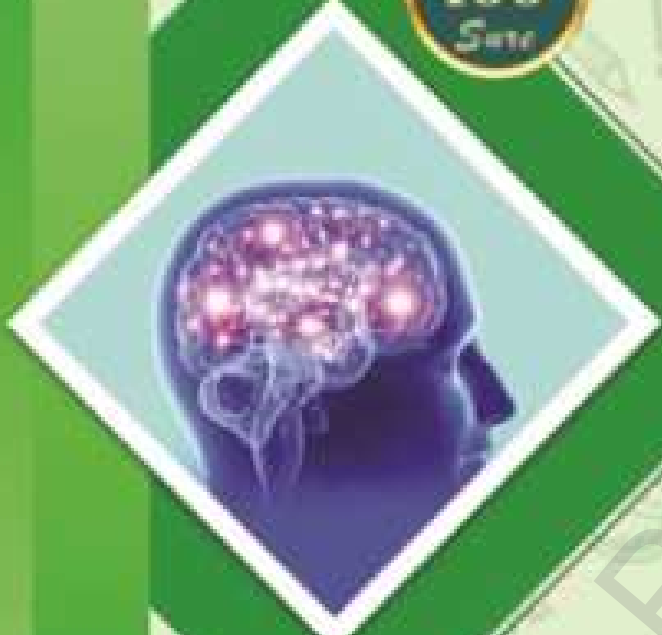# DOLPHIN
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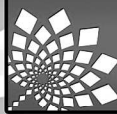
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Greetings to beloved Teachers and Students,

"Science is a beautiful gift to humanity, we should not distort it."

- Dr. APJ Abdul Kalam

As quoted by Kalam sir, Science is a beautiful gift to us. Students are the future pillars of the nation. We should develop our interest towards science and technology. It will help us think logically.

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dream is something that does not let you sleep"*

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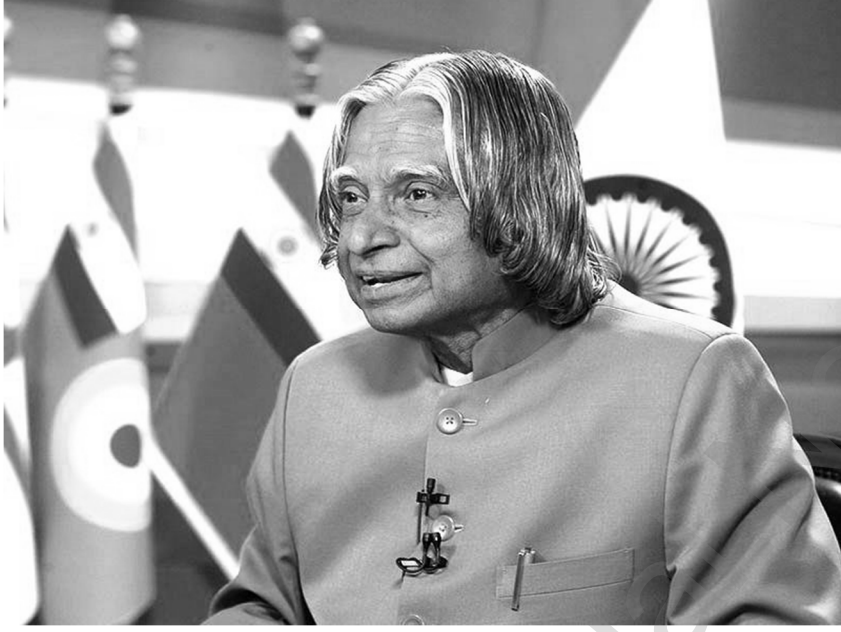Open UPI app > Select 'Tap to Pay' > Scan QR Code > Enter Amount

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- Dr. A.P.J. அப்துல்கலாம்

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S. No.	Formula		Unit
1.	Linear Momentum	$P = m \times v$	$Kg\ ms^{-1}$
2.	Torque	$\tau = F \times d$	Nm
3.	Moment of Couple	$M = F \times S$	Nm
4.	Resultant force parallel forces acting in the same direction	$F_{net} = F_1 + F_2$	N
5.	Resultant force parallel unequal forces acting in the same direction	$F_{net} = F_2 - F_1$	N
6.	Force	$F = m \times a$	N
7.	Impulse	$J = F \times t$	Ns
8.	Acceleration due to gravity	$g = \dfrac{GM}{R^2}$	ms^{-2}
9.	Change in momentum	$\triangle p = P_f - P_i$	$Kg\ ms^{-1}$
10.	Mass of the Earth	$M = \dfrac{gR^2}{G}$	kg

Textbook Evaluation   **PAGE-13**

I. CHOOSE THE CORRECT ANSWER

1. **Inertia of a body depends on**   **(APR-24)**
   a) weight of the object
   b) acceleration due to gravity of the planet
   c) mass of the object   d) Both a & b
   Ans: c) mass of the object

2. **Impulse is equal to**   **(PTA-1)**
   a) rate of change of momentum
   b) rate of force and time
   c) change of momentum
   d) rate of change of mass
   Ans: c) change of momentum

3. **Newton's III law is applicable**
   a) for a body is at rest
   b) for a body in motion
   c) both a and b
   d) only for bodies with equal masses
   Ans: c) both (a) & (b)

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4. **Plotting a graph for momentum on the X-axis and time on Y-axis. Slope of momentum-time graph gives**

a) Impulsive force b) Acceleration

c) Force   d) Rate of force

Ans: c) Force

5. **In which of the following sport the turning of effect of force used**

a) swimming b) tennis

c) cycling   d) hockey

Ans: c) cycling

6. **The unit of 'g' is m s^{-2}. It can be also expressed as**

a) cms^{-1} b) Nkg^{-1}

c) $N\,m^2\,kg^{-1}$ d) $cm^2\,s^{-2}$

Ans: b) NKg^{-1}

7. **One kilogram force equals to**

a) 9.8 dyne   b) 9.8×10^4 N

c) 98×10^4 dyne d) 980 dyne

Ans: c) 98×10^4 dyne

8. **The mass of a body is measured on planet Earth as M kg. When it is taken to a planet of radius half that of the Earth then its value will be _____ kg**

a) 4 M   b) 2M

c) M/4   d) M **Ans: d) M**

9. **If the Earth shrinks to 50% of its real radius its mass remaining the same, the weight of a body on the Earth will**

a) decrease by 50% b) increase by 50%

c) decrease by 25% d) increase by 300%

Ans: d) increase by 300%

10. **To project the rockets whice of the following principle(s) is /are required?**

(G.MQ.SEP-21.AUG-22)

a) Newton's third law of motion

b) Newton's law of gravitation

c) law of conservation of linear momentum

d) both a and c **Ans: d) both a and c**

ADDITIONAL QUESTIONS

11. **F be the force between the two bodies placed at a certain distance. If the distance between them is doubled then the gravitational force F will be_____** **(PTA-5)**

a) 2F   b) F/2

c) F/4   d) 4F **Ans: c) F/4**

12. **The force required to produce an acceleration of 1cm s^{-2} on a body of mass 1 g is** **(PTA-6)**

a) 1 N   b) 10 N

c) 10^2 N   d) 1 dyne **Ans: d) 1 dyne**

II. FILL IN THE BLANKS

1. To produce a displacement _____ is required. **Ans: Force**

2. Passengers lean forward when sudden brake is applied in a moving vehicle. This can be explained by_____ **Ans: Inertia of motion**

3. By convention, the clockwise moments are taken as _____ and the anticlockwise moments are taken as _____. **Ans: Negative, Positive**

4. _____ is used to change the speed of car. **Ans: Gear**

5. A man of mass 100 kg has a weight of _____ at the surface of the Earth. **Ans: 980 N**

DOLPHIN-10TH Science   UNIT-1   *UNNAL MUDIYUM*

III. STATE WHETHER THE FOLLOWING STATEMENTS ARE TRUE OR FALSE. CORRECT THE STATEMENT IF IT IS FALSE

1. The linear momentum of a system of particles is always conserved.

   Ans   : False.

   Correct Statement : The linear momentum of a system of particles is always conserved when **no external force is applied.**

2. Apparent weight of a person is always equal to his actual weight.

   Ans   : False.

   Correct Statement : Apparent weight and actual weight is **not equal** during upward or downward motion.

3. Weight of a body is greater at the equator and less at the polar region.

   Ans   : False.

   Correct Statement : Weight of a body is **less at the equator and greater** at the polar region.

4. Turning a nut with a spanner having a short handle is so easy than one with a long handle.

   Ans   : False.

   Correct Statement : Turning a nut with a spanner having a **long handle** is so easy than one with a **short handle**.

5. There is no gravity in the orbiting space station around the Earth. So the astronauts feel weightlessness.

   Ans   : False.

   Correct Statement : The space station and astronauts have equal acceleration, they are under free fall condition, So the astronaut and space station are in the state of weightlessness.

IV. MATCH THE FOLLOWING (PTA – 1)

S. No.	Column I	Column II	Answer
1.	Newton's I law	(a) propulsion of a rocket	**b) stable equilibrium of a body**
2.	Newton's II law	(b) stable equilibrium of a body	**c) law of force**
3.	Newton's III law	(c) law of force	**d) flying nature of bird**
4.	Law of conservation of linear momentum	(d) flying nature of bird	**a) propulsion of a rocket**

DOLPHIN-10TH Science   **UNIT-1**   *UNNAL MUDIYUM*

V. ASSERTION & REASONING

Mark the correct choice as

a) If both the assertion and the reason are true and the reason is the correct explanation of assertion.

b) If both the assertion and the reason are true, but the reason is not the correct explanation of the assertion.

c) Assertion is true, but the reason is false.

d) Assertion is false, but the reason is true.

1. **Assertion** : The sum of the clockwise moments is equal to the sum of the anticlockwise moments.

    Reason : The principle of conservation of momentum is valid if the external force on the system is zero.

