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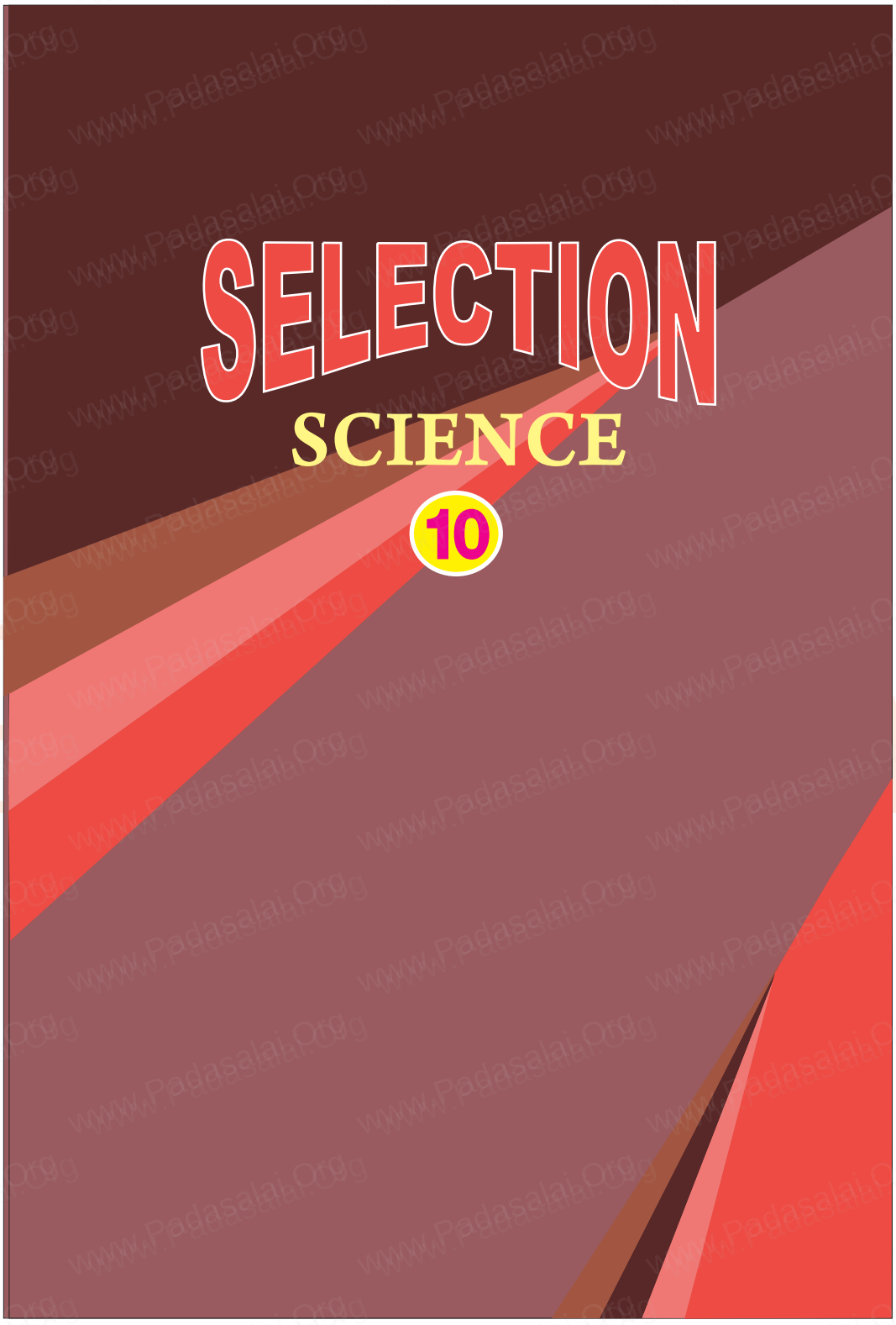
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CONTENT

SELECTION 10 SCIENCE

PHYSICS

1. Laws of Motion

TEXT BOOK EVALUATION

I. Choose the correct answer:

1) Inertia of a body depends on

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 equals to

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 & b d) only for bodies with equal masses
Ans : c) both a & b

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) cm s^{-1} b) N kg^{-1}
c) N m^2 kg^{-1} d) cm^2 s^{-2} **Ans : b) N kg^{-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 : c) M/4**

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 : c) decrease by 25%

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

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 : Gears**
5. A man of mass 100 kg has a weight of _____ at the surface of the Earth
Ans : 980 N(w=mg= 100x9.8=980N)

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 : True
2. Apparent weight of a person is always equal to his actual weight
Ans : False. Apparent weight of a person **is not** equal to his actual weight
3. Weight of a body is greater at the equator and less at the polar region.
Ans : False. 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. Turning a nut with a spanner having a short handle is so **difficult** than one with a long handle.
5. There is no gravity in the orbiting space station around the Earth. So the astronauts feel weightlessness.
Ans : False. Since the space station and astronauts have equal acceleration, they are under free fall condition. Hence the astronauts feel weightlessness.

IV. Match the following.

Column I		Column II
a. Newton's I law	-	1. Propulsion of a rocket
b. Newton's II law	-	2. Stable equilibrium of a body
c. Newton's III law	-	3. Law of force
d. Law of conservation of Linear momentum	-	4. Flying nature of bird

Ans :

Column I		Column II
a. Newton's I law	-	2. Stable equilibrium of a body
b. Newton's II law	-	3. Law of force
c. Newton's III law	-	4. Flying nature of bird
d. Law of conservation of Linear momentum	-	1. Propulsion of a rocket

---

V. Assertion & Reasoning

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

VI. Answer briefly.

1. Define inertia. Give its classification.
Inertia :
Ability of a body to maintain its state of rest or motion is called inertia.
Classification :
(i) Inertia of rest
(ii) Inertia of motion
(iii) Inertia of direction

---

2. Classify the types of force based on their application.

Types of force		Application
(i) Like parallel force	-	Pulling a cart
(ii) Unlike parallel forces	-	Tug of war

---

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

(i) The resultant force = 5N - 15N = -10N
(ii) The resultant force is directed along the greater force (15 N)

---

4. Differentiate mass and weight.

Mass	Weight
(i) Quantity of matter contained in the body	(i) Gravitational force exerted on a body due to the earth's gravity alone
(ii) Its SI unit is Kilogram (Kg)	(ii) Its SI unit is Newton (N)
(iii) Remains the same	(iii) Varies from place to place
(iv) Fundamental quantity	(iv) Derived quantity

5. Define moment of a couple.

Rotating effect of couple is known as the moment of a couple.

Moment of the couple is measured by the product of any one of the forces and the perpendicular distance between two forces.

Moment of a couple = Force x Perpendicular distance between the line of action of forces

$$M = F \times S$$

Its SI Unit is Newton meter (Nm)

6. State the principle of moments.

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.

Moment in clockwise direction = Moment in anticlockwise direction

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

7. State Newton's second law.

Newton's Second 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.

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

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

★ Moment of force = Force x Perpendicular distance

τ = F X d

★ If a spanner have a long handle the perpendicular distance will be large

★ So, moment of force is large

★ Hence a spanner with a long handle is preferred to tighten screws in heavy vehicles.

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

Because the fielder experiences a smaller force for a longer interval of time to catch the ball, 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 spacestation and astronauts have equal acceleration, they are under free fall condition.

★ Hence, both the astronauts and the spacestation are in the state of weightlessness.

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.

