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NOTE FROM PUBLISHER

It gives me great pride and pleasure in bringing to you **Sura's Science Guide** for **9th Standard**. It is prepared as per the Latest New Textbook.

This guide encompasses all the requirements of the students to comprehend the text and the evaluation of the textbook.

- Additional questions have been provided exhaustively for clear understanding of the units under study.

In order to learn effectively, I advise students to learn the subject section-wise and practice the exercises given. It will be a teaching companion to teachers and a learning companion to students.

Though these salient features are available in this Guide, I cannot negate the indispensable role of the teachers in assisting the student to understand the subject thoroughly.

I sincerely believe this guide satisfies the needs of the students and bolsters the teaching methodologies of the teachers.

I pray the almighty to bless the students for consummate success in their examinations.

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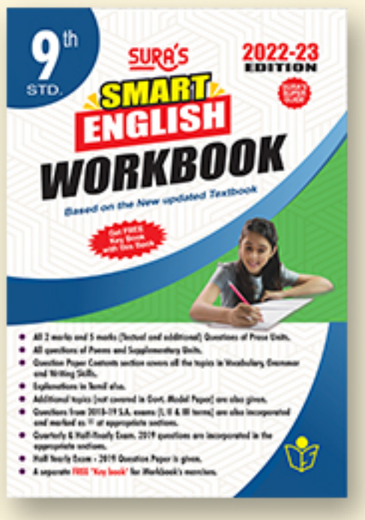

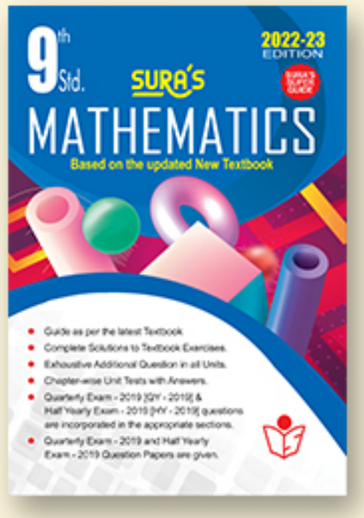

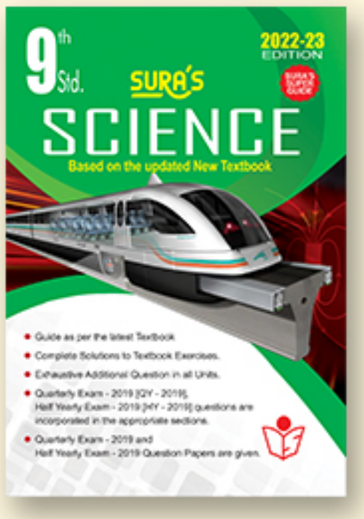

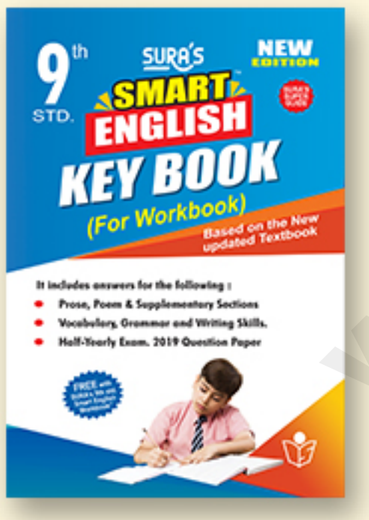

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UNIT
01

PHYSICS

MEASUREMENT

LEARNING OBJECTIVES

At the end of this lesson, students will be able to

- Understand the fundamental and derived quantities and their units.
- Know the rules to be followed while expressing physical quantities in SI units.
- Get familiar with the usage of scientific notations.
- Know the characteristics of measuring instruments.
- Use vernier caliper and screw gauge for small measurements.
- Find the weight of an object using a spring balance.
- Know the importance of accurate measurements.

TEXT BOOK EXERCISES

I. Choose the correct answer :

1. Choose the correct one. *[QY - 2019]*

(a) mm < cm < m < km (b) mm > cm > m > km

(c) km < m < cm < mm (d) mm > m > cm > km

[Ans : (a) mm < cm < m < km]

2. Rulers, measuring tapes and metre scales are used to measure

(a) mass (b) weight (c) time (d) length

[Ans : (d) length]

3. 1 metric ton is equal to

(a) 100 quintals (b) 10 quintals

(c) 1/10 quintals (d) 1/100 quintals **[Ans : (b) 10 quintals]**

4. Which among the following is not a device to measure mass?

(a) Spring balance (b) Beam balance

(c) Physical balance (d) Digital balance

[Ans : (a) Spring balance]

II. Fill in the blanks :

1. Metre is the unit of _____. **[Ans : length]**
2. 1 kg of rice is weighed by _____. **[Ans : beam balance]**
3. Thickness of a cricket ball is measured by _____. **[Ans : vernier caliper]**
4. Radius of a thin wire is measured by _____. **[Ans : screw gauge]**
5. A physical balance measures small differences in mass up to _____. **[Ans : 1mg or less]**

III. State whether true or false. If false, correct the statement :

1. The SI unit of electric current is kilogram.

Ans. False.

Correct statement : The SI unit of electric current is **ampere**.

2. Kilometre is one of the SI units of measurement.

Ans. False.

Correct statement : Metre only SI unit. Kilometre is multiple of metre.

3. In everyday life, we use the term weight instead of mass.

Ans. True.

4. A physical balance is more sensitive than a beam balance.

Ans. True.

5. One Celsius degree is an interval of 1K and zero degree Celsius is 273.15 K.

Ans. True.

6. With the help of vernier caliper we can have an accuracy of 0.1 mm and with screw gauge we can have an accuracy of 0.01 mm.

Ans. True.

IV. Match the following :

1.

Length	kelvin
Mass	metre
Time	kilogram
Temperature	second

Ans.

Length	metre
Mass	kilogram
Time	second
Temperature	kelvin

2.

Screw gauge	Vegetables
Vernier caliper	Coins
Beam balance	Gold ornaments
Digital balance	Cricket ball

Ans.

Screw gauge	Coins
Vernier caliper	Cricket ball
Beam balance	Vegetables
Digital balance	Gold ornaments

V. Assertion and reason type questions :

Mark the correct answer as :

(a) Both A and R are true but R is not the correct reason.
(b) Both A and R are true and R is the correct reason.
(c) A is true but R is false.
(d) A is false but R is true

1. **Assertion (A) :** The scientifically correct expression is "The mass of the bag is 10 kg"
   Reason (R) : In everyday life, we use the term weight instead of mass.
   [Ans : (a) Both A and R are true but R is not the correct reason]
2. **Assertion (A) :** 0° C = 273.16 K. For our convenience we take it as 273 K after rounding off the decimal.
   Reason (R) : To convert a temperature on the Celsius scale we have to add 273 to the given temperature.
   [Ans : (b) Both A and R are true and R is the correct reason]
3. **Assertion (A) :** Distance between two celestial bodies is measured in terms of light year.
   Reason (R) : The distance travelled by the light in one year is one light year.
   [Ans : (b) Both A and R are true and R is the correct reason]

VI. Answer very briefly :

1. Define measurement.

Ans. Measurement is the processes of comparison of the given physical quantity with the known standard quantity of the same nature.

2. Define standard unit. *[QY - 2019]*

Ans. Unit is the quantity of a constant magnitude which is used to measure the magnitudes of other quantities of the same nature.

3. What is the full form of SI system?

Ans. International System of Units.

4. Define least count of any device. *[HY - 2019]*

(i) The smallest length which can be measured by metre scale is called least count.

(ii) Least count of the instrument = $\frac{\text{Value of one main scale division}}{\text{Total number of vernier scale division}}$

Least count = [Pitch / No. of head scale divisions]

5. What do you know about pitch of screw gauge?

Ans. Pitch of the screw gauge is the distance between two successive screw threads. It is measured by the ratio of distance travelled on the pitch scale to the number of rotations of the head scale.

Pitch = [Distance travelled on the pitch scale / Number of rotations of the head scale]

6. Can you find the diameter of a thin wire of length 2 m using the ruler from your instrument box?

Ans. Yes, first you have to wound the wire around the scale for 10 cm and count the number of turns in it. Then if you divide 10 cm by number of turns which gives the thickness of the wire.

