CHAPTER 1. Matter

Check Point 1

1. (a) space (b) molecules (c) attract

2. (a) Molecule (b) Plastic, Rubber, Water, Oil and Air

Check Point 2

1. (a) liquid (b) Solid (c) gas

2. (a) Solid

(b) A liquid can be transformed into a gas on heating through evaporation process.

TEST YOURSELF

A. 1. solid, gas **2.** minimum/least **3.** weak **4.** liquid **5.** gas

B. 1. Matter **2.** Molecule **3.** Intermolecular force **4.** Rigidity **5.** Gas

C. 1. Anything which has mass and occupies space is called matter.

2. The smallest part of a substance that can exist independently in nature is called a molecule.

3. The substance which has definite volume but no definite shape of its own is called a liquid.

4. The substance which has neither a definite volume nor a definite shape of its own is called a gas.

D. 1.

Solids	Liquids
(a) Solids have a definite volume and definite shape of their own.	(a) Liquids have definite volume but do not have definite shape of their own.
(b) They do not flow but can be heaped.	(b) They can flow but cannot be heaped.
(c) They are rigid and cannot be compressed.	(c) They are nonrigid and can be slightly compressed.

2.

Liquids	Gases
(a) Liquids have definite volume but do not have definite shape of their own.	(a) Gases have neither definite volume nor definite shape of their own.
(b) Liquids can flow from higher to lower level.	(b) Gases can flow in all directions.
(c) Liquids are slightly compressible.	(c) Gases are highly compressible.

E. 1. Anything which has mass and occupies space is called matter.

2. Aim: To show that water occupies space

Materials Required: A glass tumbler, a table and water

Procedure: Take a clean, dry glass tumbler and put it on the table. Now, gently pour water into the tumbler.

Observation and Conclusion: The water level in the tumbler goes on rising as more and more water is poured into it. A limit may come when the tumbler is filled to its brim. If more water is poured into the tumbler, then it will overflow and spread on the table. This activity shows that water occupies space.

3. Molecules are the smallest particle of a substance which can independently exist in nature. They are formed by combining one or more atoms together.

4. Three characteristics of molecules are as follows:

(a) Molecules of a substance are extremely small in size. They cannot be seen even with the help of a microscope.

(b) Molecules of a substance attract each other. This attractive force amongst molecules of a substance is called intermolecular force.

(c) All molecules of a particular substance are identical in shape, size and mass.

5. Sugar and apple are solid substances.

6. Hydrogen and biogas are gaseous substances.

7. The three characteristics of liquids are as follows:

(a) Liquids have definite volume but no definite shape of their own.

(b) The molecules of liquids are less closely packed.

(c) The intermolecular forces in liquids are less strong as compared to solids.

8. A list of twenty objects is given below:

Pencil, petrol, nitrogen, oil, chair, oxygen, duster, milk, water, stapler, CNG, book, table, alcohol, stone, mercury, water vapour, sponge, blackboard, juice.

Solids	Liquids	Gases
Pencil	Petrol	Nitrogen
Chair	Oil	Oxygen
Duster	Milk	CNG
Stapler	Water	Water vapour
Book	Alcohol	
Table	Mercury	
Stone	Juice	
Sponge		
Blackboard		

F. 1.–(b) **2.**–(c) **3.**–(a)

G. 1. True

2. False; Molecules **cannot** be easily seen by the use of a microscope.

3. False; Matter particles **exert intermolecular force** on each other.

4. True

5. True

6. False; Gases have neither finite shape nor finite mass.

H. 1. Coconut oil; It is liquid but others are solid.

2. An antiseptic tablet; It is solid but others are liquid.

3. Sodawater; It is liquid but others are gas.

I. 1. (c) **2.** (d) **3.** (b) **4.** (d)

THINK ZONE

1.

Maximum intermolecular space	Minimum intermolecular space
Air	Stone
Carbon dioxide	Milk
Steam	Wood
CNG	Book
	Pencil

- Iron piece is solid and rigid. So, it cannot be compressed.
- The constituent molecules of a solid are closely packed because intermolecular space amongst the molecules of a solid is very small.
- The molecules of solids are held tightly together by strong forces of attraction. So, they have fixed position and cannot move. Therefore, solids do not flow.

CHAPTER 2. Physical Quantities and Measurement

Check Point 1

1. A standard unit of a given quantity is an appropriate measure that has some definite and convenient amount of the quantity which remains the same for every person at every place.

2. Three common unit systems being followed in daily life are (i) CGS system, (ii) FPS system, and (iii) MKS (SI) system.

3. (a) a kilo = 1000 (b) a centi = $\frac{1}{100}$ = 0.01

(c) a milli = $\frac{1}{1000}$ = 0.001 (d) a hecto = 100

4. A week consists of 7 days.

$\because$ One day = 24 hours = 24 × 60 × 60 seconds

$\therefore$ 1 week = 7 × 24 × 60 × 60 seconds

= 6,04,800 s

Check Point 2

1. (a) metre (b) left-side (c) digital

2. (a) Balance (b) 12 inches

Check Point 3

1. second **2.** 37 **3.** 10000

TEST YOURSELF

A. 1. physical **2.** one-hundredth **3.** SI **4.** physical balance **5.** mercury

B. 1. Gram **2.** Centimetre **3.** Kelvin **4.** Measuring scale (or metre rod) **5.** Measurement **6.** Thermometer **7.** Stopwatch

C. 1. Measurement is the process of comparison of a physical quantity with a fixed known quantity of the same kind.

2. A standard unit is an appropriate measure of the given quantity which remains the same for every person at every place.

3. Temperature is the degree of hotness or coldness of an object.

D. 1. Multiples of units are used for larger measurements but submultiples of units are used for smaller measurements.

2. Lower fixed point of a thermometer is the melting point of pure ice at standard atmospheric pressure, whereas upper fixed point of a thermometer corresponds to the boiling point of pure water at standard atmospheric pressure.

3. In MKS system, the units of length, mass and time are metre, kilogram and second respectively. In FPS system, the units of length, mass and time are foot, pound and second respectively.

E. 1. A physical quantity is something that can be measured. Length, mass, time, volume, temperature, capacity, etc., are examples of physical quantities.

2. While reading a measuring scale, one should follow the following precautions:

(i) The scale should be placed along the length to be measured.

(ii) While noting down the scale reading, position of eye should be just above the point where reading is to be taken.

(iii) If an edge of the scale is worn out or zero mark is invisible, then do not consider it as the reference point.