    Ans : **b) If both the assertion and the reason are true, but the reason is not the correct explanation of the assertion**

---

2. **Assertion** : The value of 'g' decreases as height and depth increases from the surface of the Earth.

    Reason : 'g' depends on the mass of the object and the Earth

    Ans : **c) Assertion is true, but the reason is false**

ADDITIONAL QUESTIONS

3. **Understand the assertion and the reason given and choose the correct choice.**   **(PTA-6)**

    Assertion : When a person swims he pushes the water using the hands backward and the water pushes the person in the forward direction

    Reason : For every action there is an equal and opposite reaction

a) Both the assertion and the reason are true and the reason is the correct explanation of assertion.

b) Both the assertion and the reason are true, but the reason is not the correct explanation of the assertion.

c) Assertion is true, but the reason is false.

d) Both the assertion and the reason are false.

Ans : a) Both the assertion and the reason are true and the reason is the correct explanation of assertion.

VI. ANSWER BRIEFLY

1. **Define inertia. Give its classification.**

    (AUG -22, APR -23)

    The inherent property of a body to resist any change in its state of rest (or) the state of uniform motion, unless it is influenced upon by an external unbalanced force is known as Inertia.

    Types of Inertia:
    ii) Inertia of rest.
    iii) Inertia of motion.
    iv) Inertia of direction.

2. **Classify the types of force based on their application.**   **(AUG-22)**
    Like parallel forces.
    Unlike parallel forces.

---

3. If a 5 N and a 15 N forces are acting opposite to one another. Find the resultant force and the direction of action of the resultant force.

$F_1 = 5$ N $F_2 = 15$ N

Resultant Force	=	$F_2 - F_1$
	=	15N – 5N
	=	10N.

The direction of action of the resultant force will be in the direction of 15 N.

4. Differentiate mass and weight. (MAY-22)

Sl. No.	Mass	Weight
1.	Quantity of matter contained in the body.	Gravitational force exerted on a body due to the gravity.
2.	SI unit is kilogram.	SI unit is Newton.
3.	It is a Scalar quantity	It is a vector quantity

5. Define moment of a couple.

Two equal and unlike parallel forces applied simultaneously at two distinct points constitute a couple. The line of action of the two forces does not coincide. It does not produce any translatory motion since the resultant is zero. But, a couple results in causes the rotation of the body. Rotating effect of a couple is known as moment of a couple.

$$M = F \times S$$

6. State the principle of moments.

When a number of like or unlike parallel forces act on a rigid body and the body is in equilibrium, then the algebraic sum of the moments in the clockwise direction is equal to the algebraic sum of the moments in the anticlockwise direction.

$$F_1 \times d_1 = F_2 \times d_2$$

7. State Newton's second law. (G.MQ, MAY-22)

The force acting on a body is directly proportional to the rate of change of linear momentum of the body and the change in momentum takes place in the direction of the force.

$$F = m \times a$$

8. Why a spanner with a long handle is preferred to tighten screws in heavy vehicles?

A spanner with a long handle give high tension with less force the turning effect of a body depends upon the distance of the line of action of the applied force from the axis of rotation. So spanner with long handle is preferred.

9. While catching a cricket ball the fielder lowers his hands backwards. Why?

The fielder lowers his hands to increase the interval of time to catch the ball, which resulting in a lesser impulse on his hands.

10. How does an astronaut float in a space shuttle?

Astronauts are not floating but falling freely around the earth due to their huge oribital velocity. Since space shuttle and astronauts have equal acceleration, they are under free fall condition.

ADDITIONAL QUESTIONS

11. Use the analogy to the fill the blank (PTA–4)

a) **opening a door : Moment of force**
   Opening a water tap : _____
   Answer: moment of couple

b) **pushing a bus by a group of people :**
   Like parallel forces
   Tug of war   : _____
   Answer : unlike parallel forces

12. Why the apples weigh more at poles than at equator? (PTA - 3)

Weight of a body varies from one place to another place on the Earth since it depends on the acceleration due to gravity of the Earth (g), which is not the same at all places on the Earth. Since, weight W = mg, as g varies, the weight of a body is more at the poles than at the equatorial region. So weight of apples will be more at poles than at equator.

13. Write short notes on gears. (SEP-20)

A gear is a circular wheel with teeth around its rim. It helps to change the speed of rotation of a wheel by changing the torque and helps to transmit power.

VII. SOLVE THE GIVEN PROBLEMS

1. Two bodies have a mass ratio of 3:4 the force applied on the bigger mass produces an acceleration of 12 ms^{-2}. What could be the acceleration of the other body, if the same force acts on it.

$m_1 : m_2$ = 3 : 4

$a_2 = 12$ ms^{-2}

$a_1 = ?$

According to Newton's second law of motion.

$F_1 = -F_2$

$m_1 \times a_1 = -(m_2 \times a_2)$

$3 \times a_1 = 4 \times 12$

$a_1 = \dfrac{48}{3}$

$\boxed{a_1 = 16 \text{ms}^{-2}}$

So acceleration due to the same force on the smaller body $a_1 = 16$ ms^{-2}

---

2. A ball of mass 1 kg moving with a speed of 10 ms-1 rebounds after a perfect elastic collision with the floor. Calculate the change in linear momentum of the ball.

Mass of the ball (m) = 1 kg

Initial speed (u) = 10 ms^{-1}

Final speed (v) = 10 ms^{-1}

Change in momentum

Δp = mv – mu

Δp = 1 (–10) – 1 (10)

= –10 – 10

$\boxed{\Delta p = -20 \text{ kg m s}^{-1}.}$

---

3. A mechanic unscrew a nut by applying a force of 140 N with a spanner of length 40 cm. What should be the length of the spanner if a force of 40 N is applied to unscrew the same nut?

Force F_1 = 140 N

Length (l_1) = 40 cm = 0.4m

Force, F_2 = 40 N

Length, (l_2) = ?

Length of the spanner,

$F_1 l_1$ = $F_2 l_2$

140 x 0.4 = 40 x l_2

l_2 = $\dfrac{140 \times 0.4}{40}$

$\boxed{\text{Length of the spanner } (l_2) = 1.4 \text{ m}}$

---

4. The ratio of masses of two planets is 2:3 and the ratio of their radii is 4:7. Find the ratio of their accelerations due to gravity.

Accelerations due to gravity (g)	=	$\dfrac{GM}{R^2}$
$g_1 : g_2$	=	?
$M_1 : M_2$	=	2 : 3
$R_1 : R_2$	=	4 : 7

$\dfrac{g_1}{g_2}$	=	$\dfrac{M_1}{M_2} \times \dfrac{R_2^2}{R_1^2}$
	=	$\dfrac{2}{2} \times \dfrac{7^2}{4^2}$
	=	$\dfrac{98}{48} = \dfrac{49}{24}$

Ratio of their Acceleration due to gravity
$g_1 : g_2 = 49 : 24$

ADDITIONAL QUESTIONS

5. **A lift is moving downwards with an acceleration of 1.8 ms⁻¹. Then what is the apparent weight realised by a man of mass 50 kg** (PTA-1)

Acceleration due to gravity for Earth (at sea level) is	=	9.8 ms^{-2}.
Acceleration (a)	=	1.8 ms^{-1}
mass (m)	=	50 kg
Apparent weight R	=	m (g-a)
R	=	50 (9.8 -1.8)
	=	50 x 8

= 400 N

6. **A force of 5 N applied on a body produces and acceleration 5 cm s⁻². Calculate the mass of the body.** (PTA-5)

F	=	5 N
a	=	5 cm s^{-2} (0.05 m s^{-2})
F	=	Ma
m	=	$\dfrac{F}{a}$
m	=	$\dfrac{5}{0.05}$

m = 100 kg

7. **Calculate the velocity of a moving body of mass 5kg whose linear momentum is 2KGms⁻¹** (GMQ

Linear momentum	=	2 kg ms^{-1}
Mass	=	5 Kg
Linear momentum	=	Mass x Velocity
Velocity	=	$\dfrac{\text{Linear momentum}}{\text{Mass}}$
V	=	$\dfrac{2}{5}$
	=	0.4ms^{-1}

VIII. ANSWER IN DETAIL

1. **What are the types of inertia? Give an example for each type.**
(PTA-3, AUG-22, APR-24)

There are 3 types of Inertia. They are

I) Inertia at rest

II) Inertia of motion

III) Inertia of direction

I) **Inertia at rest:**

The resistance of a body to change its state of rest is called inertia of rest.

Ex: When you vigorously shake the branches of a tree, some of the leaves and fruits are detached and they fall down.

II) **Inertia of motion:**

The resistance of a body to change its state of motion is called inertia of motion.

Ex: An athlete runs some distance before jumping because this will help him jump longer and higher.

III) Inertia of direction:

The resistance of a body to change its direction of motion is called inertia of direction.

Ex: When you make a sharp turn while driving a car, you tend to lean sideways,

2. State Newton's laws of motion?

Newton's First Law:

This law states that everybody continues to be in its state of rest or the state of uniform motion along a straight line unless it is acted upon by some external force.

Newton's Second Law:

According to this law, the force acting on a body is directly proportional to the rate of change of linear momentum of the body and the change in momentum takes place in the direction of the force.

Newton's Third Law:

Newton's third law states that for every action, there is an equal and opposite reaction. They always act on two different bodies.

3. Deduce the equation of a force using Newton's second law of motion. (APR - 23)

This law helps us to measure the amount of force. So it is also called as law of force.

Let 'm' be the mass of a moving body, moving along a straight line with an initial speed 'u' after a time interval of 't', the velocity of the body changes to 'v' due to the impact of an unbalanced external force 'F'.

Initial momentum of the body P_i = mu

Final momentum of the body P_f = mv

Change in momentum Δ_p = $P_f - P_i$

= mv – mu

By Newton's second law of motion,

Force, F ∝ rate of change of momentum.

F ∝ change in momentum / time.

