Total No. of Questions : 4]

[Total No. of Printed Pages : 7

12ᵗʰ ARM(SZ)JKUT 2024
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

(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... 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
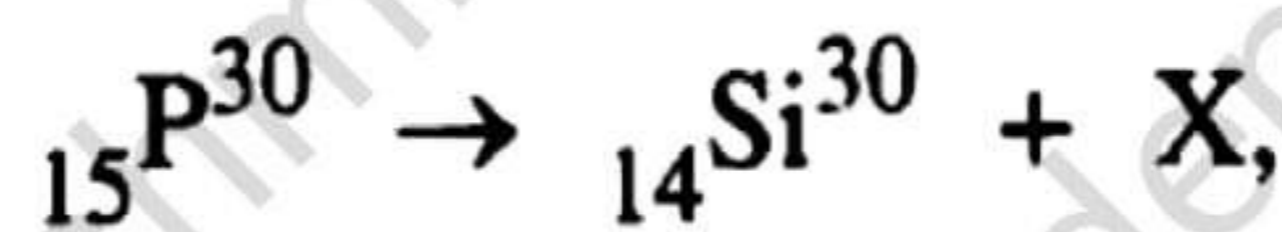
(A) Cosmic rays

(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–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.

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B–8–X

(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.

12th ARM(SZ)JKUT2024
1108–Y
PHYSICS

Time : 3 Hours]

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SECTION–A

1 each

1. (i) What are the dimensions of $K = \dfrac{1}{4\pi\epsilon_0}$?

   (A) $C^2 N^{-1} m^{-2}$

   B) $Nm^2 C^{-2}$

   (C) $Nm^2 C^2$

   (D) Unitless

   (ii) What is the angle between the electric dipole moment and the electric field strength due to it on th equatorial line ?

   (A) $0°$

   (B) $90°$

   (C) $180°$

   (D) None of these

(iii) Ohm's law is not obeyed by :

    (A) Electrolytes

    (B) Discharge tubes

    (C) Vacuum tubes

    (D) All of these

(iv) Which of the following is paramagnetic ?

    (A) Antimony

    (B) Silver

    (C) Marble

    (D) Aluminium

(v) A transformer steps up or steps down :

    (A) a.c. only

    (B) d.c. only

    (C) either a.c. or d.c.

    (D) a.c. mixed with d.c.

(vi) Red light differs from blue light in its :

    (A) Speed

    (B) Frequency

    (C) Intensity

    (D) Amplitude

(vii) A plane wavefront is propagating in a medium. Which of the following is true ?

(A) It propagates parallel to itself

(B) It cannot propagate in the medium

(C) It changes to spherical wavefront

(D) It changes to cylindrical wavefront

(viii) The minimum energy required to remove an electron is called :

(A) Work function

(B) Kinetic energy

(C) Stopping potential

(D) Potential energy

(ix) The most abundant isotope of natural uranium is :

(A) $_{92}U^{238}$

(B) $_{92}U^{235}$

(C) $_{92}U^{234}$

(D) None of these

(x) In an insulator. the forbidden energy gap between the valence band and conduction band is of the order of :

(A) 5 eV

(B) 1 eV

(C) 2 MeV

(D) 10^{-3} eV

SECTION-B   2 each

2. (a) No two equipotential surfaces intersect each other. Why ?

    (b) State principle of a.c. generator. From where does the electric energy come in it ?

    (c) What does an electromagnetic wave consist of ? On what factors does its velocity in vacuum depend ?

    (d) How does refraction of light affect the length of the day ?

    (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. https://www.jkboseonline.com

    (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) Define resistivity and state its S.I. unit. Explain how the resistivity of a conductor varies with temperature.

(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'. 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.

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

<div align="right">5 each</div>

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.

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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.