The ratio of mass of two bodies = $\frac{m_1}{m_2} = \frac{3}{4} = 3:4$

The acceleration produced by the bigger mass of a body $a_2 = 12ms^{-2}$

Acceleration of the other body $a_1 = ?$

Same force acts on the body

$\therefore F_1 = F_2$

$m_1a_1 = m_2a_2$

$a_1 = \frac{m_2}{m_1} x a_2$

$a_1 = \frac{4}{3} x 12 = 16\,ms^{-2}$

Acceleration of the other body **$a_1 = 16ms^{-2}$**

---

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 a ball, m	=	1 kg
Initial velocity of a ball u	=	$10ms^{-1}$
Final velocity of a ball v	=	$-10ms^{-1}$
Initial momentum of the ball, P_i	=	mu
p_i	=	$1 X 10 = 10\,kgms^{-1}$
Final momentum of the ball, P_f	=	$mv = 1X(-10) = -10\,kgms^{-1}$
Change in linear momentum ΔP	=	$P_f - P_i = (-10-10)\,kgms^{-1}$
Change in linear momentum of the ball	=	$-20\,kgms^{-1}$

---

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 of spanner, d_1	=	40 cm = 0.4 m
The moment of a force M	=	$F_1 x d_1$
	=	$140 x 0.4 = 56\,Nm$
Force, F_2	=	40 N
Length of spanner, d_2	=	?
The moment of a force M	=	56 Nm
	M =	$F_2 x d_2$

$d_2 = \frac{M}{F_2} = \frac{56}{40} = 1.4m = 140\,cm$; length of spanner **$d_2 = 140$ cm**

---

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.

The ratio of masses of two planets $= \frac{M_1}{M_2} = \frac{2}{3} = 2:3$

The ratio of their radii $= \frac{R_1}{R_2} = \frac{4}{7} = 4:7$

The ration of their accelerations due to gravity $= \frac{g_1}{g_2} = ?$

$$g = \frac{GM}{R^2} \; ; \; g_1 = \frac{GM_1}{R_1^2} \; ; \; g_2 = \frac{GM_2}{R_2^2}$$

$$\frac{g_1}{g_2} = \frac{GM_1/R_1^2}{GM_2/R_2^2} = \frac{GM_1}{R_1^2} \times \frac{R_2^2}{GM_2} = \frac{M_1}{M_2} \times \left(\frac{R_2}{R_1}\right)^2$$

$$= \frac{2}{3} \times \left(\frac{7}{4}\right)^2$$

$$\frac{g_1}{g_2} = \frac{2}{3} \times \frac{49}{16} = \frac{49}{24}$$

The ratio of their acceleration due to gravity = $g_1 : g_2 = 49 : 24$

VIII. Answer in detail.

1. What are the types of inertia? Give an example for each type.

Types of Inertia :

a) Inertia of rest: Th e resistance of a body to change its state of rest is called inertia of rest.

b) Inertia of motion: Th e resistance of a body to change its state of motion is called inertia of motion.

c) Inertia of direction: The resistance of a body to change its direction of motion is called inertia of direction.

Examples of Inertia :

★ An athlete runs some distance before jumping. Because, this will help him jump longer and higher. (Inertia of motion)

★ When you make a sharp turn while driving a car, you tend to lean sideways, (Inertia of direction).

★ When you vigorously shake the branches of a tree, some of the leaves and fruits are detached and they fall down, (Inertia of rest).

---

2. State Newton's laws of motion?

(i) NEWTON'S LAWS OF MOTION

Newton's First Law :

This law states that every body 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.

(ii) NEWTON'S SECOND LAW OF MOTION :

"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".

(iii) NEWTON'S THIRD LAW OF MOTION :

'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.

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 $\Delta p = P_f - P_i = mv - mu$

By Newton's second law of motion,

Force, $F \alpha$ rate of change of momentum

$F \alpha$ change in momentum / time

$$F \alpha \frac{mv - mu}{t} \quad ; \quad F = \frac{km(v-u)}{t}$$

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

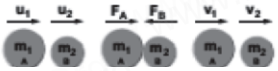
---

4. State and prove the law of conservation of linear momentum.

Law of Conservation of linear momentum :

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

Let us prove the law of conservation of linear momentum with the following illustration:



(Conservation of linear momentum)

Proof:

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,

$$F_B = m_2 (v_2 - u_2)/t$$

Force on body A due to B,

$$F_A = m_1 (v_1 - u_1)/t$$

By Newton's III law of motion,

Action force = Reaction force

$F_A = -F_B$

$m_1 (v_1 - u_1)/t = -m_2 (v_2 - u_2)/t$

$\mathbf{m_1 v_1 + m_2 v_2 = m_1 u_1 + m_2 u_2}$

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

Hence the law of conservation linear momentum is proved.

---

5. Describe rocket propulsion.

Rocket Propulsion :

Propulsion of rockets is based on the law of conservation of linear momentum as well as Newton's III law of motion. Rockets are filled with a fuel (either liquid or solid) in the propellant tank. 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. To balance this momentum, an equal and opposite reaction force is produced in the combustion chamber, which makes the rocket project forward.

While in motion, the mass of the rocket gradually decreases, until the fuel is completely burnt out. Since, there is no net external force acting on it, the linear momentum of the system is conserved. The mass of the rocket decreases with altitude, which results in the gradual increase in velocity of the rocket. 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. (This topic will be discussed in detail in higher classes).

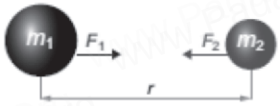
---

6. State the universal law of gravitation and derive its mathematical expression.

Newton's universal law of gravitation :

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.



Gravitational force between two masses

Let, m_1 and m_2 be the masses of two bodies A and B placed r metre apart in space

Force $F \alpha m_1 \times m_2$

$F \alpha 1/r^2$

On combining the above two expressions

$$F \alpha \frac{m_1 \times m_2}{r^2}$$

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

Where G is the universal gravitational constant.

Its value in SI unit is $6.674 \times 10^{-11} Nm^2 kg^{-2}$.

---

7. Give the applications of universal law gravitation.

Application of Newton's law of gravitation:

1) Dimensions of the heavenly bodies can be measured using the gravitation law. Mass of the Earth, radius of the Earth, acceleration due to gravity, etc. can be calculated with a higher accuracy.

2) Helps in discovering new stars and planets.

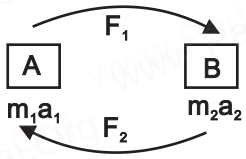
3) One of the irregularities in the motion of stars is called 'Wobble' lead to the disturbance in the motion of a planet nearby. In this condition the mass of the star can be calculated using the law of gravitation.

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

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

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 A, m_1 = 8 kg

Mass of block B, m_2 = 2 kg

Applied force, F = 15N

$F = F_1 = F_2 = 15\,N$

The force acting on B, $F_1 = 15N$

The force acting on A, $F_2 = -15N$

According to third law of Motion = $F_1 = -F_2$ Action = -Reaction

Force exerted on 2 kg mass = **15N**

---

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.

Mass of bike = m_1

Mass of heavy truck = m_2

$m_2 = 4m_1$

Same Kinetic energy

So, $V = V_1 = V_2$

Momentum $p = mv$

$p_1 = m_1V_1 = m_1V$

$p_2 = m_2V_2 = m_2V$

Ratio of their momenta

$$\frac{p_1}{p_2} = \frac{m_1V}{m_2V} = \frac{m_1}{m_2} \quad ; \quad \frac{p_1}{p_2} = \frac{m_1}{4m_1} = \frac{1}{4}$$

Ratio of their momenta = **1:4**

---

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

According to **Newton's first law**,

If we don't wear a seat belt, we will move forward due to a sudden brake. Because, our vehicle comes to a quick stop. But our body continues in the state of motion due to inertia. So, we will get injury.