VII. Answer briefly :

1. Write the rules that are followed in writing the symbols of units in SI system.

[QY - 2019]

Ans. (i) Units named after scientists are written in lower case.
Eg. joule, kelvin and newton.

(ii) Symbols for the units are always written in lower case.
Eg. m, kg and s.

(iii) However, the symbols for the units derived from the names of scientists are written in capital letters.
Eg. C (Celsius), N (newton) and J (joule).

(iv) Symbols are not followed by a full stop.
Eg. 75 cm and not 75 cm.

(v) Symbols are never written in plural.
Eg. 100 kg, not as 100 kgs.

2. Write the need of a standard unit.

Ans. A Standard Unit is needed to maintain uniformity in measurements like length, weight, size and distance. Eg: Standard Unit of length is metre.

3. Differentiate mass and weight. *[HY - 2019]*

Ans.

Sl. No.	Mass	Weight
1.	Fundamental quantity	Derived quantity
2.	Has magnitude alone – scalar quantity	Has magnitude and direction – vector quantity
3.	It is the amount of matter contained in a body	It is the normal force exerted by the surface on the object against gravitational pull
4.	Remains the same	Varies from place to place
5.	It is measured using physical balance	It is measured using spring balance
6.	Its unit is kilogram	Its unit is newton

4. How will you measure the least count of vernier caliper?

Ans. Least Count or L.C. is the minimum reading or value that can be measured with a measuring tool or device.

VIII. Answer in detail :

1. Explain a method to find the thickness of a hollow tea cup.

Ans. Step 1 : The Pitch, Least count and the type of zero error of the screw gauge are determined.

Step 2 : The given cup is placed in between two studs.

Additional Questions

I. Choose the correct answer :

1. Length is _____
(a) The amount of matter in an object
(b) The amount of space an object takes up.
(c) The distance between two points.
(d) The amount of stuff in an object **[Ans : (c) The distance between two points]**

2. Mass is _____.
(a) The distance between two points
(b) The distance between three points
(c) The amount of matter contained in an object
(d) The amount of space an object occupies.
[Ans : (c) The amount of matter contained in an object]

3. Unit used to measure length
(a) metre (b) litre
(c) gram (d) cubic metre (m^3) **[Ans : (a) metre]**

4. Unit which is used to measure mass
(a) ml (b) l (c) cm (d) gram
[Ans : (d) gram]

5. How many metres are there in 1 nanometer?
(a) 10^{-10}m (b) 10^{-9}m (c) 10^{9}m (d) 10^{10}m
[Ans : (b) 10^{-9}m]

6. What unit will you use to measure the length of our classroom?
(a) km (b) m (c) cm (d) mm
[Ans : (b) m]

7. The Kelvin is the basic unit of _____
(a) temperature (b) mass (c) length (d) volume
[Ans : (a) temperature]

8. _____ consists of 'U' shape metal frame
(a) Screw gauge (b) Vernier caliper (c) Beam balance (d) Spring balance
[Ans : (a) screw gauge]

9. Least count of a vernier caliper is _____ cm.
(a) 1 (b) 0.1 (c) 0.01 (d) 0.001
[Ans : (c) 0.01]

10. If no object is placed on the hook, then the pointer of the spring balance reads _____
(a) 3 (b) 2 (c) 1 (d) 0 **[Ans : (d) 0]**

11. SI unit of mass and weights are _____.
(a) kg, N (b) N, kg (c) K, N (d) N, K
[Ans : (a) kg, N]

12. Units named after scientists _____.
(a) lower case (b) upper case
(c) both (a) and (b) (d) neither (a) or (b) **[Ans : (a) lower case]**

13. An instrument that is used to measure the diameter of a cricket ball is _____.
(a) Screw guage (b) Meter scale
(c) Vernier caliper (d) Spring balance
[Ans : (a) Vernier caliper]

14. Distance between Chennai and Kanyakumari can be found in

(a) Kilometres (b) Metres (c) Centimetres (d) Millimetres.

[Ans : (a) Kilometres]

II. Fill in the blanks :

1. The precision of vernier calipers is _____ mm. **[Ans : (a) 0.1mm]**

2. The gravity accelerates any object, the distance fallen is proportional to _____. **[Ans : time squared]**

3. SI unit of electric current is _____. **[Ans : ampere]**

4. Larger unit for measuring time is _____. **[Ans : millennium]**

5. The value of an astronomical unit is _____. **[Ans : 1.496×10^{11}m]**

6. Mass is a _____ quantity. **[Ans : scalar]**

III. State whether true or false. If false, correct the statement :

1. The precision of screw guage is 0.001cm.

Ans. True.

2. The unit of amount of substance is candela

Ans. False.

Correct statement : The unit of amount of substance is **mole**.

3. The symbol for the units derived from the names of scientists are written in capital letter

Ans. True.

4. Yard was used as the unit of length.

Ans. True.

5. Micron is also known as micro-metre

Ans. True.

6. A vernier caliper using the scale invented by Galileo.

Ans. False.

Correct statement : A vernier caliper using the scale invented **Pierre Vernier**.

7. The SI unit of mass is kg.

Ans. True.

8. Weight has both magnitude and direction.

Ans. True.

IV. Match the following :

1.

Column - I	Column - II
FPS	Metre, kilogram and second
CGS	Foot, pound and second
MKS or SI	centimetre, gram and second

Ans.

Column - I	Column - II
FPS	Foot, pound and second
CGS	centimetre, gram and second
MKS or SI	Metre, kilogram and second

2.

Column I	Column II
10 years	1 year
10 centuries	1 century (100 years)
10 decades	1 millennium
365.24 days	1 decade

Ans.

Column I	Column II
10 years	1 decade
10 centuries	1 millennium
10 decade	1 century (100 years)
365.24 days	1 year

3.

Column I	Column II
Angle	m
Solid angle	radian
Length	s
Time	steradian

Ans.

Column I	Column II
Angle	radian
Solid angle	steradian
Length	m
Time	s

4.

Column I	Column II
Millimeter	10^{-15}m
Nanometer	10^{-3}m
Angstrom	10^{-9}m
Fermi	10^{-10}m

Ans.

Column I	Column II
Millimeter	10^{-3}m
Nanometer	10^{-9}m
Angstrom	10^{-10}m
Fermi	10^{-15}m

5.

Column I	Column II
Temperature	Beam balance
Mass	Ruler
Length	Digital clock
Time	Thermometer

Ans.

Column I	Column II
Temperature	Thermometer
Mass	Beam balance
Length	Ruler
Time	Digital clock

V. Assertion and reason type :

1. **Assertion (A) :** Light year and wave length both measure distance
Reason (R) : Both have dimensions of time.
(a) Both A and R are true but R is not the correct explanation of A.
(b) Both A and R are true and R is the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true. **[Ans : (c) A is true but R is false]**

2. **Assertion (A) :** Density is a derived physical quantity
Reason (R) : Density cannot be derived from the fundamental physical quantities.
(a) Both A and R are true but R is not the correct explanation of A.
(b) Both A and R are true and R is the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true. **[Ans : (c) A is true but R is false]**
Correct statement : Density can be derived from **mass and volume**.

3. **Assertion (A) :** Mass, Length and Time are fundamental physical quantities.
Reason (R) : They are independent of each other.
(a) Both A and R are true but R is not the correct explanation of A.
(b) Both A and R are true and R is the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.
[Ans : (b) Both A and R are true and R is the correct explanation of A]

UNIT
02

MOTION

LEARNING OBJECTIVES

Students will be able to

- List the objects which are at rest and which are in motion around them.
- Understand distance and displacement.
- Determine the displacement and distance covered by an object describing a circular path .
- Classify the motion of vehicles as uniform motion and non-uniform motion. distinguish between speed and velocity.
- Relate accelerated and unaccelerated motion.
- Deduce the equations of motion of an object from velocity – time graph.
- Write the equations of motion for a freely falling body.
- Understand the nature of circular motion.
- Identify centripetal force and centrifugal force in day to day life.