F α (mv – mu) / t

F = Km (v-u) / t

Here K is the proportionality constant. K=1 in all systems of units. Hence,

$$F = \frac{m(v-u)}{t}$$

Since, acceleration = change in velocity/time, a = (v-u)/t. Hence, we have

> **F = m × a**
> **Force = mass × acceleration**

4. State and prove the law of conservation of linear momentum. (G.M.Q)

There is no change in the linear momentum of a system of bodies as long as no net external force acts on them.

Let two bodies A and B having masses m_1 and m_2 move with initial velocity u_1 and u_2 in a straight line. Let the velocity of the first body be higher than that of the second body. i.e, $u_1 > u_2$. During an interval of time t second, they tend to have a collision. After the impact, both of them move along the same straight line with a velocity v_1 and v_2 respectively.

Force on body B due to A,

$F_A = m_2 (v_2–u_2)/t$

Force on body A due to B,

$F_B = m_1 (v_1–u_1)/t$

By Newton's III law of motion,

Action force = Reaction force

$F_B = –F_A$

$m_1 (v_1-u_1)/t = –m_2 (v_2-u_2)/t$

$\mathbf{m_1v_1 + m_2v_2 = m_1u_1 + m_2u_2}$

The above equation confirms **in the absence of an external force, the algebraic sum of the momentum after collision is numerically equal to sum of the momentum before collision.**

5. **Describe rocket propulsion.**

(PTA – 4, SEP-20, AUG-22)

i) Propulsion of rockets is based on the law of conservation of linear momentum as well as Newton's third law of motion.

ii) Rockets are filled with a fuel in the propellant tank.

iii) When the rocket is fired, this fuel is burnt and a hot gas is ejected with a high speed from the nozzle of the rocket, producing a huge momentum.

iv) To balance this momentum, an equal and opposite reaction force is produced in the combustion chamber, which makes the rocket project forward.

v) While in motion, the mass of the rocket gradually decreases, until the fuel is completely burnt out.

vi) Since, there is no net external force acting on it, the linear momentum of the system is conserved.

vii) The mass of the rocket decreases with altitude, which results in the gradual increase in velocity of the rocket.

viii) At one stage, it reaches a velocity, which is sufficient to just escape from the gravitational pull of the Earth. This velocity is called escape velocity.

6. **State the universal law of gravitation and derive its mathematical expression** (JUNE-23)

This law states that every particle of matter in this universe attracts every other particle with a force. This force is directly proportional to the product of their masses and inversely proportional to the square of the distance between the centers of these masses. The direction of the force acts along the line joining the masses.

Force between the masses is always attractive and it does not depend on the medium where they are placed
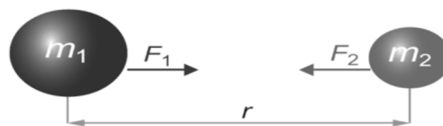
Let, m_1 and m_2 be the masses of two bodies A and B placed r metre apart in space

Force　$F \propto m_1 \times m_2$

$F \propto \dfrac{1}{r^2}$

On combining the above two expressions

$F \propto \dfrac{m_1 \times m_2}{r^2}$

$F = \dfrac{G m_1 m_2}{r^2}$

Where G is the universal gravitational constant. Its value in SI unit is 6.674×10^{-11} N m^2 kg^{-2}.

7. **Give the applications of gravitation.**

i) Dimensions of the heavenly bodies can be measured using the gravitation law.

ii) Mass of the Earth, radius of the Earth, acceleration due to gravity, etc. can be calculated with a higher accuracy.

iii) Helps in discovering new stars and planets.

iv) One of the irregularities in the motion of stars is called 'Wobble' lead to the disturbance in the motion of a planet nearby. In this condition the mass of the star can be calculated using the law of gravitation.

v) Helps to explain germination of roots is due to the property of geotropism which is the property of a root responding to the gravity.

vi) Helps to predict the path of the astronomical bodies.

ADDITIONAL QUESTIONS

8. **i) Shock absorbers are used in luxury buses.why?** (PTA -2)

Absorbers are used in luxury buses shock absorbers to reduce jerks while moving on uneven roads.

ii) **A weight of a man 686N on the surface of the earth. Calculate the weight of the same person on moon ('g' value of a moon is 1.625 ms^{-2})**

w	=	686 N
w	=	mg
m	=	$\dfrac{W}{g}$
	=	$\dfrac{686}{9.8}$
	=	70 kg

Weight on moon,

w	=	mg
	=	70 x 1.625
		113.75 N

iii) **Name the law of motion used in flying of birds. Give another example for the same law**
Newton's third law of motion.
(E.g) Man swimming and Rocket propulsion.

When a person swims he pushes the water using the hands backwards (Action), and the water pushes the swimmer in the forward direction (Reaction)

9. **A body of mass m is initially moving with a velocity u. When a force F acts on the body it picks up velocity v in t second so that the acceleration (a) is produced. Using this data derive the relation between the force, mass and acceleration.** (PTA-5)

Let 'm' be the mass of a moving body, moving along a straight line with an initial speed 'u' after a time interval of 't', the velocity of the body changes to 'v' due to the impact of an unbalanced external force 'F'.

Initial momentum of the body P_i = mu
Final momentum of the body P_f = mv
Change in momentum Δ_p = $P_f – P_i$
= mv – mu

By Newton's second law of motion,

Force, F ∝ rate of change of momentum.

F ∝ change in momentum / time.

F α (mv – mu) / t

F = Km (v-u) / t

Here K is the proportionality constant. K=1 in all systems of units. Hence,

$$F = \frac{m(v-u)}{t}$$

Since, acceleration = change in velocity/time,

a = (v-u)/t. Hence,

F = m × a

Force = mass × acceleration

10. **At what height from the centre of the earth surface, the acceleration due to gravity will be 1/4 the of its value on the surface of the earth.** (PTA-6)

The acceleration due to gravity = g
Height from the centre of the Earth, R' = R + h
The acceleration due to gravity at that height,
g' = $\dfrac{g}{4}$

g'	=	GMm/(R')^2
g	=	GMm/(R)^2
$\dfrac{g}{g'}$	=	$\left(\dfrac{R'}{R}\right)^2$
	=	$\left(\dfrac{R+h}{R}\right)^2$
	=	$\left(1+\dfrac{h}{R}\right)^2$
4	=	$\left(1+\dfrac{h}{R}\right)^2$
2	=	$1+\dfrac{h}{R}$
h	=	**R**
Since R'	=	R + h
h	=	R'
So R'	=	**2R**

From the centre of the Earth, the object is placed at twice the radius of the earth.

IX. HOT QUESTIONS

1. Two blocks of masses 8 kg and 2 kg respectively lie on a smooth horizontal surface in contact with one other. They are pushed by a horizontally applied force of 15 N. Calculate the force exerted on the 2 kg mass.

Mass of block 1, m_1	=	8
Mass of block 2, m_2	=	2kg
Force, F_1	=	15N
Force exerted on 2 kg, F_2	=	massXacceleration
	=	$\frac{m_2}{m_1 + m_2}$ x F
	=	$\frac{2}{8+2}$ X 15
	=	3 N
Force exerted on 2 kg, F_2	=	3N

2. A heavy truck and bike are moving with the same kinetic energy. If the mass of the truck is four times that of the bike, then calculate the ratio of their momenta. (Ratio of momenta = 1:2)

Since K.E are equal

$\frac{1}{2} m_1 v_1^2$	=	$\frac{1}{2} m_2 v_2^2$
$\frac{1}{2} m_1 v_1^2$	=	$\frac{1}{2} (4) (m_1) v_2^2$
v_1^2	=	$4 v_2^2$
v_1	=	$2 v_2$

Ratio of momenta	=	$\frac{m_1 v_1}{m_2 v_2}$
	=	$\frac{m_1 v_1}{4m_1 \left(\frac{v_1}{2}\right)}$
	=	$\frac{2}{4}$
	=	$\frac{1}{2}$

The ratio of their momenta = 1:2

3. "Wearing helmet and fastening the seat belt is highly recommended for safe journey" Justify your answer using Newton's laws of motion.

i) According to Newton's law of inertia, the passenger in the car are more likely to maintain the same state of motion, which will result in the banging the glass (wind shield) or thrown away in the front by breaking the glass windshield. So wearing seatbelts is highly recommended for a safe journey.

ii) According to Newton's third law, an equal and opposite reacting force on the ground is exerted on your body or head. When you do not wear a helmet, this reacting force can cause fatal head injuries.
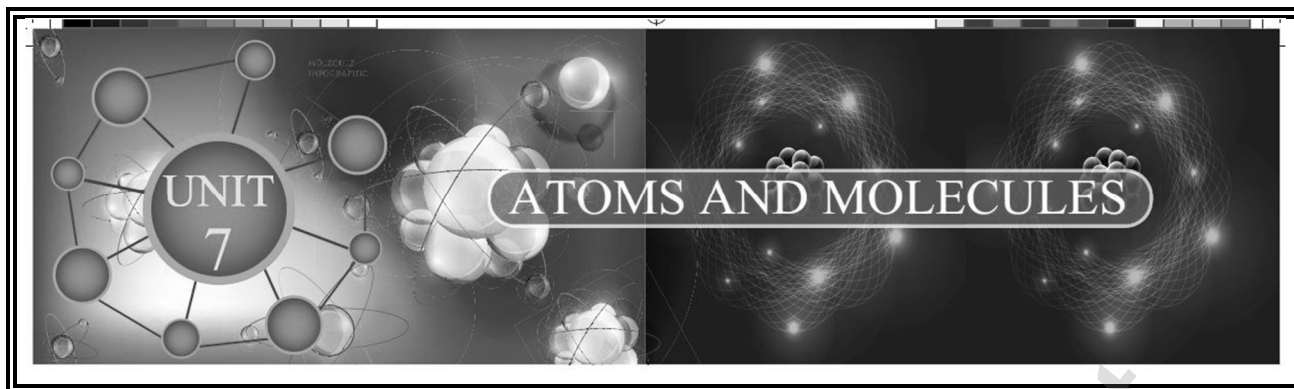
S. No.	Formula	
1.	Number of moles	$\dfrac{\text{Mass}}{\text{Atomic Mass}}$
2.	Number of moles	$\dfrac{\text{Mass}}{\text{molecular Mass}}$
3.	No. of molecules	$\dfrac{\text{Mass x Avogadro's Number}}{\text{molecular Mass}}$
4.	No. of molecules	$\dfrac{\text{Mass x Avogadro's Number}}{\text{Atomic Mass}}$
5.	Relative molecular mass	2 x Vapour density
6.	Mass percentage of an element	$\dfrac{\text{Mass of that element in the compound}}{\text{Molar mass of the compound}}$
7.	Atomicity	$\dfrac{\text{Molecular mass}}{\text{Atomic mass}}$