According to the **second law of motion**,

When we are wearing our seat belt, it supplies the force to decelerate us in the event of crash. So that we don't hit the windshield.

According to **third law of motion** ,

During crash if we don't wear helmet, we will get head injury.

Additional Questions :

I. Choose the correct answer.

1. 'Push' or 'Pull' is called as.....
a) inertia b) momentum c) force d) power **Ans : c) force**

2. ..... deals with the bodies, which are at rest under the action of forces
a) Statics b) Dynamics c) Kinematics d) Kinetics **Ans : a) Statics**

3. According to ....., the natural state of earthly bodies is 'rest'
a) newton b) Galileo c) Aristotle d) Fleming **Ans : c) Aristotle**

4. An athlete runs some distance before jumping to jump longer and higher. It is due to .....
a) inertia of motion b) inertia of direction
c) inertia of rest d) inertia of body **Ans : a) inertia of motion**

5. The SI unit of momentum is .....
a) $kgms^{-2}$ b) $kgms^{-1}$ c) $kgms^{1}$ d) $kgms^{2}$ **Ans : b) $kgms^{-1}$**

6. SI unit of moment of the force is .....
a) Nm^{2} b) Nm^{3} c) Nm d) Nm^{4} **Ans : c) Nm**

7. 1 N = ... dyne.
a) 10^{2} b) 10^{3} c) 10^{4} d) 10^{5} **Ans : d) 10^{5}**

8. If the lift is moving downward with an acceleration 'a', the apparent weight is ..... than the actual weight
a) greater b) lesser c) more d) equal **Ans : b) lesser**

9. Newton's law of ..... helps in discovering new stars and planets.
a) motion b) gravitation c) rest d) inertia **Ans : b) gravitation**

10. The SI unit of weight is .....
a) kgf b) cgf c) mg d) Nm **Ans : a) kgf**

II. Fill in the blanks.

1. ..... is the study of moving bodies under the action of forces. **Ans : Dynamics**
2. ..... deals with the motion of bodies without considering the cause of motion. **Ans : Kinematics**
3. ..... deals with the motion of bodies considering the cause of motion **Ans : Kinetics**
4. If moving body naturally comes to rest without any external force, the motion is termed as ..... **Ans : natural motion**
5. When dropped from a height in vacuum, bodies of different size, shape and mass fall at ..... **Ans : same rate**
6. When you make a sharp turn while driving a car, you tend to lean sideways because of ..... **Ans : inertia of direction**
7. The .....measures the impact of a force on a body **Ans : linear momentum**
8. Force is ..... quantity **Ans : vector**
9. Rotating effect of a couple is known as ..... **Ans : moment of a couple**
10. SI unit of force is ..... **Ans : newton (N)**
11. SI unit of gravitational unit of force is ..... **Ans : kilogram force**
12. A large force acting for a very short interval of time is called as ..... **Ans : impulsive force**
13. The velocity of the rocket to escape from the gravitational pull of the Earth is called ..... **Ans : escape velocity**
14. SI unit of acceleration due to gravity is ..... **Ans : ms^{-2}**
15. The value of 'g' is ..... **Ans : $9.8ms^{-2}$**

16. The value of 'G'is ..... Ans :$6.674X10^{-11}Nm^2kg^{-2}$
17. The mass of the Earth is ..... Ans :$5.972X10^{24}kg$
18. The relation between 'g' and 'G' is ..... Ans : $\left(g=\frac{GM}{R^2}\right)$
19. The value of 'g' is ..... in the polar region and ..... at the equatorial region.
Ans :maximum, minimum
20. The value of acceleration due to gravity on the surface of the moon is .....
Ans :$1.625ms^{-2}$
21. When the person in a lift moves down with an acceleration (a) equal to the acceleration due to gravity (g) (i.e) when a = g, this motion is called .....
Ans :free fall
22. One of the irregularities in the motion of stars is called ..... Ans :wobble

III. Match the following

quantity		formula
a) linear momentum (p)	-	i) mg
b) moment of force(ι)	-	ii) mV
c) Force (F)	-	iii) F X t
d) Impulse (J)	-	iv) F X d
e) Weight (w)	-	v) ma

Ans :

quantity		formulla
a) linear momentum (p)	-	ii) mV
b) moment of force(ι)	-	iv) F X d
c) Force (F)	-	v) ma
d) Impulse (J)	-	iii) F X t
e) Weight (w)	-	i) mg

IV. Short questions.

1. Define balanced and unbalanced forces.

If the resultant force of all the forces acting on a body is equal to zero, then the body will be in equilibrium. Such forces are called **balanced forces.** If the resultant force is not equal to zero, then it causes the motion of the body due to **unbalanced forces**

2. Define moment of force.

The rotating or turning effect of a force about a fixed point or fixed axis is called **moment of the force** about that point or **torque (ι).**

3. Define couple.

Two equal and unlike parallel forces applied simultaneously at two distinct points constitute a **couple.**

4. Define unit force.

The amount of force required to produce an acceleration of 1 m s^{-2} in a body of mass 1 kg is called **'unit force'.**

5. Give an example for newton's third law of motion.

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

6. What is meant by acceleration due to gravity?

The acceleration of the body is due to the Earth's gravitational force. So, it is called as 'acceleration due to gravity of Earth'. It is denoted by 'g' . The value of $g = 9.8 ms^{-2}$

7. What are the applications of Torque?

(i) Gears
(ii) Seasaw
(iii) Steering wheel

8. Define Impulse.

When a force F acts on a body for a period of time' t', then the product of force and time is known as 'impulse'

Impulse, $J = F X t$

9. Define the state 'weightlessness'

Whenever a body or a person falls freely under the action of Earth's gravitational force alone, it appears to have zero weight. This state is referred to as **'weightlessness'**

2. Optics

TEXT BOOK EVALUATION

I. Choose the correct answer:

1. The refractive index of four substances A, B, C and D are 1.31, 1.43, 1.33, 2.4 respectively. The speed of light is maximum in

a) A b) B c) C d) D **Ans : a) A**

2. Where should an object be placed so that a real and inverted image of same size is obtained by a convex lens

a) f b) 2f c) infinity d) between f and 2f **Ans : 2f**

3. A small bulb is placed at the principal focus of a convex lens. When the bulb is switched on, the lens will produce

a) a convergent beam of light b) a divergent beam of light
c) a parallel beam of light d) a coloured beam of light

Ans : c) a parallel beam of light

4. Magnification of a convex lens is

a) Positive b) negative
c) either positive or negative d) zero **Ans : c) either positive or negative**

5. A convex lens forms a real, diminished point sized image at focus. Then the position of the object is at

a) focus b) infinity
c) at 2f d) between f and 2f **Ans : b) infinity**

6. Power of a lens is -4D, then its focal length is

a) 4m b) -40m c) -0.25 m d) -2.5 m **Ans : c) -0.25 m**

7. In a myopic eye, the image of the object is formed

a) behind the retina b) on the retina
c) in front of the retina d) on the blind spot **Ans : c) in front of the retina**

8. The eye defect 'presbyopia' can be corrected by

a) convex lens b) concave lens
c) convex mirror d) Bi focal lenses **Ans : d) Bifocal lenses**

9. Which of the following lens would you prefer to use while reading small letters found in a dictionary?

a) A convex lens of focal length 5 cm b) A concave lens of focal length 5 cm
c) A convex lens of focal length 10 cm d) A concave lens of focal length 10 cm

Ans : a) A convex lens of focal length 5 cm

10. If V_B, V_G, V_R be the velocity of blue, green and red light respectively in a glass prism, then which of the following statement gives the correct relation?

