MARKING SCHEME MODEL PAPER PHYSICS CLASS 10

NOTE: Attempt all questions of Section-A by filling the corresponding bubble on the **MCQs RESPONSE SHEET.** It is mandatory to return the attempted MCQs sheet to the Superintended within given time

Section-A

Time: 20 Minutes **Marks:** 12

1. **Choose the correct option for the following.**

i. Simple Harmonic Motion is a special type of:

A. Translatory Motion B. Rotatory Motion C. **Oscillatory Motion D**. Circulatory Motion

ii. Speed of sound in air at 0℃ is 331m/s, at 20 ℃ speed will be:

A. 340m/s B.341m/s C.342m/s D.**343m/s**

iii. Which property of light waves remains same during the refraction of light?

A. Speed B. **Frequency** C. Wavelength D. Direction

iv. The speed of light in water having refractive index 1.5 is:

A. **2×10^8 m/s** B.2.5×10^8 m/s C.3×10^8 m/s D.3.5×10^8m/s

v. The SI unit of Electric Field Intensity is:

A. JC^{-1} B.**NC^{-1}** C.Nm^{-1} D. VC^{-1}

vi. The power rating of a lamp connected to a 15V source when it carries 2A current is:

A. 7.5W B.10W C. 20W D. **30W**

vii. Which form of energy is converted into electrical energy by generator?

A. Chemical B. Nuclear C. **Mechanical** D. Thermal

viii. If magnetic field is applied perpendicular to the direction of electron beam, the electrons will be:

A. Speed up B. Slow down C. **Deflected** D. Undeflected

ix. The term E-mail stands for:

A. Emergency mail B. **Electronic mail** C. External mail D. Extra mail

x. The diameter of nucleus is approximately:

A. 10^{-10} m B. 10^{-12} m C. **10^{-15} m** D. 10^{-18} m

xi. Release of energy by sun is due to:

A. **Nuclear Fusion** B. Nuclear Fission C. Burning of gases D. Chemical Reaction

xii. Two capacitors of 6μF are connected in series, the equivalent capacitance is:
A. 1μF B.2μF C.**3μF** D.4μF

MCQs	i	ii	iii	iv	v	vi	vii	viii	ix	x	xi	xii
Key	**C**	**D**	**B**	**A**	**B**	**D**	**C**	**C**	**B**	**C**	**A**	**C**

Section-B

i. What happens to sound when it strikes a:

(a) Flat surface (b) Parabolic surface (c) Porous surface (d) Jagged Surface

Answer:

(a) When sound strike a flat surface it is reflected back. (1)
(b) When sound strike a parabolic surface it is focused. (1)
(c) When sound strike a porous surface it is absorbed. (1)
(d) When sound strike a jagged surface it is dispersed. (1)

ii. What is the effect of medium on speed of sound? In which medium sound travels faster? Justify your answer.

Answer: The speed of the sound depends on the density and the elasticity of the medium through which it travels. (2)

Sound travels fastest through solids. (1)

This is because molecules in a solid medium are much closer together than those in a liquid or gas, allowing sound waves to travel more quickly through it. (1)

iii. Define the terms: Refraction, Normal, Angle of refraction, Angle of incidence.

Answer:

<u>Refraction of ligh</u>t; Bending of light as it goes from one medium to another. OR Change in direction of light as it moves from one material (medium) to another. (1)

<u>Normal</u>: The line drawn at right angle to the refracting surface at the point of incidence. (1)

<u>Angle of incidence</u>: The angle between the incidence ray and the normal. (1)

<u>Angle of refraction</u>: The angle between the refracted ray and the normal. (1)

iv. How does electrostatic induction differ from charging by friction?

Answer:

Charging by friction	Charging by induction
i. Charging by friction/rubbing requires direct contact of objects to be charged. (1) ii. There is transfer of charge from one body to another. (1)	i. Charging by induction does not require direct contact of objects to be charged. (1) ii. There is only rearrangement of charges rather than transfer.(1)

v. State Ohm's Law and derive its mathematical form.

<u>**Ohm's Law**</u>:

<u>Statement</u>: "The current in a conductor is directly proportional to the voltage applied across the conductor as long as temperature and the physical state of the conductor is kept constant". (2)

<u>Mathematical Form:</u>

$$I \propto V$$
$$I = KV$$
$$K = 1/R$$
$$I = V/R$$
$$V = IR \qquad (2)$$

vi. Explain why it is possible for birds to perch safely on high tension wires without being electrocuted.

