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Science

IX - Standard

Based on the Updated New Textbook

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- Complete Solutions to Textbook Exercises.

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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.

Subash Raj, **B.E., M.S.**

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All the Best

CONTENTS

UNIT 01

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) :**   0º 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 defined as the determination of the size or magnitude of a quantity. It 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. A unit is a standard quantity with which the unknown quantities are compared. 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*]

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

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

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

Ans. The pitch of the screw is the distance moved by the tip of the screw for one complete rotation of the head. It is equal to 1 mm in typical screw gauges.

   Pitch of the screw = $\dfrac{\text{Distance moved by the pitch}}{\text{No. of rotations by head scale}}$

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.

(vi) When temperature is expressed in kelvin, the degree sign is omitted. **Eg.** 283 K not as 283° K

(vii) Use of solidus (/) is recommended for indicating a division of one unit symbol by another unit symbol. Not more than one solidus is used. **Eg.** ms^{-1} or m/s.

(viii) The number and units should be separated by a space. **Eg.** 15 kgms^{-1} not as 15 kgms^{-1}.

(ix) Accepted symbols alone should be used. **Eg.** ampere should not be written as amp and second should not be written as sec.

(x) The numerical values of physical quantities should be written in scientific form. **Eg.** the density of mercury should be written as 1.36×10^4 kgm^{-3} not as 13600 kgm^{-3}.

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 of the instrument (L.C) $= \dfrac{\text{Value of one main scale division}}{\text{Toal number of vernier scale division}}$

The main scale division will be in centimeter, further divided into millimetre. The value of the smallest main scale division is 1 mm. In the Vernier scale there will be 10 divisions.

$$(L.C) = \frac{1mm}{10} = 0.1mm = 0.01cm$$

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.

Step 3 : The head screw using the ratchat arrangement is freely rotated until the given cup is held firmly, but not tightly.

Step 4 : Pitch scale reading (PSR) by the head scale and head scale coincidence (HSC) with the axis of the pitch scale, are found.

Step 5 : The readings are recorded and the experiment for different positions of the given cup is repeated.

Step 6 : The thickness of the cup is calculated using the formula P.S.R+(HSC×L.C)

Step 7 : Then the average of the last column of the table. is found.
Hence the thickness of a hollow tea cup = _____ mm.

2. How will you find the thickness of a one rupee coin? ⊗

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

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

Step 3 : The head screw using the ratchat arrangement is freely rotated until given one rupee coin is held firmly, but not tightly.

Step 4 : Pitch scale reading (PSR) by the head scale and head scale coincidence (HSC) with are axis of the pitch scale are found.

Step 5 : The reading are recorded and the experiment for different positions of the given coin is repeated.

Step 6 : The thickness of the coin is computed using the formula P.S.R+(HSC×L.C)

Step 7 : Then the average of the last column of the table is found.

S. No.	P.S.R. (mm)	HSC (division)	CHSC = HSC ± ZC (Division)	CHSR = CHSC × LC (mm)	Total reading =PSR + CHSR (mm)
1.					
2.					
3.					

mean = _____ mm

Hence the thickness of a one rupee coin = _____ mm

IV. Match the following :

1.

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

2.

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

3.

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

4.

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

5.

Column I	Column II	Ans.	Column I	Column II
Temperature	Beam balance		Temperature	Thermometer
Mass	Ruler		Mass	Beam balance
Length	Digital clock		Length	Ruler
Time	Thermometer		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]**

10. Give some examples of derived units.

Ans. The units of area, volume, density.

11. What is the standard unit of weight?

Ans. Newton is the standard unit of weight.

12. What is the standard unit of mass?

Ans. Kilogram is the standard unit of mass.

13. Define Mass.

Ans. Mass is the amount of matter contained in a body.

14. Define Weight.

Ans. The force with which the earth attracts a body towards its center is called weight.

15. What is the SI unit of temperature?

Ans. Kelvin is the SI unit of temperature.

16. What is the measuring unit of the thickness of a plastic carry bag?

**Ans.** 1 micron = 10^{-6}m (or) μm.

VIII. Answer briefly :

1. Write temperature conversion.

Ans. Temperature Conversion (Exact)

From	To Fahrenheit	To Celsius	To Kelvin
Fahrenheit (°F)	°F	$\left(\dfrac{F-32}{1.8}\right)$	$\left[\dfrac{F-32}{1.8}+273\right]$
Celsius (°C)	(C × 1.8) + 32	°C	°C + 273
Kelvin (K)	[(K – 273) × 1.8] + 32	K – 273	K

2. Write about the positive zero error in screw gauge instrument.

Ans. When the plane surface of the screw and the opposite plane stud on the frame are brought into contact, if the zero of the head scale lies below the pitch scale axis, the zero error is positive. For example, the 5th division of the head scale coincides with the pitch scale axis, then the zero error is positive and is given by Z.E = + (n × LC) where 'n' is the head scale coincidence. In this case, Zero error = + (5 × 0.01) = 0.05 mm. So the zero correction is – 0.05 mm.
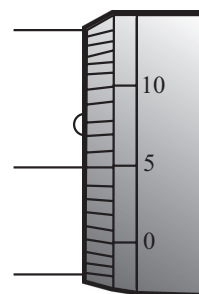
Positive Zero error

3. Write SI units for the fundamental quantity.

Ans.

Basic Quantity	Unit
Length	metre
Mass	kilogram
Time	second
Electric current	ampere
Temperature	kelvin
Amount of substance	mole
Luminous intensity	candela

4. **Convert the following units in metre.**

Ans.

Smaller units	Value in metre
centimetre (cm)	10^{-2} m
millimetre (mm)	10^{-3} m
micron or μm	10^{-6} m
nanometre (nm)	10^{-9} m
angstrom (Å)	10^{-10} m
fermi (f)	10^{-15} m

5. **Draw and mark the parts of vernier caliper**

Ans. PARTS Marked in the Vernier caliper

1. Lower fixed jaw
2. Upper fixed jaw
3. Lower movable jaw
4. Vernier scale
5. Retainer
6. Main scale
7. Depth probe.
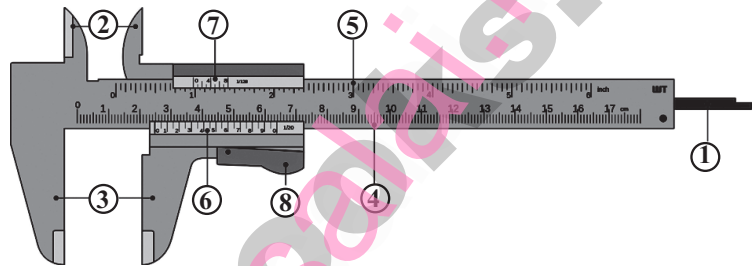
IX. Numerical Problems :

1. **A piece of iron of volume 40cm³ whose density is 6.8g/cm³. Find the mass of iron.**

Solution :

Given, density of iron, D = 6.8g/cm³
volume of iron, V = 40 cm³
mass of iron, M = V × D   [∴ mass = volume × density]

$$= 40 \; cm^3 \times \frac{6.8g}{cm^3}$$

$$m = \mathbf{272.0g.}$$

2. **Solve : The mass of 40 apples in a box is 5 kg.**

(i) **Find the mass of a dozen of them.**

(ii) **Express the mass of one apple in gram.**

Solution :

(i)   40 apple = 5 kg = 5000 g

$$1 \text{ apple} = \frac{5000}{40}$$

1 apple = 125 g

∴ 1 dozen = 12 apples

12 apples = 125 × 12 g

12 apples = 1500 g.

(ii)   40 apples = 5000 g

$$1 \text{ apple} = \frac{5000}{40} g = 125g$$

The mass of 1 apple = 125 g.

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 uniform motion and non-uniform motion.
- 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 :
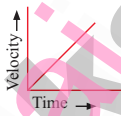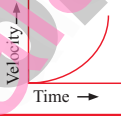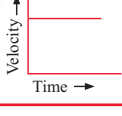
   Mark the correct choice as:
   (a)   If both assertion and reason are true and reason is the correct explanation of
         assertion.
   (b)   If both assertion and reason are true but reason is not the correct explanation of
         assertion.
   (c)   If assertion is true but reason is false.
   (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]**

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

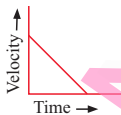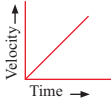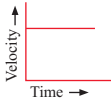   **Reason** : The displacement is the shortest distance between initial and final position.

   [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 in unit time. It is a vector quantity. The SI unit of velocity is ms^{-1}.

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

✍ 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?

D 4m C
3m   5m   3m
A 4m B
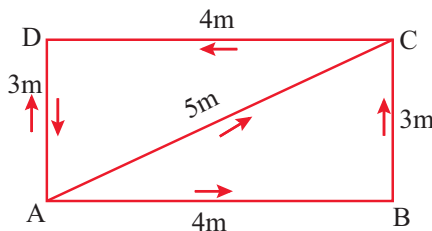
Solution :

1. Distance covered by the car through the path ABCD = 4m + 3m + 4m = 11 m and the distance covered by the car through the path ACD = 5 m + 4m = 9m. The distance covered by the car through the path ABCD is large compared to ACD.

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.

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Additional Questions

</div>

I.   Choose the correct answer :

1. A particle is moving in a circular pattern of radius *r*. The displacement after half a circle would be

(a)   zero   (b) πr (c) $2r$ (d) $2\pi r$

[Ans : (c) 2r]

2. In which of the following cases of motions, the distance moved and the magnitude of displacement are equal?

(a)   If the car is moving in the straight road.

(b)   If the car is moving in a circular road.

(c)   The Earth is revolving around the sun.

