1. Laws Of Motion Brief Questions :

1 B) Define inertia. Give its classification.

Inertia :

* **The inherent property of a body**
* **To resist any change in its**
* **State of rest or in uniform motion**
* **Unless it is influenced upon by an external unbalanced force.**
* **It is known as " inertia "**

Types of inertia :

1. Inertia of rest 2. Inertia of motion 3.Inertia of direction

---

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

1. Like parallel force :

Two or more forces of equal or unequal magnitude acting along the same direction , parallel to each other are called like parallel force.

2. Unlike parallel force :

Two or more forces of equal or unequal magnitude acting along the opposite direction , parallel to each other are called like parallel force.

---

3 B) 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.

Given :

Force F_1 = 5 N ; Force F_2 = 15 N

Formula :

Resultant force = $F_2 - F_1$ ($F_2 > F_1$)

F_{net} = 15 N - 5 N

F_{net} = 10 N

The direction of force will be along with greater magnitude 15 N

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4 B) Differentiate mass and weight.

Mass :

1. **It is the quantity of matter contained in the body .**
2. **It is a fundamental quantity.**
3. **It has magnitude alone – scalar quantity.**
4. **Remains the same everywhere.**
5. **Its unit is kilogram.**

Weight :

1. **It is the gravitational force exerted on it due to the earth gravity .**
2. **It is a derived quantity.**
3. **It has magnitude and direction – vector quantity.**
4. **Varies from place to place.**
5. **Its unit is newton (N)**

---

5 B) Define moment of a couple.

- **The rotating effect of a couple is known as " moment of a couple "**
- **It is measured by the product of any one of the forces (F) and the perpendicular distance (S) between the line of action of two force.**

$$M = F \times S$$

Moment of couple = Force X perpendicular distance between line of action of forces

Example : Turning of tap SI unit : N m CGS unit : dyne cm

---

6 B) 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 moments in the anticlockwise direction.

Moment of clockwise direction = Moment of anticlockwise direction

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

---

7 B) State 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. It is called as " law of force "

$$F = m \times a$$

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

1. When the handle of the spanner is long , the force required to turn the body is less.

2. This turning effect of a body depends upon the perpendicular distance of the line of action of the applied force from the axis of rotation.

Moment of force = F X d

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

---

9 B) While catching a cricket ball the fielder lowers his hands backwards . why ?

1. In cricket , a fielder pull back his hands while catching the ball.

2. Because , he experiences a smaller force for a longer interval of time to catch the ball resulting in a lesser impulse on his hands.

3. Further , as time increases , the rate of change in momentum decreases and force acting on his is reduced.

$$\text{Force} = \frac{\text{Momentum}}{\text{Time}}$$

---

10 B) **How does an astronaut float in a space shuttle ?**

1. Astronauts are not floating but freely around the earth due to their huge orbital velocity.
2. Since space station and astronauts have equal acceleration , they are under free fall condition.
3. Hence , astronauts are in the state of weightlessness and seem floating.

Detail Questions :

1D). Define inertia . What are types of inertia? Give an example for each type.

Inertia :

* **The inherent property of a body**
* **To resist any change in its**
* **State of rest or in uniform motion**
* **Unless it is influenced upon by an external unbalanced force.**
* **It is known as " inertia "**

Types of inertia :

1.Inertia of rest 2.Inertia of motion 3.Inertia of direction

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1. Inertia of 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 fell down.

2. 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.

3. 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 D) State 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. It gives the definition of force as well as inertia.

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. It is called as " law of force " .

$$F = m \times a$$

Newton's third law :

*** For every action , there is an equal and opposite reaction.**

*** They always act on two different bodies.**

Action Force = Reaction Force

$$F_B = - F_A$$

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3 D) Deduce the equation of a force using newton's second law of motion.

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. It is called as " law of force"

$$F = m \times a$$

Theory :

- **Mass of a body → m**
- **Initial speed → u**
- **Final speed → v**
- **Unbalanced external force → F**

Equation :

1. **Initial momentum = p_i = m u**
2. **Final momentum = p_f = m v**
3. **Change in momentum = Δp = m v – m u**
4. **Force α rate of change of momentum**

$$F \alpha \frac{m v - m u}{t}$$

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

k = 1 is proportionality constant.

Acceleration = change in velocity / time

$$a = v - u / t$$

$$F = m \times a$$

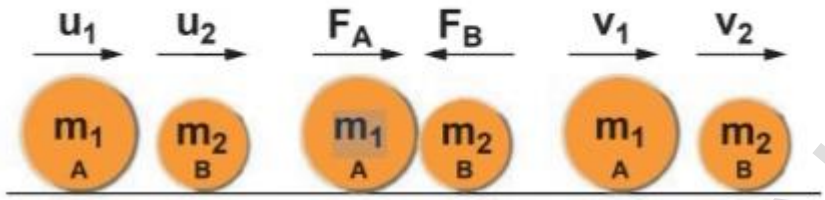
Force = mass X acceleration

4 D) 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.

Diagram :



Conservation of linear momentum

Formula :

$$m_1 v_1 + m_2 v_2 = m_1 u_1 + m_2 u_2$$

Proof :

Let us consider two A and B move in a straight line.

- **Masses of bodies** ⟶ m_1 , m_2
- **Initial velocity** ⟶ u_1 , u_2
- **Final velocity** ⟶ v_1 , v_2

1. **Force on body B due to A** : $F_A = m_2 (v_2 - u_2) / t$
2. **Force on body A due to B** : $F_B = m_1 (v_1 - u_1) / t$
3. **By Newton's III law of motion**

   Action Force = Reaction Force

   $F_B = - F_A$
4. $m_1 (v_1 - u_1) / t = - m_2 (v_2 - u_2) / t$
5. $m_1 v_1 - m_1 u_1 = - m_2 v_2 + m_2 u_2$

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6. $m_1 v_1 + m_2 v_2 = m_1 u_1 + m_2 u_2$

"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".

Hence , the law of conservation linear momentum is proved.

---

5 D) Describe rocket propulsion.

- **Principle**
- **FFF**
- **HHH**
- **Equal opposite CC**
- **Conservation of momentum**
- **Mass of rocket**
- **Escape Velocity**

1. Propulsion of rocket based on

- **conservation of linear momentum**
- **Newton's III law of motion.**

2. Rockets are filled with fuel (fluid or solid) in the propellant tank.

3.When the rocket is fired , the fuel is burnt .

