smooth? Had you slipped on rolling objects or non-rolling objects?

Usually less resistance (opposing force) is produced in between the wet, smooth and rolling surfaces. Opposite to it, more resistance is produced in between the dry, rough and non-rolling surfaces. The opposing force produced between two surfaces when a body moves on the surface is called friction. Every object does not have perfect smooth surface. The surfaces appearing very smooth also have fine projections and depressions at their surface which can be noticed when observed under a hand lens. Projections are the raised structures and the depressions are the pressed structures found at the surface. When a body slides over the other body, the projections of the surfaces interlock each

other and oppose the motion. This opposing force creates friction on the surfaces of moving bodies.

Fig 6.8

Activity 6.7

Objective:

To measure frictional force

Materials required:

Rope, bricks or rectangular wooden blocks, spring balance

Method:

Take a rope and tie the brick or wooden block in such a way that it is suitable to fasten in a spring balance. Fasten the rope in a spring balance and slide the object (brick or wooden block) in the position as shown in the condition 1 of the figure.

Then repeat the activity 1 by adjusting the object as shown in the condition 2 of the figure.

Finally repeat the activity 1 keeping the object in the same position of activity 2 but place another object also over the first as shown in condition 3.

Discussion and conclusion:

Analyze the result of the activity and find the result.

The amount of frictional force depends on the nature of the surface and the pressing force on the surface. Friction is more on the rough surface than on the smooth surface. More pressing force on moving surface increases the friction on the moving body.

Advantages and disadvantages of friction

Why does the possibility of slipping increases when the projections made on the sole of shoes wear away? Is it easier to walk by animals and run vehicles on the roads if there was no friction?

We have seen different designs made at the rolling surface of tyres of vehicles. The cause of making so is to increase the friction between the tyre and the road. It avoids the slipping of tyres and supports to move the vehicle. We apply brakes to stop a rolling bicycle. Is it possible to stop moving vehicles if there is no friction? The friction also plays an important role to join two wooden pieces hammering nails in them or fastening by using nut-bolts. In this way friction is essential for us as it supports to make our daily life easier.

There are some disadvantages of friction too. Do you remember any event of life that became difficult to do due to friction? The friction produced between the sliding or rolling surfaces changes the kinetic energy into heat energy. In this way input energy is wasted and efficiency of machine decreases. It needs more effort to accomplish any work by using that machine. More frictions between the parts of a machine causes wearing and tearing of the parts. Friction is taken as necessary evil because of its advantage and disadvantages.

6.5.2 Measures of minimizing friction

Observe the given figure. Try to find the cause of using oil and grease in the hinge of the door and the chain of bicycle? Friction reduces the efficiency of machines, thus friction is reduced to increase the efficiency of the machines. There are different methods of minimizing friction in machines. What methods have you seen by using which friction is reduced in machines?

Activity 6.8

Objective:

To compare friction produced at smooth and rough surfaces.

Materials required:

Polythene bag, books, rope or string, table, spring balance

Method:

Fig 6.9

1. Keep two books in a polythene bag and tie the mouth of the bag using a string.
2. Fasten the bag in the hook of the spring balance and pull the bag with books. Measure the force required.
3. Now repeat the activity 2 by placing 10 ml of water on the table. Measure the force applied to pull the same bag. Is it easier or difficult to pull now?

Discussion and conclusion:

Does the spring balance show same or different value? What is its cause? Discuss.

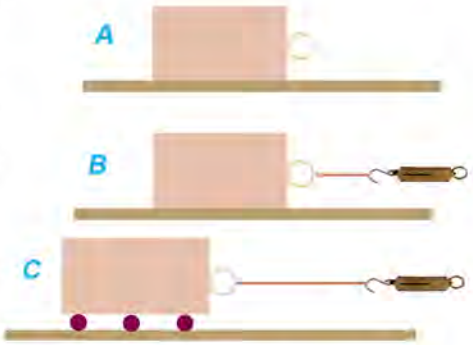


Fig 6. 10 Minimizing friction

There is more friction between rough surfaces than between smooth surfaces. Due to this fact, friction between moving surfaces is minimized by making the sliding or rolling surfaces smoother.

Activity 6.9

Objective:

To compare friction produced in sliding and rolling surfaces.

Fig 6.11 Ball bearing

Materials required: A wooden block, spring balance, a cylindrical pencil

Method: Adjust the wooden block on a table as shown in figure A. Pull the block by fastening the block in a spring balance as shown in the figure B. record the force required to pull it. Then

place 2-3 pencils below the wooden block and roll the block over them as shown in figure C. Record again the force applied to roll the block.

Discussion and conclusion:

What is the difference in applied force to slide and to roll the block? Find the conclusion on the are used in machines to reduce friction. Such lubricants make the sliding and rolling surfaces smoother. Ball bearings are also used in machines for the same purpose. In ball bearings, iron balls are kept in between two flat rings to roll the rings one over the other. It reduces friction as magnitude of rolling friction is lesser than that of the sliding friction. Such ball bearings are used in electric fans, electric motors and in all those machines which roll.

The front part of those objects which have to move fast in air or in water is made narrower than other parts. The shape of the object is called streamlined. In fact streamlined objects have both the ends narrower than the middle part. For example, aeroplanes, ships, boats, bullet trains etc are provided streamlined shape to reduce friction between them and air or water.

6.6 Work and power

6.6.1 Work

Observe the given figures. The figures show a standing security person, a girl reading book, a man playing Madal and a person walking in a park. Are all of them doing work in the language of science? Who of them are doing the work? Identify with reason.

Fig 6.12

In fact, science does not consider work, if a person is staying at rest with load on his/her body. In science, for doing work an object has to cover a distance in the direction of force applied on it. Thus, work is defined as displacement done by application of force.

fig 6.13

Or, Work (W) = force (F) x displacement (d)

The SI unit of work is joule (J). When a body covers a distance of 1 m by the application of 1 N force, 1 J work is done.

1 J = 1 N x 1 m

If force applied on a body while doing work is in opposite direction of the frictional force, the work done is called work against friction.

When we slide or roll an object, the applied force is in opposite direction of frictional force and it is called as work against friction. Walking, cycling, pushing or pulling cart etc. are some examples of this type of work.

If force is applied on a body to do any work is in opposite direction of gravity, it is called work against gravity. While lifting a load or throwing an object upwards is work against gravity. Pulling up water from a well, lifting a body walking on slope, etc. are some other examples of this type of work.

6.6.2 Power

Consider you have to go to the market which is distant from your house. By using which mean of transportation can you reach faster; by a bicycle ora motor bike? Do both means of transportation have same capacity to do work?

चित्र 6.14

All the persons or machines do not have same capacity to do work. Some persons or machines can do a work in less duration but other persons or machines may need more duration to do the same amount of work. The reason is that different persons and different types of machines have different capacities of doing work. The capacity to do work by a person or machine is called as power of that person or machine. If Dataram dug a field in 3 hours but Sohan used only two hours to dig the same area of field, what is the difference in the work done by them? If there is no difference in work done by them, Sohan did the same amount of work in less time. If we analyze, the work done by them per unit time, we find that Sohan has done more work in unit time relative to Dataram. The person or machine completing a work in less time has more power. The work done per unit time by a person or a machine is called as power of that person or machine. Power is also called as rate of doing work. Its SI unit is watt (W).

$$\text{power} = \frac{\text{Work (W)}}{\text{time(t)}}$$

The SI units of work and time are joule (J) and second (s) respectively. Thus we can say that unit of power is joule per second. 1 Joule per second is also called as 1 watt (1 W). If we know the power of a machine, we can understand that how fast a work can be done by using that machine. 1 W power of a machine shows that the machine can do 1 J of work in 1 s. Power of a machine is also expressed in the unit horsepower. The relation between horse power and other units of power with watt is mentioned below:

1 horse power (hp)= Approx. 746 W

1000 W = 10^3 W = 1 kilowatt (kW)

1000000 W= 10^6 W = 1 megawatt (MW)

Numerical problem

Example

Rashmila carried 20 kg of maize from her house to the watermill that is 2 km far from her house. What is work done by her? If she consumed 1 hour to complete the work, what is her power?

Here,

Distance (d) = 2 km =2 x 1000 m = 2000 m

Mass (m) = 20 kg

Time (t) = 1 h = 60 x 60 s = 3600 s

Work (W) = ?

Power (P) = ?

Now for the weight of the body, we have-

F (weight) = m x g

= 20 x 9.8 = 196 N

We also have,

Work (W) =F x d

= 196 x 2000

=392000 J

Again, for power

$$\text{Power} = \frac{w}{t}$$

$$= \frac{39200}{3600}$$

= 10.89 watt

Thus, Rashmila does 39200 J work and her power is 108.9 W.

Exercise

1. Tick (√) the correct answer:

a. What is unit of work?

i. W ii. N iii. J iv. hp

b. What is the product of force and distance called?

i. Work ii. Power

iii. Displacement iv. Friction

c. Which of following is an example of displacement?

i. Distance travelled in circular path

ii. Distance travelled in rectangular path

iii. Distance travelled in spiral path

iv. Distance travelled in straight path

d. Which of the following statement is true?

i. Rolling friction is greater than the sliding friction

ii. Sliding friction is greater than the rolling friction

iii. Friction in between the rough surfaces is more

iv. Friction on wet path is more

e. Which of the following statement is true?

i. Distance and weight both are vector quantities

ii. Distance and weight both are scalar quantities

iii. Distance is scalar quantity as it always travels in a particular direction

iv. Weight is a vector quantity as it always applied towards the earth's centre.

f. A person covers a distance of 70 m around his house from the main gate. Which statement is true about this event?

   i. Distance covered by him and his displacement both are 70 m.

   ii. Distance covered by him is 70 m but displacement is 0.

   iii. Distance covered by him is 0 m but his displacement is 70 m.

   iv. Distance covered by him and his displacement both are 0 m.

g. Which of the following is the cause of more weight of big stone and less weight of small stone?

   i. More gravity on the big stone as it has more mass.

   ii. Equal gravity on both of them but small stone has less mass.

   iii. Less gravity on the big stone.

   iv. No relationbetween weight and mass.

h. Which statement is true about sliding friction?

   i. It is produced in the direction of motion of the body.

   ii. Due to weight of a body it produces below the load of it.

   iii. It is produced in opposite direction of the motion of a body.

   iv. It is produced in opposite direction of the load or upward.

i. Which of following relation is incorrect?

i. 1 MW = 10^6 W ii. 1 MW = 10^3 kW

iii. 1 kW = 10^3 W iv. 1 hp= 764 W

2. Fill in the blanks suitable words given below:

Power Gravity Velocity Speed Friction Watt

a. The distance covered in unit time is.....

b. Unit of power is.....

c. Rate of doing work is called.....

d. Use of ball bearing reduces .....

3. Answer the following questions:

a. Write the unit of the following physical quantities-

Distance, Displacement, Work, Power, Speed, Velocity

b. Clarify distance and displacement with suitable examples.

c. "Friction is necessary evil" justify the statement.

d. Define work and write its unit.

e. Write any three measures of minimizing friction.

f. Define power and mention its unit.

g. Complete the formula of following physical quantities-

Work =

Speed=

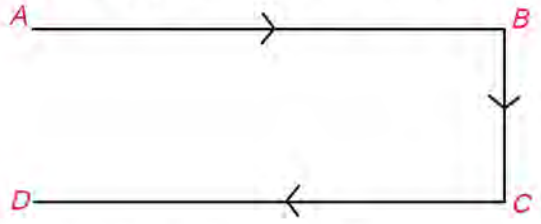
Velocity =

Power =

h. "Friction also plays supportive role for us." Justify the statement.

i. Clarify the reason of reducing friction.

j. A car starts to move from the point A and it reaches to point D through B and C at the rate of 5 m/s. Answer the following questions on the basis of it.



i. What is the velocity of the car in the path AB? Why?

ii. What is the velocity of the car in the path BC? Why?

iii. What is the velocity of the car in the path CD? Why?

k. Is a person pushing the wall of the house doing work or not? Give reason.

l. If two persons are doing same amount of work, in which condition there power will be same and in which condition their power will be different? Clarify.

m. If a person is walking carrying load on his head, is he doing work or not? Clarify.

4. Solve the numerical problems:

a. Rohit covers a distance of 400 m by running in a straight path in 35 s. Calculate his velocity. (11.43 m/s)

b. An object covers a distance of 100 m in 5 seconds. Calculate its speed. (20 m/s)

c. What distance is covered by the car in 10 seconds, if it is travelling in speed of 20 m/s? (200 m)

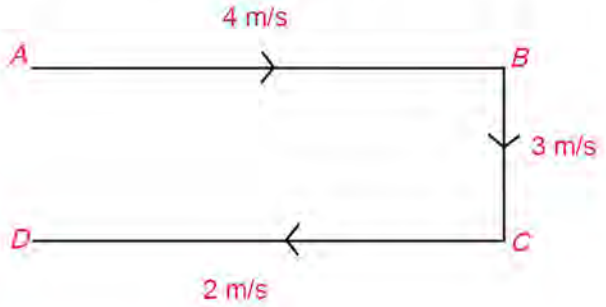
d. If a crane takes 20 s to lift a jeep of 1500 kg upto 120 m high, calculate work done by the crane and its power. (1764000 J, 88200 W)

e. A person carries 50 kg rice bag at 3 m high roof of a bus from the ground. Then he slides the bag towards the anterior part of the bus for 4 m by applying an effort of 450 N.

   i. What amount of work against gravity is done? (1470 J)

   ii. What amount of work against friction is done? (1800 J)

f. An object is travelling in the path ABCD, as shown in the figure. If the objects take 4 s to cover the distance between A and B, 2 s to cover the distance between B and C and 6 s to cover the distance between C and D , what is the total distance covered by the object? (34 s)



7 Energy in Daily Life

Which forms of energy are required for us to do daily activities? Recall.

Fig 7.1

a. Which energy sources are shown in the figure?

b. Which energy sources are used in our daily life?

We can see the things around us because of the light of the sun or light from any other sources. The heat energy from the sun helps to maintain suitable temperature for living beings along with sunlight. We can talk to one another because of sound energy. Sound energy is produced when television, radio and musical instruments are operated. Electrical energy is important source of energy used in our daily life. Electrical energy is used to light a lamp, to watch television, to operate computer and so on. Use of electricity is being increased day by day. A large amount of heat energy can be produced from nuclear energy. Electrical energy can also be generated from nuclear reaction. The necessity of today's world is to make a wise use of energy sources for more comfortable human life. A constructive, rather than destructive, use of energy makes human life easy and simple.

7.1 Energy

The figure in the right side shows that people are working in a farm. You might have also seen your parents working similarly in your farm.

Fig 7.2 Agricultural work

1. What is necessary for our body for digging field, carrying load and running?
2. What is used to run vehicles and operate factories?

Fig 7.3 Coal used as fuel in train

We need energy to do work. We get energy from the food we eat to do various works in our daily life. Human being get necessary energy from plants and animals in the form of food. Electrical energy required to run various machines of buses, airplanes and factories is obtained from diesel, petrol, kerosene, coal etc.

Renewable and non-renewable sources of energy

What is used to cook food at your home? How do we get or produce firewood, biogas, LP (liquefied petroleum) gas and electricity that are used to cook food?

You might have used firewood, biogas, LP gas, electric heater or induction stove to cook food. Firewood is obtained from forest. By using energy of running water, we produce hydro-electricity and LP gas is extracted after refining crude oil obtained from mine. Energy is necessary to run vehicles, to keep body warm in winter season, to dry grain, to operate various tools or machines used in construction.

The capacity to do work is called energy. The substance from

Fig 7.4

which energy is obtained is called source of energy. Firewood, biogas, coal, LP gas, petroleum substance, the sun, etc. are the sources of energy.

The source of energy, which is reproduced, in short period once it is used, is called renewable energy. Electricity, wind energy, solar energy, firewood, biogas, gobar gas, etc. are renewable sources of energy. They can be reused in short period so we need to emphasize to use renewable source of energy.

Fig 7.5 Mineral oil

The sources of energy, which cannot be reused in short period, are called non-renewable source of energy. With the continuous use, non-renewable source of energy keeps on decreasing and may get finished one day. Diesel, petrol, kerosense, LP gas, coal, nuclear energy,etc. are non-renewable sources of energy.

Fossil fuel

Nowadays, most of the vehicles run with diesel or petrol. We can run train and machines of factories from the heat energy produced from burning of coal.

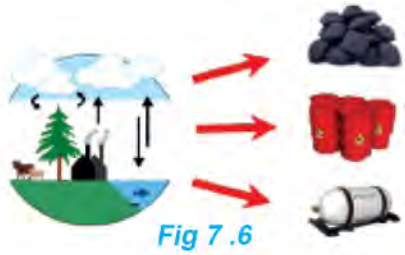


Fig 7 .6

Have you ever thought how these petrol, diesel, kerosene, coal, etc. are formed?

Due to some huge changes in the earth's surface, big forest and ocean creatures buried in the earth finally turns to fossil. Due to excessive pressure and heat on fossil for millions of years, the fossil turns into coal and oil. Therefore, petroleum oil (petrol, diesel, kerosene, etc.) and coal are called fossil fuel.

Advantages of fossil fuel

1. Fossil fuel is easily available in comparison with other source of energy.
2. It can be transported easily from one place to another.
3. It is multi-useful fuel. So, it is used to run different vehicles and factories.
4. Fossil fuel is used in industries and factories since it produces enormous extent of heat energy.

Fig 7.7 Process of formation of fossil fuel

Disadvantages of fossil fuel

1. Because of continuous and excessive use of fossil fuel, there is risk of extinction.
2. Burning of fossil fuels pollute environment.

Activity 7.2

Classify the given source of energy into renewable and non-renewable energy sources and write an advantage and a disadvantage of each.

Source	Renewable or non-renewable	Advantage	Disadvantage
Coal	Non-renewable	Easy to transport	Burning of coal pollutes environment
Hydroelectricity			
Solar energy			

Gobar gas			
Petrol			
Wind energy			

Alternative energy

The source of energy used to minimize the use of non-renewable energy is called alternative energy. Hydroelectricity, solar energy, *gobar gas*, bio gas, etc are alternative source of energy used in Nepal. Nepal is agricultural country so the people of Nepal are involved in agriculture. Cattles are reared for cultivation and dairy products. Biogas is used to cook food extracted from animal excreta. Solar energy could be the best alternative source of energy for the places where there is not easy access of electricity and is geographically difficult. Therefore, solar energy and *gobar gas* are used as the best alternative energy sources because of geographical structure and condition of Nepal. To enhance the use of alternative source of energy, Government of Nepal has given some subsidy in the installation of such alternative source of energy.

Ways of saving energy

The demand and consumption of fossil fuel has highly been increased in the world at present. The deficiency of energy in near future due to excessive use of non-renewable energy is called energy crisis.

It is necessary to conserve energy to prevent from energy crisis. Economic and right use of energy is the conservation of energy. The following measures can be adopted to minimize energy crisis in Nepal.

1. We can avoid unnecessary use of energy.
2. Nepal is an agricultural country and more effort should be given for the use of *gobar gas* in remote area.

3. Hydroelectricity production should be increased and electricity should be used to cook food, run electric vehicles and for other various purposes.
4. Electricity produced from solar panel can be used for different purposes.
5. It is good to use an alternative source of energy instead of crude oil, coal or natural gases.
6. Public awareness program should be conducted on the ways of energy conservation

Exercises

1. Fill in the blanks with appropriate words:

Lakhs, renewable, carbon dioxide, alternative, saving, non-renewable

a. Coal is ..... source of energy.

b. To form non-renewable source of energy, it takes ..... of years.

c. ..... gas formed during the burning of fossil fuel pollutes air.

d. We should develop the habit of ..... of energy.

e. We should give more effort on the use of ..... energy to minimize energy crisis.

2. Tick (√) the correct answer.

a. Which of the following is environment friendly source of energy?

i. Diesel ii. Petrol

iii. Hydroelectricity iv. Coal

b. Which of the following is renewable source of energy?

i. Petrol ii. Coal

iii. LP gas iv. Hydroelectricity

c. From which source, maximum electrical energy has been produced in Nepal?

i. Water ii. Air

iii. Geothermal iv. Sun

d. Which of the following is non-renewable source of energy?

i. Coal ii. Hydroelectricity

iii. Bio gas iv. Firewood

e. Study the two sentences given below and select the best option based on this context.

1. Energy necessary for us is obtained from food.
2. Energy, we get from food, is actually obtained from the sun.

i. 1 correct and 2 incorrect ii. both are correct

iii. 1 incorrect and 2 correct iv. both are incorrect

f. Identify the odd one from the following.

i. Firewood ii. Coal iii. Petrol iv. Diesel

g. Select the best option based on the given statement and its reason,

Statement: LP gas and *gobar gas* are both fossil fuels.