Answer: When a bird is perched on a single wire, its two feet are at the same electrical potential. (1) As both of the bird's feet are on the wire no electricity flows through it (1) Because current flow from high potential to low potential. (1) Electricity travels along the wire instead of through the bird, so the bird doesn't get shocked. (1)

vii. A 2m long wire carries a current of 6A, at right angle to a uniform magnetic field of 0.04T. Determine the force exerted on the wire.

Given Data:

$$L = 2m$$
$$I = 6A$$
$$B = 0.04T$$
$$\theta = 90° \qquad (1)$$

To Find:

$F = ?$

Formula:

$F = ILBsin\theta$ (1)

Solution:

$F = ILBsin90°$

$F = 6x2x0.04$ $sin90° = 1$ (1)

Answer:

$F = 0.48N$ (1)

viii. What is CRO? Write its three uses.

Answer: CRO stands for Cathode Ray Oscilloscope, which consists of electron gun, deflecting plates and florescent screen enclosed in an evacuated chamber. It works on the principle of deflection of electron beam in electric and magnetic field. (1)

Uses of C.R.O: It is used to:

i. Display different types of waveform. (1)
ii. Measure short time interval (1)
iii. Measure potential difference (1)

ix. Explain the transmission of radio waves through space.

Answer: A radio wave is generated by a transmitter and then detected by a receiver. (1) For transmission of a signal radio-frequency electrical energy from the transmitter is converted into electromagnetic energy by the antenna and radiated into the surrounding environment. (2) For reception of a signal, electromagnetic energy from antenna is converted into radio- frequency electric energy and fed into the receiver. (1)

x. Cobalt-60 is a radioactive element with half-life of 5.25 years. What fraction of the original sample will be left after 26 years?

Given data:

$Half\ life\ of\ Cobalt, T_{\frac{1}{2}} = 5.25\ years$

$Time, \Delta t = 26\ years$

To find:

$Fraction\ of\ sample\ left, N = ?$ (1)

Formula: (1)

$$N = N_o(\frac{1}{2})^n$$

Solution:

The number of half-lives 'n' = $\frac{\Delta t}{T_{\frac{1}{2}}}$

$n = \frac{26}{5.25}$

$n = 5$

$N = N_o(\frac{1}{2})^5$ (1)

$N = \frac{1}{32}N_o$

Answer: Thus $\frac{1}{32}$th of original sample of Cobalt will be left after 26 years i.e. after 5 half lives. (1)

xi. Define radioactivity. Write the effect of alpha, beta and gamma emission on parent nucleus?

Radioactivity: The spontaneous release of subatomic particles (electrons and protons) or gamma rays by unstable atoms as their nuclei tend to break apart into other particles to attain stability is called radioactivity. (1)

Alpha Emission: In alpha emission mass number of parent element decreases by 4 and atomic number decreased by 2. (1)

Beta Emission: In beta emission there is no change in mass number of parent element but atomic number increases by 1. (1)

Gamma Emission: In gamma emission there is no change in mass number and atomic number of parent nucleus. (1)

Section-C

3. a. **What is Simple Harmonic Motion? Show that simple pendulum executes Simple Harmonic Motion.**

Simple Harmonic Motion:

Simple harmonic motion (SHM) is a special kind of vibratory or oscillatory motion which occurs whenever the restoring force F_{res} is proportional to the displacement x from equilibrium position.

Mathematically:

$$F_{res} \propto -x \quad (1)$$

We can also define simple harmonic motion in terms of acceleration as the type of motion in which the acceleration a is directly proportional to the displacement x and is directed towards the mean position.

Mathematically:

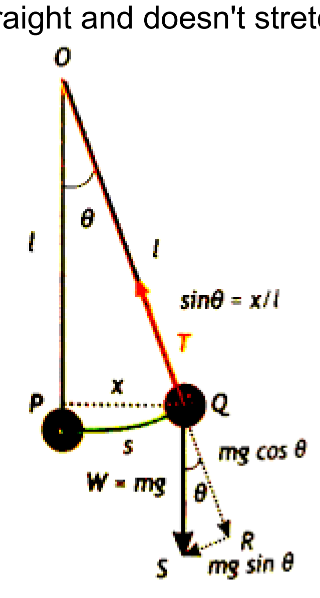
$$a \propto -x$$

Where the negative sign signifies that restoring force is directed towards equilibrium position opposite to the displacement.

