CHAPTER 1. Measurement

Check Point 1

1. (a) 10000 (b) volume (c) measuring cylinder

2. (a) The SI unit of capacity is litre (L).

(b) When a solid is immersed into a liquid, the volume of the liquid displaced is equal to the volume of the immersed solid.

Check Point 2

1. volumes **2.** kilogram/(metre)^3 [kg/m^3 or kg m^{-3}]

3. mass; volume **4.** 1000

Check Point 3

1. (a) speed (b) m/s

2. A boy going to his school, a girl walking in a park and a child crawling on the floor are in motion.

3. (a) A running train (b) An aeroplane in flight

TEST YOURSELF

A. 1. area **2.** capacity **3.** litre **4.** 1000 **5.** different **6.** 1000 **7.** km/h

B. 1. Volume **2.** Measuring cylinder **3.** Density **4.** Speed

C. 1. The surface occupied by an object is called its area. The SI unit of area is square metre.

2. Two multiples of SI unit of area and their values in SI are as follows:

$$1 \text{ hectare} = 100 \text{ m} \times 100 \text{ m} = 10000 \text{ m}^2$$

$$1 \text{ sq km} = 1 \text{ km} \times 1 \text{ km}$$

$$= 1000 \text{ m} \times 1000 \text{ m} = 1000000 \text{ m}^2$$

3. The space occupied by a substance is called its volume. The SI unit of volume is cubic metre.

4. Two submultiples of SI unit of volume and their numerical values in SI unit are as follows:

$$1 \text{ cu cm} = 1 \text{ cm}^3$$

$$= 1 \text{ cm} \times 1 \text{ cm} \times 1 \text{ cm}$$

$$= \frac{1}{100} \text{ m} \times \frac{1}{100} \text{ m} \times \frac{1}{100} \text{ m}$$

$$= \frac{1}{1000000} \text{ m}^3$$

$$1 \text{ cu mm} = 1 \text{ mm}^3$$
$$= 1 \text{ mm} \times 1 \text{ mm} \times 1 \text{ mm}$$
$$= \frac{1}{1000} \text{ m} \times \frac{1}{1000} \text{ m} \times \frac{1}{1000} \text{ m}$$
$$= \frac{1}{1000000000} \text{ m}^3$$

5. The mass of an object contained per unit volume is called density. The SI unit of density is kg/m^3.

6. Take two identical beakers. Fill one beaker with liquid A (say water) and the other beaker with liquid B (say kerosene) such that both liquids are up to the same level in the beakers. Now, place one beaker on left pan and other beaker on right pan of a beam balance. The beam is not horizontal but tilted downward on the side of the beaker containing water. This observation clearly shows that equal volumes of different substances have different masses.

7. Take a small piece of the given irregular solid (say a stone piece) which is heavier than water and insoluble in it. Find its mass M using a beam balance.

Take a measuring cylinder and fill it about half with water. Note down the water level when steady. Let it be V_1. Now, gently immerse the given solid piece into water. The water level in the cylinder rises to V_2 now.

Then, volume of the solid, $V = V_2 - V_1$

$\therefore$ Density of the given solid, $D = \dfrac{\text{Mass, } M}{\text{Volume, } V}$

$$= \frac{M}{V_2 - V_1}$$

8. The distance covered by an object in unit time is called speed. The SI unit of speed is m/s.

D. 1. True

2. False; The SI unit of volume is **cubic metre.**

3. False; $V = \dfrac{4}{3}\pi r^3$

4. True

5. False; Density is the **ratio** of mass and volume.

6. True

7. True

8. True

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

F. 1. The density is equal to the ratio of mass and volume. The SI units of mass and volume are kg and m^3. That is why, the SI unit of density is kg/m^3.

2. The volume of a crystal of potash alum cannot be determined by immersing it into water because being soluble it will dissolve in water.

3. Since the car covers a greater distance in a given interval of time as compared to cycle, so, the speed of a car is more than the speed of a cyclist.

G. 1. The mass of an object contained per unit volume is called density.

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

2. The distance covered by an object in unit time is called speed.

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

H. 1. kg/m^3; It is the SI unit of density but others are units of speed.

2. Beam balance; It is used to measure the weight of an object but others are used to measure the volume of an object.

I. 1. Here, radius of circle = 7 cm

$$\text{Area of circle} = \pi r^2$$

$$= \frac{22}{7} \times 7 \times 7 = 154 \text{ cm}^2$$

2. Here, length = 180 m, breadth = 105 m

$$\text{Area of school playground} = l \times b$$

$$= 180 \text{ m} \times 105 \text{ m}$$

$$= 18900 \text{ m}^2$$

or $= 1.89$ hectares

($\because$ 1 hectare = 10,000 m^2)

3. $\because$ Diameter of coin = 4.2 cm

$\therefore$ $$\text{Radius } (r) = \frac{\text{Diamter}}{2}$$

$$= \frac{4.2}{2} = 2.1$$

$\therefore$ $$\text{Area of coin} = \pi r^2$$

$$= \frac{22}{7} \times 2.1 \times 2.1$$

$$= 22 \times 0.63 = 13.86 \text{ cm}^2$$

4. Here, length = 3 m, width = 2 m, height of water = 1.2 m

Volume of water in tank = $l \times b \times h$

$= 3 \text{ m} \times 2 \text{ m} \times 1.2 \text{ m}$

$= 7.2 \text{ m}^3$

or $= 7.2 \times 1000 \text{ L}$ $(\because 1 \text{ m}^3 = 1000 \text{ L})$

$= 7200 \text{ L}$

5. Volume of wooden log (in cylindrical form),

$$V = \pi r^2 h$$

$$= \frac{22}{7} \times \left(\frac{42}{100}\right)^2 \times 3.6$$

$$= \frac{22}{7} \times 0.42 \times 0.42 \times 3.6$$

$$= 22 \times 0.06 \times 0.42 \times 3.6$$

$$= 1.996 \text{ m}^3$$

6. (a) Volume of spherical ball $= \frac{4}{3}\pi r^3$

$$= \frac{4}{3} \times \frac{22}{7} \times 3.5 \times 3.5 \times 3.5$$

$$= 179.6 \text{ cm}^3$$

(b) Surface area of spherical ball

$$= 4\pi r^2$$

$$= 4 \times 3.14 \times 3.5 \times 3.5$$

$$= 154 \text{ cm}^2$$

7. Here, volume of stone piece = 88.3 mL – 56.5 mL

$= 31.8 \text{ mL}$

or $= 31.8 \text{ cm}^3$ $(\because 1 \text{ mL} = 1 \text{ cm}^3)$

8. Here, mass of the iron piece, $M = 624$ g and volume, $V = 80 \text{ cm}^3$

$\therefore$ Density of the iron piece, $D = \dfrac{\text{Mass, } M}{\text{Volume, } V}$

$$= \frac{624 \text{ g}}{80 \text{ cm}^3} = 7.8 \text{ g/cm}^3$$

9. Here, mass of the stone piece, $M = 225$ g and volume, $V = 75 \text{ cm}^3$

$\therefore$ Density of the stone piece, $D = \dfrac{\text{Mass, } M}{\text{Volume, } V}$

$$= \frac{225 \text{ g}}{75 \text{ cm}^3} = 3 \text{ g/cm}^3$$

10. Given that density of copper, $D = 8.9\ \text{g/cm}^3$

We know that density of $1\ \text{g/cm}^3 = 1000\ \text{kg/m}^3$

$\therefore$ Density of copper in kg/m^3 is given as:

