Ascent Classes

An Educational Institute

CLASS XII
C.B.S.E. (Physics)

Time: 3.00 hrs MM: 70

General Instruction:- ***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 choices in such questions.*

3. *Questions numbers 1 to 8 are very short answer type questions, carrying one mark each.*

4. *Question numbers 9 to 18 are short answer type questions, carrying two marks each.*

5. *Question numbers 19 to 27 are also short answer type questions, carrying three marks each.*

6. *Question numbers 28 to 30 are long answer type questions, carrying five marks each.*

7. *Use of calculators is not permitted. However, you may use log tables, if necessary.*

Q1)- An electron, an alpha particle and a proton have the same kinetic energy. Which one of these particles has material the largest de – Broglie wave length?

Q2)- Why should the material used for making permanent magnet has high coercivity?

Q3)- The radio active isotope D decays according to the sequence.

$$D \xrightarrow{\beta^-} D_1 \xrightarrow{\alpha\ particle} D_2$$

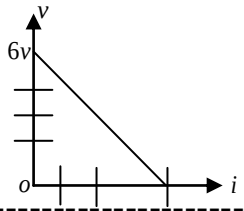
if the mass no. and atomic no. of D_2 are 176 and 71 respectively, what is (i) mass number (ii) atomic number of D?

Q4)- Name the part of electromagnetic spectrum of wave length 10^{-2} m and mention its one application.

Q5)- A glass lens of refractive index 1.5 is placed in a trough of liquid. What must be the refractive index of the liquid in order to make the lens disappear?

Q6)- A 500 μ C charge is at the centre of a square of side 10 cm. Find the work done in moving a charge of 10 μ C between two diagonally opposite points on the square.

Q7)- The plot of the variation of potential difference across a combination of three identical cells in series, versus current is as shown here. What is the emf of each cell?



Q8)- Why should a photodiode be operated at a reverse bias?

Q9)- 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) amp. What are the average and rms values of the current?

Q10)- Write the relation for the force $\vec{F}$ acting on a charge carrier on a charge carrier q moving with velocity $\vec{v}$ Through a magnetic field $\vec{B}$ in vector notation. Using this relation, deduce the conditions under which this force will be (i) maximum (ii) minimum.

Q11)- The electric field E due to a point charge at any point near it is defined as $E = \lim_{q \to o} \frac{F}{q}$ where q is the test charge and F is the acting on it. What is the physical significance of $\lim_{q \to o}$ in this expression? Draw the electric field lines of a point charge Q when, (i) Q>O and (ii) Q<O

OR

Define electric flux. Write its S.I. units. A spherival rubber balloon carries a charge that is uniformly distributed over its surface. As the balloon is blown up and increases in size, how does the total electric flux coming out of the surface change? Give reason.

Q12)- A cylindrical metallic wire is stretched to increase its length by 10%. Calculate the percentage change in tis resistance.

Q13)- The output of a 2 – input AND gate is fed to a NOT gate. Draw the logic circuit of this combination of gates and write its truth table.

Q14)- Derive the expression for the electric potential at any point along the axial line of an electric dipole?

Q15)- A transmitting antenna at the top of a tower has a height of 36 m and the height of the receiving antenna 49m. What is the maximum distance between them, for satisfactory communication in the LDS mode? (Radius of earth = 6400 Km.)

Q16)- Prove that an ideal inductor does not dissipate power in an a.c. circuit.

Q17)- Draw a ray diagram of a compound microscope. Write the expression for its magnifying power.

Q18)- How does a charge q oscillating at certain frequency produce electromagnetic waves?
Sketch a schematic diagram depicting electric and magnetic fields for an electromagnetic wave propagating along the z – direction.

Q19)- Calculate the amount of energy released during the α - decay $^{238}_{92}U \rightarrow {}^{234}_{90}Th + {}^{4}_{2}He$

Given, 1. atomic mass of $^{238}_{92}U = 238.05079u$

2. atomic mass of $^{234}_{90}Th = 234.04363u$

3. atomic mass of $^{4}_{2}He = 4.00260u$

Is this decay spontaneous? Give reason.

Q20)- State Gauss's theorem in electrostatics. Using it, deduce an expression for electric field intensity at a point near a thin infinite plane sheet of electric charge.