(d)   The pendulum is moving to and fro

[Ans : (a) If the car is moving in the straight road]

3. A body is thrown vertically upward with velocity *u*, the greatest height h to which it will rise is

(a) $u^2/2g$ (b) u^2/g (c) u/g (d) $u/2g$

[Ans : (a) $u^2/2g$]

4. If the displacement of an object is proportional to square of time, then the object moves with

(a)   uniform velocity   (b)   uniform acceleration

(c)   increasing acceleration   (d)   decreasing acceleration

[Ans : (b) uniform acceleration]

5. From the given *v–t* graph, u can be inferred that the object is

(a)   in uniform motion   (b)   at rest

(c)   in non-uniform motion   (d)   moving with uniform acceleration
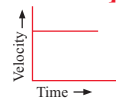
[Ans : (a) in uniform motion]

6. Area under *v–t* graph represents a physical quantity which has the unit.

(a) m^2 (b)   m   (c) m^3 (d) ms^{-1}

[Ans : (b) m]

7. m/s^2 is the unit of

(a)   distance   (b)   displacement   (c)   velocity   (d)   acceleration

[Ans : (d) acceleration]

8. The rate of change of displacement

(a)   speed   (b)   velocity   (c)   acceleration   (d)   retardation

[Ans : (b) velocity]

9. A scalar quantity has

(a)   magnitude only   (b)   direction only

(c)   both   (d)   none   **[Ans : (a) magnitude only]**

10. When an object undergoes acceleration

(a)   there is always an increase in its velocity

(b)   there is always an increase in its speed

(c)   a force always acting on it.

(d)   all of the above   **[Ans : (c) a force always acting on it]**

4. When an object is thrown upwards, what is true of velocity and acceleration at the highest point of motion of the object?

Ans. (i) Velocity becomes zero

(ii) Acceleration remains same as g.

5. Name the two quantities, the slope of whose graph gives (i) speed (ii) acceleration.

Ans. (i) Distance – Time

(ii) Speed – Time

6. Define Average speed.

Ans. It is the total distance travelled divided by the total time taken to cover this distance.

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

7. What do you infer if

(i) Distance - time graph is straight line.

(ii) Velocity time graph is curved.

(iii) Displacement time is zig zag.

Ans. (i) Speed is constant.

(ii) Acceleration is not uniform.

(iii) Non uniform velocity.

8. Give the formula for each.

(i) Relation between initial, final velocity, acceleration and displacement in a uniformly accelerated straight line motion.

(ii) Relation between initial, final velocity, acceleration & time in a uniformly accelerated straight line motion.

(iii) Relation between initial velocity, acceleration, displacement and time.

Ans. (i) Relation between initial, final velocity, acceleration & displacement in a uniformly accelerated straight line motion. $v^2 = u^2 + 2as$

(ii) Relation between initial, final velocity, acceleration & time in a uniformly accelerated straight line motion. $v = u + at$

(iii) Relation between initial velocity, acceleration, displacement and time.

$s = ut + \frac{1}{2}at^2$

9. What is the difference between uniform acceleration and non - uniform acceleration?

Ans.

Sl. No.	Uniform Acceleration	Non - Uniform Acceleration
1.	It is the acceleration in which the object changes its velocity with equal intervals of time.	It is the acceleration in which the object changes its velocity with unequal intervals of time.
2.	eg. The motion of a ball rolling down.	A car travels 2 km in 1st hour, 3 km in 2nd hour and 3.5 km in 3rd hour.

10. Define Acceleration. ⊗

Ans. Acceleration is the rate of change of velocity with respect to time or it is the rate of change of velocity in unit time. It is a vector quantity. The SI unit of acceleration is ms^{-2}.

VI. Paragraph Questions :

1. Define acceleration and state its SI unit for motion along a straight line, when do we consider the acceleration to be (i) positive (ii) negative? Give an example of a body in uniform acceleration.

Ans. Acceleration is the rate of change of velocity with respect to time or it is the rate of change of velocity in unit time. It is a vector quantity. The SI unit of acceleration is ms^{-2}.

$$\text{Acceleration} = \text{Change in velocity/time}$$
$$= (\text{Final velocity – initial velocity})/\text{time}$$
$$a = \frac{v-u}{t}$$

If $v > u$, then 'a' is positive. If final velocity is greater than initial velocity, the velocity increase with time, the value of acceleration is positive.

If $v < u$, then a is negative. If final velocity is less than initial velocity

Example : The motion of a freely falling body and vertically thrown up body are the examples of uniform acceleration.

The motion of ball rolling down on an inclined plane is another example.

2. Distinguish between uniform motion and non uniform motion.

Ans.

Sl. No.	Uniform Motion	Non - Uniform Motion
1	An object is said to be in uniform motion if it covers equal distances in equal intervals of time.	If a body covers unequal distances in equal interval of time (or) equal distances in different interval of time
2	example of uniform motion 'train'	example of non - uniform motion 'bus'

3. Define uniform circular motion and give example of it. Why is it called accelerated motion?

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

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.

Example:
1. The Earth moves around the sun in the uniform circular motion.
2. The Moon moves in uniform circular motion around the Earth.

4. **When a body is said to be in (i) uniform acceleration (ii) non - uniform acceleration?**

Ans. (i) A body is said to be in uniform acceleration if it travels in a straight line and its velocity increases or decreases by equal amounts in equal time intervals.

(ii) A body is said to be in non-uniform acceleration if the rate of change of its velocity is not constant i.e. differs in different time intervals.

6. **What remains constant in uniform circular motion? And what changes continuously in uniform circular motion?**

Ans. (i) Speed remains constant in uniform circular motion.

(ii) Velocity changes continuously in uniform circular motion.

Problems

1. **A bus speed decreases from 50 km/h to 40 km/h in 3s, find the acceleration of the bus.**

Ans.

Initial speed (u) = 50 km/h = $\dfrac{50 \times 1000 \text{m}}{3600 \text{ sec.}}$ = $\dfrac{250}{18}$ m/s = 13.888 m/s

Final speed (v) = 40 km/h = $\dfrac{40 \times 1000 \text{m}}{3600 \text{ sec}}$ = $\dfrac{200}{18}$ m/s = 11. 111 m/s

Time taken (t) = 3s

$v = u + at$

$\therefore a = \dfrac{v-u}{t} = \dfrac{-2.777}{3} = -0.9256 \text{ ms}^{-2}$

(Negative) acceleration = -0.9256 ms^{-2}

2. **A car starting from rest moves with uniform acceleration of 0.2 ms^{-2} for 3 min. Fine the (a) speed acquired (b) the distance travelled.**

Ans.

Initial speed (u) = 0 m/s

Acceleration (a) = 0.2 ms^{-2}

Time taken (t) = 3 min = 3 × 60 = 180 s

Final velocity (v) = ?

Distance covered(s) = ?

$v = u + at = 0 + 0.2 \times 180 = 36$ m/s

$v = 36$ m/s

$s = ut + \frac{1}{2} at^2 = 0 + \frac{1}{2} \times 0.2 \times (180)^2$

= $0.1 \times 32400 = 3240$ m

$s = 3240$ m

3. **In a long distance race the athletes were expected to take four rounds of the track such that the line of finish was same as the line of start. Suppose the length of the track was 300m,**

(i) What is the total distance to be covered by the athletes?

(ii) What is the total displacement of the athletes when they touch the finish line?

(iii) Is the motion of the athletes uniform or non-uniform?
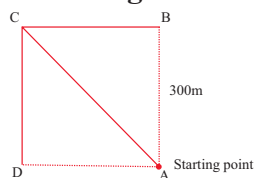
FLUIDS

LEARNING OBJECTIVES

After completing this lesson, students will be able to :

- ❑ Define pressure in terms of weight.
- ❑ Explain the variation of pressure with respect to depth in a fluid.
- ❑ Learn the fact that water exerts an upward force on objects immersed in it.
- ❑ Calculate density when pressure and altitude are given.
- ❑ Learn the formula for finding the relative density of an object and apply the same.
- ❑ Understand the behaviour of floating bodies.

TEXT BOOK EXERCISES

I. Choose the correct answer :

1. The size of an air bubble rising up in water   [*HY - 2019*]

   (a) decreases   (b) increases

   (c) remains same   (d) may increase or decrease

[Ans : (b) increases]

2. Clouds float in atmosphere because of their low   [*QY - 2019*]

   (a) density   (b) pressure

   (c) velocity   (d) mass   **[Ans : (a) density]**

3. In a pressure cooker, the food is cooked faster because

   (a) increased pressure lowers the boiling point.

   (b) increased pressure raises the boiling point.

   (c) decreased pressure raises the boiling point.

   (d) increased pressure lowers the melting point.

[Ans : (b) increased pressure raises the boiling point]

4. An empty plastic bottle closed with an airtight stopper is pushed down into a bucket filled with water. As the bottle is pushed down, there is an increasing force on the bottom. This is because,

(a) more volume of liquid is displaced.

(b) more weight of liquid is displaced.

(c) pressure increases with depth.

(d) All the above.   **[Ans : (c) pressure increases with depth]**

II. Fill in the blanks :

1. The weight of the body immersed in a liquid appears to be _____ than its actual weight   **[Ans : less]**

2. The instrument used to measure atmospheric pressure is_____.

[Ans : Barometer] [*HY - 2019*]

3. The magnitude of buoyant force acting on an object immersed in a liquid depends on _____ of the liquid.   **[Ans : density]**

4. A drinking straw works on the existence of _____. **[Ans : atmospheric pressure]**

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

1. The weight of fluid displaced determines the buoyant force on an object.

Ans. True.

2. The shape of an object helps to determine whether the object will float or not.

Ans. False.

Correct statement : The **density** of an object helps to determine whether the object will floater sink.

3. The foundations of high-rise buildings are kept wide so that they may exert more pressure on the ground.

Ans. False.

Correct statement : They may exert **less** pressure on the ground.

4. Archimedes' principle can also be applied to gases.

Ans. True.

5. Hydraulic press is used in the extraction of oil from oil seeds.

Ans. True.

IV. Match the following :

Density	-	hρg
1 gwt	-	Milk
Pascal's law	-	$\dfrac{Mass}{Volume}$
Pressure exerted by a fluid	-	Pressure
Lactometer	-	980 dyne

Ans.

Density	-	$\dfrac{Mass}{Volume}$
1 gwt	-	980 dyne
Pascal's law	-	Pressure
Pressure exerted by a fluid	-	hρg
Lactometer	-	Milk

V. Answer in brief :

1. On what factors the pressure exerted by the liquid depends on?

Ans. The pressure exerted by the liquid depends on the
  (i) Depth   (ii) Density of the liquid
  (iii) Acceleration due to gravity.