TEXT BOOK EXERCISES

I. Choose the correct answer :

1. The area under velocity – time graph represents the

(a) velocity of the moving object. (b) displacement covered by the moving object.
(c) speed of the moving object. (d) acceleration of the moving object.

[Ans : (b) displacement covered by the moving object]

2. Which one of the following is most likely not a case of uniform circular motion?

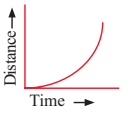
(a) Motion of the Earth around the Sun.
(b) Motion of a toy train on a circular track.
(c) Motion of a racing car on a circular track.
(d) Motion of hours' hand on the dial of the clock.

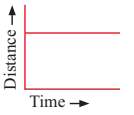
[Ans : (c) Motion of a racing car on a circular track]

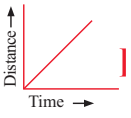
3. Which of the following graph represents uniform motion of a moving particle?

(a) 

(b) 

(c) 

(d) 

[Ans : (b) 

]

4. The centrifugal force is

(a) a real force.
(b) the force of reaction of centripetal force.
(c) a virtual force.
(d) directed towards the centre of the circular path. **[Ans : (c) a virtual force]**

II. Fill in the blanks :

1. Speed is a _____ quantity whereas velocity is a _____ quantity. ***[HY - 2019]*** **[Ans : Scalar, Vector]**

2. The slope of the distance – time graph at any point gives _____. **[Ans : Speed]**

3. Negative acceleration is called _____. **[Ans : retardation (or) deceleration]**

4. Area under velocity – time graph shows _____. **[Ans : displacement]**

III. State whether true or false. If false, correct the statement :

1. The motion of a city bus in a heavy traffic road is an example for uniform motion.

Ans. False.

Correct statement : The motion of a city bus in a heavy traffic road is an example for **non-uniform motion**.

2. Acceleration can get negative value also.

Ans. True.

3. Distance covered by a particle never becomes zero but displacement becomes zero.

Ans. True.

4. The velocity – time graph of a particle falling freely under gravity would be a straight line parallel to the *x* axis.

Ans. False.

Correct statement : The velocity - time graph of a particle **moving at uniform velocity,** would be straight line parallel to the *x* axis.

5. If the velocity – time graph of a particle is a straight line inclined to X-axis then its displacement – time graph will be a straight line.

Ans. True.

IV. Assertion and reason type questions :

Mark the correct choice as:

(a) If both assertion and reason are true and reason is the correct explanation of assertion.
(b) If both assertion and reason are true but reason is not the correct explanation of assertion.
(c) If assertion is true but reason is false.
(d) If assertion is false but reason is true.

1. Assertion : The accelerated motion of an object may be due to change in magnitude of velocity or direction or both of them.

Reason : Acceleration can be produced only by change in magnitude of the velocity. It does not depend the direction.

[Ans : (c) If assertion is true but reason is false.]

2. Assertion : The Speedometer of a car or a motor-cycle measures its average speed.

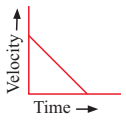
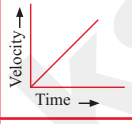
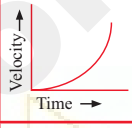
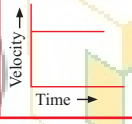
Reason : Average velocity is equal to total displacement divided by total time taken. **[Ans : (d) If assertion is false but reason is true]**

3. **Assertion** : Displacement of a body may be zero when distance travelled by it is not zero.

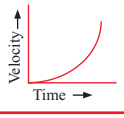
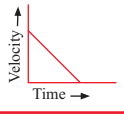
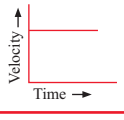
Reason : The displacement is the shortest distance between initial and final position.

[Ans : (a) If both assertion and reason are true and reason is the correct explanation of assertion]

V. Match the Following :

	List I		List II
1.	Motion of a body covering equal distances in equal intervals of time	A	
2.	Motion with non uniform acceleration	B	
3.	Constant retardation	C	
4.	Uniform acceleration	D	

Ans.

	List I		List II
1.	Motion of a body covering equal distances in equal intervals of time	A	
2.	Motion with non uniform acceleration	B	
3.	Constant retardation	C	
4.	Uniform acceleration	D	

VI. Answer briefly :

1. Define velocity.

Ans. (i) Velocity is the rate of change of displacement. It is the displacement with unit time. It is a vector quantity. The SI unit of velocity is ms^{-1}.

(ii) Thus, Velocity = Displacement / time taken.

2. Distinguish distance and displacement. [QY - 2019]

Ans.

Sl. No.	Distance	Displacement
1	The actual length of the path travelled by a moving body irrespective of the direction	The change in position of a moving body in a particular direction
2	It is a Scalar quantity	It is a Vector quantity

3. What do you mean by uniform motion?

Ans. An object is said to be in uniform motion if it covers equal distances in equal intervals of time however big or small these time intervals may be.

4. Compare speed and velocity.

Ans.

Sl. No.	Speed	Velocity
1.	It is the rate of change of distance with respect to time	It is the rate of change of displacement with respect to time
2.	It is a scalar quantity having magnitude only	It is a vector quantity having both magnitude and direction
3.	Speed is velocity without a particular direction	Velocity is speed in a particular direction
4.	It is measured in ms^{-1} in SI system	It is also measured in ms^{-1} in a particular direction in SI system
5.	Speed in any direction would be a positive quantity, since the distance in any direction is a positive quantity.	Velocity can get both positive and negative values. If velocity in one direction is assumed to be positive then the velocity in the opposite direction would be a negative quantity. Velocity can get zero value also.

5. What do you understand about negative acceleration?

Ans. If velocity decreases with time the value of acceleration is negative.

Note : Negative acceleration is called retardation or deceleration.

6. Is the uniform circular motion accelerated? Give reasons for your answer.

Ans. When an object is moving with a constant speed along a circular path, the change in velocity is only due to the change in direction. Hence it is accelerated motion.

7. What is meant by uniform circular motion? Give two examples of uniform circular motion.

Ans. When an object moves with constant speed along a circular path, the motion is called uniform circular motion.

Example :

1. The Earth moves around the Sun in the uniform circular motion.
2. The Moon moves in uniform circular motion around the Earth.

VII. Answer in detail :

1. Derive the equations of motion by graphical method. [QY - 2019]

Ans. Equations of motion from velocity – time graph:

Intext Activities

ACTIVITY - 1

Look around you. You can see many things: a row of houses, large trees, small plants, flying birds, running cars and many more. List the objects which remain fixed at their position and the objects which keep on changing their position.

Solution :

1. Row of houses, large trees, small plants are the examples, of immovable objects.
2. Flying birds, running cars and buses are the examples of movable objects.

Activity to be done by the students themselves

ACTIVITY - 2

Tabulate the distance covered by a bus in a heavy traffic road in equal intervals of time and do the same for a train which is not in an accelerated motion. From your table what do you understand?

The bus covers unequal distance in equal intervals of time but the train covers equal distances in equal intervals of time.

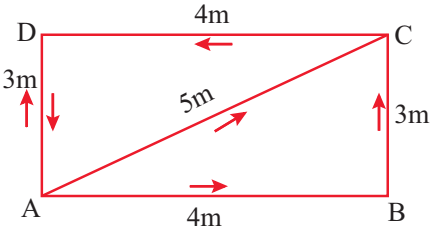
Solution :

Distance covered by a BUS in a heavy traffic	Distance covered by a TRAIN which is NOT in an accelerated motion
In first 10 minutes = 1 km. Next 10 minutes = 2 km. Next 10 minutes = 1.5 km	In first 5 minutes = 2 km. Next 5 minutes = 2 km. Next 5 minutes = 2 km
Covers unequal distance in equal intervals of time.	Covers equal distances in equal intervals of time
Such motion is called Non Uniform Motion.	Such motion is called Uniform Motion.

ACTIVITY - 3

Observe the motion of a car as shown in the figure and answer the following questions:

Compare the distance covered by the car through the path ABC and AC. What do you observe? Which path gives the shortest distance to reach D from A? Is it the path ABCD or the path ACD or the path AD?



Solution :

1. Distance covered by the car through the path ABC = 4m + 3m = 7 m. and AC = 5 m. The distance covered by the car through the path ABC is large compared to AC.
2. The shortest distance to reach D from A is path AD = 3m.
3. The total distance covered by the car ABCDA = 14 m. It finally reaches to A.

