

ATUL VIDYALAYA
FIRST PRELIMINARY EXAMINATION-2012-13
PHYSICS
PAPER - 1 (THEORY)

STD- XII
DATE- /0 /2012/13
SESSION: I

MM-70
TIME - 3HRS

Attempt *all the* questions from Part-I & any two out of three questions from each of the sections of Part –II. The intended marks for questions or parts of questions are given in brackets [].

Part-I (20 marks)

All the questions are compulsory.

Question 1

[20 x 1 =20]

(A) Choose the alternative A,B,C or D for each of the questions given below:

i) There exists an electric field of 200 N/C along Z - direction. The flux passing through square of 10 cm sides placed on XY plane inside the electric field is Nm^2C^{-1} .

(a) 1/4 (b) 4 (c) 1/2 (d) 2

ii) The rating of a car battery of 12 V is 60 A, which means that 60 A of current will flow when the battery is connected to a conducting wire. The internal resistance of the battery will be Ω .

(a) 0.2 (b) 0.02 (c) 0.015 (d) 0.15

iii)

The speed of charged particle in a cyclotron is independent of

(a) its mass (b) its charge (c) its linear speed (d) magnetic field

iv) The real power in an A. C. circuit containing only inductor is equal to W.

(a) $2 L 21 I$ (b) $I L 21$ (c) (d) zero $2L 2I$

v) 1 mCi = Becquerel.

(a) 3.7×10^4 (b) 3.7×10^7 (c) 3.7 (d) 3.7×10^{-7}

(B) Answer all questions briefly:

- 1). Draw schematically an equipotential surface of a uniform electrostatic field along X axis.
- 2) An electron is brought closer to another electron. What happens to electrostatic potential energy of the system?
- 3) A charge q is placed at the centre of an imaginary spherical surface. What will be the electric flux due to this charge through any half of the sphere
- 4) You are required to select a carbon resistor of resistance $47k \pm 10\%$ from a large collection. What should be the sequence of color bands used to code it?
- 5) What is the shape of fringes in young's double slit experiment?
- 6) A ray of light passing through a prism deviates towards the base of the prism. Can you think of a situation when the ray would deviate away from the base?
- 10) What is the phase difference between two points on a cylindrical wave front?
- 11) Define dispersive power of the material of a prism.
- 12) For an achromatic combination of two lenses in contact, why should the lenses be of opposite nature?
- 13) Give Einstein's equation for photoelectric emission. What do the symbols stand for?

14) What is the function of heavy water in a nuclear reactor.

15) Write the value of resistance offered by an ideal diode when (i) forward biased (ii) reverse biased.

Std: XII

Page-2

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Physics

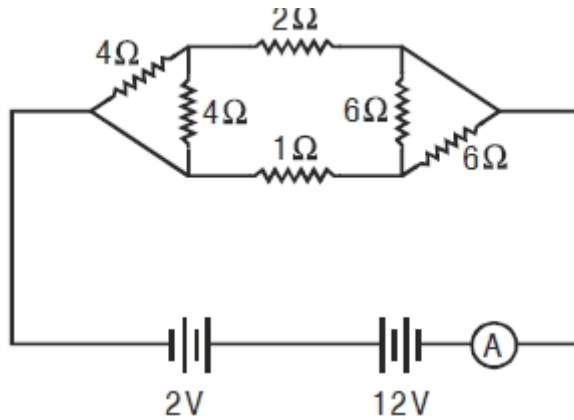
Part-II (50 marks)

Section A

Answer any two out of three questions

Question 2

a) Calculate the equivalent resistance and current shown by the ammeter in the circuit diagram given [3]



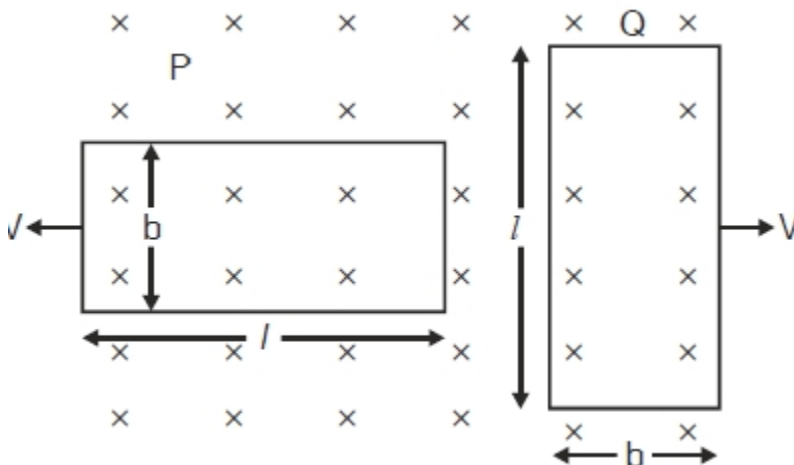
b) Derive expression of electric field for an infinitely long distribution of charge using Gauss's law. [3]

c) Derive an expression for the impedance of an a.c. circuit consisting of an inductor and a resistor. [3]