$$D = 8.9 \times 1000 = 8900\ \text{kg/m}^3$$

11. Here, mass of the object, $M = 1.35$ kg and each side of cubical object, $a = 15$ cm $= 0.15$ m

$\therefore$ Volume of the object, $V = a^3$

$$= (0.15)^3\ \text{m}^3 = 0.003375\ \text{m}^3$$

$\therefore$ $$\text{Density, } D = \frac{\text{Mass, } M}{\text{Volume, } V}$$

$$= \frac{1.35\ \text{kg}}{0.003375\ \text{m}^3} = 400\ \text{kg/m}^3$$

12. Here, radius of the spherical object, $R = 3.0$ cm

and density, $D = 7\ \text{g/cm}^3$

$\therefore$ Volume of the spherical object, $V = \frac{4}{3}\pi R^3$

$$= \frac{4}{3} \times \frac{22}{7} \times (3.0)^3$$

$$= \frac{792}{7}\ \text{cm}^3$$

$\because$ $$\text{Density, } D = \frac{\text{Mass, } M}{\text{Volume, } V}$$

$\therefore$ Mass of the spherical object, $M = D \times V$

$$= 7 \times \frac{792}{7} = 792\ \text{g}$$

or $$= \frac{792\ \text{g}}{1000} \quad (\because 1\ \text{kg} = 1000\ \text{g})$$

$$= 0.792\ \text{kg}$$

13. Here, mass of the given wooden object, $M = 280$ kg

and density of the wood, $D = 800\ \text{kg/m}^3$

$\because$ $$\text{Density, } D = \frac{\text{Mass, } M}{\text{Volume, } V}$$

Hence, volume of the object, $V = \dfrac{\text{Mass, } M}{\text{Density, } D}$

$$= \frac{280\ \text{kg}}{800\ \text{kg/m}^3} = 0.35\ \text{m}^3$$

14. Here, $\text{density} = \dfrac{\text{Mass}}{\text{Volume}}$

$$910 = \frac{\text{Mass}}{75 \times 60 \times 30}$$

$\therefore$ $\text{Mass} = 910 \times 75 \times 60 \times 30$

$$= \frac{910 \times 75 \times 1800}{100 \times 100 \times 100}$$

$$= \frac{910 \times 75 \times 18}{10000}$$

$$= \frac{1350 \times 910}{10000} = 122.8 \text{ kg}$$

15. Here, volume of the empty density bottle, $V = 25 \text{ mL} = 25 \text{ cm}^3$; mass of the empty bottle, $M_1 = 22.6$ g and mass of the empty bottle when filled with liquid, $M_2 = 43.8$ g

$\therefore$ Mass of the liquid, $M = M_2 - M_1 = (43.8 - 22.6)$ g $= 21.2$ g

$\therefore$ Density of the liquid, $D = \dfrac{\text{Mass, } M}{\text{Volume, } V}$

$$= \frac{21.2 \text{ g}}{25 \text{ cm}^3} = 0.848 \text{ g/cm}^3$$

or $= 0.848$ g/mL $\quad (\because 1 \text{ cm}^3 = 1 \text{ mL})$

16. Here, mass of the given solid, $M = 84.2$ g; Initial volume of water in cylinder, $V_1 = 36$ mL and final volume of water and solid, $V_2 = 60$ mL

$\therefore$ Volume of the solid, $V = V_2 - V_1$

$= (60 - 36) \text{ mL} = 24 \text{ mL} = 24 \text{ cm}^3$

$\therefore$ Density of the solid, $D = \dfrac{\text{Mass, } M}{\text{Volume, } V}$

$$= \frac{84.2 \text{ g}}{24 \text{ cm}^3} = 3.51 \text{ g/cm}^3$$

17. Here, $\text{speed} = \dfrac{\text{Distance}}{\text{Time}}$

$$= \frac{24}{30} = 0.8 \text{ cm/s}$$

18. Here, $\text{speed} = \dfrac{\text{Distance}}{\text{Time}}$

$$= \frac{100}{12} = 8.33 \text{ m/s}$$

19. Here, speed of the car = 36 km/h

$$= 36 \times \frac{5}{18} = 10 \text{ m/s}$$

20. Here, $\text{time} = \frac{\text{Distance}}{\text{Speed}}$

$$= \frac{2.25 \times 1000}{4.5}$$

$$= 0.5 \times 1000$$

$$= \mathbf{500\ s\ (8\ min\ 20\ s)}$$

21. Here, distance = Speed × Time

$$= 4.2 \text{ km/h} \times \frac{40}{60} \text{ h}$$

$$= 4.2 \times 0.66 \text{ km}$$

$$= 2.8 \text{ km}$$

22. Here, $\text{speed} = \frac{\text{Distance}}{\text{Time}}$

$$= \frac{\text{Circumference of park}}{\text{Time}}$$

$$= \frac{2 \times \frac{22}{7} \times 70}{3 \times 60}$$

$$= 2.44 \text{ m/s}$$

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

CHAPTER 2. Motion

Check Point 1

1. An object is said to be in a state of motion if its position changes with time with respect to its surroundings.

2. Motion shown by a car moving on a hill road is a 'complex' (or multiple) motion.

3. In rotatory motion, an object moves about a fixed axis or a fixed point, without changing its position as a whole.

Motion of a merry-go-round and motion of a spinning *charkha* are examples of rotatory motion.

4. A combination of two or more types of motion shown by an object simultaneously is called a complex motion.

Example: The earth rotates about its own axis and simultaneously revolves around the sun. Thus, motion of the earth is a complex motion.

5. A periodic motion is that which repeats itself again and again after a fixed time interval. Motion of the hands of a clock is periodic motion.

Check Point 2

1. (a) uniform

(b) km/h

(c) scalar quantity; vector quantity

2. (a) Since the child covers equal distance per minute, so, his motion is uniform.

(b) The SI unit of weight is newton.

TEST YOURSELF

A. 1. relative **2.** circular **3.** rotatory motion **4.** oscillatory **5.** periodic **6.** nonuniform **7.** m/s **8.** Weight

B. 1. Periodic motion **2.** Oscillatory motion **3.** Uniform motion **4.** Uniform motion **5.** Gravity **6.** Speed

C. 1. Three different types of motion and their examples are as follows:

(i) **Translatory motion,** e.g., walking of a man in a park

(ii) **Rotatory motion,** e.g., motion of a spinning top or a wheel

(iii) **Oscillatory motion,** e.g., motion of the pendulum of a clock

2. Translatory motion is the motion in which an object moves on the whole from one place to another place such that each part of the object moves the same distance in a given time. The motion may be along a straight path or a curved path in translatory motion. Motion of a train from one station to another station, motion of an automobile from one place to another place are examples of translatory motion.

3. Oscillatory motion is a special type of periodic motion in which the object moves to and fro about its mean position. For example, the pendulum of a clock oscillates to and fro about its mean position and completes one oscillation in a definite time known as its time period. Thus, motion of an oscillating pendulum is periodic in nature. Similarly, motion of the needle of a sewing machine and motion of a child swing are also periodic.

4. Rotatory motion is the motion in which an object rotates about a fixed axis or a fixed point and as a whole the object does not change its position.

Motion of a spinning top, motion of a giant wheel as well as of a merry-go-round and rotation of the earth about its own axis are some examples of rotatory motion.

5. When an object simultaneously shows a combination of two or more types of motion, the object is said to have 'multiple motion'. For example, the wheels of a moving car show translatory motion as well as rotatory motion about their respective axes.

6. Motion of lungs while breathing, swinging of the arms of a person while walking and motion of a ball rolling over the ground are examples of repetitive motion which are nonperiodic.

7. The distance covered by a moving object in unit time is called its speed. The SI unit of speed is m/s.

8. The weight of an object is the force with which the earth attracts it. The weight of an object does not remain constant under all conditions. Its value varies from place-to-place.

Weight of an object is maximum on the earth's surface but it decreases as one goes to a height. On the earth's surface, it is maximum at the poles and minimum at the equator. If one goes inside the earth, then again weight of an object decreases.