3. Four fundamental quantities and their SI units are given below:

(i) length – metre (ii) mass – kilogram (iii) time – second

(iv) temperature – kelvin

4. Mass of an object is a measure of the quantity of matter contained in it. The SI unit of mass is kilogram.

5. To determine the mass of an object using a beam balance, place the given object on left pan of the balance. Standard weights of appropriate values are placed on right pan of the balance till the pans are balanced and the beam is perfectly horizontal. The total sum of standard weights gives the mass of the given object.

6. Following precautions should be followed while using a clinical thermometer:

(i) The thermometer should be washed well before use.

(ii) Give few soft jerks to the thermometer so that initial reading of mercury level is below 35°C.

(iii) Never hold the thermometer by the bulb.

(iv) Keep the thermometer in a person's mouth under the tongue for at least one minute.

(v) While reading the thermometer, hold it at the eye level.

(vi) Never wash the thermometer in hot water.

7. The normal body temperature of a healthy person is 37°C (98.6°F).

F. 1.–(b) **2.**–(e) **3.**–(a) **4.**–(f) **5.**–(c) **6.**–(g) **7.**–(d)

G. 1. False; The SI unit of length is **metre.**

2. True

3. True

4. False; A **second** is a standard international unit of time.

5. True

6. False; In a **beam** balance, mass of an object is compared with masses of standard weights.

7. True

8. False; The symbol for 40 metres is 40 **m**.

H. 1. Newton; All other units are fundamental units but newton is a derived unit.

2. Measuring tape; All other devices measure time but a measuring tape measures the length.

3. Weight box; All other devices are used to measure the temperature but weight box is used for measuring the mass.

4. Square metre; It is SI unit of area but others are units of length.

I. 1. The standard unit should not change with place or time to avoid confusion and inconvenience in measurement.

2. Since hectare is a multiple and bigger unit of area, it is used to measure the bigger size like area of playgrounds and fields.

3. The constriction provided in the capillary tube of a clinical thermometer prevents the fall of mercury column from its original

position when the thermometer is taken out of the patient's mouth.

J. 1. 600 m = $\frac{600}{1000}$ km = 0.6 km

2. Here, 1.2 km = 1.2 × 1000 m
= 1200 m = 1200 × 100 cm = 120000 cm

3. Here, 35 cm = 35 × 10 mm = 350 mm

4. (a) Height of Ginni in metre = $\frac{142}{100}$ m = 1.42 m

(b) Height of Ginni in millimetre = 142 cm × 10 = 1420 mm

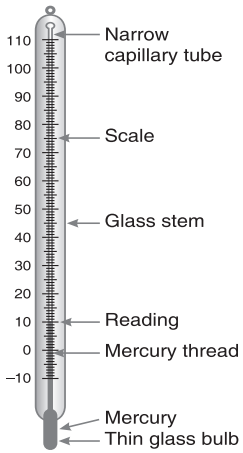
5. Length of the cellphone = 13.3 cm – 0.5 cm
= 12.8 cm
= 12.8 × 10 mm
= 128 mm

6. Here, length, l = 60 cm and breadth, b = 30 cm
∴ Surface area of wall painting, $A = lb$
= 60 cm × 30 cm = 1800 cm^2
and surface area in square metre = $\frac{1800}{100 \times 100}$ = 0.18 m^2

7. ∴ Time taken = 1.25 hours
= 1.25 × 60 min
= 75 min = 75 × 60 s = **4500 s**

K. 1. (b) **2.** (d) **3.** (a) **4.** (d) **5.** (c) **6.** (b) **7.** (c) **8.** (b) **9.** (d)

L. 1. The diagram of a laboratory thermometer is given below:



2. The student having eye at position B will get the correct reading. The correct length of the pencil is 5 cm.

3. Thermometer A is Celsius thermometer because it ranges $0^{o}C - 100^{o}C$.

Thermometer C is Fahrenheit thermometer because it ranges $32 - 212^{o}F$.

THINK ZONE

- Ritika should keep one edge (starting) of the pencil at 1 cm mark and then she should calculate the actual length of the pencil by subtracting 1 from the reading at the other end of pencil.
- Given, total number of pages in the book = 200

  Cover pages in a book = 4 (2 × 2 sheets)

  So, number of pages excluding cover pages

  = 200 – 4 = 196 pages

  We know, there are 2 pages in a sheet

  So, number of sheets for 196 pages = $\frac{196}{2}$ = 98 sheets

  $\because$ Thickness of 1 sheet = 0.005 cm

  $\therefore$ Thickness of 98 sheets = 98 × 0.005 cm

  = 0.49 cm

  Now, thickness of 1 cover sheet = 0.05 cm

  $\therefore$ Thickness of 2 cover sheets = 2 × 0.05 cm

  = 0.1 cm

  Hence, the thickness of textbook = Thickness of pages + Thickness of covers

  = 0.49 cm + 0.1 cm

  = 0.59 cm
- (a) Electronic balance (b) Measuring tape

  In (a), we use electronic balance because it does not require standard weights like beam balance.

  In (b), the length of the room can be easily measured with the measuring tape. It cannot be easily measured with metre scale and metre rod due to their small length.
- Here, length of cloth = 2 m = 2 × 100 = 200 cm

  $\therefore$ Length of each piece of the cloth = $\frac{200}{5}$ = 40 cm

CHAPTER 3. Force

Check Point 1

1. (a) Force (b) pulls (c) motion

2. (a) Force is a push or a pull which changes or tends to change the state of rest or uniform motion along a straight line. Force may also change shape or size of an object.

(b) Pushing the almirah and pushing a striker on carom board.

(c) A force can change the shape of an object, e.g., if a balloon is compressed with fingers, its shape changes.

Check Point 2

1. newton **2.** contact force **3.** noncontact force

Check Point 3

1. (a) opposes (b) less (c) friction

2. (a) Friction is a contact force that comes into action whenever a body moves or tries to move over a surface. It always acts in a direction opposite to that of motion.

(b) Two advantages of friction are as follows:

(i) Friction helps us to tie a knot.

(ii) Friction helps to construct a building.

(c) Oil and grease are used as lubricant in machinery.

