CONTENTS

ALLEN CAREER INSTITUTE KOTA (RAJASTHAN)

FOUNDATION PHYSICS-3

LIGHT

7

"I really wonder what is the colour of fire"

7.1 Introduction

We need a source of light to make the objects visible. It is the light which makes things visible to us. **Light is a form of energy which gives us the sensation of sight.** Objects are seen when light, after striking them returns into the same medium and reaches our eyes. Light travels in straight lines in the form of rays.

7.2 Source of light

An object which gives out light is called a source of light.

The various sources of light around us are sun, stars, bulb, tubelight, oil lamp, candle, torch, firefly etc. The most important source of light for us is the sun, its light makes the things bright on the earth. At night we use electric bulb, tubelight, oil lamp, torch as a source of light.

We have two types of sources of light

i. Natural source of light

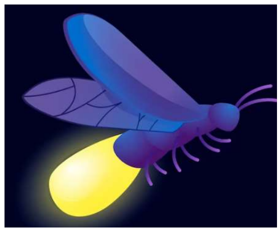
ii. Artificial source of light

Natural source of light: Those sources of light which occur in nature as such are called natural sources of light. The sun is the main natural source of light. Because of light we see all the things around us. Other natural sources of light are stars that helps to see the sky in the night. Since they are very far away from us we receive very less light from them.

A firefly also emits light naturally due to certain chemicals present in its body.

THE SPOT LIGHT

Light doesn't require any medium to propagate and travels at speed of 3×10^{8} m/s in vacuum



Sun **Star** **Firefly**

Fig. 1(a) Some natural sources of light

Artificial sources of light: At night when we do not receive light from the natural source we use artificial source of light. Those sources of light which have been made by man are called man-made or artificial source of light.

Example: Electric bulb, Tubelight, Kerosene oil lamp, Candle, Torch are artificial source of light.(see fig. 1(b))

Tubelight

Electric bulb

Kerosene oil lamp

Candle

Torch

Fig. 1(b) Some artificial sources of light

Luminous objects

The objects which emit their own light are called '**luminous objects**'.
Examples : Sun and other stars, lamp (bulb), tube light, candle flame, etc. (see fig. 1(b))

Non-luminous objects

The objects which do not emit their own light but only reflect the light which falls on them are called '**non-luminous**' objects (or **illuminated objects**).

Examples : Table, chair, animals, plants, planets, satellites, moon, etc. (see fig. 2)

☞ Moonlight is reflected sunlight i.e., Moon has no light of its own, it is a non-luminous object. Depending on the location of the Moon in its orbit around Earth, different parts of the Moon reflect sunlight onto the Earth. Since Earth and the Moon are so close together, and since the Moon has such a shiny surface, large amounts of sunlight come to the Earth after bouncing off the Moon. Thus, the Moon appears so bright.

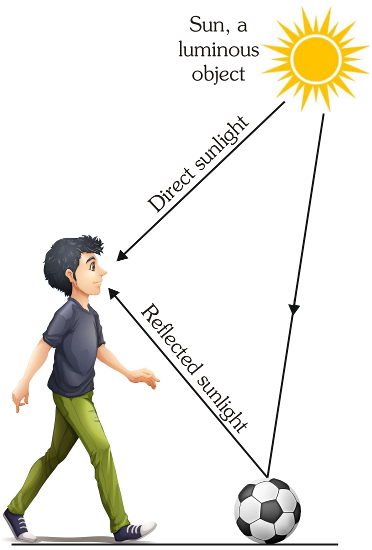


Fig.2 Seeing luminous and non-luminous objects.

BUILDING CONCEPTS 7.1

How could we see non-luminous objects and luminous objects ?

Explanation

When the light falls on a non-luminous object, it reflects a part of the light towards us. When this light reaches our eyes, we could see such an object. A luminous object emits its own light. When this light reaches our eyes, we could see a luminous objects. Thus, for us to see an object, it must reflect or emit some light that reaches our eyes.

Bioluminescence

- Emission of light by certain living organisms such as glow-worm is called bioluminescence. The light is produced due to chemical reaction with in the organism, in which chemcial energy is directly converted into light energy. Firefly, some marine fishes, fungi and algae also exhibit bioluminescence.

7.3 Absorption, transmission, and reflection

Objects can absorb light, reflect light, and transmit light – allow light to pass through them. The type of matter in an object determines the amount of light it absorbs, reflects, and transmits.

Absorption is the process of taking in something. A small portion of light is always absorbed by surface on which light falls. A black colour body absorbs almost all the light falling on it. The light that is absorbed is converted to heat energy.

Reflection is the process in which light rays bounce off a surface. We see a red rose as 'red' because it reflects red colour and absorbs all other colours of light.

Transmission is the process in which light can pass through a material. We can see through the glass window plate because of transmission of light through it.

Transparent object

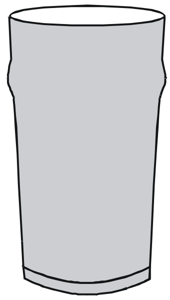
Transparent object or material transmits almost all the light striking them. Only a small amount of light is absorbed and reflected by transparent materials. Behind transparent objects, objects look clear and crisp, i.e., you can see objects clearly through them.

Translucent object

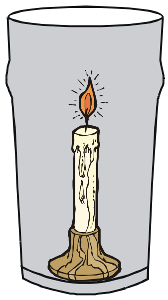
Object or material that allows small portion of light to pass through them are described as **translucent**. When light rays strike an object that is translucent, some light passes through, and some is either absorbed or reflected in different directions. Objects viewed through translucent materials do not look clear or crisp; they appear blurred i.e., you cannot see clearly through the translucent objects.

THE SPOT LIGHT

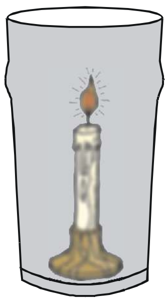
An object appears green if it reflects green light and absorbs all other colours



(a) A steel tumbler : we cannot see any object like an ignited candle placed inside it.



(b) A plain glass tumbler : we can see clearly any object like an ignited candle placed inside it.



(c) A tinted or milky glass tumbler : we cannot see clearly any object like an ignited candle placed inside it.

Fig.3 Active physics 7.1

Opaque object

An **opaque** object or material only absorbs and reflects light, no light passes through it. If you tried to look through an opaque material, you would not be able to see an object on the other side i.e., you cannot see through opaque objects.

Optical medium

Any medium through which light can pass partially or completely is called an optical medium.

(i) Homogeneous medium : It is an optical medium which has uniform density throughout

(ii) Heterogenous medium : An optical medium which has different density at different points is called heterogenous medium

Glass, silver, diamond, distilled water, pure alcohol, etc. are homogeneous medium whereas, air fog, mist, etc, are heterogeneous medium.

BUILDING CONCEPTS 7.2

What are hot and cold sources of light ?

Explanation

The sources of light which emit light and heat simultaneously are called hot sources of light. The sources of light which emit only light and no heat are called cold sources of light. The bodies which emit light when heated to very high temperature are called incandescent bodies. Consider the light given out by a firefly and the tip of an incense stick. The brightness of their light is almost the same. But is the temperature of the two sources also the same? No. Similarly you can touch a tube-light which is giving out light but you cannot touch a glowing bulb. If You touch the tip of an agarbatti or a glowing bulb, you will burn your hands. But, if you touch a firefly or a tube-light, your hands are safe.

ACTIVE PHYSICS 7.1

1. Take a steel tumbler, a glass tumbler and a milky or tinted glass tumbler. Take three wax candles of sizes smaller than the heights of the tumblers.

2. Place one candle each inside the above tumblers. Now, ignite all the three candles placed inside the tumblers. You will not see candle or its flame placed in the steel tumbler [see fig.3(a)]. You will see the candle and its flame clearly placed in the glass tumbler [see fig.3(b)]. The candle and its flame will appear to you blurred that was placed in the milky or tinted glass tumbler [see fig.3(c)].

Thus, we can conclude that the steel tumbler is an opaque object, the glass tumbler is a transparent object and the milky or tinted glass tumbler is a translucent object.

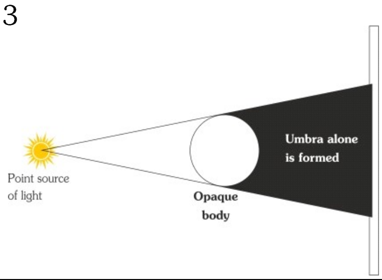
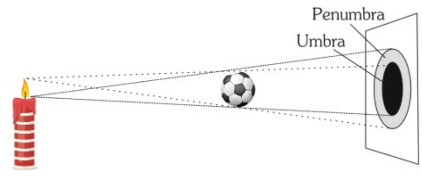
Point source of light	Extended source of light
1. Point source of light is point sized. This source of light forms only the umbra region of the shadow on the screen	1. The collection of such point sources of light together is an extended source. This source of light forms both the umbra and penumbra regions of the shadow on the screen
2. For example sun acts like a point source for an object placed far away.	2. For example, candle is an extended source of light.
3 	3 
Fig. 4(a) Shadow due to point source	Fig. 4(b) Shadow due of light

Fig. 4 Formation of shadow

THE SPOT LIGHT

Umbra is the fully shaded inner region of a shadow cast by an opaque object.

THE SPOT LIGHT

Penumbra is the partially shaded outer region of the shadow cast by an opaque object.

7.4 Rectilinear propagation of light

Light rays from any source always travel in straight lines. This is called rectilinear propagation of light.

Regardless of its source, a ray of light will not change direction unless it travels through a different medium or is disturbed in some way.

ACTIVE PHYSICS 7.2

1. Take three rectangular cardboard sheets of equal size and make a tiny hole using a pin in the centre of each. The centre of the cardboard can be located by drawing the diagonals of the rectangular sheets. The point of intersection of the diagonals is the centre of the cardboard sheet.

2. Now, fix each cardboard sheet in vertical position by simply pasting them on a wooden or carboard base using an adhesive (glue) so that their centres are in the same horizontal line [see fig.5(a)]. Let us mark these sheets as A, B and C.