SIMPLE PENDULUM

A simple pendulum is an idealized model consisting of a point mass suspended by a weightless, in-extendable string supported from a fixed friction less support. A simple pendulum is driven by the force of gravity due to the weight of suspended mass 'm' (W= mg). A real pendulum approximates a simple pendulum if

- the bob is small compared with the length l,
- mass of the string is much less than the bob's mass, and
- the cord or string remains straight and doesn't stretch. (1)



Pull the pendulum bob aside and let it go; the pendulum then swings back and forth. Neglecting air drag and friction at the pendulum's pivot, these oscillations are periodic. We shall show that, provided the angle is small, the motion of a simple pendulum is simple harmonic oscillator. From figure for ΔQRS we resolve the weight (W = mg) in to two components $'mg\ sin\theta'$ and $'mg\ cos\theta'$. The component $'mg\ cos\theta'$ is balanced by the Tension $'T'$ in the string. The restoring force is only provided by component $'mg\ sin\theta'$. Therefore

$$F_{res} = mg\ sin\theta ----------(1) \quad (1)$$

Also note in the figure that only for small angles the arc length 's' is nearly the same length as displacement 'x'.

Therefore, from ΔOPQ $\quad \sin\theta = \frac{x}{l}$------------(2)

Putting equation 2 in equation 1

$$F_{rest} = -mg\frac{x}{l} \text{-------(3)}$$

Since mass 'm', acceleration due to gravity 'g' and length 'l' are constants for simple pendulum oscillating with small angle, therefore

$$F_{res} \propto -x$$

(1)

which is the condition for simple harmonic motion. Thus motion of simple pendulum can be approximated as simple harmonic motion.

b. Find the time period of simple pendulum having length 1m placed at the surface of moon. (g= 1.63 m/s²)

Given Data:

$$l = 1m$$
$$g = 1.63\ m/s^2 \qquad 1$$

To Find:

$$T = ?$$

Formula:

$$T = 2\pi\sqrt{\frac{l}{g}} \qquad 1$$

Solution:

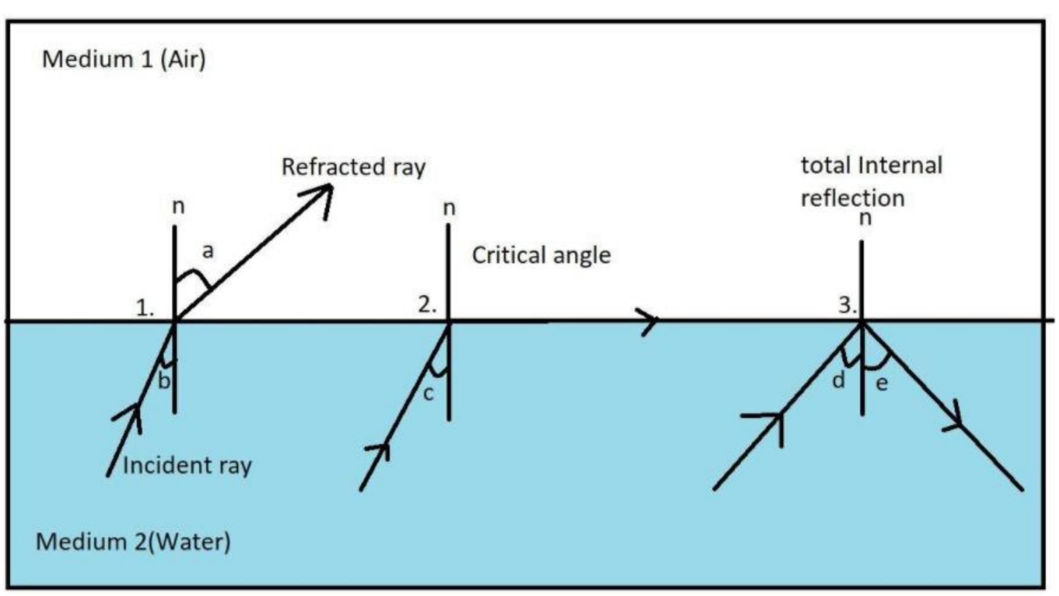
$$T = 2\pi\sqrt{\frac{l}{g}}$$

$$T = 2 \times 3.14\sqrt{\frac{1}{1.63}} \qquad 1$$

Answer: $T = 4.91\ sec$

4. a. **Using diagram, explain under what condition total internal reflection occur? Construct equation for critical angle:**

Total internal reflection:



(2)

Total internal reflection occurs when light traveling from a region of a higher index of refraction to a region of a lower index of refraction strikes the boundary at an angle greater than the critical angle such that all light reflects back into the region of the higher index of refraction. (1)

To construct an equation for the critical angle of any boundary, we can use Snell's Law and substitute $\theta_1 = \theta_c$, and $\theta_2 = 90°$.

$$n_1 \sin\theta_c = n_2 \sin 90°$$

Since $\sin 90° = 1$

therefore, $n_1 \sin\theta_c = n_2$

Hence $\sin\theta_c = \frac{n_2}{n_1}$ (1)

$$\theta_c = Sin^{-1}\frac{n_2}{n_1}$$

4. b. **Find the critical angle for light traveling from glass (n= 1.502) to air (n= 1.002)**