Textbook Evaluation **PAGE-102**

I. CHOOSE THE BEST ANSWER

1. **Which of the following has the smallest mass?**
    a) 6.023×10^{23} atoms of He
    b) 1 atom of He
    c) 2 g of He
    d) 1 mole atoms of He **Ans: b) 1 atom of He**

2. **Which of the following is a triatomic molecule?** (PTA – 1, GMQ)

    a) Glucose b) Helium
    c) Carbon dioxide d) Hydrogen
    Ans: c) Carbon dioxide

3. **The volume occupied by 4.4 g of CO_2 at S.T.P**
    a) 22.4 litre b) 2.24 litre
    c) 0.24 litre d) 0.1 litre
    Ans: b) 2.24 litre

4. Mass of 1 mole of Nitrogen atom is
a) 28 amu   b) 14 amu
c) 28 g   d) 14 g   **Ans: d) 14 g**

5. Which of the following represents 1 amu?
a) Mass of a C - 12 atom
b) Mass of a hydrogen atom
c) $1/12^{th}$ of the mass of a C – 12 atom
d) Mass of O – 16 atom
    Ans: c) $1/12^{th}$ of the mass of a C-12 atom

6. Which of the following statement is incorrect?
a) 12 gram of C -12 contains Avogadro's number of atoms.
b) One mole of oxygen gas contains Avogadro's number of molecules.
c) One mole of hydrogen gas contains Avogadro's number of atoms.
d) One mole of electrons stands for 6.023×10^{23} electrons.
    Ans: c) One mole of hydrogen gas contains Avogadro's number of atoms.

7. The volume occupied by 1 mole of a diatomic gas at S.T.P is
a) 11.2 litre   b) 5.6 litre
c) 22.4 litre   d) 44.8 litre
    Ans: c) 22.4 litre

8. In the nucleus of $_{20}Ca^{40}$, there are
a) 20 protons and 40 neutrons
b) 20 protons and 20 neutrons
c) 20 protons and 40 electrons
d) 40 protons and 20 electrons
    Ans: b) 20 protons and 20 neutrons

9. The gram molecular mass of oxygen molecule is   (AUG-22)
a) 16 g   b) 18 g
c) 32 g   d) 17 g   **Ans: c) 32 g**

10. One mole of any substance contains ____ molecules.   (APR-24)
a) 6.023×10^{23} b) 6.023×10^{-23}
c) 3.0115×10^{23} d) 12.046×10^{23}
    Ans: (a) 6.023×10^{23}

ADDITIONAL QUESTIONS

11. If a molecule is made of similar kind of atoms, then it is called ____   (PTA-6)
a) mono atomic molecule
b) hetero atomic molecule
c) homo atomic molecule
d) poly atomic molecule
    Ans: c) homo atomic molecule

12. Analyse the following and choose the correct statement (S)   (PTA – 4)
i) An electron has considerable mass
ii) A hetero atomic molecule is formed from different kinds of atoms
iii) Mass number and atomic mass of an element are same
a) i, ii and iii are correct
b) i and iii are correct
c) Only (ii) is correct
d) only (iii) is correct
    Ans: c) Only (ii) is correct

II. FILL IN THE BLANKS

1. Atoms of different elements having _____ mass number, but _____ atomic numbers are called isobars.   **Ans: same, different**

2. Atoms of one element can be transmuted into atoms of other element by _____.   **Ans: Artifical transmutation**

3. The sum of the numbers of protons and neutrons of an atom is called its ___.   **Ans: Mass number**

4. Relative atomic mass is otherwise known as _____.   **Ans: Standard Atomic Weight**

5. The average atomic mass of hydrogen is _____ amu.   (PTA-6)   **Ans: 1.008**

6. If a molecule is made of similar kind of atoms, then it is called _____ atomic molecule.   (PTA-4)   **Ans: Homo**

7. The number of atoms present in a molecule is called its _____. **Ans: Atomicity**

8. One mole of any gas occupies _____ ml at S.T.P. **Ans: 22400**

9. Atomicity of phosphorous is _____. **Ans: 4**

ADDITIONAL QUESTIONS

10. Atoms of different elements having same number of _____ are called isotones **(PTA-4)**

Ans : neutrons

IV. MATCH THE FOLLOWING

1.

S. No.	Column I	Column II	Answer
1	8 g of O_2	4 moles	0.25 moles
2	4 g of H_2	0.25 moles	2 moles
3	52 g of He	2 moles	13 moles
4	112 g of N_2	0.5 moles	4 moles
5	35.5 g of Cl_2	13 moles	0.5 moles

IV. TRUE OR FALSE (IF FALSE GIVE THE CORRECT STATEMENT)

1. **Two elements sometimes can form more than one compound.**
   Ans   : True.

2. **Noble gases are Diatomic.**
   Ans   : False.
   Correct Statement : Noble gases are Monoatomic.

3. **The gram atomic mass of an element has no unit.**
   Ans   : False.
   Correct Statement : The gram atomic mass of an element has unit.

4. **1 mole of Gold and Silver contain same number of atoms.**
   Ans   : True.

5. **Molar mass of CO_2 is 42g.**
   Ans   : False.
   Correct Statement : Molar mass of CO_2 is 44 g.

V. ASSERTION AND REASON

Answer the following questions using the data given below:

i) A and R are correct, R explains the A.

ii) A is correct, R is wrong.

iii) A is wrong, R is correct.

iv) A and R are correct, R doesn't explains A.

1. **Assertion** : The Relative Atomic mass of aluminium is 27
   Reason : An atom of aluminium is 27 times heavier than $1/12^{th}$ of the mass of the C – 12 atom.

Ans: iv) A and R are correct, R doesn't explains A

2. **Assertion** : The Relative Molecular Mass of Chlorine is 35.5 a.m.u.   (PTA – 3)
    Reason : The natural abundance of Chlorine isotopes are not equal.

Ans: iii) A is wrong, R is correct.

VI. SHORT ANSWER QUESTIONS

1. **Define: Relative atomic mass.**
    (PTA-3, AUG-22, JUNE-23)

    Relative atomic mass of an element is the ratio between the average mass of its isotopes to 1/12th part of the mass of a carbon–12 atoms. It is denoted as A.

2. **Write the different types of isotopes of oxygen and its percentage abundance.**

S. No.	Isotope	% abundance
1	$_8O^{16}$	99.757
2	$_8O^{17}$	0.038
3	$_8O^{18}$	0.205

3. **Define: Atomicity.**
    (SEP-21, MAY-22,AUG-22, APR-23)

    The number of atoms present in the molecule is called its Atomicity.

4. **Give any two examples for heterodiatomic molecules.**   (AUG-22)
    i)   Hydrogen Chloride
    ii) Carbon Monoxide

5. **What is Molar volume of a gas?**

    One mole of any gas occupies 22.4 litre or 22400 ml at STP. This volume is called as molar volume.

6. **Find the percentage of nitrogen in ammonia.**
    (PTA-1)

    Formula of Ammonia = NH_3
    N = 14,   H = 1

Molecular mass of Ammonia = 14 + 3 = 17 g.

% of Nitrogen	=	$\dfrac{\text{Mass of nitrogen}}{\text{Molecular mass of Ammonia}} \times 100$
	=	$\dfrac{14}{17} \times 100$
	=	0.8235 x 100
% of Nitrogen	=	82.35%

ADDITIONAL QUESTIONS

7. **Calculate the relative molecular mass of CO_2**
    (SEP-21)

    Solution:
    Atomic masses of C = 12 & O = 16.
    Relative molar mass of CO_2 = $(12 \times 1) + (16 \times 2)$
    = 12 + 32
    Relative molar mass of CO_2 = 44 g.

8. **Write the applications of Avogadro's law.**
    (SEP-20, APR-23)

    i)   It explains Gay – lussac's law.
    ii) It helps in the determination of atomicity of gases.
    iii) Molecular formula of gases can be derived from Avogadro's law.
    iv) It determines the relation between molecular mass and vapour density.
    v)   It helps to determine gram molar volume of all gases. (22.4 lit at STP)

9. **Write the difference between atoms and molecules.**   (MAY-22)

S.No	Atoms	Molecules
1	An atom is the smallest particle of an element	A molecule is the smallest particle of an element or compound
2	Atom does not exist in free state except in noble gas	Molecule exists in a free state
3	Except some of noble gas, other atoms are highly reactive	Molecules are less reactive
4	Atom does not have a chemical bond	Atoms in a molecule are held by chemical bonds

VII. LONG ANSWER QUESTIONS

1. Calculate the number of water molecule present in one drop of water which weighs 0.18g. (APR-23)

Mass of one water drop	=	0.18 g
Avogadro number	=	6.023×10^{23}
Molecular Mass of water	=	18 g
	=	(2 x 1) + (1 x 16)
	=	18g

No. of water molecules	=	$\dfrac{\text{Avogadro number x Given mass}}{\text{Gram molecular mass}}$
	=	$\dfrac{0.18 \times 6.023 \times 10^{23}}{18}$
	=	$0.01 \times 6.023 \times 10^{23}$
No. of water molecules	=	0.06023×10^{23}

2. $N_2 + 3H_2 \rightarrow 2NH_3$.