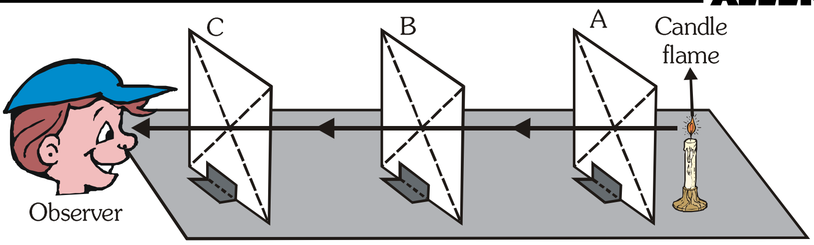
3. Place a burning candle in front of the sheet A and look through the pin hole in sheet C. You will see the candle clearly.

4. Now remove the sheet B from its postion and paste it again at small distance away from its original position [see fig.5(b)]. Again look through pin hole C. This time you will not see the candle.

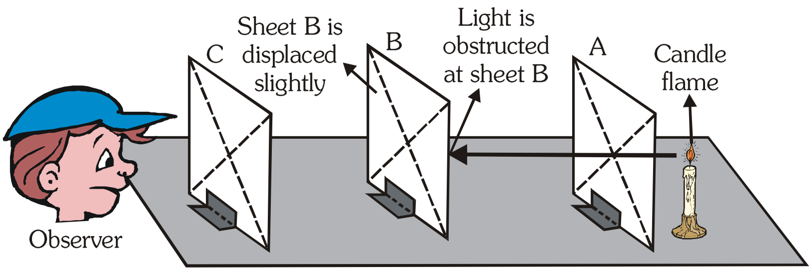
From this activity we conclude that lighl travels in a straight line. When pin holes on the cardboard sheets are in straight line, the light passes through them. When pin holes on the cardboad sheet are not in straight line, light fails to pass through them.

THE SPOT LIGHT

LASER stands for light amplification by stimulated emission of radiation.



(a) Candle flame can be seen as all three sheets are in a straight line



(b) Candle flame cannot be seen as all three sheets are not in a straight line

Fig.5 Active physics 7.2

THE SPOT LIGHT

Our sky appears blue because of Rayleigh scattering of white light by the tiny air molecules present in the atmosphere.

7.5 Some basic terms

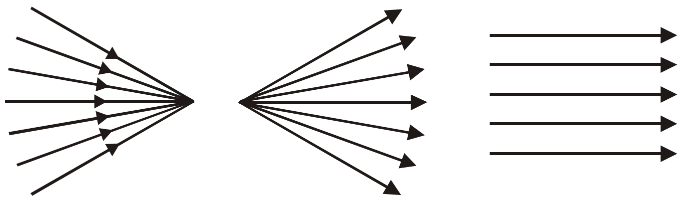
Ray of light : A ray of light is the direction in which light travels.

Beam of light : A bundle of light rays is called **beam of light (or light beam)**.

Convergent beam : A beam of light in which all the rays move towards a single point is called **convergent beam** (fig.6 (a)).

Divergent beam : A beam of light in which all the rays emerge out from a single point is called **divergent beam** (fig.6 (b)).

Parallel beam : A beam of light in which all the rays are parallel to each other is called **parallel beam** (fig.6 (c)).



(a) A Convergent beam (b) A divergent beam (c) A parallel beam

Fig.6 Various beams of light

☞ There are many gas and dust particles floating in the air. When the sun rays fall on these particles, they absorb and re-emit some light in all directions. This is called the scattering of light. Due to scattering of sunlight, our surrounding becomes bright.

Application of rectilinear propagation of light

i. Pinhole camera ii. Formation of shadows

iii. Eclipses

7.6 Pinhole camera

Pinhole camera is a simple application of the rectilinear propagation of light. It is usually used to view the images of various objects like, trees and buildings. The pinhole camera can also be used to take photograph of an object if a photographic film is placed on the screen.

Construction: The pinhole camera consists of a closed box having a small pinhole in the front and a translucent screen at the back side. This translucent screen is made of butter paper or tracing paper. The butter paper acts as a screen to receive the image of the object. Since butter paper is translucent, some light can pass through it due to which we can see the image formed on it by keeping our eye behind the pinhole camera.

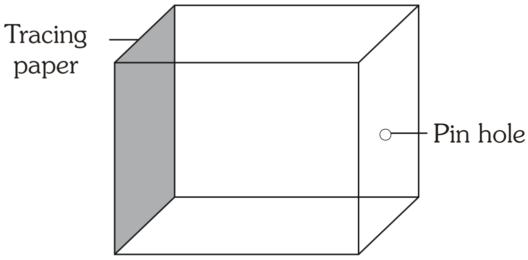


Fig. 7 Pin hole camera

Principle: The pinhole camera principle is often known as camera obscura. Pinhole cameras work on the theory of rectilinear light motion, which states that light travels in straight lines. A pinhole camera generates an inverted image due to the straight-line passage of the light. We can take a picture of the same quality as a digital SLR camera utilizing the right dimensions of a pinhole camera and the size of a tiny hole through which the light enters. Pinhole cameras are distinguished by the fact that they lack a lens. A lensed camera can never be a pinhole camera.

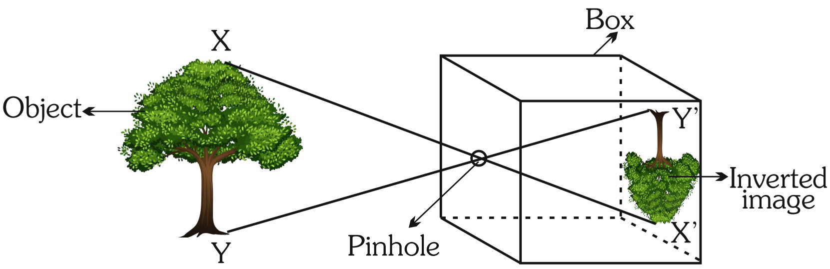


Fig. 8 Image formation in a pin hole camera

A ray of light coming from the point X of the tree passes through the pinhole in a straight line to form an image at point X' on the screen. Another ray of light coming from the bottom Y of the tree also passes through the pinhole in a straight line to form an image at point Y' on the screen. In this same way, each point on the tree XY forms its corresponding image on the screen between X' and Y' image X'Y' is produced on the screen.

The working of pinhole camera illustrates the property that light travels in straight line. The light rays XX' and YY' coming from the top and bottom of the tree cross over at the pinhole. Due to the crossing over of light rays at the pinhole, the top of the tree comes at the bottom in image and the bottom of the tree comes at the top in image.

Characteristics of the image in a pinhole camera:

i. Image is inverted

ii. Image is formed on screen so it is real image

iii. The image in a pinhole camera can be smaller than the object or equal to the object or bigger than the object.

THE SPOT LIGHT

Mirrored camera like DSLR (Digital Single-Lens Reflex) consists of a mirror that directs light from lens to the viewfinder.
In contrast mirrorless camers don't have a mirror. The light passes through the lens and straight onto a sensor to be processed.

iv. A pinhole camera can also be used to take the photograph of an object if a photographic film is placed on the screen. If pinhole cameras were used for taking photographs, only a very small number of light rays pass through it and a sharp image of the object is formed on the screen.

Factors affecting the size of image:

a. The distance of screen from pinhole and the distance of object in front of pin hole.

b. Size of image increases when increasing the distance of screen from the pinhole.

c. If the object is moved away from the pinhole, the size of the image decreases.

$$\frac{\text{The size of image}}{\text{The size of object}} = \frac{\text{Distance of screen from the pin hole}}{\text{Distance of object from the pin hole}}$$

7.7 Shadow

Shadows are formed when light is stopped by an object. The object produces a shade of dark area behind it. An opaque object stops the light completely so an opaque object casts a dark shadow behind it. A translucent object casts a weak shadow because it stops the light partially. A transparent object does not stop any light from passing through it. So transparent object does not cast any shadow. The shadows of object are usually similar in outline to the object and hence we can identify the object from their shadows. The sunlight forms shadows of the objects which are on the ground or near the ground. When we walk in the sun, our shadows always walk with us. Our shadow is very long in the morning when the sun just rises. The length of our shadow goes on decreasing till noon. Our shadow is shortest at noon. The length of our shadow starts increasing in the afternoon and our shadow becomes very long in the evening, just before sunset.

THE SPOT LIGHT

Glass is transparent whereas mirror is opaque

The shadow of an object can be seen only on a screen. Walls of room, ground and a building act as screen for the shadows. Three things are required to observe a shadow:

a. A source of light

b. An opaque object

c. A screen on which the shadow can be seen.

Shadows are formed because light rays travels in a straight line. The shape of the shadow is also the same as the shape of the object.

For a point source of light, the shadow of an opaque object on the screen is completely dark, it is called umbra. But for an extended source the shadow of an opaque object on the screen is dark at the centre which is surrounded by some brightness. The dark portion of shadow is called umbra while the surrounding portion of less brightness is called penumbra.

Umbra: It is the portion of shadow where no light reaches from the source of light due to opaque object. It is completely dark.

Penumbra: It is the portion of shadow where a portion of light from the source of light reaches the shadow even in the presence of the opaque object in between them. It is not completely dark, but it is less bright.

Formation of umbra: Umbra alone is obtained on the screen when the opaque object is illuminated by a point source of light. Take a piece of cardboard and make a pin hole in it and put a lighted candle or an electric lamp behind it. Place a screen in front of cardboard at some distance from it. Now place an opaque object AB in between the hole and the screen as shown in fig. 9.

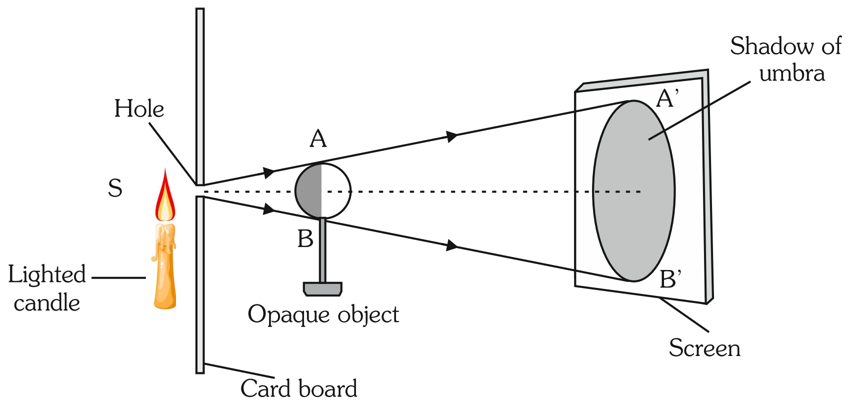


Fig. 9 Formation of umbra alone

Shadow formed due to point source A'B' is umbra the dark region. This is we say umbra is formed. In this case, the size of shadow is always bigger than the size of the opaque object. If we move the screen towards the object, you will notice that the size of the shadow decreases, but if we move the screen alway from the object, the shadow increases in size.