a) $V_B = V_G = V_R$ b) $V_B > V_G > V_R$
c) $V_B < V_G < V_R$ d) $V_B < V_G > V_R$ **Ans : b) $V_B > V_G > V_R$**

II. Fill in the blanks.

1. The path of the light is called as ..... **Ans : ray of light**
2. The refractive index of a transparent medium is always greater than ..... **Ans : 1**
3. If the energy of incident beam and the scattered beam are same, then the scattering of light is called as ..... scattering **Ans : elastic**
4. According to Rayleigh's scattering law, the amount of scattering of light is inversely proportional to the fourth power of its ..... **Ans : wavelength**
5. Amount of light entering into the eye is controlled by ..... **Ans : Iris**

III. True or False. If false correct it.

1. Velocity of light is greater in denser medium than in rarer medium
   Ans : False. Velocity of light is **less** in denser medium than in rarer medium
2. The power of lens depends on the focal length of the lens
   Ans : True.
3. Increase in the converging power of eye lens cause 'hypermetropia'
   Ans : False. Increase in the converging power of eye lens cause **'myopia'**
4. The convex lens always gives small virtual image.
   Ans : False. The convex lens always gives **real** image.

IV. Match the following.

Column - I		Column - II
1) Retina	-	a) Path way of light
2) Pupil	-	b) Far point comes closer
3) Ciliary muscles	-	c) near point moves away
4) Myopia	-	d) Screen of the eye
5) Hypermetropia	-	e) Power of accommodation

Ans :

Column - I		Column - II
1) Retina	-	**d) Screen of the eye**
2) Pupil	-	**a) Path way of light**
3) Ciliary muscles	-	**e) Power of accommodation**
4) Myopia	-	**b) Far point comes closer**
5) Hypermetropia	-	**c) near point moves away**

V. Assertion and reasoning type
Mark the correct choice as

1. Assertion: If the refractive index of the medium is high (denser medium) the velocity of the light in that medium will be small
Reason: Refractive index of the medium is inversely proportional to the velocity of the light

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

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

---

2. Assertion: Myopia is due to the increase in the converging power of eye lens.
Reason: Myopia can be corrected with the help of concave lens.

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

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

VI. Answer briefly.

1. What is refractive index?

The ratio of speed of light in vacuum to the speed of light in a medium is defined as refractive index 'μ' of the medium.

$$\text{refractive index } '\mu' = \frac{\text{speed of light in vacuum}}{\text{speed of light in medium}}$$

2. State Snell's law.

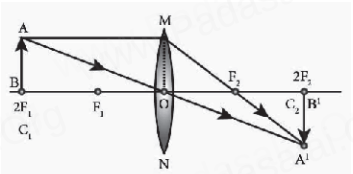
The ratio of the sine of the angle of incidence and sine of the angle of refraction is equal to the ratio of refractive indices of the two media. This law is also known as Snell's law.

$$\frac{\sin i}{\sin r} = \frac{\mu_2}{\mu_1}$$

3. Draw a ray diagram to show the image formed by a convex lens when the object is placed between F and 2F.

Object placed between F and 2F

When an object is placed in between the F and 2F, a real and inverted image is formed beyond $2F_2$. The size of the image is bigger than that of the object (Figure).



Object placed between F and 2F

4. Define dispersion of light

When a beam of white light is refracted through any transparent media such as glass or water, it is split into its component colours. This phenomenon is called as 'dispersion of light'.

5. State Rayleigh's law of scattering

The amount of scattering of light is inversely proportional to the fourth power of its wavelength.

$$\text{Amount of scattering 'S'} \quad \alpha \frac{1}{\lambda^4} \quad ; \quad \lambda\text{-wave length}$$

6. Differentiate convex lens and concave lens.

Convex Lens	Concave Lens
1) A convex lens is thicker in the middle than at edges.	A concave lens is thinner in the middle than at edges.
2) It is a converging lens.	It is a diverging lens.
3) It produces mostly real images.	It produces virtual images.
4) It is used to treat hypermeteropia.	It is used to treat myopia.

7. What is power of accommodation of eye?

The ability of the eye lens to focus nearby as well as the distant objects is called power of accommodation of the eye.

8. What are the causes of 'Myopia'?

(i) The lengthening of eye ball

(ii) The focal length of eye lense is reduced.

---

9. Why does the sky appear in blue colour?

When sunlight passes through the atmosphere, the blue colour (shorter wavelength) is scattered to a greater extent than the red colour (longer wavelength). This scattering causes the sky to appear in blue colour.

---

10. Why are traffic signals red in colour?

★ In traffic signals red colour light is used to stop vehicles because it has larger wave length.

★ According to Rayleigh's scattering law the shorter wavelength colours are scattered much more than the longer wavelength colours.

VII. Give the answer in detail

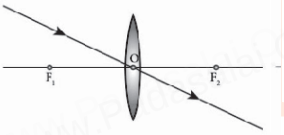
1. List any five properties of light

1. Light is a form of energy.
2. Light always travels along a straight line.
3. Light does not need any medium for its propagation. It can even travel through vacuum.
4. The speed of light in vacuum or air is, $c = 3 \times 10^8 ms^{-1}$.
5. Different coloured light has different wavelength and frequency.

---

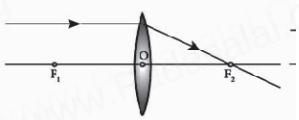
2. Explain the rules for obtaining images formed by a convex lens with the help of ray diagram.

Rule-1: When a ray of light strikes the convex lens obliquely at its optical centre, it continues to follow its path without any deviation.



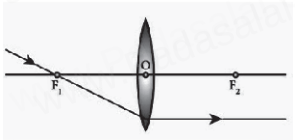
Rays passing through the optical centre

Rule-2: When rays parallel to the principal axis strikes a convex lens, the refracted rays are converged to the principal focus



Rays passing parallel to the optic axis

Rule-3: When a ray passing through the principal focus strikes a convex lens, the refracted ray will be parallel to the principal axis.



Rays passing through or directed towards the principal focus

---

3. Differentiate the eye defects: Myopia and Hypermetropia

Myopia	Hypermetropia
(i) Myopia is also known as short sightedness. (ii) With this defect, nearby objects can be seen clearly.	Hypermetropia is also known as long sightedness. With this defect distant objects can be seen clearly
(iii) It occurs due to the lengthening of eye ball	It occurs due to the shortening of eye ball
(iv) The image of distant objects are formed before the retina	The image of nearby objects are formed behind the retina.
(v) This defect can be corrected by using a concave lens.	This defect can be corrected by using a convex lens.

4. Explain the construction and working of a 'Compound Microscope'.

Compound microscope is also used to see the tiny objects. It has better magnification power than simple microscope.

Construction :

★ A compound microscope consists of two convex lenses.

★ The lens with the shorter focal length is placed near the object, and is called as 'objective lens' or 'objective piece'.

★ The lens with larger focal length and larger aperture placed near the observer's eye is called as 'eye lens' or 'eye piece'.

★ Both the lenses are fixed in a narrow tube with adjustable provision.

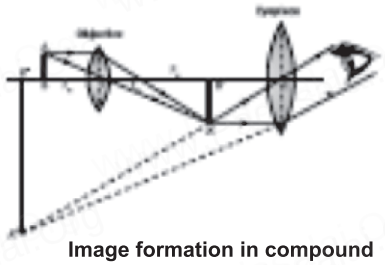


Image formation in compound microscope

Working :

★ The object (AB) is placed at a distance slightly greater than the focal length of objective lens ($u > f_o$).

★ A real, inverted and magnified image (A'B') is formed at the other side of the objective lens.

★ This image behaves as the object for the eye lens.