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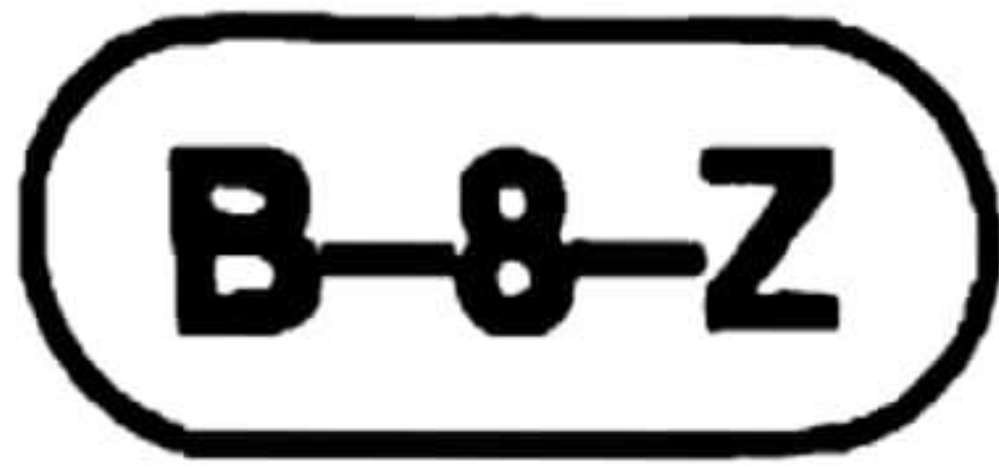
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Derive an expression for the force per unit length experienced by each of the two long current carrying conductors placed parallel to each other in air. Hence, define one ampere of current.

(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.

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1108-Z
PHYSICS

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SECTION-A   1 each

1.   (i)   A stationary charge produces :

     (A)   An electric field

     (B)   A magnetic field

     (C)   Both electric and magnetic fields

     (D)   An electromagnetic wave

     (ii) A soap bubble is given negative charge. Then its radius :

     (A)   Decreases

     (B)   Increases

     (C)   Remains same

     (D)   Nothing can be predicted

(iii) The reciprocal of resistance is :

(A) Conductance

(B) Specific resistance

(C) Voltage

(D) Current

(iv) Susceptibility is positive and small for :

(A) Paramagnetic

(B) Ferromagnetic

(C) Diamagnetic

(D) Non-magnetic

(v) The core used in transformer is laminated so as to :

(A) Reduce the magnetism in the core

(B) Reduce eddy current losses

(C) Increase the magnetic field

(D) Increase the magnetic flux

(vi) For a wave propagation in a medium, identify the property that is independent of the others :

(A) Velocity
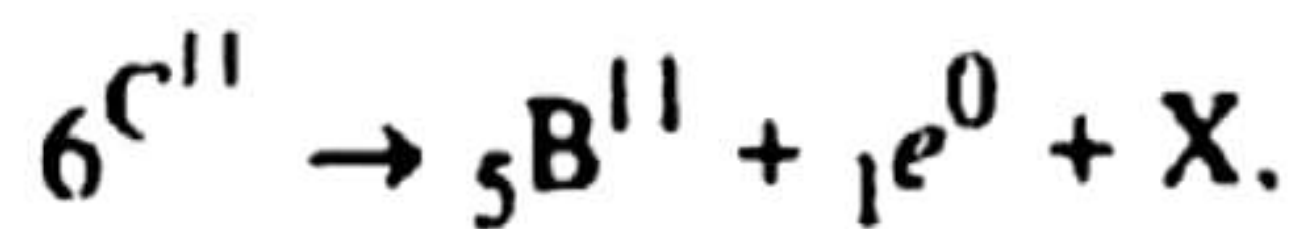
(B) Wavelength

(C) Frequency

(D) All of these

(vii) Huygen's principle of secondary waves is used to :

   (A) Obtain the new position of wavefront

   (B) Explain principle of superposition of waves

   (C) Explain interference phenomenon

   (D) Explain polarisation

(viii) The unit of Planck's constant is :

   (A) Nm

   (B) eV

   (C) JS^{-1}

   (D) JS

(ix) In the nuclear reaction

$$_6C^{11} \rightarrow {}_5B^{11} + {}_1e^0 + X.$$

what does X stand for :

   (A) An electron

   (B) A proton

   (C) A neutron

   (D) A neutrino

(x) The barrier potential of silicon diode at room temperature is :

   (A) 0.3 V

   (B) 0.7 V

   (C) 1 V

   (D) 2 mV

SECTION-B

2 each

1. (a) Distinguish between electric potential and potential energy and state the relation between these.

(b) Explain why the inductance coils are made of copper.

(c) How are infrared waves produced ? Write their two important uses.

(d) Why does a tank filled with water appear shallow ?

(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) Using Kirchhoff's laws, derive the condition for balance of Wheatstone bridge.

(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 ?

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5 each

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