No. of printed pages: 4

INDIAN SCHOOL SOHAR
PREBOARD EXAM- 2018
PHYSICS – THEORY

CLASS: XII **MARKS: 70**
DATE: 7 /1/2018 **TIME: 3hrs**

General Instructions:

1. All questions are compulsory.

2. There are 26 questions in all .Questions 1 to 5 carry one mark each; questions 6 to 10 carry two marks each, and questions 11 to 22 carry three marks each. Question 23 is a value based question carrying four marks and questions 24 to 26 carry five marks each.

3. There is no overall choice. However, internal choice has been provided in one question of two marks, one question of three marks and all three questions of five marks each. You have to attempt only one of the given choices in such questions.

4. Use of calculator is not permitted.

5. You may use the following physical constants wherever necessary

$C = 3X\ 10^{8}\ m/s$ $h = 6.626\ X10^{-34}\ Js$ $e = 1.6X\ 10^{-19}\ c$

$\frac{1}{4\pi\varepsilon_o} = 9\ X\ 10^{9}\ Nm^2/c^2$. $\mu o = 4\pi\ X\ 10^{-7}\ T\ m\ A^{-1}$. $N_A = 6.023\ X10^{23}/mol$

$Mass\ of\ proton = 1.676\ X\ 10^{-27}\ kg.$ $Mass\ of\ neutron = 1.675\ X\ 10^{-27}\ kg.$

SECTION-A

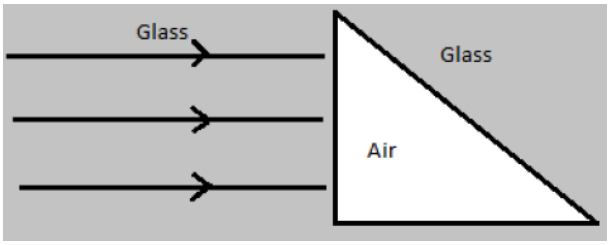
1. Write the expression for speed of electromagnetic waves in a medium of electrical permittivity ε and magnetic permeability μ.

2. A photosensitive surface emits photoelectrons when red light falls on it. Will the surface emit photoelectrons when blue light is incident on it? Give reason.

3. Plot a graph showing the variation of current 'I' versus resistance 'R', connected to a cell of emf E and internal resistance r.

4. In the wave picture of light, intensity is determined by square of the amplitude of the wave. What determines the intensity of light in the photon picture of the light?

5. Sketch the emergent wavefront.



SECTION-B

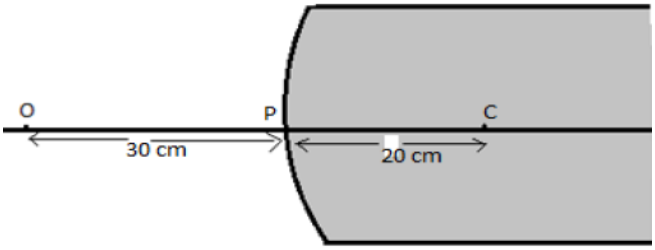
6. Describe, with the help of a circuit diagram, the working of a photodiode.

7. Give reason, why high frequency carrier waves are needed for effective transmission of information signals.

OR

What is the range of frequencies used for T.V. transmission? State two factors by which the range of signals can be increased.

8. A spherical convex surface of radius of curvature 20 cm, made of glass (n=1.5) is placed in air. Find the position of the image formed, if a point object is placed at 30 cm in front of the convex surface on the principal axis.



9. The magnetic field in a plane electromagnetic wave is given by:

$B_y = 12 \times 10^{-8} \sin (1.20 \times 10^{7} z + 3.60 \times 10^{15})$. Calculate the

(i) Energy density associated with the electromagnetic wave

(ii) Speed of the wave.

10. An alternating voltage $E = E_0 \sin\omega t$ is applied to a circuit containing a resistor R connected in series with a black box. The current in the circuit is found to be $I = I_0 \sin(\omega t + \pi/4)$.

(i) State whether the element in the black box is a capacitor or inductor.

(ii) Draw the corresponding phasor diagram and find the impedance in terms of R.

SECTION-C

11. A proton and an α-particle move perpendicular to a magnetic field. Find the ratio of radii of circular paths described by them when both have (i) equal velocities, and (ii) equal kinetic energy.

12. Draw the intensity distribution for (i) the fringes produced in interference (ii) the diffraction bands produced due to single slit. Write two points of difference between the phenomena of interference and diffraction.

13. The following table gives the length of three copper wires, their diameters, and the applied potential difference across their ends. Arrange the wires in increasing order according to the following:

(a) The magnitude of the electric field within them,

(b) The drift speed of electrons through them, and

(c) The current density within them.

Wire no.	Length	Diameter	Potential Difference
1	L	3d	V
2	2L	d	V
3	3L	2d	2V

14.

a) How are electromagnetic waves produced? Explain.

b) A plane electromagnetic wave is travelling through a medium along the positive z-direction.

c) Depict the electromagnetic wave showing the directions of the oscillating electric and magnetic fields.

15.

a) Derive the relation between the decay constant and half-life of a radioactive substance.

b) A radioactive element reduces to 25% of its initial mass in 1000 years. Find its half-life.