Formation of umbra and penumbra both: When the opaque object is illuminated by an extended source of light such as burning candle or glowing torch both umbra and penumbra are obtained on screen. Take a burning candle or glowing torch PQ. Place a screen at some distance in front of it. Now place an opaque object AB in between the source of light and the screen. The size of the object AB is of same size or bigger than that of the source PQ. We will see the dark shadow CD(umbra) and light shadow (EF) penumbra.

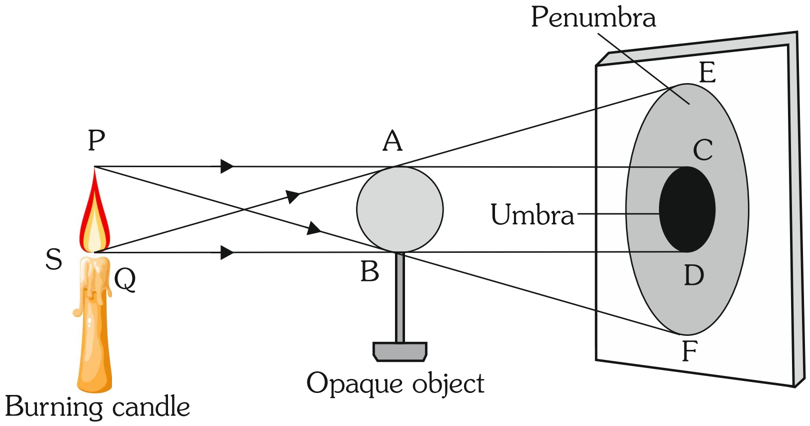


Fig. 10 Formation of both umbra and penumbra

THE SPOT LIGHT

Aeroplanes & birds flying at a greater height doesnot cast shadow on ground because the umbra is created in the atmosphere itself and the penumbra spreads over a large area

THE SPOT LIGHT

S O L A R
sun moon earth

L U N A R
sun earth moon

Difference between pinhole image and shadow:

a. The pinhole image of an object is inverted whereas the shadow of an object is erect.

b. The pinhole image of an object is of the same colour as the object but the shadow of an object is always black.

7.8 Eclipses

Eclipses of the Sun and Moon are impressive events. They have fascinated people since before recorded history and continue to excite us even today.

An **eclipse** is a total or partial hidding of one celestial object by another. For example, when the Moon and Earth move so that they line up with the Sun, an eclipse can occur.

Lunar eclipse (Eclipse of the Moon)

A lunar eclipse occurs when the Moon passes through the shadow of the Earth. For this to happen, the Moon must be on the side of the Earth opposite the Sun, at the time when the Moon's phase is full.

☞ A lunar eclipse occurs when Earth is between the Sun and the Moon, causing Earth to cast its shadow on the Moon.

BUILDING CONCEPTS 7.3

Does every full Moon results in a lunar eclipse ?

Explanation

Not every full Moon results in a lunar eclipse, since the orbit of the Moon lies in a plane tilted about 5° to the ecliptical plane, the plane containing Earth's orbit around the Sun and in which the Earth and the Sun always lie. When a full Moon occurs and when the Moon is very close to crossing the ecliptic plane, the Earth's shadow can fall on the Moon. Otherwise, Earth's shadow will miss the Moon at full Moon and no eclipse will take place. This condition has been known and used to predict eclipses since ancient times and is the source of the name of the ecliptical plane.

In fig.11, eclipse can occur only when the Moon is at point A or point B. This is because, the Sun, Earth, and Moon lie on the same plane.

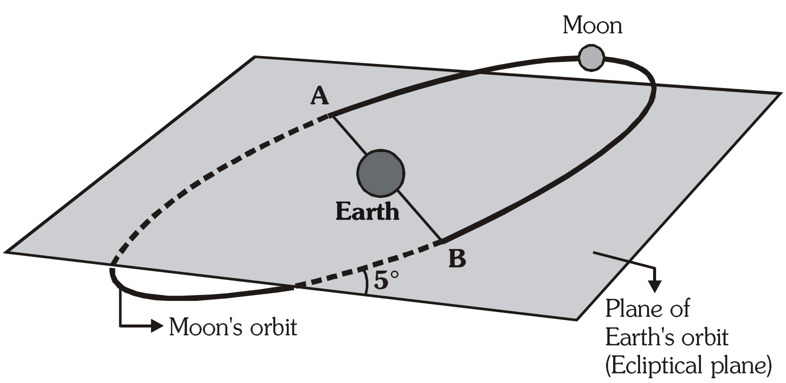


Fig.11 Building Concepts 7.3

A lunar eclipse is visible from all points on Earth where the Moon is above the horizon. It may be either umbral or penumbral.

(1) During an **umbral lunar eclipse**, at least a part of the Moon passes through the Earth's umbra, the dark inner shadow in which the Earth blocks light coming from all parts of the Sun. If the entire Moon passes through the umbra, it is called a **total lunar eclipse**. In fig.12, position 2 of the Moon shows total lunar eclipse. If only part of the Moon passes through the umbra, it is called a **partial lunar eclipse**. In fig.12, position 3 of the Moon shows partial lunar eclipse.

(2) During a **penumbral lunar eclipse**, the entire Moon misses the umbra and passes only through the Earth's penumbra, a region of partial shadow surrounding the umbra in which Earth cuts off light from some but not from all parts of the Sun. In fig.12, position 1 of the Moon shows penumbral lunar eclipse.

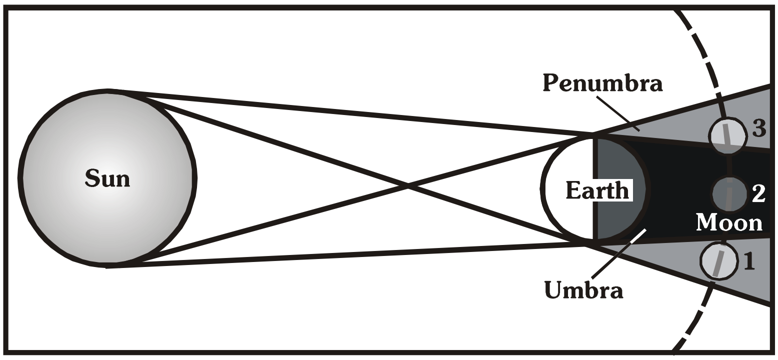


Fig.12 Lunar eclipse

The Moon is dimmed slightly while in the penumbra, but it does not darken appreciably unless it enters the umbra. When the Moon enters the umbra, the previously bright surface of the full Moon darkens to a much dimmer reddish glow, illuminated only by sunlight that has been spreaded around the Earth by Earth's atmosphere.

☞ A total lunar eclipse can last several hours. From the time the Moon begins to enter the umbra, it takes about an hour for the eclipse to become total. Totality can last for nearly two hours, with another hour required for the Moon to leave the umbra entirely.

Solar eclipse (or eclipse of the Sun)

A solar eclipse occurs when the Moon passes between the Earth and the Sun, blocking all or part of the Sun as seen from Earth. For this to happen, the Moon's phase must be new.

☞ A solar eclipse occurs when the Moon moves directly between Earth and the Sun, casting a shadow on Earth's surface.

Solar eclipses are somewhat more complex. Though the Sun is quite large as compared to the Moon still, the Sun and the Moon looks almost of equal sizes. This is because the Moon is quite near to us and the Sun is far away

THE SPOT LIGHT

An annular eclipse occurs when the Moon is farther from Earth than the length of its shadow cone (umbra). The Moon looks smaller than the Sun, and blocks from view all of the Sun's bright disc except for an outer ring (annulus) of sunlight.

THE SPOT LIGHT

A solar eclipse occurs at new Moon because at this position the Moon is exactly in front of the Earth i.e., the Moon lies in between the Sun and the Earth.

THE SPOT LIGHT

Svalbard is the place in Norway where the midnight sun occurs for longest period. Here, the sun doesn't set between 20th April and 22nd August

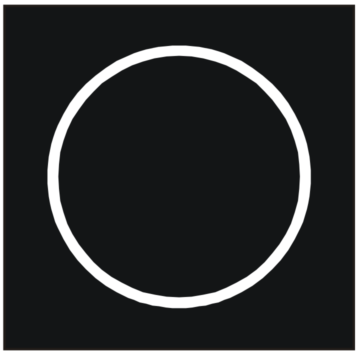


Fig.13 Annular solar eclipse

from the Earth. The Sun looks marginally bigger than the Moon. However, when the Moon is nearest to the Earth while orbiting around the Earth, it appears slightly bigger than the Sun. If a solar eclipse occurs then, the Moon can completely cover the Sun. The Moon's umbra is a convergent cone, with its base at the Moon and narrowing to its tip as it is near Earth.

(1) The eclipse is total when the Moon is closer to Earth than the length of its shadow cone. The Moon looks bigger than the Sun and blocks the Sun's bright disc from view. The region of the Earth's surface within the umbra at any moment is quite small, never more than a few hundred kilometers across. Totality lasts only a few minutes and can be seen only at successive places along a narrow curved path inside the Moon's umbra on Earth. The maximum duration of totality is 7.5 minutes, which is not predicted to occur again until July 16, 2186.

(2) Because the Moon's size is slightly smaller than the Sun's size, the tip of the Moon's umbra will not always reach the Earth's surface during a solar eclipse. If this is the case, the Moon will not completely cover the Sun's disc. When the Moon is centered on the Sun, a narrow ring, or annulus, of the Sun's bright disc remains visible around the Moon's shadow. This is called an **annular solar eclipse**. Annular solar eclipses are about 20 percent more frequent than total solar eclipses.

