

RAMAKRISHNA VIVEKANANDA MISSION
MODEL ANSWER FOR ANNUAL EXAM 2020
SUB – PHYSICAL SCIENCE (ENGLISH MEDIUM)
CLASS – IX

1. MCQ:-

- i. With increase of temperature the elasticity of a material - b) decreases
- ii. The number of basic units in SI system are – a) 7
- iii. The slope of distance-time graph is – d) speed
- iv. Saturated vapour obeys – d) none of these laws
- v. The speed of sound is maximum in – d) iron
- vi. A force of 100N acting on a body does 100J work' The distance through which the body is displaced – c) 10m
- vii. The valency of the element having atomic number 20 is – a) 2 [electronic configuration = 2,8,8,2]
- viii. Which of the following solvents is used to remove nail polish – c) Acetone
- ix. Avogadro's number is used in – d) Chemistry, Physics and Biology
- x. If a P^H paper is soaked into gastric juice, it will indicate a P^H – b) less than 7
- xi. Boiling point of a liquid – c) increases with increase of pressure
- xii. Which of the following ions responsible for hardness of water – a) Fe^{2+}
- xiii. The nature of commonly used toothpaste is – c) Basic

Rough

$$W = F \times S$$

$$1000J = 100N \times S$$

$$\Rightarrow \frac{1000}{100} m = S$$

$$\Rightarrow S = 10M$$

2. VSA :

- i. The SI unit of thrust is newton (N).

Or,

The SI unit of density is Kg/m^3 .

- ii. The dimensional equation of power.

$$\text{Power} = \frac{\text{Work}}{\text{Time}} = \frac{\text{Force} \times \text{Displacement}}{\text{Time}}$$

$$= \frac{\text{Mass} \times \text{Acceleration} \times \text{Displacement}}{\text{Time}}$$

$$[P] = \frac{[M \times LT^{-2}] \times [L]}{[T]} = [ML^2T^{-3}]$$

$\therefore$ The dimensional equation of power is $[ML^2T^{-3}]$.

- iii. **Newton's first law of motion:** - Everybody continues in its state of rest or of uniform motion in a straight line unless it is acted on by some unbalanced force to change that state.

Or,

A rocket works on the principle of conservation of momentum.

- iv. **Echo:** When a sound after reflection from some reflector is again heard separated from the original sound, then this reflected sound is called an echo.

Or,

Quality of sound: quality of a sound is the characteristic which distinguishes two sounds of same loudness and pitch produced by two different instruments.

- v. Two favourable conditions for the formation of dew are clear sky still air, high moisture content of the air.
- vi. 1 Calorie = 4.18 joule
- vii. The distance between two successive compressions is λ (Lamda)

viii. **Definition of work :** - Work is said to be done by or against a force when its point of application moves in or opposite to the direction of the force and is measured by the product of the force and displacement of the point of application in the direction of the force.

ix. Mass (m) of a body = 2 kg
Speed (v) of it = 20 m/s

$$\begin{aligned}\therefore \text{Kinetic energy of the body} &= \frac{1}{2} mv^2 \\ &= \frac{1}{2} \times 2 \times (20)^2 \text{ joule} \\ &= 400 \text{ joule}\end{aligned}$$

Ans:- The Kinetic energy of the body is 400 joule.

x. The value of latent heat of fusion of ice in SI system is 3.36×10^5 J /kg.

xi. The charge and mass of an α -particle are +2 and 4.

Or,

Rutherford imagined the presence of neutron in the nucleus.

xii. The particles present in the nucleus of an atom are called nucleons. Protons and neutrons are called nucleons.

xiii. Molar mass of nitrogen (N_2) is (14×2) gm = 28 gm. And molar volume of it is 22.4 l .

$\therefore$ Volume of 28gm. Of Nitrogen is 22.4 l at STP.

$\therefore$ Volume of 1gm. Of nitrogen is $\frac{22.4}{28}$ l at STP.

