12th ARM(SZ)JKUT2024
1108-X
PHYSICS

Time : 3 Hours]   [Maximum Marks : 70

SECTION-A   1 each

1. (i) A body can be negatively charged by :

    (A) Giving excess of electrons to it

    (B) Removing some electrons from it

    (C) Giving some protons to it

    (D) Removing some neutrons from it

    (ii) It is possible to have a positively charged body at :

    (A) Zero potential

    (B) Negative potential

    (C) Positive potential

    (D) All of these

(2)

(iii) Which of the following relation is called as current density ?

(A) $\dfrac{I}{A}$

(B) $\dfrac{A}{I}$

(C) $\dfrac{I^2}{A}$

(D) $\dfrac{I^3}{A^2}$

(iv) Which of the following is ferromagnetic ?

(A) Aluminium

(B) Quartz

(C) Nickel

(D) Bismuth

(v) A transformer is used to change

(A) High voltage d.c. into low voltage d.c.

(B) High voltage a.c. into low voltage a.c.

(C) Electrical energy into mechanical energy

(D) Mechanical energy into electrical energy

(vi) Which of the following are not electromagnetic wave

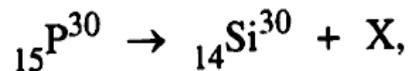(A) Cosmic rays

(B) γ-rays

(C) β-rays

(D) X-rays

(vii) Which of the following produces a plane wave front ?

    (A) Point source

    (B) Line source

    (C) Extended source

    (D) None of these

(viii) Electron volt is the unit of :

    (A) Charge

    (B) Momentum

    (C) Potential difference

    (D) Energy

(ix) In case of artificial radioactive transformation as given by :

$$_{15}P^{30} \rightarrow \, _{14}Si^{30} + X,$$

particle X is :

    (A) Neutron

    (B) Proton

    (C) Electron

    (D) Positron

(x) The type of bond in a silicon crystal is :

    (A) Ionic

    (B) Metallic

    (C) Covalent

    (D) Van der Waals

SECTION-B   2 each

2. (a) What is an equipotential surface ? Give the direction of electric field with respect to an equipotential surface.

   (b) Self induction is called the inertia of electricity. Explain. why.

   (c) What is Maxwell's displacement current ? Is displacement current, a source of magnetic field ?

   (d) When does Snell's law of refraction fail ?

   (e) For glass-air interface, the critical angle is C. Will the critical angle for glass-water interface be greater or less than C ? Explain.

   (f) A ray of light incident on an equilateral glass prism ($\mu_g = \sqrt{3}$) moves parallel to the base line of the prism inside it. Find the angle of incidence for this ray.

   (g) Why do we fail to observe the diffraction from a wide slit illuminated by monochromatic light ?

   (h) What are nuclear forces ? State their three properties.

   (i) Write two important significances of binding energy per nucleon curve.

SECTION-C

3 each

3. (a) Derive a relation between e.m.f., potential difference and internal resistance of a cell.

   (b) A 10 C charge flows through a wire in 5 minutes. The radius of the wire is 1 mm. It contains 5×10^{22} electrons per centimeter^3. Calculate current and drift velocity.

   (c) What is an ammeter ? How can a galvanometer be converted into an ammeter ?

   (d) State Lenz's law and show that it does not violate the law of conservation of energy.

   (e) A capacitor of 1 μF is connected to source of a.c. having e.m.f. given by equation $E = 200 \cos 120 \pi t$. Find r.m.s. value of current through the capacitor. https://www.jkboseonline.com

   (f) Calculate de-Broglie equation for a material particle.

   (g) On the basis of Bohr's atomic model, find an expression for radius of nth orbit of a hydrogen atom.

   (h) Explain the forward and reverse bias characteristic curve of a p-n junction.

   (i) Distinguish between intrinsic and extrinsic semiconductors.

SECTION-D   5 each

4. (a) State Gauss's law in electrostatics. Derive an expression for the electric field due to an infinitely long straight charged wire at a point distant r from it. Plot a graph showing the variation of electric field with r.

Or

What is a capacitor ? Derive an expression for total capacitance when three capacitors of capacitances C_1, C_2 and C_3 are connected in (i) series (ii) parallel.

(b) What is magnetic dipole and magnetic field intensity ? Derive an expression for the torque acting on a bar magnet placed in a uniform magnetic field.

Or

Derive an expression for the force per unit length experienced by each of the two long current carrying conductors placed parallel to each other in air. Hence, define one ampere of current.

(c) What is interference of light ? Deduce the conditions for constructive and destructive interference in Young's double slit experiment.

Or

What is compound microscope ? With the help of ray diagram, explain the working of compound microscope. Find an expression for its magnifying power.