(see fig. 13)

(3) Beyond the region of the Earth's surface in which a total or annular solar eclipse is seen, there is an area thousands of kilometers wide inside the Moon's penumbra. Within this area, the shadow of the Moon covers part but not all of the Sun's disc. This is called a **partial solar eclipse**.(see fig. 14)

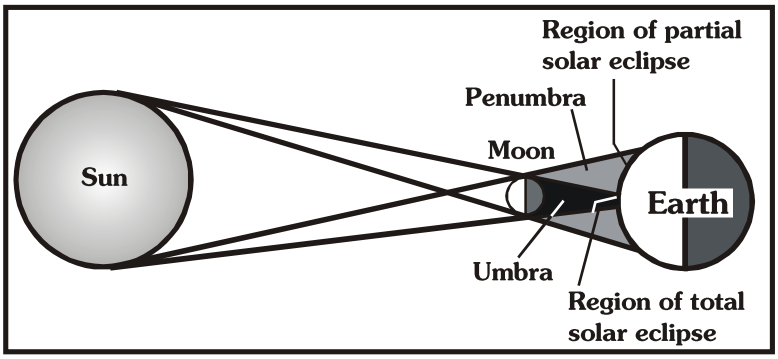


Fig.14 Solar eclipse

☞ Regardless of where you are standing, never look directly at a solar eclipse. The light can permanently damage your eyes. Even when 99% of the Sun's surface is hidden during the partial phases of a solar eclipse, the remaining lighted part of the Sun is still intense enough to cause a severe damage to our eyes.

EXERCISE # 1

Multiple choice questions

1. If we are able to see anything clearly through an object, then such an object is said to be _______ object.

(1) Transparent (2) Translucent
(3) Opaque (4) None of these

2. Which of the following is not always necessary to observe a shadow ?

(1) Sun (2) Screen
(3) Source of light (4) Opaque object

3. Objects like that give out or emit light of their own are called

(1) Non luminous object
(2) Opaque objects
(3) Translucent object
(4) Luminous objects

4. Cardboard sheets, a piece of rock is example of

(1) Opaque object (2) Luminous objects
(3) Translucent object (4) Transparent object

5. Image formed by pinhole camera is

(1) Erect
(2) Inverted
(3) Sometimes erect, sometimes inverted
(4) All of these

6. What is the speed of light in vacuum ?

(1) 3×10^5 km/s (2) 3×10^8 m/s
(3) 2×10^5 m/s (4) Both (1) & (2)

7. What is the nature of the propagation of light?

(1) Curvilinear (2) Rectilinear
(3) Random (4) Circular

8. What are the two types of earth's shadow that can be cast on the moon during a lunar eclipse?

(1) Major shadow, minor shadow
(2) Umbra, penumbra
(3) Umbra only
(4) Penumbra only

9. Solar eclipse happens during

(1) New moon
(2) Full moon
(3) On a full moon or new moon day
(4) None of the above

10. Which of the following is not a source of natural light?

(1) Lightening (2) Flash light
(3) Jellyfish (4) Fire

11. Which of the following is not a luminous object?

(1) Sun (2) Candle
(3) Moon (4) Tube light

12. Which of the following can never form a circular shadow?

(1) A ball (2) A flat disc
(3) A shoe box (4) An ice cream cone

13. A solar eclipse occurs when the_____ blocks out the light of the _____.

(1) Earth, sun (2) Moon, sun
(3) Sun, moon (4) Moon, earth

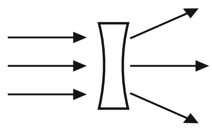
14. Why doesnot a solar eclipse occur every month?

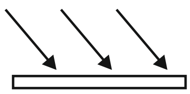
(1) Moon's orbit tilted relative to the orbit of earth
(2) Earth's orbit changes regularly
(3) The distance of sun is very far
(4) All of the above

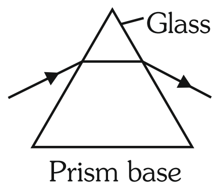
15. What is the colour of the moon during total lunar eclipse?

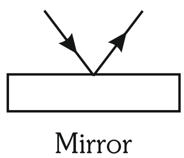
(1) Dark blue or black
(2) Yellow
(3) Red
(4) Grey

16. Which diagram shows the reflection of light correctly?

(1) 

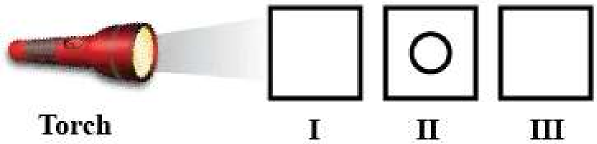
(2) 

(3) 

(4) 

17. Vikash placed three objects made of different materials as shown in figure. He observed bright spot light at II but he did not get any spot on III.

Choose the correct option from the following statements.



(1) I and II are made of transparent material and III is opaque material.

(2) I is transparent, II is translucent material and III is opaque material.

(3) I is made of transparent material, II is made of opaque material and III is made of either transparent or opaque, transluent material.

(4) I and II are made of opaque material and III is made of transparent material.

18. We see a non luminous objects when light

(1) Emitted by the object

(2) Completely passes through the object

(3) Completely absorbed by the object

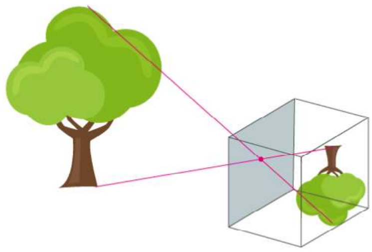
(4) Is reflected from the object towards our eye

19. A plane mirror reflects a beam of light to form a real image. The incident beam is

(1) Parallel (2) Convergent

(3) Divergent (4) None of the above

20. The given image shows the working of which optical instrument?



(1) Microscope (2) Pin hole camera

(3) Telescope (4) Periscope

EXERCISE # 1 ANSWER KEY

Multiple choice questions

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	1	1	4	1	2	4	2	2	1	2	3	3	2	1	3
Que.	**16**	**17**	**18**	**19**	**20**										
Ans.	4	3	4	2	2										

EXERCISE # 2

Short answer type questions

1. Classify the objects as luminous and non-luminous object: Moon, Stars, Sun, Table, Chair.

2. Is moon a luminous body? Explain with suitable diagram.

3. What is shadow? What are the things necessary to make a shadow?

4. What is umbra and penumbra ?

5. Write the differences between pinhole image and shadow.

6. Write the characterstic of image made by pinhole camera?

7. Classify the following into opaque, transparent amd translucent objects.

Spectacles, wax, a stone, dense smoke, chair, rubber, milk, wood, ballon, skin, glass, oil paper.

8. Write three examples of natural and artificial sources of light.

9. Explain "Rectilinear propagation of light".

10. What is an eclipse? Give examples and explain briefly.

Long answer type questions

1. What are the types of sources of light. Explain with example.

2. Differentiate transparent, translucent and opaque objects.

3. Explain ray and beam of light. Write types of beam of light.

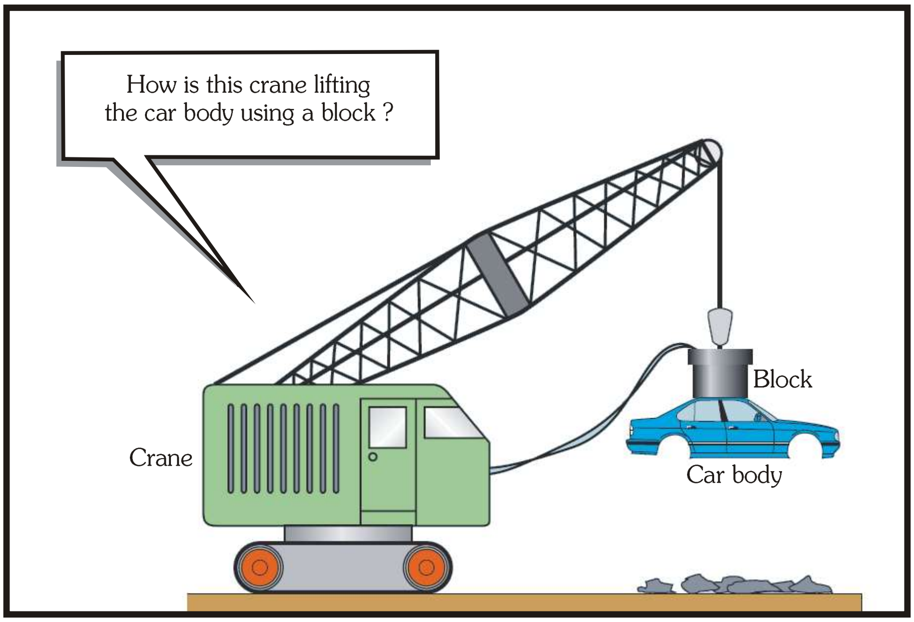
4. Explain formation of umbra and penumbra both with the help of ray diagram.

5. Explain principle and working of pinhole camera.

Important Notes

Magnetism

8



"A magnet attracts the magnetic materials like iron. Here, the block is a magnet which is attracting car body made of iron."

8.1 Introduction

It is said that, there was a shepherd named Magnes, who lived in ancient Greece. He used to take his herd of sheep and goats to the nearby mountains for grazing. He would take a stick with him to control his herd. The stick had a small piece of iron attached at one end. One day he was surprised to find that he had to pull hard to free his stick from a rock on the mountainside. It seemed as if the stick was being attracted by the rock. The rock was a natural magnet and it attracted the iron tip of the shepherd's stick. It is said that this is how natural magnets was discovered. Such rocks were given the name **magnetite**, perhaps after the name of that shepherd. Magnetite contains iron. It is also known as **lodestone**.

Some people believe that magnetite was first discovered at a place called Magnesia. The island of Magnesia is situated in west of present day Turkey. Chinese also used magnetic needles for navigation on ships as early in 400 B.C.

☞ The force with which a magnet attracts, substances made of iron, steel, nickle and cobalt is called magnetic force or magnetism.

Fig. 1 The magnetic effects of certain materials were observed by ancient Greeks as early as 800 BC.

8.2 What is a magnet ?

You may have played with magnets and watched them snap together or push apart. Magnets can also make some objects move or even fly through the air. A magnet can affect an object without even touching it.

The substances having the property of attracting magnetic materials like iron are now known as **magnets**.

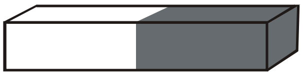
When you bring two magnets close together, they will either repel or attract each other. The force that pushes magnets apart or pulls them together is called **magnetic force**. In other words 'a magnet is any object with magnetic force'.

Natural magnets

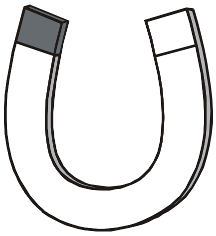
Natural occuring minerals or ores having magnetic properties are called '**natural magnets**'. Due to their irregular shapes and weak attracting power, natural magnets are rarely used now a days.

THE SPOT LIGHT ✓

Magnetism is the ability of an object to push or pull an another object that has the magnetic property.