$\therefore$ Volume of 7gm. Of nitrogen is $\frac{22.4 \times 7}{28}$ l at STP.

$$= 5.6 \text{ l at STP.}$$

Ans:- The volume of 7gm. Of nitrogen at STP is 5.6 l at STP.

Or, Mass of 1 mole of CO_2 = 44gm.

$\therefore$ Mass of 0.5 mole of CO_2 = (44×0.5) gm.
 $= 22 \text{ gm.} = 22\text{gm.}$

Ans:- The mass of 0.5 mole of CO_2 is 22gm.

xiv. **Atomic mass unit :** - one twelfth ($\frac{1}{12}$)th of mass of one atom of carbon – 12 (C – 12) is known as atomic mass unit.

$$1 \text{ atomic mass unit (amu or u)} = \frac{\text{mass of one atom of C-12}}{12}$$

xv. **Emulsion:** - An emulsion is a type of colloid formed by mixing two immiscible liquids. One of the two liquids is water and the other is an oil. Butter, milk, cold cream are the examples of emulsion.

Or,

Electrophoresis: - The colloidal particles carry particular type of electrical charge (+ve or –ve charge). Depending on the nature of charge, these particles move either towards cathode or anode. This is called electrophoresis.

xvi. Benzene can dissolve rubber.

xvii. **Acid-Base indicator :** - Acid-Base indicators are those substances which change their colour in acid and base. Litmus solution, phenolphthalein, methyl orange are few acid base indicators.

Or,

Phenolphthalein is an indicator which is used to determine the end point of neutralisation of acid base titration.

xviii. Tooth decay takes place when the pH decreases to 5.5.

xix. By the process of fractional distillation, the fractions of crude petroleum are collected.

xx. The process of distillation is used for separating the iodine and ethanol from their mixture.

xxi. **Water pollution:-** Water pollution is defined as the contamination of water bodies due to any natural cause or human activity.

xxii. The safe limit of arsenic in drinking water prescribed by WHO is 0.05 mg/L.

xxiii. Basic lead chloride ($Pb(OH)Cl$) is an example of basic salt.

3. SA:

- i. **Surface tension** :- Surface tension is the property of a liquid by virtue of which the free surface of liquid at rest tends to have minimum area and so it behaves as if covered with a stretched membrane. It is measured as the force acting on unit length of an imaginary line drawn tangentially anywhere on the free surface of the liquid at rest.

SI unit of surface tension is Nm^{-1} or N/m .

Or,

Strain :- Strain is the ratio of the change in length, volume or shape to the original configuration.

Since strain is a ratio of two similar quantities, so it is a pure number having no unit.

- ii. **Hook's law** :- Within elastic limit, the stress developed in body is proportional to the strain produced in it.

So, according to this law, within elastic limits $\text{stress} \propto \text{strain}$

$$\frac{\text{stress}}{\text{strain}} = \text{a constant}$$

This proportionality constant is known as elastic modulus of the material of the body.

Elastic modulus can be defined as the stress developed per unit strain.

- iii. Mass (m) of the body = $250 \text{ gm} = \frac{250}{1000} \text{ kg}$

Force (F) = 1N

Acceleration (a) = ?

$$\therefore F = m \times a$$

$$\therefore \frac{F}{m} = a$$

$$\therefore a = \frac{1}{\frac{250}{1000}}$$

$$\text{Or, } a = 1 \propto \frac{1000}{250}$$

$$\therefore a = 4 \text{ m/sec}^2$$

Ans : - The acceleration of the body is 4 m/sec^2

Or

Mass (m) of a body = 0.5kg

Acceleration (a) = 10 m/S^2

Force (F) = ?

$$\therefore F = m \times a$$

$$\therefore F = 0.5 \times 10 \text{ N}$$

$$F = 5 \text{ N}$$

Ans: - The required force is 5N

- iv. **V=u+at**

Consider a particle moving with acceleration 'a' along a straight line, starting with initial velocity 'u' attains a velocity 'v' in interval of time 't', In this velocity-time graph