4. A hot gas is ejected with a high speed from the rocket nozzle and produces high momentum.

5.To balance this momentum , an equal and opposite force is produced in combustion chamber.

6.It makes the rocket project in forward motion.

7.While in motion, the mass of the rocket gradually decreases .Until the fuel is completely burn out.

8.There is no external force acts on it , the linear momentum is conserved.

9.The mass of the rocket decreases with altitude then gradual increase in velocity.

10.A velocity at which is sufficient to just escape from gravitational pull of the earth is known as " escape velocity "

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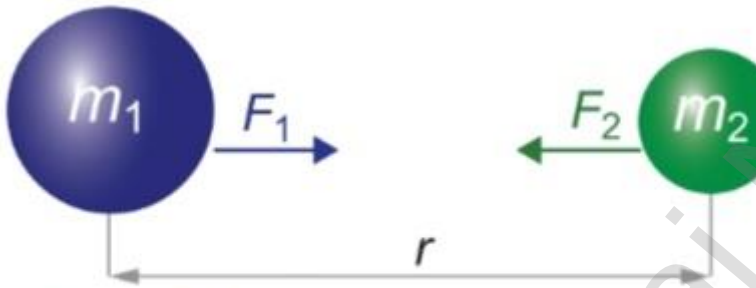
6 D) State the universal law of gravitation and derive its mathematical expression.

Definition :

This law states that 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.

Diagram :



Gravitational force between two masses

Theory :

Force between the masses is always attractive and it does not depend on the medium where they are placed.

- **Masses of two bodies → m_1 , m_2**
- **Distance between bodies → r**
- **Force acts on bodies → F**
- **$F \alpha m_1 X m_2$**
- **$F \alpha \frac{1}{r^2}$**
- **$F \alpha \frac{m_1 X m_2}{r^2}$**
- **$F = \frac{G m_1 m_2}{r^2}$**
- **Where G is the universal gravitational constant.**
- **Its value in SI units is 6.674×10^{-11} N m^2 kg^{-2}**

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7 D) Give the applications of universal law gravitation.

1. **Dimensions of the heavenly bodies can be measured using the gravitational 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 the star 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.**

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2. Optics

Brief Questions :

1 B) What is refractive index ?

The ratio of speed of light in vacuum to the speed of light in a medium .

$$\mu = \frac{c}{v}$$

---

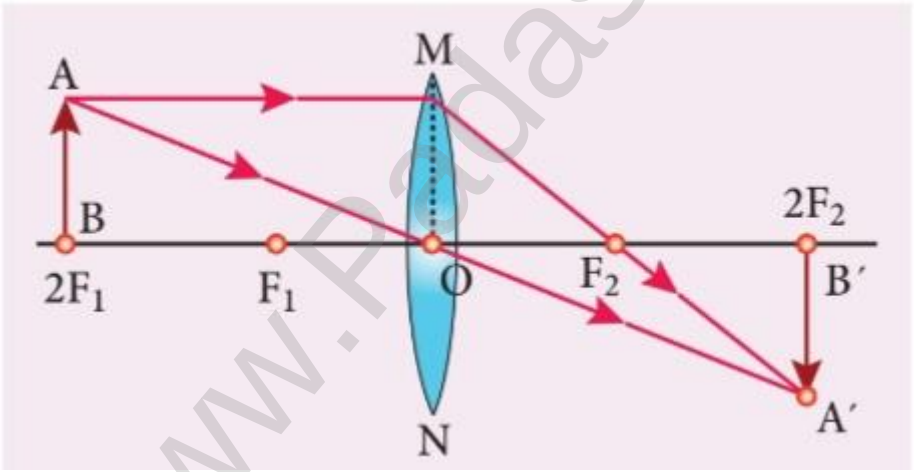
2 B) State Snell' s Law .

1. **The ratio of sine of angle of incidence to sine of angle of refraction .**
2. **It is equal to the ratio of refractive indices of the two media.**

$$\frac{\text{Sin } i}{\text{Sin } r} = \frac{\mu_2}{\mu_1}$$

---

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



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4 B) Define dispersion of light.

- **When a beam of white light or composite light is refracted through any transparent media .**
- **Such as glass or water , it splits into its component colours.**
- **It is called as dispersion of light.**

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5 B) State Rayleigh's law of scattering .

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

$$S \alpha \frac{1}{\lambda^4}$$

---

6 B) Differentiate between convex lens and concave lens .

S.NO	Convex Lens	Concave Lens
1.	Thicker in middle	Thinner in middle
2.	Converging lens	Diverging Lens
3.	Produce real image	Produce virtual images
4.	Used in hypermetropia	Used in myopia

---

7 B) What is power accommodation of eye ?

- **Ability of eye lens to focus near by as well as distant object.**
- **By changing focal length of eye lens.**
- **With the help of ciliary muscles.**

---

8 B) What are the causes of myopia ?

1. **1.It is known as short sightedness.**
2. **Near by object seen clearly.**
3. **Distant object can not seen clearly.**
4. **Far point come closer.**
5. **Due to lengthening of eye ball.**
6. **Focal length of eye lens is reduced.**
7. **Image formed before retina.**
8. **Corrected by concave lens**
9. **Increases distance between eye lens & retina.**
10. **. Focal length :** $f = \frac{x\,y}{x - y}$

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9 B) Why does the sky appear in blue colour ?

1. **When sunlight passes through the atmosphere ,**
2. **Blue colour scattered to greater extent than red colour.**
3. **Blue colour has shorter wavelength.**
4. **Red colour has longer wavelength.**

---

10 B) Why are traffic signals red in colour ?

1. Red colour has longer wavelength and scattered least.
2. Red colour travels longer distance through rain , fog , dust etc .,,
So red colour is used in traffic signals.