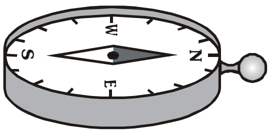
(a) A bar magnet



(b) A U-shaped magnet or horse-shoe magnet

(c) A Cylindrical magnet

(d) A ball ended magnet



(e) A magnetic compass needle

Fig.2 Magnets of different shapes

THE SPOT LIGHT

The bar magnets, horseshoe magnets, magnetic compass needle, etc, all have magnetism that exists for many years. Thus, they are called permanent magnets.

Artificial magnets

Now a days pieces of iron and many other materials of suitable shapes and sizes are made as magnets. Such magnets are called **artificial magnets**. e.g. Bar magnet, U-shaped magnet (horse-shoe magnet), cylindrical magnet or a ball ended magnet, magnetic compass needle, etc.

ACTIVE PHYSICS 8.1

1. Take a plastic or a paper cup. Fix it on a stand with the help of a clamp as shown in fig.3. Place a magnet inside the cup and cover it with a paper so that the magnet is not visible.

2. Attach a thread to a clip made of iron. Fix the other end of the thread at the base of the stand just below the paper cup. Keep the length of the thread sufficiently short.

3. Gradually lower the paper cup. When the cup is quite near to the clip, the clip get raised in air without support, like a kite. This is because the iron clip is attracted towards the magnet present inside the cup.

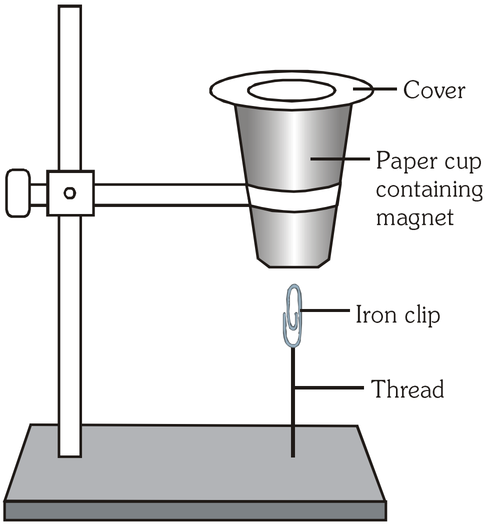


Fig.3 Active physics 8.1

8.3 Temporary and permanent magnets

On the basis of the retention of magnetism, artificial magnets can be broadly classified as temporary and permanent magnets.

Temporary magnets : These magnets are usually made of soft iron. They can retain their magnetism only for a short duration.
They lose their magnetism after the magnetising force is removed.

Permanent magnets : These magnets are made of steel, cobalt, nickel or alnico and are able to retain their magnetism for a long time even when the magnetising force is removed.

8.4 Magnetic and non-magnetic materials

The magnet attracts certain materials whereas some do not get attracted towards magnet.

The materials which get attracted towards a magnet are called **magnetic materials.** Iron, nickel and cobalt are magnetic in nature.

The materials which do not get attracted towards a magnet are called **non-magnetic materials.** Most of the materials we use in our daily life are non-magnetic in nature. Copper, aluminium, silver, wood, plastics, rubber, paper, etc. all are non-magnetic in nature.

BUILDING CONCEPTS 8.1

A magnet is kept quite close to a gold ring, but the ring did not get attracted towards the magnet. Try to find out the reason behind it.

Explanation

First thing that should come in your mind is that ‘ a magnet always attract a magnetic material, it does not attract a non-magnetic material. This means gold is a non-magnetic material.

THE SPOT LIGHT

Magnetic separation is used to separate magnetic ores like magnetite from non-magnetic impurities.

ACTIVE PHYSICS 8.2

1. Take a magnet and put it in the sand. Move the magnet in the sand for few seconds. Now, pull out the magnet from the sand.
2. Some particles of sand or soil may stick to the magnet. Now, gently shake the magnet to remove the particles of sand. But some particles may continue to sticking to the magnet. These particles are surely magnetic in nature and usually they are small pieces of iron (iron filings) present in the sand.
3. Through this activity, we can find out whether the soil or sand from a given place contains particles that have iron. Also, we can conclude that ‘magnetic particles can be separated from non-magnetic particles using magnets’.

8.5 Magnetic poles

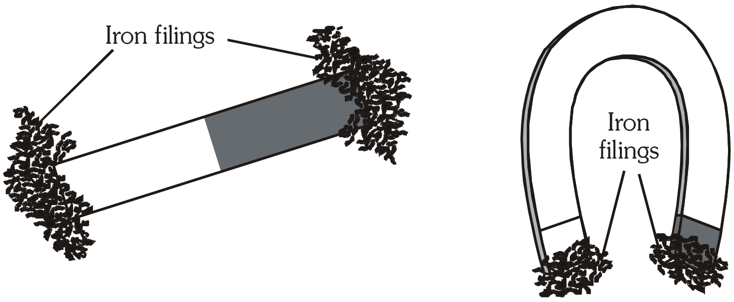
The parts of a magnet where the magnetic force is strongest are called the **magnetic poles**. All known magnets have two poles, a north pole and a south pole.

THE SPOT LIGHT

Magnets that are far apart do not pull or push enough to move each other. The magnetic force between two magnets is weak when magnets are far apart. The magnetic force gets stronger as the magnets are brought closer together.

ACTIVE PHYSICS 8.3

1. Put some iron filings on a sheet of paper. Roll a bar magnet in the filings and then lift it up. You will observe that most of the iron filings stick to the magnets at the ends [see fig.4(a)]. There are fewer iron filings in between and almost none at the middle of the bar magnet. This means the iron filings does not stick to the magnet uniformly along its length. They stick more to certain portions of the magnet.
2. Now, repeat this activity with a horseshoe magnet. Again, you will observe that most of the iron fillings stick to the two ends of the horseshoe magnet [see fig.4(b)].
3. From this activity, we can conculde that ‘in a bar magnet or a horseshoe magnet, the regions of strongest magnetism are near their ends. These ends are called **magnetic poles**.



(a) Bar magnet (b) Horseshoe magnet

Fig.4 Active physics 8.3

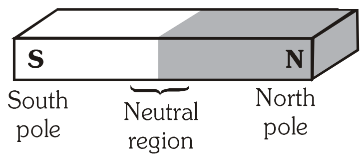


Fig.5 A magnet has two poles

8.6 Properties of a magnet

Attractive nature

When iron filings are put near a bar magnet, the magnet attracts iron filings towards it. The attracting power is maximum (see fig.5) near the ends (poles) and minimum at the middle (neutral region).

Directive property

When a magnet is suspended freely, it aligns itself to north-south direction. The pole of the bar magnet pointing towards north direction when suspended freely is called '**north pole** (or north seeking pole)'. The pole of the bar magnet pointing towards south direction when suspended freely is called '**south pole** (or south seeking pole)'.

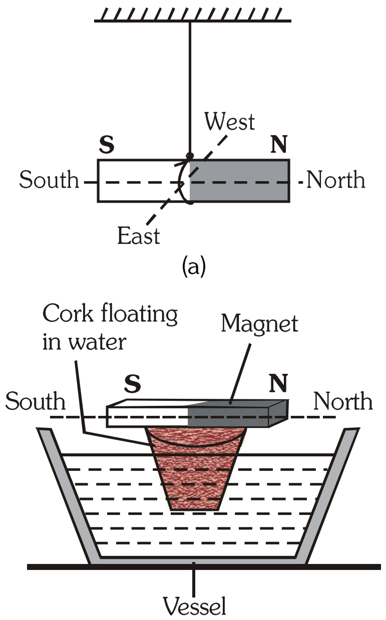


Fig.6 Active physics 8.4

ACTIVE PHYSICS 8.4

1. Take a bar magnet and suspend it using a thread [see fig.6(a)]. Another method is to place the magnet on a cork and float the cork in a vessel containing water [see fig.6(b)]. There should not be a magnet or magnetic material present near the suspended bar magnet so that it does not disturb the suspended bar magnet.
2. You will observe that the freely suspended bar magnet always comes to rest in the north-south direction. One end of the magnet points towards the north. This pole is called the north pole of the magnet. The other end which points towards the south is called the south pole of the magnet.

BUILDING CONCEPTS 8.2

A freely suspended magnet aligns in a north-south direction. Why ?

Explanation

Earth has its own magnetism, similar to the magnetism of a bar magnet. The poles of the giant imaginary magnet inside the Earth are located near, but not exactly at, Earth's geographic poles. This is why, a freely suspended magnet align itself to Earth's magnetic north and south poles. Actually, a freely suspended magnet aligns approximately not exactly in the geographic north-south direction.

THE SPOT LIGHT

In 1600, an English physician, William Gilbert, suggested that the Earth acts like a giant magnet.

Poles exist in pairs

In a bar magnet there are always two poles which are equal in strength and opposite in nature. In other words, 'a magnet is always a dipole'.

BUILDING CONCEPTS 8.3

Can we separate the north pole of a magnet from its south pole by breaking it from the middle ?

Explanation

If we break a magnet into two parts from the middle, we cannot isolate the north and the south poles. Instead we will get with two separate magnets, each with its own north and south poles. If we further cut these two magnets, we would get four separate magnets, each with its own north and south poles (see fig.7). This means, poles always exist in pairs, and we can never have an isolated north pole or south pole.

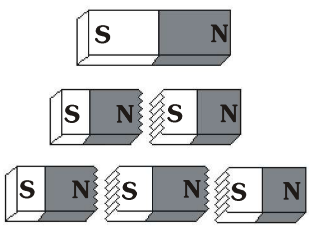


Fig.7 A magnet always have two poles

Inductive nature

When certain substances like iron, steel, cobalt, nickel are placed near a bar magnet, they acquire magnetisation called 'induced magnetisation'. The phenomenon is called '**magnetic induction**'. It involves inducing opposite pole in a magnetic material like iron on the side facing the magnetic pole (see fig.8).

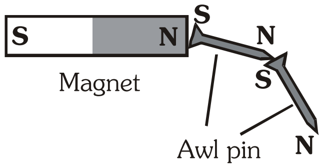
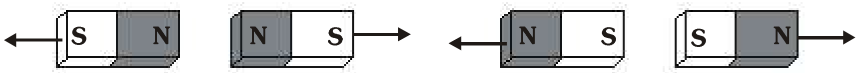


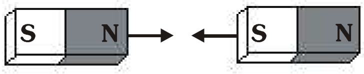
Fig.8 Magnetic induction

Forces between the poles of two magnets

When two magnets are brought together, a north pole and a south pole attract each other i.e., unlike poles attract each other [see fig.9(a)]. Like poles (north-north or south-south) repel each other [see fig.9(b)].