★ The position of the eye lens is adjusted in such a way, that the image (A'B') falls within the principal focus of the eye piece.

★ This eye piece forms a virtual, enlarged and erect image (A" B") on the same side of the object

★ Compound microscope has 50 to 200 times more magnification power than simple microscope

VIII. Numerical Problems:

1. An object is placed at a distance 20cm from a convex lens of focal length 10cm. Find the image distance and nature of the image.

Object distance 'u' = -20 cm

Focal length 'f' = 10 cm

Image distance 'v' = ?

Lens formula $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$; $\frac{1}{v} = \frac{1}{f} + \frac{1}{u}$

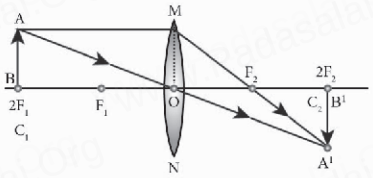
$\frac{1}{v} = \frac{1}{10} + \frac{1}{(-20)} = \frac{-20+10}{-200} = \frac{-10}{-200} = \frac{1}{20}$

Image distance v = 20 cm

The image is formed behind the lens.

Nature of image : Real and inverted image

Size of image : Same size as that of object.



2. An object of height 3cm is placed at 10cm from a concave lens of focal length 15cm. Find the size of the image

Object distance 'u' = -10 cm

Focal length 'f' = -15 cm

Height of object 'h' = 3 cm

The object is placed between 'f' and 'o'

Image distance 'v' = ?

Lens formula $\boxed{\frac{1}{f} = \frac{1}{v} - \frac{1}{u}}$; $\frac{1}{v} = \frac{1}{f} + \frac{1}{u}$

$\frac{1}{v} = \frac{1}{(-15)} + \frac{1}{(-10)} = \frac{-10-15}{150} = \frac{-25}{150} = \frac{-1}{6}$

v = -6 cm

Size of the image :

$m = \frac{h^1}{h} = \frac{v}{u}$; h = 3 cm; v = -6 cm ; u = -10 cm

$h^1 = h \times \frac{v}{u} = 3 \times \frac{-6}{10} = \frac{-18}{10} = \frac{-9}{5}$

h^1 = - 1.8 cm

Size of the image **h^1 = 1.8 cm**

(Negative sign indicates the image formed in the downward direction)

IX. Higher order thinking (HOT) questions:

1. While doing an experiment for the determination of focal length of a convex lens, Raja Suddenly dropped the lens. It got broken into two halves along the axis. If he continues his experiment with the same lens, (a) can he get the image? (b) Is there any change in the focal length?

(a) Yes, he can get the image

(b) No, there is no change in the focallength

2. The eyes of the nocturnal birds like owl are having a large cornea and a large pupil. How does it help them?

The eyes of the nocturnal birds having a large cornea and large pupil. These features increase their field of vision and an increase retinal surface help them to collect more ambient light during night.

Additional Questions & Answers :

I. Choose the best answer.

1. The speed of light in vacuum is .....
a) $3x10^8 ms^{-1}$ b) $3x10^8 ms^{-2}$ c) $3x10^5 ms^{-1}$ d) $3x10^5 ms^{-2}$ **Ans :a) $3x10^8 ms^{-1}$**

2. Among the visible light, ... light has the lowest wavelength
a) red b) blue c) yellow d) violet **Ans :d) violet**

3. ..... is the fundamental and natural source of light
a) Moon b) Star c) Fire d) Sun **Ans :d) Sun**

4. ..... is a composite light which consists of light of various colours.
a) Sunlight b) Vehicle lamp
c) I R rays d) UV rays **Ans :a) Sunlight**

5. Angle of refraction is the ..... for red.
a) highest b) smallest c) 1 d) zero **Ans :b) smallest**

6. ..... scattering is caused by pollen, dust, smoke, water droplets.
a) Rayleigh b) Tyndall c) Mie d) Raman **Ans :c) Mie**

7. The lines having frequencies lower than the incident frequency is called ..... lines.
a) Anti stokes b) Stokes
c) Raman lines d) Rayleigh line **Ans :b) Stokes**

8. ..... lens is called as converging lens
a) Concave b) Plane c) Convex d) Bipolar **Ans :c) Convex**

9. ..... lenses are used in wide angle spy hole in doors.
a) Concave b) Convex c) Plane d) Bipolar **Ans :a) Concave**

10. If the magnification is ..... 1, then we get a diminished image.
a) greater than b) less than
c) equal to d) equal to or greater than **Ans :b) less than**

11. The value of ID = ...
a) $1m^{-1}$ b) $1m^{-2}$ c) $1cm^{-1}$ d) $1cm^{-2}$ **Ans : a) $1m^{-1}$**

12. The diameter of a eye ball is about .....
a) 2.5 cm b) 2.8 cm c) 2.3 cm d) 2.9 cm **Ans : c) 2.3 cm**

13. The light enters through the .....in eye
a) iris b) pupil c) cornea d) retina **Ans : c) cornea**

14. ..... is the centre part of the iris.
a) Cornea b) Pupil c) Retina d) Ciliary muscles **Ans : b) Pupil**

15. Eye lens is ..... in nature
a) concave b) plane c) bifocal d) convex **Ans : d) convex**

16. If the time interval between two consecutive light pulses is less than....., human eye cannot distinguish them separately.
a) 0.5 second b) 0.4 second c) 1 second d) 0.1second **Ans : d) 0.1second**

17. The near point is .....for normal human eye.
a) 20 cm b) 25 cm c) 15 cm d) 10 cm **Ans : b) 25 cm**

18. The far point is .....for normal eye.
a) 100 cm b) 200 cm c) 300 cm d) infinity **Ans : d) infinity**

19. ..... is known as shortsightedness.
a) Hypermetropia b) Myopia
c) Presbyopia d) Astigmatism **Ans : b) Myopia**

20. Hypermetropia can be corrected by using a .....
a) convex lens b) concave lens
c) Bifocal lens d) Plane lens **Ans : a) convex lens**

II. Fill in the blanks.

1. The sources emit their own light are called as ..... . **Ans : luminous objects**
2. Among the visible light, ... light has the highest wave length. **Ans : red**
3. If a source of light produces a light of single colour, it is known as a ..... source. **Ans : monochromatic**
4. An example for a composite source is a ..... **Ans : mercury vapour lamp**
5. The band of colours is termed as ..... **Ans : spectrum**
6. The interacting particle of the medium is called as ..... **Ans : scatterer**
7. If the energy of the incident beam of light and the scattered beam of light are not same, then it is called as ..... **Ans : inelastic scattering**
8. ..... lens is also called as diverging lens. **Ans : Concave**
9. Concave lenses are used as eye lens of ..... **Ans : Galilean Telescope**
10. Lens formula = ... **Ans :** $\left(\frac{1}{f} = \frac{1}{v} - \frac{1}{u}\right)$
11. If the magnification is greater than 1, then we get an ..... **(enlarged image)**
12. Lens Maker's formula ..... **Ans :** $\left[\frac{1}{f} = (\mu\text{-}1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)\right]$
13. The lens formula and lens maker's formula are applicable to only ..... **Ans : thin lenses**
14. .....produces virtual images **Ans : Concave lense**
15. ..... is the coloured part of eye **Ans : Iris**
16. ..... is the most sensitive part of human eye **Ans : Retina**
17. Myopia can be corrected by using ..... **Ans : concave lens**
18. ..... is known as long sightedness **Ans : Hypermetropia**
19. Astigmatism can be corrected by using ..... **Ans : cylindrical lenses**
20. Distinct vision for normal human eye is ..... **Ans : 25 cm**
21. ..... is used to observe finger prints in the field of forensic science **Ans : simple microscope**
22. ..... is used by watch repairers and jewellers **Ans : simple microscope**
23. Travelling microscope works based on the principle of .....**Ans : vernier**
24. The least count for travelling microscope is ..... **Ans : 0.01mm**
25. ..... is an optical instrument to see the distant objects **Ans : Telescope**
26. The first telescope was invented by ..... in 1608 **Ans : Johann Lippershey**
27. Galileo made a telescope to observe..... **Ans : distant stars**
28. Galileo observed the satellites of ..... and rings of ..... through his telescope. **Ans : Jupiter, Saturn**
29. Kepler invented telescope in ..... **Ans : 1611**
30. In refracting telescope ..... are used **Ans : lenses**
31. ..... and ..... are some refracting telescopes **Ans : Galilean telescope, Keplerian telescope**
32. In reflecting telescope ..... are used **Ans : Parabolic mirrors**
33. ..... and ..... are some reflecting telescopes **Ans : Gregorian telescope, Newtonian telescope**
34. ..... and ..... are the two major types of telescope **Ans : Astronomical telescope, Terrestrial telescope**
35. ..... is used to view heavenly bodies like stars, planets, galaxies and satellites. **Ans : Astronomical telescope**