D. 1. False; An object travelling along a curved path is said to have **curvilinear** motion.

2. False; A car moving around a circular park is said to be in **circular** motion.

3. True

4. True

5. True

6. False; Weight of an object is the **product of its mass and force of gravity.**

7. True

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

F. 1. Oscillatory motion

2. Vibratory motion

3. Rotatory and translatory motion (or complex motion/multiple motion)

4. Oscillatory motion

5. Rotatory motion

6. Rectilinear motion

7. Random motion

8. Random motion

G. 1. For an object at **rest,** its position does not change with time with respect to its surroundings. However, if position of an object continuously changes with time with respect to its surroundings then the object is in **motion.**

2. Motion of an object along a straight path is called **rectilinear motion.** On the other hand, motion of an object along a curved path is called **curvilinear motion.**

3. **Periodic motion** is that type of motion which repeats itself again and again after a fixed interval of time. On the other hand, a motion which does not repeat itself at regular intervals of time is known as **nonperiodic motion.**

4. A motion is said to be a **uniform motion** if the object covers equal distances in equal intervals of time along a given straight path. But, **nonuniform motion** means that the object covers unequal distances in equal intervals of time while moving along a straight path.

5. Differences between mass and weight are as follows:

Mass	Weight
1. The mass is the quantity of matter present in an object.	1. The weight is the force with which an object is attracted by the earth towards its centre.
2. It is a constant quantity and independent of change of place.	2. It varies from place-to-place.
3. The SI unit of mass is kilogram (kg).	3. The SI unit of weight is newton (N).
4. It is measured by a beam/physical balance.	4. It is measured by a spring balance.
5. Mass is a scalar quantity.	5. Weight is a vector quantity.
6. Mass of an object can never be zero.	6. Weight of an object may be zero in gravity-free space.

H. 1. (a) **Clock tower:** It is at rest but others are in motion.

(b) **A running train:** It is in translatory motion but others are in rotatory motion.

I. 1. When an object has no specific path and frequently changes its motion, the motion is called random motion, e.g., motion of a flying mosquito.

2. The actual length of a path covered by a moving object is called the distance covered by it.

3. The ratio of total distance covered and the total time taken for motion is called average speed.

$$\text{Average speed} = \frac{\text{Total distance covered}}{\text{Total time taken}}$$

4. The motion of a moving object is said to be uniform, if it covers equal distances in equal intervals of time along a given straight path.

J. 1. Here, total distance, s = 63 km and time, t = 1 h 45 min

$$\therefore \quad \text{Average speed, } v = \frac{\text{Total distance covered, } s}{\text{Total time, } t}$$

$$= \frac{63 \text{ km}}{1 \text{ h } 45 \text{ min}} = \frac{63 \text{ km}}{1\frac{45}{60} \text{ h}} = \frac{63 \text{ km}}{1\frac{3}{4} \text{ h}}$$

$$= \frac{63 \times 4}{7} \text{ km/h} = 36 \text{ km/h}$$

2. Here, $$\text{average speed} = \frac{\text{Total distance covered}}{\text{Total time taken}}$$

$$= \frac{800 \text{ m}}{2 \times 60 \text{ s}} = \frac{800}{120} \text{ m/s} = 6.67 \text{ m/s}$$

3. Uniform speed of the car = 90 km/h = $\frac{90 \times 1000 \text{ m}}{60 \times 60 \text{ s}}$ = 25 m/s

4. Here, $$\text{average speed} = \frac{\text{Total distance covered}}{\text{Total time taken}}$$

$$= \frac{1650}{22} = 75 \text{ km/h}$$

5. Here, $$\text{speed} = \frac{\text{Distance}}{\text{Time}}$$

$$= \frac{3.5 \times 10}{20} = 1.75 \text{ m/s}$$

6. Here, $$\text{distance} = \text{Velocity} \times \text{Time}$$

$$= 6 \times \frac{40}{60} = 4 \text{ km}$$

7. Here, $$\text{average speed} = \frac{\text{Total distance covered}}{\text{Total time taken}}$$

$$72 = \frac{507}{\text{Time}}$$

$$\therefore \quad \text{Time, } t = \frac{507}{72} = 7 \text{ h } 2.5 \text{ min}$$

8. Here, average speed = $\frac{\text{Total distance covered}}{\text{Total time taken}}$

$= \frac{24.5 + 24.5}{30 + 40} = \frac{49}{70} = 0.7$ km/min

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

THINK ZONE

- No, because distance covered is the actual path length which is different as the paths taken by them may be straight or curved.
- No, speed does not depend on the direction of motion of an object.

CHAPTER 3. Energy

Check Point 1

1. (a) joule (b) Kinetic (c) potential

2. (a) The capacity of doing work is called energy.

(b) 1 calorie = 4.186 joule (≈ 4.2 joule)

Check Point 2

1. (a) heaters (b) muscular energy (c) heat energy

2. The energy contained in the nucleus of an atom is called nuclear energy.

3. Electrical energy is the most commonly used energy in our daily life.

Check Point 3

1. (a) Energy (b) sound; electrical (c) photosynthesis

2. (a) CFLs and electric bulbs

(b) Energy can neither be created nor be destroyed but it can be transformed from one form into another form.

TEST YOURSELF

A. 1. joule **2.** Gravitational potential **3.** kinetic **4.** elastic potential **5.** chemical **6.** Electrical **7.** nuclear **8.** muscular **9.** electrical; heat **10.** chemical; electrical

B. 1. Kinetic energy **2.** Photosynthesis **3.** Sound energy **4.** Nuclear energy **5.** Chemical energy **6.** Electrical energy

C. 1. Energy of an object is said to be one joule if it has the capacity to do one joule of work.

2. The capacity of doing work is called energy.

3. The energy possessed by a magnet is called magnetic energy.

4. The energy possessed by muscles of human or animal's body is called muscular energy.

5. Whenever energy gets converted from one form into another form, the total energy remains unchanged. The energy lost in one form exactly reappears in the other form and total energy remains unchanged.

D. 1.

Light energy	Sound energy
Light is a form of energy which enables us to see the objects all around us.	Sound is a form of energy which causes the sensation of hearing.

2.

Kinetic energy	Potential energy
The energy possessed by an object in motion is called its kinetic energy.	The energy stored in an object when it is at rest is called its potential energy.

3.

Solar energy	Nuclear energy
The energy emitted by the sun in the form of light and thermal radiations is called solar energy.	The energy contained in the nucleus of an atom is called nuclear energy.

E. 1. Energy of an object is measured by its capacity to do work. It is measured in joule.

2. Light energy and heat energy are produced in a fire. These energies come from the chemical energy stored in wood, coal, petrol, etc.

3. The process of changing energy from one form to another form is called transformation of energy, e.g., a cell phone transforms electrical energy into sound and light energy, a microphone transforms sound energy into electrical energy.

4. The energy emitted by the sun in the form of light and thermal radiations is called solar energy. Solar energy is very important as plants trap it and synthesise food for all living things. Also, solar cookers used for cooking and solar heaters used for heating water use solar energy.

5. Light is a form of energy which enables us to see the objects clearly all around us. The sun, CFLs, LED lamps, etc., are the main sources of light. Green plants also use sunlight in preparing food through photosynthesis process. Incident rays of light in photographic film cause a chemical change due to which the image is recorded on the film.

6. Energy is the ability to do work. More the work to do, more energy is required. The energy stored in your body helps you to do work. A person gets tired on doing work. Work-energy relationship states that if an object does work, then its energy decreases. On the other hand, when the work is being done on an object, the energy of the object increases.

7. The two kinds of mechanical energy are kinetic energy and potential energy.

F. 1. True

2. True

3. True

4. True

5. False; When a matchstick is rubbed against a matchbox, heat and light are produced at the expense of **chemical** energy.

6. True

7. True

8. False; **Heat** energy is produced on burning a fuel.

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

H. 1. When water falls from a height, its potential energy is converted into kinetic energy due to which it can rotate the turbine in hydel power plant.

2. Since electrical energy is used to light bulbs, to run fans, washing machines, computers, TVs, coolers, fridges, etc., it is considered the most commonly used energy in our daily life. Also, electricity can be stored and transmitted from one place to another place and can be converted into heat, light and sound energy easily.