TEST YOURSELF

A. 1. force **2.** force **3.** contact force **4.** opposite **5.** reducing **6.** less **7.** Streamlined

B. 1. Contact force **2.** Friction **3.** Streamlined shape **4.** Resultant force

C. 1. A push or a pull applied on an object is known as force.

2. The force acting between two objects when they are in actual contact with each other is known as contact force.

3. Friction is a contact force that comes into action whenever a body moves or tries to move over a surface.

4. The force of friction acting on an object which tends to move over a surface but does not actually move is called static friction.

5. The force of friction which opposes rolling motion of an object over a given surface is called rolling friction.

D. 1.

Contact force	Noncontact force
(a) The force which acts by directly touching the object is called contact force.	(a) The force which acts from a distance without directly touching the object is called noncontact force.
(b) Muscular, mechanical and frictional forces are contact force.	(b) Gravitational, magnetic and electrostatic forces are noncontact force.

2.

Static friction	Sliding friction
(a) The force of friction that comes into play when one object tends to move over a surface but there is no actual motion of the object in spite of a force being applied on it is called static friction.	(a) The frictional force exerted by a surface on an object when it is actually sliding on the surface is called sliding friction.
(b) Static friction is more than sliding friction.	(b) Sliding friction is less than static friction.

3.

Pushing force	Pulling force
A force applied on pushing an object ahead is called pushing force, e.g., a person pushing an almirah.	A force applied on pulling an object back is called pulling force, e.g., a person pulling a cart.

E. 1. A man pulling a cart and a fielder catching a ball are two examples of force as a pull.

2. Three important effects of a force are as follows:

(i) Force may start motion in an object or may change the speed of its motion.

(ii) It may change the direction of motion.

(iii) It may change the shape or size or both of an object.

3. Take a spring and stretch it by applying force at its ends. In this process, the size of the spring increases. Again, take a sheet of paper and crumple it up into a small bead, the shape and size of the paper change. Thus, a force can change the shape or size or both of an object.

4. Force of friction is that contact force which opposes motion of one object on the surface of another object. Force of friction always acts in a direction opposite to the direction of motion of the given object.

5. The two factors which affect the force of friction are:

(a) Roughness of the surfaces in contact.

(ii) Mass of the moving object.

6. An object experiences more friction while sliding on a wooden surface.

7. The three disadvantages of friction are as follows:
(i) Friction always opposes motion of a body over another.
(ii) Our shoes and tyres of vehicles wear out due to friction.
(iii) Heat produced due to continuous use of machinery causes wear and tear of its moving parts.

8. We can reduce friction by following methods:
(i) By making the surfaces smooth and polished
(ii) By using oil and grease as lubricants in moving machine parts
(iii) By using wheels and rollers
(iv) By using ball bearings
(v) By streamlining of cars, boats, aeroplanes, ships, etc.

9. (a) We need higher friction at the steps of staircase and ramps of buildings.
(b) We need higher friction at sloping concrete roads made on hills.

10. The three kinds of friction are rolling friction, sliding friction and static friction.

11. The rolling friction can be minimised by using wheels and ball bearings.

F.1. Sit: All other terms mean application of some force but sit does not mean application of force.

2. Resultant force: It occurs when two forces act in opposite or same direction while others are types of frictional force.

3. Grooved tyres: Tyres are grooved so as to increase friction. However, all other terms are meant for reducing friction.

G. 1. False; A force can start and stop motion.
2. True
3. True
4. True
5. False; Friction is a **contact** force.
6. False; The force of friction is **useful as well as harmful.**
7. True
8. True
9. False; Furniture is polished so as to **reduce friction.**
10. False; Rolling friction is **less** than sliding friction.

H. 1.–(d) **2.**–(a) **3.**–(b) **4.**–(c)

I. 1. When a cyclist stops paddling the bicycle, it comes to rest slowly due to force of friction acting between its types and the road.

2. When a player kicks the football with his foot, he applies force on it and as a result, the football starts moving on the ground.

3. A rolling ball stops after moving some distance on account of the frictional force due to the ground.

4. When two or more persons apply force on a heavy box simultaneously in the same direction, the resultant force, being sum of the individual forces, is increased. As a result, they are able to push the box.

5. Tyres of vehicles become hot after a long drive on account of friction acting between tyres and road.

6. The moving parts of machinery are greased from time to time so as to reduce friction between them.

7. During winter, we can warm our hands by rubbing them together because rubbing of hands generates heat due to friction.

8. The shape of boats and ships is streamlined so as to reduce the friction due to water.

9. Vehicles give less mileage when being driven on a rough road because a part of the fuel consumed is spent in overcoming the friction.

10. Tyres of trucks are grooved to increase friction to make them move smoothly on the road.

11. Silk thread is slippery as compared to jute string. So, jute string offers more friction than silk thread, that is why, a knot tied in jute string does not slip easily.

J. 1. (d) **2.** (c) **3.** (a) **4.** (b) **5.** (b) **6.** (d)

K. 1. A footballer is applying a force on the football. The football starts to move when force is applied on it.

2. Resultant force = 40 N + 30 N = 70 N

The resultant force is 70 N because both the boys are applying force in the same direction.

THINK ZONE

- When we kick a football, it stops after moving some distance due to the friction acting between the football and the ground.
- The body of birds pointed on both the ends means that their body is streamlined which helps them to reduce friction due to air and fly easily.
- People sprinkle talcum powder on the carom board because it reduces friction on the board. As a result, people hit the coins with a striker smoothly on the board.

CHAPTER 4. Energy – Simple Machines

Check Point 1

1. (a) Energy (b) simple machine (c) three

2. (a) A simple machine is a tool that helps us in doing our work easily and efficiently.

(b) Yes, a machine can change the speed. In a bicycle, the speed of moving wheels is different from the speed of rotation of paddles.

(c) Lever, inclined plane and pulley are three examples of simple machines.

(d) Mechanical advantage of third class lever is always less than one.

Check Point 2

1. Two important applications of inclined plane are as follows:

(i) Wheelchairs and stretchers of patients can be easily pushed from one floor to another by the use of ramps (i.e., inclined plane) in a hospital.

(ii) Heavy loads can be easily loaded in a truck by the use of a wooden plank placed as an inclined plane.

2. A wedge is a simple machine that has two or more inclined surfaces which taper either to form a sharp edge or a pointed edge.