OA = u = initial velocity

CB = V = final velocity

OC = t = time interval

Acceleration (a) of

$$\text{The body} = \text{slope AB} = \frac{BD}{AD}$$

$$= \frac{CB - CD}{OC} \quad [\because AD = OC = t]$$

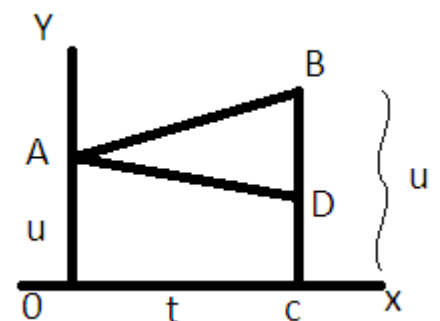
$$\therefore a = \frac{CB - OA}{OC} \quad [\because CD = OA]$$

$$\text{or, } a = \frac{v - u}{t}$$

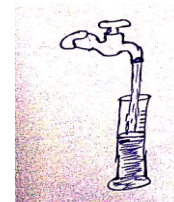
$$\text{or, } at = v - u$$

$$\text{or, } at + u = v$$

$$\therefore v = u + at$$



- v. With the help of measuring cylinder and stop watch we can determine the rate of fall of water.
A measuring cylinder is held just below the water flowing out of the tap.
After certain interval of time. When sufficient water is collected in the cylinder, the tap is closed and the stop watch is also stopped. Let in the time interval of t seconds volume of water collected be $v\text{cm}^3$.



$$\text{Thus rate of fall of water} = \frac{v}{t} \text{ cm}^3/\text{sec}$$

- vi. **Energy** :- Energy is the capacity to do work.
In SI system the unit of power is watt.
In FPS system the unit of power is horse power (hp).
1 horse power = 746 watt
- vii. When two objects of different temperature are kept in contact with each other then the object at the higher temperature will release its heat energy and the object at the lower temperature will absorb that heat energy. This heat exchange will continue till the temperature of the objects become same.
Assuming that there is no heat exchange with the surroundings and that the heat is exchange between the objects only and there is no chemical reaction between them then,
Heat lost by the hotter object = Heat gained by the colder object.
This is known as principal of calorimetry.
- viii. **Frequency** :- The number of complete vibration oscillations performed in one second by a particle in the path of the wave is called the frequency of the wave.
Now the time taken for one complete oscillation is called time period.
 $\therefore \text{Time period (T)} = \frac{1}{\text{frequency (n)}}$
 $\therefore T \times n = 1$
This is the relation between time period and frequency.
- ix. Polyphosphate from detergents serve as algal nutrients and enhance the production of algal blooms.
An organic pesticide is malathion.
- x. The boiling point of a liquid increases with the increase in pressure and decreases with the decreases in pressure. So they are directly proportional to each other.
LPG and petrol are two commercial materials obtained from the fractional distillation of crude petroleum.
- xi. If a solution of barium chloride (BaCl_2) is addes in the colourless liquid and a white precipitate is obtained which is insoluble in concentrated HCl then it is clear that colourless liquid is H_2SO_4 acid.
$$\text{BaCl}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{BaSO}_4 \downarrow + 2\text{HCl}$$

White Precipitate

Or

The commercial name of nitric acid (HNO_3) is aqua fortis.

