PHYSICS

A Highly Simulated Practice Question Paper for CBSE Class XII Examination

Time : 3 hrs | Max. Marks : 70

General Instructions

1. All questions are compulsory. There are 33 questions in all.
2. This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
3. **Section A** contains ten very short answer questions and four assertion reasoning MCQs of 1 mark each, **Section B** has two case based questions of 4 marks each, **Section C** contains nine short answer questions of 2 marks each, **Section D** contains five short answer questions of 3 marks each and **Section E** contains three long answer questions of 5 marks each.
4. There is no overall choice. However internal choice is provided. You have to attempt only one of the choices in such questions.

SECTION-A

All questions are compulsory. In case of internal choices, attempt anyone of them.

1. The electric field of an electromagnetic wave is given by

$$E_z = 5 \times 10^{-7} \sin(2 \times 10^3 x + 8.28 \times 10^{12} t)$$

What is the wavelength of the electromagnetic wave?

Or

Give the definition of electromagnetic wave and general equation of electric field in electromagnetic wave.

2. Ge and Ag are cooled to a temperature of 305 K, then how it affect their resistivity?

3. A single slit of width d is illuminated by violet light of wavelength 400 nm and the width of the diffraction pattern is measured as y. When half of the slit width is covered and other half illuminated by yellow light of wavelength 600 nm, then how much the width of diffraction pattern becomes?

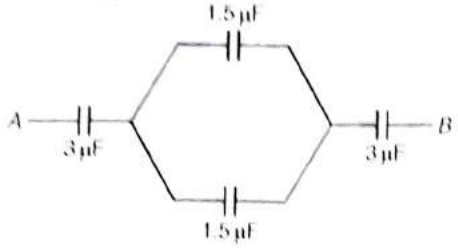
Or

What are the conditions for total internal reflection to take place?

4. On which principle a transformer works?

5. What is the motion of charge carriers in forward bias and reverse bias of a p-n junction?

6. Find the equivalent capacitance between the points A and B in the following circuit.



Or

Can a body has charge of 1.5e, where e is the electronic charge?

7. Write the name of spectral series of hydrogen atom, which lies in visible range of electromagnetic wave.

8. The maximum voltage in AC circuit is 141 V. What is the effective voltage in circuit?

Or

Voltage V and current i in AC circuit are given by, $V = 100\sin(50t)$ V and $i = 200\sin\left(50t + \frac{\pi}{3}\right)$mA. Calculate the power dissipated in circuit.

9. Why does the conductivity of metals decrease with increase in temperature?

10. Why does the width of depletion layer of p-n junction increase in reverse biasing?

For question numbers 11, 12, 13 and 14, two statements are given-one labelled Assertion (A) and the other labelled **Reason** (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false and R is also false.

11. **Assertion** If Gaussian surface does not enclose any charge, then **E** at any point on the Gaussian surface must be zero.
Reason No net charge is enclosed by Gaussian surface, so net flux passing through the surface is non-zero.

12. **Assertion** Critical angle of light passing from glass to air is minimum for violet colour.
Reason The wavelength of violet light is greater than the light of other colours.

13. **Assertion** To observe diffraction of light the size of obstacle aperture should be of the order of 10^{-7} m.
Reason 10^{-7} m is the order of wavelength of visible light.

14. **Assertion** It is not possible to use ^{35}Cl as the fuel for fusion energy.
Reason The binding energy of ^{35}Cl is too small.

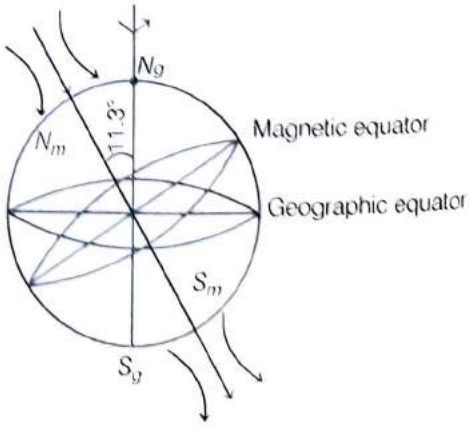
SECTION-B

Questions 15 and 16 are case study based questions and are compulsory. Attempt any 4 sub parts from each question. Each question carries 1 mark.