Given Data:

$$Index\ of\ refraction\ of\ glass\ n_1 = 1.502$$

$$Index\ of\ refraction\ of\ air\ n_2 = 1.002$$ 1

To Find:

$$Critical\ angle\ \theta_c = ?$$

Formula:

$$\theta_c = Sin^{-1}\frac{n_2}{n_1}$$ 1

Solution:

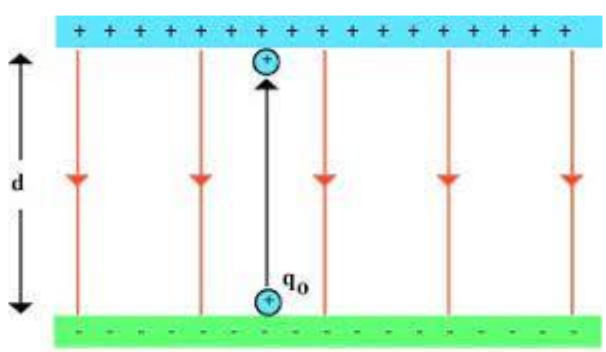
When light goes from glass to air

$$\theta_c = Sin^{-1}\frac{n_2}{n_1}$$

$$\theta_c = Sin^{-1}\left(\frac{1.002}{1.502}\right)$$

$$\theta_c = 42°$$ 1

5. a. Show that potential difference can be describe as energy transfer per unit charge between two points. Also define its unit.



Let us consider a positive charge +q is placed in an electric field at point B. If the charge is allowed to move freely, it will acquire kinetic energy and will move from B to A. Conversely, we can say that an external force is required to keep the charge at rest or to move with uniform velocity from A to B. (1)

Thus $V_B - V_A = \frac{W_{AB}}{q}$--------(1)

Often point A is taken to be at infinity, meaning a large distance from the charges that produce the electric field, the electric potential at A is taken to be zero. Note that the choice of zero potential at infinity is taken arbitrarily and for simplicity, such that

$V = \frac{W}{q} = \frac{U}{q}$------------(2) (1)

Thus we can say that the electric potential energy 'U' per unit charge 'q' in an electric field is called electric potential 'V'. (1)

Unit:

The SI unit of electric potential is joule per coulomb (J/C) or volt (V). The potential at a point is one volt, when it requires one joule of work to move a positive charge of one coulomb from a point of zero potential to that point.

$1\text{ volt} = \frac{1\ joule}{1\ coulomb}$ (1)

5.b. The potential difference between two points is 220V. when an unknown charge is moved between these two points, the work done is 750J. What is the magnitude of charge?

Given Data:

$V = 220V$

$W = 750J$ 1

To Find:

$q = ?$

Formula:

$$V = \frac{W}{q}$$

$\Rightarrow q = \frac{W}{V}$ 1

Solution:

$$q = \frac{750}{220}$$

$q = 3.4c$ 1

6. a. What is meant by electromagnetic induction? Which factors effect the magnitude of induced emf?

<u>ELECTROMAGNETIC INDUCTION:</u> (1)

When magnetic field through a wire is changed, current is found to flow in the loop, the phenomena is called Electromagnetic Induction. A changing magnetic field induces an emf.

<u>Factors affecting magnitude of induced em</u>f: (any 3 factors) (3)

- When a double loop of wire is used, the deflection on the galvanometer is twice as large as before. A triple loop induces three times the e.m.f. and so on. This shows that "the e.m.f. is proportional to the number of turns in a coil."
- The faster the wire is moved, the larger the deflection on the galvanometer. This indicates that the speed at which the conductor moves through the magnetic field also determines the magnitude of induced e.m.f.
- The longer the length of the conductor in the magnetic field, the greater is the induced e.m.f.
- The larger the magnetic field, the greater the e.m.f induced.

6. b. A 20cm wire at an angle of 30° to uniform magnetic field of 0.08T is exerted by a force of 0.024N. What is the magnitude of current flowing through the wire?

Given Data:

$L = 20cm = 0.2m$

$\theta = 30°$

$B = 0.08T$

$F = 0.024N$ 1

To Find:

$I = ?$

Formula:

$F = ILBsin\theta$

$\Rightarrow I = \frac{F}{LBsin\theta}$ 1

Solution:

$I = \frac{0.024}{0.2\times0.08\times sin30°}$ $sin30 = 0.5$

$I = \frac{0.024}{0.2\times0.08\times0.5}$

$I = \frac{0.024}{0.008}$

$I = 3A$ 1