

**CBSE Board
Class XII Physics
Sample Paper - 8****Time: Three Hours****Maximum Marks: 70****General Instructions**

- (a) All questions are compulsory.
- (b) There are 29 questions in total. Questions 1 to 8 carry one mark each, questions 9 to 16 carry two marks each, questions 17 to 25 carry three marks each and questions 27 to 29 carry five marks each.
- (c) Question 26 is a value based question carrying four marks.
- (d) 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 each. You have to attempt only one of the given choices in such questions.
- (e) Use of calculator is not permitted.
- (f) You may use the following physical constants wherever necessary.

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

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

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

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

$$K_B = 1.38 \times 10^{-23} \text{ J K}^{-1}$$

$$N_A = 6.023 \times 10^{23} \text{ /mole}$$

$$m_n = 1.6 \times 10^{-27} \text{ kg}$$

1. Two point charges +q & -q are situated at a distance d from each other. At which points will the resultant electric field will be parallel to the line joining the two charges? (1)
2. Which two magnetic properties are revealed by the study of hysteresis loops of different materials? (1)
3. A coil is removed from a magnetic field i) rapidly ii) slowly. In which case more work will be done? Why? (1)
4. When current flows through the coil of the transformer, the core of the transformer gets hot. Why? (1)

5. Why is ground waves transmission not advisable for the em waves of frequencies beyond 1500 kHz? (1)
6. What is the effect on the interference fringes when:
 - (i) one of the slits is so painted that it transmits half the intensity of the other?
 - (ii) if one of the two slits is covered? (1)
7. How does the maximum kinetic energy of electrons emitted vary with work function of the metal? (1)
8. Draw energy band diagram of p type semiconductor. (1)
9. What is the shape of equipotential surfaces around a point charge? Can two equipotential surfaces intersect? Justify your answer. (2)
10. Find the capacitances of three parallel plates, each of area $A \text{ m}^2$ and separated by d_1 and d_2 metres. The in-between spaces are filled with dielectrics of relative permittivity ϵ_1 and ϵ_2 . The permittivity of free space is ϵ_0 . (2)
11.
 - (a) You are to measure an emf of the cell. What will you use, a high resistance voltmeter or a potentiometer? Why?
 - (b) Give two reasons why copper wire is not typically used in potentiometer? (2)
12. A galvanometer coil has a resistance of 12Ω and the meter shows full scale deflection for a current of 3 mA. How will you convert the galvanometer into a voltmeter of range 0 to 18 V? (2)
13. Name the type of modulation scheme preferred for digital communication. How does the power radiated by an antenna vary with wavelength? (2)
14.
 - (a) A conducting loop is held stationary normal to the field between the NS poles of a fixed permanent magnet. By choosing a magnet sufficiently strong, can we hope to generate current in the loop?
 - (b) A closed conducting loop moves normal to the electric field between the plates of a large capacitor. Is a current induced in the loop when it is
 - (i) wholly inside the capacitor
 - (ii) partially outside the plates of capacitor?
 The electric field is normal to the plane of the loop. (2)

15. Draw the phasor diagram to represent the relation between instantaneous current & voltage in an ac circuit with capacitor only. What is the phase difference between two in capacitive ac circuit? (2)

16. If a clear blue portion of the sky is seen through a rotating Polaroid, variation in the intensity of light is observed. Why is it so? (2)

OR

What is the principle of working of:

(i) Light emitting diode?

(ii) Solar cell? (2)

17. A potential difference V exists across a copper wire of length L & diameter d . How is the drift velocity affected if i) V is doubled, ii) L is doubled, and iii) d is doubled? (3)

18. In a.c. circuits:

(a) When an LCR circuit is brought into resonance, the current has a large value. Why? When does the LCR circuit become purely resistive?