Reason1: gobar is remnant of animal so the gas obtained form it is also fossil fuel.

Reason 2: LP gas is extracted from purification of crude oil. Mineral oil is fossil fuel so LP gas is also a fossil fuel.

i. The given statement is only correct but both the reasons are incorrect.

ii. Reason 1 is correct but reason 2 and statement are incorrect

iii. Reason 2 is correct but reason 1 and statement are incorrect

iv. Both reasons are correct but statement is incorrect

3. Differentiate between:

a. Renewable energy and non-renewable energy

b. Bio fuel and fossil fuel

c. LP gas and *gobar gas*

4. Answer the following questions:

a. What is energy crisis? Explain any two efforts made in your surrounding for the minimization of energy crisis.

b. Which is the best alternative source of energy in the context of Nepal? Clarify with suitable reason.

c. Economic use of energy is the saving of energy. Clarify with reason.

d. Mention the advantages and disadvantages of fossil fuel.

e. Use of fossil fuel causes pollution. Which source of energy could be the best alternative source of energy instead of fossil fuel? Give your suggestions.

f. Why is hydro-electricity called alternative source of energy?

g. What is geothermal energy?

7.2 Heat and temperature

Fig 7.8

Which form of energy is necessary for us for drying grain and clothes or cooking food? What are the sources of it?

Solar heat is the main source of energy. Various works can be done from the heat energy obtained from the sun. Solar heat is used for drying clothes, drying of wood and drying of cereals, to get warmth at winter, to take out salt from sea etc. Heat is also obtained from other sources except the sun. Firewood, fossil fuel, electric heater, etc. are also the sources of heat energy.

Heat is a form of energy which gives sensation of warmth. SI unit of heat is Joule (J). When we supply heat, the temperature of the object is increased.

Temperature

fig 7.9

Generally, the degree of hotness or coldness of a body is called temperature of the body. First glass has lukewarm water, second glass has tap water and the third glass has very cold water.

Can you identify the glasses with lukewarm water, tap water and the very cold water by touching the glasses? Discuss with your friends.

In the above figure you can easily identify the glass with lukewarm water, tap water and the very cold water simply by touching them. But if you are given three glasses having lukewarm water in the first, warmer water in the second and the boiled water in the third, it is difficult in finding them out because all of them are warm. The degree of hotness is different in individual glasses. The water with high degree of hotness has high temperature. The rate of vibration of water molecules in boiling water is high.

Thermometer

Clinical thermometer | Laboratory thermometer | Digital thermometer

Fig 7.10

Have you measured body temperature while having fever? The instrument used to measure degree of hotness of a body is called thermometer. The thermometer which is used to measure body temperature is called clinical thermometer. Nowadays people use digital thermometer instead of clinical thermometer to measure the body temperature accurately and safely. The thermometer used to measure temperature of any substance or used in laboratory is called laboratory thermometer.

Laboratory thermometer

Fig7.11 Laboratory thermometer

The outer surface of laboratory thermometer is cylindrical in shape. It is made up of glass. One end of the thermometer has thin-walled glass bulb which is connected to stem. A narrow path inside the thermometer, also called capillary tube, runs from one end of the stem to the other end. Capillary tube is surrounded with thick-walled glass. The bulb is filled with mercury or alcohol. With the increase and decrease in temperature, the liquid rises and falls in the capillary tube.

To measure temperature of a substance, the bulb of the thermometer is kept in contact with the substance or insert inside. When the mercury bulb is kept in contact with a substance, the volume of liquid present at the bulb either increases or decreases due to effect of heat.

When volume of liquid increases, the level of liquid rises in the capillary tube and the level of liquid falls with decrease in

volume of mercury. The value of rise and fall of mercury in the capillary tube gives magnitude (value) of temperature.

Units of temperature

What is the present temperature of your surrounding? Guess.

It is easier to know whether you are having fever or not by measuring body temperature. Which unit is used to measure body temperature? Generally, human body temperature is measured in degree Fahrenheit (°F). The normal human body temperature is 98.6°F but the temperature increases during fever. Therefore, body temperature is higher than normal body temperature (98.6°F) during fever.

Temperature is also measured in degree Celsius (°C). Though °C and °F are widely used units, the SI unit of temperature is Kelvin (K).

Relationship between different scales of temperature

Heat changes state of matter. Heat changes solid state of a substance into liquid and liquid state of a substance into gas. The particular temperature at which solid substance changes into liquid state is called its melting point. Ice melts at 0° C at sea level. So the melting point of ice is 0°C. Similarly, the fixed temperature at which liquid state of matter changes into gaseous state is called boiling point. Water boils at 100° C at sea level so the boiling point of water is 100° C. Temperature has three different scales; Celsius, Fahrenheit and kelvin. The melting point of ice and the boiling point of water at sea level in different scales are given below.

Scales	Celsius	Fahrenheit	Kelvin
Melting point of ice	0° C	32° F	273K
Boiling point of water	100° C	212°F	373K

Temperature can be converted into various units using the formula given below.

$$\frac{C-0}{100-0} = \frac{F-32}{212-32} = \frac{K-273}{373-273}$$

$$\frac{C-0}{100} = \frac{F-32}{180} = \frac{K-273}{100}$$

Here, there are three scales but we can convert temperature from one scale into another easily using the formula. For example: To convert Celsius into Fahrenheit the formula $\frac{C-0}{100-0} = \frac{F-32}{212-32}$ can be used.

Mathematical problem

Example 1

A normal human body temperature is 98.6^0 F. Convert it into Celsius scale.

Here,

F = 98.6^0 F C = ?

Solution

We know,

$$\frac{C-0}{100} = \frac{F-32}{180}$$

or, $\frac{C-0}{100} = \frac{98.6-32}{180}$

or, $\frac{C}{100} = \frac{66.6}{180}$

or, $C \times 180 = 100 \times 66.6$

or, $C = \frac{6660}{180} = 37$

Therefore, normal human body thermometer is 37^0C in Celsius

scale.

The temperature of air of a place is 50° F. Convert it into kelvin and Celsius units.

F = 50 K=? C = ?

By formula,

$$\frac{K - 273}{100} = \frac{F-32}{180}$$

$$\text{or, } \frac{K-273}{100} = \frac{50-32}{180}$$

$$\text{or, } \frac{K-273}{100} = \frac{18}{180}$$

$$\text{or, } \frac{K-273}{100} = \frac{1}{10}$$

$$\text{or, } K = \frac{100}{10} + 273$$

$$\text{or, } K = 10 + 273$$

$$\text{or, } K = 283$$

∴ Therefore, 50° is equal to 283 K.

Similarly,

$$\frac{C-0}{100} = \frac{K-273}{100}$$

$$\text{or, } C - 0 = K - 273$$

$$\text{or, } C = 283 - 273$$

$$\text{or, } C = 10$$

∴ Therefore, 50° F is equal to 10°C.

Activity 7.3

Take a record of the temperature at your place in the morning for a week. Calculate the magnitude of temperature of each day with the help of thermometer or mobile application. Convert the unit of temperature into two other units and complete the table given below.

Day	Temperature (^{0}C)	Temperature (^{0}F)
Sunday		
Monday		
.....	.....	.....

Activity 7.4

Objective: Temperature of a body decreases when the body loses heat.

Apparatus required: beaker, water, laboratory thermometer, watch, graph paper

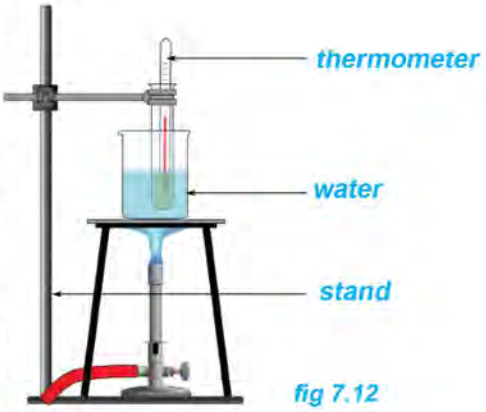
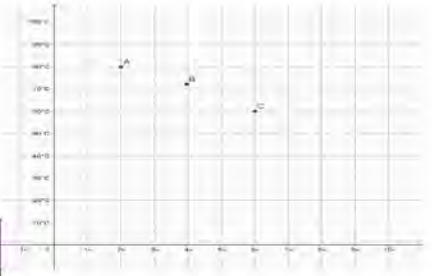


fig 7.12

Procedure: Keep water in a beaker and boil it with the help of burner. Now immerse a laboratory thermometer with its bulb into the boiling water. Record the temperature of the boiling water at an interval of two minutes. Plot the temperature in X-axis and time in Y-axis in a graph paper or spreadsheet in computer. Draw a line joining the points and present the graph in your classroom.

Time (minute)	Temprature (^{o}C)
.....	.....



Object	Temprature (^{o}C)
Tap water	.....
Melting ice	.....
Boiling water	.....

Activity 7.5

Measure the temperature of your classroom, water from tap, a piece of melting ice, boiling water and other various substances in your surrounding and fill in the table.

a. Based on the above activity, find out either water from tap has higher temperature or boiling water.

b. Why is the temperature of the boiling water greater than that of the water from the tap?

Relationship between heat and temperature

Why do the hot substances like tea or coffee become colder after a while? Why is tap water too cold during winter season? Have you ever thought about these questions?

The temperature of hot tea is greater than the temperature in our surrounding. Tea absorbs heat from the source during heating. When tea loses its heat to the surrounding, the amount of heat decreases in tea, and its temperature falls. Heat always flows from hot body to cold body. Temperature of any substances increases when it gains heat and the temperature decreases when it loses heat.

The temperature of our surrounding is less in winter time. The temperature of water is equal to the surrounding temperature. Human body temperature is constant at normal condition; so, when we touch any cold water, heat flows from our body to the cold water and we feel cold.

Activity 7.6

Objective: To find out the direction of flow of heat.

Apparatus required: Two small glasses and one bigger glass, cold water, hot water, laboratory thermometer

Fig. 7.13
Hot water, cold water and mixed water

Procedure: Take two glasses-one smaller glass with half-filled cold water and other bigger glass with half-filled hot water. Measure the temperature of the water in both the glasses. Now mix water from both the glasses into a single big glass and measure the temperature of the mixed water.

Discussion and conclusion: Discuss in the given question and come to conclusion.

Which one has higher temperature; hot water or mixed water?

Why is the temperature of mix water different from the hot water and the cold water?

Water is heated and mixed with cold water to make it lukewarm while we bath in the winter. The temperature of lukewarm water is less than hot water and more than cold water.

Exercises

1. Fill in the blanks with appropriate words. Read the text and prepare a summary.

Increase	100 °C	Warmth	Temperature	Decrease
0° C	kelvin	A thermometer	Heat	37° C

Heat is a form of energy which provides us sensation of ..... . Due to degree of heat, temperature of a body ..... or ..... . When a body is heated ..... of the body increases. ..... is used to measure body temperature. Celsius, Fahrenheit and ..... are the scales of temperature. Normal human body temperature is .... flows from hotter body to colder body. At sea level water freezes at ..... and boils at ..... .

2. Tick the correct answer:

a. What is the SI unit of temperature?

i. Celsius ii. Fahrenheit iii. Kelvin iv. Joule

b. What is the range of temperature in a laboratory thermometer?

i. 0°C to 100°C ii. 10°C to 110°C

iii. -10°C to 110°C iv. 0°C to 110°C

c. Generally, when the external energy is not used, the heat:

i. Flows from hotter body to colder body.

ii. Flows from colder body to hotter body

iii. Flows from the body having lower temperature to the body having higher temperature.

iv. Flows in between hotter and colder body.

d. Rita and Sarita measured body temperature and found 37°C and 98.6°F respectively. Choose the best option based on it.

i. Body temperature of sarita is greater than Rita.

ii. Sarita is having a fever.

iii. Rita and sarita have equal body temperature.

iv. Both Rita and Sarita are suffering from fever.

e. What does thermometer measure?

i. Degree of hotness

ii. Degree of coldness

iii. Degree of hotness and coldness

iv. Degree of hotness or coldness

f. Select the best option studying the given statement and reason.

Statement: Heat indicates how hot or cold the body is but temperature gives the direction of flow of heat.

Reason 1: The body having more heat is hotter and the body having less heat is colder.

Reason 2: Temperature flows from one body to other. So, temperature gives the direction of flow of heat.

i. The given statement and both reasons are correct.

ii. The given statement and both reasons are incorrect.

iii. The given statement is correct but reasons are incorrect.

iv. The given statement is incorrect but reasons are correct.

g. Which of the following respectively gives the order of human body temperature, boiling point of water and melting point of ice respectively?

i. 37°C, 273 K, 0°C

ii. 98.6° F, 273 K, 32°F

iii. 310 K, 100°C, 32°F

iv. 98.6°F, 373K, 100°C

h. What happens when two bodies come into contact with each other?

i. Heat flows from hot body to cold body.

ii. Temperature flows from high temperature body to low temperature body.

iii. Temperature flows from low temperature body to high temperature body.

iv. Temperature flows from high temperature body to low temperature body.

i. Which of the following facts is true about thermometer?

i. The glass bulb is thick-walled and the stem is thin-walled.

ii. The glass bulb has mercury and the stem has capillary tube.

iii. The stem of thermometer is dipped into water to measure temperature of the water.

iv. The Capillary tube runs from the bulb to other end of the stem.

j. Which one of the following is correct?

i. $37^{\circ}C = 98.6^{\circ} F = 310$ K

ii. 373 K $= 212^{\circ}F = 0^{\circ}C$

iii. $32^{\circ}F = 0^{\circ}C = 373$ K

iv. $100^{\circ}C = 212^{\circ}F = 273$ K

3. Answer the following questions:

a. What is heat? Write its SI unit.

b. Draw a well-labelled diagram of laboratory thermometer.

c. Mention any two differences between heat and temperature.

d. We feel cold when we touch well water or tap water in the winter season. Give reason.

e. Digital thermometer is used instead of clinical thermometer to measure human body temperature, why? Give reason.

3. Convert the following:

i. 50° C into $^{\circ}$F

ii. 27° C into K

iii. 100 K into $^{\circ}$C

7.3 Wave

Fig 7.14 Transverse wave

Energy is transferred from one place to another in two ways. The transfer of energy from one place to another by the actual movement of a substance like bullet fired from a gun or a hurled stone is one of the ways of energy transfer. Sometimes, energy may transfer from one place to another without the actual movement of the particles like that of in the wave.

For example, when a stone is thrown into a stagnant pond, the molecules of water are set into vibration due to kinetic energy present in the stone. Such disturbance travels in the form of wave from the point (at which the thrown stone falls) towards the edges of the pond without the actual movement of the water molecules. The movement of water is observed all around. In this way, the kinetic energy of water is transferred from middle of the pond towards the edge. So, the formation of wave is the transfer of energy.

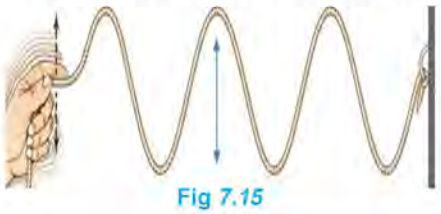


Fig 7.15

Activity 7.7

Objective: To observe origin of wave

Material required: Rope

Procedure: Tie up (fix) one end of a rope at a wall or a pole and hold the other end in your hand. Shake the rope up and down.

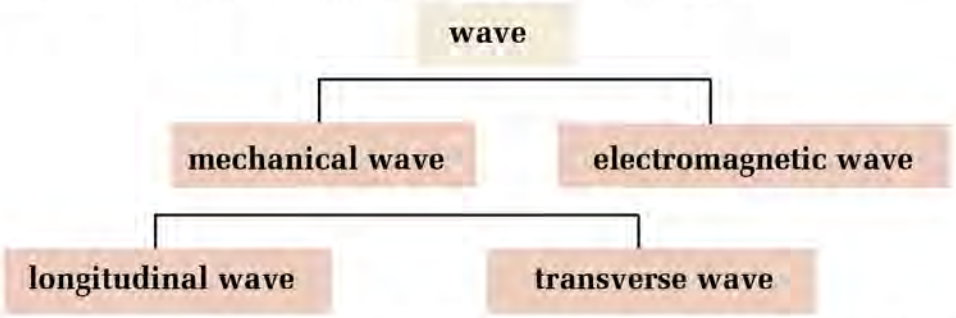
Discussion and conclusion: Repeat the activity, observe carefully and discuss.

Where does the energy transfer when the rope is shaken with a frequent jerk?

Compare the above process with the vibration of the water molecules during the formation of wave in pond.

Types of wave

Some waves need a medium to travel whereas some do not. Based on the need for medium, waves are of two types.



The wave, which needs a medium to travel is called mechanical wave and the wave, which can propagate without any medium is called electromagnetic wave. Light, X-ray, radio wave, etc. are electromagnetic wave. Mechanical waves are of two type. They are transverse waves and longitudinal waves.

Transverse wave

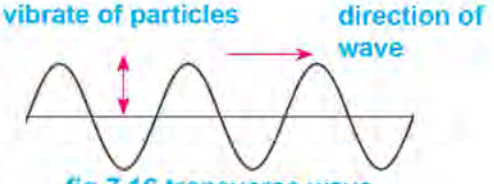


fig 7.16 transverse wave

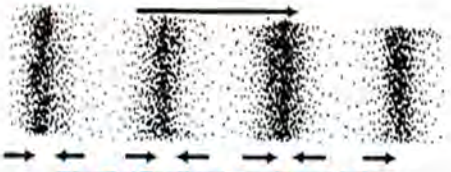


Fig 7.17 vibrate of particle

The wave in which the particles of the medium vibrate perpendicular to the direction of propagation of wave is called transverse wave. In transverse wave, the particles of the medium vibrate perpendicularly. The wave produced in water is called transverse wave. In a transverse wave a crest and a trough are formed. The crest is the maximum displacement of the vibration of particles whereas the trough is the minimum displacement of the vibrating particles.

Longitudinal wave

Sound wave is a longitudinal wave. The longitudinal wave is the wave in which the particles of the medium vibrate in the direction of the propagation of wave.

The wave in which particles of the medium vibrate to-and-fro towards the direction of wave is called longitudinal wave.

Activity 7.8

Objective: To observe longitudinal wave

Materials required: Slinky spring coil

Procedure:

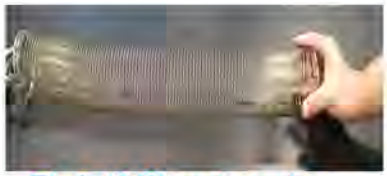


Fig 7.18 Wave in spring

1. Fix one end of the slinky spring coil as shown in the figure on a wall with the help of a clip or ask your friend to hold.
2. Give a disturbance or a jerk at the free end of the coil towards the fixed end and observe the vibration at different parts of the spring.
3. Repeat the process for several times and observe carefully. In this way, we can know how a wave is produced.

Discussion and conclusion: The state at which the rings of the spring come closer is called compression and the state at which the rings of the spring coil are far from each other is called rarefaction. It is a longitudinal wave. Here, the parts or the rings of the spring coil act as molecules and the pattern of compression and rarefaction represent direction of propagation of the wave. Have you observed compression and rarefaction in the spring? Have you also observed the formation and propagation of compression and rarefaction? Which direction have you noticed the propagation of the wave?

Fig 7.19

During the propagation of a sound wave, the region at which the air molecules come closer is called compression and the region at which the molecules are apart from each other is called rarefaction. A compression (C) and a rarefaction (R) make a complete wave. In the figure given below, the particles of air vibrate left and right and the sound energy travels in the same direction.

Some terms related to waves

A transverse wave is shown in the figure.

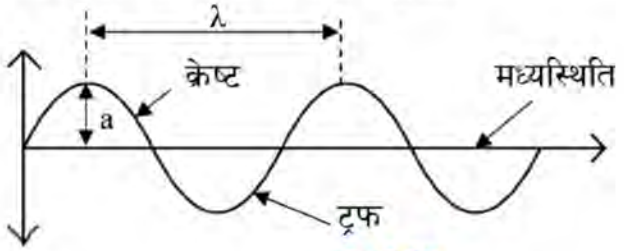


fig 7.20

Crest

The maximum upward displacement of the vibrating particles from its mean position during formation of wave in any medium is called crest.

Trough

The maximum downward displacement of the vibration particles from its mean position during formation of wave in any medium is called trough.

Amplitude

The maximum displacement of the vibrating particles in a medium from its mean position is called amplitude. It is represented by 'a' and its SI unit is meter (m).