(a) Like poles repel



(b) Unlike poles attract

Fig.9 Forces between the poles of two magnets

CHECK YOUR CONCEPTS 8.1

1. A tailor was stitching buttons on his shirt. The needle has slipped from his hand on to the floor. Can you help the tailor to find the needle ?
2. If you put a magnet in a heap of iron filings, which part of magnet attracts them the least ?
3. You are given two identical bars which look as if they might be made of iron. One of them is a magnet, while the other is a simple iron bar. How will you find out, which one is a magnet ?

THE SPOT LIGHT

If a magnet attracts an object, it does not mean that the object is surely a magnet. It may be an unmagnetised piece of iron or it may be a magnet.

8.7 Various parts of a bar magnet

(i) Magnetic poles : The end points of a magnet where most of its magnetic power is concentrated are called the poles of a magnet.

(ii) Magnetic north pole : The point N at the end of the freely suspended bar magnet which points towards the geographic north pole is called magnetic north pole.

(iii) Magnetic south pole : The point S at the end of the freely suspended bar magnet which points towards the geographic south pole is called magnetic south pole.

(iv) Magnetic axis : An imaginary line (XY) passing from the magnetic north pole and the magnetic south pole of a bar magnet is called magnetic axis.

(v) Length of a magnet : The total distance between the north pole to the centre (NO) and the centre to the south pole (SO) of a magnet is called the length of a magnet.

(vi) Effective length : The distance (NS) between the magnetic north pole and the magnetic south pole is called the effective length of the magnet.

(vii) Magnetic equator : An imaginary line (PQ) bisecting the effective length is called the magnetic equator.

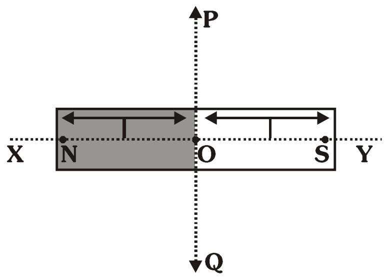


Fig.10 Parts of a magnet

THE SPOT LIGHT

Magnets are surrounded by a magnetic field, an invisible area where the forces of magnetic attraction or repulsion can be detected.

THE SPOT LIGHT

Our Earth is actually a giant magnet. Much of the inside of the Earth is made up of molten iron. This iron creates a magnetic field that surrounds our planet.

Fig.12 The chariot with direction finding statue

8.8 Magnetic field

A region of influence surrounding a magnet, in which other magnets or materials like iron are affected by magnetic forces is called '**magnetic field**'.

ACTIVE PHYSICS 8.5

1. Fix a sheet of white paper on a drawing board using some adhesive material. Place a bar magnet in the centre of it. Sprinkle some iron filings uniformly around the bar magnet. You can use salt-sprinkler for this purpose.

2. Now tap the board gently. You will observe that iron filings align themselves in a specific curved manner around the magnet. This pattern of curve lines is the magnetic field of the bar magnet.

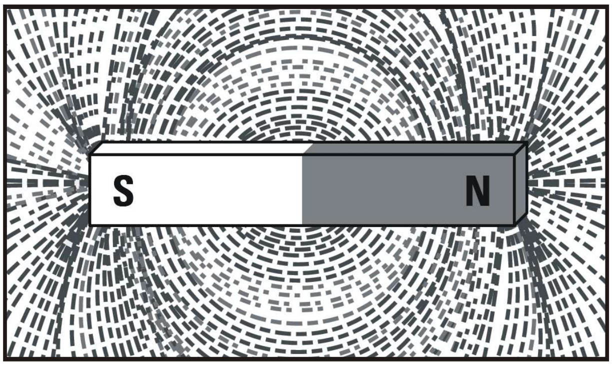


Fig.11 Active physics 8.5

8.9 Finding direction using magnets

Magnets were known to people from ancient times. Many properties of magnets were also known to them. It is said that an emperor in China named Hoang Ti had a chariot with a statue of a lady that could rotate in any direction. It had an extended arm as if it was showing the way (see fig.12). The statue had an interesting property. It would rest in such a position that its extended arm always pointed towards South. By looking at the extended arm of the statue, the Emperor was able to locate directions when he went to new places on his chariot. The property of magnet that was used in statue of the lady is that, 'a freely suspended magnet always keeps itself in north-south direction'.

Magnetic compass needle (or compass)

Pretend you are on a boat at night. No land is in sight. The sky is cloudy. Ancient sailors could become lost on such nights until the compass was invented.

☞ A magnetic compass needle or simply 'compass' is an instrument that uses Earth's magnetic field to help people find directions. A compass needle is actually a thin magnet. The needle points in north direction because it aligns in the direction Earth's magnetic field. Since a compass needle points north, the compass can be used to tell north, east, south, and west, and other directions in between.

BUILDING CONCEPTS 8.4

Why is repulsion the sure test for magnetism ?

Explanation

If a magnet attracts a magnetic substance from one pole and repels from another pole then the magnetic substance is a magnet. But if a magnet attracts a magnetic substance from both the poles then that substance is not magnet. So, repulsion is the sure test for magnetism.

Fig.13 A magnetic compass needle

8.10 Methods of making magnets

The method of preparation of artifical magnets from magnetic substances is called magnetisation. The various method used for making magnets from magnetic substances (iron, cobalt, nickel) by using magnets are

(i) magnetic induction method (ii) single-touch method

(iii) double-touch method (iv) electrical method

Magnetic induction

When certain substances like iron, steel, cobalt, nickel are placed near a bar magnet, they acquire magnetisation called 'induced magnetisation'. The phenomenon is called '**magnetic induction**'. In fig. 14 (a) the pins do not get attracted towards the nail but as soon as magnet is brought near the nail, pins get attracted towards it [Fig.14(b)].

Single-touch method

In this method, the magnetic substance is rubbed with a magnet.

THE SPOT LIGHT

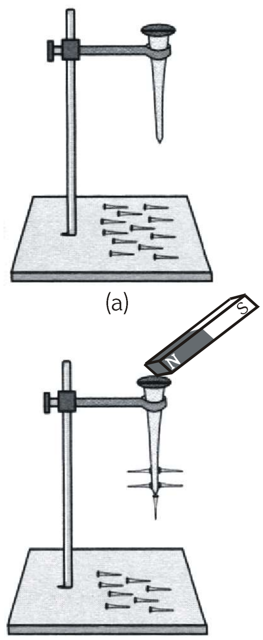
A magnetic compass needle approximately point toward Earth's north pole. The geographic north pole and the magnetic north pole are in slightly different places.

ACTIVE PHYSICS 8.6

1. Take a rectangular piece of iron. Place it on the table. Now take a bar magnet and place one of its poles near one edge of the bar of iron. Without lifting the bar magnet, move it along the length of the iron bar till you reach the other end.

2. Now, lift the magnet and bring the pole (the same pole you started with) to the same point of the iron bar from which you began (see fig.15). Move the magnet again along the iron bar in the same direction as you did before. Repeat this process about 50-60 times.

3. Now bring a awl pin near the iron bar. If iron bar attracts the pin, it means it has become a magnet. If not, continue the process for some more time. Remember that the pole of the magnet and the direction of its movement should remains the same. Try this activity on iron nail, a needle or a blade and convert them into a magnet.



(a)

(b)

Fig.14 (a) Nail does not attract the pins (b) Magnetised nail attracts the pins

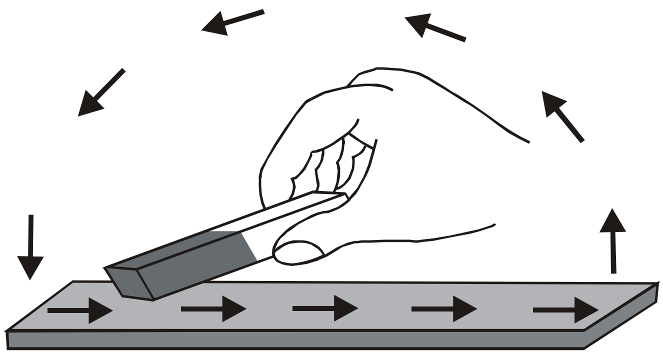


Fig.15 Active physics 8.6 : Making your own magnet

Double-touch method

In this method, the magnetic substance is rubbed with a pair of magnets.

ACTIVE PHYSICS 8.7

1. Take a rectangular piece of iron. Place it on the table. Now take two bar magnets of same size and strength. Place north pole of one magnet and south pole of another magnet at the middle of the bar of iron.

2. Rub the two bar magnets on the iron bar again and again towards the opposite ends. Each time start from the middle of the iron bar and rub upto its ends.

3. Now bring a awl pin near the iron bar. If iron bar attracts the pin, it means it has become a magnet. If not, continue the process for some more time. Remember that the pole of the magnet and the direction of its movement should remains the same. Try this activity on iron nail, a needle or a blade and convert them into a magnet.

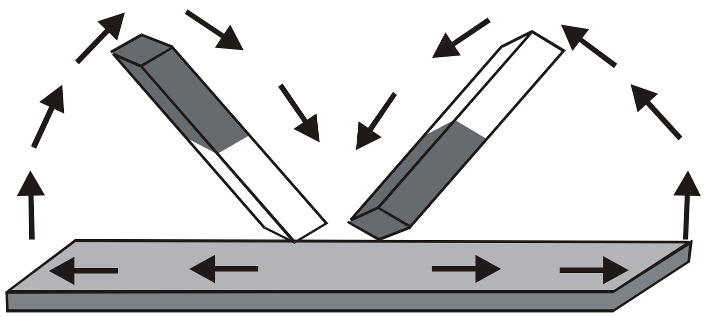


Fig.16 Active physics 8.7 : Making your own magnet

THE SPOT LIGHT

In single touch method, if we rub a north pole of a magnet over a piece of iron from one end to another end, the starting point of interaction in the iron bar becomes north pole where as the end point of interaction becomes the south pole

Electrical method

In the 1820s and 1830s, scientists such as Michael Faraday and Joseph Henry made some amazing discoveries about electric currents and magnets. They found that electric currents make magnetic fields and that magnets could generate, or make, an electric current.