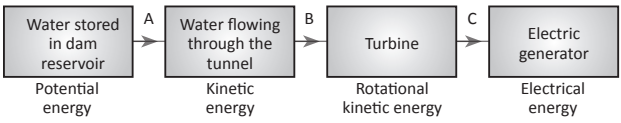
3. During interconversion of energy, energy disappeared in one form exactly reappears in the other form because as per law of conservation of energy, energy can neither be created nor be destroyed.

I. 1. Moon; The moon is a heavenly body while others are kinds of energy.

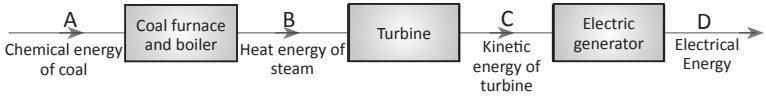
2. Microphone; Microphone transforms sound energy into electrical energy whereas electric bulb, tubelight, CFL lamp and LED bulb transform electrical energy into light energy.

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

K. 1.



2.



THINK ZONE

- Kinetic energy.
- Kinetic energy.
- First of all the chemical energy stored in waste is transformed into heat energy which is then transformed into electrical energy.

CHAPTER 4. Light Energy

Check Point 1

1. polishing **2.** same **3.** lateral inversion **4.** virtual

Check Point 2

1. (a) black (b) green; white (c) cyan

2. (a) Milk appears white because milk reflects all the light wavelengths and absorbs none.

(b) White colour

TEST YOURSELF

A. 1. diffused **2.** A virtual **3.** laterally **4.** plane **5.** 3×10^8

6. primary **7.** yellow **8.** reflected

B. 1. Reflection of light **2.** Incident ray **3.** Angle of reflection

4. Lateral inversion **5.** Secondary colours

C. 1. Reflection of light: The phenomenon of bouncing back of light from a surface is called reflection of light.

2. Lateral inversion: Interchange of left and right sides of an object in the image formed by a plane mirror is called lateral inversion.

3. Primary colours: The colours which cannot be formed by other colours are called primary colours, i.e., red, green, blue.

4. Colour subtraction: The phenomenon due to which an opaque object selectively reflects light of few colours out of white light and absorbs light of other colours is called the colour subtraction.

D. 1.

Regular reflection	Diffused reflection
Reflection of light taking place from a smooth and polished surface is known as regular reflection.	Reflection of light taking place from an opaque, rough and uneven surface is known as diffused reflection.

2.

Real image	Virtual image
1. Real image is formed when light rays from an object, after reflection, actually meet (intersect) at one point.	1. Virtual image is formed when light rays from an object, after reflection, appear to meet (intersect) at one point.
2. Real image can be obtained on a screen.	2. Virtual image cannot be obtained on a screen.
3. Real image is an inverted image.	3. Virtual image is an erect image.

3.

Incident ray	Reflected ray
Incident ray is a ray of light which strikes the reflecting surface of a mirror.	Reflected ray is the ray which bounces back after reflection from a mirror.

4.

Primary colours	Secondary colours
Colours which cannot be obtained by the combination of other colours but they can be mixed to form all other colours are called primary colours. These are red, blue and green.	Colours obtained by combination of any two primary colours are called secondary colours. These are cyan, magenta and yellow.

E. 1. Reflection of light is the phenomenon of bouncing back of light from a surface.

2. The laws of reflection of light are as follows:

(i) The angle of incidence is equal to the angle of reflection.

(ii) The incident ray, the normal and the reflected ray all lie in the same plane.

3. A mirror is a smooth polished surface which reflects light regularly. There are two types of mirrors, namely, plane mirror and curved mirror.

4. Set a plane mirror vertically upright on a table. Put some object (say, a toy) in front of it. Now, look into the mirror. A clear image of the object is seen in the mirror whose size is same as that of the object.

5. The characteristics of image formed by a plane mirror are as given below:

(a) The image is of same size as the object.

(b) The image is formed as far behind the mirror as the object is in front of it.

(c) The image is a virtual image.

(d) The image is an erect image.

(e) The image is laterally inverted.

6. Rules for drawing geometric image of an object placed in front of a concave mirror are as follows:

(a) A ray travelling parallel to the principal axis, after reflection, passes through its principal focus.

(b) A ray passing through principal focus gets reflected parallel to the principal axis.

(c) A ray passing through the centre of curvature gets reflected back along the same path.

7. The speed of light in air is 3×10^8 m/s. The speed of light does not vary with time or place but its value depends on the nature of the medium, e.g., the speed of light in water, glass, etc., is less than its value in air.

8. Colours which cannot be obtained by the combination of other colours but they can be mixed to form all other colours are called primary colour. Red, blue and green are primary colours.

9. Colours obtained by combination of any two primary colours are called secondary colours. Cyan, magenta and yellow are primary colours.

10. (a) The colour of an opaque object depends on the colour of light reflected by it.

(b) The colour of a transparent object depends on the colour of the light that passes through it.

11. The green leaves of marigold appear green when seen in white light because they reflect green light. Likewise, the colour of flowers appears yellow because they reflect yellow light.

12. Three uses of a plane mirror are given below:

(a) A plane mirror is used as a looking glass.

(b) It is used in showcases displaying fancy items.

(c) It is used in solar cookers to reflect the sunrays into the interior of the cookers.

13. (a) A glass plate appears green in green light because it allows light of green colour to pass through it.

(b) When a glass plate is seen in red light, it appears to be black because it absorbs the red light and does not allow any light to pass through it.

14. Angle of incidence is equal to angle of reflection.

F. 1. False; A plane mirror forms a **virtual** image of an object placed in front of it.

2. True
3. False; The angle of reflection is **equal to** angle of incidence.
4. True
5. False; Speed of light in glass is 2.0×10^8 m/s.
6. False; Speed of light is maximum in **air.**
7. True
8. True

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

H. 1. Green leaves; These are not related to reflection of light but others are related to it.

2. Real image; All the remaining three terms represent characteristics of image formed by a plane mirror but the term 'real image' is not related to a plane mirror.

3. Yellow; It is a secondary colour but others are primary colours.

4. White; It is basic component of colour while other three are secondary colours.

I. 1. The image formed by a plane mirror is a virtual image. Therefore, it cannot be obtained on a screen.

2. Plane mirrors form erect images having same size as the person using it. Moreover, the image is formed behind the mirror and can be seen by the person from any distance. Therefore, plane mirrors are used as dressing mirrors.

3. A white drawing sheet appears white when seen in white light because it reflects light of all the colours. But when it is seen in blue light, it reflects blue light and appears blue in colour.

4. School blackboard appears black because it absorbs light of all the colours and does not reflect light of any colour.

5. For regular reflection, all the reflected rays should travel parallel to each other. It is possible only if the reflecting surface is smooth and polished.

6. When the light reflected from the objects enters our eyes through the pupil, it forms images of objects on the retina of eye. This makes us to see the objects.

J. 1. Here, incidence angle, $\angle i = 45^\circ$

$\therefore$ Angle of reflection, $\angle r = \angle i = 45^\circ$

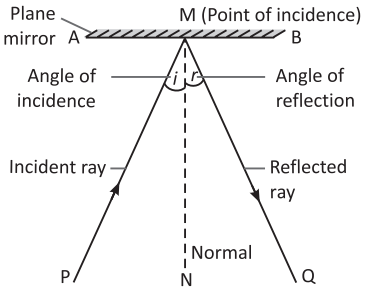
2. Here, angle subtended by incident ray from the mirror surface $= 25^\circ$

$\therefore$ Angle of incidence = Angle subtended by incident ray from the normal, i

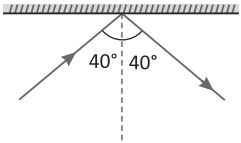
$= 90^\circ - 25^\circ = 65^\circ$

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

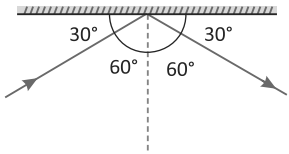
L. 1.



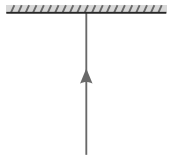
2.