ACTIVITY - 4

Take a large stone and a small eraser. Stand on the top of a table and drop them simultaneously from the same height? What do you observe? Now, take a small eraser and a sheet of paper. Drop them simultaneously from the same height. What do you observe? This time, take two sheets of paper having same mass and crumple one of the sheets into a ball. Now, drop the sheet and the ball from the same height. What do you observe?

Solution :

Both the stone and the eraser have reached the surface of the Earth almost at the same time.

The eraser reaches first and the sheet of paper reaches later.

The paper crumpled into a ball reaches ground first and plain sheet of paper reaches later, although they have equal mass. It is because of air resistance. The magnitude of air resistance despends on the area of object exposed to air. So the sheet of paper reaches later.

Government Exam Questions

1 Mark

1. Unit of acceleration is [*QY - 2019*]

(a) ms^{-1} (b) ms^{-2} (c) ms (d) ms^2

[Ans : (b) ms^{-2}]

2. The magnitude of the centripetal force is given by (F = _____)

(a) $\frac{mv^2}{r}$ (b) $\frac{v^2}{r}$ (c) $\frac{2\pi}{T}$ (d) ma

[Ans : (a) $\frac{mv^2}{r}$]

3. In India the voltage of alternating current used for domestic purpose is _____.

(a) 50V (b) 5V (c) 220V (d) 110V

[Ans : (c) 220V]

2 Mark

1. A sound is heard 5 s later than the lightning is seen in the sky on a rainy day. Find the distance of location of lightning? Given the speed of sound = 346 ms^{-1}

Solution :

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

Distance = Speed × Time = 346 × 5 = 1730 m

Thus, the distance of location of lightning is 1730 m.

UNIT

04 ELECTRIC CHARGE AND ELECTRIC CURRENT

LEARNING OBJECTIVES

After completing this lesson, students will be able to:

- Understand the electric charge, electric field and Coulomb's law.
- Explain concepts of electric current, voltage, resistance and Ohm's law.
- Draw electrical circuit diagrams, series and parallel circuits .
- Explain effects of electric current like heating or thermal effect, chemical effect, magnetic effect.
- Understand direct and alternating currents.
- Know safety aspects related to electricity.

TEXT BOOK EXERCISES

I. Choose the correct answer :

1. In current electricity, a positive charge refers to,

(a) presence of electron (b) presence of proton
(c) absence of electron (d) absence of proton

[Ans : (c) absence of electron]

2. Rubbing of comb with hair

(a) creates electric charge (b) transfers electric charge
(c) either (a) or (b) (d) neither (a) nor (b)

[Ans : (b) transfers electric charge]

3. Electric field lines _____ from positive charge and _____ in negative charge. *[HY - 2019]*

(a) start; start (b) start; end
(c) start: end (d) end; end **[Ans : (b) or (c) start, end]**

4. Potential near a charge is the measure of its _____ to bring a positive charge at that point.

(a) force (b) ability (c) tendency (d) work

[Ans : (d) work]

5. Heating effect of current is called, [QY - 2019]

(a) Joule heating (b) Coulomb heating
(c) Voltage heating (d) Ampere heating

[Ans : (a) Joule heating]

6. In an electrolyte the current is due to the flow of

(a) electrons (b) positive ions
(c) both (a) and (b) (d) neither (a) nor (b)

[Ans : (c) both (a) and (b)]

7. Electroplating is an example for

(a) heating effect (b) chemical effect
(c) flowing effect (d) magnetic effect

[Ans : (b) chemical effect]

8. Resistance of a wire depends on,

(a) temperature (b) geometry
(c) nature of material (d) all the above **[Ans : (d) all the above]**

II. Match the following :

[QY - 2019]

1.	Electric Charge	(a)	ohm
2.	Potential difference	(b)	ampere
3.	Electric field	(c)	coulomb
4.	Resistance	(d)	newton per coulomb
5.	Electric current	(e)	volt

Ans. 1 - c, 2 - e, 3 - d, 4 - a, 5 - b

III. State whether true or false. If false, correct the statement :

1. Electrically neutral means it is either zero or equal positive and negative charges.

Ans. True.

2. Ammeter is connected in parallel in any electric circuit.

Ans. False.

Correct statement : Ammeter is connected in **series** in any electric circuit.

3. The anode in electrolyte is negative.

Ans. False.

Correct statement : The anode in electrolyte is **positive**.

4. Current can produce magnetic field.

Ans. True.

IV. Fill in the blanks :

1. Electrons move from _____ potential to _____ potential. **[Ans : lower, higher]**

2. The direction opposite to the movement of electron is called _____ current.

[Ans : conventional] [QY - 2019]

3. The e.m.f of a cell is analogues to _____ of a pipe line. **[Ans : water pump]**

4. The domestic electricity in India is an ac with a frequency of _____ Hz.

[Ans : 50] [QY - 2019]

V. Conceptual questions :

1. A bird sitting on a high power electric line is still safe. How?

Ans. Birds can sit on power lines and not get electric shocks because the electricity is always looking for a way to get to the ground (i.e.) the current is not flowing out of its body to any other material.
Current flows in a loop (which means the circuit is closed). A bird sitting on a transmission line does not complete the circuit. If the same bird keeps one leg on one line and another leg or any part of its body on another line or the neutral points, then it will get burnt.

2. Does a solar cell always maintain the potential across its terminals constant? Discuss.

Ans. Solar cell delivers a constant current for any given illumination level, while the voltage is determined by the load resistance. Potential in a solar cell depends on the intensity of the solar radiation. Since the intensity of solar radiation is not always constant, the potential across its terminal is also not constant.

3. Can electroplating be possible with alternating current?

Ans. The heating effect and the chemical effect experiments have to be performed only with a dc cell of around 9V. The 9V dc cell will not give any electrical shock.
At any cost we **should not use** the main domestic electric supply which is 220V ac voltage. If it is used it will give a heavy electric shock leading to a severe damage to our body.

VI. Answer the following :

1. On what factors does the electrostatic force between two charges depend?

Ans. The numerical value (magnitude) of electric force between two charges depend on the,
(i) value of charges on them,
(ii) distance between them and
(iii) nature of medium between them.

2. What are electric lines of force? [*HY - 2019*]

Ans. The lines representing the electric field are called electric lines of force.

3. Define electric field. [*HY - 2019*]

Ans. Electric field is the region around a charged body within which its influence can be experienced (i.e) within which it can attract or repel another charged body.

4. Define electric current and give its unit. [*HY - 2019*]

Ans. The electric current is defined as the rate of flow of electric charge through any section of a conductor.

Electric current $I = \frac{Q}{t}$

Its unit is Cs^{-1}

Its SI unit : ampere (A).

5. State Ohm's law.

Ans. Ohm's law states that, the current passing through a conductor is directly proportional to the potential difference across its ends, provided the physical conditions like temperature, density, etc. remain unchanged. $V \alpha I$ or $V = IR$.

6. Name any two appliances which work under the principle of heating effect of current.

Ans. Electric heating appliances like iron box, water heater, toaster, etc.

7. How are the home appliances connected in general, in series or parallel. Give reasons. *[QY - 2019]*

Ans. In a household electric circuit, different home appliances are connected in parallel to one another due to the following reasons:

(i) The appliances can be operated independently. If one appliance is switched off, others remain unaffected.

(ii) Each appliance gets the same constant voltage.

(iii) In parallel connection of electrical appliances, the overall resistance of the circuit it reduced due to which the current form the power supply is high.

8. List the safety features while handling electricity.

Ans. (i) Ground connection:

The metal bodies of all the electrical appliances are to be connected to the ground by means of a third wire apart from the two wires used for electrical connection.

(ii) Trip switch:

It is an electromechanical device which does not allow a current beyond a particular value by automatically switching off the connection.

(iii) Fuse:

A fuse is another safety mechanism which works on joule heating principle.

VII. Exercises :

1. Rubbing a comb on hair makes the comb get – 0.4C.

(a) Find which material has lost electron and which one gained it.

(b) Find how many electrons are transferred in this process.

