

CBSE – 2007 CLASS XII PHYSICS - III

General Instructions:

1. All questions are compulsory.
2. 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 three questions of five marks. You have to attempt only one of the choice in such questions.
3. Question numbers 1 to 5 are very short answer type questions, carrying one mark each.
4. Question numbers 6 to 12 are short answer type questions, carrying two marks each.
5. Question numbers 13 to 24 are also short answer type questions, carrying three marks each.
6. Questions numbers 25 to 27 are long answer type questions, carrying five marks each

Q. 1. Is the force acting between two point electric charges q_1 and q_2 kept at some distance apart in air, attractive or repulsive when (i) $q_1q_2 > 0$ (ii) $q_1q_2 < 0$? 1

Q. 2. Show graphically how the stopping potential for a given photosensitive surface varies with the frequency of incident radiations. 1

Q. 3. A TV tower has a height of 71 m. What is the maximum distance upto which TV transmission can be received ? Given that the radius of the earth = 6.4×10^6 m. 1

Q. 4. Which one of the two diodes D_1 and D_2 in the given figures is (i) forward biased, (ii) reverse biased ? 1

Q. 5. Suggest a possible communication channel for the transmission of a message signal which has a bandwidth of 5 MHz. 1

Q. 6. A spherical Gaussian surface encloses a charge of .

1. Calculate the electric flux passing through the surface.
2. How would the flux change if the radius of the Gaussian surface is doubled and why ? 2

Q. 7. In a copper voltameter, the mass of the ions deposited in 30 seconds is m grams. The current (i) vs. time (t) graph for the experiment is as shown in the given figure.

Calculate the value of E.C.E. of copper in terms of the mass, m , deposited. 2

Or

For a given thermocouple, the emf generated across its ends is given by $E = at + bt^2$ where t in $^{\circ}\text{C}$ is the temperature of the hot junction, the cold junction being at 0°C . If $V/^{\circ}\text{C}^2$, calculate the value of inversion temperature $\mu\text{V}/^{\circ}\text{C}$ and $b = -0.02 \mu\text{a} = 10$ in $^{\circ}\text{C}$.

Q. 8. In an ammeter (consisting of a galvanometer and a shunt), 0.5% of the main current passes through the galvanometer. Resistance of the galvanometer coil is G . Calculate the resistance of the shunt in terms of galvanometer resistance, G . 2

Q. 9. An electric bulb B and a parallel plate capacitor C are connected in series to the a.c. mains as shown in the given figure. The bulb glows with some brightness. How will the glow of the bulb be affected on introducing a dielectric slab between the plates of the capacitor? Give reasons in support of your answer. 2

Q. 10. What does the statement, "natural light emitted from the sun is unpolarized" mean in terms of the direction of electric vector? Explain briefly how plane polarized light can be produced by reflection at the interface separating the two media. 2

Q. 11. The output of a 2-input NOR gate is fed to a NOT gate. Draw the logic circuit of this combination of gates and write the truth table for the output of the combination for all inputs. (i) attractive, (ii) repulsive. 2

Q. 12. What is remote sensing? Write its two applications. 2

Q. 13. On what principle does a metre bridge work? Draw a circuit diagram and explain how this device can be used for determination of an unknown resistance. 3

Q. 14. Derive a mathematical expression for resistivity of a conductor in terms of number density of charge carriers in the conductor and relaxation time. 3

Q. 15. State Ampere's circuital law. Write the expression for the magnetic field at the centre of a circular coil of radius R carrying a current I . Draw the magnetic field lines due to this coil. 3

Q. 16. Write the expression for the force acting on a charged particle of charge q moving with velocity in the presence of magnetic field. Show that in the presence of this force

1. the kinetic energy of the particle does not change.
2. its instantaneous power is zero. 3

Q. 17. In a series LCR circuit, define the quality factor (Q) at resonance. Illustrate its significance by giving one example.

Show that power dissipated at resonance in LCR circuit is maximum. 3

Q. 18. rad/s about an axis π A circular copper disc 10 cm in radius rotates at a speed of 20 through its centre and perpendicular to the disc. A uniform magnetic field of 0.2 T acts perpendicular to the disc.

1. Calculate the potential difference developed between the axis of the disc and the rim.
2. What is the induced current if the resistance of the disc is ? 3

Or

F are connected in series to 220 V a.c. μ A resistor of and a capacitor of 40 source with angular frequency . Calculate the voltages (rms) across the resistor and the capacitor. Why is the algebraic sum of these voltages more than the source voltage ? How do you resolve this paradox ?

Q. 19. Draw a labelled diagram of Hertz's experiment. Explain how electromagnetic radiations are produced using this set-up. 3

Q. 20. How does the frequency of a beam of ultraviolet light get affected when it goes from air into glass ?

A ray of light incident on an equilateral glass prism shows minimum deviation of 30° . Calculate the speed of light through the glass prism. 3

Q. 21. An electron, α -particle and a proton have the same de-Broglie wavelength. Which of these particles has (i) minimum kinetic energy, (ii) maximum kinetic energy, and why ? In what way has the wave nature of electron been exploited in electron microscope ? 3

Q. 22. State the law of radioactive decay. Establish a mathematical relation between half-life period and disintegration constant of a radioactive nucleus. 3

Q. 23. Distinguish between nuclear fission and fusion. In a fusion reaction calculate the amount of energy (in MeV) released. Given. 3

Q. 24. Draw a schematic diagram of a single optical fibre structure. On what principle does such a device work ? Explain the mechanism of propagation of light signal through an optical fibre. 3

Q. 25. Derive the expression for the energy stored in a parallel plate capacitor of capacitance C with air as medium between its plates having charges Q and $-Q$. Show that this energy can be expressed in terms of electric field as where A is the area of each plate and d is the separation between the plates.

How will the energy stored in a fully charged capacitor change when the separation between the plates is doubled and a dielectric medium of dielectric constant 4 is introduced between the plates ? 5

Or

Define the term dipole moment of an electric dipole indicating its direction. Write its SI unit.

An electric dipole is placed in a uniform electric field. Deduce the expression for the torque acting on it. In a particular situation, it has its dipole moment aligned with the electric field. Is the equilibrium stable or unstable ?

Q. 26. Define the term 'wavefront'. Draw the wavefront and corresponding rays in the case of a

(i) diverging spherical wave, (ii) plane wave.

Using Huygen's construction of a wavefront, explain the refraction of a plane wavefront at a plane surface and hence verify Snell's law. 5

Or

Derive the relation between the focal length of a convex lens in terms of the radii of curvature of the two surfaces and refractive index of its material. Write the sign conventions and two assumptions used in the derivation of this relation,

A convex lens of focal length 40 cm and a concave lens of focal length — 25 cm are kept in contact with each other. What is the value of power of this combination ?

Q. 27. Explain, with the help of a circuit diagram, the use of an n-p-n transistor as an amplifier in common-emitter configuration. Write the expression for voltage gain of the transistor. Draw frequency response curve of this amplifier.

How will the current gain of a transistor be affected if its base region is made thicker as compared to a usual transistor and why ? 5

Or

Draw energy band diagrams for (i) an intrinsic semiconductor, (ii) p-type semiconductor.

Draw symbolic representation of a zener diode. Draw its V-I characteristics and explain, with the help of a circuit diagram, its use as a voltage regulator.