KARNATAKA ICSE SCHOOLS ASSOCIATION

ISC STD. XII Preparatory Examination 2024

Subject – Physics Paper I

Time Allowed : 3 hrs   **Maximum Marks :70**   **Date: .01.2024**

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*(Candidates are allowed **additional 15 minutes** for **only** reading the paper.*
*They must **NOT** start writing during this time).*

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*This paper is divided into **four** sections – **A, B, C** and **D**.*
*Answer **all** questions.*
*Section A consists of **one** question having sub-parts of **one** mark each.*
*Section B consists of **seven** questions of **two** marks each.*
*Section C consists of **nine** questions of **three** marks each, and*
*Section D consists of **three** questions of **five** marks each.*
Internal choices have been provided in two questions each in
Section B, Section C and Section D.
The intended marks for questions are given in brackets [ ].
All working, including rough work, should be done on the same sheet as and
adjacent to the rest of the answer.
Answers to sub parts of the same question must be given in one place only.
A list of useful physical constants is given at the end of this paper.
A simple scientific calculator without a programmable memory may be used for
calculations.

SECTION A – 14 MARKS

Question 1

(A) In questions (i) to (vii) below, choose the correct alternative (a), (b), (c) or (d) for each of the questions given below:

i)Two bulbs A and B rated with powers 80 W and 60W respectively, designed to operate at 200V are connected in parallel as shown in figure. Which one among the following is correct, when the bulbs are glowing?   [1]

a) Bulb A glows brighter than bulb B   b) Bulb A glows equally bright as bulb B

c) Power consumed by A is more than B   d) Power consumed by B is more than A

ii) Two a-particles have the ratio of their velocities as 3: 2 on entering the field. If they move in different circular paths, then the ratio of the radii of their paths is

   a) 2: 3   b) 3: 2   c) 9: 4   d) 4: 9   [1]

iii) **Assertion:** If a compass needle be kept at the north pole of the earth, the needle may stay in any direction.

Reason: The dip needle will stay horizontal at the equator of earth.   [1]

a) both Assertion and Reason are correct, and reason is the correct explanation of assertion.

b) Assertion and Reason are correct, but reason is not the correct explanation of assertion.

c) Assertion is false but Reason is true.   d) Assertion is true but Reason is false.

iv) The radius of curvature of the curved surface of a plano-convex lens is 20 cm. If the refractive index of the material of the lens be 1.5, it will [1]

a) act as a convex lens only for the objects that lie on its curved side.

b) act as a concave lens for the objects that lie on its curved side.

c) act as a convex lens irrespective of the side on which the object lies.

d) act as a concave lens irrespective of side on which the object lies.

v) What should be the order of the size of an obstacle or aperture for diffraction light? [1]

a) Order of wavelength of light   b) Order of wavelength of obstacle

c) Order in ranges of micrometer   d) Order in ranges of millimeter

vi) When ultraviolet rays are incident on a metal surface photoelectric effect does not occur. It may occur by the incidence of: [1]

a) X- rays   b) Infrared rays   c) Red light   d) microwaves

vii) Select the incorrect statement with respect to a p- type semiconductor: [1]

  a) majority charge carriers are holes   b) electrons are minority charge carriers

  c) doped with pentavalent impurities   d) doped with trivalent impurities

(B) Answer the following questions briefly:

i)Identify the p n junction whose V-I characteristic is as shown below.

[1]
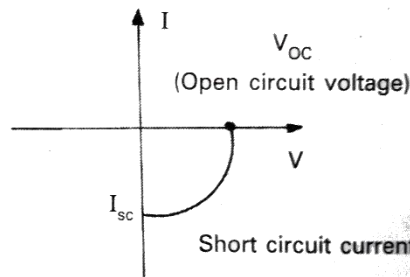
ii) A student performed an experiment with 1m long wire potentiometer and 4m long wire potentiometer. Which one is more sensitive? [1]

iii) What will be the magnetic flux linked with a rectangular coil, if its plane is held parallel to the uniform magnetic field? [1]

iv) Name the type of wave fronts are associated with extended source. [1]

v) The susceptibility versus temperature graph of a substance is as shown.

  Identify the type of substance. [1]
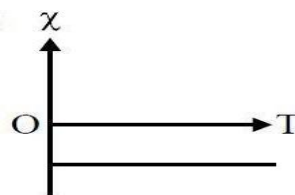
vi) What do you mean by coherent sources? [1]

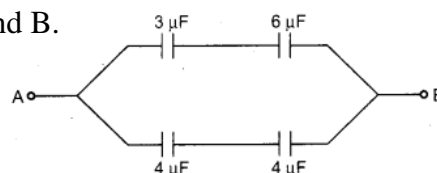vii) Give an example of mass converted to energy. [1]

SECTION B – 14 MARKS

Question 2 [2]

 i) At the centre of a spherical Gaussian surface a point charge is kept. How does the electric flux through the surface change when,

  a) the sphere is replaced by a cylinder

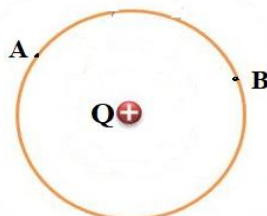 b) the charge is shifted to another point inside the sphere

ii) Calculate the effective capacitance between A and B.