Wave length

Wave length is the distance between any two consecutive crests or troughs. It is represented by lambda(λ). Its SI unit is meter (m).

Complete wave

One crest and one trough together form a complete wave. It is also called a complete cycle.

Frequency

The number of complete vibration or the complete wave made in one second is called frequency. It is represented by 'f' and its SI unit is Hertz (Hz).

The distance travelled by a wave in one second is called velocity of the wave. Mathematically, velocity is the product of wavelength and frequency.

Velocity (V) = wavelength (λ) $\times$ frequency (f)

Exercise

1. Fill in the blanks with the correct word.

meter frequency Medium air vibration solid

a. Sound is produced due to production of -----in any body.

b. Sound wave propagates faster in ------ medium.

c. SI unit of wavelength is ------.

d. .....is necessary for the propagation of sound.

e. The number of complete wave formed in one second is called ..... .

2. Tick the correct answer.

a. Which medium is required for the propagation of sound wave?

i. Solid ii. Liquid

iii. Gas iv. Solid, liquid and gas

b. What is the SI unit of frequency?

i. Hertz ii. Hertz/second

iii. Meter iv. Hertz/minute

c. What is wavelength?

i. Distance between crest and its successive trough

ii. Distance between any two consecutive crests

iii. Distance between any two consecutive troughs

iv. Distance between any two consecutive crests or two consecutive troughs

d. In which direction do the vibration of molecule and propagation of wave take place in case of longitudinal wave?

i. Same direction ii. Opposite direction

iii. Perpendicularly iv. Different direction

e. What type of sound is produced when a drum set is hit loudly with stick?

i. Loud ii. Dull

iii. Pleasant iii. Hoarse

f. Which of the following indicates a complete wave?

i. The distance between highest point of crest and the perpendicular line drawn from highest point of the trough

ii. The distance between mean position of wave to the highest point of crest or trough

iii. Distance between mean position and maximum displacement of vibrating particle

iv. The distance between highest point of any two consecutive trough

g. What happens when longitudinal wave is produced?

i. Particles of medium vibrate in the same direction of wave.

ii. Particles of medium vibrate perpendicularly in the direction of propagation of wave.

iii. Particles of medium vibrate in the direction of propagation of wave.

iv. particles of medium vibrate perpendicularly in both directions.

h) Which wave travels without medium?

i. Mechanical wave ii. Electromagnetic wave

iii. Transverse wave iv. Longitudinal wave

i) Study the given statement and the reason then choose the correct option.

Statement: When a stone is thrown in the middle of a still pond, the wave formed in the pond transfers mechanical energy of stone towards its edge.

Reason 1: The vibration is parallel to the direction of the propagation of the wave.

Reason 2: The vibration of a particle is parallel to the direction of the propagation of the wave.

i. The above statement is correct but both reasons are incorrect.

ii. The above statement is incorrect but both the reasons are correct.

iii. The above statement and reason 1 is correct.

iv. The above statement and reason 2 is correct.

j) A wave having wavelength 1 m has velocity 10 m/s. What is its frequency?

i. 10 Hz ii. 1 Hz

iii. 100 Hz iv. 0.1 Hz

2. Differentiate between:

a. Longitudinal and transverse wave

b. Amplitude and frequency

c. Crest and trough

d. Mechanical wave and electromagnetic wave

3. Answer the following questions.

a. What is sound energy? Write any four sources of sound.

b. How does sound propagate when we talk? Explain with diagram.

c. When drum set is hit loudly, the amplitude of sound is high. Give reason.

d. Write the symbol and SI unit of:

Wavelength	amplitude
frequency	wave speed

e. Draw a diagram of wave and show crest, trough, wavelength and amplitude in the diagram.

f. Mention the feature of compression and rarefaction produced in sound wave. Also discuss the relationship between them.

g. How many complete waves are formed from the beginning of one compression to the next rarefaction? Clarify with diagram.

7.4 Light

Fig 7.21

Which form of energy is necessary to see objects around us? Is it possible to see objects at a dark night without using a torch light or any other source of light? Which source of light is shown in the figure? What are other sources of light?

We can see the things around us because of the sunlight. We need other sources of light like, a bulb, a candle or a torch to see object at night time. When a ray of light from any object or the reflected ray of light from an object falls in the retina of our eyes, an image is formed and we can see the object. In this chapter, we will discuss about the process of reflection of light.

Activity 7.9

Fig 7.22
Reflection in a plane mirror

Stay in a room taking a mirror where the sunlight enters into it in the morning time. Face the mirror towards the sunlight coming towards the room. When the sunlight falls on the mirror, move the mirror left and right. Then, discuss the questions given below.

1. Which face of the mirror reflects the sunlight?
2. Can the dial of a watch and the screen of a mobile phone reflect sunlight like a plane mirror?
3. Can a book or a copy reflect sunlight? Discuss and make a conclusion.

The above activities show that substances like mirror, the dial of

a watch and the screen of a mobile which have smooth surface can reflect most part of the light.

When the rays of light strike the surface of a mirror, the ray is reflected back. Therefore, when light falls on the surface of an opaque object, the ray is reflected back.

Reflection of light

The process of returning back of rays of light after striking any surface is known as reflection of light. Reflection takes place on smooth or rough surface of any opaque object.

Regular reflection

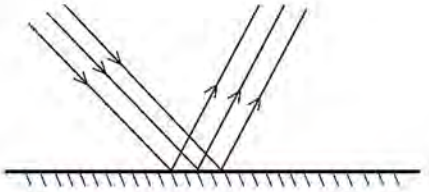


Fig 7.23 Regular reflection

When the parallel rays of light fall on any plane or smooth surface, after reflection, the reflected beams of light are also parallel to each other. Such reflection of light is called regular reflection. The regular reflection takes place in a mirror, a mobile screen, a metallic plate, etc. Due to regular reflection, image of an object is formed. We can see our face in mirror or a still pond.

Irregular reflection

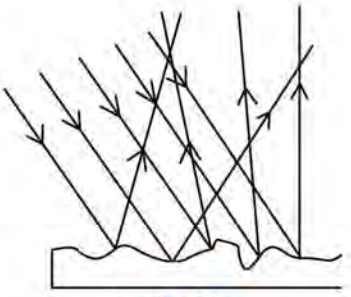


Fig 7.24
Irregular reflection

When the parallel rays of light fall on a rough or irregular surface, after reflection the reflected rays of light get scattered in different directions. Such reflection of light is called irregular reflection. Irregular reflection takes place in rough surfaces like, wood, the wall of a house, leaves of a plant and so on. The irregular reflection does not help in the formation of an image because in irregular reflection, the reflected rays are scattered in different directions. The reflected rays get scattered in different directions in irregular reflection and they fall on our eyes. Thus, irregular reflection helps us to see the things around.

Some terms related to reflection of light

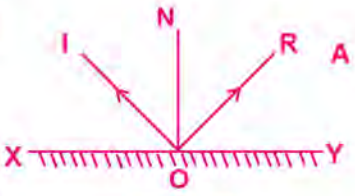


Fig 7.25
Reflection in a plane mirror

Incident ray

It is a ray of light from source which strikes on a surface. In the ray diagram, IO is an incident ray. The downward arrow head shows the direction of incident ray i.e. from I to O.

Reflected ray

The ray of light that returns after striking a surface is called a reflected ray. In the diagram, OR is the reflected ray and the arrow shows the direction of reflected ray i.e. from O to R.

Normal

Normal is a perpendicular line formed on a plane surface at the point where the incident ray and the reflected ray meet. In the given diagram NO is a normal and it makes 90° with the plane surface XY.

The angle of incidence

The angle made by an incident ray with the normal is called the angle of incidence. In the diagram <ION is an angle of incidence and it is denoted by <i.

The Angle of reflection

The angle made by a reflected ray with the normal is called the angle of reflection. In the diagram <RON is a reflected angle and it is denoted by <r.

Activitiy 7.10

Objective: The angle of incidence is equal to the angle of reflection in the reflection of light.

Materials required: Plane mirror, drawing board, white paper sheet, pin, thumb pin etc.

Procedure:

1. Attach a white sheet of paper on a drawing board with the

help of a pin.

2. Draw a straight line AB at the middle of the sheet.
3. Place a plane mirror on line AB
4. Draw a perpendicular line PQ on line AB.

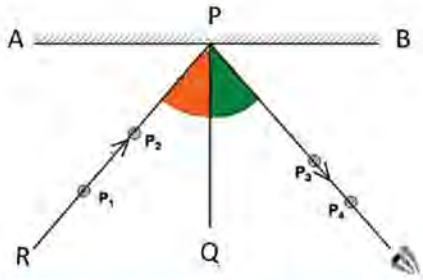


Fig 2.26 Reflection on a plane mirror

5. Insert two pins P1 and P2 in the drawing sheet in line PR.

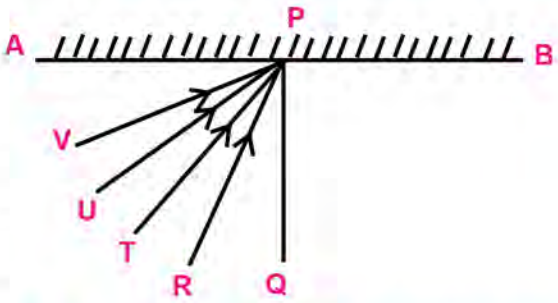


Fig 7.27 Incident rays falling on plane mirror

6. Look at the plane mirror from other side of the normal with the help of one of your eyes. Observe two pins P1 and P2 and insert pins P3 and P4 straight to the image of two pins P1 and P2 as given in the figure.
7. Now remove pin P3 and P4 and draw a line joining the two points up to point P on the plane surface of the mirror.
8. Repeat the process from step 1 to 7 with the line ray TP, UP and VP.
9. Based on this activity, measure the angle of incidence and the angle of reflection with the help of a protractor and fill in the table.

S.N.	Angle of incidence	Angle of reflection	Result
1	*<RPQ= ----*	*<SPQ= ---*	*The angle of incidence is equal to the angle of reflection*
2	*<TPQ= --*	----------	----------
3	*<UPQ= ----*	----------	----------

Discussion and conclusion: Is the angle of incidence equal to the angle of reflection? Discuss and draw a conclusion.

Laws of reflection of light

Regular reflection follows certain laws known as laws of reflection. The laws of reflection are as follows:

1. The angle of incidence is always equal to the angle of reflection.
2. The incident ray, reflected ray and the normal, all lie at the same point of the same plane.

Image formed in plane mirror

In figure, the image formed by a plane mirror after reflection of light is shown. The process of formation of such image is called ray diagram. The image formed by this plane mirror is only virtual because the reflected light never reaches to the image. A virtual image cannot be drawn in screen. The image is erect and equal to the size of the object. The image we see in a mirror is also virtual.

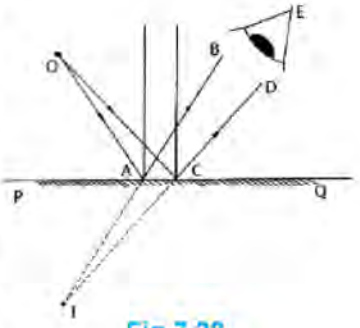


Fig 7.28

Some applications of reflections of light

The mirror of a microscope reflects all the rays of light at a point. The microorganisms can be seen by the help of microscope. The reflection occurred in mirror used in vehicles helps to see the objects at the back.

Periscope

Periscope is an optical instrument based on reflection of light. Periscope is used to view the things at certain height that are out of sight. You can even prepare model of periscope with the help of materials which are easily available at your home. The way

of making periscope is given below.

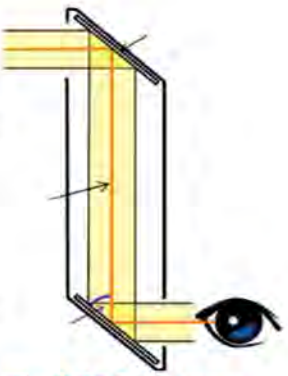


Fig 7.29 Periscope

Materials required: Hollow cylinder of hard paper, two plane mirrors, glue, scissors and color

Procedure:

1. Prepare a hollow cylinder with a piece of hard paper.
2. Fix two plane mirrors at both ends of the cylinder at an angle of 45° with glue such that the two mirrors are parallel.
3. Connect a short cylindrical pipe perpendicularly at both the ends of the paper cylinder as shown in the figure.
4. Close both the mouth of the end of paper pipe and a small hole is made at both the ends at opposite to the mirror such that the two holes are in opposite direction.
5. Wrap up the pipe with the help of paper keeping a small hole opened at both ends. Color the paper around to make it attractive. Your Periscope is ready to use.
6. Now place one of your eyes at the lower end hole and close the other eye. In this way, you can easily see objects at much higher place with the help of periscope even from a comparatively lower height.

Application of the periscope

a. The periscope is used in submarine which helps to see surrounding while remaining under sea.

b. The periscope is used in wars which helps to see enemies at a certain height.

Exercise

1. Fill in the blanks with the correct words.

law reflect Equal parallel perpendicular refract

a. A plane mirror ..... light.

b. In regular reflection the reflected rays of light are ..... to each other.

c. In reflection of light the angle of incidence and the angle of reflection are .....

d. The periscope is based on .....of light.

e. The normal is drawn ..... to the surface of plane mirror.

2. Tick the correct answer.

a. How does light propagate?

i. Curve way ii. Straight

iii. Zigzag iv. Depends on medium

b. Why are objects not seen in dark place?

i. Color of the objects is black at night.

ii. Our eyes do not work in dark place.

iii. Light does not reflect from the object.

iv. Things reflect light in all direction.

c. Why are we able to see the objects around us?

i. Things absorb light.

ii. Reflected light from objects reaches to the retina of our eyes.

iii. Objects scatter light in all direction

iv. Objects refracts the light

d. What is the value of the angle of incidence if the angle between incident ray and reflected ray is 80°.

i. 80° ii. 40° iii. 20° iv. 90°

e. What type of mirror is used in periscope?

i. Concave mirror

ii. Convex mirror

iii. Plane mirror

iv. Plane surface in one side and convex surface in other

f. Choose the correct option studying given statement and reason.

Statement: The process of returning back of ray through the same path after striking the incident ray on a surface is called reflection of light.

Reason 1: In this process, the incidence angle and the reflected angle are parallel.

Reason 2: Because of this process, objects are seen and an image is formed.

i. The statement is correct but reasons are incorrect.

ii. The statement is incorrect but reasons are correct.

iii. only reason 1 is correct.

iv. only reason 2 is correct.

g. Which of the following statement is correct?

i. The angle made by an incident ray with a plane surface is an incidence angle.

ii. The angle made by a reflected ray with a plane surface is called a reflected angle.

iii. The angle between an incident ray and a reflected ray is equal to the sum of the angle of incidence and the angle of reflection.

iv. The angle between the reflecting surface and the normal is equal to the sum of the angle of incidence and the angle of reflection.

h. Which of the following is the nature of image formed by a plane mirror?

i. Real, erect and equal to size of object

ii. Virtual, erect and greater than object

iii. Virtual, erect and image distance is equal to object distance.

iv. Virtual, inverted and laterally inverse

i. Which of the following is true about regular and irregular reflection?

i. We can see things around us due to regular reflection.

ii. Image is formed in mirror due to irregular reflection of light.

iii. An object shines due to regular reflection.

iv. Reflected beam of light is bright in regular reflection.

J. Which of the following is false?

a. Light does not reach up to virtual image.

b. Light reaches up to real image.

c. Erect image is formed on plane mirror.

d. Plane mirror forms image behind.

3. Differentiate between:

a. Incident ray and reflected ray

b. Regular and irregular reflection

c. Angle of incidence and angle of reflection

4. Answer the following questions.

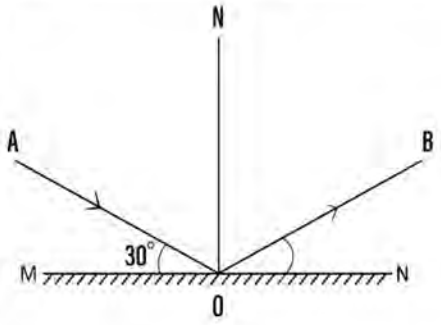
a. What is reflection of light? Write laws of reflection of light.

b. What is the irregular reflection of light? Explain with a ray diagram.

c. Describe any two applications of reflection of light in daily life.

d. How does a periscope work? Explain with a ray diagram.

e. Study the figure given below and answer the questions.



i. Name the incidence ray and the reflected ray.

ii. Name the angle of incidence and the angle of reflection

iii. With which surface does normal make 90°?

iv. What is the value of <BON?

8 Electricity and Magnetism

Electrical energy is necessary to do various activities in our daily life. Electricity is necessary to run different electrical appliances at our home. Electromagnet is prepared with the help of electricity. The substance, which attracts iron dust or iron pin towards it is called a magnet. Electromagnet is used to generate electricity in hydropower.

Fig 8.1 Electricity and magnet

a. By which methods is electricity produced in the given two figures?

b. What are the other methods of producing electricity?

c. For what purposes are electricity and magnet used in our daily life?

Electricity is necessary to conduct various devices like electric bulb, computer, projector, TV, fan, heater, refrigerator, etc. Electrical energy is produced from various sources to operate these electrical appliances. Electricity is transmitted to different houses and industries through different sources with the help of conducting wire. Thus, the electricity which can be transmitted is called current electricity.

You may have experienced lightning and thundering in the sky. In the same way, you may have observed electric spark and crackling sound at the time of taking off any natural fabric like woolen cloth at night. This is a form of electricity. The electricity thus produced is static electricity.

8.1 An introduction to static electricity

Fig 8.2 Static electricity

Keep some small pieces of paper on a table. Rub a plastic bulb pen or a rubber comb in dry hair. Take the pen or the comb near the pieces of paper and observe carefully. Predict why are the paper pieces attracted toward pen or comb?

Experiment 8.1

Balloon and wool experiment

Fig 8.3

Take a balloon and fill it with air. Rub the balloon gently in woolen sweater for a while. Then leave the balloon slowly from your hand. The balloon is attached to the sweater. Why does it happen? Write the conclusion.

While taking off fabric clothes made of polyester, nylon, acrylic or wool bright, spark and crackling sound are produced. What may be the reason of it?

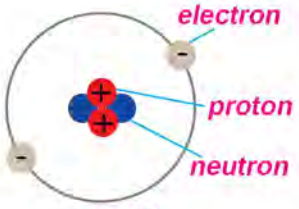


Fig 8.4
Structure of an atom

Every matter is made of atoms or molecules. Molecules are formed from atoms. An atom has two types of charges. One is positively charged present in the nucleus and another is negatively charged electron, which revolves round the nucleus. When we rub two substances, electron transfers from one atom to other.

During the process, the substance which loses electron gets positively charged as the number of electron decreases in that substance and the substance which gains electron is negatively charged as the number

of negative charge increases in that substance.

Fig 8.5

Due to the friction, charges are produced in insulators like plastic, wool, nylon, polyester, acrylic, etc. Such clothes produce charge due to friction with body parts. Therefore, spark is seen at dark along with crackling sound while taking off such clothes. In this condition, charge may increase or decrease. Thus, the electricity, which is produced in insulators due to friction by increasing or decreasing the charge, is called static electricity.

While combing, electron transfers from hair to comb. The pieces of paper at the beginning is neutral but when the negatively charged comb is taken near the small pieces of paper, the positive charges of paper come near to the comb due to effect of negative charges of comb. The opposite charges attract each other. So the small pieces of paper are attracted towards the comb. The force of attraction between two opposite charges is called electrostatic force.

8.2 Effects of static electricity

The direct effects of static electricity in our daily life are given as follows:

a. Thundering or lightening
b. Fire in fuel tank during transportation
c. Damage of computer chips due to excessive deposition of charge
d. Sticking dust and fur or hair in clothes and electronic equipment like TV, computer, mobile, etc.

The uses of static electricity in our daily life are given as follows:

a. To make attraction of ink or toner and photocopy paper takes place in printer or photocopy machine
b. To prepare paint sprayer in coloring

Do you know?

One end of the nozzle of fuel pipe is connected to the fuel tank or other part of vehicles carrying inflammable substances are towards ground level. Why?

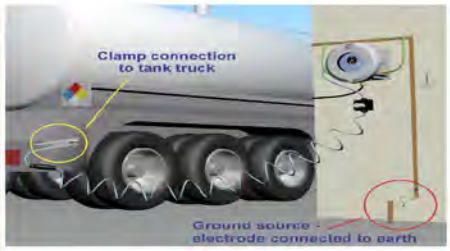


Fig 8.6

The static electricity that can be generated while filling of fuel in the fuel tank is transferred to the land. Due to it, there won't be contact between static electricity and vapor of fuel. Hence it can save from fire.

c. To use in air filtering devices

d. To make dust removing equipment.