(The atomic mass of nitrogen is 14, and that of hydrogen is 1)

1 mole of nitrogen (___g) +

3 moles of hydrogen (__ g) →

2 moles of ammonia (___ g)

1 mole of nitrogen N	=	1 x 14	=	14 g
3 moles of hydrogen H	=	3 × 1	=	3g

2 moles of hydrogen NH$_3$

NH$_3$	=	(2 x 14) + (2 x 3)
		28 + 6
		34 g

3. Calculate the number of moles in (PTA – 5)

   i) 27g of Al

   ii) 1.51×10^{23} molecules of NH$_4$Cl. (APR-24)

Solution:

i)

Atomic mass of Al	=	27g
Mass of Al	=	27g
No. of moles	=	$\dfrac{\text{Mass}}{\text{Atomic Mass}}$
	=	$\dfrac{27}{27}$
	=	1 mole of Al

ii)

No. of moles	=	$\dfrac{\text{No. of molecules of NH4Cl}}{\text{Avogadro's Number}}$
	=	$\dfrac{1.51 \times 10^{23}}{6.023 \times 10^{23}}$
	=	$\dfrac{1}{4}$
	=	0.25 mole

4. Give the salient features of "Modern atomic theory". (PTA – 5, SEP-20, APR-24)

Modern Atomic Theory:

i) An atom is no longer indivisible

ii) Atoms of the same element may have different atomic mass (Isotopes $_{17}Cl^{35}$, $_{17}Cl^{37}$).

iii) Atoms of different elements may have same atomic masses (Isobars $_{20}Ar^{40}$, $_{20}Ca^{40}$).

iv) Atoms of one element can be transmuted into atoms of other elements. (artificial transmutation).

v) Atom is the smallest particle that take part in a chemical reaction.

vi) The mass of an atom can be converted into energy ($E=mc^2$).

5. Derive the relationship between Relative molecular mass and Vapour density.

(GMQ,PTA – 6)

Relative Molecular Mass:

The ratio between the Mass of one molecule of gas or vapour to the mass of one atom of hydrogen.

Vapour Density:

The ratio of the mass of a certain volume of a gas or vapour to the mass of an equal volume of hydrogen, measured under the same conditions of temperature and pressure.

Avogadro's law, equal volume of all gases contain equal number of molecules

Thus, let the number of molecules in one volume = n, then

$$V.D. \text{ at S.T.P} = \frac{\text{Mass of 'n' molecules of a gas or vapour at S.T.P}}{\text{Mass of n' molecules of hydrogen}}$$

Cancelling 'n' which is common,

$$V.D = \frac{\text{Mass of 1 molecules of a gas or vapour at S.T.P}}{\text{Mass of 1 molecules of hydrogen}}$$

Since Hydrogen is diatomic

$$V.D = \frac{\text{Mass of 1 molecules of a gas or vapour at S.T.P}}{\text{Mass of 2 atoms of hydrogen}}$$

Comparing Relative Molecular Mass with Vapour Density:

$$V.D = \frac{\text{Mass of 1 molecules of a gas or vapour at S.T.P}}{2 \times \text{Mass of 1 atom of hydrogen}} \rightarrow 1$$

Relative Molecular Mass =

$$\frac{\text{Mass of 1 molecules of a gas or vapour at S.T.P}}{\text{Mass of 1 atom of hydrogen}} \rightarrow 2$$

Substituting eqn (1) and (2)

$$V.D = \frac{\text{Relative Molecular Mass}}{2}$$

Now on cross multiplication

$2 \times VD = $ Relative Molecular Mass of a gas.

ADDITIONAL QUESTIONS

6. Calculate the percentage of sulphur in H$_2$SO$_4$
(APR-23)

Molecular mass of H2SO4	=	(1x2)+(32x1)+(16x4)
	=	2+32+64
	=	98g.
% of s in H$_2$SO$_4$	=	$\dfrac{\text{Mass of sulphur}}{\text{Molecular mass of } H_2SO_4} \times 100$
	=	$\dfrac{32}{98} \times 100$
	=	32.65%

VIII. HOT QUESTION

1. Calcium Carbonate is decomposed on heating in the following reaction. **(JUNE-23)**
$CaCO_3 \rightarrow CaO + CO_2$
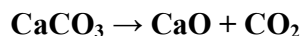
i) How many moles of Calcium Carbonate are involved in this reaction?

1 mole

ii) Calculate the gram molecular mass of Calcium Carbonate involved in this reaction.

Gram molecular mass of Calcium Carbonate of
$CaCO_3 = (1 \times 40) + (1 \times 12) + (3 \times 16)$
$= 40 + 12 + 48$
$= 100$ g.

iii) How many moles of CO$_2$ are there in this equation?

1 mole

IX. SOLVE THE FOLLOWING PROBLEMS

1. How many grams are there in the following?
(PTA – 4)

i) 2 moles of hydrogen molecule, H$_2$.

Mass = No. of moles × Molecular Mass.

Mass	=	2 × (2×1)
	=	4g

ii) 3 moles of chlorine molecule, Cl$_2$.

Molecular Mass Cl_2 = (2 x 35.5) = 71g

Mass	=	No. of moles × Molecular Mass.
	=	3 x 71
	=	213g

iii) 5 moles of sulphur molecule, S_8.

Molecular Mass S_8 = (8 x 32)

= 256

Mass	=	No. of moles × Molecular Mass.
	=	5 x 256
	=	1280 g

iv) 4 moles of phosphorous molecule, P_4.

Molecular Mass P_4 = (4 x 31)

= 124

Mass	=	No. of moles × Molecular Mass.
	=	4 x 124
	=	496 g.

2. Calculate the % of each element in calcium carbonate. (Atomic mass: C-12, O-16, Ca - 40). (PTA -2)

Molar Mass of $CaCO_3$	=	(1 x 40) + (1 x 12) + (3 x 16)
		40 + 12 + 48
		100 g

% of Ca in $CaCO_3$	=	$\dfrac{\text{Mass of Ca}}{\text{Molecular Mass of } CaCO_3} \times 100$
	=	$\dfrac{40}{100} \times 100$
	=	40%

% of C in $CaCO_3$	=	$\dfrac{\text{Mass of C}}{\text{Molecular Mass of } CaCO_3} \times 100$
		$\dfrac{12}{100} \times 100$
		12%

% of O in $CaCO_3$	=	$\dfrac{\text{Mass of O}}{\text{Molecular Mass of } CaCO_3} \times 100$
		$\dfrac{48}{100} \times 100$
		48%

3. Calculate the % of oxygen in $Al_2 (SO_4)_3$. (Atomic mass: Al-27, O-16, S -32) (PTA – 2)

Molecular Mass of $Al_2 (SO_4)_3$	=	(2 x 27) + ((1 x 32) + (4 x 16)) 3
	=	54 + (32 + 64) 3
	=	54 + (96) 3
	=	342 g

Mass of Oxygen in $Al_2 (SO_4)_3$	=	12 x 16
	=	192 g

% of Oxygen in $Al_2 (SO_4)_3$	=	$\dfrac{\text{Mass of O}}{\text{Molecular Mass of } Al_2 (SO_4)} \times 100$
		$\dfrac{192}{342} \times 100$
		56.14 %

4. Calculate the % relative abundance of B - 10 and B - 11, if its average atomic mass is 10.804 amu.

Let

B – 10 = x %

B – 11 = (100 – x) % --------→ 1

Average Atomic Mass:

$\dfrac{10x + 11(100 - x)}{100}$	=	10.804
10x + 1100 – 11x	=	1080.4
-x + 1100	=	1080.4
-x	=	1080.4 - 1100
-x	=	**-19.6**
x	=	**19.6**

Substittute in (1)

B – 11 = (100 – 19.6) %

B – 11 = 80.4 %

% relative abundance of B - 11 = 80.4%

% relative abundance of B - 10 = 19.6%

ADDITIONAL QUESTIONS

5. The mass percentage of carbon is 27.28% and the mass percentage of oxygen is 72.73%. Calculate the molecular mass of that compound. (PTA – 4)

Mass of carbon	=	27.28 %
Mass of oxygen	=	72.73 %
Number of moles of carbon	=	Mass of Carbon / Atomic mass of Carbon
	=	$\dfrac{27.28}{12}$
	=	2.27
Number of moles of carbon	=	2
Number of moles of oxygen	=	Mass of Oxygen / Atomic mass of Oxygen
	=	$\dfrac{72.73}{16}$
	=	4.54
Number of moles of oxygen	=	4
Molecular formula	=	C_2O_4 (or) $2\ CO_2$
Molecular mass	=	$(2×12) + (4×16)$
	=	88g

6. i) Calculate the mass of 1.51×10^{23} molecule of H_2O. (GMQ)

ii) Calculate the moles of 46g sodium

ii) Calculate the number of molecules present in the 36 g water.

Solution :

i) 1.51×10^{23} molecules of water

molecular mass of H_2O = 18g

Number of moles	=	Number of molecules of water / Avogadro's number
	=	$\dfrac{1.51 \times 10^{23}}{6.023 \times 10^{23}}$
	=	$\dfrac{1}{4}$
	=	0.25 mole
Number of moles	=	Mass / molecular mass
	=	0.25 = mass /18
Mass	=	0.25 x 18
Mass	=	4.5g

ii)

| Number of moles | = | Mass of the elemet / Atomic mass of the element |

| | = | $\dfrac{46}{23}$ |
| | = | 2 moles of sodium |

iii)

The Molecular weight of H_2O	=	18
Thus 18 grams of H_2O	=	1 mole of H_2O
36 grams of H_2O	=	2 mole of H_2O
1 mole H_2O	=	6.023×10^{23} molecules of H_2O
	=	1.204×10^{23} molecules of H_2O

7. Under same conditions of temperature and pressure, if you collect 3 litre of O_2, 5 litre of Cl_2 and 6 litre of H_2.　(APR–24)

A) Which has the highest number of molecules?