2. Why does a helium balloon float in air? **[QY - 2019]**

Ans. Helium balloon floats in air because helium gas is less dense than air.

3. Why it is easy to swim in river water than in sea water? **[QY - 2019]**

Ans. The question itself is wrong. It is easier to swim in **sea water** than in the river water. It is because sea water has (i) greater density and (ii) larger buoyant force than river water.

4. What is meant by atmospheric pressure? **[HY - 2019]**

Ans. Earth is surrounded by a layer of air up to certain height (nearly 300 km) and this layer of air around the earth is called atmosphere of the earth. Since air occupies space and has weight, it also exerts pressure. This pressure is called atmospheric pressure.

5. State Pascal's law. **[QY - 2019]**

Ans. Pascal's law states that the external pressure applied on an incompressible liquid is transmitted uniformly throughout the liquid.

VI. Answer in detail :

1. With an appropriate illustration prove that the force acting on a smaller area exerts a greater pressure.

Ans. 1. Take a nail. It has two ends. One end is sharp and other end is a bulged head.
  2. We usually keep the pointed end on the wall or wood and hammer on the bulged head.
  3. So very small area creates a large pressure.
  4. Thus the nail penetrates into the wall or wood.
  5. Thus the force acting on a smaller area exerts a greater pressure.

2. Describe the construction and working of mercury barometer.

Ans.

Vacuum

Pressure exerted by the column of mercury

760mm

Atmospheric pressure

Surface of mercury
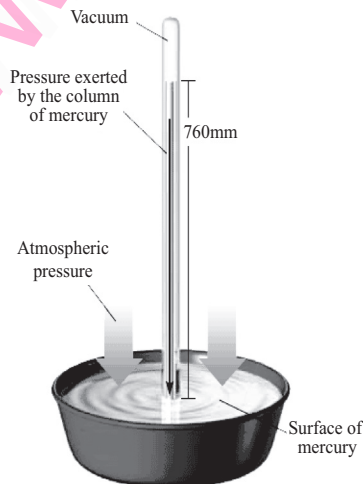
2. **Density of mercury is 13600 kg m⁻³. Calculate the relative density.**

Ans. Density of Mercury $= 13600$ kg m^{-3}

Density of water at 4°C $= 1000$ kg m^{-3}

Relative density $= \dfrac{\text{Density of mercury}}{\text{Density of water at } 4°C} = \dfrac{13600\,\text{kg m}^{-3}}{1000\,\text{kg m}^{-3}}$

Relative Density $=$ **13.6**

3. **The density of water is 1 g cm⁻³. What is its density in S.I. units?**

Ans. Density of water in SI units $=$ **1000 kg / m³.**

4. **Calculate the apparent weight of wood floating on water if it weighs 100g in air.**

Ans. Apparent Weight $=$ Weight of the body – Weight of the liquid

Since the body is floating, the weight of the body and liquid will be equal.

So, apparent weight $= 100 - 100$

$= 0.$

∴ Apparent Weight of wood is Zero.

IX. Higher Order Thinking Skills :

1. **How high does the mercury barometer stand on a day when atmospheric pressure is 98.6 kPa?**

Ans. Pressure of Atmosphere P_{atm} $= 98.6$ kPa.

Density of Mercury, ρ_{Hg} $= 13.6 \times 10^3$ kg/cm³

Acceleration due to gravity, g $= 9.8$ m/s²

Pressure, P_{atm} $= h \times \rho_{Hg} \times g$

$$h = \dfrac{P_{atm}}{\rho_{Hg} \times g} = \dfrac{98.6 \text{ kPa}}{(13.6 \times 10^3) \times (9.8\,\text{ms}^{-2})}$$

$$= \dfrac{98.6 \times 10^3 \text{Pa}}{(13.6 \times 10^3) \times (9.8\,\text{ms}^{-2})}$$

Height of Barometer, h $=$ **0.7397 m = 739.7 mm**

2. **How does a fish manage to rise up and move down in water?**

Ans. (i) Fish manages to rise up in water by reducing its density by filling oxygen in bladder via the gills. Thus volume will be increased to support its ascending motion.

(ii) Fish moves down by decreasing its volume by releasing oxygen from bladder. Thus volume will be decreased so it will sink in the water.

3. **If you put one ice cube in a glass of water and another in a glass of alcohol, what would you observe? Explain your observations.**

Ans. **Ice cube in water :** As the density of ice cube is less than water, the ice cube floats in water.

Ice cube in alcohol : As the density of ice cube is greater than alcohol, the ice cube will sink in alcohol.

[Note : Density : Water = 1.00, Ice cube = 0.917, Alcohol = 0.78].

Additional Questions

I. Choose the correct answer :

1. Intermolecular forces are stronger in _____
(a) gases
(b) liquids
(c) solids
(d) all the above   **[Ans : (c) solids]**

2. Water (or) liquids exert pressure on
(a) Upward direction
(b) Downward direction
(c) Lateral direction
(d) All the above **[Ans : (d) All the above]**

3. The pressure does not depend upon
(a) Depth
(b) Area
(c) Density
(d) Acceleration due to gravity

[Ans : (b) Area]

4. Fluids in general are
(a) Gases
(b) Liquids
(c) Gases or Liquids
(d) None of these

[Ans : (c) Gases or Liquids]

5. Scuba divers wear special suits to withstand
(a) Low pressure
(b) High pressure
(c) Low temperature
(d) High temperature

[Ans : (b) High pressure]

6. To find out relative density of the substance, with respect to density of water at _____ **C is taken.**
(a) $4°$
(b) $0°$
(c) $100°$
(d) $60°$

[Ans : (a) 4º]

7. Density Bottle is also called as
(a) Saccharometer
(b) Lactometer
(c) Pycnometer
(d) Barometer   **[Ans : (c) Pycnometer]**

8. An object completely immersed in fluid displaces its own volume of fluid.
(a) Floatation principle
(b) Principle of buoyancy
(c) Pascal's law
(d) Archimedes principle

[Ans : (d) Archimedes principle]

9. A solid floats in liquid with a portion of it being submerged. Then
(a) The liquid exerts an upthrust equal to weight of the solid
(b) The weight of the dispersed liquid is equal to the weight of solid
(c) Solid exerts a force equal to its weight on liquid
Choose correct statements
(A) a & b
(B) a & c
(C) b & c
(D) All of these

[Ans : (A) a & b]

VI. Answer in brief :

1. **What happen when pressure is increased in solids?**

Ans. If pressure is increased in solids

   (i) it experiences tension,   (ii) it ultimately deforms (or) breaks.

2. **How will you calculate fluid pressure?**

Ans. Fluid pressure = $\dfrac{\text{Total Force exerted by the fluid}}{\text{Area over which the force is exerted}} = \dfrac{F}{A}$

3. **How will you find the absolute pressure?**

Ans. (1)   For pressures higher than atmospheric pressure:

   Absolute pressure = Atmospheric pressure + Gauge pressure.

   (2)   For pressures lower than atmospheric pressure:

   Absolute pressure = Atmospheric pressure – Gauge pressure.

4. **Why do Scuba divers wear special suits and equipment?**

Ans. (1)   Deep sea has pressure twice that of atmospheric pressure.

   (2)   At high pressure, parts of our body including blood vessels & soft tissues cannot withstand.

   Hence they use special suits & equipments for protection.

5. **Define : Relative Density.**

Ans. Relative density of a substance is defined as ratio of density of substance to density of water at 4°C.

   Relative density = $\dfrac{\text{Density of substance}}{\text{Density of water at } 4^\circ C}$.

6. **Name different types of Hydrometers with their applications.**

Ans.

S.No	Name of Hydrometer	Application (measuring)
1.	Lactometer	Density of milk
2.	Saccharometer	Density of sugar in a liquid
3.	Alcoholometer	Higher levels of alcohols in Spirits

7. **What do you understand by the term "Buoyancy".**

Ans. When a body partially or completely immersed in a liquid (fluid), pressure is more at the bottom and less at the surface in the liquid.

   This Pressure difference causes an upward force called "Buoyant force". The phenonmenon is called 'Buoyancy'.

8. **How do submarines sink and float in water?**

Ans. Submarines change the level of floating by pumping in and pumping out water into its compartments.

9. **Differentiate positive & negative buoyant.**

Ans.

S.No	Positive Buoyant	Negative Buoyant
1.	Weight of the object is less than the amount of water displaced.	Weight of the object is more than the amount of water displaced.
2.	More buoyant force	Less Buoyant force.
3.	Object will float	Object will sink.

10. **You have a bag of cotton and an iron bar, each indicating a mass of 100 kg when measured on a weighing machine. In reality, one is heavier than other. Can you say which one is heavier and why?**

Ans. The bag containing iron bar is heavier than cotton.

Reason : Although both of them have same weight, the bag of iron bar has less volume so more dense compared to the bag of cotton which has more volume and less dense.

VII. Answer in detail :

1. **Derive expression for Pressure due to Liquid column.**

Ans. A tall beaker filled with water to form a liquid column

$$\text{Area of cross section at bottom} = A$$
$$\text{Height of liquid column} = h$$
$$\text{Density of the liquid} = \rho$$
$$\text{Thrust at bottom of liquid column (F)} = \text{Weight of liquid.}$$
$$F = mg \quad \text{...(1)} \quad (\because m - \text{mass of liquid})$$
$$\text{Mass, } m = \rho \times V \quad \text{.......(2)}$$
$$\text{Volume of liquid column, } V = \text{Area of cross section (A)} \times \text{height } (h)$$
$$V = A h \quad \text{....... (3)}$$
$$\text{Substitute (3) in (2) } m = \rho A h \quad \text{.........(4)}$$
$$\text{Substitute (4) in (1) } F = \rho A h g \quad \text{.........(5)}$$
$$\text{Pressure (P)} = \frac{\text{Thrust (F)}}{\text{Area (A)}} = \frac{\rho A h g}{A}$$

$\therefore$ **P = hρg** – This is the expression for pressure due to liquid column.