Detail Questions :

1 D) List any five properties of light.

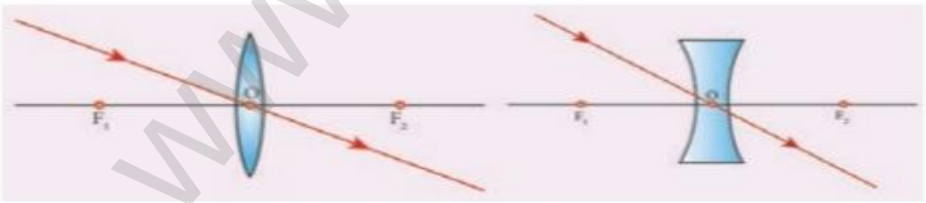
1. **Light is a form of energy.**
2. **It travels along straight line.**
3. **It does not need any medium for its propagation.**
4. **It can even travel through vacuum.**
5. **Speed of light in vacuum c = 3 X 10^8 m s^{-1}.**
6. **Different coloured light different wavelength and frequency.**
7. **Violet has lowest wavelength , Red has highest wavelength.**
8. **It is partly reflected and partly refracted.**

---

2 D). 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 obliquely at optical centre.**
- **It follow its path without any deviation.**



Fi Rays passing through the optical centre

Rule 2 :

- **When a ray of light passes parallel to principal axis.**
- **It converged to the principal focus.**

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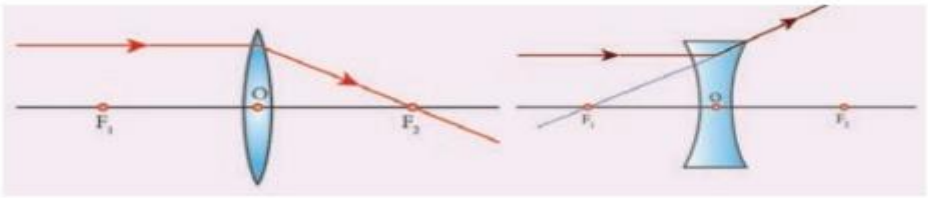
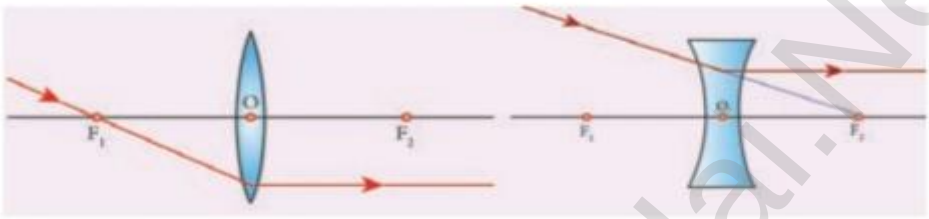


Rays passing parallel to the optic axis

Rule 3 :

- **When a ray of light passes principal focus.**
- **It parallel to parallel to the principal axis.**



Rays passing through or directed towards the principal focus

---

3 D). Differentiate the eye defects Myopia and hypermetropia.

Eye defects of Myopia :

1. **It is known as short sightedness.**
2. **Near by object seen clearly.**
3. **Distant object can not seen clearly.**
4. **Far point come closer.**
5. **Due to lengthening of eye ball.**
6. **Focal length of eye lens is reduced.**
7. **Image formed before retina.**
8. **Corrected by concave lens**
9. **Increases distance between eye lens & retina.**
10. **Focal length :** $f = \frac{x\,y}{x - y}$

Eye defects of Hypermetropia :

1. **It is known as long sightedness.**
2. **Distant by object seen clearly.**
3. **Nearby object can not seen clearly.**
4. **Near point move farther.**
5. **Due to shortening of eye ball.**
6. **Focal length of eye lens is increased.**
7. **Image formed behind retina.**

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8. **Corrected by convex lens.**
9. **Decreases distance between eye lens & retina.**
10. **Focal length :** $f = \frac{d\,D}{d - D}$

---

4 D). Explain the construction and working of " Compound Microscope "

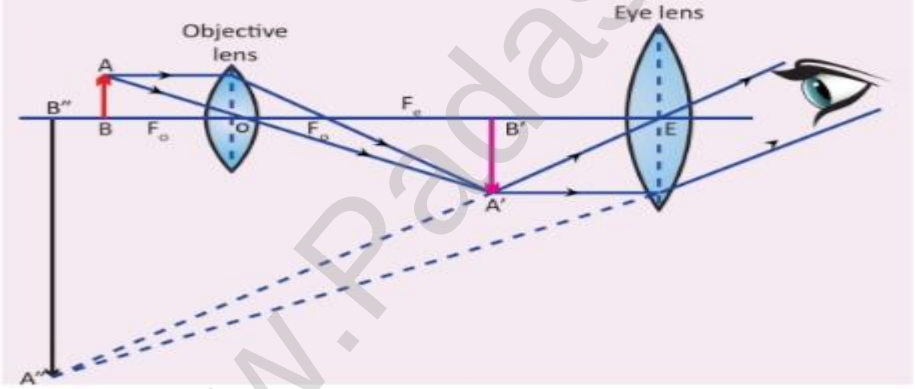
Compound Microscope

- **Used to see tiny objects.**
- **Better magnification power.**
- **Its like simple microscope.**

Construction :

1. **It consists of two convex lenses.**
2. **Lens placed near object is objective lens.**
3. **Objective lens has shorter focal length.**
4. **Lens placed near eye is eye lens.**
5. **Eye lens has larger focal length.**
6. **Both lens are fixed in narrow tube.**

Diagram :



Working :

1. **Object is denoted as A B .**
2. **Real inverted and magnified image is $A'B'$.**
3. **Virtual , enlarged and erect image is $A''B''$**
4. **Focal length of objective lens f_o. ($u > f_o$)**
5. **Focal length of eye lens f_e.**
6. **It has 50 to 200 times more magnification power than simple microscope.**

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3. Thermal Physics Brief Questions :

1 B) Define calorie.

- **Amount of heat energy need to rise the temperature.**
- **1 gram of water through 1^{O} C.**
- **It is known as calorie.**

---

2 B) Distinguish between linear , areal or superficial expansion .

Linear Expansion	Areal or Superficial expansion
Length of the body changes due to change in temperature.	Area of the body changes due to change in temperature.
Due to heating or cooling	Due to heating
Coefficient of linear expansion	Coefficient of areal expansion
Ratio of increase in length of body per degree rise in temperature in unit length.	Ratio of increase in area of body per degree rise in temperature in unit area.
$\frac{\Delta L}{L_o} = \alpha_L \Delta T$	$\frac{\Delta A}{A_o} = \alpha_L \Delta T$

---

3 B). What is the co – efficient of cubical expansion ?

Ratio of increase in volume of body per degree rise in temperature in unit volume. It is called as co – efficient of cubical expansion.