When an electric current flows through a wire, it creates a magnetic field around the wire. Increasing the current makes the magnetic field stronger. You can also make the magnetic field stronger by winding the wire into a long coil. Each loop of wire is like a little magnet that has its own magnetic force. All loops together produce a strong magnetic field.

The magnet made by using electric current is called an **electromagnet**. An electromagnet works on the magnetic effect of currect.

An electromagnet consits of a long coil of insulated copper wire wrapped around the iron rod. When the two ends of the coil are connected to a cell and current passes through the coil and produces a magnetic effect. This magnetic effect magnetises the iron rod and iron rod becomes an electromagnet. The magnetism of an electromagnet remains as long as the current is following in its coil. It current is not passing then all magnetism of the iron rod disappears and it no longer behaves as a magnet.

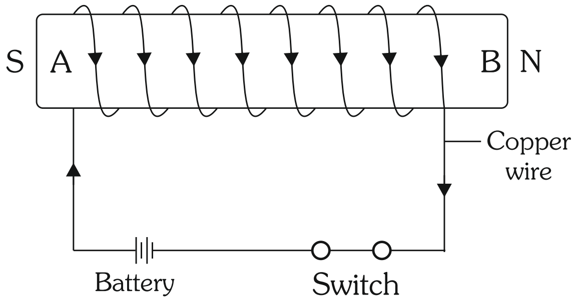


Fig. 17 Bar Electromagnet

Take an iron bar AB and wrapped insulated copper wire over the bar. Connects the ends of the wire to a battery through a switch as shown in fig. 17. When current passes through it behaves like a magnet. The end A of the bar at which the current enters the coil in clockwise direction becomes the south pole(S) and the end (B) of the bar becomes the north pole (N) by reversing the direction of current in the coil the polarity of the electromagnet also gets reversed.

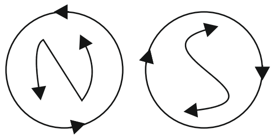


Fig. 18 Polarities N and S depending on the direction of flow of current.

Horse shoe electromagnet

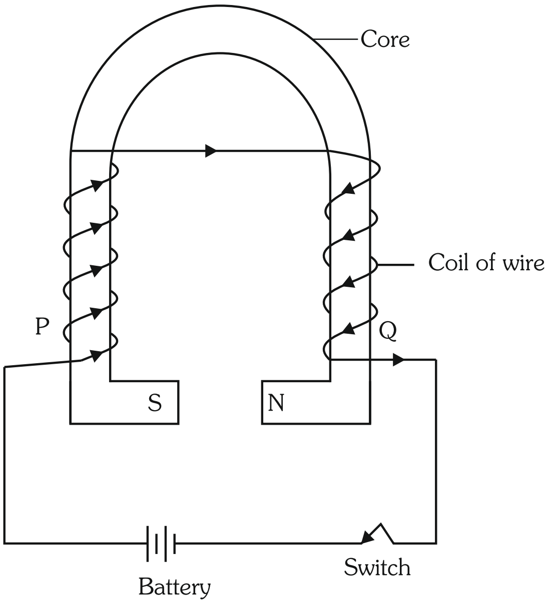


Fig. 19 Horse shoe electromagnet

A horseshoe magnet is a magnet made in the shape of a horseshoe or U-shape. It was invented by William Sturgeon in 1825. The poles of U shaped magnet are closer together so together they create much stronger magnetic field. Take a U shaped soft iron piece and wrap it with a thin insulated copper wire on its arms such that winding in the two arms in opposite direction. As shown in fig.19 winding in the arm P starts from the front and runs in clockwise direction. On the upper side of P winding starts from the back at the top of arm and runs in the anticlockwise direction. Then connect it with the cell/battery and switch between the two ends of wire. When

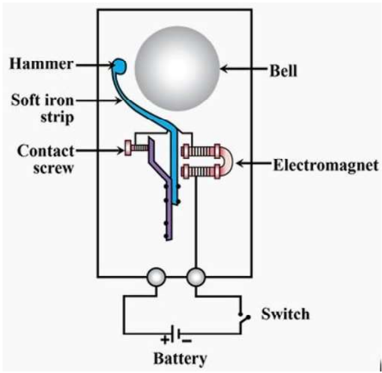


Fig. 20 An electric bell

switch is turned on the current passes through the coil and soft iron piece becomes a magnet. A magnetic field is produced in the gap between the ends of arms P and Q. As the switch is turned off the current stops flowing in the winding coil and it loses its magnetism. Thus, we get a horseshoe or U shaped electromagnet. When the direction of current is anticlockwise it becomes the north pole and when the direction of current is clockwise it becomes the south pole of the U shaped electromagnet.

THE SPOT LIGHT

Strength of an electromagnet increases with the increase in current. The more tightly the turns are wound stronger will be the electromagnet.

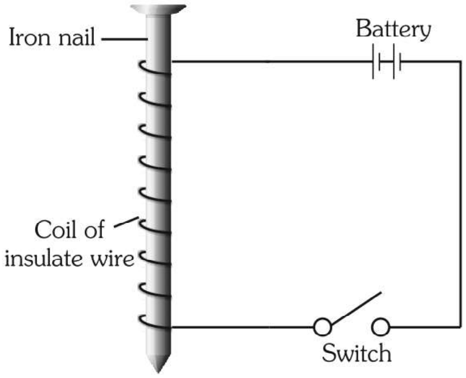


Fig. 21 Making an electromagnet

Take a long insulated copper wire and a large iron nail. Wrap the insulated copper wire closely around the iron nail so that it may form a coil. Connect the free ends of the coil of wire to the two terminals of an electric cell through a switch. Switch on the current in the coiled wire by closing the gap in the switch. Now place some iron pins. We will find that the iron pins cling to the iron nail. It attracts because current flowing in copper wire coil has turned the iron nail into an electromagnet. Switch off the current through the coiled wire by opening the gap in the switch. We will see that iron pins get detached from the iron nail because the iron nail no longer remains a magnet. Thus the iron nail behaves as a magnet only when electric current flows through it. When current stops the iron nail loses its magnetism.

THE SPOT LIGHT

An electromagnet can be switched on and off by turning the electric current on and off. Also, by changing the current, the magnetic field can be made stronger or weaker.

Advantage of electromagnet over permanent magnet

(i) An electromagnet can produce a strong magnetic field as compared to a permanent magnet.

(ii) The strength of magnetic field of an electromagnet can be changed easily by changing the current or the number of turns in the coil.

(iii) The polarity (north pole or south pole) of the electromagnet can be changed by reversing the direction of the current.

(iv) An electromagnet can be easily magnetised or demagnetised as per the requirement.

THE SPOT LIGHT

Keep magnets away from cassettes, mobiles, television, music system, compact disks (CDs) and the computer.

Uses of magnets and electromagnets

(1) They are used in radio and stereo speakers.

(2) They are used in almirah and refrigerator doors to keep them in closed position.

(3) They are used on video and audio cassette tapes.

(4) They are used on the hard discs and floppies for computers.

(5) They are used in different children's toys.

(6) In medicine, they are used in magnetic resonance imaging (MRI) scanners to examine the inner body parts of human beings.

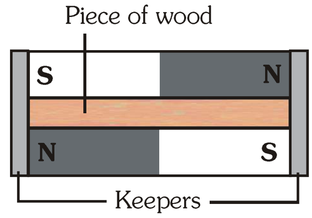
(7) Electromagnets are frequently use now a days for various purposes. e.g. lifting heavy iron pieces, electric doorbells, telephones, miniature circuit breakers (MCB), electric guitars, vacuum cleaners, etc.

(8) Magnetic compass needle is used to find the approximate north-south direction.

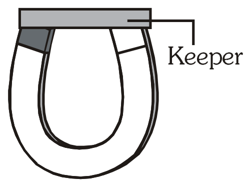
8.11 Safety measures for magnets

(i) Magnets should not be heated at high temperatures, repeatedly hammered or dropped from some height. This is because by doing so, they loose their magnetism.

(ii) Magnets become weak if they are not stored properly. Magnets tend to become weaker after some time if their poles are left free. This is called **self demagnetisation**. To avoid this, bar magnets are kept in pairs separated by a piece of wood, with unlike poles on the same side. Pieces of iron, called **magnetic keepers** or simply **keepers**, are placed across both ends. A horseshoe magnet needs only one keeper across its poles.



(a) Bar magnets



(b) Horseshoe magnet

Fig.22 Keeping magnets safely

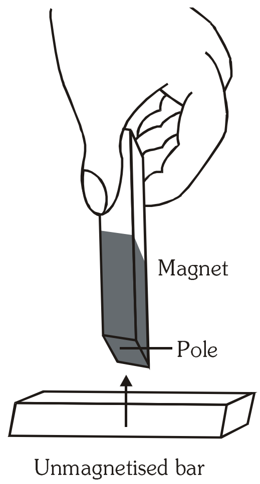
CHECK YOUR ANSWERS 8.1

1. By using a magnet, we can help the tailor in finding the iron needle. When we move magnet on the floor, the iron needle will get attracted towards it as iron is a magnetic material. In this way we can find the lost needle.

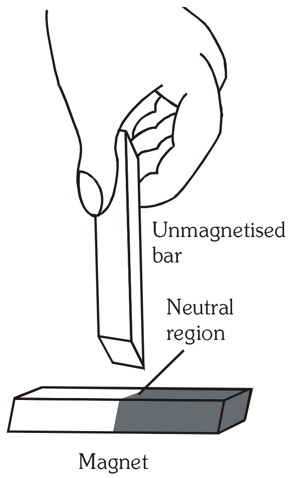
2. When you bring a magnet near an object made of iron, the object will become a temporary magnet. The pole developed on the object on the side facing the magnet is opposite to the pole of magnet. As we know that opposite (unlike) poles attract, the object get attracted towards the magnet. This phenomenon is called magnetic induction.

3. First, we will take one of the bar in our hand and touch its end with the centre of the other bar. If there is a significant attraction between them, then the bar in hand is magnetised. If there is a negligible attraction between the two bars, then the bar in hand is unmagnetised, this means the other one is magnetised.

This is because the central part of a magnet is its neutral region (the region where the attractive power is minimum). If the magnetised bar is in our hand, this means we are touching its pole to the unmagnetised bar, there will be a siginficant attraction between the two bars. If the unmagntised bar is in our hand, this means we are touching its end with the neutral region of the magnetised bar, thus, the attraction between them will be negligible.