- a. It is used for the manufacture of fertilisers like (ammonium nitrate)
- b. It is also used for the manufacture of explosives like nitroglycerine (used in dynamite), trinitrotoluene (T.N.T)
- xii. **Stone leprosy** :- The acid rain causes corrosive damage to marble stones historical monuments like Tajmahaal etc.
The pitting and deformation of stone surface by acid rain is known as stone leprosy,
$$\text{CaCO}_3 + \text{H}_2\text{SO}_4 = \text{CaSO}_4 + \text{CO}_2 \uparrow + \text{H}_2\text{O}$$

(marble)
Due to the reaction of acid with marble a salt, CO_2 gas and sometimes water also are formed. This reaction causes damage on marble.
- xiii. **Seeding** :- The process of inducing and enhancing crystallization by adding a crystal of pure substance into its saturated solution is called seeding.
A salt which contains water of crystallization is blue vitriol ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$)

Or

Solubility of KNO_3 at 25°C is 40 means at 25°C temperature 100 gm water dissolves maximum 40 gm KNO_3 to make a saturated solution.

- xiv. The volume occupied by one gram-molecule of any substance (element or compound) at S.T.P in gaseous state is called gram molecular volume or molar volume.
Its value is 22.4 litre ($2.24 \times 10^{-2} \text{m}^3/\text{mol}$)
- xv. The outermost shell of an atom cannot contain more than 8 electrons. If the outermost shell of an atom is fulfilled means contains 8 electrons, its chemical reaction will be very poor and its valency is taken to be 0(zero).
Among inert gases, only Helium atoms contain 2 electrons in their outermost shell. The atoms of other inert gases contain 8 electrons in their outermost shell, so they have got a stable electronic configuration. This is the reason for what inert gas elements are inert.

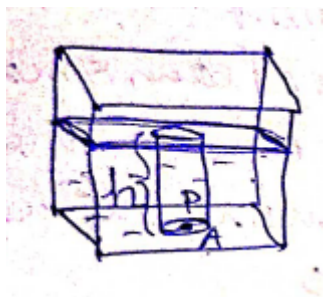
Or

Two characteristics of cathode rays : -

- Cathode rays affect photographic plate.
- The rays are deflected from the straight line towards the positive pole of the electric and magnetic field, which indicates that cathode rays are negatively charged.

4. LA

- Let a horizontal area A containing the point P is considered at a depth h below the surface of the liquid of density 'p'. We have to find the pressure of the liquid at the point P. For this let us imagine a vertical column inside the liquid having base area A.



$$\therefore \text{Volume of the liquid column} = \text{base area} \times \text{height} \\ = A \times h$$

$$\text{Thus mass of liquid column} = \text{density} \times \text{volume} \\ = p \times A \times h$$

$$\therefore \text{weight of the water column} = \text{mass} \times \text{acceleration due to gravity} \\ = p \times A \times h \times g = F$$

F is the force acting at P.

$$\therefore \text{pressure at P} = \frac{F}{A} = \frac{p \times A \times h \times g}{A}$$

$$\therefore P = hpg$$

This is the required expression for the pressure .

Or

From the equation of continuity we have come to know that the volume of a liquid entering per second in a tube and volume of the liquid leaving per second from the tube having different area of cross section, remain same.

$$\text{i. e rate of flow of liquid} = a \times v = \text{constant}$$

a = area of cross section

v = velocity of the liquid

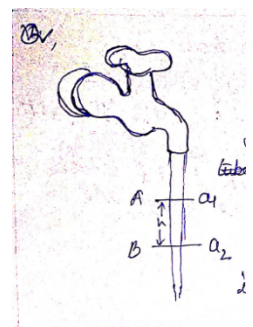
Thus larger the area of cross section, smaller will be the velocity of liquid flow and vice versa.

