

# CBSE 12th Physics 2011 Unsolved Paper Delhi Board

TIME - 3HR. | QUESTIONS - 30

THE MARKS ARE MENTIONED ON EACH QUESTION

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## SECTION - A

- Q.1.** A point charge  $Q$  is placed at point  $O$  as shown in the figure. Is the potential difference  $V_A - V_B$  positive, negative or zero, if  $Q$  is (i) positive (ii) negative? *1 mark*



- Q.2.** A plane electromagnetic wave travels in vacuum along  $z$ -direction. What can you say about the direction of electric and magnetic field vectors? *1 mark*
- Q.3.** A resistance  $R$  is connected across a cell of emf  $\epsilon$  and internal resistance  $r$ . A potentiometer now measures the potential difference between the terminals of the cell as  $V$ . Write the expression for ' $r$ ' in terms of  $\epsilon$ ,  $V$  and  $R$ . *1 mark*
- Q.4.** The permeability of a magnetic material is 0.9983. Name the type of magnetic materials it represents. *1 mark*
- Q.5.** Show graphically, the variation of the de-Broglie wavelength ( $\lambda$ ) with the potential ( $V$ ) through which an electron is accelerated from rest. *1 mark*
- Q.6.** In a transistor, doping level in base is increased slightly. How will it affect (i) collector current and (ii) base current? *1 mark*
- Q.7.** Define the term 'wattless current'. *1 mark*
- Q.8.** When monochromatic light travels from one medium to another its wavelength changes but frequency remains the same, Explain. *1 marks*

## SECTION - B

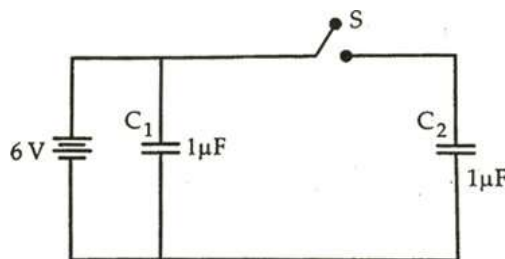
- Q.9.** Two uniformly large parallel thin plates having charge densities  $+\sigma$  and  $-\sigma$  are kept in the X-Z plane at a distance 'd' apart. Sketch an equipotential surface due to electric field between the plates. If a particle of mass  $m$  and charge  $-q$  remains stationary between the plates, what is the magnitude and direction of this field? *2 marks*

OR

Two small identical electrical dipoles AB and CD, each of dipole moment ' $p$ ' are kept at an angle of  $120^\circ$  as shown in the figure. What is the resultant dipole moment of this combination? If this system is subjected to electric field ( $\vec{E}$ ) directed along + X direction, what will be the magnitude and direction of the torque acting on this?

- Q.10.** A magnetic needle free to rotate in a vertical plane parallel to the magnetic meridian has its north tip down at  $60^\circ$  with the horizontal. The horizontal component of the earth's magnetic field at the place is known to be 0.4 G. Determine the magnitude of the earth's magnetic field at the place. *2 marks*

- Q.11.** Figure shows two identical capacitors,  $C_1$  and  $C_2$ , each of  $1\ \mu\text{F}$  capacitance connected to a battery of 6 V. Initially switch 'S' is closed. After sometime 'S' is left open and dielectric slabs of dielectric constant  $K = 3$  are inserted to fill completely the space between the plates of the two capacitors. How will the (i) charge and (ii) potential difference between the plates of the capacitors be affected after the slabs are inserted? *2 mark*



- Q.12.** Two convex lenses of same focal length but of aperture  $A_1$  and  $A_2$  ( $A_2 < A_1$ ), are used as the objective lenses in two astronomical telescopes having identical eyepieces. What is the ratio of their resolving power? Which telescope will you prefer and why? Give reason. *2 marks*

- Q.13.** Draw the output waveform at X, using the given inputs A and B for the logic circuit shown below. Also, identify the logic operation performed by this circuit. *2 marks*

- Q.14.** Name the semiconductor device that can be used to regulate an unregulated dc power supply. With the help of I-V characteristics of this device, explain its working principle. *2 marks*
- Q.15.** How are infrared waves produced? Why are these referred to as 'heat waves'? Write their one important use. *2 marks*
- Q.16.** Draw the transfer characteristic curve of a base biased transistor in CE configuration. Explain clearly how the active region of the  $V_0$  versus  $V_1$  curve in a transistor is used as an amplifier. *2 marks*
- Q.17.** (i) Define modulation index. *2 marks*  
(ii) Why is the amplitude of modulating signal kept less than the amplitude of carrier wave?
- Q.18.** A current is induced in coil  $C_1$  due to the motion of current carrying coil  $C_2$ . (a) Write any two ways by which a large deflection can be obtained in the galvanometer G. (b) Suggest an alternative device to demonstrate the induced current in place of a galvanometer. *2marks*

