INDIAN SCHOOL MUSCAT
SECOND PRELIMINARY EXAM
SUBJECT : PHYSICS

CLASS: XII | Answer key : SET B | Time Allotted: 3 Hrs.

06.01.2019 | Max.Marks: 70

Section A

1. Workdone is zero (since same pd) 1

(OR)

As these charges will be conducted away to the ground through the moist air, the experiments will not work.

2. Current sensitivity is defined as 'The deflection produced for a unit current flowing through an instrument (galvanometer)' .S.I unit: rad/A (1/2 +1/2) 1

3. 1

Given, $\frac{B_V}{B_H} = \sqrt{3}$

where,

B_v is the vertical component of earth's magnetic field.

B_H is the horizontal component of earth's magnetic field.

And we have,

$$\boxed{\tan\delta = \frac{B_V}{B_H}}$$

$$= \frac{\sqrt{3}\, B_H}{B_H} = \sqrt{3}$$

$\tan\delta = \sqrt{3}$

$\delta = 60^\circ \rightarrow$ (angle of dip)

4. Remain same 1

5. To reduce distortions in the signal 1

(OR)

As the wave front of ground wave travels along the Earth's surface it gets attenuated (1/2). The degree of attenuation is mainly dependent on the frequency of the wave and is directly proportional to it (1/2). So, ground wave propagation is not suitable for high frequency as the losses are high.

Section B

6. (i) to minimize the resistance 2

(ii) Alloys, such as manganin or constantan are used for making meter bridge wire due to their low temperature coefficient of resistance and high resistivity.

7. Emf induced in a rod of length 'ℓ' with angular speed in a uniform magnetic field is given by, 2

$\epsilon = \frac{1}{2}B\ell^2\omega$ (1/2)

For earth's magnetic field,

Horizontal component is given by,

$B_H = |B_I|\cos\delta$

Vertical component is given by,

$B_V = |B_I|\sin\delta$

Therefore, emf induced is given by,

$\epsilon = \frac{1}{2}|B_I|\cos\delta\, l^2\omega$ (1/2)

$= \frac{1}{2} \times 0.4 \times 10^{-4} \cos 60^\circ \times (0.5)^2 \times 2\pi\nu$

$= \frac{1}{2} \times 0.4 \times 10^{-4} \times \frac{1}{2} \times (0.5)^2 \times 2\pi\nu \times \left(\frac{120\ \text{rev}}{60\ \text{sec}}\right)$

$= 10^{-5} \times 0.25 \times 2 \times 3.14 \times 2$

$= 3.14 \times 10^{-5}$ volt (1)

8. (a) inductive reactance increases as soft iron is ferromagnetic and impedance increases and the current decreases so the bulb glows with less brightness. (1) 2
(b) inductive reactance decreases as bismuth is diamagnetic , impedance decreases and the current increases so the bulb glows brighter. (1)

9. a) Heavy water is used because they are more likely to react with the fissile uranium-235 than with uranium-238, which captures neutrons without fissioning (1) 2
(b) cadmium that are capable of absorbing many neutrons without themselves fissioning. (1)

10. If energy of photon = E (= hv), work function of metallic surface = ϕ = (hv_0) 2
kinetic energy of emitted electron = $1/2mv^2$

$E = \phi + 1/2mv^2$

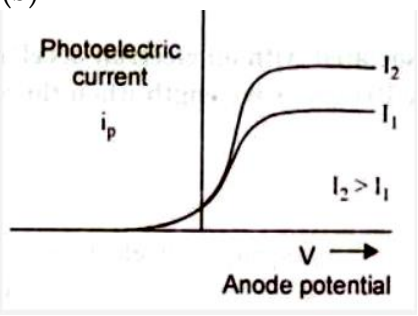
$1/2mv^2 = h(v - v_0)$(1)

Any one charactristics of photons (1)

(OR)

(a)Definition of the term threshold frequency (1)

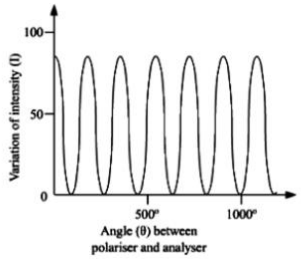
(b)



(1)

11. (a) Statement of Law of Malus. (1) 2

(b)



(OR)

(a) Definition of 'linearly polarised light.' (1)

(b) when angle between analyser and polariser is 0 or parallel

12. 1. The hight of the transmitting antenna required will be very large. (1) 2

2. The power, with which the signal can be transmitted, will be very small.

(1)

(OR)

function of repeater (1) and demodulator (1) in a communication system.