It is found that stream of water coming out has different velocities at different places. Let two points A and B are considered at a distance of h, having cross sectional areas a_1 and a_2 respectively. Let velocities of stream of water at A and B be V_1 and V_2

V_1 =initial velocity

V_2 =final velocity

From the law of motion



$$V^2 = u^2 + 2gh$$

We can write

$$V_2^2 = V_1^2 + 2gh$$

$$\therefore V_2 > V_1$$

$$\therefore a_1 V_1 = a_2 V_2 = a \times v = \text{constant}$$

$$\therefore a_2 < a_1$$

So water falling out of a tap becomes narrower as it goes down.

ii. Initial velocity (u) = 30 km/hr

Final velocity (v) = 60 km/hr

Time (t) = 1 minute = 60 second

$\therefore$ Change in velocity = v - u

$$= (60-30) \text{ km/hr}$$

$$= 30 \text{ km/hr}$$

$$= \frac{30 \times 1000 \text{ m}}{3600 \text{ sec}}$$

$$= \frac{10}{12}$$

$$= \frac{5}{6}$$

$$= \frac{25}{3} \text{ m/sec}$$

$\therefore$ acceleration (a) = $\frac{\text{change in velocity}}{\text{time}}$

$$= \frac{\frac{25}{3} \text{ m/sec}}{60 \text{ sec}}$$

$$= \frac{25}{3} \times \frac{1}{60} \text{ m/sec}^2$$

$$= \frac{5}{36} \text{ m/sec}^2$$

$$= 0.14 \text{ m/s}^2 \text{ [approx]}$$

$\therefore$ The acceleration of the train in SI system is 0.14 m/s^2 (approx)

Or

$$\text{Mass of the bullet (m)} = 100 \text{ gm} = \frac{100}{1000} \text{ kg} = \frac{1}{10} \text{ kg}$$

$$\text{Mass of the gun (M)} = 20 \text{ kg}$$

$$\text{Velocity of the bullet (v)} = 100 \text{ m/s}$$

Let the recoil velocity of the gun be V

$$\text{Initial momentum of the gun + bullet} = (M+m) \times 0 \\ = 0$$

$$\text{Final momentum of the gun + bullet} = MV + mv \\ = 20V + \frac{1}{10} \times 100 \\ = 20V + 10$$

According to law of conservation of momentum

$$20V + 10 = 0$$

$$\text{Or, } 20V = -10$$

$$\text{Or, } V = -\frac{10}{20}$$

$$\therefore V = -0.5 \text{ m/s}$$

The -ve sign indicates the gun moves backwark.

$\therefore$ The recoil velocity of the gun is 0.5 m/s.

iii. Distance (s) travelled by the wave pulse = 8m

Time taken (t) = 0.5 sec

$$\therefore \text{Velocity of the pulse} = \frac{\text{Distance}}{\text{Time}} = \frac{8\text{m}}{0.5 \text{ sec}} = \frac{16}{1} \text{ m/s} = 16 \text{ m/s}$$

Now,

Frequency (n) = 200 Hz

Velocity (v) = 16m/s = $\frac{16 \times 100 \text{ cm}}{\text{Sec}}$

Wave length = λ = ?

$$\therefore \text{Wave length of the wave} = \frac{\text{Velocity}}{\text{Frequency}} \quad [\because V = n \cdot \lambda]$$

$$\lambda = \frac{16 \times 100}{200} \text{ cm}$$

$$\lambda = 8 \text{ cm.}$$

$\therefore$ Velocity of the pulse is 16m/sec and wave length the wave is 8 cm.

Or,

Frequency (n) = 100Hz

Wave length (λ) = 50 cm.

Distance (s) = 500 m. = 500 X 100 cm.

Time (t) = ?

Velocity (v) of the wave = $n \times \lambda$

= 100 X 50 cm/sec

= 5000 cm/sec

$$\therefore S = V \times t$$

$$\therefore 500 \times 100 = 5000 \times t$$

$$\text{Or, } \frac{50000}{5000} = t$$

$$\text{Or, } t = 10 \text{ sec.}$$

$\therefore$ The time taken by the wave is 10 sec.