8.3 Introduction to lightning

Fig 8.7 Lightning

Question to think

a. Lightening does not occur when the sky is clear. Why?

b. Lightening does not occur without storm even in a cloudy day. Why?

Collect necessary information from various sources like library, internet, resource persons, etc. for these questions and discuss in classroom.

Fig 8.8

Lightning is also transmission of electricity. Cloud is formed due to evaporation of water from the earth surface. Small droplets of water are present in cold cloud. The small droplets of water fall towards the earth. The hot air goes upward turning into vapour due to heat. The double motion thus occured creates friction and the exchange of electron. Charge is generated in the cloud due to this. Generally, positive charge is generated at the upper cloud and negative charge is generated at the lower cloud. Electron is transferred from negatively charged cloud to positively charged cloud. This is called electric discharge. At this time, large amount of heat, light and sound is produced. Sometimes, the discharge

occurs over buildings, trees or land which is known as lightning. Buildings or trees may be damaged by electric discharge.

Fig 8.9

Question to think

a. Lightning is observed before we hear thundering. What is the reason?

b. It is not good to stay under a tree during lightening. Why?

c. It is suggested not to use electrical appliances during lightning. Why?

Lightning rod

Lightning rod is fitted at the top of house to protect house from the possible damage during lightning. One end of the copper wire is connected to the lightening rod whereas the other end of the copper wire is connected to ground and this is known as earthing.

Think, how can we protect our house from lightening?

Earthing is done to protect house from lightning. For this, a wide rod of copper is fixed at the roof or the top of a house as shown in the figure.

It transmits high voltage coming from lightning towards land rather than house.

Lightning rod allows high voltage current towards ground, not towards house. Copper wire connected to the rod is taken down and its end is buried under ground. A hole is made in the ground and it is filled with small pieces of coal or salts. Such substances absorb water and become moist all the time. The copper wire

taken towards the moist is connected with the buried rod. Nowadays the buildings constructed by using modern technology like earthquake resistance schools, apartments, commercial buildings, cinema hall, etc. have used lightening rod.

Project work

Collect information on effects of lightening in different parts of Nepal using various sources like newspaper, internet and other reliable sources. Prepare a short report and present in class.

8.4 Introduction to current electricity

How does the electricity, which is used in various electrical appliances used at home and school, come from? What is such electricity? Does the electricity used in house and school have same source? Discuss.

Fig 8.10 Glowing of bulb in electric circuit

Source, conducting wire, switch and load are necessary for the conduction of electricity. The path in which electric current flows is called electric circuit. The continuous flow of electron from one end to another is called current electricity.

The electrical appliances such as bulb, radio, television, computer, water pump, fan, heater, electric watch, etc. used at home, school and factories run by the help of electric current. These electrical appliances convert electric energy into heat, light, sound and magnetic energy.

Fig 8.11 cells

Combination of cells

Cell is one of the sources of electricity. A single cell has a positive pole and a negative pole. A group of cells is called battery. Cells are of different shapes and sizes. For example: simple cell, dry cell, lead acid cell, etc.

These cells can be connected in electric circuit in various ways.

Fig 8.12 Arrangement of cell in different ways

Activity 8.2

Take different daily used electrical appliances such as wall clock, television remote, torch, etc. in which cell is used. Observe the cell case of the appliances carefully. How does positive and negative poles are arranged in the case? Discuss in your classroom based on the following questions.

a. Is arrangement of cells same in all different electric appliances?

b. In which appliances is positive pole of one cell connected with positive pole of another cell? In which appliances are different poles connected? Fill the table below.

Appliances where two similar poles are connected	Appliances where two opposite poles are connected

Use of two or more than two cells at a time is called combination of cells. Based on above activity, combination of cells are of two types. They are series combination and parallel combination.

Series combination

It is the combination of cells where negative terminal of first cell is connected to positive terminal of second cell and the negative terminal of the second cell is connected to positive terminal of the third cell.

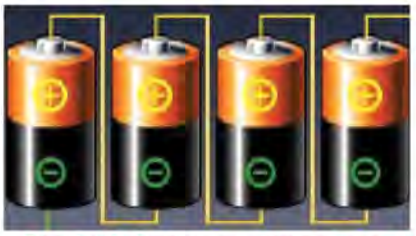


Fig 8.13 Series combination of cells

Activity 8.3

Objective: To prepare and study of series combination of cells.

Materials required: Three dry cells, conducting wire, bulb, switch, tape, etc.

Procedure:

1. Connect positive terminal of first cell with negative terminal of second cell, as well as positive terminal of the second with negative terminal of third cell.
2. Connect a switch using a conducting wire with positive terminal of the third cell.
3. Connect a bulb along with switch using wire and connect another end of bulb to the negative terminal of the first cell using a wire.

Discussion and conclusion: Show the electric circuit prepared by you in a diagram. What are the electrical appliances where such combination of cells are used? Discuss.

Activity 8.4

Objective: To study the relation between brightness of bulb with number of cells in series combination.

Materials required: Conducting wire, few dry cells, bulb and switch

Procedure: Connect bulbs in the circuits of one cell, two cells and three cells as shown in the figure a, b and c. Fill the result in the table given below.

Fig 8.14 Brightness in series combination

Figure	Number of cells	Brightness	Conclusion
a.	1		
b.	2		
c.	3		

Discussion and conclusion: What effect is seen in brightness of bulb with the increase in number of cells? Observe and discuss.

Uses of the series combination of the cells

Uses of series combination of the cells are given below.

a. It is used to increase brightness of bulb by increasing the number of cells.

b. Such combination of cell is used in torch light, radio, remote and many other appliances.

Parallel combination

It is the combination of cells where the positive terminal of more than two cells are connected at one point and the negative terminal of the cells are connected at another point.

Activity 8.5

Objective: To prepare a parallel combination of cells and study.

Materials required : Three dry cells, conducting wire, bulb, switch, tape, etc.

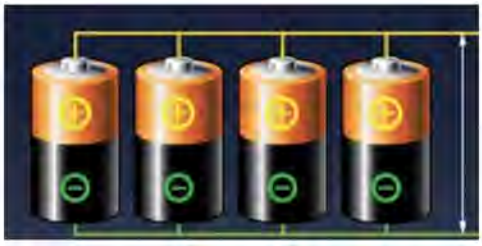


Fig 8.15 Parallel combination of cells

Procedure:

1. Arrange the cells in parallel combination and connect the cells with wire as shown in the figure.
2. Connect bulb and a switch in the circuit.

Conclusion and discussion: What effect is seen in the brightness of the bulb with the increase in number of cells? Observe and discuss.

Activity 8.6

Connect cells with bulbs as shown in the figure a, b, and c. Fill the result in the given table.

a. b. c.

Fig 8.16 Brightness in parallel combination

Figure	Number of cells	Brightness	Conclusion
a.	1		
b.	2		
c.	3		

In this combination, the bulb glows for long time. The brightness of the bulb does not change with increase or decrease in the number of cells. The voltage remains the same, but the time of current flow in the circuit increases. Such combination of cells is called parallel combination. The total voltage of the combination is equal to the voltage of each cell.

Uses of parallel combination of cells

The parallel combination is used for the following purposes.

a. To increase the life span of cell.

b. To supply constant and less current for long time.

Exercises

1. Choose the best option.

a. What type of electricity is produced from friction?

i. Current electricity ii. Static electricity

iii. Hydroelectricity iv. Solar electricity

b. Which one is electric load?

i. Solar bulb ii. Solar battery

iii. Dry cell iv. Photocell

c. Which one is the effect of static electricity?

i. Ringing of bell ii. Sound production from a radio

iii. Glowing of a bulb iv. Lightening

d. What is the effect in brightness of bulb with increase in number of cells in series combination?

i. Brightness decreases.

ii. Brightness increases.

iii. Brightness does not change.

iv. Brightness increases or decreases.

e. From which condition does the given figure represent for the protection of house?

i. Earthquake ii. Storm

iii. Lightning iv. Fire

f. Study the given statement and reasons and choose the correct option.

Statement:

The electricity which is produced due to friction but current does not flow within them is called static electricity.

Reason 1: The substance which loses electron is negatively charged in static electricity.

Reason 2: The substance which gains proton is positively charged in static electricity.

i. Statement is correct but both the reasons are incorrect.

ii. Reason 1 is only the correct one.

iii. Statement and both the reasons are incorrect.

iv. Reason 2 is only the correct one.

g. Which of the following statement is true?

i. Static electricity is produced in conductor but it does not flow through it.

ii. Static electricity is produced in insulator and flows through it.

iii. Static electricity is produced from cell, battery and generator.

iv. Static electricity is produced due to friction in some insulators.

h. Which of the following statement is true?

i. Cells are connected in parallel combination to light a bulb for long time.

ii. More cells are connected in parallel combination

to increase brightness of bulb.

iii. Cells are connected in series combination to light bulb brightly for long time.

iv. Most of the electrical appliances have parallel combination of cells.

i. Which of the following statement is NOT true?

i. Electric charge is produced due to friction in cloud.

ii. One should hide under tree during lightning to be saved from lightning.

iii. Lightning is electric charge on any tree or tall substance or building.

iv. If electrically charged cloud reaches above house, it helps to develop electric charge in the house.

j. Which of the following statement is true?

i. Current flows from positive terminal to negative terminal of a cell that is called flow of electron.

ii. Flow of proton from positive terminal to negative terminal of a cell is current electricity.

iii. Flow of electron from negative terminal to positive terminal of a cell is current electricity.

iv. Flow of electron sometime from positive terminal to negative terminal of a cell and sometime from negative terminal to positive terminal in the circuit prepared by connecting cell is called current electricity.

2. Differentiate between:

a. Current electricity and static electricity

b. Series combination and parallel combination

3. Give reason:

a. It is dangerous to stay under a tall tree or building while it is lightning.

b. Pieces of paper get attracted to comb after combing hair with it.

c. Crackling sound is heard while taking off woolen clothes at dark.

4. Answer the following questions.

a. What is electrostatic force? How is it produced? Describe.

b. What is static electricity? Write any three effects of it.

c. What is lightening? How is it produced? Explain.

d. How can we save house or building from lightning?

e. What is combination of cells? Why is it done?

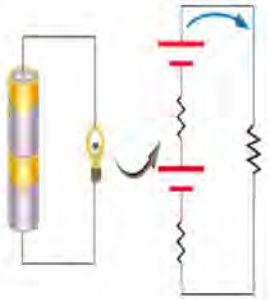
f. Which combination of cells is used to increase brightness of bulb? Describe with diagram.

g. Draw diagrams to show series combination and parallel combination of two cells separately.

h. You have a torch light that needs 3V electricity. How will you connect the cells using two cells each of 1.5V? What are the advantages of such combination?

i. You have a radio that needs 3V electricity? How will you hear radio using two cells? Draw the diagram for such combination of cells.

j. Study the given figure and answer the questions?



i. What type of combination of cell does it have?

ii. What happens in brightness of the bulb when the number of cells is increased? Give reason.

iii. Write the uses of such combination.

k. Study the picture and answer the following questions.

i. What is shown in the picture?

ii. For what purpose does it use?

iii. How does lightning occurswhen negatively charged cloud comes just above a house? Explain with a diagram.

9 Matter

We have different substances like air, water, soil, stone, light, wood, etc. around us. Have all of them occupied space? Do they have mass? Is it possible to collect light or sound in a container as like air in balloon or football?

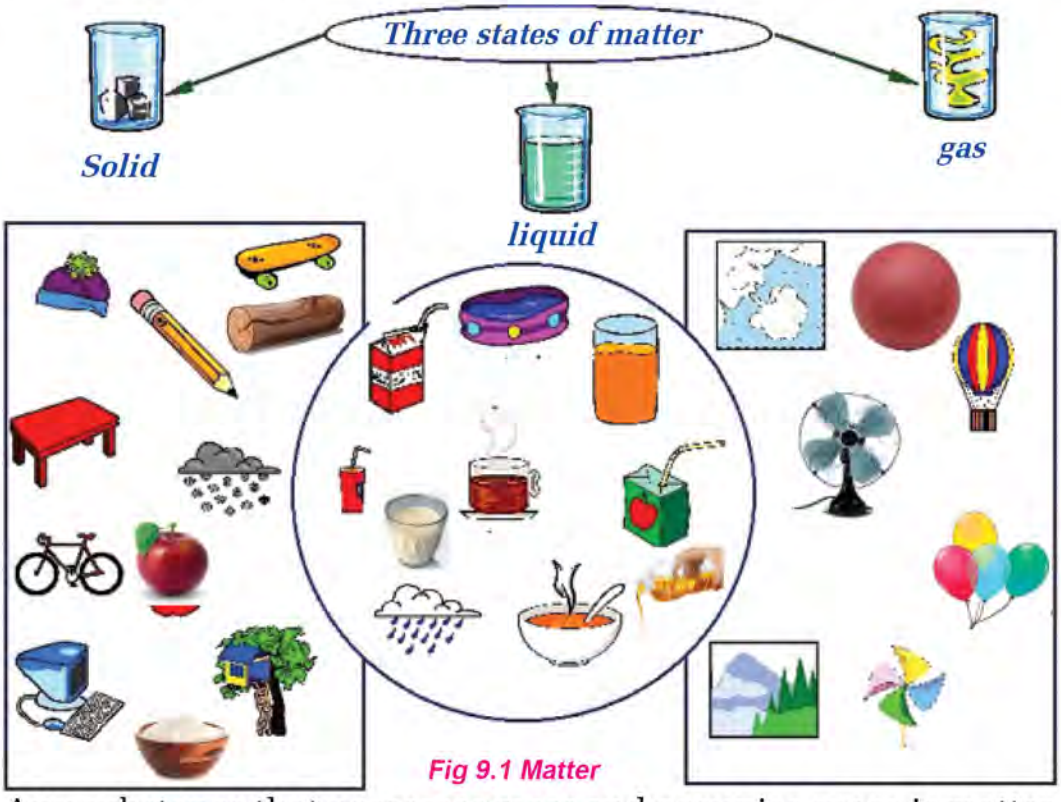


Fig 9.1 Matter

Any substance that possesses mass and occupies space is matter. But shadow, heat and light are not matter because they do not have mass and volume. Some substances occupies more space and has more mass but sometime substance may have less mass even if it occupies more space. Metals like iron, gold, mercury, etc. have more mass but are small in size. The paper, plastic and other light substances have less mass but more volume. The

molecules are tightly held in heavy substances but loosely held in light substances.

9.1 Density of matter

Let's discuss:

a. If you have a piece of iron and a piece of wood with equal volume, which one would have more mass between them? Why?

b. If you have one-liter water and one-liter kerosene, which one would have more mass between them? What is the reason behind this?

Fig 9.2

At normal temperature, different substances are found in different states of matter; solid, liquid and gas. Molecules are loosely packed in liquid than in solid and more loosely packed in gas than in liquid. The substances having equal volume may not have equal mass. It is because the compaction of molecules is different in different substances. The compactness of molecules in a substance is called its density.

Activity 9.1

Objective: To compare density of different substances

Materials required: Hollow cuboidal box, plastic bags, beam balance, sand, soil, husk, saw dust, etc.

Procedure:

Fig 9.3

1. Measure the length, breadth and height of the cuboidal box and calculate its volume.
2. Fill the box completely with sand and keep separately in a plastic bag.
3. Repeat step 2 for soil, husk, saw dust, etc. and keep each of them in a separate plastic bag.
4. Measure the mass of each with the help of beam balance
5. Divide each mass of the substances by volume of the box and complete the table below.

S.N	Name of matter	Mass of matter	Mass (m)/volume(v)
1.	Sand		
2.	Soil		
3.	Husk		
4.	Saw dust		

Discussion and conclusion: Mass per unit volume for all different substances is not equal. Mass per unit volume of a substance is called density.

a. What is the reason of having different masses in equal volume of the substances?

b. What is the density of sand, soil, husk and saw dust?

The relation between density, mass and volume of a substance is given by:

$$\text{Density of a substance (D)} = \frac{\text{mass of object (m)}}{\text{volume of object (v)}}$$

If mass is measured in kilogram (kg) and volume in cubic meter (m^3), the unit of density is kilogram per cubic meter (Kg/m^3) which is the SI unit of volume.

But if mass is measured in gram (g) and volume in cubic centimeter (cm^3), the unit of density is gram per cubic centimeter (g/cm^3) which is the CGS unit of volume.

Numerical problems

Example 1

What is the density of a stone of mass 5000kg and volume $2m^3$?

Here,

Volume of stone (V) = $2m^3$

Mass of stone (m) = 5000kg

Density of stone (D) = ?

By formula, $D = \frac{m}{v}$

$= \frac{5000}{2}$

By formula

$= 2500\ kg/m^3$

Therefore, the density of the stone is 2500kg/m^3.

Example 2

How many Kg of water is required to fill a drum of volume 6m^3, where water has density 1000kg/m^3?

Here,

Volume of drum (V) = 6m^3

Density of water (D) = 1000kg/m^3

Mass of water (m) = ?

By formula, $D = \frac{m}{v}$

or, $1000 = \frac{m}{6}$

or, $m = 1000 \times 6$

or, $m = 6000\ kg$

Therefore, mass of water in the drum is 6000kg.

Relative density

Activity 9.2

Objective: To compare the density of sand and water

Materials required: Two equal beaker, sand, water, plastic bags and beam balance

Procedure:

1. Fill sand completely in a beaker and water in an another beaker with exactly same size.
2. Collect the sand and the water in separate plastic bags and measure each of their masseswith beam balance.
3. Now calculate the volume of the sand and the water.

Discussion and conclusion: Discuss the following questions and draw a conclusion.

a. How many times more mass of the sand is there than the water?

b. How many times more density of the sand is there than the water?

Relative density of a substance is calculated by comparing density of a substance with the density of water at 4°C. Density of water at 4°C is 1g/cm^3.

The ratio of density of a substance to the density of water at 4°C is called relative density of the substance. Relative density of a substance helps to compare mass of the substance of certain volume with the mass of water at 4°C of the same volume.

$$\text{Relative density} = \frac{\text{density of a substance}}{\text{densitiy of water at 4°C}}$$

Relative density does not have any unit as it is a simple ratio of two densities.

Density of a substance and relative density

S.N.	Name of substance	Density *(kg/m^3)*	Density *(g/cm^3)*	Relative density
1.	Ice	920	0.92	0.92
2.	Aluminium	2700	2.7	2.7
3.	iron	7800	7.8	7.8

Example 3

If the density of gold is 19 g/cm^3, what is its relative density? (density of water at 4°C = 1g/cm^3)

Here,

Density of gold = 19 g/cm^3

Density of water at 4°C = 1 g/cm^3

Relative density of gold = ?

We know, $$\frac{\text{density of gold}}{\text{densitiy of water at } 4^0 \text{ C}}$$

$$\text{Relative density of gold} = \frac{19 g/cm^3}{1 g/cm^3}$$

$$= 19$$

Hence, relative density of gold is 19. It means the mass of gold with equal volume of water is 19 times more.

Floating and sinking

Fig 9.4: Floating and sinking

Activity 9.3

Objective: To identify floating and sinking substances in water

Materials required: A piece of wood, a piece of stone, plastic, a piece of iron, eraser, spoon, etc.

Procedure: Take a big plastic bucket with water. Keep the different objects one at a time and observe whether they float or sink.

Discussion and conclusion:

Some objects float on water and others sink, why? Does relative density have any relation with sinking and floating of an object? Discuss and draw a conclusion.

If the relative density of a substance is greater than 1, the substance sinks in water and if the relative density is less than 1 it floats. Similarly, a substance sinks in a liquid if the density of it is greater than the liquid and it floats if the density of the substance is less than the liquid.

Example 4

Find the density of an iron box of mass 20 kg with dimension 1 m × 0.5 m ×0.2m. Also find out whether the box sinks or floats in water.

Here,

Volume of iron box (V) = 1 m ×0.5 m ×0.2m

$= 0.1\ m^3$

Mass of iron box (m) = 20 kg

Density of iron (D) = ?

By formula,

$$D = \frac{m}{v}$$

$$\text{or, } D = \frac{20\ kg}{0.1\ m^3}$$

$$\text{or } D = 200\ kg/m^3$$

The density of iron box is 200kg/m^3. Since, the density of iron box is less than that of water, it floats in water.

Element and compound

Element

Question to think

If an iron piece is broken down into microscopic particles, are the properties of the particles similar to the iron piece?