2. **Describe the construction and working of Pycnometer.**

**Ans. Pycnometer (Density Bottle)**

Purpose : To measure relative density.

Construction :

(1) Pycnometer consists of a ground glass stopper with a fine hole through it.

(2) When the bottle is filled and the stopper is inserted, the excess liquid rises through the hole and runs down outside the bottle.

VIII. Numerical Problems :

1. A vessel with water is placed on a weighing pan and it reads 600 g. Now a ball of mass 40 g and density is 0.80g / cm³ is sunk into the water with a pin of negligible volume as shown in figure. The weighing pan will show the reading of ....?
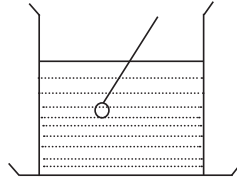
Solution :

$$\text{Weight of vessel with water} = 600 \text{ g}$$
$$\text{Mass of ball} = 40 \text{ g}$$
$$\text{Density of bal} = 0.80 \text{ g / cm}^3$$
$$\text{Volume of the ball} = \frac{\text{mass}}{\text{density}} = \frac{40}{0.80} = 50 \text{ g}$$
$$\text{So, weight of vessel + volume of ball} = 600 + 50 \text{ g}$$
$$\text{The weighing pan will show} = 650 \text{ g}$$
$$\text{The weighing pan will show} = \mathbf{650 \text{ g}}$$

2. The reading of a spring balance when a block is suspended from it in air is 60 newton. This reading is changed to 40 newton when the block is submerged in water. Calculate the specific gravity of block.

Solution :

$$\text{Weight of block in air} = 60 \text{ newton}$$
$$\text{Loss of weight of block in water} = 60 - 40 = 20 \text{ newton}$$
$$\text{Relative density (or) specific gravity} = \frac{\text{Weight of block in air}}{\text{Loss of weight in water}}$$
$$= \frac{60 \text{ newton}}{20 \text{ newton}}$$
$$\text{Specific gravity of block} = \mathbf{3}$$

3. The mass of a body is 4 kg and its volume is 500 cm³. Find its relative density.

Solution :

$$\text{Mass of the body m} = 4 \text{ kg} = 4000 \text{ g}$$
$$\text{Volume of the body v} = 500 \text{ cm}^3$$
$$\therefore \text{Density of the body} = \frac{\text{Mass (m)}}{\text{Volume (v)}} = \frac{4000}{500}$$
$$\therefore \text{The relative density of the body} = 8 \text{ g cm}^{-3}$$
$$= \frac{\text{Density of substance}}{\text{Density of water}}$$
$$= \frac{8 \ g/cm^3}{1 \ g/cm^3} = 8$$
$$\text{Relative density of the body} = \mathbf{8}$$

4. **Calculate the pressure produced by a force of 800 N acting on an area of 2.0 m².**

Solution : Force   =   800 N

Area   =   2.0 m²

Pressure, P   = $\dfrac{\text{Force}}{\text{Area}} = \dfrac{800}{2.0}$ = 400 Nm⁻²

Pressure P   =   **400 Nm⁻²** (or) **400 Pa**

5. **A swimming pool of width 9.0 m and length 24.0 m is filled with water of depth 3.0 m. Calculate the pressure on the bottom of the pool due to the water.**

Solution :   Width of the pool, b =   9.0 m

Length of the pool, l =   24.0 m

Depth of the pool, h =   3.0 m

Density of water, ρ =   1000 kg/m³

Pressure due to column of Fluid, P   =   **$\rho h g$**

Acceleration due to gravity, g =   9.8 m/s²

Substituting the values,   P   =   **$\rho h g$**

P   =   (1000 kgm⁻³) ×(3.0m) × (9.8 ms⁻²)

Pressure, P   =   29400 kgm⁻¹s⁻²   ∵ **1Pa = 1 kgm⁻¹s⁻²**

∴   P   =   **29400 Nm⁻²(or) 29400 Pa**

6. **A body of volume 100 cc is immersed completely in water contained in a jar. The weight of water and the jar before immersion of the body was 700 g. Calculate the weight of water and jar after immersion.**

Ans. Volume of body completely immersed in water, V   =   100 cc.

Weight of water and jar before Immersion   =   700 g.

Volume of jar immersed in water   =   Volume of water displaced

=   100 cc.

Density of water   =   1g/cm³

Mass of water displaced   =   Apparent weight loss

Mass of water displaced   =   Volume × Density.

=   100 cc ×1g/cm³.

Apparent weight loss of body   =   100 g

Weight of jar and water after immersion   =   Weight of water and

jar before immersion +

Apparent weight loss

=   700 g + 100 g

=   **800 g.**

07

HEAT

LEARNING OBJECTIVES

After completing this chapter, the students will be able to:

- ❑ Understand the nature and the effects of heat.
- ❑ Differentiate the conducting powers of various substances.
- ❑ List out good and bad conductors of heat and their uses.
- ❑ Explain conduction using kinetic theory.
- ❑ Describe the experiments to show convection in fluids.
- ❑ Understand the concept of radiation.
- ❑ Define specific heat capacity and thermal capacity.
- ❑ Describe the concept of change of state.
- ❑ Define specific latent heat of fusion and specific latent heat of vaporisation.

TEXT BOOK EXERCISES

I. Choose the correct answer :

1. Calorie is the unit of
   (a) heat   (b) work   (c) temperature   (d) food

[Ans : (a) heat]

2. SI unit of temperature is
   (a) fahrenheit   (b) joule
   (c) celsius   (d) kelvin   **[Ans : (d) kelvin]**

3. Two cylindrical rods of same length have the area of cross section in the ratio 2:1. If both the rods are made up of same material, which of them conduct heat faster?
   (a) Both rods   (b) Rod-2
   (c) Rod-1   (d) None of them

[Ans : (c) Rod-1]

4. In which mode of transfer of heat, molecules pass on heat energy to neighbouring molecules without actually moving from their positions?
   (a) Radiation   (b) Conduction
   (c) Convection   (d) Both B and C   **[Ans : (a) Radiation]**

5. **A device in which the loss of heat due to conduction, convection and radiation is minimized is** ⊗

   (a) solar cell   (b) solar cooker

   (c) thermometer   (d) thermos flask

[Ans : (d) Thermos flask]

II. Fill in the blanks :

1. The fastest mode of heat transfer is _____.   **[Ans : radiation]**
2. During day time, air blows from _____ to _____. **[Ans : sea to land]**
3. Liquids and gases are generally _____ conductors of heat.   **[Ans : poor]**
4. The fixed temperature at which matter changes state from solid to liquid is called _____.   **[Ans : melting point]**

III. 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 :** Food can be cooked faster in vessels with copper bottom.

   Reason : Copper is the best conductor of heat.

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

2. **Assertion :** Maximum sunlight reaches earth's surface during the noon time.

   Reason : Heat from the sun reaches earth's surface by radiation.

   [Ans : (b) If both assertion and reason are true but reason is not the correct explanation of assertion]

   Reason : When the sun is at its highest point, the earth's surface absorbs more heat and retains. This heat is slowly radiated out causing increase in temperature.

3. **Assertion :** When water is heated up to 100º C, there is no raise in temperature until all water gets converted into water vapour.

   Reason : Boiling point of water is 10º C.

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

   Reason : When a substance changes from one state to another, a considerable amount of heat energy is absorbed or liberated. This energy is called latent heat.

IV. Answer briefly :

1. **Define conduction.**

Ans. The process of transfer of heat in solids from a region of higher temperature to a region of lower temperature without the actual movement of molecules is called conduction.

2.   Ice is kept in a double-walled container. Why?

Ans. An ice-box is made of double wall and the space between the walls is filled with some non-conducting materials to provide heat insulation, so that the loss of heat can be minimized. Hence ice is kept in a double-walled container.

3.   How does the water kept in an earthen pot remain cool?   **[*HY - 2019*]** ⊗

Ans. As the water seeps out of the earthern pot, it gets evaporated and takes away heat from the vessel. The water in the pot gets cooled.

4.   Differentiate convection and radiation.

Ans.

Convection	Radiation
Convention is the flow of heat through a fluid from places of higher temperature to places of lower temperature by the movement of fluid itself.	Radiation is a method of heat transfer that does not require particles to carry the heat energy. Thus, radiation is the flow of heat from one place to another by means of electromagnetic waves.
Convection needs matter to be present.	Radiation can occur even in vacuum.
Convection seen in daily life. **Eg :** Hot air balloons, breeze, Wind, Chimney	Radiation seen in daily life. **Eg:** White or light coloured cloths, highly polished surface of airplane helps to reflect most of the heat radiation from from the sun.

5.   Why do people prefer wearing white clothes during summer?

Ans. People prefer white or light coloured clothes during summer as they are good reflecters of heat and hence they keep us cool. On the other hand, dark coloured clothes absorb more heat from the sun and keep us warm in winter.

6.   What is specific heat capacity?   ⊗

Ans. Specific heat capacity of a substance is defined as the amount of heat required to raise the temperature of 1 kg of the substance by 1ºC or 1 K. The SI unit of specific heat capacity is $Jkg^{-1} K^{-1}$. The most commonly used units of specific heat capacity are J/kg°C and J/g°C.

7.   Define thermal capacity.

Ans. Thus, heat capacity or thermal capacity is defined as the amount of heat energy required to raise the temperature of a body by 1°C. It is denoted by C'.

Heat Capacity = $\dfrac{\text{Quantity of heat required}}{\text{Raise in Temperature}}$

$C' = Q / T$

SI unit of heat capacity is J/K. It is also expressed in cal/°C, kcal/°C or J/°C.

8.   Define specific latent heat capacity.

Ans. Specific latent heat is the amount of heat energy absorbed or liberated by unit mass of a substance during change of state without causing any change in temperature.

The SI unit of specific latent heat is J/kg.

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]

[138]

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 Vibrations (complete waves or cycles) 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.

(or) There is no medium on moon for the sound to travel.