B) Which has the lowest number of molecules?

i) Number of Moles of O_2	=	Volume of S.T.P / Molar Volume
	=	3 / 22.4
	=	0.1339 moles
Number of Molecules	=	Number of moles x Avagadro number
	=	$0.1339 \times 6.023 \times 10^{23}$
	=	0.8064×10^{23}
	=	$8.064 \times 10^{22}\ O_2$ molecules

Number of moles of Cl_2	=	5 / 22.4 = 0.2232 moles
Number of molecules	=	$0.2232 \times 6.023 \times 10^{23}$
	=	1.344×1023 molecules
Number of moles of H_2	=	
	=	6 / 22.4 = 0.2678 moles
Number of molecules	=	$0.2678 \times 6.023 \times 10^{23}$
	=	1.6129×10^{23} molecules

1) 6 litre of H_2 has the highest number of molecules

2) 3 litre of O_2 has the lowest number of molecules

Textbook Evaluation   **PAGE-184**

I. CHOOSE THE BEST ANSWER

1. **Casparian strips are present in the _____ of the root.** (GMQ, JUNE-23)

   a) cortex   b) pith

   c) pericycle   d) endodermis

   Ans: d) Endodermis

2. **The endarch condition is the characteristic feature of** (MAY-22, AUG-22, APR-24)

   a) root   b) stem

   c) leaves   d) flower   **Ans: b) Stem**

3. **The xylem and phloem arranged side by side on same radius is called _____.**

   a) radial   b) amphivasal

   c) conjoint   d) None of these

   Ans: c) Conjoint

4. **Which is formed during anaerobic respiration** (GMQ SEP-20)

   a) Carbohydrate   b) Ethyl alcohol

   c) Acetyl CoA   d) Pyruvate

   Ans: b) Ethyl alcohol

5. **Kreb's cycle takes place in** (PTA - 3, APR-23)

   a) chloroplast   b) mitochondrial matrix

   c) stomata

   d) inner mitochondrial membrane

   Ans: b) Mitochondrial matrix

6. **Oxygen is produced at what point during photosynthesis?** (PTA – 4)

   a) when ATP is converted to ADP

   b) when CO_2 is fixed

   c) when H_2O is splitted

   d) All of these   **Ans: c) When H_2O is splitted**

II. FILL IN THE BLANKS

1. The innermost layer Cortex in root is called _____.   **Ans: Endodermis**

2. Xylem and phloem are arranged in an alternate radii constitute a vascular bundle called _____.

   Ans: radial bundle

3. Glycolysis takes place in _____.   **Ans: Cytoplasm**

4. The source of O_2 liberated in photosynthesis is _____.   **Ans: water**

5. _____ is ATP factory of the cells.   **Ans: Mitochondria**

III. STATE WHETHER THE FOLLOWING STATEMENTS ARE TRUE OR FALSE. IF FALSE CORRECT THE STATEMENT.

1. Phloem tissue is involved in the transport of water in plant.

Ans : **False.**

Correct statement : Phloem tissue is involved in the transport of **food** in plant.

2. The waxy protective covering of a plant is called as cuticle.

Ans : **True.**

3. In monocot stem cambium is present in between xylem and phloem.

Ans : **False.**

Correct statement : In **dicot stem** cambium is present in between xylem and phloem.

4. Palisade parenchyma cells occur below upper epidermis in dicot root.

Ans : **False.**

Correct statement : Palisade parenchyma cells occur below upper epidermis in **dicot leaf**.

5. Mesophyll contains chlorophyll.

Ans : **True.**

6. Anaerobic respiration produces more ATP than aerobic respiration.

Ans : **False.**

Correct statement : Anaerobic respiration produces **less ATP** than aerobic respiration.

IV. MATCH THE ITEMS IN COLUMN-I TO THE ITEMS IN COLUMN-II

S. No.	Column I	Column II	Answer
1	Amphicribal	Dracaena	Fern
2	Cambium	Translocation of food	Secondary growth
3	Amphivasal	Fern	Dracaena
4	Xylem	Secondary growth	Conduction of water
5	Phloem	Conduction of water	Translocation of food

V. ANSWER IN A SENTENCE

1. What is collateral vascular bundle?

collateral vascular bundle is a type of bundle in which xylem lies towards the centre and phloem lies towards the periphery.

2. Where does the carbon that is used in photosynthesis come from?

From atmosphere in the form of CO_2.

3. What is the common step in aerobic and anaerobic pathway?

Glycolysis.

4. Name the phenomenon by which carbohydrates are oxidized to release ethyl alcohol.

Anaerobic respiration or fermentation.

Eg: Yeast.

VI. SHORT ANSWER QUESTIONS

1. Give an account on vascular bundle of dicot stem.

i) Vascular bundles of dicot stem are conjoint, collateral, endarch and open.

ii) They are arranged in the form of a ring around the pith.

2. Write a short note on mesophyll.

The tissue present between the upper and lower epidermis is called mesophyll. It is differentiated into palisade and Spongy Parenchyma

a) Palisade parenchyma:

It is found just below the upper epidermis. These cells have more number of chloroplasts.

The cells do not have intercellular spaces and they take part in photosynthesis.
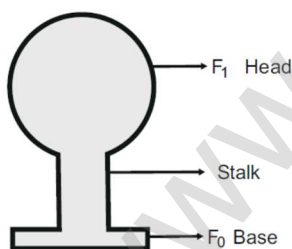
The cells are elongated

b) Spongy parenchyma:

It is found below the palisade parenchyma tissue.

Cells have intercellular spaces. It helps in gaseous exchange.

The cells are almost spherical or oval.

**3. Draw and label the structure of Oxysomes.**
(JUNE-23)

4. Name the three basic tissues system in flowering plants. (APR-23)

i) Dermal or Epidermal tissue system

ii) Ground tissue system

iii) Vascular tissue system

5. What is photosynthesis and where in a cell does it occur? (PTA-3,SEP-21)

i) Photosynthesis is a process in which **carbon dioxide** combines with **water** in the presence of **sunlight** and **chlorophyll** to form **carbohydrates**. During this process **oxygen** is released as a byproduct.

ii) It occurs in the **chloroplast** of plant cell.

$$6CO_2 + 12H_2O \xrightarrow[chlorophyll]{Light} C_6H_{12}O_6 + 6 H_2O + 6O_2\uparrow$$
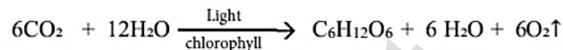
6. What is respiratory quotient?
(PTA - 1, SEP-21, MAY-22, AUG-22, APR-24)

Respiratory quotient is the ratio of volume of carbon dioxide liberated and the volume of oxygen consumed during respiration.

Respiratory Quotient (RQ) =

$$\frac{Volume\ of\ CO_2\ liberated}{Volume\ of\ O_2\ liberated}$$

7. Why should the light dependent reaction occur before the light independent reaction?
(APR-24)

Because light dependent reaction supplies organic energy molecules such as ATP and NADPH$_2$, which is necessary to reduce CO_2 into carbohydrate in the light independent reaction.

8. Write the reaction for photosynthesis?
(MAY-22)

$$6CO_2 + 12H_2O \xrightarrow[Chlorophyll]{Sunlight /} C_6H_{12}O_6 + 6H_2O + 6O_2$$
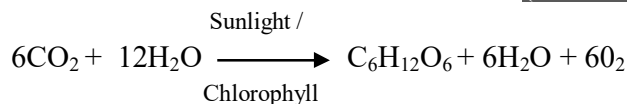
ADDITIONAL QUESTIONS

9. What is the common step in aerobic and anaerobic pathway and where does it occur in a cell? (PTA-5)

i) It take place in cytoplasm in cell

ii) It is a breakdown of one molecule of glucose (6 carbon) into two molecules of pyruvic acid (3 carbon)

iii) It is the first step of both aerobic and anaerobic respiration.

10. What is vascular bundle?   **(PTA - 1)**

Xylem and phloem tissues present in the form of bundles are called as vascular bundles.

11. What are the factors affecting photosynthesis?   **(AUG-22, APR-23)**

a) Internal Factors :

i) Pigments

ii) Leaf age

iii) Accumulation of carbohydrates

iv) Hormones

b) External Factors.

i) Light   ii) Carbon dioxide

iii) Temperature   iv) Water

v) Mineral elements

VII. LONG ANSWER QUESTIONS

1. Differentiate the following   **(G.MQ. AUG-22)**

a) Monocot root and Dicot root   **(SEP-20)**

b) Aerobic and Anaerobic respiration.   **(SEP-21)**

Ans:

a) Monocot root and Dicot root

S.No.	Tissue	Monocot root	Dicot root
1	Number of Xylem	Polyarch	Tetrarch
2	Cambium	Absent	Present (During secondary growth only)
3	Secondary Growth	Absent	Present
4	Pith	Present	Absent
5	Conjunctive Tissue	Sclerenchyma	Parenchyma
6	Example	Maize	Bean

b) Aerobic and Anaerobic Respiration.

S.No.	Aerobic Respiration.	Anaerobic Respiration. (AUG-22)
1	Glucose is **completely** oxidized with the help of oxygen.	oxidation of Glucose takes place without oxygen.
2	Glucose oxidized into CO_2 , H_2O and Energy	Glucose is converted into ethanol or lactic acid
3	It occurs in most plants and animals.	It occurs in some bacteria
4	$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O +$ ATP	$C_6H_{12}O_6 \rightarrow 2CO_2 + 2C_2H_5OH +$ Energy (ATP)

2. Describe and name three stages of cellular respiration that aerobic organisms use to obtain energy from glucose.

Stages of Aerobic respiration

a) Glycolysis:

i) It is the breakdown of one molecule of glucose into two molecules of pyruvic acid.

ii) Glycolysis takes place in cytoplasm of the cell.

iii) It is the first step of both aerobic and anaerobic respiration.

b) Krebs Cycle:

   i)   This cycle occurs in mitochondria matrix.

  ii)   At the end of glycolysis, 2 molecules of pyruvic acid enter into mitochondria.

 iii)   The oxidation of pyruvic acid into CO_2 and water takes place through this cycle.

c) Electron Transport Chain;

   i)   This is accomplished through a system of electron carrier complex called Electron Transport Chain (ETC) located on the inner membrane of the mitochondria.

  ii) $NADH_2$ and $FADH_2$ molecules formed during glycolysis and Krebs cycle are oxidised to NAD^+ and FAD^+ to release the energy via electrons.

 iii)   The electrons, as they move through the system, release energy which is trapped by ADP to synthesize ATP. This is called oxidative phosphorylation.

 iv)   In this process, O_2 the ultimate acceptor of electrons gets reduced to water.