Earth Magnetic Field

15. The magnetic field lines of the earth resemble that of a hypothetical magnetic dipole located at the centre of the earth. The axis of the dipole is presently tilted by approximately 11.3° with respect to the axis of rotation of the earth.

The pole near the geographic North pole of the earth is called the North magnetic pole and the pole near the geographic South pole is called South magnetic pole.



(i) The strength of the earth's magnetic field varies from place to place on the earth's surface, its value being of the order of

(a) 10^5 T (b) 10^{-6} T

(c) 10^{-5} T (d) 10^8 T

(ii) A bar magnet is placed North-South with its North-pole due North. The points of zero magnetic field will be in which direction from centre of magnet?

(a) North-South

(b) East-West

(c) North-East and South-West

(d) North-East and South-West

(iii) The value of angle of dip is zero at the magnetic equator because on it

(a) V and H are equal

(b) the values of V and H are zero

(c) the value of V is zero

(d) the value of H is zero

(iv) The angle of dip at a certain place, where the horizontal and vertical components of the earth's magnetic field are equal, is

(a) 30° (b) 90°

(c) 60° (d) 45°

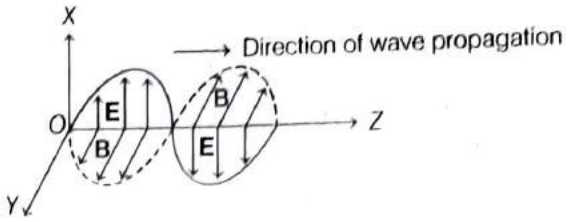
(v) At a place angle of dip is 30°. If horizontal component of earth's magnetic field is H, then the total intensity of magnetic field will be

(a) $H/2$ (b) $2H/\sqrt{3}$

(c) $H\sqrt{3/2}$ (d) $2H$

Oscillating Charge

16. An oscillating charge is an example of accelerating charge. It produces an oscillating electric field in space, which produces an oscillating magnetic field, which in turn produces an oscillating electric fields and so on. The oscillating electric and magnetic fields regenerate each other as a wave which propagates through space.



(i) Electromagnetic waves can be deflected by

(a) only electric field

(b) only magnetic field

(c) Both (a) and (b)

(d) None of the above

(ii) Total energy density of electromagnetic waves in vacuum is given by the relation

(a) $\frac{1}{2}\cdot\frac{E^2}{\varepsilon_0}+\frac{B^2}{2\mu_0}$ (b) $\frac{1}{2}\varepsilon_0 E^2+\frac{1}{2}\mu_0 B^2$

(c) $\frac{E^2+B^2}{c}$ (d) $\frac{1}{2}\varepsilon_0 E^2+\frac{B^2}{2\mu_0}$

(iii) The speed of electromagnetic wave in vacuum depends upon the source of radiation

(a) increases as we move from γ-rays to radio waves

(b) decreases as we move from γ-rays to radio waves

(c) is same for all of them

(d) None of the above

(iv) Solar radiation is

(a) transverse electromagnetic wave

(b) longitudinal electromagnetic wave

(c) stationary wave

(d) None of the above

(v) A plane electromagnetic wave of frequency 25 MHz travels in free space along the x-direction. At a particular point in space and time, $E = 6.3$ J-V/m. What is B at this point?

(a) $2.1\times 10^{-8}\,\hat{\mathbf{k}}$T (b) $2.1\times 10^{8}\,\hat{\mathbf{k}}$T

(c) $3.5\times 10^{6}\,\hat{\mathbf{k}}$T (d) $3.0\times 10^{5}\,\hat{\mathbf{k}}$T

SECTION-C

All questions are compulsory. In case of internal choices, attempt anyone.

17. A 10 kg satellite circles earth once energy 2h in an orbit having a radius of 8000 km. Assuming that Bohr's angular momentum postulate applies to satellites just as it does to an electron in hydrogen atom, find the quantum number of the orbit of the satellite.

18. Why is it that while using a moving coil galvanometer as a voltmeter, a high resistance in series is required? Also draw the circuit diagram for a voltmeter.

19. Write any two applications of a meter bridge with their mathematical expression.

20. Draw energy band diagrams for germanium and wood.

21. Four identical cells, each of emf 8 V and internal resistance 2.5 Ω are connected in series and charged by a 100 V DC supply, using a 24 Ω resistor in series.