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.
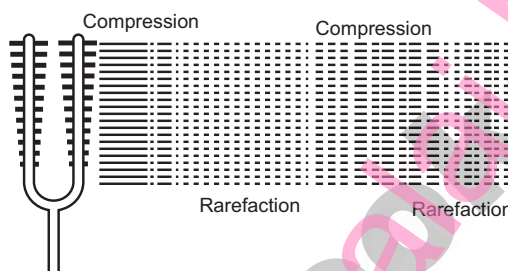
Rarefaction :

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.
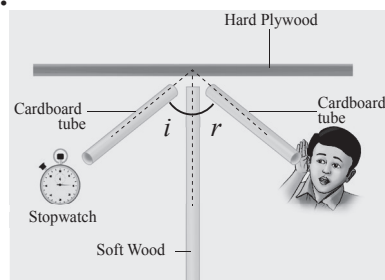
3. **List the applications of sound.**

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.

2. **Industry :**

To detect cracks and flaws in metal blocks.

3. **Medicine**

(i) **Echo cardiography :**

Ultrasonic waves are made to reflect from various parts of the heart and form the image of the heart.

(ii) **In Kidney :**

To break small stones formed in the kidney into fine grains, which is flushed out with urine.

4. **Explain how does SONAR work.**

Ans. (i) **SONAR** stands for SOund Navigation And Ranging. Sonar consists of a transmitter and a detector and is installed at the bottom of boats and ships.

(ii) **The Transmitter** produces and transmits ultrasonic waves. These waves travel through water.

(iii) **The detector** converts the ultrasonic waves into electrical signals which are appropriately interpreted. The distance of the object that reflected the sound wave can be calculated by knowing the speed of sound in water and the time interval between transmission and reception of the ultrasound.

(iv) Let the time interval between transmission and reception of ultrasound signal be 't'. Then, the speed of sound through sea water is $2d/t = v$.

(v) This method is called echo-ranging. Sonar technique is used to determine the depth of the sea and to locate underwater hills, valleys, submarine, icebergs etc.

VI. Numerical problems :

1. **The frequency of a source of sound is 600 Hz. Calculate the number of times it vibrates in a minute?**

Solution :

Given :

Frequency, v = 600 Hz.
Frequency = Number of vibrations in a second.
Frequency in a minute = Frequency per second × 60
= 600 Hz × 60
No. of vibrations in a minute = 36,000 times

2. **A stone is dropped from the top of a tower 750 m high into a pond of water at the base of the tower. Calculate the number of seconds for the splash to be heard?**

(Given g = 10 m s⁻² and speed of sound = 340 m s⁻¹)

Solution :

Given :

Height of tower, s = 750 m
Acceleration, g = 10 ms⁻²
Speed of sound, v = 340 ms⁻¹
Initial velocity of stone, u = 0 (stone at rest)

Consider

(i) Time taken to reach the pond, t_1.

(ii) Time taken by sound to reach top, t_2

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.
- ❑ Know Kepler's laws of motion.
- ❑ 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]

[154]

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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 the 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.

Time Period, $T = \dfrac{\text{Distance covered}}{\text{Orbital velocity}} \Rightarrow T = \dfrac{2\pi r}{V}$

By Substituting the value of V, we get, $T = \dfrac{2\pi(R + h)}{\sqrt{\dfrac{GM}{(R + h)}}}$

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.

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, each lasting 42 years.

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. It saved a village in Irag from being deserted due to lack of clean water.

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.
    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 is called as orbital velocity.

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.
4. The orbital speed and distance permit the satellite to make one revolution in 24 hours.
5. Since Earth also rotates once in 24 hours, a satellite stays in a fixed position relative to a point on Earth's surface.

UNIT 12

PERIODIC CLASSIFICATION OF ELEMENTS

LEARNING OBJECTIVES

After completing this lesson, students will be able to

- ❑ Know the concept of classification of elements in early days.
- ❑ Understand the postulates, advantages and limitations of modern periodic table.
- ❑ Understand the classification of elements based on the electronic configuration.
- ❑ Learn about the position of hydrogen in the periodic table.
- ❑ Study about the position of rare gases (Noble gases) in the periodic table.
- ❑ Distinguish between metals and non-metals.
- ❑ Know about metalloids and alloys.

TEXT BOOK EXERCISES

I. Choose the correct answer :

1. If Dobereiner is related with 'law of triads', then Newlands is related with [*HY - 2019*]
   - (a) Modern periodic law
   - (b) Hund's rule
   - (c) Law of octaves
   - (d) Pauli's Exclusion principle

   [Ans : (c) Law of octaves]

2. Modern periodic law states that the physical and chemical properties of elements are the periodic functions of their _____ .
   - (a) atomic numbers
   - (b) atomic masses
   - (c) similarities
   - (d) anomalies   **[Ans : (a) atomic numbers]**

3. Elements in the modern periodic table are arranged in _____ groups and _____ periods .   [*QY - 2019*]
   - (a) 7, 18
   - (b) 18, 7
   - (c) 17, 8
   - (d) 8, 17

   [Ans : (b) 18, 7]

II. Fill in the blanks :

1. In Dobereiner's triads, the atomic weight of the middle element is the _____ of the atomic masses of 1st and 3rd elements.   **[Ans: average]**

[203]

2. Noble gases belong to _____ group of the periodic table.   **[Ans: 18th]**

3. The basis of the classifications proposed by Dobereiner, Newlands and Mendeleev was _____.   **[Ans: atomic mass]**

4. Example for liquid metal is _____ .   **[Ans: mercury]**

III. Match the following :

Triads	Newlands
Alkali metal	Calcium
Law of octaves	Henry Moseley
Alkaline earth metal	Sodium
Modern Periodic Law	Dobereiner

Ans.

Triads	Dobereiner
Alkali metal	Sodium
Law of octaves	Newlands
Alkaline earth metal	Calcium
Modern Periodic Law	Henry Moseley

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

1. Newlands' periodic table is based on atomic masses of the elements and modern periodic table is based on atomic number of elements.

Ans. True.

2. Metals can gain electrons.

Ans. False.

  Correct statement : Metals tend to **lose** electrons.

3. Alloys bear the characteristics of both metals and nonmetals.

Ans. False.

  Correct statement : Metalloids bear the characteristics of both metals and nonmetals.

4. Lanthanides and actinides are kept at the bottom of the periodic table because they resemble each other but they do not resemble with any other group elements.

Ans. True.

5. Group 17 elements are named as Halogens.

Ans. True.

V. Assertion and reason type questions :   *[QY - 2019]*

Statement : Elements in a group generally possess similar properties but elements along a period have different properties.

Reason : The difference in electronic configuration makes the element differ in their chemical properties along a period.

  a) Statement is true and reason explains the statement.

  b) Statement is false but the reason is correct.

  [Ans : (a) Statement is true and reason explains the statement]

VI. Answer the following :

1. State modern periodic law. [QY - 2019] ⊗

Ans. The Modern periodic law can be stated as follows: "The Chemical and Physical properties of the elements are the periodic functions of their atomic number".

2. What are groups and periods in the modern periodic table? [QY - 2019]

Ans. (i) The horizontal rows in the periodic table are called periods.

(ii) Vertical columns in the periodic table starting from top to bottom are called groups.

3. What are the limitations of Mendeleev's periodic table? [QY - 2019] [HY - 2019]

Ans. (i) Elements with large difference in properties were included in the same group. Eg: Hard metals like copper (Cu) and silver (Ag) were included along with soft metals like sodium (Na) and potassium (K).

(ii) No proper position could be given to the element hydrogen. Non-metallic hydrogen was placed along with metals like lithium (Li), sodium (Na) and potassium (K).

(iii) The increasing order of atomic mass was not strictly followed throughout. Eg. Co & Ni, Te & I.

(iv) No place for isotopes in the periodic table.

4. State any five features of modern periodic table. [QY - 2019]

Ans. (i) All the elements are arranged in the increasing order of their atomic number.

(ii) The horizontal rows are called periods. There are seven periods in the periodic table.

(iii) The elements are placed in periods based on the number of shells in their atoms.

(iv) Vertical columns in the periodic table starting from top to bottom are called groups. There are 18 groups in the periodic table.

(v) Based on the physical and chemical properties of the elements, they are grouped into various families.

✎ Intext Activities

ACTIVITY - 1

Find the pair of elements having similar properties by applying Newlands' law of Octaves (Example: Mg & Ca):

Set I : F, Mg, C, O, B

Set II: Al, Si, S, Cl, Ca

Ans. (1) F - Cl

(2) Mg - Ca

(3) C - Si

(4) O - S

(5) B - Al

UNIT
14

ACIDS, BASES AND SALTS

LEARNING OBJECTIVES

After completing this lesson, students will be able to :

- Know about formation, properties and uses of acids, bases and salts.
- Know the importance of acid, bases and salts in daily life.
- Understand how to identify the nature of a solution by using indicators and pH paper.
- Know strength of acid or base solutions.
- Define pH scale and explain the significance of pH in everyday life.
- Know aquaregia and its properties.

TEXT BOOK EXERCISES

I.   Choose the correct answer :

1. $Zn + 2\ HCl \rightarrow ZnCl_2 + ...\uparrow$ (H_2, O_2, CO_2) **[Ans : H_2]**

2.   Apple contains malic acid. Orange contains _____ (citric acid, ascorbic acid). ⊗
                                                                                          [Ans : ascorbic acid]

3.   Acids in plants and animals are organic acids. Whereas Acids in rocks and minerals are _____ (Inorganic acids, Weak acids).   **[Ans : inorganic acids]**

4.   Acids turn blue litmus paper to _____ (green, red, orange).   **[Ans : red]**

5.   Since metal carbonate and metal bicarbonate are basic, they react with acids to give salt and water with the liberation of _____ (NO_2, SO_2, CO_2).   **[Ans : CO_2]**

6.   The hydrated salt of copper sulphate has _____ colour (red, white, blue).

                                                                                          [Ans : blue]

II.   Answer briefly :

1.   Classify the various types of Acids based on their sources.

Ans. The acids are classified based on their sources as organic and inorganic acids.