#### SECTION - C

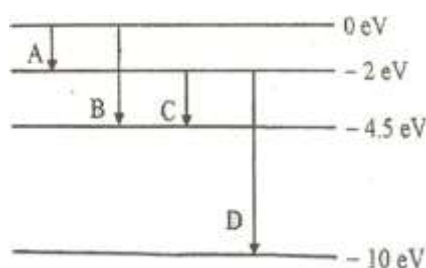
- Q.19.** Define the terms (i) drift velocity, (ii) relaxation time. *3 marks*  
A conductor of length  $L$  is connected to a dc source of emf  $\epsilon$ . If this conductor is replaced by another conductor of same material and same area of cross-section but of length  $3L$ , how will the drift velocity change?
- Q.20.** Using Gauss's law obtain the expression for the electric field due to a uniformly charged thin spherical shell of radius  $R$  at a point outside the shell. Draw a graph showing the variation of electric field with  $r$ , for  $r > R$  and  $r < R$ . *3 marks*
- Q.21.** An electron and a photon each have a wavelength  $1.00 \text{ nm}$ . Find *3 marks*  
(i) their momenta,  
(ii) the energy of the photon and  
(iii) the kinetic energy of electron.
- Q.22.** Draw a schematic diagram showing the (i) ground wave (ii) sky wave and (iii) space wave propagation modes for em waves. Write the frequency range for each of the following: *3 mark*  
(i) Standard AM broadcast  
(ii) Television  
(iii) Satellite communication

**Q.23. Describe Young's double slit experiment to produce interference pattern due to a monochromatic source of light. Deduce the expression for the fringe width. 3 marks**

**Q.24. (a) Describe briefly, with the help of suitable diagram, how the transverse nature of light can be demonstrated by the phenomenon of polarization. 3 marks**

**(b) When polarized light passes from air to a transparent medium, under what condition does the reflected light get polarized? 3 marks**

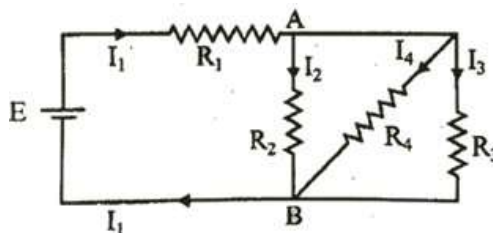
**Q.25. The energy levels of a hypothetical atom are shown below. Which of the shown transitions will result in the emission of a photon of wavelength 275 nm? Which of these transitions correspond to emission of radiation of (i) maximum and (ii) minimum wavelength? 3 marks**



**Q.26. State the law of radioactive decay. Plot a graph showing the number (N) of undecided nuclei as a function of time (t) for a given radioactive sample having half life  $T_{1/2}$ .**

**Depict in the plot the number of undecided nuclei at (i)  $t = 3 T_{1/2}$  and (ii)  $t = 5 T_{1/2}$ . 3 marks**

**Q. 27. In the circuit shown,  $R_1 = 4 \Omega$ ,  $R_2 = R_3 = 15 \Omega$ ,  $R_4 = 30 \Omega$  and  $E = 10 \text{ V}$ . Calculate. the equivalent resistance of the circuit and the current in each resistor. 3 mark**



## SECTION - D

**Q.28. State Biot-Savart law, giving the mathematical expression for it. 5 mark**

**Use this law to derive the expression for the magnetic field due to a circular coil carrying current at a point along its axis. How does a circular loop carrying current behave as a magnet? 5 marks**

OR

With the help of a labelled diagram, state the underlying principle of a cyclotron. Explain clearly how it works to accelerate the charged particles. Show that cyclotron frequency is independent of energy of the particle. Is there an upper limit on the energy acquired by the particle? Give reason.

Q.29. (a) Draw radiograms show refraction of a ray of monochromatic light passing through a glass prism. *5 marks*

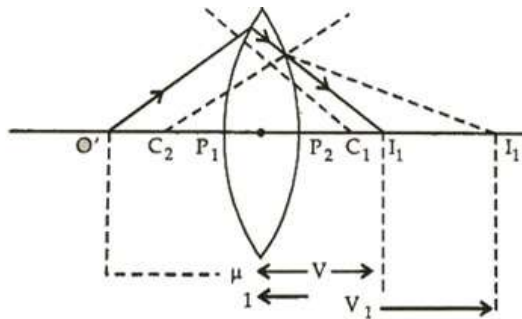
Deduce the expression for the refractive index of glass in terms of angle of prism and angle of minimum deviation.

(b) Explain briefly how the phenomenon of total internal reflection is used in fibre optics

OR

Here the ray is propagating from a rarer medium of refractive index ( $n_1$ ) to a denser medium of refractive index ( $n_2$ ) is incident on the convex side of spherical refracting surface of radius of curvature  $R$ ,

(b) Draw a ray diagram to show the image formation by a concave mirror when the object is kept between its focus and the pole. Using this diagram, derive the magnification formula for the image formed.



Q.30. (i) With the help of a labelled diagram, describe briefly the underlying principle and working of a step up transformer. *5 marks*

(ii) Write any two sources of energy loss in a transformer.

(iii) A step up transformer converts a low input voltage into a high output voltage. Does it violate law of conservation of energy? Explain.