Ans : a. Comb gained electrons. Dry hair lost electron.

b. No. of electrons transferred = – 0.4 C

1 coulomb = 6.25×10^{18} electron

– 0.4 C = $0.4 \times 6.25 \times 10^{18}$ electrons

= -2.5×10^{18} electrons

2. Calculate the amount of charge that would flow in 2 hours through an element of an electric bulb drawing a current of 2.5A.

Ans : Current I = 2.5 A

time t = 2 hours = 2×3600 seconds

t = 7200 s

Amount of charge Q = I × t

= 2.5×7200

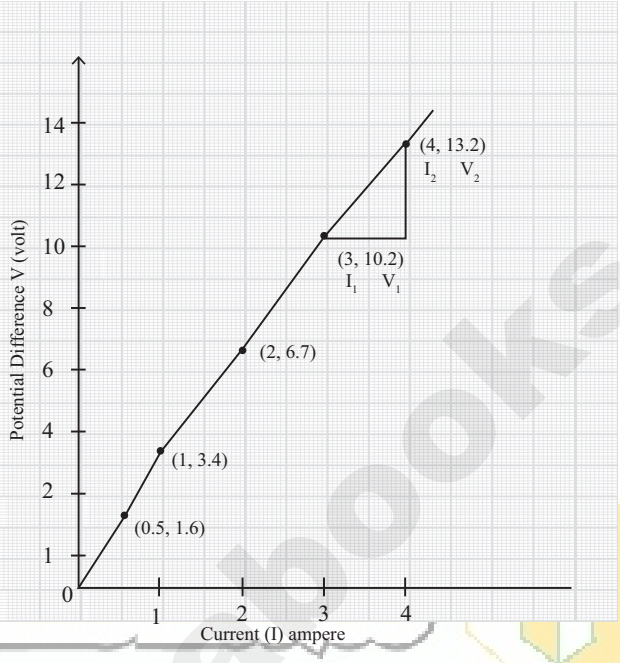
Q = 18,000 C

3. **The values of current (I) flowing through a resistor for various potential differences V across the resistor are given below. What is the value of resistor?**

I (ampere)	0.5	1.0	2.0	3.0	4.0
V (volt)	1.6	3.4	6.7	10.2	13.2

[Hint : plot V-I graph and take slope]

Ans.



Resistance of the resistor R $= \frac{V_2 - V_1}{I_2 - I_1}$

$= \frac{13.2 - 10.2}{4 - 3}$

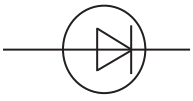
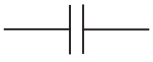
$= \frac{3}{1} = 3\Omega$

R = 3Ω

Intext Activities

ACTIVITY - 1

Take a condemned electronic circuit board in a TV remote or old mobile phone. Look at the electrical symbols used in the circuit. Find out the meaning of the symbols known to you.

Electrical symbols	Meaning
	Semi -conductor diode
	Capacitor

UNIT

05

MAGNETISM AND ELECTROMAGNETISM

LEARNING OBJECTIVES

After completing this lesson, students will be able to:

- Understand the concept of magnetic field.
- Know the properties of magnetic field lines.
- Calculate the force exerted on a current carrying conductor in a magnetic field.
- Understand the force between two parallel current carrying conductors.
- Know the concept of electromagnetic induction and apply it in the case of generators.
- Appreciate how voltage can be increased or decreased using transformers.
- Understand the applications of electromagnet and apply the knowledge in constructing devices using electromagnets.

TEXT BOOK EXERCISES

I. Choose the correct answer :

1. Which of the following converts electrical energy into mechanical energy?

(a) Motor (b) Battery
(c) Generator (d) Switch **[Ans : (a) Motor]**

2. Transformer works on _____.

(a) AC only (b) DC only
(c) Both AC and DC **[Ans : (a) AC only]**

3. The part of the AC generator that passes the current from the armature coil to the external circuit is

(a) field magnet (b) split rings
(c) slip rings (d) brushes **[Ans : (d) brushes]**

4. The unit of magnetic flux density is ***[HY - 2019]***

(a) Weber (b) weber/metre
(c) weber/metre^2 (d) weber . metre^2 **[Ans : (c) weber/metre^2]**

II. Fill in the blanks :

1. The SI Unit of magnetic field induction is _____. **[Ans : Tesla]** ***[HY - 2019]***

2. Devices which is used to convert high alternating current to low alternating current is _____ **[Ans : transformers]**

3. An electric motor converts _____. **[Ans : electrical energy into mechanical energy]**

4. A device for producing electric current is _____ . **[Ans : generator]**

III. Match the following :

1.	Magnetic material	a)	Oersted
2.	Non-magnetic material	b)	Iron
3.	Current and magnetism	c)	Induction
4.	Electromagnetic induction	d)	Wood
5.	Electric generator	e)	Faraday

Ans. 1 - b, 2 - d, 3 - a, 4 - e, 5 - c

IV. State whether true or false. If false, correct the statement :

1. A generator converts mechanical energy into electrical energy.

Ans. True.

2. Magnetic field lines always repel each other and do not intersect.

Ans. True.

3. Fleming's Left hand rule is also known as Dynamo rule.

Ans. False.

Correct statement : Fleming's Left hand rule is also known as **motor** rule.

4. The speed of rotation of an electric motor can be increased by decreasing the area of the coil.

Ans. False.

Correct statement : The speed of rotation of an electric motor can be increased by **increasing** the area of the coil.

5. A transformer can step up direct current.

Ans. False.

Correct statement : A transformer can step up **alternating current** (AC).

6. In a step down transformer the number of turns in primary coil is greater than that of the number of turns in the secondary coil.

Ans. True.

V. Answer in brief :

1. State Fleming's Left Hand Rule. ***[HY - 2019]***

Ans. The law states that while stretching the three fingers of left hand in perpendicular manner with each other, if the direction of the current is denoted by middle finger of the left hand and the second finger is for direction of the magnetic field then the thumb of the left hand denotes the direction of the force or movement of the conductor.

2. Define magnetic flux density.

Ans. The number of magnetic field lines crossing unit area kept normal to the direction of field lines is called magnetic flux density. Its unit is Wb/m^2.

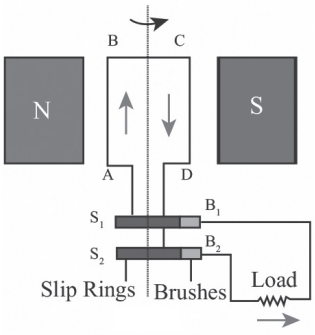
3. List the main parts of an electric motor.

Ans. Main parts of an electric motor

(i) Field magnet.
(ii) Armature (Rectangular coil)
(iii) Split ring (Commutator)
(iv) Brushes
(v) Battery

4. Draw and label the diagram of an AC generator. [*HY - 2019*]

Ans.



PARTS

N, S - Permanent magnet
A B C D - Rectangular coil or armature.
S_1, S_2 - Slip rings
B_1, B_2 - Carbon brushes

5. State the advantages of ac over dc.

Ans. (i) The voltage of ac can be varied easily using a device called transformer. The ac can be carried over long distances using step up transformers.
(ii) The loss of energy while distributing current in the form of ac is negligible.
(iii) Direct current cannot be transmitted as such. The ac can be easily converted into dc and generating ac is easier than dc.
(iv) The ac can produce electromagnetic induction which is useful in several ways.

6. Differentiate step up and step down transformer.

Ans.

S. No.	Step up transformer	Step down transformer
1.	It is a device used to raise the electric voltage ($V_S > V_P$).	It is designed to reduce the voltage ($V_S < V_P$).
2.	It has more turns on its secondary winding in comparison to the primary one ($N_S > N_P$).	It has less turns on the secondary winding ($N_S < N_P$).
3.	It is used to start the electrical motor and step-up the windings.	It is used to balance the ratio of voltage and current on the primary and secondary windings.

4.	It takes a lot of voltage to initially start the motor turning. It increases the voltage but decreases the current.	The secondary windings has fewer turns which mean low voltage and higher current while it is opposite in the case of the primary winding.
5.	It is found is television and in power stations.	It is found in laptops and phone chargers.