Organic acids - acids present in plants and animals. Eg: $HCOOH$, CH_3COOH

Inorganic acids - acids prepared from rocks and minerals. Eg: HCl, HNo_3, H_2So_4

2. Write any four uses of acids.

Ans. (i) Sulphuric acid is called King of Chemicals because it is used in the preparation of many other compounds. It is used in car batteries also.

(ii) Hydrochloric acid is used as a cleansing agent in toilets.

(iii) Citric acid is used in the preparation of effervescent salts and as a food preservative.

(iv) Nitric acid is used in the manufacture of fertilizers, dyes, paints and drugs.

(v) Oxalic acid is used to clean iron and manganese deposits from quartz crystals. It is also used as bleach for wood and removing black stains.

(vi) Carbonic acid is used in aerated drinks.

(vii) Tartaric acid is a constituent of baking powder.

3. Give the significance of pH of soil in agriculture.

Ans. In agriculture, the pH of soil is very important. Citrus fruits require slightly alkaline soil, while rice requires acidic soil and sugarcane requires neutral soil.

4. What are the various uses of Aquaregia.

Ans. (i) It is used chiefly to dissolve metals such as gold and platinum.

(ii) It is used for cleaning and refining gold.

5. What are the uses of Plaster of Paris?

Ans. (i) It is used for plastering bones.

(ii) It is used for making casts for statues.

6. Two acids 'A' and 'B' are given. Acid A gives one hydrogen ion per molecule of the acid in solution. Acid B gives two hydrogen ions per molecule of the acid in solution. [*HY - 2019*]

(i) **Find out acid A and acid B.**

(ii) **Which acid is called the King of Chemicals?**

Ans. (i) **Acid A** is HCl (Hydrochloric acid) **Acid B** is H_2SO_4 (Sulphuric acid).

(ii) Sulphuric acid - H_2SO_4.

7. Define aquaregia.

Ans. (i) Metals like gold and silver are not reactive with either HCl or HNO_3. But the mixture of these two acids can dissolve gold. This mixture is called Aquaregia.

(ii) It is a mixture of hydrochloric acid and nitric acid prepared optimally in a molar ratio of 3:1.

(iii) It is a yellow-orange fuming liquid. It is a highly corrosive liquid, able to attack gold and other substances.
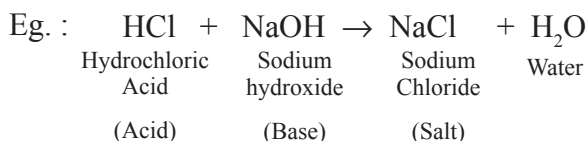
8. Correct the mistakes :

(a) **Washing soda is used for making cakes and bread soft, spongy.**

(b) **Calcium sulphate hemihydrate is used in textile industry for bleaching cloths .**

Ans. (a) Baking soda (Sodium bicarbonate - $NaHCO_3$) is used for making cakes and bread soft and spongy. (or) Washing soda is used for softening hard water.

(b) Calcium sulphate hemihydrate ($CaSO_4 : 1/2\ H_2O$)is used for plastering bones (or) Bleaching powder (Calcium Oxychloride - $CaOCl_2$) is used in textile industry.

9.   What is neutralization reaction? Give an example.

Ans. Neutralization reaction is a reaction in which an acid reacts with a base to form salt and water and H^+ ion and OH^- ion combines to generate water. The neutralization of a strong acid and strong base has a pH equal 7.

Eg. :   HCl   +   NaOH   →   NaCl   + H_2O
        Hydrochloric   Sodium   Sodium   Water
            Acid   hydroxide   Chloride

          (Acid)   (Base)   (Salt)

III. Answer in detail :

1.   Differentiate hydrate and anhydrous salts with examples.

Ans.

	Hydrate Salt	**Anhydrous Salt**
1.	Salts that contain water of cyrstallisation are called hydrated salts.	Salts that do not contain water of crystallisation are called anhydrous salt.
2.	The number of molecules of water hydrated to a salt is indicated after a dot in its chemical formula.	They are generally found as powders.
3.	For example, Copper sulphate crystal have five molecules of water. It written as $CuSo_4.5H_2O$ and named as Copper Sulphate Pentahydrate.	Anhydrous compounds can absorb water from the air. Example: NaCl.

2.   Give the tests to identify Acids and Bases.   [*HY - 2019*]

Ans. (i)   Acids turn blue litmus red, bases turn red litmus blue.
      (ii)   In acid, phenolphthalein is colourless. In base Phenolphthalein is pink in colour.
      (iii)   In acid, methyl orange is pink. In base, methyl orange is yellow.

3.   Write any four uses of bases.   ⊗

Ans. (i)   Sodium hydroxide is used in the manufacture of soap.
      (ii)   Calcium hydroxide is used in white washing of building.
      (iii)   Magnesium hydroxide is used as a medicine for stomach disorder.
      (iv)   Ammonium hydroxide is used to remove grease stains from cloth.

4.   Write any five uses of salts.

Ans. Common Salt (NaCl) :
      It is used in our daily food and used as a preservative.
      Washing Soda (Sodium Carbonate - Na_2CO_3) :
      (i)   It is used in softening hard water.
      (ii)   It is used in glass, soap and paper industries.
      Baking Soda (Sodium bicarbonate -$NaHCO_3$) :
      (i)   It is used in making of baking powder which is a mixture of baking soda and tartaric acid.
      (ii)   It is used in soda-acid fire extinguishers.
      (iii)   Baking powder is used to make cakes and bread, soft and spongy.
      (iv)   It neutralizes excess acid in the stomach and provides relief.
      Bleaching powder (Calcium Oxychloride - CaOCl_2) :
      (i)   It is used as disinfectant.
      (ii)   It is used in textile industry for bleaching cotton and linen.

UNIT 16

APPLIED CHEMISTRY

LEARNING OBJECTIVES

After completing this lesson, students will be able to :

- ❑ Understand the various branches of applied chemistry.
- ❑ Know the technology of Nanochemistry.
- ❑ Know the various types of drugs.
- ❑ Understand the various uses of electrochemistry.
- ❑ Understand the applications of radiochemistry.
- ❑ Understand the various types of dyes and their application.
- ❑ Acquire knowledge about food chemistry and agricultural chemistry.
- ❑ Understand some basic ideas about forensic chemistry.

TEXT BOOK EXERCISES

I. Choose the correct answer :

1. One Nanometre is

(a) 10^{-7} metre (b) 10^{-8} metre   (c) 10^{-6} metre   (d) 10^{-9} metre

[Ans : (d) 10^{-9} metre]

2. The antibiotic Penicillin is obtained from _____.

(a) plant   (b) microorganism

(c) animal   (d) sunlight **[Ans : (b) microorganism]**

3. 1% solution of Iodoform is used as

(a) antipyretic   (b) antimalarial

(c) antiseptic   (d) antacid **[Ans :(c) antiseptic]**

4. The cathode of an electrochemical reaction involves _____.

(a) oxidation   (b) reduction

(c) neutralisation   (d) catenation **[Ans :(b) reduction]**

[Hint : It involves gain of electrons]

[259]

5. **The age of a dead animal can be determined by using an isotope of _____.**
   (a) carbon   (b) iodine
   (c) phosphorous   (d) oxygen   **[Ans : (a) carbon]**

   [Hint : C_6^{14} isotope is used]

6. **Which of the following does not contain natural dyes?**
   (a) Potato   (b) Beetroot   (c) Carrot   (d) Turmeric
   [Ans : (a) Potato]

7. **This type of food protect us from deficiency diseases.**
   (a) Carbohydrates   (b) Vitamins
   (c) Proteins   (d) Fats   **[Ans : (b) vitamins]**

8. **Radiochemistry deals with**
   (a) oxidants   (b) batteries   (c) isotopes   (d) nanoparticles
   [Ans : (c) isotopes]

9. **The groups responsible for the colour of an organic compound is called**
   (a) isotopes   (b) auxochrome   (c) chromogen   (d) chromophore
   [Ans : (d) chromophore]

10. **Chlorinated hydrocarbons are used as**
    (a) fertilizers   (b) pesticides
    (c) food colourants   (d) preservatives   **[Ans : (b) pesticides]**

II. Fill in the blanks :

1. _____ is an electrochemical cell which converts electrical energy into chemical change (Reaction).   **[Ans : Electrolytic cell]**

2. Painkiller drugs are called _____.   **[Ans : analgesics]**

3. Indigo is a _____ dye.   **[Ans : vat]**

4. _____, _____ and _____ are macronutrients required for plant growth.
   [Ans : Nitrogen, phosphorous and potassium]

5. _____ is a chemical used in finger print analysis.   **[Ans : Ninhydrin]**

III. Match the following :

Antipyretics	-	Large surface area	**Ans.**	Antipyretics	-	Fever
Corrosion prevention	-	Iodine–131		Corrosion prevention	-	Electroplating
Hyperthyroidism	-	Fever		Hyperthyroidism	-	Iodine–131
Nanoparticle	-	Body building		Nanoparticle	-	Large surface area
Proteins	-	Electroplating		Proteins	-	Body building

IV. Answer briefly :

1. What is Radio Carbon Dating?

Ans. Radio carbon dating is a method by which the age of fossil wood or animal is determined using C–14 isotope.

2. What are called Anaesthetics? How are they classified?

Ans. The drugs which cause loss of sensation is called **Anaesthetics.**

Classification : Anaesthetics are classified according to the area of application as, 1. General Anaesthetics, 2. Local Anaesthetics.

3. What is the need for chemical fertilizers in crop fields?

Ans. The need for chemical fertilizers in crop fields is to supply essential micro and macro nutrients required for crop growth.

4. What is Forensic chemistry related to?

Ans. Forensic chemistry is related to application of scientific principles, techniques and methods to the investigation of crime.

V. Answer in detail :

1. Explain the types of dyes based on their method of application.

Ans. (i) Acid dyes :
   (a) These are acidic in nature.
   (b) They are used for dyeing animal fibres and synthetic fibres.
   (c) These can be used for protein fibre such as wool and silk.
       Example: Picric acid, Naphthol yellow-s.

(ii) Basic dyes :
   (a) These are basic dyes containing basic group ($- NH_2$, NHR, $-NR_2$).
   (b) They are used for dyeing animal fibres and plant fibres.
       (Example : Crystal violet, Methylene Blue).