Angle of reflection = 40°



Angle of reflection = 60°



Angle of reflection = 0°

THINK ZONE

- No; No
- Distance covered by him relative to his image = $d + d = 2d$

CHAPTER 5. Heat

Check Point 1

1. (a) cal (b) mercury (c) 32°F; 212°F

2. (a) The direction of flow of heat is from higher temperature to a lower temperature.

(b) Yes, heat energy can be transformed into other forms of energy.

Check Point 2

1. (a) rises (b) expand; contract (c) Heat

2. (a) The process of expansion of a substance on supplying heat energy to it is called thermal expansion.

(b) Yes, combustion is a chemical change because it releases a large amount of heat and light.

Check Point 3

1. Stainless steel is a good conductor of heat. Hence, the spoon easily draws heat from hot soup and becomes hot.

2. Copper and silver are conductors of heat.

Plastic and wood are insulators of heat.

3. Water is a poor conductor of heat.

Check Point 4

1. solids **2.** daytime **3.** land breeze **4.** upwards; downwards

Check Point 5

1. vacuum **2.** absorber **3.** heat radiation **4.** warmer **5.** black

TEST YOURSELF

A. 1. expand; contract **2.** Temperature; 32°F; 212°F **3.** Mercury
4. warmer; large air pockets **5.** convection **6.** bad (or poor)
7. vacuum **8.** good; poor **9.** Bad (or poor)

B. 1. Temperature **2.** Thermometer **3.** Celsius scale
4. Insulator or bad conductor of heat **5.** Conduction **6.** Radiation

C. 1. Heat: Heat is a form of energy which causes sensation of warmth or cold to an object. If an object gets heat energy, its temperature rises and it becomes warm.

2. Thermal expansion: Increase in size of a substance on heating is known as thermal expansion.

3. Conduction: Conduction is the process of heat transfer from hotter end to the colder end of a solid, without any visible movement of material particles of the solid substance.

4. Convection: Convection is the method of heat transfer in which medium particles actually move to the heat source, receive heat and move away from it.

D. 1. Heat is the form of energy which causes sensation of hotness to an object. Its SI unit is joule.

Temperature of an object is a measure of its degree of hotness or coldness. Its SI unit is kelvin.

2. Conductors are those materials which allow flow of heat through them easily. Metals and their alloys are good conductors of heat.

Insulators are those materials which do not allow flow of heat through them easily. Wood, glass, plastic, liquids and gases are insulators.

3.

Conduction	Convection
1. It is the process of heat transfer from hotter end to colder end of a substance without any actual visible movement of particles of the substance.	1. It is the process of heat transfer in which medium particles actually move to the heat source, receive heat and move away from it.
2. Conduction takes place in solids only.	2. Convection takes place in liquids and gases.

4.

Thermal absorber	Thermal reflector
The substance which absorbs the heat incident on it and does not reflect heat is called heat absorber.	The substance which reflects the heat incident on it is called heat reflector.

E. 1. Three main effects of heat are as follows:

(a) Temperature of a substance rises on receiving heat.

(b) A substance expands on heating.

(c) Heat may cause change in the state of a substance.

2. The common mercury thermometer consists of a fine glass capillary tube having a uniform fine bore. A thin glass bulb, filled with pure mercury, is provided at one end of the tube. The other end of the tube is sealed after removing air from it. The capillary tube is protected by a thick glass tube called stem. Markings called graduations or degrees are made on the stem to note the temperature.

3. For graduating a laboratory thermometer, we mark two fixed points. First, the bulb of the thermometer is immersed into ice. When mercury level in the thermometer becomes steady, we mark the point as 0°C. This is known as lower fixed point or ice point. Now, the bulb of the thermometer is kept in steam above boiling water taken in a flask. When mercury level becomes steady, we mark it as 100°C. This is known as upper fixed point or steam point. Finally, the space between two fixed points is divided into 100 equal parts and each part is called 1°C.

4. The process of expansion of a substance on supplying heat energy to it is called thermal expansion, e.g., telephone transmission cables sag between two poles during summer on account of thermal expansion.

5. Materials which allow the heat energy to pass easily through them are called good conductors of heat, e.g., all metals like copper, silver, etc.

6. The three applications of heat conductors are as follows:

(a) Cooking utensils are made up of conductors like copper and aluminium which easily transfer heat from heat source to the food being cooked.

(b) Conductors like copper are used to make cooling coils of air conditioners and refrigerators and tubing of automobile radiators.

(c) Conductors are used to make the base of electric irons, solar heating pipes and boilers used in power houses and factories.

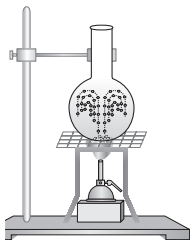
7. Drop an ice cube wrapped in a wire gauge in a test tube filled with water. Heat the mouth of the test tube over a burner. We find that water near the surface starts boiling but ice cube at the bottom of the test tube does not melt. It shows that there is no conduction of heat through water. In other words, water is a bad conductor of heat.

8. Three important applications of thermal insulators from daily life are as follows:

(a) Handles of cooking utensils are made up of insulating material like plastic or wood.

(b) We wear insulating woollen clothes during winter to protect ourselves from cold.

(c) Insulating hand gloves are used to take a hot dish out of an oven.



9. Take a round bottomed flask and fill it three-fourths with water. Drop few mustard seeds (or a crystal of potassium permanganate) into the flask. Heat the flask using a burner. Observe the pattern of movement of mustard seeds. The hotter seeds become lighter and rise up while colder ones move down to take their place. Thus, a circulatory movement is set up which creates continuous currents. This rise and fall of mustard seeds is the pattern of convection currents formed in liquids.

10. Two important applications of thermal convection are given below:

(a) In coastal areas, temperature remains moderate due to land breeze and sea breeze formed by convection currents.

(b) In factories, the smoke and hot gases, being lighter, rise up and escape out through chimneys.

11. Take identical cans. Paint one can black and the other white. Fill both the cans with boiling water. Take two thermometers and dip them in boiling water. Observe the readings of thermometers after few minutes. We find the thermometer reading in black can less than the thermometer in white can. This is because temperature of water in black can falls more quickly than in the white can as black can radiates more heat. This shows that a black surface is a better radiator of heat.

12. Heat transfer in a thermos flask is minimised by following methods:

(a) We use a double-walled glass container with vacuum

in between. The vacuum prevents heat transfer due to conduction and convection.

(b) The outer surface of the inner wall and inner surface of outer wall of the thermos flask are silvered so as to minimise heat transfer by radiation.

(c) Insulating padding between thermos flask and its container as well as insulating stopper also help in preventing heat transfer.

F. 1. True

2. False; The body temperature of a healthy person is 37°C.

3. True

4. False; Heat coming from the sun travels to us by **radiation.**

5. True

6. False; Metals are **good** conductors of heat.

7. False; The bottom parts of cooking utensils are **blackened.**

8. True

9. True

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

H. 1. Rubber: Rubber is a heat insulator while all others are conductors of heat.

2. Platinum: Platinum is a conductor of heat while all other substances are heat insulators.

3. Thermal expansion: All other terms denote change of physical state of a matter but thermal expansion has nothing to do with change of state.

I. 1. Mercury is used as a thermometric liquid due to the following reasons:

(a) It is a good conductor of heat.

(b) It is an opaque and shining liquid and can be easily seen.

(c) It does not stick to the glass capillary tube in thermometer.

(d) Its freezing point is –39°C and boiling point is 357°C. So, the range of a mercury thermometer is quite large.

2. Cooking utensils are made of metals so that they easily transfer heat from burner to food being cooked. But, handles of cooking utensils are invariably of an insulating material so that we can easily hold the utensils with our hands.

3. We wear woollen clothes in winter because woollen yarn has trapped air pockets. As air is a bad conductor of heat, it does not allow body heat to flow outwards. Hence, we feel warm.

4. Two thin blankets taken together are warmer than a single

thick blanket because the air gets trapped between two thin blankets.