- **It is measured in K^{-1} .**

$$\frac{\Delta V}{V} = \alpha \Delta T$$

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4B). State Boyle's law.

- **When the temperature kept constant.**
- **Volume of a fixed mass gas**
- **Inversely proportional to pressure.**

$$P \propto \frac{1}{V}$$

$$PV = \text{Constant}$$

---

5 B). State law of volume. (Charle's law)

- **When the pressure kept constant.**
- **Volume of a gas**
- **Directly proportional to pressure.**

$$V \propto T$$

$$\frac{V}{T} = \text{Constant}$$

6B). State Avogadro's law.

At constant pressure and temperature ,Volume of a gas is directly proportional to number of atoms or molecules.

$$V \propto n$$

$$\frac{V}{n} = \text{Constant}$$

7B). State Avogadro's number.

Total number of atoms per mole of the substance. $N_A = 6.023 \times 10^{23}$ **/ mol.**

---

9 B). What is co – efficient of real expansion?

Ratio of the true rise in volume of the liquid per degree rise in temperature to its unit volume. Its unit is K^{-1} **.**

---

10 B). What is co – efficient of apparent expansion?

Ratio of the apparent rise in volume of the liquid per degree rise in temperature to its unit volume. Its unit is K^{-1} **.**

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8 B).Distinguish between ideal gas and real gas.

Ideal Gas	Real Gas
1. Atoms or molecules of gas not interact with each other.	1. Atoms or molecules of gas not interact with each other.
2. At low pressure or high temperature	2. At low pressure or high temperature
3. Inter atomic or inter molecular force of attraction is weak.	3. No inter atomic or inter molecular force of attraction is weak.

Detail Questions :

1 D) Derive the ideal gas equation .

1. **Boyle's Law : $PV = \text{Constant}$**
2. **Charle's Law : $VT = \text{Constant}$**
3. **Avogadro's Law : $\frac{V}{n} = \text{Constant}$**
4. **Combined law of gases : $\frac{PV}{nT} = \text{Constant}$**
5. **Avogadro's Number : $n = \mu N_A$**
6. **Substitute n value in above equation : $\frac{PV}{\mu N_A T} = \text{Constant}$**
7. **Boltzmann constant : $\frac{PV}{\mu N_A T} = K_B = 1.38 \times 10^{-23}\ J\ K^{-1}$**
8. **$PV = \mu N_A K_B T$**
9. **Universal gas constant : $\mu N_A K_B = R = 8.31\ J\ mol^{-1}\ K^{-1}$**
10. **Ideal Gas Equation : $PV = RT$**

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

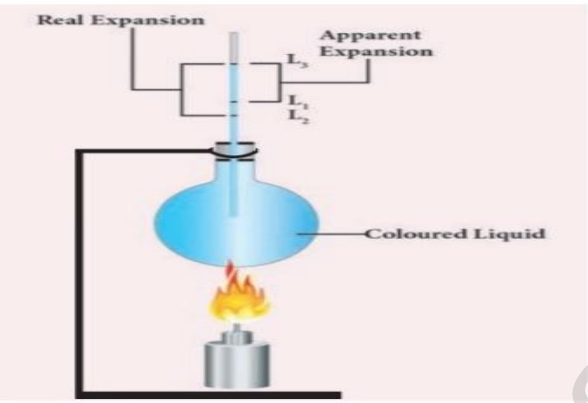
Aim :

To measure the real and apparent expansion of liquid.

Apparatus Required :

1. Flask 2. Glass Tube 3. Scale 4. Burner

Diagram :



Procedure :

1. **Pour the liquid in a container.**
2. **Mark this level as L_1 .**
3. **Heat the container by using burner.**
4. **Container receives thermal energy .**
5. **Volume of the liquid reduced.**
6. **Mark this level as L_2 .**
7. **On further heating , liquid expands.**
8. **Mark this level as L_3 .**
9. **Apparent Expansion : $L_3 - L_1$**
10. **Real Expansion : $L_3 - L_2$**

Result :

Real expansion is always more than that of apparent expansion.

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4. Electricity

Very Short Answer Questions :

1 B) Define the unit of current.
When a charge of 1 coulomb flows across any cross section of a conductor in one second is called 1 ampere .

S I Unit of electric current : ampere (A)

$$1 \text{ ampere} = \frac{1 \text{ Coulomb}}{1 \text{ second}}$$

---

2 B) What happens to resistance , as the conductor is made thicker ?

If the conductor is made thicker its resistance decreases. Resistance is inversely proportional to area of cross section.

---

3 B). Why is tungsten metal used in bulbs , but not in fuse wire ?

Tungsten has very high melting point. If it is used in fuse wire , it will not melt.

When high current passes through it and appliance be damaged.

---

4 B). Name any two devices , Which are working on the heating effect of the electric current.

1. Electric Heater 2. Electric Iron

Short Answer Questions

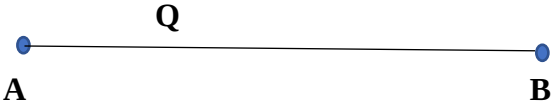
1 B).Define electric potential and potential difference.

Electric Potential :

- **Amount of work done moving a unit positive charge.**
- **From infinity to that point against the electric force.**

Electric Potential Difference :

- **Amount of work done moving a unit positive charge.**
- **From one point to other point against the electric force.**



$$\text{Potential Difference} = \frac{\text{Work Done}}{\text{Charge}} \qquad V = \frac{W}{Q}$$

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2 B). What is the role of the earth wire in domestic circuits ?