7. A portable radio has a built in transformer so that it can work from the mains instead of batteries. Is this a step up or step down transformer? Give reason.

Ans. It is a step down transformer. So that rectified DC voltage is equal to battery voltage, hence it can work on mains as well as on battery.

8. State Faraday's laws of electromagnetic induction.

Ans. First law : Whenever there is a change in magnetic flux linked with a coil, an electric current is induced. The induced potential difference lasts so long as there is a change in the magnetic flux linked with the coil.

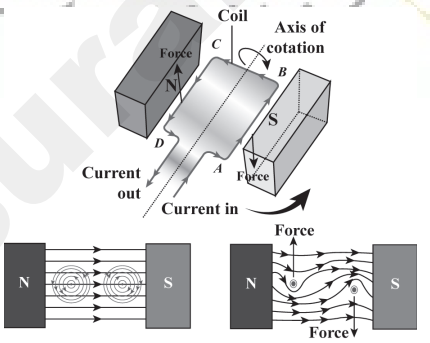
Second law : The magnitude of the induced current is directly proportional to the rate of change of magnetic flux linked with the coil.

VI. Answer in detail :

1. Explain the principle, construction and working of a DC motor.

Ans. Principle : An electric motor works on the principle that a current carrying conductor placed in a magnetic field experiences a force. The direction of force is given by Fleming's left hand rule.

Construction : An electric motor consists of the following main parts:



Armature : It is a rectangular coil ABCD having a large number of turns of this insulated copper wire wound over a soft iron core. The armature is placed between the poles of the field magnet and it can be rotated about an axis perpendicular to the magnetic field lines.

Split rings (commutators) : It consists of a cylindrical metal ring split into two halves S_1 & S_2. As the coil rotates, the split rings also rotate about the same axis of rotation. The function of the split ring is to reverse the direction of current in the coil after every half rotation.

Carbon brushes : Two graphite or flexible metal rods maintain a sliding contact with split rings S_1 and S_2 alternately.

Battery : A battery of few cells is connected to the brushes. The current from the battery flows to the armature coil through the brushes and the split rings.

UNIT
06

LIGHT

LEARNING OBJECTIVES

At the end of this lesson, students will be able to:

- Apply the laws of reflection for plane mirrors and spherical mirrors.
- Draw ray diagrams to find the position and size of the image for spherical mirrors.
- Distinguish between real and virtual images.
- Apply the mirror equation to calculate position, size and nature of images for spherical mirrors.
- Identify the direction of bending when light passes from one medium to another.
- Solve problems using Snell's law.
- Predict whether light will be refracted or undergo total internal reflection.

TEXT BOOK EXERCISES

I. Choose the correct answer :

1. A ray of light passes from one medium to another medium. Refraction takes place when angle of incidence is

(a) 0° (b) 45° (c) 90° **[Ans : (b) 45°]**

2. _____ is used as reflectors in torchlight.

(a) Concave mirror (b) Plane mirror
(c) Convex mirror **[Ans : (a) Concave mirror]**

3. We can create enlarged, virtual images with

(a) concave mirror (b) plane mirror
(c) convex mirror **[Ans : (a) concave mirror]**

4. When the reflecting surface is curved outwards the mirror formed will be

(a) concave mirror (b) convex mirror
(c) plane mirror **[Ans : (b) convex mirror]**

5. When a beam of white light passes through a prism it gets

(a) reflected (b) only deviated

(c) deviated and dispersed **[Ans : (c) deviated and dispersed]**

6. The speed of light is maximum in ***[HY - 2019]***

(a) vacuum (b) glass

(c) diamond **[Ans : (a) vacuum]**

II. State whether true or false. If false, correct the statement :

1. The angle of deviation depends on the refractive index of the glass.

Ans. True.

2. If a ray of light passes obliquely from one medium to another, it does not suffer any deviation.

Ans. False.

Correct statement : If a ray of light passes obliquely from one medium to another, it **bends away from the normal**.

3. The convex mirror always produces a virtual, diminished and erect image of the object.

Ans. True.

4. When an object is at the centre of curvature of concave mirror the image formed will be virtual and erect.

Ans. False.

Correct statement : When an object is at the centre of curvature of concave mirror the image formed will be **real and inverted**.

5. The reason for brilliance of diamonds is total internal reflection of light.

Ans. True.

III. Fill in the blanks :

1. In going from a rarer to denser medium, the ray of light bends _____.

[Ans: towards the normal]

2. The mirror used in search light is _____ . **[Ans: concave]**

3. The angle of deviation of light ray in a prism depends on the angle of _____ . **[Ans: incidence]**

4. The radius of curvature of a concave mirror whose focal length is 5cm is _____.

[Ans: 10 cm]

5. Large _____ mirrors are used to concentrate sunlight to produce heat in solar furnaces. **[Ans: concave]**

IV. Match the following :

Ratio of height of image to height of object.	Concave mirror
Used in hairpin bends in mountains.	Total internal reflection
Coin inside water appearing slightly raised.	Magnification
Mirage	Convex mirror
Used as Dentist's mirror.	Refraction

Ans.

Ratio of height of image to height of object.	Magnification
Used in hairpin bends in mountains	Convex mirror
Coin inside water appearing slightly raised	Refraction
Mirage	Total internal reflection
Used as Dentist's mirror	Concave mirror

V. Assertion and reason type questions :

Mark the correct choice as:

(a) If both assertion and reason are true and reason is the correct explanation.
(b) If both assertion and reason are true and reason is not the correct explanation.
(c) If assertion is true but reason is false.
(d) If assertion is false but reason is true.

1. Assertion : For observing the traffic at a hairpin bend in mountain paths a plane mirror is preferred over convex mirror and concave mirror.

Reason : A convex mirror has a much larger field of view than a plane mirror or a concave mirror. **[Ans : (d) If assertion is false but reason is true]**

2. Assertion : Incident ray is directed towards the centre of curvature of spherical mirror. After reflection it retraces its path.

Reason : Angle of incidence (i) = Angle of reflection (r) = 0°.

[Ans : (a) If both assertion and reason are true and reason is the correct explanation]

VI. Answer very briefly :

1. According to cartesian sign convention, which mirror and which lens has negative focal length?

Ans. Concave, mirror is having negative focal length.

2. Name the mirror(s) that can give (i) an erect and enlarged image, (ii) same sized, inverted image.

Ans. Concave mirror.

3. If an object is placed at the focus of a concave mirror, where is the image formed?

Ans. Infinity as real and inverted.

4. Why does a ray of light bend when it travels from one medium to another?

Ans. A ray of light bend when it travels from one medium to another due to the change in velocity of light in two different medium.

5. What is the speed of light in vacuum?

Ans. The only medium in which speed of light is equal to that in vacuum is air. Speed of light in vacuum is 3×10^8 m/s. Armand Fizeau first measured the speed of light.

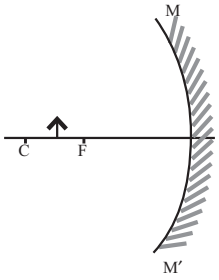
6. Concave mirrors are used by dentists to examine teeth. Why?

Ans. As concave mirror produces virtual, erect and magnified images when an object is placed in between focus and pole. So he can clearly gets a magnified view of cavities.

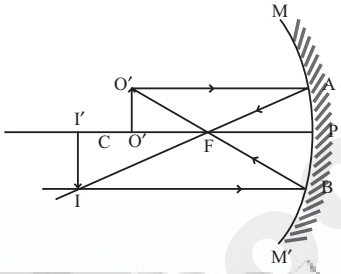
VII. Answer briefly :

1. a) Complete the diagram to show how a concave mirror forms the image of the object. [*HY - 2019*]

b) What is the nature of the image?



Ans. a)



b) Real, inverted and magnified.

2. Pick out the concave and convex mirrors from the following and tabulate them. Rear-view mirror, Dentist's mirror, Torch-light mirror, Mirrors in shopping malls, Make-up mirror.

Ans.

Concave Mirror	Convex Mirror
Dentist's mirror	Rear view mirror
Torch light mirror	Mirrors in shopping malls
Make up mirror	

3. State the direction of incident ray which after reflection from a spherical mirror retraces its path. Give reason for your answer.