Question 3 [2]

The figure shows a hollow charged sphere of radius R carries a charge Q. How much work has to be done in moving a charge q from the point A to B? Give reason.
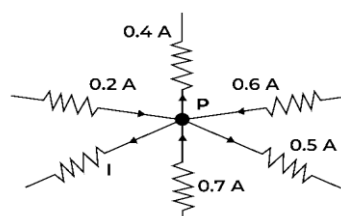

Question 4 [2]

i) What is the physical significance of binding energy per nucleon?

ii) A proton and a deuteron have same velocity. What is the ratio of their de- Broglie wavelength?
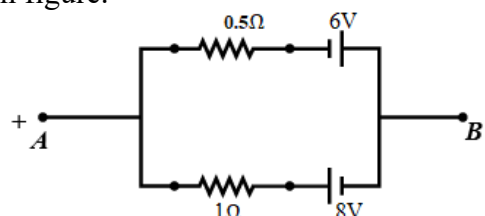
Question 5 [2]

i) Calculate the current I of the circuit.

OR

ii) Two cells of emf and internal resistances 6V,0.5 Ω and 8V, 1 Ω are connected in parallel as shown in figure. Calculate the net emf across AB.

Question 6 [2]

The refractive indices of a material of prism for indigo and orange lights are 1.531 and 1.510 respectively. Calculate the angular dispersion produced by a prism of angle 5°.

Question 7 [2]

i) What is displacement current?

ii) Name the electromagnetic waves which are suitable for radar systems used in aircraft navigation.

Question 8 [2]

The motion of copper plate is damped, when it is allowed to oscillate between the two poles of a magnet. What is the cause this damping?

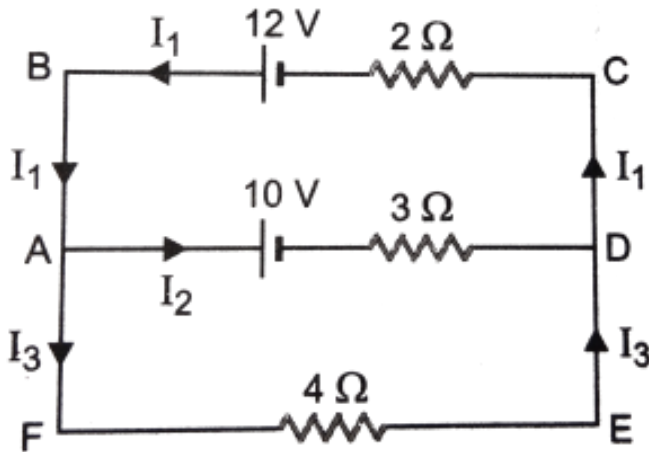## SECTION C – 27 MARKS

Question 9 [3]

Derive the expression for electric field intensity due to an electric dipole at a point on its perpendicular bisector.
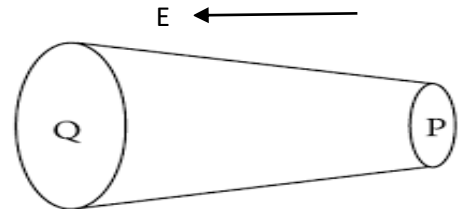
Question 10 [3]

i) Using Kirchhoff's laws calculate the currents in each resistance.

OR

ii) a) An electron is moving from Q to P when it is subjected to an electric field E as shown. What change do you expect in the drift velocity of the electron? Explain.

b) The drift velocity of free electron in a conductor is v when a current 'I' is flowing in it. If both the area of cross section and current is halved, then what will be the drift velocity?

Question 11 [3]

A moving coil galvanometer of resistance 80Ω must be converted to an ammeter of range 0 to 3A. Galvanometer shows full scale deflection when 30mA current flows through it.

a) Calculate the shunt resistance used.

b) Find the resistance of the ammeter.

Question 12 [3]

i) a) Draw a labelled diagram of an astronomical telescope when the final image is formed at the least distance of distinct vision.

b) Write an expression for magnifying power of the astronomical telescope when the final image is formed at infinity.

OR

ii) Derive lens maker's formula $\frac{1}{f} = (n - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$, the symbols have their usual meanings.

Question 13 [3]

Prove Snell's law of refraction using Huygens wave theory.

