ISC Physics Sample Paper 2013

Class – XII **Subject–Physics**

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*Answer **all** questions in **Part I** and six questions from **Part II**, choosing **two** questions from **each of** the Sections **A**, **B** and **C**.*
All working, including rough work, should be done on the same sheet as, and adjacent to, the rest of the answer.
The intended marks for questions or parts of questions are given in brackets [ ].
(Material to be supplied: Log tables including Trigonometric functions)
A list of useful physical constants is given at the end of this paper.
(*Candidates are allowed additional 15 minutes for **only** reading the paper. They must NOT start writing during this time.*)

PART I (20 Marks)
Answer **all** questions.

Question 1

A. Choose the correct alternative (a), (b), (c) or (d) for each of the questions given below: **[5]**

(i) A dipole placed in a uniform electric field experiences

(a) only a net force (b) only a torque

(c) both a net force and a torque (d) neither a fore nor a torque

(ii) The force on a charged particle moving in a magnetic field is maximum when the angle between direction of motion and field is

(a) zero (b) 45^o (c) 90^o (d) 180^o

(iii) An important component of Michelson's method to determine speed of light is

(a) A Nicol prosm (b) A bi prism (c) a grating (d) an octagonal mirror

(iv) In a sample of radioactive material what percentage of material will decay in one half life?

(a) 50% (b) 37% (c) 69.3% (d) 63%

(v) The kinetic energy of a photon depend upon…….of radiation

(a) intensity (b) frequency (c) velocity (d) direction

B. Answer **all** questions given below briefly and to the point: **[15]**

(i) State Gauss's law in electrostatics.

(ii) Which conservation principles are involved in Kirchoff's current and voltage laws?

(iii) What is specific resistance?

(iv) Alternating current I flowing through a device lags behind the potential difference V across it by 90° or $\pi/2$ radian. Is this electrical device a resistor, an inductor or a capacitor?

(v) What kind of source produces a cylindrical wave front?

(vi) Which factors does the deviation produced by a thin prism depend on?

(vii) A convex lens forms a virtual image of an object. Where is the object? Answer in terms of focal length.

(viii) Write down the relation between mean life τ of a radioactive substance and its half life $T_{½}$.

(ix) Write down the truth table of AND gate.

(x) Find the frequency of a photon of energy 1 eV.

(xi) Draw the reverse characteristics of a Zener diode.

(xii) Define thermo electric power.

(xiii) Find the energy of X-radiation at wavelength 1 Å in eV.

(xiv) Define half – life of a radioactive sample.

(xv) Mention one phenomenon each in support of wave nature and particle nature of light.

PART II (50 Marks)

Answer **six** questions in this part, choosing **two** questions

from **each** of the Sections **A**, **B** and **C**.

SECTION A

*Answer any **two** questions.*

Question 2

(a) Define an electric dipole. Find the torque experienced by an electric dipole of moment **p** placed is a uniform electric field **E**. **[3]**

(b) What do you mean by electric lines of force? Draw the electric lines of force for an electric dipole. **[3]**

(c) Two capacitors C_1 and C_2 are connected in series. Find the equivalent capacitance of the system. **[3]**

Question 3

(a) State Kirchoff's current and voltage laws. **[3]**

(b) Define Peltier effect. Write down two important differences between Peltier effect and Joule effects. **[3]**

(c) State Ampere's circuital law and apply it to find the magnetic field due a straight long current carrying conductor. **[3]**

Question 4

(a) Draw the circuit diagram of a series L – C – R circuit and find the condition of resonance. **[3]**

(b) A rectangular loop of sides *a* and *b* is carrying a current I. Find the magnetic moment associated with it. [**2**]

(c) Show that the phase difference between the current and voltage is 90° in a pure inductive and purely capacitive circuit. **[4]**

SECTION B

*Answers any **two** questions*

Question 5

(a) Show that the reflected and transmitted rays are perpendicular at the Brewster's angle of incidence. **[2]**

(b) Draw a labelled diagram to show the deviation of a monochromatic ray while passing through a prism. Show the variation in the deviation as a function of the angle of incidence. Write down the condition for minimum deviation. **[3]**

(c) Two convex lenses of focal lengths 15 cm and 30 cm are in contact. Find the equivalent focal length of the system. What is the power of the combination? **[3]**

Question 6

(a) In a Young's double slit experiment with a monochromatic light of wavelength 500 nm, 5^{th} order bright fringe is observed at a distance 3 mm from the central order fringe. Find the fringe width. What is the distance between the coherent sources if the screen be placed at a distance 80 cm from the sources? **[3]**

(b) Define diffraction of light. Write down the differences between interference and diffraction. **[3]**

(c) Write down the conditions for sustained interference pattern. **[2]**

Question 7

(a) (i) A thin lens, having two surfaces of radii of curvature r_1 and r_2, made from a material of refractive index μ_2, is kept in a medium of refractive index μ_1. Derive the Len's Maker's formula for this 'set – up'.

(ii) Consider the lens in the above problem to be bi – convex. Under what condition will the lens behave as a diverging lens? [**4 + 1**]

(b) Draw the ray diagram relevant to a simple microscope. **[3]**

SECTION C

*Answers any **two** questions*

Question 8

(a) Draw a labelled circuit diagram of a full wave rectifier and explain its working principle. **[1+3]**

(b) What is the symbol of a **NAND** gate? Write its truth table. **[2]**

(c) Define mass defect and nuclear binding energy. **[2]**

Question 9

(a) Draw a labelled circuit diagram of an p – n – p transistor in CE mode to study the input and output characteristics. Show the input and output characteristics of this transistor. Identify the (i) cut – off region, (ii) saturation region and (iii) active region in the output characteristics. [**3**]

(b) Distinguish between avalanche breakdown and zener breakdown. [**3**]

(c) A monochromatic source, emitting light of wavelength 500 nm, has a power 40 W. Find the energy of each photon and hence the total number of photons emitted from the source per second. **[2]**

Question 10

(a) Compare the nuclear radii of Helium (*A = 4*) and Oxygen (*A = 32*) nuclei. Define binding energy of nucleus and show in a plot how the binding energy per nucleon varies with mass number. **[3]**

(b) The ground state energy of hydrogen atom is – 13.6 eV.

(i) Find the potential energy and the kinetic energy of the electron in the 2^{nd} excited state.

(ii) If the electron jumps from 2^{nd} excited state to the ground state, find the wavelength of the corresponding radiation **[3]**

(c) Write down Einstein's photoelectric equation explaining the symbols used. [**2**]

Useful Constants and Relations:

1. Planck's constant	(h)	$= 6.6 \times 10^{-34}$ Js
2. Speed of Light in vacuum	(c)	$= 3.0 \times 10^{8}$ ms^{-1}
3. Charge of an electron	(-e)	$= 1.6 \times 10^{-19}$ C
4. Mass of an electron	(m_e)	= 9.0 × 10-31 kg
	ε_o	$= 8.85 \times 10^{-12}$ Fm^{-1}

l eV	$= 1.6 \times 10^{-19}$ J
l u	= 931 MeV
π	= 3.14