Ans. Incident ray is directed towards the centre of curvature

Reason : The ray is normal to the spherical mirror, so $\angle i = 0$, $\therefore \angle r = 0$

4. What is meant by magnification? Write its expression. What is its sign for real image and virtual image? [*HY - 2019*]

Ans. Magnification is the increase in size of an image compared to true size.

$$\text{Magnification } m = \frac{\text{height of the image } h_2}{\text{height of the object } h_1}$$

$$= \frac{-\text{image distance } v}{\text{object distance } u}$$

$$\text{so } m = \frac{h_2}{h_1} = \frac{-v}{u}$$

(a) Negative sign - real image

(b) Positive sign - virtual image

UNIT

08

SOUND

LEARNING OBJECTIVES

After completing this lesson, students will be able to

- Understand the properties of sound.
- Know that sound requires a medium to travel.
- Understand that sound waves are longitudinal in nature.
- Explain the characteristics of sound.
- Gain knowledge about reflection of sound.
- Explain ultrasonic sound and understand the applications of ultrasonic sound.

TEXT BOOK EXERCISES

I. Choose the correct answer.

1. Which of the following vibrates when a musical note is produced by the cymbals in a orchestra?

(a) stretched strings (b) stretched membranes
(c) air columns (d) metal plates **[Ans : (d) metal plates]**

2. Sound travels in air:

(a) if there is no moisture in the atmosphere.
(b) if particles of medium travel from one place to another.
(c) if both particles as well as disturbance move from one place to another.
(d) if disturbance moves. **[Ans : (d) if disturbance moves]**

3. A musical instrument is producing continuous note. This note cannot be heard by a person having a normal hearing range. This note must then be passing through

(a) wax (b) vacuum (c) water (d) empty vessel
[Ans :(b) vacuum]

4. The maximum speed of vibrations which produces audible sound will be in

(a) sea water (b) ground glass (c) dry air (d) human blood
[Ans : (b) ground glass]

5. The sound waves travel faster

(a) in liquids (b) in gases (c) in solids (d) in vacuum

[Ans : (c) in solids]

II. Fill in the blanks.

1. Sound is a _____ wave and needs a material medium to travel.
[Ans : longitudinal mechanical]

2. Number of vibrations produced in one second is _____ . **[Ans : Frequency]**

3. The velocity of sound in solid is _____ than the velocity of sound in air.
[Ans : greater]

4. Vibration of object produces _____ . **[Ans :Sound]**

5. Loudness is proportional to the square of the _____ .
[Ans : Amplitude of vibraion of sound]

6. _____ is a medical instrument used for listening to sounds produced in the body. **[Ans : Stethoscope]**

7. The repeated reflection that results in persistence of sound is called _____ .
[Ans : Reverberation]

III. Match the following :

Tuning fork	The point where density of air is maximum.
Sound	Maximum displacement from the equilibrium position.
Compressions	The sound whose frequency is greater than 20,000 Hz
Amplitude	Longitudinal wave
Ultrasonics	Production of sound

Ans. 1 - e, 2 - d, 3 - a, 4 - b, 5 - c

IV. Answer briefly :

1. Through which medium sound travels faster, iron or water? Give reason.

Ans. Sound travels faster through iron than water.

Reason : The speed of sound depends on the nature of medium. As Iron is a solid, sound travels faster through iron than Water.

2. Name the physical quantity whose SI unit is 'hertz'. Define.

Ans. The SI unit of **Frequency is Hertz. Frequency is the number of waves produced in one second.**

3. What is meant by supersonic speed?

Ans. Supersonic speed is the speed of an object that exceeds the speed of sound in air (330 ms^{-1}).

4. How does the sound produced by a vibrating object in a medium reach your ears?

Ans.
1. When an object vibrates, it sets the particles of the medium around it vibrating.
2. The vibrating particles in the medium displace from the equilibrium position and exerts pressure on adjacent particles.
3. Thus this process continues in the medium till the sound reaches our ear.

5. You and your friend are on the moon. Will you be able to hear any sound produced by your friend?

Ans. We cannot hear any sound on the moon.

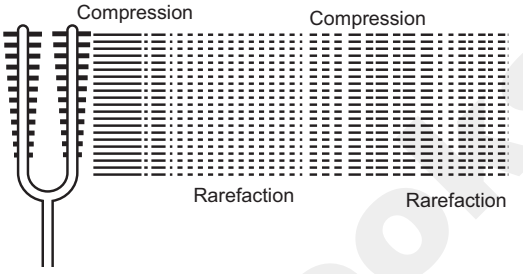
Reason : Absence of atmosphere (medium) in the moon.

V. Answer in detail :

1. Describe with diagram, how compressions and rarefactions are produced.

Ans. Compressions :

When a vibrating body moves forward, it creates a region of high pressure is known as compressions. In compression, the particles are more densed. Compressions are the region where particles are crowded together.

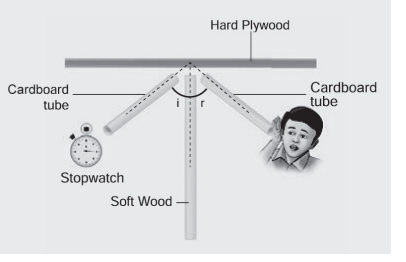


Rarefaction :

When the vibrating body moves backward, it creates a region of low pressure (i.e) low density of particles. This is called rarefaction. Rarefactions are the regions where particles are spread apart.

2. Verify experimentally the laws reflection of sound.

Ans.



1. Make two identical long pipes using chart paper.
2. Arrange them on a table near wall.
3. Keep a clock near the open end of one pipe and hear the sound of the clock through the other pipe.
4. Adjust the pipe till the sound of the clock heard with more clarity.
5. Now measure the angle of incidence and reflection and see the relationship between the angles.
6. The angle in which the sound is incident is equal to the angle in which sound is reflected.
7. Direction of incident sound, direction of the reflected and the normal are in the same plane.
8. Thus laws of reflection of sound are verified.

3. List the applications of sound.

Ans. Applications of Ultrasonic Sound

1. Cleaning Technology :

Minute foreign particles can be removed from objects placed in a liquid bath by ultrasonic sound waves.

UNIT

09

UNIVERSE

LEARNING OBJECTIVES

After completing this lesson, students will be able to

- Know the evolution of the universe.
- Understand the building blocks of the universe.
- Know more about solar system.
- Interpret Kepler's laws of motion and solve related problems.
- Calculate the orbital velocity and the time-period of satellites.
- Know about International Space Station.

TEXT BOOK EXERCISES

I. Choose the correct answer.

1. Who proposed the heliocentric model of the universe?

(a) Tycho Brahe (b) Nicolaus Copernicus
(c) Ptolemy (d) Archimedes

[Ans : (b) Nicolaus Copernicus]

2. Which of the following is not a part of outer solar system?

(a) Mercury (b) Saturn (c) Uranus (d) Neptune

[Ans :(a) Mercury]

3. Ceres is a _____.

(a) Meteor (b) Star (c) Planet (d) Asteroid

[Ans :(d) Asteroid]

4. The period of revolution of planet A around the Sun is 8 times that of planet B. How many times is the distance of planet A as great as that of planet B?

(a) 4 (b) 5 (c) 2 (d) 3 **[Ans : (a) 4]**

5. The Big Bang occurred _____ years ago.

(a) 13.7 billion (b) 15 million (c) 15 billion (d) 20 million

[Ans : (a) 13.7 billion]

II. Fill in the blanks :

1. The speed of Sun in km/s is _____. **[Ans :250 km/s]**
2. The rotational period of the Sun near its poles is _____. **[Ans : 36 days]**
3. India's first satellite is _____. **[Ans : Aryabhatta]**
4. The third law of Kepler is also known as the Law of _____. **[Ans : Harmonics]**
5. The number of planets in our Solar System is _____. **[Ans : 8]**

III. State whether true or false. If false, correct the statement :

1. ISS is a proof for international cooperation.

Ans. True.

2. Halley's comet appears after nearly 67 hours.

Ans. False.

Correct statement : Halley's comet appears after nearly **76 years**.

3. Satellites nearer to the Earth should have lesser orbital velocity.

Ans. False.