(b) Can a capacitor of suitable capacitance replace a choke coil in an ac circuit? (3)

19. 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) (3)

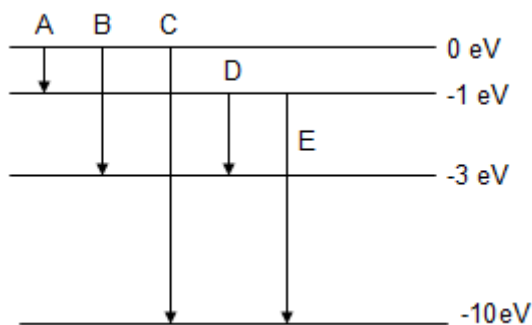
OR

A concave lens has the same radius of curvature for both sides and has a refractive index 1.5 in air. In the second case, it is immersed in a liquid of refractive index 1.4. Calculate the ratio of the focal length of the lens in the two cases. (3)

20. What is a Polaroid? How plane polarized light is obtained with its help? How will you use it to distinguish between unpolarised & polarised light? (3)

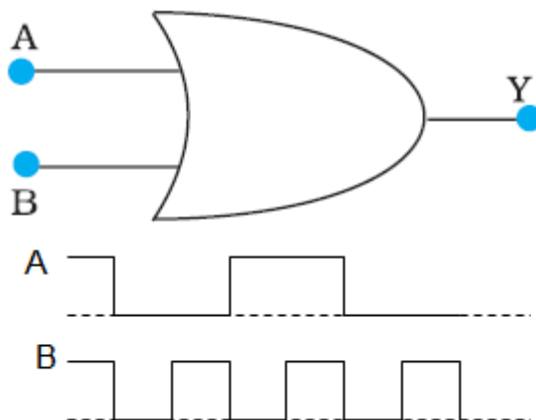
21. From the relation $R = R_0 A^{1/3}$, where R_0 is a constant and A is the mass number of a nucleus, show that the nuclear matter density is nearly constant (i.e. independent of A). What is the relation between the binding energy per nucleon & stability of the nucleus? (3)

22. The energy levels of an atom of element are shown in the following diagram. Which one of the level transitions will result in the emission of photons of wavelength 620 nm? Support your answer with mathematical calculations.



(3)

23. In the figure below, circuit symbol of a logic gate & two input waveforms 'A' and 'B' are shown.



- Name the logic gate.
- Write its truth table.
- Give the output waveform.

(3)

24.

- State two advantages of pulse code modulation over amplitude modulation.
- What is the range of FM signals? Why is an FM signal less susceptible to noise than AM signal?

(3)

25. For a series LCR circuit, draw a graph showing the variation of current with angular frequency of the source for a particular value of resistance. On the graph mark the angular frequencies for which the power is $\frac{1}{2}$ the maximum value. Also mark the bandwidth.

(3)

26. Geeta's father was riding the bike on highway and she was sitting behind him. While riding, at a place traffic signal turned red from green and her father continued riding without noticing the signal change. Geeta observed the whole situation and asked her father to stop. Her father felt happy on her daughter's intelligence.

- (a) Why Geeta's father became happy? What kind of value is expressed by Geeta?
- (b) What are the principles that are used in maintaining traffic signals? What is the leading physical quantity in the process? Write an equation for the speed of the photoelectron. (4)

27.

- (a) When a tiny circular obstacle is placed in the path of light from the distant source, a bright spot is seen at the centre of the shadow of the obstacle. Explain.
- (b) In a single slit experiment, the width of the slit is made double the original width. How does this affect the size & intensity of the central diffraction band?
- (c) Two slits are made one millimetre apart and the screen is placed one metre away. What should the width of each slit be, so as to obtain 10 maxima of the double slit pattern within the central maximum of the single slit pattern?
- (d) Draw an intensity distribution graph for diffraction due to single slit & that for interference due to double slits. State one important point of difference between these two intensity patterns. (5)