iv. Mass (m_1) of the hot solid body = 60gm = $\frac{60}{1000} \text{ kg}$

Temperature (t_1) of the body = 100°C

Set the specific heat capacity of the solid be S_1

Now,

Mass (m_2) of water = 150gm = $\frac{150}{1000} \text{ kg}$

Temperature (t_2) of it = 20°C

Sp. Heat capacity(S_2) of water = 4200 J/kg °C

The steady temperature (t) of the mixture = 25 °C

Now, according to the principle of calorimetry

Heat lost by the hotter body = Heat gained by the colder body

$$\begin{aligned} m_1 S_1 (t_1 - t) &= m_2 S_2 (t - t_2) \\ \frac{60}{1000} \times S_1 \times (100 - 25) &= \frac{150}{1000} \times 4200 \times (25 - 20). \\ \text{or, } 60 \times S_1 \times 75 &= 150 \times 4200 \times 5 \\ \text{or, } S_1 &= \frac{150^{10} \times 4200^{700} \times 5}{60 \times 75} \end{aligned}$$

$$\text{or, } S_1 = 700 \text{ J/kg}^\circ\text{C}$$

$\therefore$ Sp. Heat capacity of the solid is 700 J/ kg°C

Or,

Mass (m_1) of hot water = 40 gm

Sp. Heat capacity (S_1) of water = 4.2 J/gm°C

Temperature (t_1) of hot water = 60°C

Again, Mass (m_2) of cold water = 50gm

Sp. Heat capacity (S_1) of water = $4.2 \text{ J/gm}^\circ\text{C}$

Temperature (t_2) of it = 20°C

Now, Let mass of vessel be $m \text{ gm}$

Sp. Heat capacity of the material of the vessel be S

And its temperature (t_2) = 20°C

Final steady temperature (t) of the mixture = 30°C

According to the principle of calorimetry

Heat lost by hotter body = Heat gained by colder body

$$m_1 S_1 (t_1 - t) = m_2 S_1 (t - t_2) + m_s (t - t_2)$$

$$40 \times 4.2 (60 - 30) = 50 \times 4.2 \times (30 - 20) + m_s \times (30 - 20)$$

$$\text{Or, } 40 \times 4.2 \times 30 - 50 \times 4.2 \times 10 = m \times s \times 10$$

$$\text{Or, } \frac{4.2 (40 \times 30 - 50 \times 10)}{10} = m \times s$$

$$\text{Or, } 4.2 \times \frac{700}{10} = m \times s$$

$$\text{Or, } 294.0 = m \times s$$

$\therefore$ Thermal capacity of the vessel is 294.

v. Let a body of mass m be at rest at a position A at a height h above the ground.

Thus at position A.

Potential energy of the body, $PE = mgh$

Kinetic energy of the body $KE = 0$

So total energy of the body at A = $PE + KE = mgh + 0 = mgh$

Now, let the body falls freely under gravity and reach at position B through a height X when its velocity becomes V thus,

$$V^2 = u^2 + 2gx$$

$$V^2 = 0 + 2gx$$

$$\therefore V^2 = 2gx$$

Height BC = $h - x$

$\therefore$ At position B.

PE of the body = $mg(h - x) = mgh - mgx$

And KE of the body = $\frac{1}{2} mv^2 = \frac{1}{2} m \times 2gx = mgx$

$\therefore$ Total energy of the body at B = $PE + KE$

$$= mgh - mgx + mgx$$

$$= mgh = \text{Total Energy at A}$$

Finally the body reaches the ground at C after falling through a distance h .

The velocity V at C will be .

$$V^2 = u^2 + 2gh$$

$$= 0 + 2gh = 2gh$$

$\therefore$ At position C,

PE of the body = $mgh = mg \times 0 = 0$

KE of the body = $\frac{1}{2} mv^2 = \frac{1}{2} m \times 2gh = mgh$

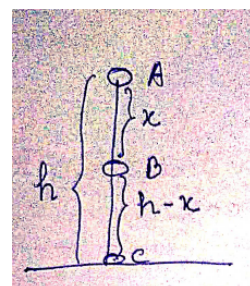
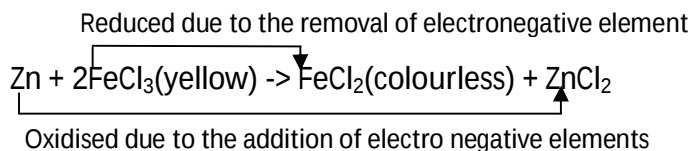
$\therefore$ Total energy of the body at C = $PE + KE = 0 + mgh = mgh$

Thus during free fall, total energy of a body at any instant remains constant.

vi. The hydrogen just at the time of its production from its compound is called nascent hydrogen. The hydrogen-producing substances are stronger reducing agents than hydrogen.