3. An inclined plane is used while loading goods in a truck or in a railway wagon.

4. A plough is an example of a wedge.

Check Point 3

1. Pulleys are of two types, namely (i) fixed pulley, and (ii) movable pulley.

2. The distance between two consecutive threads of a screw is called its pitch.

3. When we turn the door knob of our house, we make use of a 'wheel and axle' machine.

4. Machines should be lubricated regularly to reduce friction. As a result, they run smoothly.

5. A machine can be protected from dust and moisture by covering it properly.

TEST YOURSELF

A. 1. simple **2.** complex **3.** on, by **4.** fulcrum **5.** second **6.** less **7.** wedge **8.** fixed pulley **9.** screw

B. 1. Fulcrum **2.** Effort **3.** Output **4.** Wedge **5.** Pitch

C. 1. Mechanical advantage of a machine is defined as the ratio of the load overcome to the effort applied.

2. Input is the work done on a machine, i.e., the energy supplied to the machine.

3. Output is the useful work done by the machine, i.e., it is the energy imparted by the machine.

4. Efficiency of a machine is the ratio of the useful work done by the machine (output) to the work done on the machine (input).

D. 1.

Second class lever	Third class lever
(a) In a second class lever, load lies between the fulcrum and the effort.	(a) In a third class lever, effort lies between the fulcrum and the load.
(b) Mechanical advantage of second class lever is always greater than one.	(b) Mechanical advantage of third class lever is always less than one.

2. A **simple machine** is a simple tool that helps in doing our work more easily and efficiently while a **complex machine** is a combination of two or more simple machines working together.

3. An **inclined plane** is a sloping surface which helps us to make our work easier, whereas a **screw** is a simple machine which appears like a nail with a spiralling groove made on its curved surface.

4. In a **single fixed pulley,** the axle is fixed to a rigid support. Load is tied to one end of the rope and effort is applied at other end of the rope.

In a **single movable pulley,** one end of the rope is fixed to the rigid support and the effort is applied at the other end of the rope. The load is attached to the pulley.

E. 1. Three main functions of a simple machine are as follows:

(i) A simple machine multiplies the force.

(ii) A simple machine changes the speed.

(iii) A simple machine helps to change the direction of the force.

2. Lever, pulley, inclined plane and screw are four common types of simple machines.

3. According to the principle of lever, the turning effect of the effort at the fulcrum is equal to the turning effect of the load at the fulcrum.

Thus, $\text{Effort} \times \text{effort arm} = \text{Load} \times \text{load arm}$

Mechanical advantage of lever, $MA = \dfrac{\text{Load}}{\text{Effort}} = \dfrac{\text{Effort arm}}{\text{Load arm}}$

4. First class lever: In first class lever, fulcrum lies between the load and effort and generally effort arm is taken longer than load arm so as to have greater mechanical advantage. A beam balance and a pair of scissors are examples of first class levers.

Second class lever: In second class lever, load lies between the fulcrum and effort. The mechanical advantage of second class lever is always more than one. A nutcracker and a door are examples of second class levers.

Third class lever: In third class lever, effort lies between the fulcrum and load. The mechanical advantage of third class lever is always less than one. Forceps and human forearms are examples of third class levers.

5. (a) In an inclined plane and screw, we multiply force.

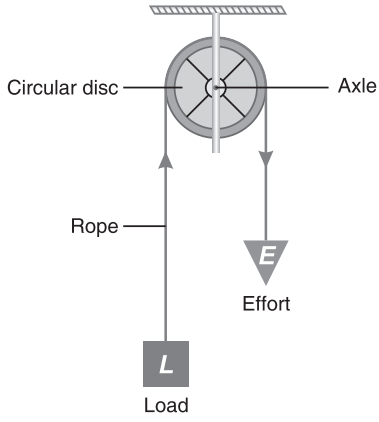
(b) In a single fixed pulley and an inclined plane, we apply force in a convenient direction.

(c) In a lever and a wedge, we apply force at a convenient point.

6. The concept of an inclined plane is used to multiply force in (i) a ramp provided at the gate of a house, (ii) a sloping plank used for loading in trucks and railway wagons, and (iii) a gang plank provided to unload the cargo from a ship.

7. In a single fixed pulley, the axle is fixed to a rigid support. The load to be raised is attached to one end of the rope and the effort is applied at the other end of the rope.

A single fixed pulley helps us to apply effort in a convenient downward direction for pulling a load in the upward direction.



8. A screw works on the principle that when the screw is given one complete rotation, it advances a distance equal to the space between two consecutive threads.

The screw is used to fit doors in door frames. Nut and bolt arrangement of screws are used to hold objects or components together.

9. Three common examples of wheel and axle arrangement are:

(i) the door knob, (ii) a screwdriver, and (iii) steering wheel of a car.

10. Following ways can ensure proper maintenance of machines:

(i) Iron parts of a machine should be painted to prevent rusting.

(ii) Moving parts of a machine should be regularly lubricated so as to minimise friction and reduce wear and tear of the machinery.

(iii) Machines should be regularly cleaned.

(iv) When not in use, machines should be covered properly.

F. 1. False; A nutcracker is a **second** class lever.

2. False; A machine can raise heavy load when energy is **supplied** to it.

3. False; A wheel and axle is a **simple** machine.

4. True

5. False; Sewing machine is a **complex** machine.

6. True

7. False; If the **effort** arm is longer than the **load** arm, the force applied by the effort will increase.

8. True

G. 1.–(d) **2.**–(e) **3.**–(b) **4.**–(a) **5.**–(g) **6.**–(c) **7.**–(f)

H. 1. Spade; It is a third class lever while others are first class levers.

2. A pair of pliers; It is a first class lever while others are second class levers.

3. Watch; It is a complex machine while others are simple machines.

4. Screwdriver; It is a wheel and axle arrangement while others are inclined planes.

5. Screw; Its principle is different from all other devices which work on the principle of wedge.

I. 1. A machine cannot be 100% efficient because some part of the input (energy applied) is lost to overcome the friction present in moving parts of the machine.

2. A pulley has a groove cut along its rim to hold the rope so that it may easily rotate the pulley.

3. A second class lever always increases the effect of effort applied because its load arm is smaller than the effort arm.

4. Mechanical advantage of a third class lever is always less than one because its load arm is longer than the effort arm.

5. It takes less effort to insert a screw into wood than to insert a nail because mechanical advantage of the screw is greater than that of the nail.