Correct statement : Satellites nearer to the Earth should have **faster** orbital velocity.

4. Mars is called the red planet.

Ans. True.

IV. Answer briefly :

1. What is solar system?

Ans.
1. The Sun and celestial bodies which revolve around it form the solar system.
2. It consists of larger number of bodies such as planets, comets, asteroids and meteors.

2. Define orbital velocity.

Ans. The horizontal velocity that has to be imparted to a satellite at the determined height so that it makes a circular orbit around the planet is called **"orbital velocity"**.

3. Define time period of a satellite.

Ans. Time taken by the satellite to complete one revolution round the Earth is called time period of a satellite.

$$\text{Time Period, } T = \frac{\text{Distance covered}}{\text{Orbital velocity}}.$$

4. What is a satellite? What are the two types of satellites?

Ans. A body moving in an orbit around a planet is called satellite.

The two types of Satellites are

1. Natural satellites, 2. Man made satellites.

5. Write a note on the inner planets.

Ans.
1. The planet that are relatively close together and close to the sun. They form the inner solar system and are called inner planets.
2. There are four inner planets namely
   1. Mercury, 2. Venus, 3. Earth and 4. Mars.
3. They have a surface of solid rock crust and are called terrestrial (or) rocky planets.

6. Write about comets.

Ans.
1. Comets are lumps of dust and ice that revolve around the Sun in highly elliptical orbits.
2. Their period of revolution is very long.
3. Comet vapourises and forms a head and tail on approaching the sun.
4. Tail of the biggest comet may be around 160 million km.
5. There are period comets (e.g) Halley's comet which appears after every 76 years.

7. State Kepler's laws.

Ans. Kepler's first law - the law of ellipses

The path of the planets about the Sun is elliptical in shape, with the centre of Sun being located at one of the foci.

Second law - the law of equal areas.

An imaginary line drawn from the centre of the Sun to the centre of the Planet will sweep out equal areas in equal intervals of time.

Third law - the law of Harmonics.

The ratio of the squares of the periods of any two planets is equal to the ratio of the cubes of their semi major axis from the Sun.

8. What factors have made life on Earth possible?

Ans. Factors responsible for life on Earth.
1. Right distance from the Sun.
2. Right temperature.
3. Presence of water.
4. Suitable atmosphere.
5. Blanket of ozone.

V. Answer in detail :

1. Give an account of all the planets in the solar system.

Ans. 1. Mercury :
1. It is a Rocky planet nearest to the Sun.
2. It moves around the Sun faster than any other planet.
3. It rotates very slowly.

2. Venus :
1. It is almost the same size as the Earth.
2. It is the Hottest planet in our solar system.
3. It is brightest heavenly body in our night sky.
4. It spins in the opposite direction to all other planets.

3. The Earth :
1. The only Life-Supporting planet in the solar system.
2. It appears Bluish green due to the reflection of light from water and land mass on its surface.
3. It moves around the Sun in 365.25 days and rotation period is 23.93 hours.

4. Mars :

1. The first planet outside the orbit of the Earth.
2. It is also called the Red Planet having two small natural satellites.

5. Jupiter :

1. Jupiter is called as Giant planet.
2. It is the largest of all planets.
3. It has 3 rings and 65 moons.
4. Its moon Ganymede is the largest moon of our solar system.

6. Saturn :

1. It has bright shiny rings and appears yellowish in colour.
2. It is the second biggest and a giant gas planet in the outer solar system.

7. Uranus :

1. It is a cold gas giant and can be seen only with the help of large telescope.
2. It has longest summers and winters.

8. Neptune :

1. It appears as Greenish star and is the windiest plant.
2. It has the largest moon - Triton that moves in opposite direction to the direction in which its planet spins.

2. Discuss the benefits of ISS.

Ans. 1. Water purification efforts :

The water recovery system (WRS) and the oxygen generation system (OGS) techniques developed by ISS provides advanced water filtration and purification to water scarcity areas.

2. Eye tracking technology :

Eye tracking technology can be used in many laser surgeries which tracks eye's position very accurately and helps the disabled people with limited movement and speech.

3. Robotic arms and Surgeries :

Robotic arms provide significant help to surgeons in removing inoperable tumor and taking biopsies with great accuracies.

4. Apart from the above, there are many other applications such as development of improved vaccines, breast cancer detection and treatment and so on.

3. Write a note on orbital velocity.

Ans. Definition of orbital velocity :

The horizontal velocity that has to be imparted to a satellite at the determined height so that it makes a circular orbit around the planet.

1. The orbital velocity of the satellite depends on its altitude above the Earth.
2. Nearer the object to the earth, faster is the required orbital velocity.
3. At an altitude of 200 km, the required orbital velocity is little more than 27,400 kph.

Geostationary orbit :

Satellite stays in a fixed position all the time while earth rotates. This kind of orbit is called geostationary.

Orbital velocity formula : $v = \sqrt{\frac{GM}{(R+h)}}$

G - Gravitational constant (6.673×10^{-11} Nm^2kg^{-2})

M - Mass of the Earth (5.972×10^{24} kg)

R - Radius of the Earth (6371 km).

h - Height of the satellite from the surface of the Earth.

VI. Conceptual questions :

1. Why do some stars appear blue and some red?

Ans. 1. Stars appear in different colours depending on their temperatures.
2. Hot stars are white or blue in colour.
3. Cooler stars are orange or red in colour.

2. How is a satellite maintained in nearly circular orbit?

Ans. 1. The satellite is carried by a rocket to the desired height and released horizontally with a high velocity.
2. So that it remains moving in a nearly circular orbit.

3. Why are some satellites called geostationary?

Ans. The Earth rotates once in 24 hours, a satellite stays in a fixed position. Because the satellite stays over the same spot all the time, this kind of orbit is called "geostationary".

4. A man weighing 60 kg in the Earth will weigh 1680 kg in the Sun. Why?

Ans. 1. Weight of the object depends upon the gravity of the planet.
2. The gravity of the sun is 28 times higher than the Earth.
3. So an object with 60 kg in the Earth will weigh 1680 kg (28× 60 = 1680 kg) in the Sun.

VII. Numerical problems :

1. Calculate the speed with which a satellite moves if it is at a height of 36,000 km from the Earth's surface and has an orbital period of 24 hr (Take R = 6370 km).

[Hint : Convert hr into seconds before doing calculation]

Solution : Given: Height of the satellite, h = 36,000 km

Radius of the Earth, R = 6370 km

T = 24hr [24hr = 24×60×60 = 86400s]

$$T = \frac{2\pi(R+h)}{v}$$

$$86400s = \frac{2(3.14)\times(6370+36000)}{v}$$

$$V = \frac{2(3.14)\times(42370)}{86400}$$

$$= \frac{6.28\times 42370}{86400}$$

$$= \frac{266083.6}{86400} = 3.0796$$

Orbital velocity, v = **3.0796×10^3 m/s** (or) **30796m/s** (or) **3.0796 km/s**.

2. At an orbital height of 400 km, find the orbital period of the satellite.

Solution : Given : Orbital height, h = 400 km = 400×10^3m

We know : Gravitational constant, G = $6.673\times10^{-11}Nm^2kg^{-2}$

Mass of the Earth, M = 5.972×10^{24} kg

Radius of the Earth, R = 6371 km = 6371×10^3m.

Orbital Velocity, $v = \sqrt{\frac{GM}{(R+h)}}$

On Substitution : $v = \sqrt{\frac{\left(6.673\times10^{-11}Nm^2kg^{-2}\right)\times\left(5.972\times10^{24}kg\right)}{(6371+400)\times10^3m}}$

$$v = \sqrt{\frac{39.85\times10^{13}}{6771\times10^3}} = \sqrt{\frac{39.85\times10^{13}}{0.6771\times10^7}} = \sqrt{58.85\times10^6}$$

$= 7.671\times10^3$ m/s.

v = 7671 m/s.

Time Period, $T = \frac{2\pi(R+h)}{v} = \frac{2\times3.14\times\left[(6371+400)\times10^3\right]}{7671}$

$$T = \frac{2\times3.14\times(677\times10^3)}{7671} = 5.54\times10^3 s = 5540 \text{ s.}$$

T = **92.3 min.**