CLASS XII
SAMPLE PAPER
PHYSICS

Time: Three Hours **Full Marks: 70**

General Instructions:

- All questions are compulsory.
- There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and all questions of five marks. You have to attempt only one the choice in such questions.
- Question numbers 1 to 5 are very short answer type questions, carrying 1 mark each.
- Questions numbers 6 to 10 are short answer type questions carrying 2 marks each.
- Question numbers 11 to 22 are also short answer type questions, carrying 3 marks each.
- Question numbers 23 is a value based type question, carries 4 marks.
- Question numbers 24 to 26 are long answer type questions, carrying 5 marks each.
- Use of calculators is not permitted. However, you may use log tables, if necessary.
- You may use the following values of physical constants wherever necessary:

  $C = 3 \times 10^{8}\ ms^{-1}$,

  $h = 6.626 \times 10^{-34}$ Js ,

  $e = 1.602 \times 10^{-19}$ C

  $\mu_0 = 4\pi \times 10^{-7}$ T m A^{-1} ,

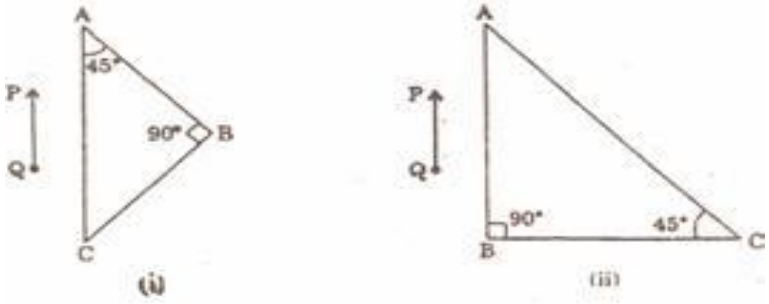
  $1/4\pi\varepsilon_0 = 9 \times 10^{9}\ Nm^2\ C^{-2}$

  $M_e = 9.1 \times 10^{31}$ kg

1. What do you mean by resistivity of a material? Write SI unit of resistivity.
2. In a plane e.m. wave, the electric field oscillates sinusoidally with amplitude 48 Vm^{-1}. What is the amplitude of the oscillating magnetic field?
3. The refractive index of glass is 1.5 for light whose □□= 6000Å in vacuum. Calculate the wavelength of the light when it passes through glass.
4. What is depletion region in p-n junction?
5. Two metals A and B have work functions 2 eV and 4 eV respectively. Which metal has a lower threshold wavelength for photoelectric effect?
6. State the condition under which the phenomenon of resonance occurs in a series LCR circuit. Plot a graph showing variation of current with frequency of a.c. source in a series

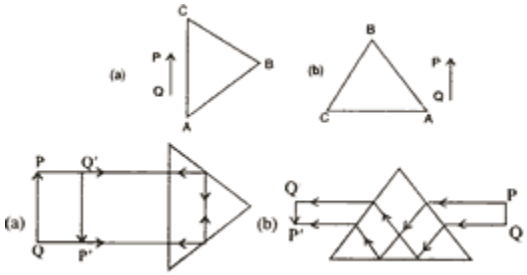
LCR circuit.

7. Distinguish between the terms 'average value' and 'rms value' of an alternating current. The instantaneous current from an a.c. source is I = 5 sin (314 t) ampere. What are the average and rms values of the current ?
8. Name the constituent radiation of electromagnetic spectrum which
   (a) is used in satellite communication.
   (b) is used for studying crystal structure.
   (c) is similar to the radiations emitted during decay of radioactive nuclei.
   (d) has its wavelength range between 390 nm and 770 nm.
   (e) is absorbed from sunlight by ozone layer.
   (f) produces intense heating effect.
9. A right-angled crown glass prism with critical angle 41 0 is placed before an object PQ, in two positions as shown in the figures (i) and (ii). Trace the paths of the rays from P and Q the prisms in the two cases.



Or

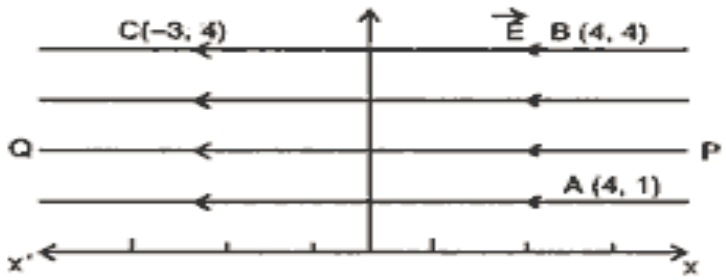
An object is placed in front of a right angled prism ABC in two positions (a) and (b) as shown. The prism is made of crown glass with critical angle of 41^0. Trace the path of two rays from P and Q, (i) in (a), normal to the hypotenuse and (ii) in (b), parallel to the hypotenuse



10. With the help of a bb diagram, explain the principle of an optical communication system.

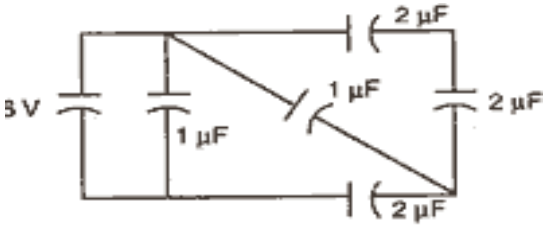
11. What is an equipotential surface?