16. A charge Q is distributed uniformly over a metallic sphere of radius R. Obtain the expression for the electric (E) and electric potential (V) at a point 0<x<R.
Show on a plot the variation of E and V with x for 0<x<2R.

17. Using Bohr's Postulates, derive the expression for the orbital period of the electron moving in the n^{th} orbit of hydrogen atom.

18.

a) Draw a plot showing the variation of photoelectric current with collector potential for different frequencies but same intensity of incident radiation.
b) Use Einstein's photoelectric equation to explain the observations from this graph.
c) What change will you observed if intensity of radiation is changed but frequency remains the same.

19. Using Biot-Savart law, deduce the expression of magnetic field at a point (x) on the axis of a circular current carrying loop of radius R. How the direction of magnetic field determined at this point?

20. What is the space wave propagation? Which system of communication use space wave? What is "Radio horizon" of transmitting antenna of height h? Why is the space wave propagation suitable for frequencies above 40 MHz?

21. A source ac voltage $v=v_0 \sin \omega t$, is connected across the pure indicator of inductance L. Derive the expression for the instantaneous current in the circuit. Show that the average power dissipated in the circuit is zero.

22. A point object is placed on the principle axis of a convex spherical surface of radius of curvature R, which separates the two media of refractive indices n_1 and n_2 ($n_2 > n_1$). Draw the ray diagram and deduce the relation between object distance (u) image distance (v) and the radius of curvature (R) for refraction to take place at the convex spherical surface from rarer to denser medium.

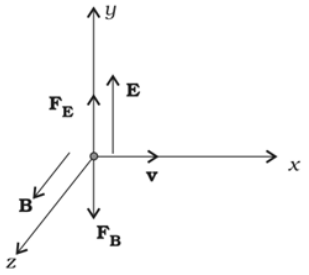
SECTION D

23. Muthuswami a resident of Kundakulam was all set to leave everything and shift to another place in view of the decision of Government to start nuclear thermal power plant at Kundakulam. His granddaughter Prachi, a science student was really upset on the ignorant decision of her grandfather. She could finally convince him not to shift, since adequate safety measures to avoid any nuclear mishap have already been taken by the Government before starting nuclear thermal power plants.

(i) What is the value displayed by Prachi in convincing her grandfather?
(ii) What is the principle behind working of nuclear reactor?
(iii) What are the main components of nuclear reactor?
(iv) Why is heavy water used as moderator? (4)

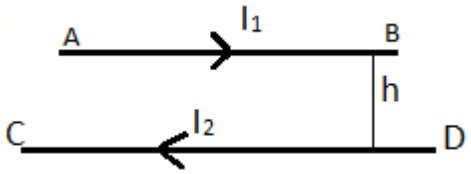
SECTION E

24. (a) A particle of charge q is moving with velocity v in the presence of crossed Electric field E and Magnetic field B as shown. Write the condition under which the particle will continue moving along x- axis. How would the trajectory of the particle be affected if the electric field is switched off?



(b) A horizontal wire AB of length 'l' and mass 'm' carries a steady current I_1, free to move in vertical plane is in equilibrium at a height of 'h' over another parallel long wire CD carrying a steady current I_2, which is fixed in a horizontal plane as shown. Derive the expression for the

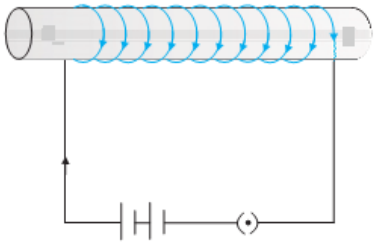
force acting per unit length on the wire AB and write the condition for which wire AB is in equilibrium.



OR

(a) An electron in the ground state of Hydrogen atom is revolving in a circular orbit of radius R. Obtain the expression for the orbital magnetic moment of the electron in terms of fundamental constants.

(b) Draw the magnetic field lines for a current carrying solenoid when a rod made of (i) copper, (ii) aluminium and (iii) iron are inserted within the solenoid as shown.



25. (a) Draw a ray diagram of compound microscope for the final image formed at least distance of distinct vision?

(b) An angular magnification of 30X is desired using an objective of focal length 1.25 cm and an eye piece of focal length 5 cm. How will you set up the compound microscope for the final image formed at least distance of distinct vision?

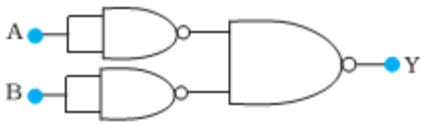
OR

(a) Draw a ray diagram of an astronomical telescope for the final image formed at least distance of distinct vision?

(b) An astronomical telescope has an angular magnification of magnitude 5 for distant objects. The separation between the objective and an eye piece is 36 cm and the final image is formed at infinity. Calculate the focal length of the objective and the focal length of the eye piece?

26. (a)With proper diagram, explain the movement of charge carriers through different parts of the transistor and hence show that $\mathbf{I_E = I_B + I_C}$.

(b) Identify the logic operation carried out by the circuit shown below and write its truth table.



OR

Draw a circuit diagram to study the input and output characteristics of an n-p-n transistor in its common emitter configuration.

Draw the typical input and output characteristics and explain how these graphs are used to calculate current amplification factor of the transistor.