But at present the idea of nascent hydrogen as a reducing agent is unnecessary or baseless.

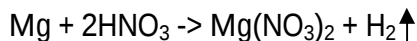
Such as,



In the above reaction without hydrogen reduction and oxidation have taken place. For this reaction idea of nascent hydrogen is baseless.

Or,

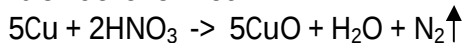
Very dilute and cold nitric acid reacts with magnesium to liberate hydrogen and magnesium nitrate is formed.



This reaction proves that nitric acid contains hydrogen.

Nitric acid being a strong oxidising agent does not liberate hydrogen reacting with metals. It is reduced by the metals to oxides of nitrogen.

Again when nitric acid vapour is passed over hot copper powder nitrogen gas is evolved and black cupric oxide is formed.



This reaction proves that nitric acid contains nitrogen.

- vii.** The molar volume of a gaseous substance depends on temperature and pressure. The molar volume varies with the variation of temperature and pressure keeping pressure constant if temperature of one gram molecule of a gas increased then its volume will also increase and volume will decrease with decrease in temperature. Similarly, keeping temperature constant volume of one gram molecule of a gas decreases with increase of pressure and increase with decrease of pressure. So the temperature and pressure are to mention to give the volume of gaseous substance.

Or,

g molecular mass of $\text{S}_8 = (32 \times 8)\text{gm} = 256\text{gm}$.

According to Avogadro's hypothesis

1gm molecule of S_8 contains 6.022×10^{23} molecules.

i.e. 256gm S_8 contains 6.022×10^{23} molecules

$$\therefore 1\text{gm } \text{S}_8 \text{ contains } \frac{6.022 \times 10^{23}}{256} \text{ molecules}$$

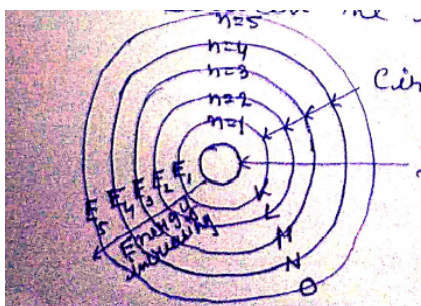
$$\begin{aligned} \therefore 24\text{gm } \text{S}_8 \text{ contains } & \frac{6.022 \times 10^{23}}{256} \times 24 \text{ molecules} \\ & = 0.564 \times 10^{23} \text{ molecules} \\ & = 5.64 \times 10^{22} \text{ molecules.} \end{aligned}$$

$\therefore 5.64 \times 10^{22}$ molecules are present in 24gm of solid sulphur.

viii. Bohr's postulates:-

In order to overcome the objections raised against Rutherford's atomic model, Niels Bohr put forward the following postulates about the model of an atom.

- Out of innumerable number of possible orbits surrounding the nucleus an electron rotates only in certain selected or permissible orbit.
- As long as electron moves in one of these permissible orbits, it neither radiates nor absorbs any energy. These are called stationary orbits.
- Electron may jump from one permissible orbit of lower energy to another orbit of higher energy, thereby a definite quantum of energy is absorbed. When an electron from an orbit of higher energy E_2 jumps to an orbit of lower energy E_1 a definite quantity of energy will be released. Electrons can not stay in an intermediate position between the two orbits.



Electronic Cell and Orbits