When a substance is broken down into tiny particles by any means, the properties of each particle remains identical with the properties of that substance. Such substances are elements. Copper is an element because it cannot be broken down into any other simpler form. But the particles having similar properties to copper are obtained. Iron, gold, silver, oxygen, hydrogen, sulphur, etc. are some of the examples of element. Scientists have discovered 118 elements in which 92 are natural elements and 26 are artificial. Element is a pure substance which cannot be broken down into simpler form by any chemical process. Elements are found in all three states; solid, liquid and gas. At normal temperature, iron, gold, silver, etc. are in solid state, bromine and mercury are in liquid state; and hydrogen, oxygen, nitrogen, etc. are in gaseous state.

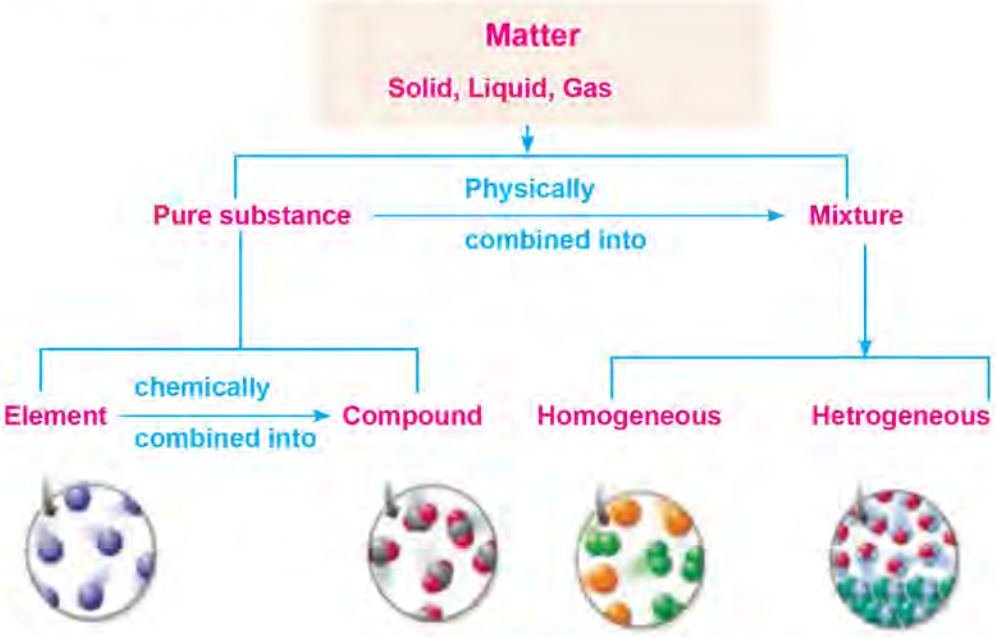


Fig 9.5 Element and compound

Atom

If an element is broken down into small particles by some chemical process, smallest particles are obtained at the end. Such

smallest particles are called atoms. The smallest particle of an element that takes part in chemical reaction is called an atom.

When iron reacts with any substance, its atom takes part in chemical reaction. Atoms take part in the process when an element undergo chemical reaction with other elements. Atoms of same elements are identical but the atoms of one element are different from the atoms of other element. For example; an atom of oxygen is different from the atom of hydrogen. Each element has their identical atom, thus, there are 118 types of atoms.

Structure of an atom

Atom is the smallest particle of an element. Atoms are made of sub-atomic particles. Electron, proton and neutron are three sub-atomic particles. Nucleus and shell are two parts of an atom. The central part of an atom is called nucleus where proton and neutron are present. Orbit or shell is present around the nucleus. Electrons revolve round the nucleus.

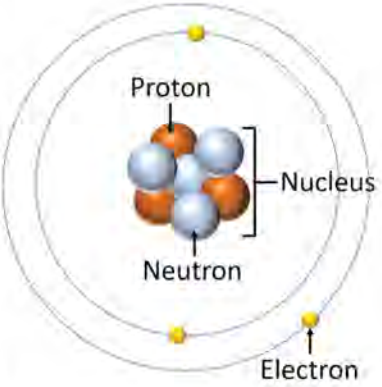


Fig 9.6

Proton

Proton is positively charged sub-atomic particle. It is present in nucleus. Mass of a proton is equal to mass of one hydrogen atom. Thus, Mass of a proton is called 1 atomic mass unit (amu).

Neutron

Neutron is neutral or chargeless in nature. It is also present in nucleus of an atom. The mass of a neutron is equal to the mass of a proton. Therefore, mass of a neutron is also 1 amu.

Electron

Electron is negatively charged particle. It revolves around the nucleus in a fixed path called shell or orbit. The mass of electron is negligible compared to mass of proton or neutron. Mass of an electron is equal to $1^{o}(1837)$ part of one proton.

The comparative study of three sub-atomic particles is given below.

Comparative study of electron, proton and neutron

Sub-atomic particle	Symbol	Mass	Charge	Location
Proton	p^{+}	*1 amu*	*+ve*	*Nucleus*
Electron	e^{-}	*1/1837 amu*	*-ve*	*Shell*
Neutron	n^{0}	*1 amu*	*0*	*Nucleus*

Elements can be represented by symbol. The symbols and features of elements are given below.

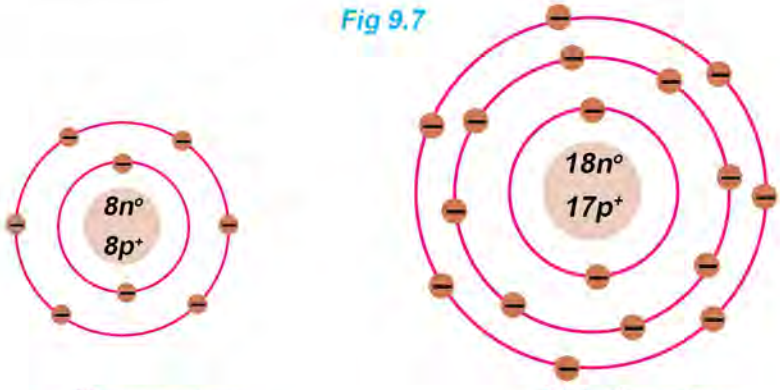
S.N.	Name of element	Symbol	Number of proton	Number of electron	Number of neutron
1.	Hydrogen	H	1	1	0
2.	Helium	He	2	2	2
3.	Lithium	Li	3	3	4
4.	Beryllium	Be	4	4	5
5.	Boron	B	5	5	6
6.	Carbon	C	6	6	6
7.	Nitrogen	N	7	7	7
8.	Oxygen	O	8	8	8
9.	Fluorine	F	9	9	10
10.	Neon	Ne	10	10	10

11.	Sodium (Natrium)	Na	11	11	12
12.	Magnesium	M	12	12	12
13.	Aluminium	Al	13	13	14
14.	Silicon	Si	14	14	14
15.	Phosphorous	P	15	15	16
16.	Sulphur	S	16	16	16
17.	Chlorine	Cl	17	17	18
18.	Argon	Ar	18	18	22
19.	Potassium (Kalium)	K	19	19	20
20.	Calcium	Ca	20	20	20

Project work

Study the figure given below and follow the instruction to prepare a model of an atom:

Fig 9.7



Oxygen atom *Chlorine atom*

Taka a chart paper. Draw a circle at the centre of the paper using pencil divider. Paste a colored thread over circumference of the circle using glue which represents nucleus of an atom. Draw another circle around the nucleus with same centre. Now paste a thread on its circumference with glue and it represents the first shell. Make necessary number of shells around the nucleus

as per required. Take two of each three types of pulses such as black gram (mas), soyabean, split red gram (rahar), black eyed beans (bodi) etc. which are locally available. Represents electron, proton and neutron each with a type of pulse. For example, use black gram for proton, soyabean for neutron, and split red gram for electron. Paste them in appropriate place to prepare a model of helium atom. In the same way, prepare a model of oxygen atom.

Atomic number = no. of proton = no. of electron

Atomic mass = no. of proton + no. of neutron

Molecule

Matter is made of smaller particles called molecule. Molecules are made up of two or more atoms of same or different elements. Molecules of element like H_2, O_2, N_2, etc. are made up of same type of atoms of an element.

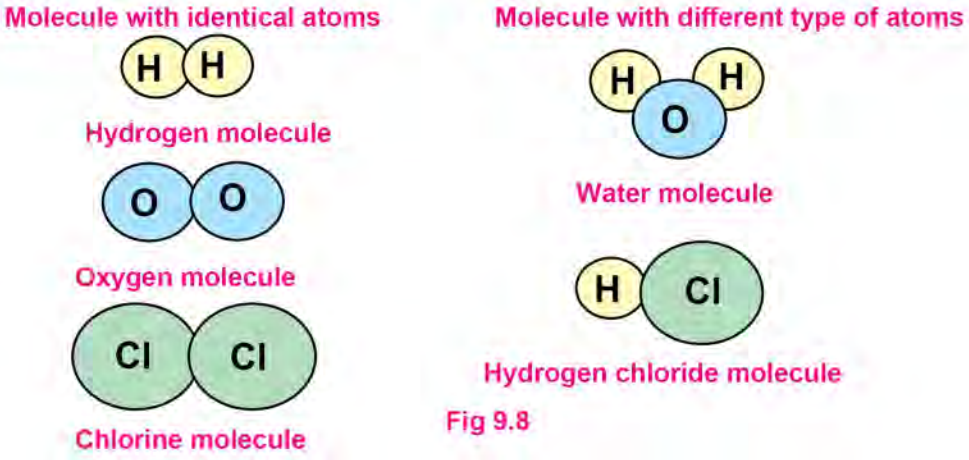


Fig 9.8

A molecule of a compound possesses all the properties of the compound. For example: one spoonful sugar is sweet in taste and so, each molecule of the sugar is also sweet in taste. The smallest particle of an element or compound which possesses all the properties of the substance is called molecule. A molecule of an element is made up of same atoms. For example: molecule of oxygen is made of two oxygen atoms. But the molecule of compound is made of two or different type of atoms.

A molecule of water is made up of one atom of hydrogen and two atoms of oxygen. In nature, elements together form compound and compound breaks down into new substances by some chemical process. Changes occur in matter by this process.

Project work

Prepare a model of molecule of water in a group using local materials like mud or flour, match stick, different color, etc. and discuss its structure in your classroom.

Compound

Discuss the questions given below in your classroom.

a. 118 elements have been discovered at present; how many type of substances are found in nature? Guess and share in your classroom.

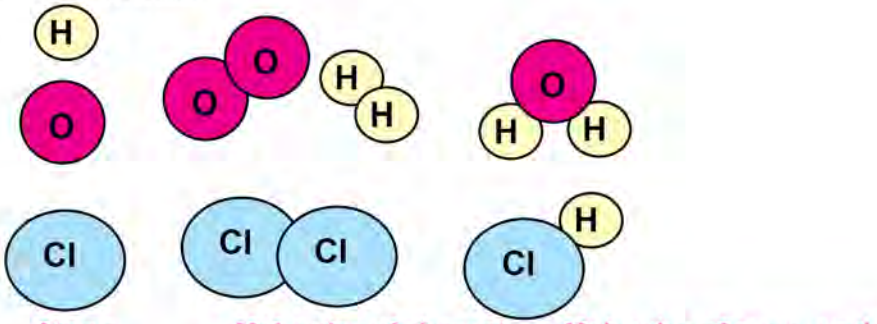


Fig 9.9

b. How are such large number of substances formed in nature?

The process of formations of new substance through the reaction between two or more atoms of elements is called chemical reaction. Compound is the product of the chemical reaction between two or more elements. Compound are formed from elements in a fix ed ratio by number. For example; water is formed from hydrogen and oxygen. Common salt is formed from sodium and chlorine. Water (H_2O) and common salt (NaCl) are the examples of compound.

9.3 Change in matter

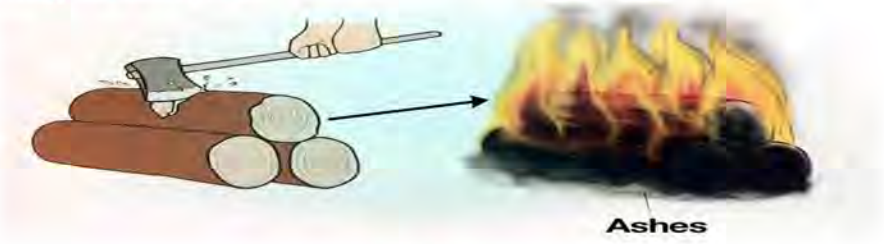


Fig 9.10

Activity 9.4

Take a piece of ice and a piece of wood. Heat the piece of ice. Similarly, burn the wooden piece and observe:

a. What differences do you find in two cases? Discuss based on the changes that occur in state, structure and property of the objects.

b. Make a list of similar changes in matter that occur in our daily life and discuss in your classroom.

Changes occur in matter due to various cause such as heat, light, pressure, etc. In some cases, changes occur in state, shape, size, colour, etc, while in other cases, change occurs in their property too. Based on the nature of change, there are two types of changes; physical change and chemical change.

Question to think

What would happen if changes do not occur in matter?

Physical change

Activity 9.5

The given figure shows the change of water into vapour and again the vapour into water. Discuss the questions given below.

fig 9.11

a. Have you found any changes in property, state and structure of matter in the given activity?

b. Is the change of milk into curd resembled such type of change?

The changes that occur in color, volume, shape, density, etc. but not in the chemical nature of matter is called physical change. Many changes can be seen in our daily life. For Example; big lump of salt breaks down into fine powder, ice or snow melts to form water, water freezes into ice, wood is chopped into smaller pieces of firewood, spices are grinded into fine powder, salt solution is formed on mixing salt and water and so on.

Make a lists of other physical changes experienced in your daily life and present it in your classroom.

Substance	Change

Characteristic of physical changes

a. State of matter changes but chemical nature remains the same.

b. No new substances are formed.

c. Change in matter can be reversed back.

d. Physical change is a temporary change.

e. Mass of matter does not change.

f. Physical changes occur due to electricity, heat, light, pressure, etc.

g. Molecular structure does not change in physical change.

Chemical change

Activity 9.6

Objective: What happens when a magnesium ribbon is burnt?

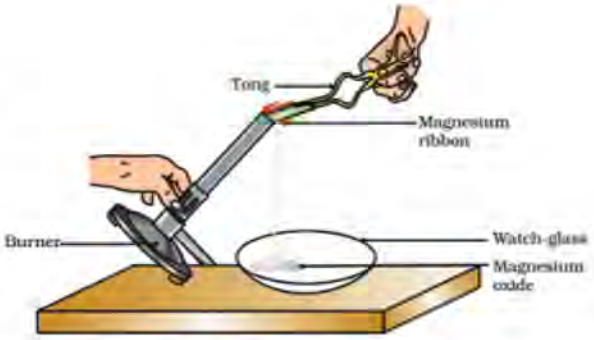


Fig 9.12

Materials required:

Magnesium ribbon, match stick or lighter, Bunsen burner or spirit lamp, watch glass

Procedure:

1. Hold a magnesium ribbon with tongs and burn it.
2. Keep the residue in a watch glass.
3. Observe the property of magnesium ribbon and the residue.

Discussion and conclusion:

a. Are the properties of magnesium ribbon and its ash same?

b. What type of change is it?

The process of changing a substance into a new substance with new property is called chemical change. In such change internal structure of the molecules changes. In the above activity change of magnesium ribbon into ash (magnesium oxide) is a chemical change. During the process magnesium ribbon reacts with oxygen atom. Besides this, rusting of iron, rottening of fruits, oxidation of digested food inside our body, photosynthesis process in leaves, burning of wood, formation of compost manure from waste, formation of water from hydrogen and oxygen, etc. are some of the examples of chemical changes.

Make a lists of other chemical changes experienced in your daily life and present in your classroom.

Question to think

What is the role of chemical changes for continuous formation of different substances in the earth?

Characteristic of chemical changes

a. In chemical change new substances are formed with different property.

b. Chemical change is a permanent change. The new substance formed cannot be reversed back to its original state.

c. Changes occur in internal structure of molecule.

d. Some chemical reaction absorbs heat and others release.

Comparison between physical change and chemical change

Physical change	Chemical change
1. State of matter may change.	1. State and property of matter may change.
2. Changes can be reversed.	2. Changes cannot be reversed.
3.No new substances are formed.	4. New substances are formed.
5. Change is temporary.	3. Change is permanent.

Activity 9.7

Iron made structures of house such as ladders, windows, gates are colored? Why? Why is the zinc galvanized before use? Discuss and present in your classroom.

Project work

Chemical change occurs on heating sugar in a spoon, show it by laboratory method. Make a presentation in your classroom including all necessary materials, procedure and conclusion required for this activity.

Project work

Locally available enzyme (marcha) is mixed with cooked cereals to prepare local alcohol through fermentation. The mixture is heated to obtain vapour of alcohol. The vapour is cooled down to get liquid alcohol which is called raksi. Find out the physical and chemical changes that occur in different steps during the whole process. Observe the real process or search from the internet, book or ask to elders. Make a presentation and discuss in your classroom.

Exercise

1. Fill in the blanks with suitable words given below.

1/(1837)	Na	volume	chemical
less	1/183 K	more	sinking

a. Density of a substance depends on mass and .....

b. The substance which has ------ density than water floats in water.

c. A ---------- body has more density than water.

d. The mass of an electron is ---------- amu.

e. Potassium is represented by symbol -------.

f. Rusting of iron is ---------- change.

2. Match the following.

Name of atom	Atomic number
Potassium	8
Helium	16
Boron	19
Sulphur	20
Silicon	5
Oxygen	14
	2

3. Choose the best alternative from the following.

a. What is the density of water?

i. 1 gm/cm^3 ii. 10 gm/cm^3

iii. 100 gm/cm^3 iv. 1000 gm/cm^3

b. Which is the correct formula for density?

i. $d = \frac{v}{m}$ ii. $d = \frac{m}{v}$

iii. $v = \frac{d}{m}$ iv. $m = \frac{v}{d}$

c. Which of the sub-atomic particle is positively charged?

i. Electron ii. Neutron

iii. Nucleus iv. Proton

d. Which of the following best defines molecule?

i. The smallest particle of matter

ii. The smallest particle having same property of the matter.

iii. The smallest particle having properties of all substances

iv. The smallest particle having mixed propertyof matter

e. Which of the following group denotes physical change?

i. Breaking down of salt lump, cooling of water to make ice, preparing furniture from wood

ii. Making curd from milk, cooling water to make ice, preparing furniture from wood

iii. Preparing furniture from wood, breaking lump of salt, rusting of iron

iv. Rusting of iron, formation of ice on cooling, grinding of spices

f. Which of the following is true for an element?

i. Any substance which can be broken down into simpler form is called an element.

ii. Any substance which cannot be broken down into any simpler form is called an element.

iii. Substance which cannot be broken is called an element.

iv. Each substance found around us is called an element.

g. Which of the following statement is true for compound?

i. The combination of two or more than two elements either less or more proportion is called compound.

ii. The combination of two or more than two elements with same number is called compound.

iii. The combination of two or more than two elements in a fix proportion is called compound.

iv. The combination of two or more elements in any proportion is called compound.

h. Which of the following is true for potassium element?

i. Atomic number of potassium is 19 and symbol of potassium is P as it begins from letter p.

ii. Atomic number of potassium is 15 and symbol of potassium is P as it begins from letter p.

iii. Atomic number of potassium is 19 and symbol is k as its latin name is Kalium.

iv. Atomic number of potassium is 15 and symbol is k as its latin name is Kalium.

4. Differentiate:

a. Chemical change and physical change

b. Element and compound

c. Density and relative density

5. Give reasons:

a. Egg sinks in pure water but floats in salty water.

b. An atom is electrically neutral.

c. Breaking down of a lump of salt into fine powder is a physical change.

d. The process of formation of water from hydrogen and oxygen is a chemical change.

e. Regular painting is necessary in iron frame where it is not necessary for aluminum frame.

6. Answer the following questions.

a. Draw a structure of an atom showing proton, electron and neutron.

b. What is density? What is the mass of aluminum with volume $2m^3$. (density of aluminum is $2700kg/m^3$)

c. What is relative density? If the densities of pure milk and water at 4^oC are 1030 kg/m^3 and 1000 kg/m^3 respectively, what is the relative density of pure milk?

d. Different objects are kept in water in the figure. Answer the questions based on density.