Question 14 [3]

The threshold wavelength of Molybdenum is 2900 Å. When it is illuminated with light of wavelength 2000 Å, find

a) work function

b) maximum kinetic energy of emitted electrons and

c) stopping potential

Question 15 [3]

The refractive index of a material of Biconvex lens is 3/2. The radius of curvature of each surface is R and its focal length is f.

a) How f and R are related for the above lens?

b) If the lens is cut in to make two identical plano- convex lenses, what will be the new focal length in terms of radius of curvature?

c) What will happen to the focal length of the biconvex lens, when it is dipped in water?

Question 16 [3]

Derive an expression for magnetic field at the axis of a current carrying loop. Hence derive the expression for the magnetic field at the centre of the loop.

Question 17 [3]

A student was performing double slit experiment to study interference pattern using red light. What happens to the fringe width of the pattern, if the student changes the following parameters:

a) distance between the slits are halved

b) red light is replaced with green light

c) one of the slit is closed.

SECTION D – 15 MARKS

Question 18 [5]

i) a) State Lenz's law.

b) How to minimize eddy currents in core of the transformer?

c) A long solenoid with 20 turns per cm has a small loop of area $2.0 cm^2$ placed inside the solenoid normal to its axis. If the current carried by the solenoid changes steadily from 2.0A to 4.0A in 1ms.What is the induced emf in the loop while the current is changing?

OR

ii) a) An alternating voltage V= 220 Sin 314t is applied across a series combination of R= 80Ω, C = 30µF and L = 800mH. Calculate:

1. Impedance of the circuit.
2. Resonant frequency
3. Rms value of current at resonance.

b) Graphically represent the variation of capacitive reactance with frequency of alternating current.

Question 19 [5]

i) a) How does the radius of orbits of an atom depends on principal quantum number?

b) Write on example of nuclear fission reaction.

c) Write the functions of a moderator in a nuclear reactor.

d) Calculate the mass defect and binding energy per nucleon of $_{10}Ne^{20}$. Given mass of Ne =19.992397 u, mass of $_1H^1$ = 1.007825 u, mass of $_0n^1$ = 1.008665 u.

OR

ii) a) For Bohr's model of hydrogen atom, the energy of electron in its ground level is found to be -13.6 eV. Draw an energy level diagram showing

1. the emission of highest wavelength of Lyman series and
2. shortest wavelength of Balmer series.
3. How much energy is required for an electron transition from the ground level(n=1) to

the first excited level(n=2) of hydrogen atom?
b) Calculate the energy equivalent of 1u.
c) In which region of electromagnetic spectrum Brackett series of hydrogen found?

Question 20 [5]

When p side of p-n junction is connected to positive terminal of battery and n side of p-n junction is connected to negative terminal of battery then the p-n junction is said to be in forward bias mode or forward biased. And when p side of p-n junction is connected to negative terminal of battery and n side of p-n junction is connected to positive terminal of battery then the p-n junction is said to be in reverse bias mode or reverse biased. The V-I characteristic curve of a p n junction is as shown.
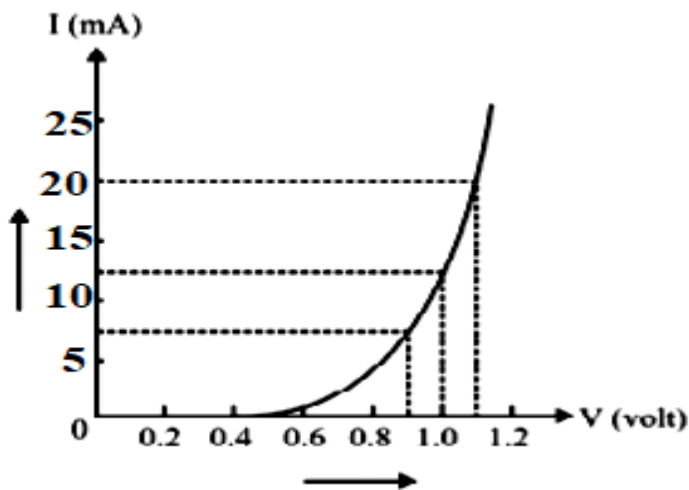
i) Identify the characteristic curve.
ii) Find out the knee voltage of the p n junction from the curve.
iii) Calculate the resistance of the diode at:
    a) I = 20 mA
    b) V = 1.0 V
iv) Which bias (reverse or forward) offers large resistance to the p n junction?

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Useful constants:

h — 6.6×10^{-34} Js

$1u$ ≡ 931.5 MeV

e = 1.6×10^{-19} J

R = 1.097×10^7 m^{-1}

$\dfrac{1}{4\pi\varepsilon_0}$ = $9 \times 10^9 Nm^2C^{-2}$

μ_0 = $4\pi \times 10^{-7} TmA^{-1}$

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