36. The image in an astronomical telescope is ..... **Ans : inverted**
37. The image in a terrestrial telescope is ..... **Ans : erect**
38. ..... can be viewed even with the low intensity of light **Ans : Telescope**
39. Magnification of a lens (m) = ... **Ans :** $\left(\frac{h^1}{h} = \frac{v}{u}\right)$
40. Power of a lens, p = ... **Ans : 1/f**
41. The SI unit of power of a lens is ..... **Ans : dioptre**
42. Light travels along a ..... **Ans : straight line**
43. The deviation in the path of light ray is called ..... **Ans : refraction**
44. ..... is also called as 'old age hypermetropia' **Ans : presbyopia**

III. Match the following

1.

a) Snell's law	-	i) m = v/u
b) Rayleigh's law	-	ii) P = 1/f
c) Power of lens	-	iii) $\sin i / \sin r = \mu_2/\mu_1$
d) Magnification	-	iv) $S \alpha 1/\lambda^4$

Ans :

a) Snell's law	-	**iii) $\sin i / \sin r = \mu_2/\mu_1$**
b) Rayleigh's law	-	**iv) $S \alpha 1/\lambda^4$**
c) Power of lens	-	**ii) P = 1/f**
d) Magnification	-	**i) m = v/u**

2.

Position of the object		Relative size of the image
1) Beyond 2F	-	a) Infinitely large
2) At 2F	-	b) Diminished
3) Between F and 2F	-	c) Same size
4) At focus F	-	d) Enlarged

Ans :

Position of the object		Relative size of the image
1) Beyond 2F	-	**b) Diminished**
2) At 2F	-	**c) Same size**
3) Between F and 2F	-	**d) Enlarged**
4) At focus F	-	**a) Infinitely large**

IV. Assertion and Reason :

Assertion (A): In traffic signals red colour light is used to stop vehicles.
Reason (R) : Because red light is having shorter wave length.
(i) Both A and R are correct
(ii) Both A and R are wrong
(iii) A is correct and R is wrong
(iv) A is wrong R is correct **Ans : (iii) A is correct and R is wrong**

IV. Short questions.

1.a) What is spectrum ?.
b) write the sequence of colours in a spectrum.
Ans :
a) The band of colours is termed as spectrum
b) Violet, Indigo, Blue, Green, Yellow, Orange and Red.

---

2. To an astronaut, sky appears dark instead of blue. Give reason.
In space, there is no possibility of scattering of light by air molecules. Hence sky is appeared to be dark instead of blue to an astronaut.

---

3. The focal length of a concave lens is 2m. Calculate the power of the lens.
Focal length of a concave lens 'f' = -2m
Power of the concave lens 'P' = 1/f = 1/-2 = -0.5 D
Power of the concave lens = **- 0.5 D**

---

4. What is refraction ?
When a ray of light travels from one transparent medium into another obliquely, the path of the light undergoes deviation. This deviation of ray of light is called refraction.

---

5. What is meant by Rayleigh's scattering ?
The scattering of sunlight by the atoms or molecules of the gases in the earth's atmosphere is known as Rayleigh scattering.

---

6. What is Tyndall effect ?
The scattering of light rays by the colloidal particles in the colloidal solution is called Tyndall Scattering or Tyndall Effect.

---

7. Define Raman scattering.
Raman Scattering is defined as "The interaction of light ray with the particles of pure liquids or transparent solids, which leads to a change in wavelength or frequency."

---

8. Define stokes lines and Anti stokes lines.
The lines having frequencies lower than the incident frequency is called stokes lines and the lines having frequencies higher than the incident frequency are called Antistokes lines.

---

9. Write the applications of convex lenses.
Applications Of Convex Lenses :
1. Convex lenses are used as camera lenses
2. They are used as magnifying lenses
3. They are used in making microscope, telescope and slide projectors
4. They are used to correct the defect of vision called hypermetropia

---

10. Define Magnification of a lens.

Magnification of a lens is defined as the ratio of the height of the image to the height of an object.

$$m = \frac{\text{height of the image}}{\text{height of the object}} = \frac{h1}{h} \quad \text{(or)}$$

$$m = \frac{\text{Distance of the image}}{\text{Distance of the object}} = \frac{v}{u}$$

11. Write the applications of concave lenses.

Applications Of Concave Lenses :

1. Concave lenses are used as eye lens of 'Galilean Telescope'
2. They are used in wide angle spy hole in doors.
3. They are used to correct the defect of vision called 'myopia'

12. Define power of a lens.

The power of a lens can be defined as the degree of convergence or divergence of light rays. Power of a lens is numerically defined as the reciprocal of its focal length.

$$P = \frac{1}{f}$$

The SI unit of power of a lens is dioptre.

V. Detail .

1. What are defects of eyes ? How these are rectified ?

Defects of eye :

(i) Myopia	-	Short sightedness
(ii) Hypermetropia	-	Long sightedness
(iii) Presbyopia		
(iv) Astigmatism		

Rectification :

(i) Myopia	-	Can be corrected by using concave lens.
(ii) Hypermetropia	-	Can be corrected by using convex lens.
(iii) Presbyopia	-	Can be corrected by using bifocal lens.
(iv) Astigmatism	-	Can be corrected by using cylindrical lenses (Torroid lenses)

3. Thermal Physics

TEXT BOOK EVALUATION

I. Choose the correct answer:

1. The value of universal gas constant

a) 3.81 mol^{-1} K^{-1} b) 8.03 mol^{-1} K^{-1}
c) 1.38 mol^{-1} K^{-1} d) 8.31 mol^{-1} K^{-1} **Ans :d) 8.31 mol^{-1} K^{-1}**

2. If a substance is heated or cooled, the change in mass of that substance is

a) positive b) negative
c) zero d) none of the above **Ans : c) zero**

3. If a substance is heated or cooled, the linear expansion occurs along the axis of

a) X or - X b) Y or - Y
c) both (a) and (b) d) (a) or (b) **Ans : c) both (a) and (b)**

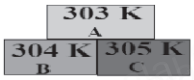
4. Temperature is the average _____ of the molecules of a substance

a) difference in K.E and P.E b) sum of P.E and K.E
c) difference in T.E and P.E d) difference in K.E and T.E

An s: c) difference in T.E and P.E

5. In the Given diagram, the possible direction of heat energy transformation is

a) A ← B, A ← C, B ← C
b) A → B, A → C, B → C
c) A → B, A ← C, B → C
d) A ← B, A → C, B ← C



An s: a) A ← B, A ← C, B ← C

II. Fill in the blanks.

1. The value of Avogadro number _____ **Ans : $6.023X10^{23}$/mol**
2. The temperature and heat are _____ quantities **Ans : scalar**
3. One calorie is the amount of heat energy required to raise the temperature of _____ of water through_____. **Ans : 1 gram, 1^0C**
4. According to Boyle's law, the shape of the graph between pressure and reciprocal of volume is _____ **Ans : Straight line**

III. State whether the following statements are true or false, if false explain why?

1. For a given heat in liquid, the apparent expansion is more than that of real expansion.
   Ans : False. For a given heat in liquid, the real expansion is **more than** that of real apparent expansion.
2. Thermal energy always flows from a system at higher temperature to a system at lower temperature.
   Ans : True.
3. According to Charles's law, at constant pressure, the temperature is inversely proportional to volume.
   Ans : False. According to Charles's law, at constant pressure, the temperature is **directly** proportional to volume.