5. The climate remains moderate in coastal areas due to land breeze and sea breeze formed by convection currents.

6. In offices, air conditioners are generally fitted at higher positions on walls so that the cold air generated by them moves downwards and the entire room is cooled quickly.

7. Black bodies are good radiators of heat. Therefore, the radiators of automobiles are painted black so that they radiate away heat easily and automobile engine is not excessively heated.

8. Ice slabs are covered with gunny bags because a gunny bag is a thermal insulator. As a result, the ice does not melt easily.

J. 1. It is given that temperature of an object on Celsius scale C = 60°C. Let the temperature on Fahrenheit scale be F, then as per relation, $\frac{C}{5} = \frac{F-32}{9}$, we have $\frac{60}{5} = \frac{F-32}{9}$

$\Rightarrow \quad F-32 = \frac{60}{5} \times 9 = 108$

$\Rightarrow \quad F = 32 + 108 = \mathbf{140°F}$

2. Given that boiling point of alcohol = 78°C

$\therefore$ Boiling point of alcohol on Kelvin scale = (78 + 273) K

$= \mathbf{351\ K}$

3. Let common temperature on Celsius and Fahrenheit scales be $x°$. Then, from the relation, $\frac{C}{5} = \frac{F-32}{9}$, we have

$\frac{x}{5} = \frac{x-32}{9}$ or $9x = 5(x-32)$

$\Rightarrow \quad 9x = 5x - 160 \quad \Rightarrow \quad 9x - 5x = -160$

$\Rightarrow \quad 4x = -160 \quad \text{or} \quad x = \frac{-160}{4} = \mathbf{-40°}$

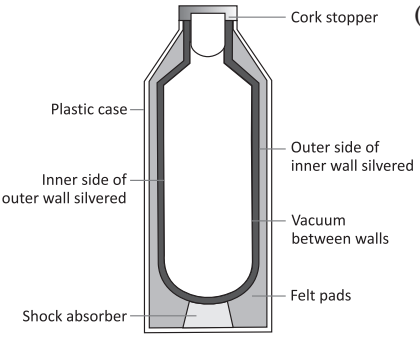
4. Temperature of a patient on Fahrenheit scale F = 100.4°F. If his temperature on Celsius scale be C°, then

$\frac{C}{5} = \frac{100.4-32}{9} = \frac{68.4}{9}$

$\Rightarrow \quad C = \frac{68.4 \times 5}{9} = \mathbf{38°C}$

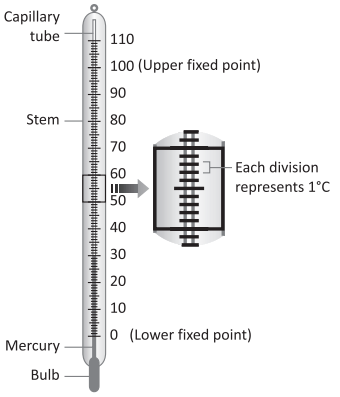
K. 1. (c) **2.** (b) **3.** (c) **4.** (b) **5.** (c) **6.** (a) **7.** (d) **8.** (c)

L. (a)



A thermos flask

(b)



A mercury thermometer

THINK ZONE

- The greenhouse effect is caused by greenhouse gases present in earth's atmosphere. These gases trap heat and reradiate it back to the earth surface. As a result, the temperature of the earth is increased and it causes global warming.
- The smoke and hot gases, being lighter, rise up and escape out through chimney. So, a taller chimney is preferred for a brick kiln.

CHAPTER 6. Sound

Check Point 1

1. vibrating **2.** stretched membrane **3.** medium
4. solids, liquids; gases

Check Point 2

1. (a) longitudinal (b) rarefactions (c) hertz
2. (a) No (b) Same direction of propagation of wave (c) Loudness

Check Point 3

1. solids **2.** increases **3.** reflection **4.** soundproof

TEST YOURSELF

A. 1. sound **2.** energy; longitudinal **3.** vacuum **4.** much less
5. frequency **6.** gases **7.** loudness **8.** reflection

B. 1. Sound **2.** Wave motion **3.** Longitudinal wave
4. Sound absorption **5.** Loudness

C. 1. Vibration: A vibration is one to and fro motion of a medium particle about its mean position.

2. Longitudinal wave: A wave in which medium particles vibrate in same line as the direction of wave propagation is called longitudinal wave.

3. Amplitude: The maximum displacement of a vibrating or an oscillating particle from its mean position on either side is called amplitude.

4. Larynx: Larynx is the sound-producing organ or voice box situated in the throat of human beings.

5. Sound box: A sound box is a structure which neither allows inner sound to go out nor allows any external sound to enter the enclosure.

6. Reverberation: The persistence of sound for some time due to repeated reflections from the walls, ceilings and floor of a hall is called reverberation.

D. 1.

Wind-type musical instrument	String-type musical instrument
In a wind instrument, sound is produced due to vibration in air column present in the instrument when we blow air into them from our mouth.	In a string instrument, sound is produced due to vibration of the string.

2.

Loudness	Pitch
1. Loudness of a sound is the degree of sensation produced by it in the ear.	1. Pitch of a sound determines its shrillness.
2. Loudness of a sound mainly depends on its amplitude. A sound of small amplitude is the soft sound but a sound of large amplitude is the loud sound.	2. Pitch of a sound depends on its frequency. As the frequency of vibration increases, the pitch (i.e., shrillness) of sound goes on increasing.

3.

Reflection of sound	Absorption of sound
The process of bouncing back of sound on striking a surface is called reflection of sound.	When sound strikes a surface with loose, rough and fluffy texture, almost whole sound is absorbed by the surface and there is no reflection of sound. This phenomenon is called absorption of sound.

E. 1. Take a drum and beat it with a soft wooden hammer. The membrane of the drum starts vibrating and sound is produced. This shows that vibrations produce sound.

2. The main types of musical instruments are as follows:

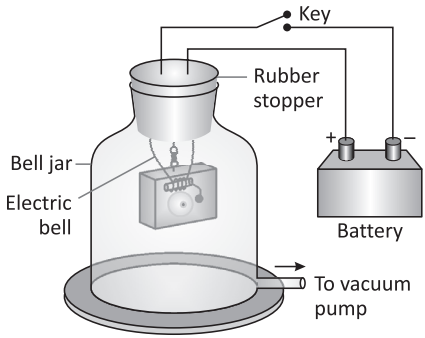
(i) String instrument (ii) Wind instrument

(iii) Percussion instrument (iv) Reed instrument

3. A bass drum, a tabla and a bongo are examples of percussion instruments.

4. The frequency of sound produced by a string instrument depends upon the length, material, thickness and tightness of the string used.

5. Take a jar and suspend an electric bell which is connected to a battery and a key arrangement. The bell jar is airtight.



If we switch 'on' the key, the bell starts ringing and sound is heard. Now, pump out the air from the bell jar using a vacuum pump. Again, switch 'on' the key. The bell is seen ringing but no sound is heard now. This shows that sound cannot travel through vacuum.

6. Speed of sound is maximum in hydrogen gas having a value of 1284 m/s.

7. The motion of energy through a medium because of to and fro vibrations of medium particles about their respective mean positions is called wave motion. There is no permanent motion of medium particles in a wave motion.

8. The time taken by a vibrating particle to complete one vibration to and fro about its mean position is called time period. On the other hand, the number of vibrations completed by a vibrating particle in unit time is called its frequency. The frequency of vibrations is reciprocal of its time period, i.e.,

$$T = \frac{1}{\nu}$$

9. Loudness of sound depends on the following factors: (a) The amplitude of vibrations, (b) The surface area of vibrating body, (c) The distance between source of sound and the listener.

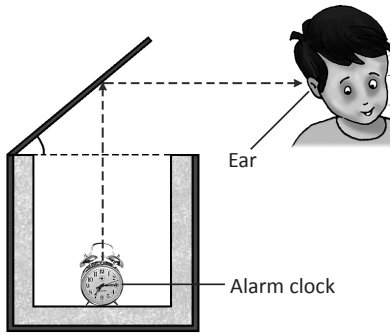
10. Yes, sound can travel both through solids and liquids. Sound travels faster in solids.