Question 3

a) An electron travels on a circular path of radius 10m in a magnetic field of 2×10^{-3} T. Calculate the speed of electron. What is the potential difference through which it must be accelerated to acquire this speed?

b) In the figure shown, coils P and Q are identical and moving apart with same velocity V. Induced currents in the coils are I_1 and I_2 . Find I_1/I_2 .



c) Derive an expression for force acting on a current carrying conductor. [3]

Question 4

a) A short bar magnet placed with its axis at 30° with an external field 1000G experiences a torque of 0.02 Nm. (i) What is the magnetic moment of the magnet. (ii) What is the work done in turning it from its most stable equilibrium to most unstable equilibrium position? [3]

b) Explain diamagnetism and para magnetism on the basis of modern electron theory. [3]

c) Find the capacitance of a capacitor to run 30 V , 10 W lamp when connected in series to an

Section B

Answer any two out of three questions

Question 5

- (a) Obtain the relation $e \sin \theta = \lambda$ for the first minimum of the diffraction pattern of a single slit of width e using light of wavelength λ . [3]
- (b) For a man shortest distance of distinct vision is 20 cm. What will be the type and power of lens which would enable him to read a book at a distance of 60 cm?
- (c) Draw a labelled ray diagram of a compound microscope and explain its working. Derive an expression for its magnifying [2]

Question 6

- a) What is Huygens principle? Use it to explain laws of refraction of light. [3]
- b) With help of ray diagram explain working of compound microscope. [3]
- c) What is Spherical aberration and how to reduce it. [2]

Question 7

- a) Discuss the case of refraction at spherical convex surface with real image using a suitable diagram. [3]
- b) What is polarization of light? Explain Brewster's law. [3]
- c) A convex lens of focal length 0.2 m and made of glass ($n = 1.5$) is immersed in water ($n = 1.33$) find the change in focal length. [2]

Section C

Answer any two out of three questions

Question 8

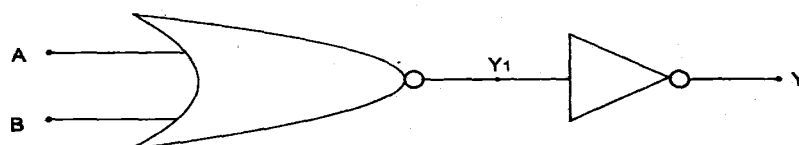
- (a) From the Bohr's theory of hydrogen atom, derive expression for the radius of electron orbit, total energy of electron in an orbit and frequency of radiation emitted when the electron passes from one energy level to another. [3]
- (b) Calculate the binding energy of a nitrogen nucleus in MeV. Given mass of hydrogen atom = 1.00783 u, mass of neutron = 1.00867 u and mass of nitrogen atom (${}^7\text{N}^{14}$) = 14.00307 u. Take $1 \text{ u} = 931.5 \text{ MeV}/c^2$. [3]
- (c) Explain the effect of increase of (i) frequency (ii) intensity of the incident radiation on photo electrons emitted by a metal.

Question 9

- (a) Explain formation of energy bands in solids. Distinguish between conductors, insulators and semiconductors on the basis of their energy band diagrams.
- (b) Find the energy equivalent of one atomic mass unit in joules and then in MeV.
- (c) Starting with $N = N_0 e^{-\lambda t}$, obtain a relation between disintegration constant ' λ ' of radioactive element and its half life (T). Various terms have their usual meaning.

Question 10

- (a) Binding energy of ${}^2\text{He}_4$ and ${}^3\text{Li}_7$ nuclei are 27.37 MeV and 39.4 MeV respectively. Which of the two nuclei is more stable? Why?
- (b) Draw the circuit diagram of a full wave rectifier and explain its working. Draw the input and output wave forms.
- (c) The following combination of gates acts as a logic gate. With the help of a truth table, find out which logic gate the combination represents:



PHYSICAL CONSTANTS

Mass of electron (m_e)	= 9×10^{-31} kg
Charge of electron (e)	= 1.6×10^{-19} C
Plank's constant (h)	= 6.6×10^{-34} Js
Permittivity of free space (ϵ_0)	= 8.85×10^{-12} F/m
$1 / 4\pi\epsilon_0$	= 9×10^9 N m ² C ⁻²
Speed of light in vacuum (c)	= 3×10^8 m/s
$\mu_0 / 4\pi$	= 10^{-7} H/m.
1 eV	= 1.6×10^{-19} J
1 a.m.u. (u)	= 931 MeV