3. **How does the light dependent reaction differ from the light independent reaction? What are the end product and reactants in each? Where does each reaction occur within the chloroplast?**

	Light dependent reaction	**Light independent reaction**
Reaction (i)	It takes place in the **presence of light**.	It takes place in the **absence of light**.
Reaction (ii)	Photosynthetic pigments absorb the light energy and convert it into chemical energy ATP and $NADPH_2$.	During this reaction CO_2 is reduced into carbohydrates
Reactants	Sunlight, Water, ADP and NADPH.	CO_2 , ATP and $NADPH_2$
End Product	O_2, ATP and $NADPH_2$	Carbohydrate
Occurrence	In the **thylakoid membranes (Grana)** of the chloroplast.	In the **stroma** of the chloroplast.

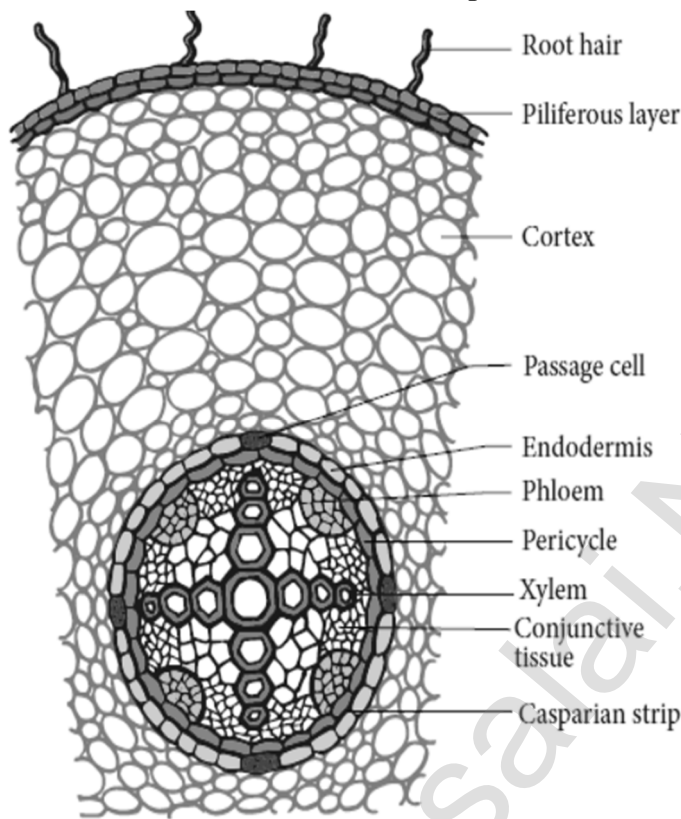## ADDITIONAL QUESTIONS

1. **Draw and label the different types of vascular bundles**   (PTA – 4)
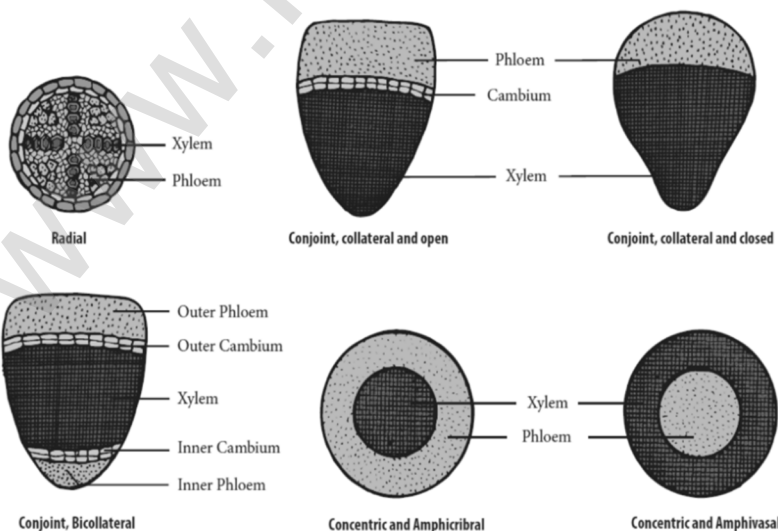
2. **Draw the internal structure of a Dicot root and label the parts** (PTA – 6)

VIII. HIGHER ORDER THINKING SKILLS (HOTS)

1. **The reactions of photosynthesis make up a biochemical pathway.** (PTA – 5)
   a) **What are the reactants and products for both light and dark reactions?**
   b) **Explain how the biochemical pathway of photosynthesis recycles many of its own reactions and identify the recycled reactants.**
   a) **The reactants and products for both light and dark reactions**
   Light reaction:
        Reactants - Light, Water, ADP and NADPH.
        End Product - O_2, ATP and $NADPH_2$
   Dark reaction:
        Reactants - CO_2, ATP and $NADPH_2$
        End Product - Carbohydrate.
   b) **Explain how the biochemical pathway of photosynthesis recycles many of its own reactions and identify the recycled reactants.**
        ADP and NADP

2. **Where do the light dependent reaction and the Calvin cycle occur in the chloroplast?**
   i)   Light dependent reaction takes place in the thylakoid membranes (Grana) of the chloroplast.
   ii) Calvin cycle takes place in the stroma of the chloroplast.
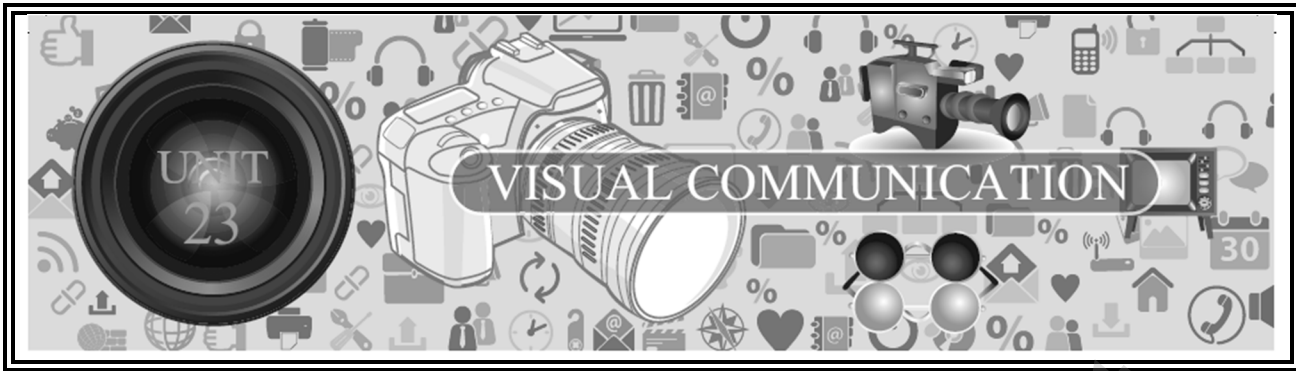
Textbook Evaluation   **PAGE-333**

I. CHOOSE THE BEST ANSWER

1. **Which software is used to create animation?**

(PTA - 3)

a) Paint   b) PDF

c) MS Word   d) Scratch   **Ans: d) Scratch**

2. **All files are stored in the _____.** (GMQ)

a) Folder   b) box

c) Pai   d) scanner   **Ans: a) Folder**

3. **Which is used to build scripts?** (PTA - 1)

a) Script area   b) Block palette

c) stage   d) sprite

Ans: a) Script area

4. **Which is used to edit programs?** (PTA-2)

a) Inkscape   b) script editor

c) stage   d) sprite

Ans: b) Script editor

5. **Where you will create category of blocks?**

a) Block palette b) Block menu

c) Script area   d) sprite

Ans: b) Block menu

ADDITIONAL QUESTIONS

6. **The application in a computer created any output is generally referred as _____.**

(PTA - 6)

a) command   b) folder

c) file   d) paint   **Ans: c) file**

7. **In computer _____ is used to collect the notes.** (PTA - 4)

a) Notepad   b) paint

c) scanner   d)scratch

Ans: a) Notepad

8. **More people are using _____ and _____ operating systems in their computers.**

(PTA - 5)

a) Mac, Amiga   b) Solaris, iOS

c) Windows, LINUX   d) Android, MiniX3

Ans: c) Windows, LINUX

II. MATCH THE FOLLOWING

S. No.	COLUMN A	COLUMN B
1	Script area	Type notes
2	Folder	Animation software
3	Scratch	Edit programs
4	Costume editor	Store files
5	Notepad	Build scripts

Ans:

S. No.	COLUMN A	COLUMN B
1	Script area	Build scripts
2	Folder	Store files
3	Scratch	Animation software
4	Costume editor	Edit programs
5	Notepad	Type notes

III. ANSWER THE FOLLOWING

1. What is Scratch?

➤ Scratch is a Visual Programming Language.

➤ Scratch is a software used to create animations, cartoons and games easily.

2. Write a short note on editor and its main parts?   (JUNE-23)

Editors are software programs that enable the user to create and edit files.

The Scratch editor has three main parts: They are Stage, Sprite and Script editor.

(i) Stage: Stage is the background appearing when we open the scratch window. The background will most often be white. You can change the background colour as you like.

(ii) Sprite: The characters on the background of a Scratch window are known as Sprite. Usually a cat appears as a sprite when the Scratch window is opened. The software provides facilities to make alternations in sprite.

(iii) Script editor / costume editor: Where you edit your programs or your sprite's pictures.

3. What is Stage?   (SEP-20, APR-24)

Stage is the background appearing when we open the scratch window. The background will most often be white. You can change the background colour as you like.