J. 1. Here, load = Weight of first boy = L = 20 kg wt and load arm = 1.2 m

Let effort = Weight of second boy = E and effort arm = 50 cm = 0.5 m

$\because$ Effort × effort arm = Load × load arm

$\therefore$ $E \times 0.5$ m = 20 kg wt × 1.2 m

$\Rightarrow$ $E = \dfrac{20 \times 1.2}{0.5}$ kg wt = 48 kg wt

$\therefore$ Weight of second boy = 48 kg

2. (a) $\because$ Load arm = 15 cm and effort arm = 30 cm

$\therefore$ Mechanical advantage = $\dfrac{\text{Effort arm}}{\text{Load arm}} = \dfrac{30 \text{ cm}}{15 \text{ cm}} = 2$

(b) Here, effort arm = 12 cm and load arm = 30 cm

$\therefore$ Mechanical advantage = $\dfrac{\text{Effort arm}}{\text{Load arm}} = \dfrac{12 \text{ cm}}{30 \text{ cm}} = 0.4$

(c) Here, load, L = 200 N and effort, E = 80 N

$\therefore$ Mechanical advantage = $\dfrac{\text{Load}}{\text{Effort}} = \dfrac{L}{E} = \dfrac{200 \text{ N}}{80 \text{ N}} = 2.5$

(d) Here, effort, E = 5 kg wt and load, L = 45 kg wt

$\therefore$ Mechanical advantage = $\dfrac{\text{Load}}{\text{Effort}} = \dfrac{L}{E} = \dfrac{45 \text{ kg wt}}{5 \text{ kg wt}} = 9$

3. (a) Here, load = 800 N, load arm = 0.8 m and effort arm = 4.0 m

$\because$ Effort × effort arm = Load × load arm

$\therefore$ Effort = $\dfrac{\text{Load} \times \text{load arm}}{\text{Effort arm}}$

$= \dfrac{800 \text{ N} \times 0.8 \text{ m}}{4.0 \text{ m}} = 160 \text{ N}$

(b) Here, load arm = 50 m, effort arm = 125 m and load = 100 kg wt

$\because$ Effort × effort arm = Load × load arm

$\therefore$ Effort × 125 m = 100 kg wt × 50 m

$\Rightarrow$ Effort = $\dfrac{100 \text{ kg wt} \times 50 \text{ m}}{125 \text{ m}} = 40 \text{ N}$

4. (a) Here, effort = 100 N, effort arm = 60 cm and load arm = 15 cm

$\because$ Load × load arm = effort × effort arm

$\therefore$ Load × 15 cm = 100 N × 60 cm

$\Rightarrow$ Load = $\dfrac{100 \text{ N} \times 60 \text{ cm}}{15 \text{ cm}} = 400 \text{ kg wt}$

(b) Here, effort = 50 N, effort arm = 1 m

and load arm = 10 cm = $\frac{10}{100}$ m = 0.1 m

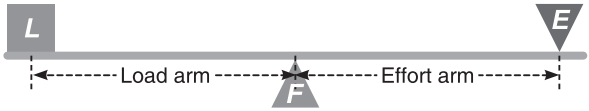
$\because$ Load × load arm = Effort × effort arm

$\therefore$ Load × 0.1 m = 50 N × 1 m

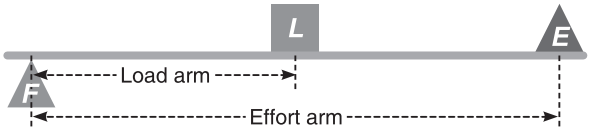
$\Rightarrow$ Load = $\frac{50 \text{ N} \times 1 \text{ m}}{0.1 \text{ m}}$ = 500 kg wt

K. 1. (a) **2.** (d) **3.** (b) **4.** (b) **5.** (c) **6.** (a) **7.** (d) **8.** (b)

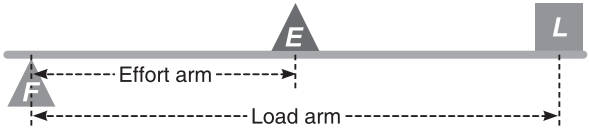
L. 1. First class lever



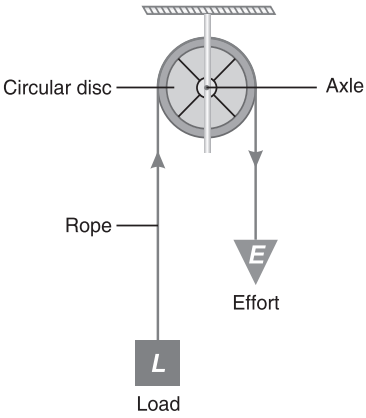
Second class lever



Third class lever



2.



3. In the given diagram, the direction of motion of load *L* and effort applied *E* are wrong.

The load *L* is moved in the upward direction and effort is applied in the downward direction.

CHAPTER 5. Light

Check Point 1

1. The sun and other stars are natural sources of light.

2. The speed of light in air is 300,000 km/s (or 3×10^8 m/s).

3. The moon is not a luminous object. It has no light of its own but shines by reflecting the sunlight falling on it.

Check Point 2

1. opaque **2.** transparent **3.** straight line **4.** direction

Check Point 3

1. A pinhole camera works on the principle of rectilinear propagation of light.

2. No lens is fitted in a pinhole camera.

3. The inside surface of the box of pinhole camera is blackened so as to absorb the light falling on the walls.

4. The image formed by a pinhole camera is real and inverted.

Check Point 4

1. shadow **2.** umbra **3.** Penumbra

Check Point 5

1. Solar **2.** Lunar eclipse **3.** solar **4.** lunar

TEST YOURSELF

A. 1. luminous object **2.** translucent **3.** light source **4.** increasing **5.** full **6.** moon, earth **7.** rectilinear propagation

B. 1. Nonluminous object **2.** Opaque object **3.** Umbra **4.** Beam of light (or light beam) **5.** Eclipse

C. 1. Light: Light is a form of energy which enables us to see the objects around us.

2. Rectilinear propagation of light: The property of light due to which it travels in a straight line through a medium is called rectilinear propagation of light.

3. Shadow: A shadow is the darkness (or a dark region) caused by an opaque object when it prevents light from falling on a surface.

4. Eclipse: The formation of the shadow of one heavenly body on another heavenly body is called an eclipse.

D. 1. Luminous objects are those which themselves emit light, e.g., the sun. On the other hand, **nonluminous objects** are those

which do not have light of their own and are visible only when light from a light source falls on them, e.g., book, stone, etc.

2.