11. The process of bouncing back of sound on striking a surface is called reflection of sound. Stethoscope used by the doctors to hear heartbeat works on the principle of reflection of sound.

12. Substances like cardboard sheets, curtains, carpets, foams, thermocol, coir matting, gunny bags, etc., are good absorbers of sound.

13. The audible range of frequency is from 20 Hz to 20,000 Hz.

14. In an arrangement as shown alongside, if the lid of the container is closed, we are unable to hear the ticking sound of alarm clock. Now, slowly, we lift the lid and adjust its position till we are able to hear the ticking sound of the clock. The sound reaches to our ear due to reflection of sound by lid in this position.



15. Following three measures should be taken while designing a soundproof hall:

(a) Thick carpets are put on the floor as well as steps of staircase.

(b) Heavy curtains are put on doors and windows of the ball.

(c) The seats arranged in the hall should be cushioned sheets.

16. The speed of sound is maximum in solids.

17. Cardboard sheets and foam sheets are two sound absorptive materials.

F. 1. True

2. False; Sound **cannot** travel through vacuum. (or Sound can easily travel through **material medium**).

3. True

4. True

5. False; The distance between two consecutive compressions or two consecutive rarefactions is called wavelength.

6. False; If time period of a wave is 0.01 s, then its frequency is **100 Hz.**

7. True

8. False; Sound travels the fastest in **solids** and the slowest in **gases.**

9. True

10. False; Heavy curtains and carpets are **bad** reflectors of sound.

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

H. 1. Guitar; A guitar is a string instrument, all others are wind instruments.

2. **Harmonium;** A harmonium is a reed instrument, all others are string instruments.

3. **Sound box;** It is an open chamber in the body of a musical instrument, others are natural phenomena related to sound.

4. **Amplifiers;** Amplifiers enhance the loudness of sound, all others reduce the loudness of sound.

I. **1.** Speed of sound is less as compared to the speed of light. As a result, we can see the lightning much before we hear the thunder.

2. Sound from the space cannot reach us because sound requires a material medium for its propagation and cannot travel through vacuum of space.

3. A large drum produces a louder sound than a small drum because its surface area of vibration is more than that of small drum.

4. We cannot talk with our friends on the moon's surface because sound needs a material medium to propagate and there is no material medium, i.e., air on the moon's surface.

5. The woman has high pitch as compared to the man. Higher the pitch, shriller the sound. So, the woman's voice is shriller than that of a man.

6. When we blow air into a bugle from our mouth, the air column inside vibrates and sound is produced. Loudness of sound of a bugle can be increased by blowing air strongly into it.

7. Cushioned seats are used in auditoriums and cinema halls because they have better sound-absorbing capacity. They absorb striking sounds and prevent reflection of sound.

J. **1.** Time period of vibration, $T = \frac{1}{\nu}$

$= \frac{1}{200}$

$= 0.005$ s

2. Here, time period, $T = 0.01$ s

$\therefore$ Frequency of a wave, $\nu = \frac{1}{T} = \frac{1}{0.01 \text{ s}} = 100$ Hz

3. Here, speed of sound $= \frac{2.4 \times 1000}{7}$

$= \frac{2400}{7}$

$= 343$ m/s

4. Here, $s = vt$

$= 340 \times 5$

$= 1700 \text{ m} = \frac{1700}{1000} \text{ km} = 1.7 \text{ km}$

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

L. 1. Longitudinal wave

2. (a) 0.1 m (b) 5 ms

THINK ZONE

- Sound needs material medium to propagate. It cannot travel in the vacuum of space. So we are unable to listen the loud sounds from space.
- Strings on a sitar of different materials/thickness are made to vibrate in it so as to produce different sounds because frequency of sound produced by a string instrument depends upon the material, thickness, etc. of the string.
- As we know, a flute is in the form of pipe. When we blow air along its length from our mouth, air columns (air holes) vibrate and a musical sound is produced. So, in order to produce vibrations in a flute, holes are necessary to be made in a flute.

CHAPTER 7. Electricity and Magnetism

Check Point 1

1. (a) repel; attract (b) Repulsion (c) temporary (d) electromagnet

2. (a) A magnet aligns itself in north-south direction. The end of the bar magnet pointing towards north is north pole and the one which is pointing towards south is south pole.

(b) Two poles of a magnet cannot be separated by any means, i.e., magnetic poles exist in pairs only.

(c) Soft iron is used as the core in an electromagnet.

Check Point 2

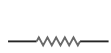
1. (a) ampere (b) negative; positive (c) conductor; insulator

2. Leather, air and kerosene are insulators.

Check Point 3

1. (a) closed (b) Copper or aluminium (c) resistance

2. (a)


Fixed resistor


Variable resistor

(b) Current cannot flow through an open circuit.

TEST YOURSELF

A. 1. north-south **2.** electromagnet **3.** number of turns; current **4.** chemical energy **5.** battery **6.** parallel **7.** ON **8.** insulator

B. 1. Magnetism **2.** Electromagnet **3.** Electric cell **4.** Button cell **5.**Resistor **6.** Electric current **7.** Switch **8.** Parallel circuit

C. 1. Magnetic pole: The two ends of a magnet, where the attractive property of the magnet is maximum are called its magnetic poles.

2. Electromagnet: A coil with a soft iron core which behaves as a magnet on passing electric current through it is called an electromagnet.

3. Law of magnetism: The law of magnetism states that like magnetic poles repel each other and unlike magnetic poles attract each other.

4. A battery: A combination of two or more electric cells is called a battery.

5. Electric insulator: An electric insulator is a material which does not allow the flow of electric current through it.

6. Electric circuit: A closed path along which an electric current flows is called an electric circuit.

D. 1.

Permanent magnet	Electromagnet
1. Magnetic property of permanent magnet is permanent.	1. Magnetic property of electromagnet is temporary. It exhibits magnetic property as long as the current flows through its coil.
2. It has fixed north and south poles and direction of magnetic field is fixed.	2. Position of magnetic poles and direction of magnetic field can be easily reversed by changing the direction of flow of current.
3. Its strength is fixed and cannot be changed.	3. Its strength can be changed by changing the strength of current and by increasing the number of turns in the coil.
4. Generally, its magnetic strength is less.	4. It can be made as much strong as desired.

2.

Electric conductors	Electric insulators
1. These are the materials which easily allow the flow of electric current through them.	1. These are the materials which do not allow the flow of electric current through them.
2. Metals and their alloys are good conductors of electricity.	2. Nonmetals, liquids and gases are insulators (bad conductors) of electricity.

3.

Series circuit	Parallel circuit
1. All appliances are connected in series to the battery/mains supply.	1. All appliances are connected in parallel among themselves as well as parallel to the battery or mains supply.
2. All the electrical appliances work simultaneously.	2. All the electrical appliances work independently.
3. If one appliance goes out of order, other appliances too stop working.	3. If one appliance goes out of order, other appliances continue working.
4. Different appliances share the applied voltage.	4. Same voltage is available to each appliance.

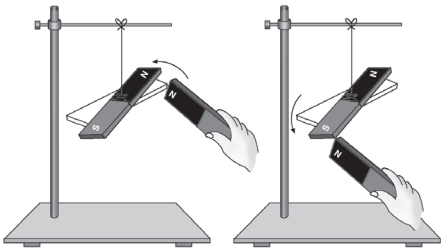
E. 1. The three important properties of a magnet are as follows:

(a) The magnetic force of a magnet is maximum at poles.

(b) Magnetic poles of a magnet exist in pairs only.

(c) A freely suspended bar magnet always aligns itself in north-south direction.

2. Take two bar magnets and mark their north and south poles. Suspend one magnet with a piece of thread from a wooden stand or a rigid support. Let the suspended magnet come to rest.