4. What is Sprite?   (APR-23)

The characters on the background of a Scratch window are known as Sprite. Usually a cat appears as a sprite when the Scratch window is opened. The software provides facilities to make alternations in sprite.

PRACTICALS

S. NO.		NAME OF THE EXPERIMENT	TIME
1.	PHYSICS	Determination of weight of an object using the principle of moments	40 minutes
2.		Determination of focal length of a convex lens	40 minutes
3.		Determination of resistivity	40 minutes
4.	CHEMISTRY	Identification of the dissolution of the given salt whether it is exothermic or endothermic	40 minutes
5.		Testing the solubility of the salt	40 minutes
6.		Testing the water of hydration of salt	40 minutes
7.		Test the given sample for the presence of acid or base	40 minutes
8.	BIO - BOTANY	Photosynthesis - Test tube and Funnel Experiment (Demonstration)	40 minutes
9.		Parts of a Flower	40 minutes
10.		Mendel's Monohybridcross	40 minutes
11.		Observation of Transeverse Section of Dicot stem and Dicot Root	40 minutes
12.	BIO - ZOOLOGY	Observation of Models - Human Heart and Human Brain	40 minutes
13.		Identification of Blood Cells	40 minutes
14.		Identification of Endocrine Glands	40 minutes

PHYSICS

1. DETERMINATION OF WEIGHT OF AN OBJECT USING THE PRINCIPLE OF MOMENTS

Aim:

To determine the weight of an object using the principle of moments

Apparatus required:

A metre scale, a knife edge, slotted weights, thread

Procedure:

- ➢ A metre scale is supported at its centre of gravity by a knife edge or suspended by using a thread tied to its centre so that the scale is in the horizontal position. Ensure that the scale is in equilibrium position.

- ➢ A known weight W_2 and an unknown weight W_1 are suspended from to either side of the scale using the weight hangers.

- ➢ Fix the position of one weight hanger and adjust the position of the second weight hanger such that the scale is in equilibrium.

- ➢ Measure the distance d_1 and d_2 of the two weight hangers from the centre of the scale accurately.

- ➢ The experiment is repeated for different positions of the unknown weight. Measure the distances. The reading are tabulated as follows:
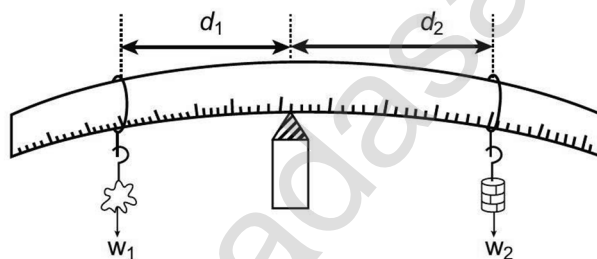
Observation:

S. No.	Weight in the weight hanger (W_2) kg	Distance of known weight d_2 (m)	Distance of unknown weight d_1 (m)	$W_2 \times d_2$ (kg x m)	Unknown weight $W_1 = \dfrac{W_2 \times d_2}{d_1}$ (kg)
1	0.050	0.2	0.13	0.01	0.077
2	0.100	0.2	0.255	0.02	0.078
3	0.150	0.2	0.375	0.03	0.080
				Mean	**0.078**

Calculations:

Moment of a force can be calculated using the formula

Moment of the force = Force x distance

Clock wise moment by unknown weight $= W_1 \times d_1$

Anticlockwise moment by known weight $= W_2 \times d_2$

$W_1 \times d_1 = W_2 \times d_2$ Unknown weight W_1 $= \dfrac{W_2 \times d_2}{d_1}$

Result:

Using the principle of moments, the weight of the unknown body $W_1 = 0.078$ Kg.

GOVT. EXAM - APRIL 2024

PART I

(i) **Answer all the questions.**

(ii) **Choose the most appropriate answer from the given four alternatives and write the option code and the corresponding answer. 12 x 1 = 12**

1. **The endarch condition is the characteristic feature of:**
   (a) Root					(b) Stem
   (c) Leaves				(d) Flowers

2. **TFM in soaps represents_____content in soap.**
   (a) Mineral				(b) Vitamin
   (c) Fatty matter			(d) Carbohydrate

3. **The value of Universal Gas Constant:**
   (a) 3.81 J mol^{-1} K^{-1}			(b) 8.03 J mol^{-1} K^{-1}
   (c) 1.38 J mol^{-1} K^{-1}			(d) 8.31 J mol^{-1} K^{-1}

4. **Kilowatt hour is the unit of:**
   (a) resistivity			(b) conductivity
   (c) electrical energy		(d) electrical power

5. **An enzyme which cuts DNA is:**
   (a) Protease
   (b) Restriction endonuclease
   (c) DNA Ligase
   (d) RNA ase

6. **One mole of nay substance contains_____molecules.**
   (a) 6.023×10^{23}			(b) 6.023×10^{-23}
   (c) 3.0115×10^{23}			(d) 12.046×10^{23}

7. **Which one is referred as "Master gland"?**
   (a) Pineal gland			(b) Pituitary gland
   (c) Thyroid gland		(d) Adrenal gland

8. **Which among the following is not the characteristic of anemophilous plants?**
   (a) the flowers produce enormous amount of pollen grains.
   (b) the stigmas are large and protruding.
   (c) the flowers are brightly coloured, have smell and nectar.
   (d) pollen grains are small and dry.

9. **Inertia of a body depends on:**
   (a) Weight of the object
   (b) Acceleration due to gravity of planet
   (c) Mass of the object
   (d) Both (a) and (b)

10. **Which is the correct sequence of blood flow?**
    (a) Ventricle $\rightarrow$ Atrium $\rightarrow$ Vein $\rightarrow$ Arteries
    (b) Atrium $\rightarrow$ Ventricle $\rightarrow$ Vein $\rightarrow$ Arteries
    (c) Atrium $\rightarrow$ Ventricle $\rightarrow$ Arteries $\rightarrow$ Vein
    (d) Ventricle $\rightarrow$ Vein $\rightarrow$ Atrium $\rightarrow$ Arteries

11. **Which of the following is not an "element + element $\rightarrow$ compound" type reaction?**
    (a) $C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}$
    (b) $2K_{(s)} + Br_{2(I)} \rightarrow 2KBr_{(s)}$
    (c) $2CO_{(g)} + O_{2(g)} \rightarrow 2CO_{2(g)}$
    (d) $4Fe_{(s)} + 3O_{2(g)} \rightarrow 2Fe_2 O_{3(s)}$

12. **Cancer of the epithelial cell is called as _____.**
    (a) Leukaemia			(b) Sarcoma
    (c) Carcinoma			(d) Lipoma

PART - II

Answer **any seven** questions. Question No.**22 is compulsory.**					**7 x 2 = 14**

13. What is coefficient of apparent expansion?

14. Why is tungsten metal used in bulbs but not used as fuse wires?
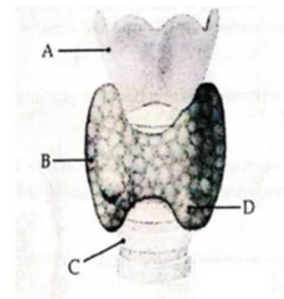
15. What is rust? Give the equation for the formation of rust.

16. What is stage?

17. Why is sinoatrial node called as pacemaker of heart?

18. What are the parts of the hind brain?

19. Identify the parts A, B, C and D in the given figure.

20. What is colostrum? How is milk production hormonally regulated?

21. What is metastasis?

22. If the pH of a solution is 4.5, find the value of its pOH.

PART - III

Answer **any seven** questions. Question No.**32 is compulsory.**   **7 x 4 = 28**

23. Explain the various types of inertia with examples.

24. (a) Write any three features of natural and artificial radioactivity.

    (b) Name any two devices, which are working on the heating effect of current.

25. (a) What happens when $MgSO_4$ $7H_2O$ is heated? Write the appropriated equation.

    (b) Define : Solubility.

26. (a) What is Respiratory Quotient?

    (b) Why should the light dependent reaction occur before light independent reaction during photosynthesis?

27. Write the dental formula of rabbit.

28. (a) Why is Euploidy considered to be advantageous to both plants and animals?

    (b) Classify Neurons based on its structure.

29. How are Arteries and Veins structurally different from one another?

30. Define Ethnobotany and write its importance.

31. (a) What are the consequences of deforestation?

    (b) State the applications of DNA finger printing technique.

32. (a) Name the acid that renders Aluminium passive. Why?

    (b) Calculate the number of moles in 1.51×10^{23} molecules of NH_4Cl.

PART - IV

Answer **all** the questions. Draw diagrams wherever necessary.   **3 x 7 = 21**

33. (a) (i) What are the uses of convex lens?

    (ii) Define dispersion of light.

    (iii) Why are traffic signals red in colour?

    (iv) What is the least count of travelling microscope?

OR

    (b) (i) What is an echo?

(ii) State two conditions necessary for hearing an echo?

(iii) What are the medical applications of echo?

(iv) How can you calculate the speed of sound using echo?

34. (a) (i) Under same conditions of temperature and pressure, if you collect 3 litre of O_2, 5 litre of Cl_2 and 6 litre of H_2.

    (A) Which has the highest number of molecules?

    (B) Which has the lowest number of molecules?

    (ii) Give the salient features of 'Modern Atomic theory'.

OR

(b) (i) How do detergents cause water pollution?

    (ii) An organic compound 'A' is widely used as a preservative and has the molecular formula $C_2H_4O_2$.

    This compound reacts with ethanol to form a sweet smelling compound 'B', then

    (A) Identify the compound 'A'

    (B) Write the chemical equation for its reaction with ethanol to form compound 'B'.

    (C) Name this process.

35. (a) (i) What are synthetic auxins? Give an example.

    (ii) With a neat labelled diagram, describe the parts of the typical angiospermic ovule.

OR

    (b) (i) Who is called the "Father of Indian Green Revolution"?

    (ii) Differentiate between out-breeding and in-breeding.

    (iii) Differentiate between Type-I and Type-II Diabetes mellitus.

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