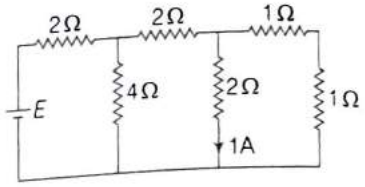
Calculate

(i) charging current in the circuit

(ii) and potential difference across the cells during recharging.

Or

Find the emf of the battery shown in circuit below.



22. Define the following terms and give their source of origin.

(i) Plane wavefront

(ii) Cylindrical wavefront

23. Give any two applications of eddy currents.

Or

Give any four characteristics of series *L-C-R* circuit at resonance.

24. Derive an expression for the force between two long parallel current carrying conductors.

25. Draw a graph to show the variation of stopping potential with frequency of radiation incident on a metal plate. How can the value of Planck's constant be determined from this graph?

Or

Consider figure for photoemission. How would you reconcile with momentum conservation? Note light (photons) have momentum in a different direction than the emitted electrons.

SECTION-D

All questions are compulsory. In case of internal choices, attempt anyone.

26. (i) Why do we need the oil drops in Millikan's experiment to be of microscopic sizes? Why cannot we carry out the experiment with bigger drops ?

(ii) What happens to the wavelength of a photon after it collides with an electron?

(iii) Can X-rays cause photoelectric effect?

27. (i) Why is the core of a nuclear reactor one of its most important part?

(ii) Why is the number of neutrons in heavier nuclei more than the number of protons?

(iii) Name the element with which control rods in nuclear reactors are made up.

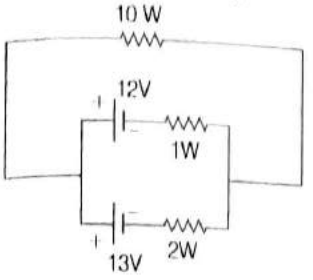
28. For a given lens, the magnification was found to be twice as large when the object was 0.15 m distant from it than when the distance was 0.2 m. What is the focal length of the lens?

Or

An astronomical telescope has objective and eyepiece of focal lengths 40 cm and 4 cm, respectively. Find the distance by which the lenses must be separated, so

that image of an object 200 cm away from the objective can be seen at infinity. Also draw the ray diagram.

29. Two batteries with emf 12 V and 13 V are connected in parallel across a load resistor of 10 Ω. The internal resistances of the two batteries are 1 Ω and 2 Ω, respectively. The voltage across the load can be calculated as below



For parallel combination of cells,

$$E_{eq} = \frac{\frac{E_1}{r_1} + \frac{E_2}{r_2}}{\frac{1}{r_1} + \frac{1}{r_2}} = \frac{\frac{12}{1} + \frac{13}{2}}{\frac{1}{1} + \frac{1}{2}} = \frac{37}{3}\text{ V}$$

Potential drop across 10 Ω resistance,

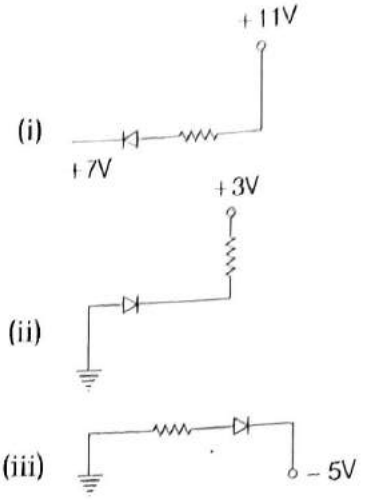
$$V = \left(\frac{E}{R_{total}}\right) \times 10 = \frac{37/3}{\left(10 + \frac{2}{3}\right)} \times 10$$

$$= 11.56\text{ V}$$

$$\therefore \quad V = 11.56\text{ V}$$

Now, give an alternate solution of above problem.

30. In the following figures, indicate which of the diodes are forward biased and which are reverse biased?



Or

Predict the effect on the electrical properties of a silicon crystal at room temperature, if every millionth silicon atom is replaced by an atom of indium. Given, concentration of silicon atoms $= 5 \times 10^{28}\,\text{m}^{-3}$, intrinsic carrier concentration $= 1.5 \times 10^{16}\,\text{m}^{-3}$, $H_e = 0.135\ \text{m}^3$ / V-s and $H_h = 0.048\text{m}^3$ / V-s.

SECTION-E

All questions are compulsory. In case of internal choices, attempt anyone.