Cock, Wood Aluminimium

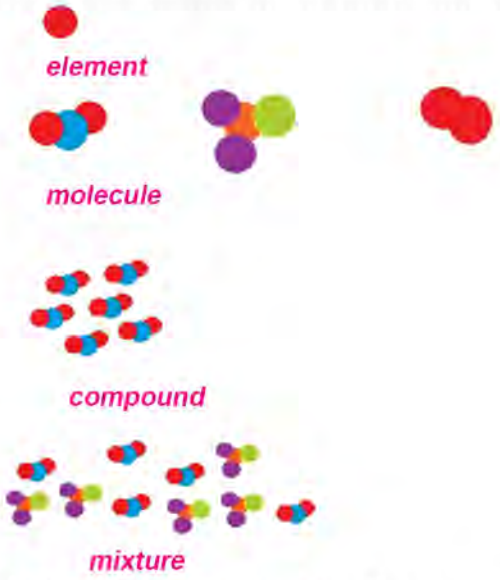
i. Why does cork float in water but aluminum sinks in water?

ii. If density of aluminum is 2.7 gram per cubic meter, calculate relative density of aluminum.

e. If relative density of an object is 0.92, identify whether the body sinks or floats in water. Analyze with suitable reason.

f. What is an element? Write the name and symbol of elements with atomic number 7, 13 and 17.

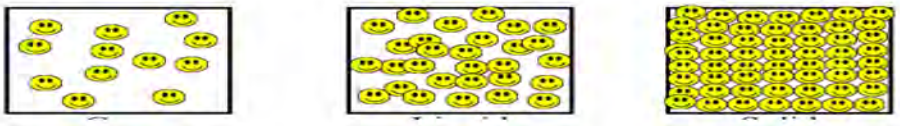
g. Based on the figure below, describe the interrelationship between element, molecule and compound.



h. Which atoms are present in a molecule of water? Also state their numbers.

i. What are sub-atomic particles? Draw an atomic structure and label the sub-atomic particles.

j. Identify the states of matter based on compaction of particles in the following figure.



k. What type of changes are called physical change? Write with example.

l. What is chemical change? Mention any three examples of the change that occurin our daily life.

m. Classify the following examples into physical and chemical change.

   i. Evaporation of water

   ii. Boiling of egg

   iii. Condensation of vapour

   iv. Burning of fossil fuel

   v. Dissolving of sugar in water

n. What is the name of the element having atomic number 18? Prepare a model of its atomic structure.

10 Materials Used in Daily Life

Fig 10.1 Materials used in daily life

We use various substances in our daily life. These substances have different properties. Various edible substances possess different taste such as sour, sweet, bitter, salty, etc. Various substances are used to prepare various items such as sugar to make tea, salt for curry, *chuke amilo* for pickle, soap for washing clothes, baking powder for baking bread, etc. Based on their property, different substances are classified into different groups.

10.1 Acid, base and salt

Activity 10.1

Classify various items used in kitchen into three different groups based on properties such as sour, bitter and salty and present them in your classroom.

Sour	Bitter	Salty

Generally, substances having sour taste are acid. Bases are bitter in taste while salts are tasteless but common salt is salty.

Indicator

It is not easy to identify all the substances by taste. Some of the substances may be harmful to our body to take taste. Therefore, indicator is necessary to study the property of such substances. Indicator is a chemical substance which is used to indicate whether the given substance is acid, base or salt. Litmus paper, methyl orange, phenolphthalein, etc. are the examples of simple indicator. Indicator changes its color when kept in different substances and thus helps to identify whether the substance is acid, base or salt.

Litmus paper

Methyl orange

Phenolphthalein

Standard list of different colour change in different indicators.

Indicators	Acid	Base	Salt
Red litmus	Red	Blue	Neutral
Blue litmus	Red	Blue	Neutral
Methyl orange	Red	Yellow	Neutral
Phenolphthalein	Colourless	Pink	Neutral

Method of preparation of indicator from local material

Various colour juice can easily be extracted from locally available plant parts such as red flower of rose, red leaf of cabbage, pieces of onion, turmeric powder, beetroot, etc and we can prepare indicator.

Fig 10.3 Juice of red leaf of cabbage, red flower and turmeric powder

Activity 10.2

Fig 10.4 Onion pieces

Take an onion and cut it into small pieces. Immerse them into alcohol or lemon juice. Then boil the mixture for 20 minutes. Filter the mixture with the help of a filter paper. Now, the juice of indicator is ready. Using the list of table above compare whether the substances such as common salt, solution of soap water and tomato juice are acid, base or salt.

Questions to think

a. Cloth, which consists solution of turmeric, becomes red on washing with soap. Why?

b. The color of skin of slaughtered goat, buffalo, sheep, etc. becomes red after using the mixture of ash and turmeric powder. Why?

Project work

Prepare an indicator from the juice of red rose or any red flower. Use the juice to identify acid, base or salt and list the change in color with different substances in the table. Also, prepare an experimental file of it.

Activity 10.3

Objective: To identify acid, base and salt by using indicator

Materials required: Red and blue litmus papers, lemon juice, curd, tomato juice, bitter guard juice, water, soap water, etc.

Procedure

1. Immerse red and blue litmus paper in different juice solution.
2. Observe whether the colour of litmus paper changes or not and fill in the table given below.

Chemicals	Red litmus	Blue litmus
Lemon juice		
Curd		
Tomato juice		
Bitter guard juice		
Water		

Discussion and conclusion: The substance which converts blue litmus into red is acid. Base turns red litmus paper into blue while colour of litmus remains same in salt. Based on observation and discussion classify the given substances into acid, base and salt.

Classify the different substances used in our daily life into acid, base and salt and study them.

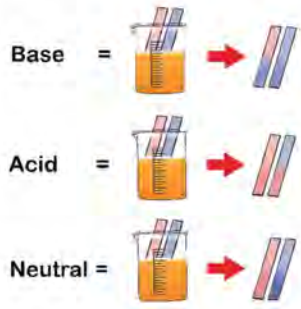


Fig 10.5

Acid

Substances like pickle, lemon, vogate, titri, etc. have sour taste. Generally, substances having sour taste are acid. Various items of pickle, fruits such as apple, orange, lemon, vogate, etc. which we eat are acidic in nature. Due to acidic nature of food stuff, they are sour in taste. Acids may be organic or inorganic based on their origin.

Acids obtained from animal, plants and fruits are organic acids. These acids are soft and edible. The acids obtained from minerals are called inorganic acids. These acids are also called mineral acid. Hydrochloric acid, sulphuric acid and nitric acid are the examples of inorganic acids.

The daily used edible acids and their sources are given below.

Fig 10.6 Sources of organic acid

Do you know?
When an ant or bee bits, it injects formic acid inside body and gives pain and sensation of burning.

S.N	Chuke amilo	lemon
1.	Citric acid	Orange, lemon, tomato
2.	Ascorbic acid	Amala or sour fruits
3.	Tartaric acid	Tomato, grapes, nettles (sisnu)
4.	Malic acid	Apple
5.	Lactic acid	Milk, curd
6.	Acetic acid	Vinegar, sour pickle
7.	Carbonic acid	Soda water, cold drinks
8.	Oxalic acid	Chariamilo, nettles (sisnu)

Physical properties of acid

a. Acids are sour in taste.
b. It changes blue litmus paper into red.
c. Strong acids are corrosive in nature.
d. Acids change methyl orange into red.
e. Phenolphthalein does not change its color in acid.

Questions to think

a. When soap solution is mixed with turmeric powder, it becomes red,why?
b. When chuck falls on wound, it burns, why?

Activity 10.4

Take moist red and blue litmus papers near to mouth of opening bottle of soda water or cold drink from where gas comes out. What changes do you notice? Give reasons to support your answer.

Base

Activity 10.5

Lather of soap tastes bitter when it enters into our mouth while bathing. Similarly, persimmon (haluwabed) tastes bitter. Curry of bitter guard is

Fig 10.7

always bitter. Why do these substances taste bitter? Discuss and present conclusion.

Generally, substances with bitter taste are base. Some base dissolves in water which are called alkali. Bases have soapy to touch. Sodium hydroxide, potassium hydroxide, etc. are some examples of base. A mixture of aluminum hydroxide and magnesium hydroxide is used as antacid during hyperacidity of stomach.

Questions to think

a. Why is vinegar used while cooking *Karkalo* or *Pindalu*?

b. Why is soap or titipati used to get relief from pain of nettles, why?

c. Soap is used in ant or bee sting and vinegar or any sour substance is used in wasps' sting, why?

Physical properties of base

a. Base changes red litmus paper into blue.

b. Most of the base taste bitter.

c. Bases have soapy touch.

d. Bases change methyl orange into yellow color.

e. Bases change phenolphthalein into pink.

Salt

Salts are generally neutral substance. Acid and base combines

Fig 10.8 Salt

Do you know?
Ash is a type of base. It is used to clean discs and cloths. It is also used to reduce acidity of soil.

to give salt. Sodium chloride (common salt), sodium carbonate, etc. are examples of salt. Salts are of three types; neutral, acidic or basic.

Activity 10.6

Write the change in color of different indicators with the substances given in the table. Complete the table and present in your classroom.

S.N	Substance	Red litmus	Blue litmus	Methyl orange	Phenolphthalein
1.	Sodium chloride				
2.	Sodium hydroxide				
3.	Sulphuric acid				

Physical properties of salt

a. Most of the salts are tasteless or bitter but common salt is salty.

b. Generally, salts are soluble in water.

c. Salts may be white, colorless and colorful.

d. Salts have high melting and high boiling point.

e. Indicator does not show any change in color with salt.

Exercise

1. Fill in the blank with suitable words.

salt, citric acid acid base

formic acid methyl orange

a. Itching and swelling of skin after bee and ant sting is due to ..... .

b. Ash is an example of ..... .

c. Sodium chloride is a ..... .

d. We can find..... in tomato.

e. Generally, substances having sour taste is found in .....

2. Choose the correct option from the following.

a. On which substance does edible soda belong to?

i. Acid ii. Base iii. Salt iv. indicator

b. Which of the following change is seen in apple juice?

i. Changes blue litmus paper to red color

ii. Changes red litmus paper to blue color

iii. Changes methyl orange to yellow color

iv. Changes phenolphthalein to colourless

c. Which of the following possesses the property of base?

i. Curd ii. Soap

iii. Vinegar iv. Grapes

d. Which of the following indicator is prepared from lichens?

i. Methyl orange ii. Phenolphthalein

iii. Litmus paper iv. Cabbage juice

e. What is the feature of base?

i. Sour and soapy ii. Salty and bitter

iii. Sour and bitter iv. Bitter and soapy

f. Which of the following is the correct effect of indicator?

i. Red litmus paper changes into blue color when dipped in acid solution.

ii. Blue litmus paper changes into red color when dipped in a base.

iii. Methyl orange changes into yellow color when dropped in acid.

iv. Phenolphthalein changes into pink color when dropped in base.

g. Match the following acid and their source.

Carbonic acid	Lemon
Tartaric acid	Curd
Citric acid	Amala
Malic acid	Vinegar
Lactic acid	Soda water
Acetic acid	Apple
Ascorbic acid	Titri

3. Give reason.

a. Nettles make skin burn.

b. Litmus paper does not show any change in color when dipped in solution of common salt.

c. Lemon is sour in taste.

d. Acids should be handled with care.

e. Ash water is slippery in nature.

4. Differentiate between:

a. Acid and base

b. Strong base and weak base

c. Lemon water and soap water

5. Answer the following questions.

a. What is acid? Give any two examples of acid found in our locality.

b. Write down the name of three acids used in laboratory.

c. What is base? Make a list of bases used in our daily life.

d. What type of acid is organic acid? Give any examples of this acid.

e. Complete the table below based on the change in color of indicators in acid, base and salt.

Indicator	Acid	Base	Salt
Methyl orange	Red	--------	Neutral
Litmus paper	----------	Blue	----------
phenolphthalein	Colourless	--------	Neutral

f. Among the given three test tubes, one has acid and the remaining two tubes have base and salt. Identify the test tubes containing acid, base and salt with the help of methyl orange.

g. Write the physical properties of acid.

h. Write the physical properties of base.

i. What is salt? Mention its main types.

j. How can you prepare litmus paper from red flower? Describe in brief.

k. On what basis do indicators identify acid, base and salt?

l. Three bottles separately contain orange juice, washing soda and salt solution. Separate them into acid, base and salt with the help of red and blue litmus paper. Explain them.

m. Make a list of any three local substances used to prepare natural indicator.

10.7 Metals and Non-metals

Activity 10.7

Study different objects at your house and school and complete the table.

S.N	Object	Hardness	Shining	Conduction of heat	Thin wire like form	Clink sound
1.	Iron	Hard	Shines	Conducts	Can be drawn	Produces
2.	Wood	Soft	Does not shine	Does not conduct	Cannot be drawn	Does not produce

We find different substances around us. They are used for various purposes. Because of some property and feature of substances, they are used for some specific purposes. Aluminum, steel, etc. are good conductor and are used to make cooking utensils. Copper is a good conductor of electricity, so, it is used as conducting wire. Similarly, plastic which is an insulator is used to cover a conducting wire. Based on such properties, elements are classified into metal and non-metal. Elements like aluminum, zinc, iron, gold, copper and silver are metals whereas sulphur and iodine are examples of non-metal. Besides these, identify other metal and non-metal and discuss in class.

Fig 10.9 Metals and non-metals

Elements which are hard, shiny, conduct heat and electricity, becomes flat and produces clink sound on hammering are metals. Some examples of metals are iron, copper, gold, aluminum, etc. Similarly, the elements which are soft, burn on heating, does not conduct heat and electricity are non-metals. Some examples of non-metals are sulphur, iodine, carbon etc.

Aluminium

Symbol : Al, Atomic number : 13

Fig 10.10 bauxite ore

Aluminum is not found in free state but found in combined state in the form of compound or in an impure form mixed with other substances. It is one of the most abundantly found element in the earth's crust. The main ore of aluminum is bauxite. Aluminum is extracted from bauxite ore.

Physical properties and uses

Fig 10.11 Aluminum in car body

a. Aluminum is light white metal. So it is used to make body parts of vehicles and aeroplane.

b. It is a good conductor of electricity. So it is used to make a conducting wire.

c. It is also a good conductor of heat. It is used to make household utensils.

d. It has low melting point. So it is used to make wire and flat plate.

e. It is not affected by air and water. Therefore, aluminum foil is used in packing food stuffs.

Zinc

Symbol: Zn Atomic number: 30

Zinc is found in the form of ore or compound. Zinc blende is the main ore of zinc from which zinc is extracted.

Physical properties

Fig 10.12 Zing blende

a. It is light and blue color metal found in granular shape.
b. It is a good conductor of heat and electricity.
c. It is not affected by air and water.
d. It melts at low melting point.

Uses

Fig 10.13 Zinc plate

a. It is used in lab to prepare hydrogen gas.
b. It is used to make alloy such as brass.
c. It is used to make outer case of a dry cell.
d. It is used to make printing block.
e. Zinc plate is used for roofing.

Iron

Symbol: Fe **Atomic number: 26**

Iron is found in the form of ores in nature. Iron is extracted mainly from hematite ore.

Fig 10.14 Hematite ore

Physical properties

a. Color of iron is black or grey.
b. It shines on rubbing.
c. It gets rusted.
d. It possesses magnetic property.
e. It is easily affected by air and water.

Fig 10.15 Iron

Uses

a. Iron is used to make various tools and weapons.
b. It is used to make different household utensils.

c. It is used to make house, bridge and body parts of vehicles.

d. It is used to make steel.

e. It is used to make rod, pipe and wire.

Gold

Symbol: Au, Atomic number: 79

Fig 10.16 Gold in rocks

Gold is found in native state. It is found in between rocks or in the river bank of sand.

Physical properties

a. It is a yellow shiny metal.

b. It is a good conductor of heat and electricity.

c. It is a non-reactive metal.

d. It does not react with air and water.

Uses

Fig 10.17 Jewelries of gold

a. It is used to make jewelries.

b. It is used make statue, coin and metal.

c. It is used to plate on cheap metals.

d. It is used to make medicine.

e. It is used to fill in teeth.

Copper

Symbol: Cu, Atomic number: 29

Copper is a metal which has been used since ancient time. Copper is extracted from ore, chalcopyrite.

Fig 10.18 Chalcopyrite ore

Physical properties

Fig 10.19 Copper wire

a. Copper is reddish brown metal.
b. It is good conductor of heat and electricity.
c. It becomes dull if kept in moist place.
d. It is reactive metal.

Uses

a. It is used to make utensils.
b. It is used as conducting wire.
c. It is used to make alloy like brass and bronze.
d. It is used to make coin, statue and medal.
e. It is used to make various chemicals and medicines.

Silver

Symbol: Ag ,Atomic number: 47

Silver is found in the form of ore and compound. Main ore of silver is argentite from which silver can be extracted.

Fig 10.20 Argentite ore

Physical properties

a. Silver is white shiny metal.
b. It is a good conductor of heat and electricity.
c. It is not affected by air and water.
d. It is less active metal.

Uses

a. It is used to make valuable utensils, coin and medal.
b. It is used to make jewelries.

c. It is used in metallic coating,

d. It is used to fill cavities of teeth.

e. It is used to make medicine.

Fig 10.21 Silver jewelry

Activity 10.8

Make a list of objects made from different metals in your house and school. Find the uses of those objects. Based on your finding ,complete the table below and present it in your classroom.

S.N	Name of metal	Object made from metal	Uses of object
1.	Aluminum		
2.	Zinc		
3.	Gold		
4.	Silver		
5.	Copper		
6.	Iron		

Sulphur

Symbol: S **Atomic number: 16**

Sulphur is non-metal which is found in free state in nature. It does not dissolve in water. Generally, it is found in volcanic region. It is found in the form of sulphide in various compounds. Sulphur is found in onion, garlic and mustard oil.

Fig 10.22 Sulphur

Physical properties

a. Sulphur is yellow straw-colored shiny solid substance.

b. It is insoluble in water.

c. It is bad conductor of heat and electricity.

fig 10.23 match stick

d. It does not react with acid.

e. It forms sulphur dioxide when burnt in air.

Uses

a. Sulphur is used to make sulphuric acid.

b. It is used make gun powder.

c. It is used to make burning material of match stick.

d. It is used to make fire cracker.

e. It is used to make medicine to heal wound.

Iodine

Symbol: I, Atomic number: 53

Iodine is a useful non-metal. It has been using since long time ago. It is found in various types of food. Imbalance intake of it may cause goiter.

Fig 10.24 Iodine

fig 10.25 Iodex

Physical properties

a. Iodine is shining non-metal.

b. It is insoluble in water.

c. It is bad conductor of heat and electricity.

d. Iodine is a sublimatory substance which changes directly into gaseous form when heated.

Uses

a. Iodine is necessary to prevent goiter.

b. It protects children from mental disabilities.

c. It is used to prepare tincture of iodine which is used to heal wound.

Exercise

1. Fill in the blank with suitable words.

iodine bad conductor chalcopyrite

hematite zinc potassium chlorate

a. Non-metals are ---------- of electricity.

b. Deficiency of ------ ----- causes swelling of thyroid gland.

c. Chemical used in matchstick is -------.

d. ---------- is used to make printing block.

e. ---------- is an ore of copper.

2. Choose the correct answer.

a. Which of the following is the property of non-metal?

i. Shining ii. Conductor

iii. Soft iv. High melting and boiling point

b. Which of the following metal is used in galvanization?

i. Silver ii. Copper

iii. Aluminum iv. Zinc

c. Which of the following in an ore of aluminum?

i. Hematite ii. Bauxite

iii. Argentite iv. Magnesite

d. Which of the following metal gets rusted?

i. Iron ii. Gold

iii. Silver iv. Copper

e. Which element is present in common salt?

i. Zinc ii. Sulphur

iii. Oxygen iv. Iodine

f. What is the reason for appearing flame of fire (people even say night ghost) in some hills at dark night?

i. Night ghost walks in some hills at night time.

ii. Some people walk with fire.

iii. Hills having sulphur mines burns when sulphur comes in contact with air.

iv. Magnesium comes out from mines and burns in air and sets fire.

3. Give reason.

a. Iodine is mixed in common salt.

b. Gold is found in free state in nature.

c. Aluminum is used to make body parts of vehicles and aeroplane.

d. The handle of pressure cooker is covered with hard plastic.

e. A flame of fire is seen at night time in the area where sulphur is present.

4. Differentiate between:

a. Metal and non-metal

b. Mineral and ore

c. Copper and sulphur

5. Identify the metal and non-metal based on the following propertes.

a. Yellow color metal is found freely in nature.

b. Outer surface of the metal is black or grey but appears white after rubbing and get rusted.

c. Yellow colored non-metal burns when it comes in contact with air

d. Non-metal is less soluble in water but dissolves in chloroform or halogen and forms a solution of violet-pink color.