1. **It gives low resistance path to electric current.**
2. **If live wire touches metallic appliance , earth wire sends current to the earth.**
3. **It serves as a protective conductor. And it saves from electric shocks.**

---

3 B). State Ohm's law.

At a constant temperature, the steady current flows through conductor is directly proportional to potential difference between two ends of the conductor.

$$V = I R$$

---

4 B). Distinguish between the resistivity and conductivity of a conductor.

Resistivity	Conductivity
It is the resistance of a conductor of Unit length and unit area of section.	It is the reciprocal of electrical resistivity.
Unit : ohm meter	Unit : ohm^{-1} $meter^{-1}$
$\rho = \frac{R A}{L}$	$\sigma = \frac{1}{\rho}$

---

4 B). What connection is used in domestic appliances and why ?

Parallel connection is used in domestic appliances. Because ,

1. **Each appliance will get the full voltage.**
2. **Parallel circuit divides the current through appliances.**
3. **Each appliances get proper current depends on resistance.**
4. **Each of them can be put ON / OFF independently.**

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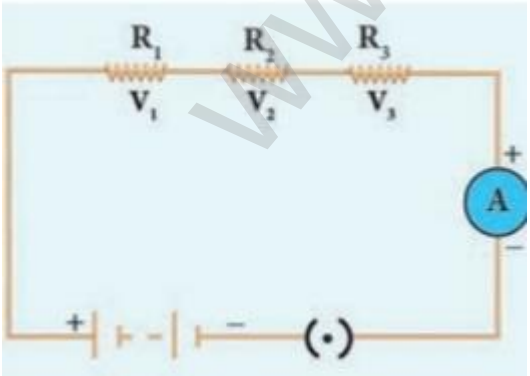
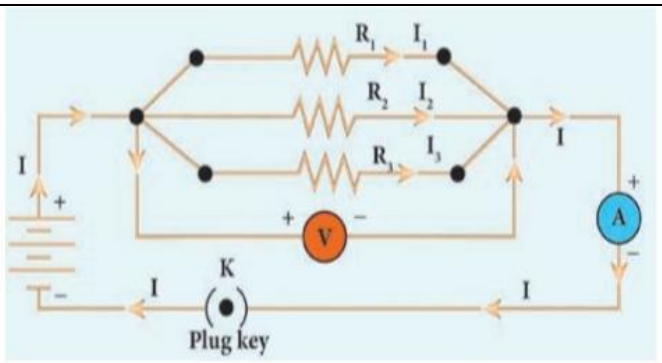
Detail Questions :

1D).With the help of a circuit diagram derive the formula for the resultant resistance of the resistance of three resistances connected. a) In series b) In parallel

Resistance in series	Resistance in parallel
R_1 , R_2 , R_3 connected in series.	R_1 , R_2 , R_3 connected in parallel.
Current be same . [I]	Current is different. [I_1 , I_2 , I_3]
Voltage is different. [V_1 , V_2 , V_3]	Voltage be same. [V]
Ohm's Law : $V = I R$	Ohm's Law : $I = \frac{V}{R}$
$V_1 = I R_1$; $V_2 = I R_2$; $V_3 = I R_3$	$I_1 = \frac{V}{R_1}$; $I_2 = \frac{V}{R_2}$; $I_3 = \frac{V}{R_3}$
$V = V_1 + V_2 + V_3$	$I = I_1 + I_2 + I_3$
$I R_S = I R_1 + I R_2 + I R_3$	$\frac{V}{R_P} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$
$R_S = R_1 + R_2 + R_3$	$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$
	

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2 D). a) What is meant by electric current ?

Rate of flow of charges in a conductor is called as " Electric current "

$$I = Q / t$$

---

b) Name and define its unit.

S I Unit of electric current : ampere (A)

When a charge of 1 coulomb flows across any cross section of a conductor in one second is called 1 ampere .

$$1 \text{ ampere} = \frac{1 \text{ Coulomb}}{1 \text{ second}}$$

---

c) Which instrument is used to measure the electric current ? How should it be connected in a circuit ?

- **Instrument : Ammeter**
- **It is connected in series connection.**

---

3 D). a) State Joule's law of heating .

Heat produced in any resistor is directly proportional to :

1. Square root of current passes through resistor.

2. Resistance of the resistor.

3. Time flow of current through the resistor.

$$H = I^2 R t$$

---

b) An alloy of nickel and chromium is used as heating element.

1. **It has high resistivity.**
2. **It has high melting point.**
3. **It is not easily oxidized.**

---

c) How does a fuse wire protect electrical appliances ?

1. **If large current passes through the circuit , fuse fire melts.**
2. **Due to Joule's law of heating .**
3. **And the circuit gets disconnected.**
4. **Electrical appliances saved from damage.**

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4 D). Explain about domestic electric circuits.

Domestic Circuit :

It brings power supply to main box from transformer.

Parts Main Box :

1. **Meter**
2. **Fuse Box**

i. **Meter :**

Used to record consume of electrical energy.

ii. **Fuse Box :**

1. **Fuse Wire**
2. **M C B**

Fuse Wire :

1. **If large current passes through the circuit , fuse fire melts.**
2. **It protects house hold electrical appliances form overloading.**

M C B

1. **M C B means " miniature circuit breaker "**
2. **It has a spring attached to the switch.**
3. **It is attracted by an electromagnet when excess current passes.**
4. **The circuit is broken and electrical appliance is ensured.**

Types of insulated wire :

1. **Red Insulation Wire**
2. **Black Insulation Wire**

i. **Red Insulation Wire :**

* **It is called as " live wire "** ii . Black Insulation Wire:
* **It is called as " live wire "**

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Working :

- **Live wire and neutral wire entered into main box.**
- **Main fuse is connected with live wire.**
- **Used to discontinue the electricity .**

Rating Circuit :

1) 5 A Rating circuit
2) 15 A Rating circuit

5 A Rating circuit :

- **It is low power rating circuit to run electrical appliances.**
- **Such as tube lights , fans**

15 A Rating circuit :

- **It is high power rating circuit to run electrical appliances.**
- **Such as air conditioner , refrigerators.**
- **All circuits in a house are in parallel connection.**
- **Disconnection one circuit does not affect other circuit.**
- **Electricity supplied to our home is alternating current of 220 V.**

---

5 . a) What are the advantages of LED TV over the normal TV ?

1. **It has brighter picture quality.**
2. **It is thinner in size .**
3. **It is more reliable.**
4. **Its life span is more.**
5. **It uses less power.**
6. **It consumes very less energy.**

6 b) List the merits of LED bulb.