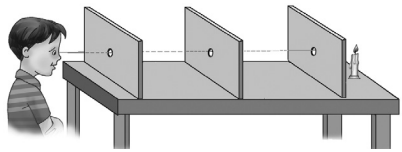
Lunar eclipse	Solar eclipse
1. In a lunar eclipse, the shadow of the earth falls on the moon and blocks its view.	1. In a solar eclipse, the shadow of the moon falls on the earth and it blocks the view of the sun.
2. Lunar eclipse takes place when the earth comes in between the sun and the moon.	2. Solar eclipse takes place when the moon comes in between the sun and the earth.
3. Lunar eclipse occurs on a full moon light only.	3. Solar eclipse occurs on a new moon day only.

3. **Umbra** is the inner part of the shadow which is completely dark and no light reaches this region.

Penumbra is that part of the shadow which is partially dark. Some light rays always reach the penumbra region.

E. 1. Transparent objects are those which allow light to pass through them. Air, glass, water, alcohol, etc., are examples of transparent objects.

2. To demonstrate rectilinear propagation of light, take three rectangular cards having fine holes in them at the same height. Arrange these cards, one after another, on a table so that the holes lie in a straight line. Place a burning candle on one side such that the candle flame lies in the line of holes. On viewing through the hole of last card on the other side, flame is clearly visible. If any one card is slightly displaced from its position, then the flame is not visible. It shows that light travels in a straight line.



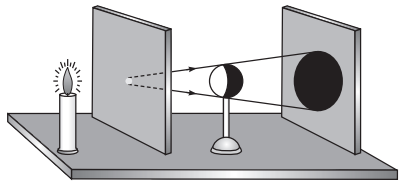
3. Formation of shadows, images and eclipses is based on the principle of rectilinear propagation of light. Shadows, images and eclipses are formed when light is blocked by an opaque object placed in the path of light beam.

4. Allow light from a point source (say a burning candle flame or a torch) to fall on a plane surface (say a wall) so that the surface is well-illuminated. Place an opaque object (say a teddy bear) in the path of light. A dark region on the plane surface is seen whose outline resembles that of the object. It shows the formation of shadow of the given opaque object on the surface.

5. Umbra is the inner part of the shadow which is completely dark and where no light reaches.

Penumbra is the outer region of the partial darkness surrounding the umbra, where some light is present.

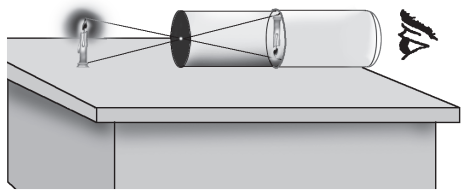
The diagram given alongside shows that when the light source is a point source, only umbra is formed on the screen.



6. Nature of the shadow formed depends on the (i) shape and size of the opaque object, (ii) nature of the source of light, and (iii) distance of the object from the light source as well as distance of the screen from the object.

7. When the moon comes in between the sun and the earth, solar eclipse occurs. Here, the moon behaves as an opaque object and the earth as a screen. When the earth comes in between the sun and the moon, lunar eclipse occurs. Here, the earth behaves as an opaque object and the moon as a screen.

8. A pinhole camera consists of a rectangular box with a film on one side and a single fine hole on the side opposite to the film. The film acts as a screen. The inside surface of the box is blackened so as to absorb the light falling on the walls.



The size of the image formed by a pinhole camera depends on the (i) distance of the screen from the pinhole, and (ii) distance of the object from the pinhole.

F. 1. False; The moon is a **nonluminous** body.
2. True
3. False; A shadow **does not show** colours of the object.
4. False; All the light falling on an opaque object **is not** absorbed. (or When light falls on an opaque object, a part of it is absorbed and the remaining part is scattered in all directions.)
5. True
6. True
7. False; Lunar eclipse occurs when the **earth** comes in between the **sun** and the moon.
8. False; **Penumbra** is that part of a shadow which is partially dark.

G. 1.–(e) **2.**–(c) **3.**–(a) **4.**–(b) **5.**–(d)

H. 1. The moon; It is a nonluminous object, all other objects are luminous objects.
2. Tree; It is an opaque object, all other objects are transparent.

3. Star; It is a luminous object, all other objects are nonluminous.

4. Glowworm; It shows bioluminescence, all other terms are the result of blocking of light by opaque objects.

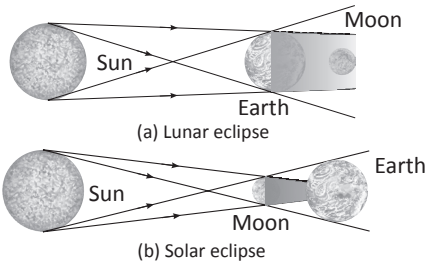
I. 1. Although the moon shines at night, it is a nonluminous body. In fact, the moon reflects the sunlight falling on it and appears shining.

2. Only opaque objects form shadow because they completely obstruct the path of light.

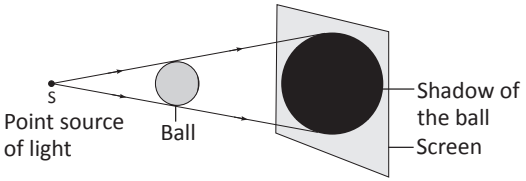
3. Birds flying high in the sky do not cast their shadows because the sun (that is the source of light) is having an extremely large size as compared to the size of flying birds.

J. 1. (b) **2.** (c) **3.** (a) **4.** (a) **5.** (b) **6.** (c) **7.** (c) **8.** (d)

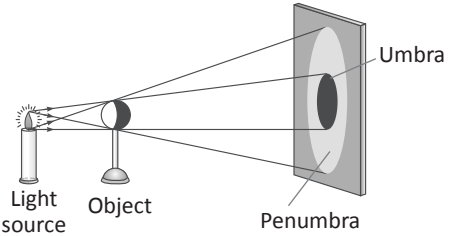
K. 1. (a)



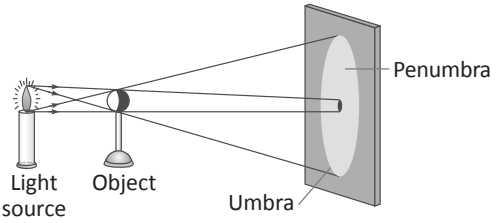
(b) Shadow of a ball formed by a point source of light.



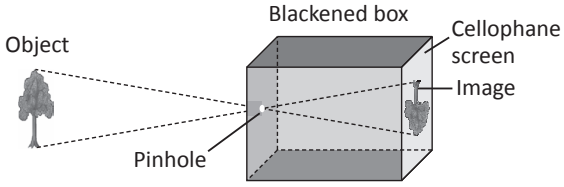
(c) Shadow formed by a light source smaller than the object.



