

# CHANANA INSTITUTE OF PHYSICS

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SAMPLE PRE BOARD

TIME: 3HRS

M.M. =70

## General Instructions:

- All questions are compulsory.
- There is no overall choice. However, an internal choice has been provided in all questions of five marks. You have to attempt only one of the choices in such questions.
- Question numbers 1 to 5 are very short answer type questions, carrying one mark each.
- Questions numbers 6 to 10 are short answer type questions carrying two marks each.
- Question numbers 11 to 22 are also short answer type questions, carrying 3 marks each.
- Question number 23 is value based type question, carrying four marks.
- Question numbers 24 to 26 are long answer type questions, carrying five marks each.
- Use of calculators is not permitted. However, you may use log tables, if necessary.

You may use the following physical constants wherever necessary.

$$c = 3 \times 10^8 \text{ ms}^{-1}$$

$$h = 6.6 \times 10^{-34} \text{ Js}$$

$$e = 1.6 \times 10^{-19} \text{ C}$$

$$\mu_0 = 4\pi \times 10^{-7} \text{ TmA}^{-1}$$

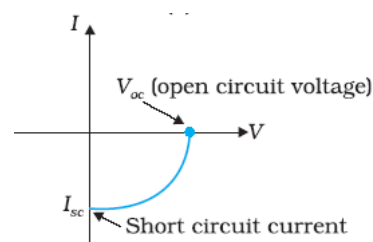
$$1/4\pi\epsilon_0 = 9 \times 10^9 \text{ N m}^2\text{C}^{-2}$$

$$\text{Avogadro number } N_A = 6.023 \times 10^{23} \text{ mol}^{-1}$$

$$\text{Mass of the neutron} = 1.675 \times 10^{-27} \text{ kg}$$

$$\text{Boltzmann constant, } k = 1.38 \times 10^{-23} \text{ J K}^{-1}$$

1. Draw equipotential surfaces for an electric dipole.
2. If a wire is stretched to double its original length, and same current is passed, how is the drift velocity affected?
3. An electron beam moving vertically upward experience a magnetic force towards south. What is the direction of magnetic field?
4. Draw a graph to show the variation of impedance of a series RLC circuit with frequency of a.c. signal.
5. Why are sky waves not used for TV transmission?
6. The polarizing angle of a medium is  $60^\circ$ . What is the refractive index of the medium? What happens to polarizing angle if red colour is replaced by blue light?
7. Name the device which shows the variation of current (I) with voltage (V) as shown. What are criteria to select materials for this device?
8. The total height of transmitting and receiving antenna is H. Prove that the range is maximum if both antennas have same height.

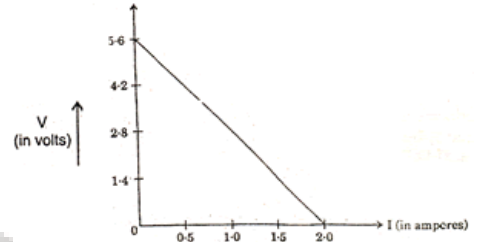


9. 1000 spherical droplets each of radius  $r$  have been charged to have a potential  $V$  each. If all these droplets were to coalesce to form a single large drop, what would be the potential of this large drop?

Or

Two concentric spheres of radii  $a$  and  $b$  ( $a < b$ ) carry charges  $q$  and  $Q$ . Find the potential at a point distant  $R$  such that (i)  $R < a$ , (ii)  $a < R < b$  and (iii)  $R > b$

10. 4 cells of identical emf  $E$ , internal resistance  $r$ , are connected in series to a variable resistor. The following graph shows the variation of terminal voltage of the combination with the current output:



(i) What is the emf of each cell used?

(ii) For what current from the cells, does maximum power dissipation occur in the circuit?

11. When four hydrogen nuclei combine to form a helium nucleus, estimate the amount of energy in MeV released in this process of fusion. (Neglect the masses of electrons and neutrinos) Given: Mass of  ${}^1_1\text{H}^1 = 1.007825\text{u}$ , Mass of helium nucleus =  $4.002603\text{u}$   $1\text{u} = 931\text{MeV}/c^2$ .

12. An electron is moving at  $10^6\text{m/s}$  in a direction parallel to a current of  $5\text{A}$ , flowing through an infinitely long straight wire, separated by a perpendicular distance of  $10\text{cm}$  in air. Calculate the magnitude of the force experienced by the electron. What is the direction of this force?