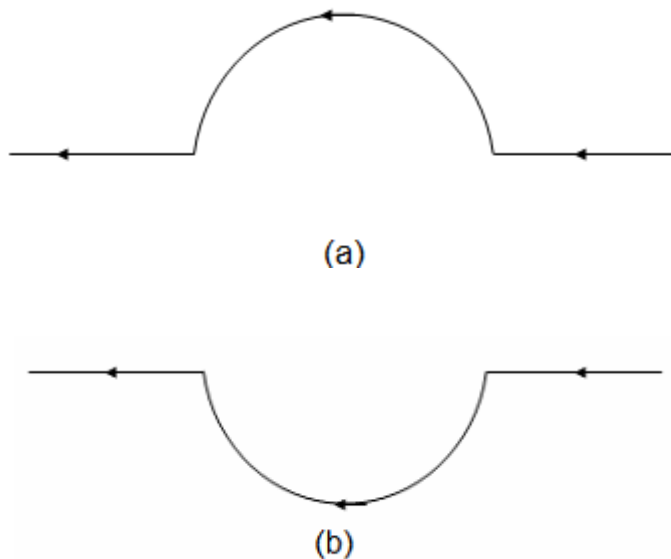
OR

Explain the principle and working of a cyclotron with the help of a labeled diagram. For a cyclotron having oscillator frequency as 10MHz , what should be the operating magnetic field for accelerating protons? If the radius of its 'dees' is 60 cm, what is the kinetic energy of the proton beam produced by accelerator? Express your answer in units of MeV. (5)

$$(e = 1.6 \times 10^{-19} \text{ C}, m_p = 1.67 \times 10^{-27} \text{ kg}, 1\text{MeV} = 1.602 \times 10^{-13} \text{ J})$$

28.

- (a) By mistake a voltmeter is connected in series & ammeter in parallel with a resistance in an electrical circuit. What will happen to the instrument?
- (b) A thick straight copper wire carrying a current of 10 A is bent into a semi circular arc of radius 7 cm as shown in the figure a. State the direction & calculate the magnitude of magnetic field at the centre of the arc. How will your answer change if the same wire were bent into a semicircular arc of the same radius but in opposite direction as shown in Fig b?



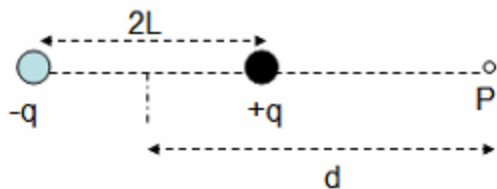
- (c) Free electrons inside the conductor are in random motion at all times. Even then, no magnetic force acts on them in a magnetic field unless a current is passed through it. Why? (5)

OR

- (a) What are the coherent sources of light? Why are coherent sources required to obtain sustained interference pattern?
- (b) State three characteristic features which distinguish the interference pattern due to two coherently illuminated sources as compared to that observed in a diffraction pattern due to a single slit. (5)

29.

- An electric dipole is placed in an external uniform electric field $\vec{E}$. What is the torque acting on the dipole? What is the net force experienced by the dipole?
- Electric charge is uniformly distributed on the surface of an inflated spherical balloon. State how the values of electric field intensity E and potential V vary on i) surface, ii) inside and iii) outside.
- As shown in the figure, calculate the net potential at point P due to two charges $+q$ & $-q$ situated in air.



(5)

OR

- State Lenz's law. Which conservation law can be used to explain this law?
- A wheel with 10 metallic spokes each 0.5m long is rotated with a speed of 120rev/min in a plane normal to the horizontal component of earth's magnetic field at a place where the earth's field is $0.4 \times 10^{-4} \text{G}$. What is the induced emf between the axle and the rim of the wheel?
- Two moving coil meters, M_1 and M_2 have the following particulars:
 $R_1 = 10 \, \Omega$, $N_1 = 30$,
 $A_1 = 3.6 \times 10^{-3} \text{ m}^2$, $B_1 = 0.25 \text{ T}$
 $R_2 = 14 \, \Omega$, $N_2 = 42$
 $A_2 = 1.8 \times 10^{-3} \text{ m}^2$, $B_2 = 0.50 \text{ T}$
 (The spring constants are identical for the two meters). Determine the ratio of (a) current sensitivity and (b) voltage sensitivity of M_2 and M_1 .

(5)