1. **There is no filament used.**
2. **There is no loss of energy in the form of heat .**
3. **It is cooler than incandescent bulb.**
4. **It is not harmful to the environment.**
5. **A wide range of colours is possible here.**
6. **It is cost efficient and energy efficient.**
7. **Mercury and other toxic material are not required.**
8. **Compare to fluorescent light , it is low power requirement.**

---

5. Acoustics

Answer very Briefly Questions :

1 B) What is longitudinal wave ?

The particles of the medium vibrate along the direction of propagation of wave. It is known as " longitudinal wave ".

---

2 B) What is the audible range of frequency ?

Audible range of frequency is 20 Hz and 20000 Hz.

---

3 B) What is the minimum distance needed for an echo ?

The minimum distance needed for an echo is 17.2 m

---

4 B) What will be the frequency sound having 0.20 m as its wavelength , when it travels with a speed of 331 ms^{-1} ?

Given :

Wavelength = λ = 0.20 m Velocity = v = 331 m s^{-1}

Frequency = n = ?

Formula :

$$n = \frac{v}{\lambda}$$

$$n = \frac{331}{0.20} = 1655 \text{ Hz}$$

---

5 B) Name three animals , which can hear ultrasonic vibrations.

Mosquito , dogs and bats can hear ultrasonic vibrations.

Brief Questions :

1 B) Why does sound travel faster on a rainy day than on a dry day ?

- **sound travel faster on a rainy day than on a dry day .**
- **During rainy day the humidity increases.**
- **When humidity increases , speed of sound increases.**
- **In rainy season , we can hear sound from long distance.**

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2. Why does an empty vessel produce more sound than a filled one ?

1.The vibration of air molecules will be more due multiple reflection.
2. Vibration of air is greater than liquids.
3. More free space allows more amplified vibration.
4. Hence , an empty vessel produce more sound than a filled one.

---

3. Air temperature in Rajasthan desert can reach 46^0 C . What is the velocity of sound in air at that temperature ?

Given :

$T = 46^0 C$; $V_O = 331 \text{ m s}^{-1}$ $V_T = ?$

Formula :

$$V_T = V_0 + 0.61 T$$

$$V_T = 331 + (0.61 X 46)$$

$$V_T = 331 + 28.06$$

$$V_T = 359.06 \text{ m s}^{-1}.$$

---

4 . Explain , why the ceilings of concert halls are curved ?

1. Due to multiple reflections of sound waves from curved surface.
2. The sound after reflection reaches every corner of concert halls.
3. The audience can hear the sound clearly.
4. The intensity of the reflected waves are changed.

---

5. Mention two cases in which there is no Doppler effect in sound ?

- When source and listener both are at rest.
- When source and listener move in such a way that distance between them remains constant.
- When source and listener are moving in mutually perpendicular directions.
-

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Detail Questions :

1.What are the factors that affect the speed of sound in gases?

Factors that affect the speed of sound in gases ;

1. **Effect of Density**
2. **Effect of Temperature**
3. **Effect of Relative humidity**

1. Effect of Density

Velocity of sound in a gas is inversely proportional to the square root of the density of the gas. Velocity decreases as the density of the gas increases.

$$V \quad \alpha \quad \frac{1}{d}$$

2. Effect of Temperature

Velocity of sound in a gas is directly proportional to the square root of the temperature. Velocity increases with the increase in temperature.

$$V_T = (V_0 + 0.61\ T)\ m\ s^{-1}$$

V_T ⟶ **Velocity of sound at T temperature**

V_0 ⟶ **Velocity of sound at 0^0 C.**

$0.61\ m\ s^{-1}$ ⟶ **Velocity of sound changes for 1^0 C.**

3. Effect of Relative humidity :

When humidity increases the speed of sound increases.

We can hear the sound from long distances clearly during rainy seasons.

---

2. What is meant by reflection of sound ?

- **A sound travels form one medium.**
- **And it strikes the surface of other medium.**
- **It bounces into the first medium .**
- **This phenomenon is known as reflection of sound.**

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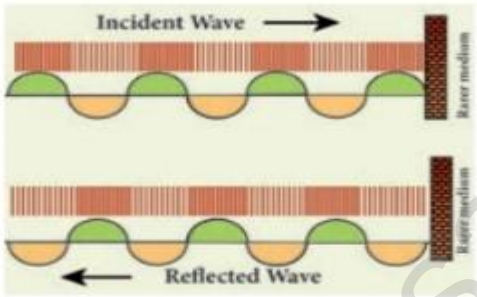
a) Reflection at the boundary of a rarer medium :

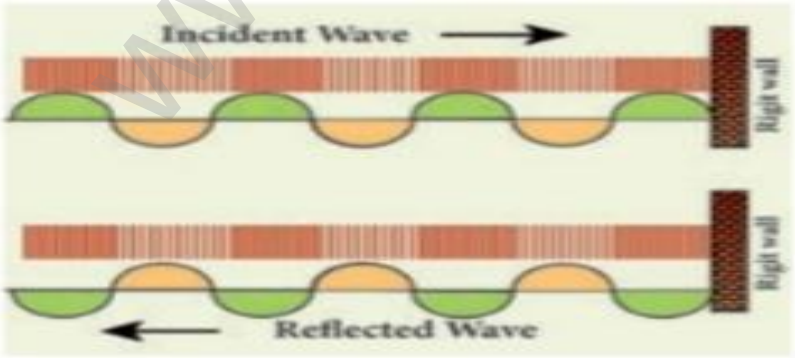
1. **A waves travels in a solid medium.**
2. **It strikes on the interface between solid and the air.**
3. **The compression exerts a force F on the surface.**
4. **It has smaller resistance for ant deformation.**
5. **The surface of separation is pushed backwards.**
6. **Compression is reflected as a rarefaction.**
7. **It travels from right to left.**



Reflection of sound at a rarer medium

b Reflection at the boundary of a denser medium :

1. **Compression travels from left to right.**
2. **It reaches a rigid wall it exerts a force F.**
3. **The wall exerts an equal and opposite reaction R = - F.**
4. **Compression reflected as compression.**
5. **The direction of compression is reversed.**



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c) Reflection at curved surface :

Reflected Surface	Intensity of Reflected Waves
Curved Surface	Intensity Changes
Convex Surface	Diverged out & Intensity Decrease
Concave Surface	Converged & Focused at point
Parabolic Surface	Focus at particular point
Elliptical Surface	Sound from one focus be reflected to other focus

---

3) a . What do you understand by the term " Ultrasonic vibration " ?