(d) Shadow formed by a light source larger than the object.



(e) Image formation by a pinhole camera.



2. (a) Lunar eclipse is shown in the diagram.

(b) Lunar eclipse occurs when the shadow of the earth falls on the moon and blocks its view.

(c) Lunar eclipse is observed only on full moon night.

CHAPTER 6. Magnetism

Check Point 1

1. Magnetism is the property of attraction of magnetic substances by a magnet.

2. Magnetic substances are those substances which are attracted by a magnet. Iron, steel, nickel and cobalt are examples of magnetic substances.

3. Wood, plastic, paper, brass, etc., are nonmagnetic substances.

4. Artificial magnets are stronger than natural magnets.

5. Two important properties of a magnet are as follows:

(i) A magnet has two poles.

(ii) A freely suspended magnet always rests in north-south direction.

Check Point 2

1. (a) north; south (b) Magnetic field (c) North

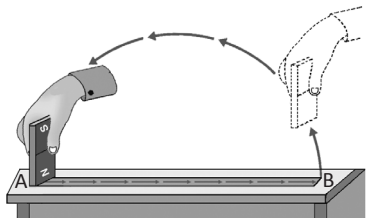
2. (a) No, two magnetic field lines do not intersect one another.

(b) The arrow marks on magnetic field lines give the direction of magnetic field.

Check Point 3

1. Steel is used to prepare permanent magnets.

2. A diagram for single touch method of magnetisation is given alongside.



3. A magnet made by using an electric current is called an electromagnet.

To prepare an electromagnet, a bar of soft iron is placed inside a coil of insulated copper wire. On passing current through the coil, the iron core becomes a magnet. On stopping current flow through the coil, it loses its magnetism.

Check Point 4

1. Electromagnets are used in electric bell, electric motor, electric dynamo, etc.

2. A magnetic compass consists of a small needle-shaped permanent magnet capable of rotation about its centre.

Magnetic compass is used by sailors and pilots to know the directions.

3. Two causes of demagnetisation of a magnet are given below:

(i) The magnet is dropped on the floor many times.

(ii) The magnet is heated to a high temperature.

4. Three precautions to be followed while handling magnets are as follows:

(i) The magnet should not be heated.

(ii) The magnet should not be hammered.

(iii) The magnet should not be repeatedly brought in contact with other magnets.

5. Magnetic keepers are used to prevent loss of magnetic power of a magnet when not in use.

TEST YOURSELF

A. 1. magnetic **2.** two **3.** repel, attract **4.** north-south **5.** magnetic keepers **6.** magnetisation

B. 1. Magnetic poles **2.** Magnetic substances **3.** Electromagnet **4.** Magnetic compass **5.** Magnetic field

C. 1. Magnet: A magnet is a substance which has the property of attracting iron and other magnetic substances.

2. Magnetic pole: Magnetic pole is a point near the edges of a magnet, where almost all the magnetic power of a magnet is concentrated. A magnet has two poles near its two edges.

3. Magnetic induction: The magnetism produced in a magnetic substance by bringing a magnet near it is known as magnetic induction.

4. Artificial magnet: Man-made magnet is known as an artificial magnet.

5. Magnetic field line: A magnetic field line is the path along

which the north pole of a small-sized magnetic compass needle moves. Magnetic field lines start from north pole of a magnet and end at its south pole. No two magnetic field lines can ever intersect each other at any point.

D. 1. Differences between permanent and temporary magnets

Permanent magnet	Temporary magnet
1. A permanent magnet does not lose its magnetisation easily.	1. A temporary magnet behaves as a magnet under certain conditions and loses its magnetisation when those conditions are not fulfilled.
2. Permanent magnets are prepared from steel and special alloys of iron.	2. Temporary magnets are prepared from soft iron.
3. A permanent magnet can be used to magnetise an iron piece.	3. A temporary magnet cannot be used to magnetise an iron piece.

2. Magnetic materials are those which are attracted by a magnet and which can be magnetised.
Nonmagnetic materials are not attracted by a magnet. They cannot be magnetised.

3. Natural magnets are the magnets occurring in nature. Their magnetic power is generally weak and they have no fixed geometrical shape.

Artificial magnets are man-made magnets. Their magnetic power is generally strong and can be controlled. They can be made in different shapes and sizes.

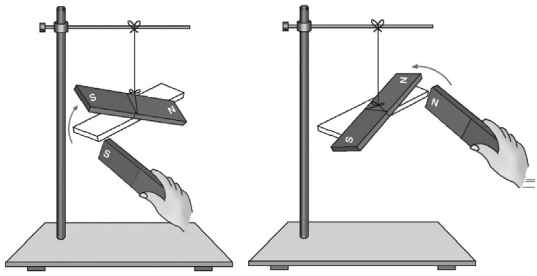
E. 1. Magnetism was accidentally discovered by a shepherd "Magnes", who found the nails in his shoes and iron tip of his stick stuck to a large block rock in Magnesia on which he was trying to climb. The rock was named 'magnetite' and attracting property of rock was called 'magnetism'.

2. Natural magnets are the magnets occurring in nature. Lodestone is an example of a natural magnet.

Artificial magnets are man-made magnets. A bar magnet is an example of artificial magnet.

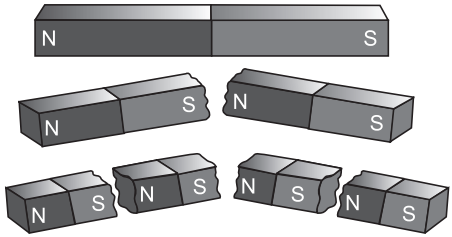
3. Suspend a bar magnet from a nonmagnetic stand and let it come to rest. Now, bring the south pole of another magnet near the south pole of the suspended magnet. We observe that south pole of suspended magnet moves away from the south pole of other

magnet. Same result is obtained when north pole of another magnet is brought near the north pole of suspended magnet. The activity clearly shows that like magnetic poles repel each other.



4. Suspend a bar magnet using a cotton thread from a nonmagnetic stand and let it come to rest. The magnet rests in north-south direction. Now, disturb the direction of the magnet and allow it to come to rest again. It again rests in north-south direction. This proves that a bar magnet exhibits directive property.