IV. Match the items in column-I to the items in column-II

Column-I		Column-II
1. Linear expansion	-	(a) change in volume
2. Superficial expansion	-	(b) hot body to cold body
3. Cubical expansion	-	(c) $1.381 \times 10^{-23} JK^{-1}$
4. Heat transformation	-	(d) change in length
5. Boltzmann constant	-	(e) change in area

Ans :

Column-I		Column-II
1. Linear expansion	-	**(d) change in length**
2. Superficial expansion	-	**(e) change in area**
3. Cubical expansion	-	**(a) change in volume**
4. Heat transformation	-	**(b) hot body to cold body**
5. Boltzmann constant	-	**(c) $1.381 \times 10^{-23} JK^{-1}$**

V. Assertion and reason type questions

1. Assertion: There is no effects on other end when one end of the rod is only heated.
Reason: Heat always flows from a region of lower temperature to higher temperature of the rod.

a. Both the assertion and the reason are true and the reason is the correct explanation of the 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. Assertion is false but the reason is true.

Ans : c. Assertion is true but the reason is false.

2. Assertion: Gas is highly compressible than solid and liquid
Reason: Interatomic or intermolecular distance in the gas is comparably high.

a. Both the assertion and the reason are true and the reason is the correct explanation of the 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. Assertion is false but the reason is true.

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

VI. Answer in briefly.

1. Define one calorie.

Calorie: One calorie is defined as the amount of heat energy required to rise the temperature of 1 gram of water through 1°C.

2. Distinguish between linear, areal or superficial expansion.

Linear expansion	Areal or superficial expansion
(i) when a body is heated or cooled, the length of the body changes due to change in its temperature	(i) If there is an increase in the area of a solid object due to heating then the expansion is called superficial or areal expansion
(ii) The equation for Linear expansion is $\frac{\Delta L}{L_o} = \alpha_L \Delta T$	(ii) The equation for Areal expansion is $\frac{\Delta A}{A_o} = \alpha_A \Delta T$

3. What is co-efficient of cubical expansion?

The ratio of increase in volume of the body per degree rise in temperature to its unit volume is called as coefficient of cubical expansion. This is also measured in K^{-1}.

4. State Boyle's law

Boyle's law:

When the temperature of a gas is kept constant, the volume of a fixed mass of gas is inversely proportional to its pressure.

$P \alpha 1/V$ (PV = Constant)

5.State-the law of volume

The law of volume :

Charles's law was formulated by a French scientist Jacques Charles. According to this law, When the pressure of gas is kept constant, the volume of a gas is directly proportional to the temperature of the gas.

$V \alpha T$ (or) $\frac{V}{T}$ = constant

6. Distinguish between ideal gas and real gas.

Ideal Gas	Real Gas
If the atoms or molecules of a gas do not interact with each other, then the gas is said to be an ideal gas or perfect gas	If the atoms or molecules interact with each other with a definite amount of inter molecular or inter atomic force of attraction then the gas is said to be Real gas

7. What is co-efficient of real expansion?

★ Coefficient of real expansion is defined as the ratio of the true rise in the volume of the liquid per degree rise in temperature to its unit volume.

★ The SI unit of coefficient of real expansion is K^{-1}.

8. What is co-efficient of apparent expansion?

★ Coefficient of apparent expansion is defined as the ratio of the apparent rise in the volume of the liquid per degree rise in temperature to its unit volume.

★ The SI unit of coefficient of apparent expansion is K^{-1}.

VII. Numerical problems

1. Find the final temperature of a copper rod. Whose area of cross section changes from 10 m^2 to 11 m^2 due to heating. The copper rod is initially kept at 90 K. (Coefficient of superficial expansion is 0.0021 /K)

Change in Area $\Delta A = 11\,m^2 - 10\,m^2 = 1\,m^2$

Original Area $A_o = 10\,m^2$

Co efficient of superficial expansion $\alpha A = 0.0021/K$; $T_1 = 90\,k$

$$\frac{\Delta A}{A_o} = \alpha_A \Delta T$$

$$\therefore \Delta T = \frac{\Delta A}{A_o \alpha_A}$$

Change in temperature $\Delta T = \frac{1}{10 \times 0.0021} = \frac{1}{0.021}$

Initial temperature $T_1 = 90\,K$

Final temperature $T_2 = ?$

Change in temperature $\Delta T = T_2 - T_1$

$$= \frac{1}{0.021} = T_2 - 90$$

$$T_2 = \frac{1}{0.021} = +90 = 137.6\,k$$

Final temperature, T_2 = **137.6 K**

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2. Calculate the coefficient of cubical expansion of a zinc bar. Whose volume is increased 0.25 m^3 from 0.3 m^3 due to the change in its temperature of 50 K.

Initial volume $V_o = 0.3\,m^3$

Final volume $= 0.25\,m^3$

Change in volume, $\Delta V = 0.3 - 0.25 = 0.05\,m^3$

Original volume, $V_o = 0.3\,m^3$

Change in temperature, $\Delta T = 50\,K$

Coefficient of cubical expansion $\alpha_v = ?$

$$\frac{\Delta V}{V_o} = \alpha_v \Delta T$$

$$\frac{\Delta V}{V_o \times \Delta T} = \alpha_v$$

$$\alpha_v = \frac{0.05}{0.3 \times 50} = \frac{0.05}{15} = 0.003\,K^{-1}$$

Co efficient of cubical expansion α_v = **$0.003\,K^{-1}$**

VIII. Answer in detail

1. Derive the ideal gas equation.

Ideal Gas Equation :

★ The ideal gas equation is an equation, which relates all the properties of an ideal gas. An ideal gas obeys Boyle's law and Charles' law and Avogadro's law. According to Boyle's law,

$PV = \text{constant} \ldots\ldots\ldots (1)$

★ According to Charles's law,

$V/T = \text{constant} \ldots\ldots\ldots (2)$

★ According to Avogadro's law,

$V/n = \text{constant} \ldots\ldots\ldots (3)$

★ After combining equations (1), (2) and (3), you can get the following equation.

$PV/nT = \text{constant} \ldots\ldots (4)$

★ The above relation is called the combined law of gases. If you consider a gas, which contains μ moles of the gas, the number of atoms contained will be equal to μ times the Avogadro number, N_A.

i.e. $n = \mu N_A \ldots\ldots\ldots\ldots (5)$

★ Using equation (5), equation (4) can be written as

$PV/\mu N_A T = \text{constant}$

★ The value of the constant in the above equation is taken to be K_B, which is called as Boltzmann constant ($1.38 \times 10^{-23}\ JK^{-1}$). Hence, we have the following equation:

$PV/\mu N_A T = k_B$

$PV = \mu N_A k_B T$

★ Here, $\mu N_A k_B = R$, which is termed as universal gas constant whose value is $8.31\ J\ mol^{-1}\ K^{-1}$.