6. Answer the following questions.

a. Complete the given table.

Name of metal	Main ore	Uses
Iron		
Silver		
Copper		
Aluminum		

b. Write the physical properties of metal.

c. Metals are good conductor of heat and electricity. Clarify with reason.

d. Identify the given metal and complete the table.

S.N	Figure of metal	Name of metal	Main feature	Main use
1				

2				
3				

e. Mention any two non-metals used as medicine and also write some more uses of the non-metals.

f. Write the physical properties of metal:

Name of metal	**Physical properties**
Iron	
Silver	
Copper	
Aluminum	
Gold	

11 Earth and Space

Various types of heavenly bodies are found in the space. The sun, earth and moon are heavenly bodies. These heavenly bodies are classified into stars, planets, satellites etc. In solar system there are other planets and satellites including earth. Human beings are still curious to know about the origin, components and extension area of the universe and the ways of formation of solar system.

Fig 11.1 Space

The sun and the heavenly bodies like planets, satellites, asteroids and comets revolving around the sun are collectively called as solar system. The earth of the solar system is our common habitat. Its maximum external and internal parts are made of rocks and soil.

11.1 Rock

You must have seen the hard substances as shown in the figure alongside. These hard substances are rocks. The earth contains such rocks inside and on its surface. Rocks

Fig 11.2 Model of rocks

are made up of different types of minerals which have different textures, colours and densities.

Soil is formed by dividing these rocks. Thus, soil contains pieces of rocks in it.

Formation of rocks

Think just a moment, how are the rocks formed in the nature? Can we manufacture rocks in industries or not?

Activity 11.1

Observe a video about the formation of rocks by using information and communication technology available in your school and house. Then discuss with your friends about it.

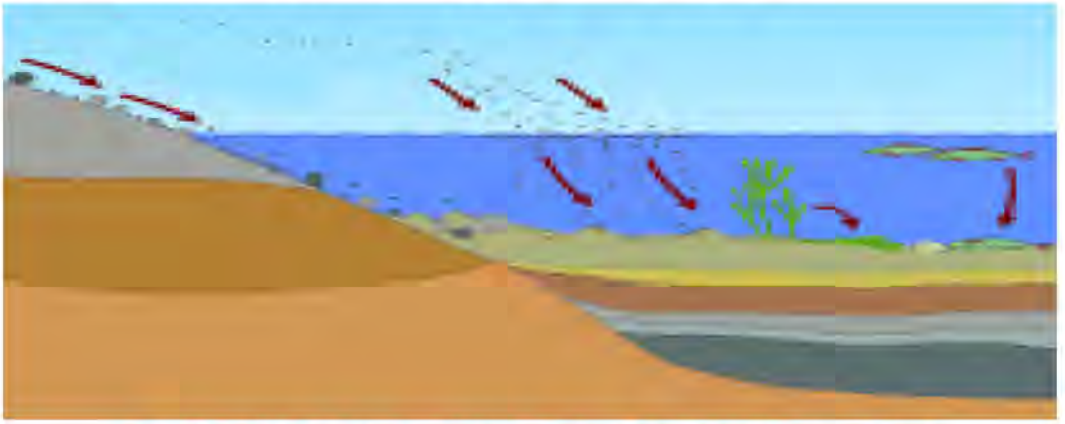


Fig 11.3 Rocks making process through sedimentation process

The water flowing in rivers and falls carries soil, sand, dead bodies of animals, plants and their parts with it. These materials are deposited at the bottom of rivers and seas. When such materials remain pressed for a very long time by the deposition of sediments over them every year, they are hardened in the form of rocks after number of years. Some rocks are hard and some are soft. Various types of rocks have different colours . They may have fine or coarse particles in them. They may have rough or smooth surfaces. Some rocks break into flakes and some into non-flakes, when hammered.

Activity 11.2

Collect the samples of different type of rocks available around your house and school and label them by different numbers. Sort out the rocks on the basis of following characteristics to fill in the table as given below. Discuss about them in class.

Label of rock	Hard / soft	Colour	Layered/non-layered	Rough/ smooth
1				
2				
3				
.....				

On the basis of hardness, colour, strata (layered/non-layered) , texture (nature of surface) and the method of formation, they are divided into following three main types;

1. Igneous rock
2. Sedimentary rock
3. Metamorphic rock

Fig 11.4 Different types of rocks

1. Igneous rock

Fig 11.5 Igneous rock

Igneous rocks are the oldest rock as they are formed from the period of origin of the earth. The rocks formed after cooling earth surface is igneous rock. When the mixture of gas and liquid called magma cools inside or outside the earth (surface) due to different geographical activities, it hardens and forms igneous rock.

Some important igneous rocks

A. Granite

Fig 11.6 Granite

Granite is black and brown rock which is very hard and strong. It has plain, attractive and smooth surface. Due to this reason the rock is used in flooring of rooms, passage, staircases, roads and historical premises.

B. Pumice

Fig 11.7 Pumice

Pumice is light and porous rock. It is formed on the earth's surface during volcanic eruption. Some samples of pumice can float on water.

C. Obsidian

Fig 11.8 Obsidian

Obsidian is also a type of volcanic igneous rock as it is formed on the earth's surface during volcanic eruption. It has small crystals so its surface is smoother and appears glassy.

2. Sedimentary rock

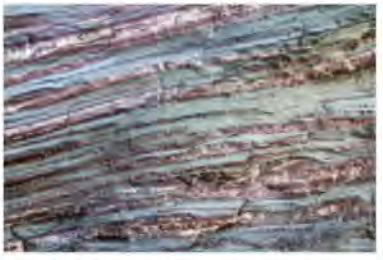


Fig 11.9 Sedimentary rock

The objects on the surface of the earth get weathered due to effect of water, air and sun. The weathered objects erode

by the effect of blowing air and flowing water that carry eroded particles at the bottom of rivers and oceans. Such particles get deposited there. The process occurs every year and the materials deposited over the particles create pressure to stick them in the form of rock. The rock formed by this method is called sedimentary rock.

Sedimentary rocks may contain fossils in them. Such rocks are used to study about the history of the earth and origin of the living beings on the earth.

Some important sedimentary rocks

A. Limestone

Hard shells and bones of dead animals inside oceans form layers at the bottom. These materials form layers. The pressure of layers of sediments forms limestone. The rock is granular and found in different colours like red, brown, white, black etc. This rock is widely used in manufacture of cement.

Fig 11.10 Limestone

B. Sandstone

The rock, which is formed when clay and silica like cementing agents join sand, quartz and feldspar like mineral is called sand stone.

Fig 11.11 Sandstone

C. Shale

The smaller particles than sand is called silt. Clay is formed by the particles smaller than silt. The sedimentary rock which is formed by the fine particles of silt and clay is called shale. This rock is black and softer than other rocks.

Fig 11.12 Shale

D. Conglomerate

Fig 11.13 Conglomerate

Conglomerate is formed by small pieces of stones, sand particles etc. by cementing together naturally. In Nepali the rock is also known as Kankad. Sangutika is an example of it.

3. Metamorphic rock

Fig 11.14 Metamorphic rock

When igneous, sedimentary and metamorphic rocks remain at high pressure and temperature for a long time inside the earth. They change their physical and chemical forms. In this process, the original composition of minerals of the rock may partially or completely change.

So, the rocks which are formed by changing one form to other is called metamorphic rock. Such rocks are formed inside the earth.

Some metamorphic rocks and their parent rocks are given below in the table.

Parent rocks	Metamorphic rock
Sandstone	Quartzite
Limestone	Marble
Coal	Graphite
Mudstone/Shale	Slate
Graphite	Diamond
Granite, diorite	Gneiss, schist

Importance of rocks

Activity 11.3

For what purposes are rocks used in our daily life? Make a list of them and discuss in class.

Rocks are hard substances found inside and on the surface of the earth. They are very important as they are used for many purposes in different sectors as given below:

Fig 11.15 Use of rocks in daily life

a. To construct houses and other buildings.

b. To make monuments.

c. For the roofing of houses and temples.

d. Various types of marbles are used in decoration of buildings and temples.

e. Rocks are also used in some indigenous technology to make Janto, Okhal, Silautoand Lohoro etc.

f. Used as gems.

g. To manufacture cement.

h. To study about origin of the earth.

Some main rocks of Nepal

Name of rocks	Occurence	Uses
Conglomerate	Rivers and riverbanks	In construction of houses

Sandstone	Rivers and river banks	In construction of houses and decoration
Sandstone	Rivers and river banks	Janto, lohoro, silauto, millstone
Limestone	Godawari, Bhainse, Chobhar, Udayapur, Jogimara etc.	Manufacture of lime, cement
Marble	Godawari	In flooring of houses, buildings, temples etc.
Slate	Bandipur, Lalitpur etc.	Roofing of houses and writing boards.

Project work

Classify the rocks collected in activity 11.2, into igneous, sedimentary and metamorphic by using the available means of ICT in your school and comparing them with the samples present in the specimen rocks. Also mention a characteristic of each in the given table and discuss about them in the class room.

Symbol of rock	Sedimentary	character	Metamorphic	Character	Igneous	Character
1.						
2.						
3.						

Exercise

1. Fill in the blanks using suitable words given below:

staircase	roof	igneous
sedimentary	remnant	limestone

a. Sedimentary, ... and metamorphic are three types of rock.

b. Sedimentary rocks may have..... of living beings.

c. We use..... in manufacture of cement.

d. Layer of different other rocks form .....rocks

e. Granite is used mainly in construction of.....

2. Tick (√) the correct answer.

a. Which of following is metamorphic rock?

i. Dolomite ii. Pumice

iii. Shale iv. Diamond

b. Which rock is used to make roofs of houses?

i. Sandstone ii. Limestone

iii. Conglomerate iv. Slate

c. Which type of rockis marble?

i. Sedimentary ii. Metamorphic

iii. Igneous iv. Volcanic

d. What is the parent rock of quartzite?

i. Silica ii. Coal iii. Granite iv. Graphite

e. Which rock is related to lava and magma?

i. Marble ii. Obsidian iii. Shale iv. Diorite

f. Select the correct statement or argument?

Statement: Igneous rock is that type of rock which is formed by cooling magma at the earth's surface.

Argument 1: Shale is a rock made of silt and clay, which is an igneous rock.

Argument 2: Igneous rock is the oldest rock

i. Statement is correct but both the arguments are incorrect.

ii. Statement is incorrect but both the arguments are correct.

iii. Statement and argument 1 are correct but argument 2 is incorrect.

iv. Statement and argument 2 are correct but argument 1 is incorrect.

g. Which of following order of rocks show the examples of igneous, metamorphic and sedimentary rocks respectively?

i. Pumice, conglomerate and slate

ii. Pumice, slate and conglomerate

iii. Conglomerate pumice and slate

iv. Slate, pumice and conglomerate

h. Which of the following group shows metamorphoses of graphite, limestone and silica respectively?

i. Diamond, quartzite and slate

ii. Marble, diamond and quartzite

iii. Diamond, marble and quartzite

iv. Quartzite,marble and diamond

3. Write differences between:

a. Sedimentary and igneous rocks

b. Marble and limestone

4. Fill the given rocks in the table:

Granite, sandstone, pumice, diamond, shale, marble, obsidian, conglomerate, schist

Metamorphic rock	Sedimentary rock	Igneous rock

5. Identify the given rock and complete the table:

S. N.	Figure of rock	rock		Main characteristics	Main uses
		Name	Type		
1.					
2.					
3.					

6. Answer the following questions:

a. What is the earth composed of?

b. What is rock?

c. For what purposes are sedimentary rocks used in your locality?

d. Describe about formation of rocks in short.

e. What type of rocks are granite, pumice and obsidian? For what purposes are the rocks used?

f. Mention name of any four rocks found in Nepal. Also mention their composition, a characteristic and one use of each of them.

g Identify the given rock. Write one characteristics and uses.

11.2 Planets

The sun is one of the star of billions of stars found in the universe. It is the closest star to the earth. Therefore, it seems the biggest and the brightest star among all other stars in the sky. The sun and the heavenly bodies revolving around it are collectively called as solar system.

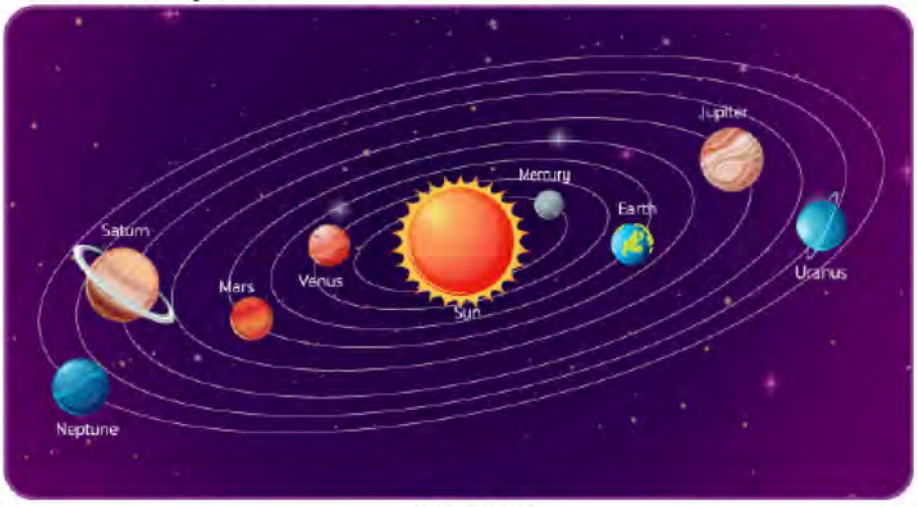


Fig 11.16

Solar system

The group of sun and other heavenly bodies like planets, satellites, asteroids, comets, meteors and meteorites that revolve around the sun are called as solar system.

The huge heavenly bodies of solar system which revolve around the sun are called planets. Planets are non-luminous bodies.

Fig 11.17

There are eight planets in the solar system.

Observe the following figure and answer the questions asked:

i. How many planets are there in the figure?

ii. Which planet is the closest and which is the farthest from the sun?

iii. Which of them are the smallest and the biggest planet? Compare.

iv. What is the difference in the structure of the planets?

v. What is the difference in the colours of the planets?

a. Mercury

Mercury is the smallest planet and situated nearest to the sun. As the planet is very close to the sun, it is very hot during the days. It does not have any satellite and atmosphere.

Fig 11.18 Mercury

b. Venus

Venus is the hottest and the brightest planet. It is the second closest planet to the sun. It is the closest planet to the earth. It is also considered as the morning and evening star. It has no satellite. As its size is about equal to the size of the earth, it is also called as twin planet of the earth.

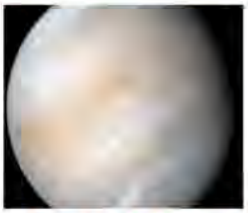


Fig 11.19 Venus

c. Earth

Earth is the planet which has all the conditions required for the survival of the organism. It is the third closest planet to the sun and it has a single satellite called as moon. The closest planet to the earth is Venus.

Fig 11.20 Earth

d. Mars

Mars is the fourth closest planet to the sun. The planet is also

called as the red planet. Scientists are studying about feasibility of survival of organisms on it. The planet is very similar to the earth. It has two satellites called Deimos and Phobos.

Fig 11.21 Mars

e. Jupiter

Jupiter is the largest planet. It is the fifth closest planet to the sun. Its outer surface is covered with clouds. There is a big red spot at the central part of this planet. The planet has the largest number of the satellites. About 67 satellites of Jupiter are discovered. This planet is considered as the king of the planets. It is the fastest revolving planet around the sun.

Fig 11.22 Jupiter

f. Saturn

Saturn is the second largest planet. It is the sixth closest planet to the sun. It is surrounded with three flat gaseous rings made of ice. It is also known as peculiar planet. There are 62 satellites of the Saturn.

Fig 11.23 Saturn

g. Uranus

Uranus is the seventh planet revolving around the sun. The planet is made of gas and liquid materials. The planet also has gaseous rings around it as in the Saturn but we can not see the rings as these rings are made up of carbon. The planet has 27 satellites.

Fig 11.24 Uranus

(h) Neptune

Neptune is the farthest planet from the sun. As it is very far from the sun, it is the coldest planet. It has 14 satellites.

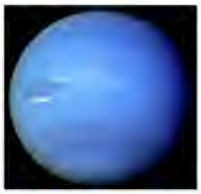


Fig 11.25 Neptune

A comparative table of the eight planets on the basis of the description of size, distance, rotation period and revolution period is given below:

S.N.	Planet's name	Average distance from the sun (km)	Size (radius) Km	Rotation period	Revolution period
1.	Mercury	5.76×10^7	4851.2	58.65 days	87.97 days
2.	Venus	1.07×10^8	12035.2	243.02 days	224.7 days
3.	Earth	1.488×10^8	12735	23 h 56 min	365. 25 days
4.	Mars	2.256×10^8	6742.4	24 h 37 min and 22 s	686.98 days
5.	Jupiter	7.68×10^8	1139040	9 h 55 min and 30 s	12 years
6.	Saturn	1.44×10^9	115811.2	10 h 30 min	29.5 years
7.	Uranus	2.88×10^9	50441.6	17 h 14 min and 24 s	84 years
8.	Neptune	4.48×10^9	48972. 8	16 h 6 min and 36 s	164 years

Before 2006 AD nine planets were considered including the Pluto. In August 2006 International Astronomical Union (IAU) decided to classify the Pluto as a dwarf planet because of following reason:

a. It intersects the orbit of Neptune during revolution of the sun.

b. Its mass is not sufficient to be a planet.

Satellites

The members of the solar system that revolve around the planets are called satellites. Satellites may be natural or man-made. Artificial satellites are widely used for information and communication. Moon is an example of natural satellite.

Asteroids

There are thousands of smaller bodies found in between the region of the orbits of Jupiter and the Mars and revolve around the sun are called asteroids. They do not have their own orbits and are smaller in size. Example: Palas, Vesta, Juno etc.

Comets

Comets are also called as tailed star found in the solar system which revolves around the sun in a long elliptical orbit. They are made of ice and rock particles and form tail when come close to the sun. Example: Halley's Comet

Project work

Make a table as given above on a chart paper. Also draw clear coloured figures of the planets in their proportional sizes in the column of the name of planet. Paste the best one on the wall of the classroom

Activity 11. 4

Prepare nine round structures of clay or flour dough in different sizes. Prepare a model of solar system on a cardboard by using them. Colour them in their natural colours and also maintain the proportion of their sizes.

Exercise

1. Fill in the blanks using suitable words given below:

Mercury	Neptune	Mars	Earth
Solar system	Pluto	Venus	

a. The group of the sun and the heavenly bodies moving around the sun is called .....

b. The farthest planet from the sun is.....

c. The closest planet to the earth is .....

d. The planet with two satellites is.....

e. The moon is satellite of the .....

2. Match the followings:

Twin planet of the earth	Pluto
Asteroid	Mars
Dwarf planet	Mercury
Red planet	Jupiter
The planet with largest number of satellites	Juno
	Venus

3. Tick (√) the correct answer.

a. Which group of following shows the order of the red planet, the brightest planet and the coldest planet respectively?

i. Mars, Earth and Neptune

ii. Jupiter, Saturn and Mars

iii. Mars, Saturn and Neptune

iv. Mars, Venus and Neptune

b. Which planet has its revolution period one day more than the earth's year?

i. Mercury ii. Venus

iii. Jupiter iv. Mars

c. Which statement and argument are correct?

Statement: Venus is the hottest planet that's why it is red in colour.

Argument 1: It is also called morning and evening star.

Argument 2: It has two satellites Deimos and Phobos.

i. Statement is correct but both the arguments are incorrect.

ii. Statement is correct but both the arguments are incorrect.

iii. Only the argument 1 is correct.

iv. Only the argument 2 is correct.

d. Which of the following planets group shows the closer order to the sun?

i. Mercury, Venus, Earth and Mars

ii. Uranus, Saturn, Mars and Earth

iii. Earth, Mars, Venus and Mercury

iv. Neptune, Uranus, Mercury and Venus

e. Choose the correct alternative on the basis of given statement and arguments.

Statement: The Saturn is surrounded with three flat gaseous rings. The planet has red spot at its central part.

Argument 1: Its rings are made of ice.

Argument 2: It is the second largest planet that has 62 satellites.

i. Statement is correct but arguments are incorrect.

ii. Statement is incorrect but arguments are correct.

iii. Statement and argument 1 are correct but argument 2 is incorrect.

iv. Statement and argument 2 are correct but argument 1is incorrect.