(a) Signficant attraction



(b) Negligible attraction

Fig.23 Check your answers 8.1 (3)

EXERCISE # 1

Multiple choice questions

1. Earth can be thought of as a giant magnet because it

(1) orbits around the Sun.

(2) has a magnetic field.

(3) rotates on its axis.

(4) has a moon.

2. Which of the following is not true about permanent magnets

(1) they have two poles.

(2) they are surrounded by magnetic fields.

(3) they have magnetic force.

(4) they can be turned on and off.

3. What is the shape of Earth's magnetic field similar to ?

(1) That of a horseshoe magnet

(2) That of a bar magnet

(3) That of a ball ended magnet

(4) None of these

4. Magnetism in materials in due to

(1) electrons at rest

(2) motion of electrons around the nucleus

(3) protons at rest

(4) neutrons at rest

5. What happens when a magnet is brought near an iron nail ?

(1) The magnet repels the nail.

(2) The nail repels the magnet.

(3) The nail becomes magnetic.

(4) Nothing will happen.

6. Iron attracts

(1) only the north pole of a magnet.

(2) only the south pole of a magnet.

(3) both north and south poles of a magnet.

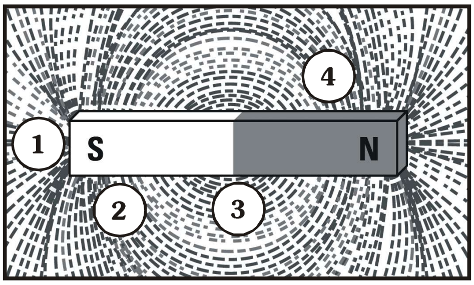
(4) the north pole but repels the south pole.

7. In which part of a bar magnet the magnetisation is minimum ?

(1) At the centre (2) At both poles

(3) At south pole (4) At north pole

8. Iron filings were sprinkled around a magnet and acquired the pattern shown below.



Where is the magnetic force strongest ?

(1) 1 (2) 2

(3) 3 (4) 4

9. An iron bar is considered as a magnet if the south pole of any other magnet

(1) repels its both the ends.

(2) attracts its both the ends.

(3) neither attracts nor repels any of its ends.

(4) attracts its one end and repels its other end.

10. A bar is confirmed to be a magnet when it

(1) attracts all metal.

(2) attracts another magnet.

(3) attracts an unmagnetised piece of iron.

(4) repels a magnet.

11. You are given two similar unmarked bars. One of them is a magnet while the other is a magnetic material. Without any other aid, how would you deduce which one of them is a magnet.

(1) By placing the two bars parallel to each other.

(2) By placing the tip of one of the bars near the middle point of the other bar.

(3) By placing the tip of one of the bars near that other bar such they are parallel to each other.

(4) By placing the tip of one of the bars near that of other such that they are perpendicular to each other.

12. Freely suspended magnet stays in direction of

(1) east-west (2) northeast- southwest

(3) north-south (4) northwest-southeast

13. When any magnet is cut into four equal parts and then they are again joined by quick fix then new magnet will behave as

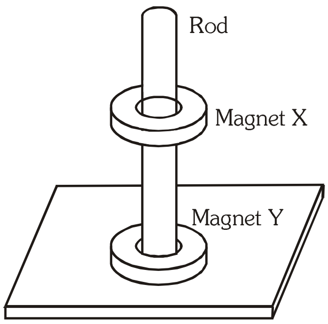
(1) four bar magnets.

(2) four ordinary rods.

(3) one ordinary bar magnet.

(4) one ordinary iron rod.

14. Two ring magnets, X and Y are connected through a rod as shown below. Magnet X floats above magnet Y because



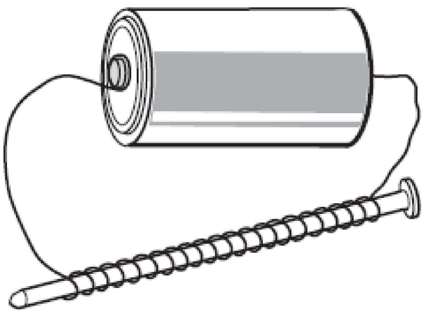
(1) Magnet X is lighter than magnet Y.

(2) Magnet Y is more powerful than magnet X.

(3) The like poles of both magnets are facing each other.

(4) The unlike poles of both magnets are facing each other.

15. Look at the simple electromagnet below.



How can you make the electromagnet's magnetic field stronger ?

(1) Remove the iron nail.

(2) Use a wooden nail instead of an iron nail.

(3) Wrap more coils of wire around the nail.

(4) Wrap fewer coils of wire around the nail.

True or false

1. Artificial magnets were discovered in Greece.

2. Rubber is a magnetic material.

3. A cylindrical magnet has only one pole.

4. Maximum iron filings stick in the middle of a bar magnet when it is brought near them.

5. Attraction of material with a magnet is a clear proof that 'it is a magnet'.

6. Bar magnets always point towards North-South direction.

7. Similar poles of a magnet repel each other.

8. A compass can be used to find East-West direction at any place.

9. Electromagnets are used in radio, speakers etc.

10. Magnetic properties of a magnet reduces by repeatedly hammering it.

Fill in the blanks

1. Any object that has magnetic force is called a ....

2. A material that maintains its magnetic properties even when it is not close to another magnet is called a ....

3. Materials similar to iron that have strong magnetic properties are called ....

4. Every magnet has a north and a south ....

5. The region of magnetic force around a magnet is called its ....

6. The influence created by a magnet that exerts forces on other magnetic objects is known as a ....

7. Two magnetic north poles .... each other.

8. A north pole and a south pole .... each other.

9. Earth's magnetic field causes a .... to point north.

10. Electric current produces a magnetic field in an ....

One word questions

1. Name two materials which are magnetic and two that are non-magnetic.

2. Which magnetic pole is attracted to a south magnetic pole ?

3. Name any two types of artificial magnets.

4. In which direction does a magnet points when suspended freely ?

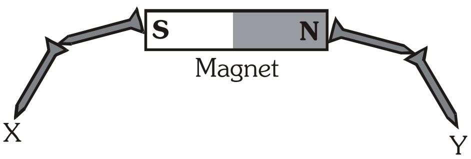
5. Where is the magnetic force strongest in a bar magnet ?

6. Which among these is the true test to check a magnet–attraction or repulsion ?

7. If the strength of current is increased in an electromagnet, will it become weaker or stronger ?

8. Mention any one method to demagnetise a magnet.

9. Observe the figure given below. What will be the polarity of ends X and Y ?



10. Name any one suitable material to be used as the core of an electromagnet ?

Match the column

1.

Column-I	Column-II
(1) A magnet is dropped from a height on a hard rock	(a) Magnetism is induced in the iron bar
(2) An electric current is passed through a coil of copper wire wound around an iron bar	(b) Magnetism is lost
(3) An iron bar is placed in line with a magnet	(c) Iron bar is a magnet
(4) A magnet repels an iron bar placed near	(d) Electromagnet

2.

Column-I	Column-II
(1) Natural magnet	(a) Electromagnet
(2) Temporary magnetism	(b) Lodestone
(3) North pole of a magnet	(c) Magnetic keeper
(4) Protection of magnet	(d) Points towards north when suspended freely

EXERCISE # 1 — ANSWER KEY

Multiple choice questions

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	2	4	2	2	3	3	1	1	4	4	2	3	3	3	3

True or false

1. True **2.** False **3.** False **4.** False **5.** True **6.** True
7. False **8.** False **9.** True **10.** False

Fill in the blanks

1. Magnet **2.** Permanent magnet **3.** Magnetic materials **4.** Pole **5.** Magnetic field
6. Magnetic field **7.** Repel **8.** Attract **9.** Magnetic compass needle
10. Electromagnet

One word answers

1. Iron, nickel ; copper, silver **2.** North **3.** Bar magnet, magnetic compass needle
4. North-South **5.** Poles **6.** Repulsion **7.** Stronger **8.** Heating
9. South pole and North pole **10.** Iron

Match the column

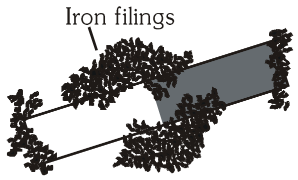
1. (1) → b ; (2) → d ; (3) → a ; (4) → c **2.** (1) → b ; (2) → a ; (3) → d ; (4) → c

EXERCISE # 2

Short answer type questions

1. What is a magnet ?

2. A bar magnet is rolled in the iron filings and then lifted up. What is wrong in figure of that magnet shown below ?



3. Why the north end of a compass always points to the northern part of the Earth ?

4. What do you think the following magnets will repel or will attract each other ?

5. What happens when like magnetic poles are bring close together ?

6. Describe, what is meant by the term magnetic field.

7. What happens if a magnet is heated ?

8. What are magnetic keepers ?

9. Why does a magnet attract unmagnetised piece of iron ? Write the name of phenomenon involved in it.

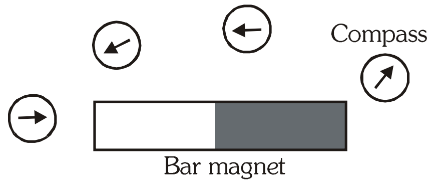
10. What do you call the type of material that is attracted to a magnet or can be magnetised? Give any two examples of this type of material.

11. A scientist says, "Magnetic poles of magnets and electric charges on bodies apply forces in similar ways." Explain what is meant by this statement?

12. What happens to the poles of a magnet if it is cut into pieces ?

13. Suppose astronauts land on Planet Z. Planet Z does not have a magnetic field. Will the astronauts be able to use a compass to find direction ? Give reason.

14. Use the figure below to answer questions.



(i) Explain why the compass needles are pointed in different directions ?

(ii) What will happen to the compass needles when the bar magnet is removed ?

15. Why does a compass change direction when it is kept near a magnet ?

16. How is a compass used to find directions ?

17. What is the difference between a permanent magnet and an electromagnet ?

18. Large electromagnetic cranes are used in junk yards for moving scrap metal from one location to another. Why would an electromagnet be more useful in this application than a permanent magnet ?

Long answer type questions

1. You are given an iron strip. How will you make it into a magnet ? Make figure.

2. Write any four properties of a magnet. Make figures.

3. (i) Where are poles of a bar magnet located ?

(ii) A bar magnet has no markings to indicate its poles. How would you find out near which end is its north pole located ? Make figure.

4. (i) What is an electromagnet ? How it works ? Make figure of an electromagnet.

(ii) How an electromagnet is better than a permanent magnet ?

Important Notes