A uniform electric field of $\vec{E}$ 300 NC^{-1} is directed along PQ. A, B and C are three points in the field having x and y coordinates (in metres) as shown in the figure. Calculate potential difference between the points (i) A and B and (ii) B and C



Or

Find the total energy stored in the capacitors in the given network.



12. Two cells of emf 1.5 V and 2 V and internal resistance 1 ohm and 2 ohm respectively are connected in parallel to pass a current in the same direction through an external resistance of 5 ohm.
(i) Draw the circuit diagram.
(ii) Using Kirchhoff's laws, calculate the current through each branch of the circuit and potential difference across the 5 ohm resistor.
13. What is meant by 'drift velocity of free electrons'? Derive Ohm's law on the basis of the theory of electron drift.
14. Two straight, parallel, current carrying conductors are kept at a distance 'r' from each other, in air. The direction of current in both the conductors is the same. Find the magnitude and direction of the force between them. Hence define one ampere.
15. Derive the relation between distance of object, distance of image and radius of curvature of a convex spherical surface, when refraction takes place from a rarer medium of

refractive index μ_1 it to a denser medium of refractive index μ_2 and the image produced is real.

16. A small bulb is placed at the bottom of a tank containing water to a depth of 80cm. What is the area of the surface of water through which light from the bulb can emerge out? Refractive index of water is 1.33. (Consider the bulb to be a point source.)
17. Define the term 'work function' of a metal. The threshold frequency of a metal is f_0. When the light of frequency $2f_0$ is incident on the metal plate, the maximum velocity of electrons emitted is v_1. When the frequency of the incident radiation is increased to $5f_0$, the maximum velocity of electrons emitted is v_2. Find the ratio of v_1 to v_2.
18. Draw a graph showing the variation of binding energy per nucleon with mass number for different nuclei. Explain, with the help of this graph, the release of energy by the process of nuclear fusion.
19. The half-life of $_{92}U^{238}$ undergoing α-decay is 4.5×10^9 years. What is the activity of 1g sample of $_{92}U^{238}$?
20. On the basis of the energy band diagrams distinguish between metals, insulators and semiconductors.
21. Explain, with the help of a schematic diagram, the principle and working of a Light Emitting Diode. What criterion is kept in mind while choosing the semiconductor material for such a device ? Write any two advantages of Light Emitting Diode over conventional incandescent lamps.
22. What is a digital signal ? Explain the function of modem in data communication. Write two advantages of digital communication.
23. Rajiv lived in a metropolitan city. Some of his villagers came to visit. Rajiv decided to visit them by metro train. When they came to metro station, the secuirity guard asked them to pass through a metal detector. They were scared of it. They decided not to travel by metro train. Rajiv explained them the purpose and working of metal detector. Then they ready for travelling.
    (i) Draw the necessary circuit diagram.
    (ii) What is a metal detector? How does it work?
24. What is principle of capacitor? Obtain an expression for energy stored in a capacitor and then energy density of capacitor 5

Or

Describe principle, construction and working of Van-de Graff generator. How is the leakage of charge is minimized from the generator.

25. (a) A rod length l is moved horizontally with a uniform velocity v in a direction perpendicular to its length through a region in which a uniform magnetic field is acting

vertically downward. Derive the expression for the emf induced across the ends of the rod.

(b) How does one understand this motional emf by involving the Lorentz force acting on the free charge carriers of the conductor? Explain.

Or

(a) derive the expression for the torque on a rectangular current carrying loop suspended in a uniform magnetic field.
(b) A proton and a deuteron having equal momenta enter in a region of uniform magnetic field at right angle to the direction of the field. Depict their trajectories in the field.

26. (a) Draw a ray diagram showing the passes of light through a glass prism. Hence, obtain a relation between the angle of deviation, incidence, emergent and the the angle of prism.
(b) Show that no ray can pass through a prism whose refracting angle A is greater than twice the critical angle for the material of the prism.

Or

(a) Define the term wavefront. Draw the wavefront and corresponding rays in the case of a (i) diverging spherical wave, (ii) plane wave.
(b) Using Huygens' construction of a wavefront, explain the refraction of a plane wavefront at a plane surface and hence verify Snell's law.

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