13. Draw a block diagram of a detector for an amplitude modulated signal and explain briefly the function of each of its components.

14. Draw a logic circuit diagram showing how only NOR gates can be converted into an AND gate.

15. An a.c. source is connected across a pure capacitor. Find the phase difference between current and voltage.

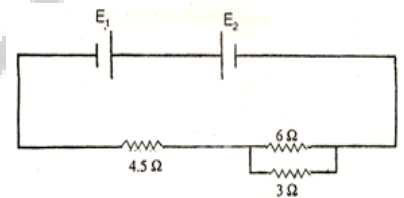
16. An optical fibre has core of refractive index  $2$  and cladding of refractive index  $1.732$ . At what angle should light enter the fibre so that it suffers TIR at the core cladding interface.

17. (i) Write an expression for de Broglie wavelength of a free neutron of mass  $m$  at absolute temperature  $T$ .

(ii) What was the purpose of Davisson and Germer experiment?

(iii) Draw a graph to show the variation of stopping potential with frequency of incident radiations.

18. Two cells  $E_1$  and  $E_2$  in the given circuit diagram have an emf of  $5\text{V}$  and  $9\text{V}$  and internal resistance of  $0.3\Omega$  and  $1.2\Omega$  respectively. Find the current in  $3\Omega$  resistance and terminal p.d. across  $5\text{V}$  cell.



19. Draw a labeled diagram to show the formation of image at least distance of distinct vision by a compound microscope.

Write any two advantages of a reflecting telescope over a refracting telescope.

20. Which constituent radiation of the electromagnetic spectrum is used:

(i) in radar

(ii) to photograph internal parts of human body

(iii) for taking photographs of the sky during the night and foggy conditions

An em wave is represented by  $B = 8 \times 10^{-6} \sin (2 \times 10^{11} t - 300\pi z)\text{T}$ .

What is direction and wavelength of wave?

21. Write an expression for magnetic moment of a circular coil of  $N$  turns and radius  $R$  carrying current  $I$ . A circular coil of  $N$  turns and radius  $R$  carries a current  $I$ . It is unwound and rewound to make another coil of radius  $3R$ . Find the current required in this coil so that magnetic moments are same in both cases.

22. (a) Draw the final wavefront when a plane wavefront

(i) is incident on a concave mirror

(ii) enters from rarer to denser medium

(b) What is the basic requirement for interference of waves?

23. You switched on the radio set to listen to your favourite music but found that reception was not clear. You adjusted the tuner in the set till you hear the music clear.

(i) What are the components of tuning circuit in a radio?

(ii) Name the phenomenon involved here.

(iii) What value can be associated with this?

24. (a) Explain common emitter transistor as an oscillator.

(b) Two amplifiers are connected one after the other in series (cascaded). The first amplifier has a voltage gain of 10 and the second has a voltage gain of 20. If the input signal is 0.01 volt, calculate the output ac signal.

OR

(a) Describe briefly, with the help of a diagram, the role of the two important processes involved in the formation of p-n junction.

(b) Name the device which is used as voltage regulator. Draw the necessary circuit diagram and explain its working.

25. (a) Use Ampere's circuital law to find an expression for magnetic field inside a long solenoid.

(b) A proton, a deuteron and an alpha particle having same K.E. enter perpendicular to a uniform magnetic field. Find the ratio of radii of the circular paths.

OR

(a) Explain, giving reasons, the basic difference in converting a galvanometer into

(i) a voltmeter and (ii) ammeter.

(b) An aeroplane with a wing span of 10m is flying horizontally with a speed of 200m/s from east to west at a place where earth's field is 0.3gauss and angle of dip  $60^\circ$ . Find the induced emf.

26. Briefly describe Young's double slit experiment and find expression for fringe width. What happens to angular fringe width if (i) the distance of screen is doubled and (ii) the apparatus is taken out from water of refractive index  $4/3$  to air?

OR

(i) Derive mirror equation for a concave mirror.

(ii) What is the minimum distance between image and its real image formed by a convex lens of focal length 20cm?

(iii) What is the effect on nature of convex lens ( $\mu = 3/2$ ) and its focal length if it is dipped in a liquid of refractive index  $4/3$ ?