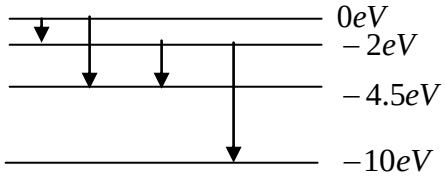
Q21)- How is a wave front defined? Using Huygen's construction, draw a figure showing the propagation of a plane surface separating two media. Hence verify Snell's law of refraction.

Q22)- The figure below shows the V – I characteristic of semiconductor diode

(i) Identify the semiconductor diode used.
(ii) Draw the circuit diagram to obtain the given characteristic of this device.
(iii) Briefly explain how this diode can be used as a voltage regulator.

Q23- An inductor of unknown value, a capacitor of 100 μF and a resistor of 10 Ω are connected in series to a 200 volt, 50 Hz a.c. source. It is found that the power factor of the circuit is unity. Calculate the inductance of the inductor and the current amplitude.

Q24)- **(a)** The energy levels of an atom are as shown below. Which of them will result in the transition of photon of wave length 275 nm?



(b) Which transition corresponds to emission of radiation of maximum wave length?

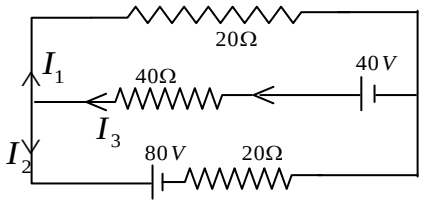
Q25)- In a single slit diffraction experiment when a tiny circular obstacle is placed in the path of light from a distant source, a bright spot is seen at the centre of the shadow of the obstacle. Explain why?

Q26)- Draw the labeled circuit diagram of a common emitter transistor amplifier. Explain clearly how the input and output signals are in opposite phase.

OR

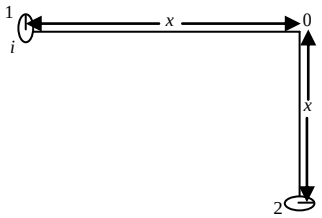
State briefly the underlying principle of a transistor oscillator. Draw a circuit diagram showing how the feedback is accomplished by inductive coupling. Explain the oscillator action.

Q27)- State Kirchhoff's rules of current distribution in an electrical network. Using these rules, determine the values of the current I_1 in the electric circuit given below.



Q28)- **(a)** Using Biot – Savart law, derive an expression for the magnetic field at the centre of a circular coil of radius R, number of turns N, carrying current I.

(b) Two small identical circular soils marked 1, 2 carry equal currents and are placed with their geometric axes perpendicular to each other as shown in the figure. Derive an expression for the resultant magnetic field at 0.



OR

Draw a schematic diagram of a cyclotron. Explain its underlying principle and working, stating clearly the function of the electric an magnetic fields applied on a charged particle.

Deduce an expression for the period of revolution and show that it does not depend no the speed of the charged particle.

Q29)- **(a)** For a ray of light traveling from a denser medium of refractive index to a rarer medium of refractive index n_2, Prove $\frac{n_2}{n_1} = Sin\ \ i_c$, where i_c is the critical angel of incidence for the media.

(b) Explain with the help of a diagram, how the above principle is used for transmission of video signals using optical fibers.

OR

(a) What is plane polarized light? Two polaroids are placed at 90^0 to each other and the transmitted intensity is zero. What happens when one more Polaroid is placed between these two, bisecting the angle between them? How will the intensity of transmitted light vary on further rotating the third Polaroid?

(b) If a light beam shows no intensity variation when transmitted through a Polaroid which is rotated, does it mean that the light is unpolarised? Explain briefly.

Q30)- (a) Using Gauss's law, derive an expression for the electric field intensity at any point outside a uniformly charged thin spherical shell of radius R and charge density $\sigma\ C/m^{2.}$. Calculate (i) charge on the sphere (ii) total electric flux passing through the sphere

OR

(a) Derive an expression for the torque experienced by an electric dipole kept in a uniform electric field.

(b) Calculate he work done to dissociate the system of three charges placed on the vertices of a triangle as shown. Here q = 1.6 x 10^{-10}C