5. Take a bar magnet NS. Split up the magnet in two pieces. Each piece is found to behave as a complete magnet having north as well as south poles. If each piece is further divided into more pieces, then each subpiece is found to behave as a complete magnet. This shows that magnetic poles always occur in pairs.



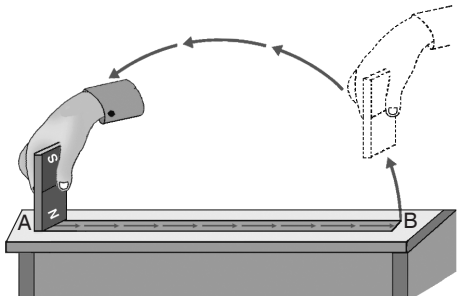
6. Three important properties of a magnet are as follows:

(i) A magnet attracts magnetic substances.

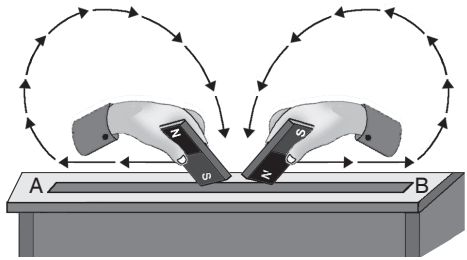
(ii) A freely suspended magnet rests in north-south direction only.

(iii) A magnet has two poles which can never be separated.

7. Place a thin iron strip AB near an edge of a table. Take a strong bar magnet NS and place the north pole N of the magnet at the end A of the strip. Rub and drag the magnet along the length of the iron strip up to end B. Lift the magnet and again put its N pole at A. Repeat the rubbing and dragging process about 50 times. The iron strip is magnetised. The end A of the strip behaves as north pole and end B as south pole.



8. Place a thin iron strip AB on a wooden table. Take two identical bar magnets. Place south pole of one magnet and north pole of another magnet at the mid-point of the iron strip. Rub and drag the two magnets against the strip taking one magnet to the end A and the other magnet to the end B as shown. Now, lift the bar magnets and again put them at the mid point of the strip. Repeat the dragging process about 50 times. The iron strip AB gets magnetised. The end A of the strip behaves as north pole and end B as south pole of the magnet.



9. The direction of the earth's magnetic field varies from place-to-place.

10. Two properties of magnetic field lines are as follows:

(i) No two magnetic field lines ever intersect one another at any point.

(ii) The arrow marks on magnetic field lines give the direction of a magnetic field.

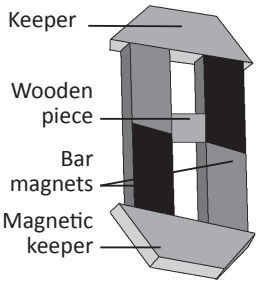
11. Important uses of magnets are given below:

(i) Magnets are used in drawers and refrigerator doors to ensure proper closing.

(ii) Magnets are used in speakers as well as in microphones.

(iii) Magnets are used to separate iron/steel from industrial waste.

12. When the bar magnets are not in use, they have a tendency to lose their magnetic power slowly. To prevent such loss of magnetic power, magnets should be stored properly by using magnetic keepers. Magnetic keepers are small pieces of iron. Bar magnets are placed in pairs separated from one another by a small wooden piece and their poles should be opposite to each other. Iron pieces of magnetic keepers are placed between opposite poles of pair of bar magnets as shown in the figure. As a result of this arrangement, the magnetic power of bar magnets remains intact.



F. 1. True

2. False; **Artificial** magnets are stronger than **natural** magnets.

3. False; Like magnetic poles **repel** each other but unlike magnetic poles **attract** each other.
4. True
5. False; The poles of a magnet have **almost whole magnetic power.**
6. True
7. True
8. False; Magnetic power of a magnet **is destroyed** on heating it.
9. False; Poles of a magnet can **never be separated.**
10. True

G. 1.–(b) **2.**–(c) **3.**–(a)

H. 1. Iron; Iron is a magnetic substance, all other given substances are nonmagnetic.

2. Copper; Copper is a nonmagnetic substance, all other substances given are magnetic substances.

3. Lodestone; Lodestone is a natural magnet, all other magnets mentioned here are man-made magnets.

I. 1. Magnetic poles are situated near the ends of a magnet and almost entire magnetic power of the magnet is concentrated at magnetic poles. Therefore, most of the iron fillings cling to the ends of the magnet.

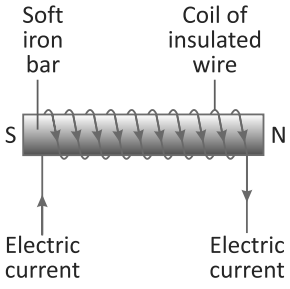
2. Magnetic poles always occur in pairs and they can never be separated. Therefore, we cannot have a magnet with one magnetic pole only.

3. Attraction is possible between a magnet and a magnetic substance. However, repulsion is possible only between two like poles of magnets. Therefore, repulsion is a sure test of magnetism.

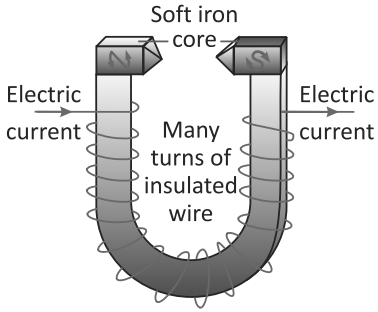
4. Electromagnets are called temporary magnets because they lose their magnetic power as soon as the electric current flowing through the coil is stopped.

J. 1. (b) **2.** (a) **3.** (b) **4.** (b) **5.** (d) **6.** (a) **7.** (d)

K. 1. The diagrams of electromagnets are given below:

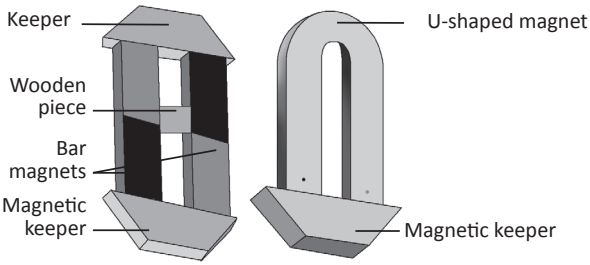


(a) A bar electromagnet



(b) A horseshoe electromagnet

2. Proper storing of magnets using magnetic keepers is shown below:



3. (a) Diagrams exhibit the attraction property between unlike magnetic poles and repulsion property between like magnetic poles.

(b) Second figure (repulsion) shows the sure test of a magnet.