(iii) Mordant dyes (or) Indirect dyes :
   (a) These dyes have a poor affinity for cotton fabrics and hence do not dye directly.
   (b) They require pretreatment of the fibre with a mordant.
   (c) Mordant is a substance which can be fixed to the fibre and then can be combined with the dye to form an insoluble complex called lake.
   (d) Salts of aluminium, chromium and iron are used as mordants.
       (Example : Alizarin).

(iv) Direct dyes :
   (a) They have high affinity for cotton, rayon and other cellulose fibre.
   (b) So they are applied directly as they fix firmly on the fabric.
       Example: Congo red.

(v) Vat dyes :
   (a) It can be used only on cotton and, not on silk and wool.
   (b) This dyeing is a continuous process and is carried out in a large vessel called vat.
   (c) So it is called as Vat dye.
       Example : Indigo

2. Name various food additives and explain their functions.

Ans.

S. No	Type of Additive	Function of the additive	Example
1.	Preservatives	They protect food from spoilage by microorganism in storage.	Vinegar, Sodium benzoate, Benzoic acid, Sodium nitrite.
2.	Colourants	They give pleasant colours to food.	Carotenoids, Anthocyanin, Curcumin.
3.	Artificial Sweeteners	They add sweet taste to food.	Saccharin, Cyclamate.
4.	Flavour enhancers	They are used to enhance the flavour of food items.	Monosodium glutamate, (MSG), Calcium diglutamate.
5.	Antioxidants	1. They prevent the oxidation of food. 2. They protect us against cardiovascular disease.	Vitamin C, Vitamin E, Carotene.

VI. Higher Order Thinking Skills :

1. Batteries that are used in mobile phone can be recharged. Likewise, can you recharge the batteries used in watches? Justify your answer.

Ans. The type of batteries used in watches are **Primary cell.** (Mercury–Oxide battery)

The type of batteries used in mobile phone are **Secondary cell.** (Lithium –ion polymer battery)

The differences between primary and secondary cell are as follow:

S.No	Primary Cell	Secondary cell
1.	The chemical reaction of primary cell is irreversible.	The chemical reaction of secondary cell is reversible.
2.	It can not be recharged.	It can be recharged.

2. Sudha met with a fire accident. What kind of drug(s), she must take?

Ans. (i) Analgesic tablets can be taken to relieve from pain.

(ii) Antiseptic creams can be given to prevent infection.

(iii) Antibiotic creams can be given in order to inhibit the growth or metabolism of some other disease causing microorganism in the wound.

3. The soil pH of a crop land is 5. What kind of fertilizers should be used in that land?

Ans. pH of 5 indicates the soil is acidic. So alkaline fertilizers should be used.

(e.g.,) Potash fertilizers, Nitrogen fertilizers.

✍ **Intext Activities**

ACTIVITY - 1

With the help of your teacher, construct the galvanic cell using lemon and potato. Identify their anode, cathode and electrolyte.

Aim : To construct a galvanic cell using lemon (or) potato.

Materials required :

A large fresh and juicy lemon, zinc coated nail, small copper coin, LED light and connecting wires.

Procedure :

(i)   Insert the copper coin into the lemon.

(ii)   Push a zinc coated nail into the other side of the lemon.

(iii) The copper coin and zinc coated nail are connected to low voltage LED bulb.

(iv)   Now observe the results. (happenings).

Observation :

(i)   Copper coin acts as cathode, zinc coated nail acts as Anode. Lemon juice act as electrolyte.

(ii)   We observe glow of LED light, which confirms the electricity to flow through the lemon.

Conclusion : Galvanic cell using lemon is constructed.   *[End of the activity]*

Additional Questions

I. Choose the correct answer :

1. **Nanoparticles are unstable when they come in contact with** _____

(a) air   (b) hydrogen   (c) oxygen   (d) all the above

[Ans : (c) oxygen]

2. **Which is the incorrect statement in the following?**

(a) The structure of nano material is in between an atom and bulk material.

(b) Nano materials exist in the corresponding bulk materials.

(c) Nano materials have extremely large surface area to volume ratio.

(d) SEM is used analyse the surface properties of a nanoparticle with high resolution.

Ans : (b) Nano materials exist in the corresponding bulk materials]

3. **Which anaesthetic forms a toxic carbonyl chloride?**

(a) Nitrous oxide   (b) Ether

(c) Chloroform   (d) Iodoform   **[Ans : (c) Chloroform]**

4. **Paracetamol is an** _____.

(a) analgesic   (b) antiseptic

(c) antimalarial   (d) antipyretic   **[Ans : (c) antipyretic]**

UNIT

18

ORGANISATION OF TISSUES

LEARNING OBJECTIVES

After completing this chapter, the students will be able to:

- ❑ Know the different types of tissues and their morphology.
- ❑ Identify how tissues are organized in specific patterns to form organs.
- ❑ Understand how tissues perform life activities in plants and animals.
- ❑ Gain knowledge about the structural organisation of tissues.
- ❑ Get familiarized with the process, types and significance of cell division.

TEXT BOOK EXERCISES

I. Choose the correct answer :

1. The tissue composed of living thin walled polyhedral cell is   [*HY - 2019*]
   (a) parenchyma   (b) pollenchyma
   (c) pclerenchyma   (d) None of above

[Ans : (d) none of above]

2. The fibres consists of   [*QY - 2019*]
   (a) parenchyma   (b) sclerenchyma
   (c) collenchyma   (d) None of above

[Ans : (b) sclerenchyma]

3. Companion cells are closely associated with
   (a) sieve elements   (b) vessel elements
   (c) trichomes   (d) guard cells   **[Ans : (a) sieve elements]**

4. Which of the following is a complex tissue?
   (a) Parenchyma   (b) Collenchyma
   (c) Xylem   (d) Sclerenchyma   **[Ans : (c) Xylem]**

5. Aerenchyma is found in
   (a) epiphytes   (b) hydrophytes   (c) halophytes   (d) xerophytes

[Ans : (b) hydrophytes]

[288]

6. **Smooth muscles occur in**

   (a)   uterus   (b)   artery   (c)   vein   (d)   all of the above

[Ans : (d) all of the above]

7. **Nerve cell does not contains**

   (a)   axon   (b)   nerve endings   (c)   tendons   (d)   dendrites

[Ans : (c) tendons]

II. Match the following.

		Ans.		
Sclereids	Chlorenchyma		Sclereids	Sclerenchyma
Chloroplast	Sclerenchyma		Chloroplast	Chlorenchyma
Simple tissue	Collenchyma		Simple tissue	Collenchyma
Companion cell	Xylem		Companion cell	Phloem
Trachieds	Phloem		Trachieds	Xylem

III. Fill in the blanks :

1. _____ tissues provides mechanical support to organs.

[Ans : Compound epithelium]

2. Parenchyma, Collenchyma, Sclerenchyma are _____ type of tissue.

[Ans : simple]

3. _____ and _____ are complex tissues.   **[Ans : Xylem, phloem]**

4. Epithelial cells with cilia are found in ____ of our body.

[Ans : trachea or wind pipe]

5. Lining of small intestine is made up of _____.   **[Ans : columnar epithelium]**

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

1. Epithelial tissue is protective tissue in animal body.

Ans. True.

2. Bone and cartilage are two types of areolar connective tissues.

Ans. False.

   Correct statement : Bone and cartilage are two types of **supportive** connective tissue.

3. Parenchyma is a simple tissue.

Ans. True.

4. Phloem is made up of tracheids.

Ans. False.

   Correct statement : Phloem is made up of **sieve tubes**.

5. Vessels are found in collenchyma.

Ans. False.

   Correct statement : Vessels are found in **xylem**.

V. Answer briefly :

1. **What are intercalary meristems? How do they differ from other meristems?**

Ans. (i) It lies between the region of permanent tissues and is part of primary meristem. It is found either at the base of leaf (e.g. pinus) or at the base of internodes (e.g. Grasses).

(ii) Further apical meristem brings about increase in length and lateral meristem, brings about increase in thickness of the plant. Intercalary meristem helps in production of branches.

2. What is complex tissue? Name the various kinds of complex tissues.

Ans. (i) Complex tissues are made of more than one type of cells that work together as a unit.

(ii) Complex tissues consist of **parenchyma** and **sclerenchyma cells.** However, collenchymatous cells are not present in such tissues.

(iii) Common examples are xylem and phloem.

3. Mention the most abundant muscular tissue found in our body. State its function.

Ans. Skeletal muscle is the most abundant muscular tissue found in our body.

Functions :

(i) These muscles are attached to the bones and are responsible for the body movements and are called **skeletal muscles**.

(ii) They work under our control and are also known as **voluntary muscles.**

(iii) They possess many nuclei (multinucleate).

(iv) For example they occur in the biceps and triceps of arms and undergo rapid contraction.

(v) The muscle fibres are elongated, cylindrical, unbranched with alternating dark and light bands, giving them the striped or striated appearance.

4. What is skeletal connective tissue? How is it helpful in the functioning of our body?

Ans. The supporting or skeletal connective tissues forms the endoskeleton of the vertebrate body. They protect various organs and helps in locomotion. The supportive tissues include cartilage and bone.

5. Why should gametes be produced by meiosis during sexual reproduction?

Ans. In meiosis, daughter cells formed after cell division have half the number of chromosomes as compared to parent cell. When gametes are formed by meiosis they will have half the number of chromosomes (haploid). When a haploid male gamete and haploid female gamete fuse during sexual reproduction the zygote will be diploid ie., It will have the same number of chromosomes like the parent cell. This is very important because any abnormality in the number of chromosomes in the zygote will lead to disorders.

6. In which stage of mitosis the chromosomes align in an equatorial plate? How?

Ans. Metaphase (meta – after) The duplicated chromosomes arrange on the equatorial plane and form the metaphase plate. Each chromosome gets attached to a spindle fibre by its centromere. The centromere of each chromosome divides into two each being associated with a chromatid.