Ultrasonic vibration are vibrations with frequency greater than 20 K Hz.

---

b) State three uses of ultrasonic vibrations.

1. **Used in SONAR to measure the depth of the sea.**
2. **Used in the treatment of muscular pain and arthritis.**
3. **Bats produced ultrasonic vibration to detect prey and obstacles in their path.**
4. **Dogs are trained to respond to a whistle which produces ultrasonic vibrations.**

---

c) Name three animals which can hear ultrasonic vibrations.

Mosquito , Dogs and Bats can hear ultrasonic vibrations.

---

4. What is an echo ?

An echo is the sound reproduced due to the reflection of the original sound from various rigid surfaces.

Example : Walls , Ceilings , Mountains

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a) State two conditions necessary for hearing an echo.

1. **Minimum time gap between original sound and an echo is 0.1 s**
2. **Minimum distance needed to hear an echo is 17.2 m**

---

b) What are the medical applications of echo ?

1. **The principal of echo is used in obstetric ultrasonography.**
2. **It is a safe testing tool .**
3. **It does not use any harmful radiations.**
4. **It is used to create real – time visual images of developing embryo.**
5. **It is used to create real – time visual images of developing Fetus in mother's uterus.**

---

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

The speed of sound using echo

$$\text{Speed of sound} = \frac{\text{Distance Travelled}}{\text{Time Taken}} = \frac{2\ d}{t}$$

---

6. Nuclear Physics

Answer in one word

1. Who discovered natural radioactivity ?

Henri Becquerel discovered natural radioactivity.

---

2. Which radioactive material is present in the ore of pitchblende?

Uranium radioactive material is present in the ore of pitchblende.

---

3. Write any two elements which are used for inducing radioactivity ?

Boron and Aluminium are used for inducing radioactivity.

---

4. Write the name of the electromagnetic radiations which is emitted during a natural radio activity ?

γ rays is emitted during a natural radio activity.

5.If A is a radioactive element which emits an α – particle and produces $_{104}Rf^{259}$. Write the atomic number and mass number of the element A.

α – decay :

$$_{106}A^{263} \longrightarrow {}_{104}Rf^{259} + {}_{2}He^{4}$$

Atomic Number – 106 Mass number – 263

---

6. What is the average energy released from a single fission process?

3.2×10^{-11} J is the average energy released from a single fission process.

---

7. Which hazardous radiation is the cause for the genetic disease?

Gamma radiation is the cause for the genetic disease.

---

8. What is the amount of radiation that may cause death of a person when exposed to it

600 R is the amount of radiation that may cause death of a person when exposed to it.

---

9. When and where was the first nuclear reactor built?

In 1942, Chicago, USA was the first nuclear reactor built.

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10. Give the SI unit of radioactivity.

SI unit of radioactivity : Becquerel

---

11. Which material protects us from radiation?

Lead material protects us from radiation.

Short Answers:

1. Write any three features of natural and artificial radioactivity?

Natural Radioactivity	Artificial Radioactivity
It cannot be controlled.	It can be controlled.
It is a spontaneous process.	It is an induced process.
Alpha, beta and gamma radiations are emitted.	Mostly elementary particles such as neutron, positron, etc are emitted.
Exhibited by elements with atomic number more than 83.	Exhibited by elements with atomic number less than 83.

---

2. Define critical mass.

1. **The minimum mass of a fissile material necessary to sustain the chain reaction is called critical mass.**
2. **It depends on the nature, density and the size of the fissile material.**

---

3. Define one roentgen.

One roentgen is defined as the quantity of radioactive substance which produces a charge of 2.58 x 10^{-4} coulomb in 1 kg of air under standard conditions of pressure, temperature and humidity.

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4. State Soddy and Fajan's displacement law.

1. When a radioactive element emits an alpha particle,

- **Daughter nucleus is formed.**
- **Mass number is less by 4 units .**
- **Atomic number is less by 2 units .**
- **Compare to the parent nucleus.**

2. When a radioactive element emits a beta particle,

- **Daughter nucleus is formed .**
- **Mass number is the same .**
- **Atomic number is more by 1 unit.**
- **Compare to the parent nucleus.**

---

5. Give the function of control rods in a nuclear reactor.

1. Used to control the number of neutrons .

2. To sustain chain reaction.

3. To absorb the neutrons.

---

6. In Japan, some of the new born children are having congenital diseases. Why?

1. The reason for congenital diseases in Japanese new born is a result of nuclear bomb blast at Hiroshima and Nagasaki during World war II.

2. As a result the radiation poisoning in Japan is still prevalent which leads to the various congenital diseases like,

i. Chronic illness – heart defects.

ii. Disability – club foot.

iii. Down syndrome

7. Mr. Ramu is working as an X – ray technician in a hospital. But, he does not wear the lead aprons. What suggestions will you give to Mr. Ramu?

1. **I will suggest Ramu to use a dosimeter to detect the levels of ionizing radiations he has been receiving.**
2. **I will ask him to use lead coated aprons and lead gloves to safe guard himself.**
3. **I will also brief him on the side effects of x – rays and the diseases he will be prone to on continuous exposure.**

---

8. What is stellar energy? • Fusion reaction that takes place in the cores of the Sun and other stars.

• Results in an enormous amount of energy is called as ' stellar energy'.