$PV = RT \ldots\ldots\ldots\ldots (6)$

★ Ideal gas equation is also called as equation of state because it gives the relation between the state variables and it is used to describe the state of any gas.

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2. Explain the experiment of measuring the real and apparent expansion of a liquid with a neat diagram

Experiment to measure real and apparent expansion of liquid :

★ To start with, the liquid whose real and apparent expansion is to be determined is poured in a container up to a level.

★ Mark this level as L_1. Now, heat the container and the liquid using a burner as shown in the Figure.

★ Initially, the container receives the thermal energy and it expands.

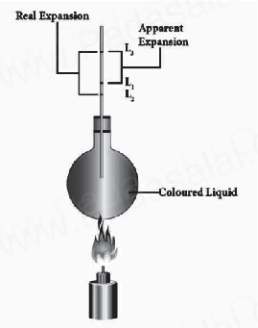
★ As a result, the volume of the liquid appears to have reduced. Mark this reduced level of liquid as L_2.

★ On further heating, the thermal energy supplied to the liquid through the container results in the expansion of the liquid.

★ Hence, the level of liquid rises to L_3.

★ Now, the difference between the levels L_1 and L_3 is called as apparent expansion, and the difference between the levels L_2 and L_3 is called real expansion.

★ The real expansion is always more than that of apparent expansion.



Real and apparent expansion of liquid

Real expansion $= L_3 - L_2$

Apparent expansion $= L_3 - L_1$

IX. HOT question

If you keep ice at 0° C and water at 0°C in either of your hands, in which hand you will feel more chillness? Why.

★ The hand in which we keep ice at 0°C feels more chillness.
★ Because, Ice is more effective in cooling than water at the same temperature.
★ Ice can absorb latent heat as well as heat energy to attain room temperature.
★ But, water at 0°C can absorb heat energy only to attain room temperature.

Additional Questions & Answers :

I. Choose the best answer.

1. ..... is the primary source of thermal energy for all living organisms.
a) Coal b) Moon c) Sun d)star **Ans :c) Sun**

2. ..... is defined as the degree of hotness of a body.
a)Heat b) Thermal energy
c) Solar energy d) Temperature **Ans :d) Temperature**

3. Temperature is the average ..... of the molecules.
a) kinetic energy b) potential energy
c) total energy d) thermal energy **Ans :a) kinetic energy**

4. The SI unit of temperature is.....
a) ampere b) kelvin
c) celcius d) volt **Ans :b) kelvin**

5. ..... is the absolute scale of temperature of the body.
a) 0 K b) 10 K c) 100 K d) 1000 K **Ans : a) 0 K**

6. The value for 0 K = ... C
a) 273° b) -273° c) 283° d) -283° **Ans :b) -273°**

7. The SI unit of heat energy absorbed or evolved is .....
a) newton b) kelvin
c) joule d)kilogram **Ans :c) joule**

8. For any change of heat, the heat gained by the cold system is..... to heat lost by the hot system.
a) less b) more c) equal d) nothing **Ans :c) equal**

9. For a given change in temperature, the extent of expansion is ..... in solids than in liquids and gases.
a) larger b) smaller c) bigger d) maximum **Ans :b) smaller**

10. The SI unit of co efficient of linear expansion is .....
a) C^{-1} b) F^{-1} c) K^{-1} d) A^{-1} **Ans :c) K^{-1}**

II. Fill in the blanks.

1. All living organisms need a particular .....for their survival **Ans :temperature**
2. ..... is the property which determines whether a body is in equilibrium **Ans :temperature**
3. ..... is the property, which determines the direction of flow of heat **Ans :temperature**
4. The temperature measured in relation to absolute zero using the kelvin scale is known as ..... **Ans :absolute temperature**
5. The relationship between celsius and kelvin scale of temperature is ..... **Ans :K = C+273**
6. Thermal energy is also known as ..... **Ans :heat energy**
7. ....., ... and ..... are the methods of transmission of heat. **Ans :Conduction, Convection, Radiation**
8. The process of transfer of heat energy is termed as ..... **Ans :Cooling**

9. The formula for co efficient of superficial expansion is.....

Ans : $\left(\alpha_A = \frac{\Delta A}{\Delta T x A_o} \right)$

10. The co efficient of cubic expansion value for Aluminium is .....**Ans :$7x10^{5}k^{-1}$**

11. The value of coefficient of cubic expansion for water is ..... **Ans :$20.7x10^{-5}k^{-1}$**

12. The co efficient of cubical expansion of liquid is independent of.....
Ans :temperature

13. If a liquid is heated without using any container, then the expansion is termed as ..... of the liquid **Ans :real expansion**

14. ..... is the total number of atoms per mole of the substance
Ans :Avogadro's number

15. The value of Avogadro's number is ..... **Ans :$6.023x10^{23}$/mol**

16. At very high temperature or low pressure a real gases behaves as an .....
Ans :ideal gases

17. If the atoms or molecules of a gas do not interact with each other then the gas is called..... **(ideal gas or perfect gas)**

18. The value for Boltzmann's constant is ..... **Ans :$1.38x10^{-23}JK^{-1}$**

19. The value of universal gas constant is ..... **Ans :8.31 J $mol^{-1}K^{-1}$**

20. ..... is called ideal gas equation **Ans : P(V = RT)**

21. Ideal gas equation is also called as ..... **Ans :equation of state**

22. All forms of matter undergo ..... on heating **Ans :expansion**

23. Real expansion is always..... than that of apparent expansion **Ans :more**

24. The formula for real expansion is ..... **Ans : $L_3 - L_2$**

25. The formula for apparent expansion is ..... **Ans : $L_3 - L_1$**

III. Match the following

1.	a) Boyle's law	-	i) PV / nT = Const
	b) Charles's law	-	ii) V/n = Const
	c) Avogadro's law	-	iii) V/T = Const
	d) Combined law of gases	-	iv) PV = Const

Ans :

a) Boyle's law	**-**	**iv) PV = Const**
b) Charles's law	**-**	**iii) V/T = Const**
c) Avogadro's law	**-**	**ii) V/n = Const**
d) Combined law of gases	**-**	**i) PV / nT = Const**

IV. Short questions.

1.a) What is thermal equilibrium ?.

Thermal equilibrium :

Two or more physical systems or bodies are said to be in thermal equilibrium if there is no net flow of thermal energy between the systems.

2. What is thermal energy ?

When a hot object is in contact with another cold object, a form of energy flows from the hot object to the cold object, which is known as thermal energy.

3. What is thermal expansion ?

★ When heat energy is supplied to a body, there can be an increase in the dimension of the object.

★ This change in the dimension due to rise in temperature is called thermal expansion of the object.

4. What are the types of expansion ?

1. Linear expansion
2. Superficial expansion
3. Cubical expansion

5. Define Avogadro's Law

Avogadro's law states that at constant pressure and temperature, the volume of a gas is directly proportional to number of atoms or molecules present in it.

i.e. $V \alpha n$ (or)

$\frac{V}{n}$ = constant

6. The temperature of a human body is 98.4°F. Convert this in kelvin scale of temperature.

The temperature of a human body = 98.4°F

Kelvin scale of temperature, K = $(F + 460) \times \frac{5}{9}$

$= (98.4 + 460) \times \frac{5}{9}$

$= 558.4 \times \frac{5}{9}$

$= 149.51 \times 5$

$= \mathbf{747.5\,K}$