(a) Hold the second magnet in your hand and bring its north pole (N) near the north pole (N) of the suspended magnet as shown in the figure.

Observation: The north pole of the suspended magnet moves away from the north pole of the magnet in your hand, i.e., it is repelled.

(b) Remove the magnet from your hand. Allow the suspended magnet to come to rest. Then, bring the north pole (N) of second magnet near the south pole (S) of the suspended magnet.

Observation: The south pole of the suspended magnet moves towards the north pole of the magnet in hand, i.e., the two poles are attracting each other.

It shows that like magnetic poles repel but unlike magnetic poles attract each other.

3. The strength of the magnetic field due to a current-carrying coil depends on factors as explained below:

(a) **Current passing through the conductor:** The strength of the magnetic field (B) is directly proportional to the current (I) passing through the conductor, i.e.,

$$B \propto I$$

(b) **Distance from the conductor:** The strength of the magnetic field (B) is inversely proportional to the distance (r) from the conductor, i.e.,

$$B \propto \frac{1}{r}$$

4. The three important applications of electromagnets are as follows:

(a) Strong electromagnets are applied to separate iron articles from household waste collected by municipal corporations.

(b) Electromagnets are applied by doctors in hospitals to remove bits of iron embedded in sensitive organs like the eye.

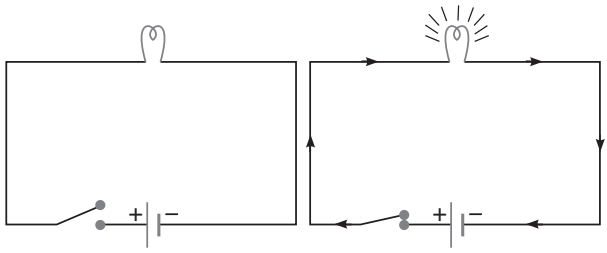
(c) Strong electromagnets are used in cranes to lift and transfer iron and steel articles from one place to another.

5. The flow of electric charge per unit time is called electric current. The SI unit of electric current is ampere.

6. Two important sources of electricity are as follows:

(a) Cell and battery (b) Mains supply

7. Prepare a circuit by connecting a bulb to a cell (or a battery) through a switch arrangement. When the switch is closed, current flows and the bulb glows. However, as soon as the switch is opened, the bulb stops glowing. It shows that complete circuit is compulsory for a bulb to glow.



(a) Open circuit (b) Closed circuit

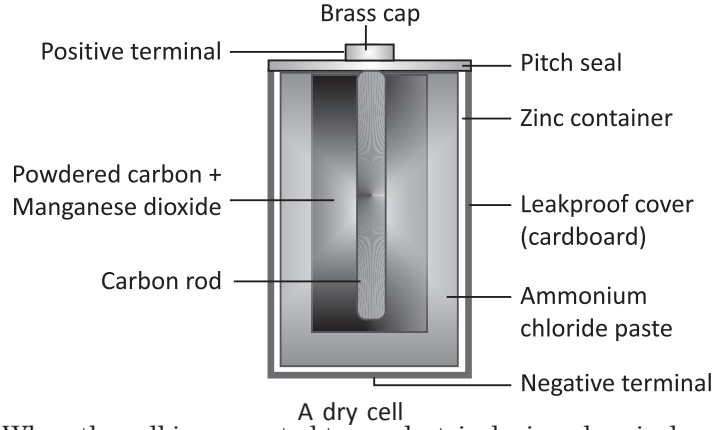
8. Following conditions should be fulfilled for flow of electric current in a circuit:

(a) The electric circuit should be complete.

(b) The switch (or key) should be in 'ON' mode so that circuit is closed.

(c) Each part of a circuit should be a conductor.

9. A dry cell consists of a carbon rod with a brass cap inserted into a mixture of manganese dioxide and carbon powder taken in a small muslin bag. The muslin bag is placed inside a zinc container and the intervening gap is filled with moist paste of ammonium chloride and gelatin. The zinc container is placed in a leakproof cardboard cover and the top is sealed with pitch.

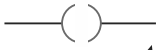


A dry cell

When the cell is connected to an electric device, chemical reactions take place in the cell and an electric current is produced. The carbon rod behaves as positive terminal and zinc vessel as the negative terminal. A dry cell gives a voltage of 1.5 V.

10. A special type of the cell which directly converts the light and heat energy received from the sun into electricity is called the solar cell.

11. (a) 

(b) 

(c) 
Fixed resistor


Variable resistor

12. The simple electric circuit in series shows following features:

(a) All the electrical appliances work simultaneously.

(b) If one of the appliances goes out of order, the other appliances too stop working.

(c) Different appliances share the applied voltage and hence, none of the appliances work to its proper capacity.

F. 1. True

2. True

3. True

4. True

5. False; An electromagnet is based on **magnetic** effect of electric current.

6. False; The electrolyte used in a dry cell is **moist paste of ammonium chloride.**

7. False; All **gases** behave as electrical insulators.

8. True

9. True

10. False; In parallel circuit, if one device is faulty, then all other devices **continue working.** (or In **series** circuit, if one device is faulty, then all other devices also stop working).

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

H. 1. Electric cell; It is a source of electricity, all others work by consuming electricity.

2. Plant cell; It is a unit of a plant body, all others are sources of electricity.

3. Silver; It is a conductor of electricity, all others are insulators of electricity.

4. Glass; It is an insulator, all others are conductors of electricity.

I. 1. Magnetic attraction is possible between a magnet and a magnetic substance even if it is not a magnet. However, magnetic repulsion is possible only between the like poles of two magnets. Hence, magnetic repulsion is a sure test of magnetism.

2. An electromagnet is a coil with a soft iron core. It behaves as a magnet when electric current is passed through the coil. But, when electric current flowing through its coil is stopped, the electromagnet loses its magnetism.

3. When the switch is in 'OFF' mode, the electric circuit breaks and the flow of electric current stops in the circuit.

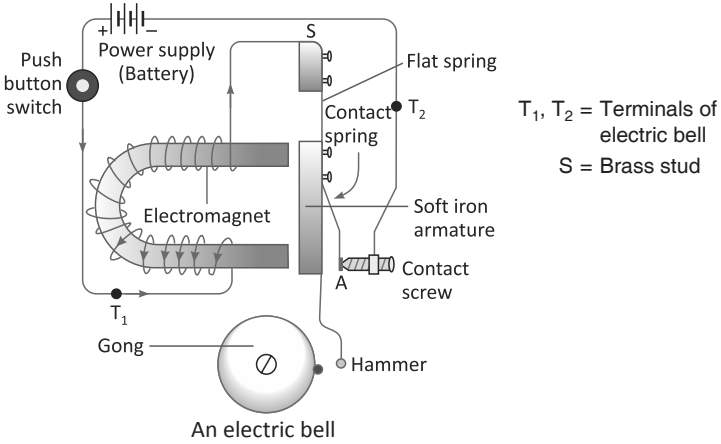
4. The current going through series circuits is smaller because two bulbs in series have a higher resistance than a single bulb.

As we know, higher the resistance, lower is the current. So, due to high resistance in series, the current will be low and the bulbs will not glow brightly.

5. In parallel circuit, each electrical appliance works independently. If one of the appliances goes out of order, others continue working and same voltage is available to all electrical appliances. Therefore, only parallel circuits are employed in our houses.

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

K. 1.



An electric bell

2. (a) The diagram shows a closed circuit.

(b) Part A is a bulb, part B is a cell and part C is a switch.

(c) If switch C is kept open, no current will flow in the circuit and the bulb will not glow.

3. (a) Series (b) parallel (c) B_1 and B_2 are in series; B_3 and B_4 are also in series; B_1, B_2 are in parallel with B_3, B_4.

THINK ZONE

- The north and south poles of a bar magnet cannot be separated because poles of a magnet always exist in pair. If a bar magnet is broken in the middle, its two pieces will behave as two magnets with independent north and south poles.
- Since dry cell is a primary cell, it cannot be recharged again once used.