---

9. Give any two uses of radio isotopes in the field of agriculture?

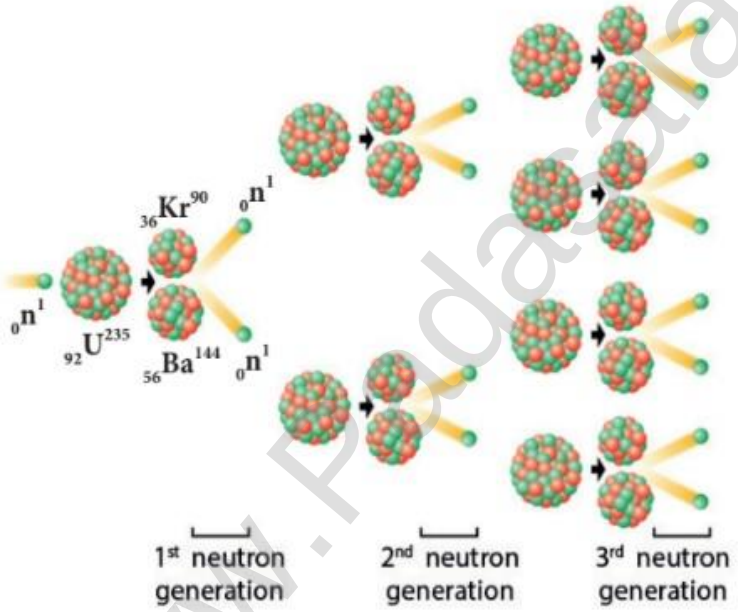
1. **Phosphorous [p – 32] helps to increase the productivity of crops.**
2. **Used to kill the insects and parasites .**
3. **Prevent the wastage of agricultural products.**
4. **Certain perishable cereals exposed to radiations remain fresh .**
5. **Beyond their normal life, enhancing the storage time.**

Long answers:

1. **Explain the process of controlled and uncontrolled chain reactions.**

Controlled chain reaction :

1. **The number of neutrons released is maintained to be one.**
2. **By absorbing the extra neutrons with a neutron absorber .**
3. **Leaving only one neutron to produce further fission.**
4. **The reaction is sustained in a controlled manner.**
5. **This is energy is utilized for constructive purposes.**
6. **It is used in a nuclear reactor to produce energy..**



Uncontrolled chain reaction:

1. **The number of neutrons multiplies indefinitely .**
2. **It causes fission in a large amount of the fissile material.**
3. **It release of a huge amount of energy within a fraction of a second.**
4. **Used in the atom bomb to produce an explosion.**

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2. Compare the properties of alpha, beta and gamma radiations.

Property	α rays	β rays	γ rays
Definition	Helium [$_2He^4$] Two protons Two neutrons.	Electrons [$_{-1}e^0$] Basic elementary particle	Electromagnetic waves consisting of photons.
Charge	Positively charged Charge = +2e	Negatively charged Charge = -e.	Neutral particles Charge = zero.
Ionising power	100 times > β ays 10,000 times > γ rays.	Comparatively low	Very less
Penetrating Power	Low power Even stopped by thick paper	Greater than α rays. It penetrate through a thin metal foil.	very high power > β rays It penetrate through thick metal blocks.
Effect of electric & magnetic field	Deflected by both fields. Fleming's left hand rule.	Deflected by both fields. Direction of deflection is opposite to alpha ray. Fleming's left hand rule.	They are not deflected by both the fields.
Speed	Speed ranges from 1/10 to 1/20 times the speed of light.	Speed can go up to 9/10 times the speed of light.	They travel with the speed of light.

3.What is a nuclear reactor? Explain its essential parts with their functions

Nuclear reactor:

It is a device in which the nuclear fission reaction takes place.

In a self-sustained and controlled manner to produce electricity.

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Essential parts and functions:

Fuels:

1. **A fissile material is used as the fuel.**
2. **Example : Uranium**

Moderator:

1. **Used to slowdown the high energy neutrons.**
2. **To provide slow neutrons.**
3. **Example : Graphite and heavy water**

Control rod:

1. **Used to control the number of neutrons .**
2. **To have sustained chain reaction.**
3. **They absorb the neutrons.**
4. **Example : Boron or cadmium**

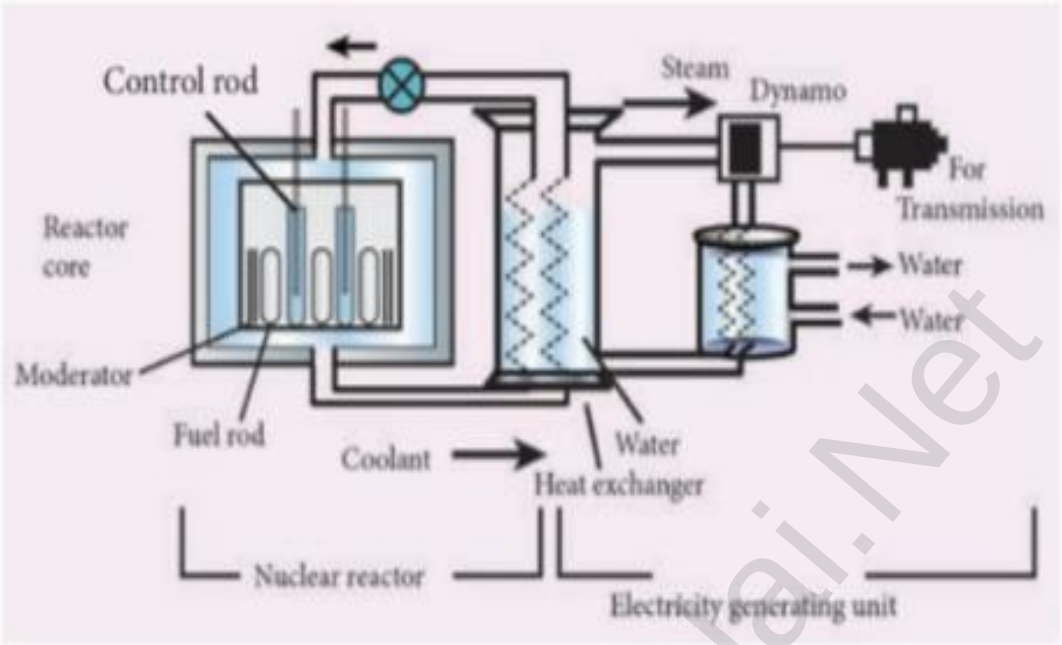
Coolant:

1. **Used to remove the heat produced in the reactor core.**
2. **To produce steam and is used to run a turbine .**
3. **And to produce electricity.**
4. **Example : Water, air and helium .**

Protection wall:

1. **A thick concrete lead wall around the nuclear reactor .**
2. **To prevent the harmful radiations from escaping into the environment.**

Schematic Diagram of a nuclear reactor



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