Section C

13. Statement of Huygen's principle (1) 3

Verifing the laws of refraction when light travels from denser to rarer medium. (diagram 1 explanation 1)

14. 3

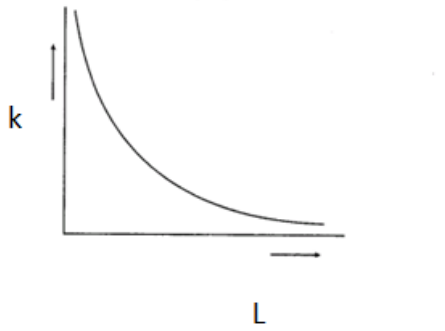
(1) We use a long wire to have a lower value of potential gradient.(1)

(2) otherwiese no balance point would be obtained

(c)

Potential gradient, $K = \frac{V}{L}$

∴ The required graph is as shown below



(1)

(OR)

circuit diagram of a potentiometer to compare emf (1),

the method to compare the emfs of the cells (1) and derivation of the necessary formula (1)

15. labelled ray diagram of a reflecting telescope (1). Any two advantages over the refracting telescope (2). 3

16. (a) Derivation of expression for the magnetic field on the axis of a circular current loop. Introduction (½) diagram with proper direction (1) derivation (1 ½) 3

(b) Drawing correct magnetic field lines due to a circular loop carrying current (1)

(OR)

Derivation of expression for v=E/B (2)
Trajectory (1/2) justification (1/2)

17. (a) How are electromagnetic waves produced? What is the source of the energy carried by the propagating electromagnetic wave. 3

(a)

Electromagnetic waves are produced by accelerating charged particle. When the charge moves with acceleration, both the magnetic and electric fields change continuously. This change produces electromagnetic waves. **(1)**

Accelerated charge is the source of energy of these waves. **(1)**

(c) (i) in remote switches of house hold electronic device: IR(ii) as a diagnostic tool in medicine X rays (1/2+1/2)

18. Magnetic field at O due to loop 1. 3

$$B_1 = \frac{\mu_0 i R^2}{2(x^2+R^2)^{3/2}}$$, acting towards left. 1/2

Magnetic field at O due to loop 2.

$$B_2 = \frac{\mu_0 i R^2}{2(x^2+R^2)^{3/2}}$$,acting vertically upwards . 1/2

where, R is the radius of each loop.

Therefore,
Resultant magnetic field at O will be

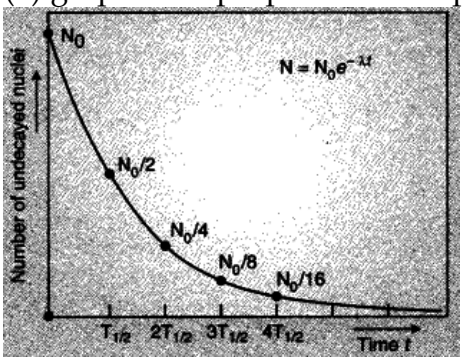
$$B = \sqrt{B_1^2+B_2^2} \quad (\because B_1 = B_2)$$
$$= \sqrt{2B_1}$$
$$= \frac{\mu_0}{\sqrt{2}} \frac{i R^2}{(x^2+R^2)^{3/2}}$$ **(2)**

This resultant field acts at an angle of 45° with the axis of loop 1.

19. Derivation of the electric field due to uniformly charged spherical shell (2) 3
graph showing the variation of electric field with correct axes and for r > R and r < R. (1)

20. Circuit of *npn* transistor in CE configuration (1). 3
Explation (1)
Plotting of the output characteristic (1)

21. (a) Statement of the law of radioactive decay (1) 3
(b) graph with proper axes and points (2)



(OR)

(a) Derivation of the expression $N = N_0 e^{\lambda t}$ (1).

(b)

The β^+ decay for is given below:

$^{22}_{11}Na \rightarrow {}^{22}_{10}Ne + \beta^+ + \nu$

A proton is converted into neutron if, the unstable nucleus has excess protons than required for stability.

In the process, a positron e^+ (or a β^+) and a neutrino v are created and emitted from the nucleus.