4. Complete the table:

1. The farthest planet from the sun	
2. The closest planet to the sun	
3. The biggest planet	
4. The brightest planet	
5. The smallest planet	
6. The planet having no satellite	

5. Write differences:

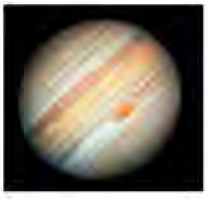
a. Star and planet

b. Inner planet and outer planet

6. Answer the following questions:

a. What is solar system? How many planets are in it? Make a list of them.

b. Identify the planets shown in the given figure; write any two characteristics of each of them.



c. Write any three characteristics of the Earth.

d. Sketch a neat and labeled figure of solar system showing the proportional sizes and distances from the sun.

e. Which planet was decided to remove from the list of planets by International Astronomical Union (IAU) ? Mention any two causes of this decision.

f. Write name of any four planets you like in the following table. Mention any two character of each of them.

S. N.	Planet's name	Characters
		a.
		b.
		a.
		b.
		a.
		b.
		a.
		b.

11.3 Moon

Fig 11.26 Moon

Question to think

What may be the cause of moon appearing brighter relative to the stars and planets at night?

The moon is the closest heavenly body to the earth. The moon is a single natural satellite of the earth. The force of gravity of the moon is lesser than that of the earth. There is no water and atmosphere on the moon. The moon has mountains and plains but no living organisms on it.

The moon revolves around the earth in a long elliptical orbit, so it is not at equal distance from the earth everyday. The average distance between the earth and the moon is 3,84,400 km. Its diameter is about 3,476 km. The surface area of the moon is 3.79×10^7 km^2. It takes about 27 days to complete one revolution around the earth.

The moon is not seen in the same shape everyday in the sky. After new moon, next day it is seen in sickle shape. Its bright region increases every day till it atains the round shape. After then its dark part increases every day and finally it becomes invisible on the new moon day. The process repeats continuously. The change in shape and brightness of the moon is called phases of the moon. The main causes of occuring phases of moon are as given below:

A. The moon revolves around the earth in its orbit.

B. The moon is non-luminous.

C. Facing of different area of bright part of the moon towards the earth.

After new moon, the minimum bright part of the moon is seen in sickle shape, it is called waxing crescent. Before full moon, the minimum part of the moon is seen dark; it is called as waxing gibbous. After full moon, the minimum part of the moon is seen dark, it is called as waning gibbous. Before new moon when the

Fig 11.27 Calender with sun and moon month

moon appears again sickle shaped is called as waning crescent.

Full moon

The phase of the moon in which the moon appears complete round is called full moon. On full moon, the earth lies in between the sun and the moon. In figure 11.27, the full moon is on 30th of the month.

New moon

The phase of the moon in which the moon does not appear in the sky is called new moon. The moon lies in between the sun and the earth on the new moon. In the figure 11.27, the new moon is on 15th of the month.

Bright half

The duration from the new moon to the full moon of a lunar month is called bright half. The bright region of the moon increases every day in bright half. The duration is of about 15 days. In the figure 11.27, 16th t0 30th of the month is bright half.

Dark half

Fig 11.28 Sideral month and Synodic month

The duration from the full moon to the new moon of a lunar month is called dark half. In dark half, the dark region of the moon increases every day. The duration is of about 15 days. In the figure 11.27, 1st to 15th of the month is dark half.

Sidereal month

The time taken by the moon to complete one revolution around the earth is called the sidereal month. The duration of sidereal month is of about 27. 33 days. The time taken by the moon to come at position 2 from position 1 is sidereal month.

Synodic month

The time taken by the moon to repeat the new moon condition is called the synodic month. The duration of synodic month is of about 29.5 days. The synodic month begins from new moon day. When the moon completes one round around the earth the earth also travels a distance of about 300(from point 2 to 3 in above figure) in its orbit. In this condition, the moon needs extra 2 days and 5 hours for the next new moon condition. It makes synodic month longer than the sidereal month.

Do you know?

A. The earth travels an angle of 360° to complete one round around the sun in its orbit. For it the earth needs one year or 12 months. The duration in which the earth forms the angle of 30° in its orbit (360°/12 =30°) is called a solar month. As the earth revolves around the sun in an elliptical orbit, the duration of each solar month is not same but it varies in between 30 to 31 days. The

month February is of 28 days normally but in leap years the month has 29 days. The duration of 12 lunar months is a lunar year.

B. A solar year has 365.25 days and a lunar year has 354. 37 days.

C. Normally a solar year is considered as 365 days which is 0.25 days lesser than real solar year. To adjust the gap of 0.25 days of each year in every 4 years an extra day is added in the month February and the year is called as leap year.

Adhik maas

Activity 11.5

Take a calendar mentioned with lunar and solar months. Observe the date from which the lunar month has started. Write the dates of lunar and solar months on which different festivals are quoted in the calendar.

We use solar calendar for official purposes but our festivals and rituals are determined by lunar calendar. Thus, both solar and lunar calendars are in our practice. A lunar month begins from new moon. The name of the lunar month is determined by the name of the solar month in which the lunar month begins. Solar month and lunar month may not begin on the same day. When a solar month is longer, there is a chance of occurring two new moons in the single solar month. In this situation, the name of the lunar month repeats by the name of the same solar month.

For example, in 2077 on 1st Asoj, there is new moon, so the name of the lunar month is Asoj. But on the 30th Asoj there is new moon again, so next lunar month is also Asoj. The repeated month is termed as Mal maas/ Pursottam mass or Adhik maas. Normally, an Adhik maas repeats in every three years.

Kshay- maas

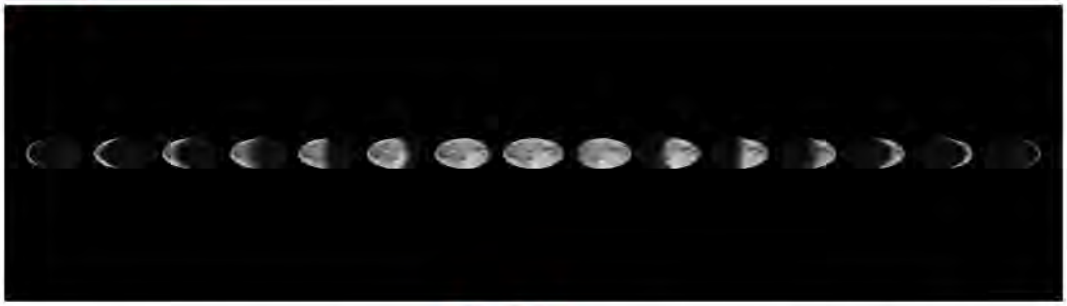


Fig 11.29

When the moon is in apogee condition, the moon is at the longest distance from the earth. It causes lunar month longer than the solar month. In this condition there may not be occurrence of any new moon in the solar month and the name of one lunar month is missed. It is called Kshay-maas. In this way solar month and lunar month are aligned. There may be two adhik maases in the solar year having kshay-maas. Normally Kshay-mass occurs in between Kartik and Magh.

Project work 11.3

A. Observe the moon from full moon to new moon and from new moon to full moon in clear sky. Make a chart of the shapes of the moon seen on different days and discuss in the classroom.

B. Learn to read the date of your festival in pocket calendar/ wall calendar by the help of your elders or the people of your society who can support you. Present the learnt things in the classroom.

Exercise

1. Tick (√) the correct answer:

a. Which statement and argument are correct?

Statement:

The duration between full moon and new moon is dark half and the duration between new moon and full moon is called bright half.

Argument 1:

The size of the moon is seen decreasing every day in the bright half.

Argument 2:

The bright region of the moon is seen increasing every day in the dark half.

i. Statement is correct but both the arguments are incorrect.

ii. Statement is incorrect but the arguments are correct.

iii. Argument 1 is correct but the statement and argument 2 are incorrect.

iv. Argument 2 is correct but the statement and argument 1 are incorrect

b. Which of the following shows the first and last date of bright half?

i. Full moon and new moon

ii. Pratipada and full moon

iii. New moon and full moon

iv. Pratipada and new moon

c. Which order of duration is correct for the bright half, dark half, sidereal month and synodic month respectively?

i. 15 d, 29.5 d, 15 d and 27.33 d

ii. $27^{1/3}$ d, 29.5 d, 15 d and 1 month

iii. 15 d, $27^{1/3}$ d, 15 d and 29.5 d

iv. 15 d, 30 d, 15 d and 29.5 d

d. What is the appearance of moon when it forms an angle of 135° on the plane of earth's orbit?

i. Maximum part bright only a margin dark

ii. Maximum part dark only a margin bright

iii. Half part bright and half part dark

iv. Totally dark

e. Which order of phases of moon shows the moon totally bright, half bright and bright only at the margin?

i. Full moon, new moon and crescent

ii. Crescent, first quarter and new moon

iii. Full moon, last quarter and new moon

iv. Full moon, first quarter and crescent

2. Answer the following questions:

a. Give a short introduction to moon.

b. What is lunar month? Write an importance of it.

c. Write differences between dark half and bright half.

d. What is Adhik maas? How does it occur?

e. Write differences between lunar and sidereal months.

f. What is kshay maas? How does it occur?

g. What are phases of moon? Describe the difference between new moon and full moon.

h. Sketch a neat and labelled figure showing phases of moon.

i. The figure shows the phases of moon according to synodic month. Identify them and write differences between them.

11.4 Eclipse

The earth and the moon are non-luminous bodies but the sun is luminous body. Shadow is formed when an opaque object obstructs light rays. By revolving the earth around the sun and the moon around the earth, all the three masses (the sun, the earth and the moon) may lie in a straight line. When they lie in a straight line either the earth casts its shadow on the moon or the moon casts its shadow on the earth. It obstructs the moon or the sun partially or completely to see, that is called eclipse.

Shadow

Activity 11.6

Adjust a ball in front of torchlight or candle (sournce of light) in a dark room as shown in the figure. Glow the source of light and observe the shadow formed by the ball on the wall.

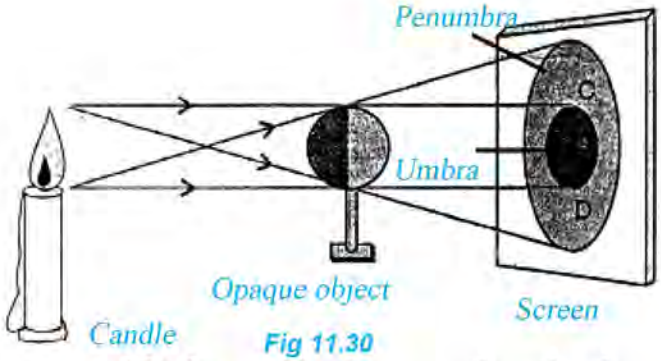


Fig 11.30

A. Are all part of the shadow similar on the screen?

B. Have you ever seen your shadow similar?

Opaque objects form shadow when they obstruct light. When an object blocks the light completely, it forms umbra and when light is blocked partially penumbra is formed. Umbra is darker than penumbra. Umbra and penumbra play main role in occuring different types of eclipses. On the basis of umbra and penumbra eclipse is studied.

Activity 11.7

Make a model as shown in the figure using a globe, a small ball

and a lamp. Consider the lamp as the sun, the globe as the earth and the ball as the moon. Align all the three bodies in a straight line. Keep the earth and the moon at the middle one after another and observe the shadow formed.

Fig 11.31

The earth revolves around the sun and the moon revolves around the earth continuously. Sometimes, all the three masses lie in a straight line in this process. If the moon lies in between the sun and the earth, the moon castes its shadow on the earth. If the earth lies in between the sun and the moon, the earth casts its shadow on the moon.

Cause of occuring eclipse

a. Travel of light in rectilinear path

b. Reovolution of earth and the moon

c. Lieing of the sun, moon and the earth in a straight line

d. Beeing the earth, and the moon opaque.

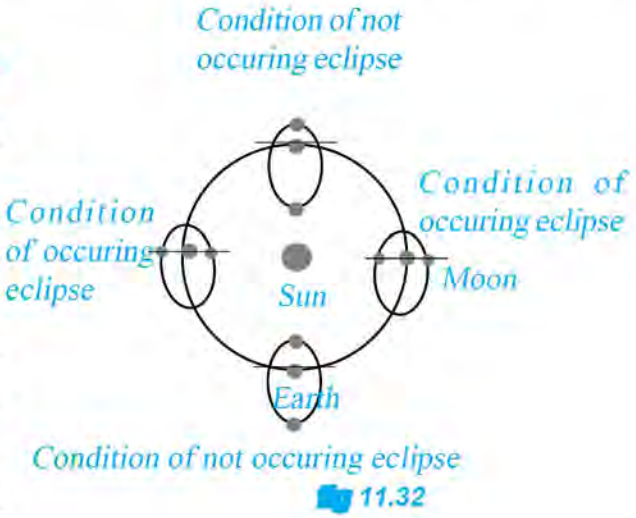


Fig 11.32

e. Beeing only sun luminous out of sun, earth and moon.

When one heavenly body casts shadow on the other heavenly body, eclipse occurs. There are two types of eclipse seen from the earth.

A. Lunar eclipse

Revolving the earth around the sun and the moon around the earth when the earth obstructs the light of the sun, it casts shadow

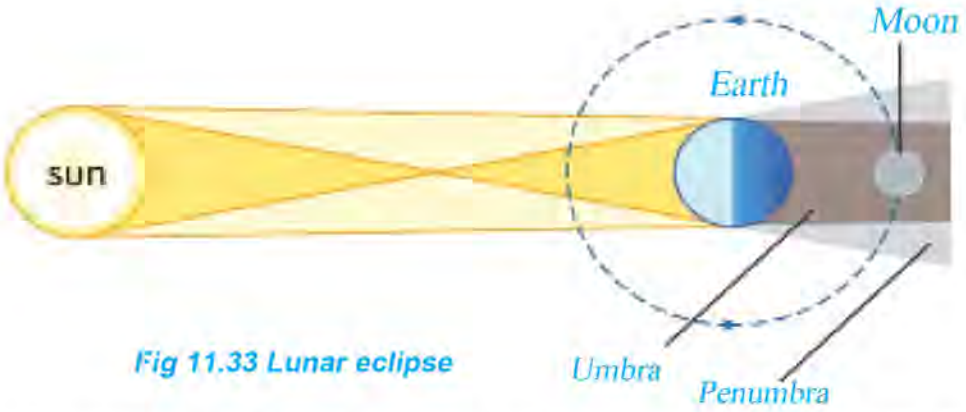


Fig 11.33 Lunar eclipse

on the moon. In this situation, the moon is not seen partially or completely. It is called lunar eclipse.

The main conditions of occuring lunar eclipse can be summed up in following points:

1. Lying the sun, the moon and the earth in a straight line.
2. Casting of earth's shadow on the moon being the earth in between the sun and the moon.
3. Travelling light in rectilinear path.

If the moon is covered totally by the umbra of the earth, it causes total lunar eclipse. If the moon is covered by the umbra partially the partial moon is seen. It is called as partial lunar eclipse. Lunar eclipse occurs on full moons only.

Project work

Study the change in the appearance of moon during lunar eclipse at night. Note down the changes seen in the brightness of the moon during the eclipse. After the eclipse finishes, make a report on the basis of the following questions to present in class using PPT slides:

A. What are the positions of the earth, the sun and the moon?

B. On which *Tithi* the eclipse occurs?

C. Sketch a diagram of the eclipse.

B. Solar eclipse

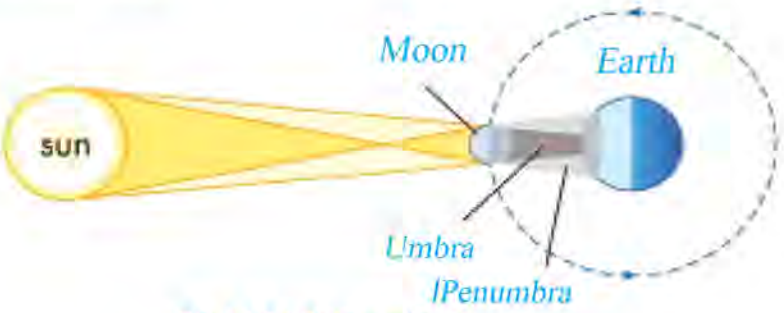


Fig 11.34 Solar eclipse

Revolving the earth around the sun and the moon around the earth, when the moon obstructs the light of the sun, it casts shadow on the earth. In this condition the sun is not seen partially or completely from the shadow region. It is called solar eclipse. Solar eclipse occurs on new moon day.

From the umbra of the moon's shadow on the earth, the sun is obstructed completely. The condition is called as total solar eclipse. If the sun is observed from the penumbra region on the earth the sun is obstructed partially. It is called partial solar eclipse. Solar eclipse should not be observed directly.

Project work

A. Collect the spherical bodies like football, cricket ball and table tennis or other spherical object made up of mud available in your locality and select the suitable bodies of them to make the sun, the earth and the moon. Construct a model of solar and lunar eclipses using them. Prepare a report including the process of occurring eclipses about your work and present in your classroom.

B. Using available ICT in school/home, make a list of quiz questions related with planets, moon, phases of the moon, lunar month, sidereal month, Adhik maas, kshay- mass and eclipses. Conduct a quiz using the questions prepared.

Exercise

1. Fill in the blanks using suitable words:

eclipse solar eclipse lunar eclipse
partial eclipse total eclipse straight line

a. When moon comes in between earth and sun in a straight line, it causes .....

b. When earth casts its shadow on the moon ..... occurs.

c. Observing direct..... may harm eyes.

d. During eclipse sun, earth and moon lie in a .....

e. Umbra is caused by .....

2. Tick (√) the correct answer :

a. Which sequence is correct for lunar eclipse?

i. Earth, sun and moon

ii. Moon, sun and earth

iii. Sun, moon and earth

iv. Sun, earth and moon

b. In which condition does solar eclipse occur?

i. When the sun is in between the moon and the earth

ii. When the moon is in between the sun and the earth

iii. When the earth is in between the moon and the sun

iv. When either the moon or the earth is in between the rest bodies

c. Which eclipse occurs when the umbra of earth covers the moon totally?

i. Partial solar eclipse
ii. Partial lunar eclipse
ii. Total solar eclipse
iv. Total lunar eclipse

d. What type of eclipse can be caused by penumbra?

i. Total solar
ii. Partial solar
iii. Total lunar
iv. Partial lunar

e. In which condition lunar eclipse does NOT occur?

i. When the earth casts umbra on the moon
ii. When the moon casts umbra on the earth
iii. When the sun, the moon and the earth lie in a straight line
iv. When penumbra of the earth covers the moon partially.

f. Which statement about the occurring eclipse is wrong?

i. The sun, the moon and the earth lie in a straight line
ii. The shadow of the sun casts on the earth or the shadow of the earth casts on the sun
iii. The new moon or full moon occurs
iv. Shadow of the moon casts on the earth or the shadow of the earth casts on the moon

3. Write differences:

a. Total and partial solar eclipses.
b. Total and partial lunar eclipses.
c. Umbra and penumbra

4. Give reasons:

a. Lunar eclipse occurs on full moon only.

b. Solar eclipse occurs on new moon only.

5. Answer the following questions:

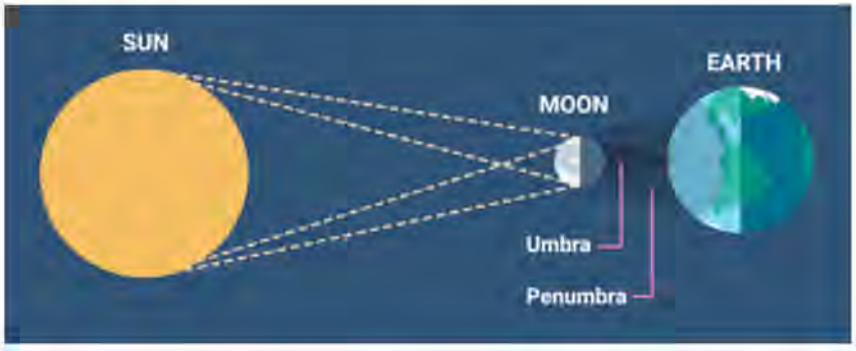
a. What is shadow? How does it occur?

b. If the earth comes in between the sun and the moon during revolution, what type of eclipse does it occur? Describe about the eclipse with labeled figure.

c. During which eclipse is the sun not seen partially or completely? Sketch a neat diagram for the eclipse and label it properly.

d. What are the general causes of occurring eclipse? Mention.

e. Study the following figure and answer the following questions.



i. Define the eclipse shown in the diagram.

ii. On which Tithi does the eclipse occur?

iii. What type of eclipse occurs from the region of umbra?

f. What is the reason of remaining total lunar eclipse longer than total solar eclipse? Clarify.