31. (i) What is the focal length of the combination of a convex lens of focal length 30 cm in contact with a concave lens of focal length 20 cm? Is the system a converging or a diverging lens? Ignore thickness of the lenses.

(ii) At what angle should a ray of light be incident on the face of a prism of refracting angle 60°, so that it just suffers total internal reflection at the other face? The refractive index of the material of the prism is 1.524.

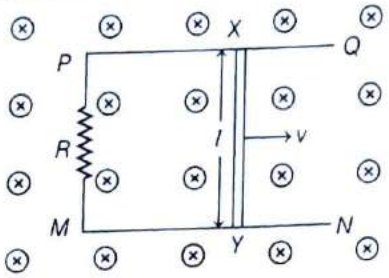
Or

(i) In Young's double slit experiment using monochromatic light L_1 of wavelength 700 nm, 10th bright fringe was obtained at a certain point P on a screen.

Which bright fringe will be obtained at the same point P, if monochromatic light of wavelength 500 nm is used in place of L_1? (No other alterations were made in the experimental set-up.)

(ii) Monochromatic light of wavelength 650 nm falls normally on a slit of width 1.3×10^{-4} cm and the resulting Fraunhofer diffraction is obtained on a screen. Find the angular width of the central maxima.

32. (i) PQ and MN are two parallel conductors at a distance l apart and connected by a resistance R as shown in figure. They are placed in a magnetic field B which is perpendicular to the plane of the conductors.



A wire XY is placed over PQ and MN and, then made to slide over PQ and MN with a velocity v. Neglecting the resistance of PQ, MN and wire XY, calculate the work done per second to slide the wire XY.

(ii) Magnetic flux through a coil of resistance R changes by an amount $\Delta\phi$ during a small time interval Δt. Calculate the total quantity of charge that passes through any cross-section in the coil during this time interval.

Or

(i) State the underlying principle of a transformer. How is the large scale transmission of electric energy over long distances done with the use of transformers?

(ii) A step-down transformer operated on a 2.5 kV line. It supplies a load with 20 A. The ratio of the primary winding to the secondary is 10 : 1. If the transformer is 90% efficient, calculate

(a) the power output,

(b) the voltage

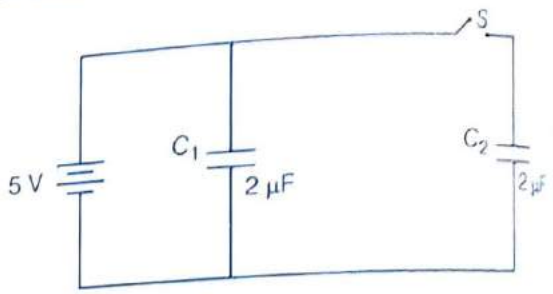
(c) and the current in the secondary coil.

33. (i) Two insulated charged copper spheres A and B have identical sizes and charge 6.5×10^{-7} C on each and their centres are separated by distance of 50 cm. A third sphere C of same size but uncharged is brought in contact with first, then brought in contact with the second and finally removed from both, find the new force of interaction between spheres A and B.

(ii) Figure shows two identical capacitors C_1 and C_2, each of 2 μF capacitance, connected to a battery of 5 V. Initially switch S is closed.

After sometime, S is left open and dielectric slabs of dielectric constant $K = 5$ are used and inserted to fill completely the space between the plates of the two capacitors.

How will the (a) charge and (b) potential difference between the plates of the capacitors be affected after the slabs are inserted?

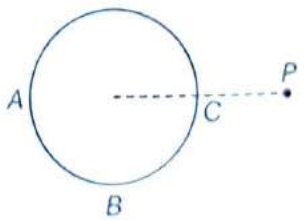


Or

(i) Intensity of electric field at a perpendicular distance of 0.5 m from an infinitely long line charge having linear charge density (λ) is 3.6×10^3 Vm^{-1}. Find the value of λ.

(ii) Three equal charges of 5.0 μC each are placed at the three vertices of an equilateral triangle of side 5.0 cm each. Calculate the electrostatic potential energy of the system of charges.

(iii) A hollow conducting sphere is placed in an electric field produced by a point placed at P as shown in figure.



Let V_A, V_B and V_C be the potentials at points A, B and C respectively.

Then, find out the relation between V_A, V_B and V_C.