$p \rightarrow n + \beta^+ + \nu$

This process is called beta plus decay. (2)

22. circuit diagram of Zener diode as a DC voltage regulator (1). 3
its I-V characteristics with correct axes (2)

(OR)

circuit diagram of a full wave rectifier (1).
Explanation of its working (1).
the input and output waveforms (1).

23. (a)The de-Broglie wavelength associated with same potential V is, 3

$$\boxed{\lambda = \frac{h}{p}} \quad \text{or} \quad \lambda = \frac{h}{mv}$$

$$\therefore \quad \lambda \propto \frac{1}{\sqrt{m}}$$

Wavelength and mass has inverse dependence a seen from the above relation.

As proton's mass is less than the mass of alpha particle thus,

$\lambda_{proton} > \lambda_{alpha}$.

Proton has greater value of de-broglie wavelength assosciated with it. 1 1/2

(b)

Now,

Energy of a photon is, E = hv

i.e., $K.E. = \frac{hc}{\lambda}$

$\Rightarrow \quad K.E. \propto \frac{1}{\lambda}$

Since, $\lambda_{proton} > \lambda_{alpha.}$ [from (i)]

Thus, kinetic energy of proton will be lesser than that of alpha particle. 1 1/2

24. (a) Ground wave propagation (1 m) 3
(b) High attenuation (1 m)
(c) Transmission of TV signal is not possible through sky wave propagation as ionosphere cannot reflect these signal to the earth(1 m)

Section C

25. (a) Statement of Gauss theorem (1). 5
Applying Gauss theorem to find the electric field strength near an infinite plane sheet of charges (2).
(b) ratio of the electric flux through S_1 and S_2= 1:2 (1) ii) becomes $1/5^{th}$ (1)

(OR)

(a) Derivation of expression for the force and torque (1+1)
To show that the system is under translational equilibrium (1)
(b) Total charge of the system = 0 (1)

Electric dipole moment of the system is given by,
p = q(2l) = 2.5 × 10−7 × 0.3 = 7.5 × 10−8 C m along positive z-axis (1)

26. (a) Statement of Faraday's law of electromagnetic induction (1) 5

(b)

$$\varepsilon = -\frac{d\phi}{dt}$$

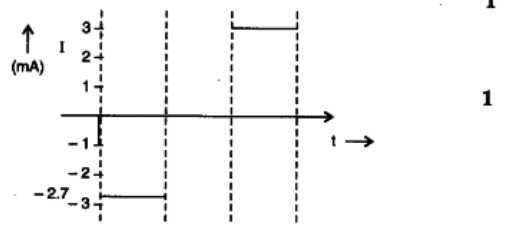
$\varepsilon = -0.023$ V,

$I = \varepsilon / R$

$= -2.7$ mA for $0<t<2$s. 1

	$0<t<2s$	$2<t<4s$	$4<t<6s$
ε (V)	–0.023	0	+0.023
I(A)	–2.7	0	+2.7

1



1

(c) To show that Lenz's law is a consequence of conservation of energy (1).

(OR)

(a) Diagram of step up transformer with label (1)
Working principle (1)
Relation between input and output voltages (1)

Hysterisis lossLoss of energy in magnetising and demagnetising the core of transformer in every cycle. It can be minimised by taking core of soft iron having low coercivity, retentivity and hysterisis loop. (1 m)

Eddy current Energy loss in the form of heat due to eddy current. It can be minimised by taking laminated core consisting of insulated rectangular sheets, piled-up one over another.(1 m)

27. (a) essential conditions for diffraction of light (1) 5

(b) Derivation of relation for width of central maximum in terms of wavelength 'λ', width of slit 'a', and separation between slit and screen 'D' (2)

(c) If the width of the slit is made double the original width, how does it affect the size and intensity of the central band?

if a is doubled, size of the central maximum is halved (1)
intensity four times. (1)

(OR)

(a) labelled schematic ray diagram of astronomical telescope in normal adjustment. (1)

b) Given, three lenses of power 0.5 D, 0.4 D and 10 D.

The formula for magnification, $M = \frac{f_o}{f_e} = \frac{P_e}{P_o}$

Therefore, an objective with power = 0.5 D and eyepiece of power 10 D should be used.

This choice would give a higher magnification.

(c)

The aperture is preferred to be large so that the telescope can collect maximum amount of light coming from the distant object.

END OF QUESTION PAPER