VI. Answer in detail :

1. What are permanent tissues? Describe the different types of simple permanent tissues.
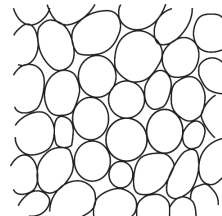
Ans. Permanent tissues :

Permanent tissues are those in which, growth has stopped either completely or for the time being. At times, they become meristematic partially or wholly.

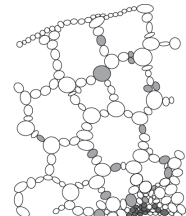**Different types of simple permanent tissue :**

Simple tissue : Simple tissue are homogeneous tissue composed of structurally and functionally similar cells. Eg : Parenchyma, collenchyma and sclerenchyma.
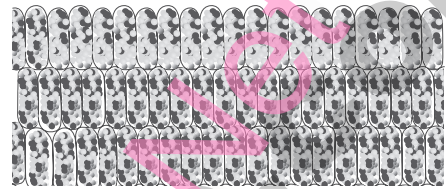
Parenchyma :

(i) Parenchyma are simple permanent tissue composed of living cells.

(ii) Parenchyma cells are thin walled, oval, rounded or polygonal in shape with well developed spaces among them.

(iii) In aquatic plants, parenchyma possesses intercellular air spaces, and is named as aerenchyma.

Parenchyma   Aerenchyma

Chlorenchyma

(iv) When exposed to light, parenchyma cells may develop chloroplasts and are known as chlorenchyma.

Functions : Parenchyma may store water in many succulent and xerophytic plants. It also serves the functions of storage of food reserves, absorption, buoyancy, secretion etc.,

Collenchyma :

(i) Collenchyma is a living tissue found beneath the epidermis.

(ii) Cells are elongated with unevenly thickened walls. Cells have rectangular oblique or tapering ends and persistent protoplast.

(iii) They possess thick primary non-lignified walls.
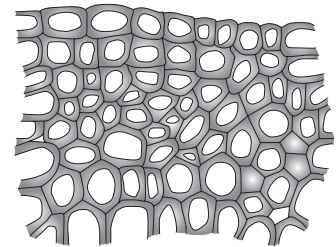
Collenchyma

Functions : They provide mechanical support for growing organs.

Sclerenchyma :

(i) Sclerenchyma consists of thick walled cells which are often lignified.

(ii) Sclerenchyma cells do not possess living protoplasts at maturity. Sclerenchyma cells are grouped into (a) fibres and (b) sclereids.

Fibres : Elongated sclerenchymatous cells, usually with pointed ends. Their walls are lignified. Fibres are abundantly found in many plants. **Eg. Jute**.

Narrow Lumen

Lignified Thick wall
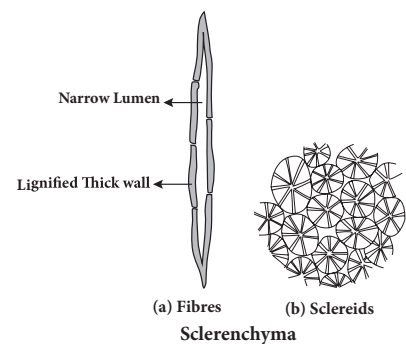
(a) Fibres   (b) Sclereids
Sclerenchyma

Sclereids :

(i) Sclereids are widely distributed in plant body. They are usually broad, may occur in single or in groups.

(ii) Sclereids are isodiametric, with lignified walls. Pits are prominent and seen along the walls.

(iii) Lumen is filled with wall materials. Sclereids are also common in fruits and seeds.

9TH STD COMMON ANNUAL EXAMINATION - MAY 2022

STANDARD - IX

SCIENCE

Reg. No. ☐☐☐☐☐☐

Time Allowed: 3.00 hours] [Max. Marks : 75

Part - I

i) **Choose the correct answer :**
ii) **Answer all the questions. 12×1= 12**

1. 1 Metric ton in equal to
   (a) 100 quintals (b) 10 quintals
   (c) 1/10 quintals (d) 1/100 quintals
2. Resistance of a wire depends on
   (a) temperature (b) geometry
   (c) nature of material
   (d) all the above
3. The unit of magnetic flux density is
   (a) Weber (b) Weber / metre
   (c) Weber / metre^2 (d) Weber . metre^2
4. The speed of light is maximum in
   (a) Vacuum (b) Glass
   (c) Diamond (d) None of the above
5. Among the following _____ is a mixture.
   (a) Common salt (b) Pure Silver
   (c) Carbon dioxide (d) Juice
6. The correct electronic configuration of Potassium is
   (a) 2, 8, 9 (b) 2, 8, 1
   (c) 2, 8, 8, 1 (d) 2, 8, 8, 3
7. Covalent bond is formed by
   (a) transfer electrons
   (b) sharing of electrons
   (c) sharing a pair of electrons
   (d) None of the above
8. Tomato contains
   (a) Malic acid (b) Tortaric acid
   (c) Oxalic acid (d) Tannic acid
9. Aerenchyma is found in
   (a) Epiphytes (b) Hydrophytes
   (c) Halophytes (d) Xerophytes
10. The bending of root of a plant in response to water is called
    (a) Thigmonasty (b) Phototropism
    (c) Hydrotropism (d) Photonasty
11. The nutrient required in trace amounts to accomplish various body functions is
    (a) Carbohydrates (b) Protein
    (c) Vitamin (d) Fat
12. The Primary organ infected during tuberculosis is
    (a) Bone marrow (b) Intestine
    (c) Spleen (d) Lungs

Part - II

Note : Answer any 7 questions :
(Ques. No. 22 is compulsory) 7×2= 14

13. What do you mean by Uniform motion?
14. On what factors the pressure exerted by the liquid depends on?
15. Match :
    1. Electric charge - a) Volt
    2. Potential difference - b) Coulomb
    3. Resistance - c) ampere
    4. Electric current - d) Ohm
16. Define Conduction.
17. Say true or false. If false correct the sentence.
    a) Oil and water are immiscible with each other.
    b) Buttermilk is an example for heterogeneous mixture.
18. Write the Electronic Configuration of K and Cl.
19. Name two metals that do not react with Sodium hydroxide.
20. What is Complex tissue?
21. What is Adaptation?
22. Expand : a) WHO b) BCG

Part - III

Note: Answer any 7 of the following
(Q. No. 24 is compulsory) 7×4= 28

23. Explain different types of motion.
24. a) Define Electric current.
    b) If 25 C of charge is determined to pass through a wire of any cross section in 50 s, what is the measure of current?
25. Draw and label the diagram of an AC generator.
26. Discuss the benefits of ISS.
27. Name the components in each of the following mixtures.
    1. Ice Cream 2. Lemonade
    3. Air 4. Soil
28. Draw the structures of Oxygen and Sulphur atoms.
29. (a) Write all the possible isomers of C_2H_6O
    (b) What is Catenation?
30. Give an account of Phylum Arthropoda.
31. Differentiate between tropic and nastic movements.
32. Differentiate Kwarshiorkar from Marasmus.

Part - IV

Answer in detail : **3×7 = 21**

33. (a) Draw ray diagrams to show how the image is formed using a concave mirror, when the position of object is (i) at C (ii) between C and F (iii) between F and P of the mirror.
Mention the position and nature of the image in each case. **(OR)**
(b) State Kepler's Law (with diagrams)

34. (a) List down the differences between Ionic and covalent compounds. **(OR)**
(b) a) Write any four uses of acids.
b) Write any three uses of bases.

35. (a) Write about the elements of Xylem.
(b) List out the medicinal importance of honey.

Answers

Part - I

1. (b) 10 quintals
2. (d) all the above
3. (c) Weber / metre^2
4. (a) Vacuum
5. (d) Juice
6. (c) 2, 8, 8, 1
7. (b) sharing of electrons
8. (a) Malic acid
9. (b) Hydrophytes
10. (c) Hydrotropism
11. (c) Vitamin
12. (d) Lungs

Part - II

13. 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.

14. The pressure exerted by the liquid depends on the (i) Depth (ii) Density of the liquid (iii) Acceleration due to gravity.

15. Match the following :
1. Electric charge - a) Coulomb
2. Potential difference - b) Volt
3. Resistance - c) Ohm
4. Electric current - d) ampere

16. The process of transfer of heat in solids from a region of higher temperature to a region of lower temperature without the actual movement of molecules is called conduction.

17. a) True b) True

18.

	K	L	M	N
Potassium, K	2	8	8	1
Chlorine, Cl	2	8	7	

19. i) Au (Gold) ii) Pt. (Platinum)

20. Complex tissues are made of more than one type of cells that work together as a unit.

21. Any feature of an organism or its part that enables it to exist under conditions of its habitat is called adaptation.

22. a) WHO - World Health Organization
b) BCG - Bacillus Calmette Guerin

Part - III

23. Different types of motion :
i) **Linear motion :** The motion of an object along a straight line is known as linear motion. Ex : Car moving on a straight road.
ii) **Circular motion :** The motion of an object is a circular path is known as circular motion. Ex : Earth revolving around the sun.
iii) **Oscillatory motion :** Repetitive to and fro motion of an object at regular interval of time is called as oscillatory motion. Ex : Motion of pendulum of a clock.
iv) **Random motion :** The disordered or irregular motion of a body is called random motion. Ex : Movement of fish under water.

24. a) The electric current is defined as the rate of flow of electric charge through any section of a conductor.
b) $I = q / t = (25 \, C) / (50 \, s) = 0.5$ C/s $= 0.5$ A

25.
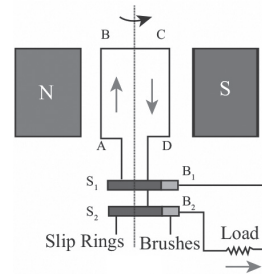
PARTS

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

26. **Benefits of ISS.**

1. **Water purification efforts :** The water recovery system (WRS) and the oxygen generation system (OGS) developed for the ISS have already saved a village in Iraq from being deserted due to lack of clean water.

2. **Eye tracking technology :** The Eye Tracking Device, built for a microgravity experiment, has proved ideal to be used in many laser surgeries. Also, eye tracking technology is helping disabled people with limited movement and speech.