Class XII, Session 2020-21 Subject: Physics Practice Paper

(Theory)

Maximum Marks: 70 Time allowed: 3 hours

General Instructions:

(1) All questions are compulsory. There are 33 questions in all.
(2) This question paper has 5 sections. Section A, section B, section C, section D and section E.
(3) Section A contains 10 very short answer questions and 4 assertion reasoning MCQs of 1 mark each. Section B has 2 case-based questions of 4 marks each. Section C contains 9 questions of short answer type questions of 2 marks each. Section D contains 5 short answer questions of 3 marks each and section E contains 3 long answer questions of 5 marks each.
(4) There is no overall choice. However internal choice is provided. You have to attempt only out of choices in such questions.
(5) You may use the following value of physical constants wherever necessary.

$c = 3 \times 10^8$ m/s
$h = 6.63 \times 10^{-34}$ Js
$e = 1.6 \times 10^{-19}$ C
$\mu_o = 4\pi \times 10^{-7}$ TmA^{-1}
$\varepsilon_o = 8.854 \times 10^{-12}$ C^{2}N^{-1}m^{-2}
$\frac{1}{4\pi\varepsilon_o} = 9 \times 10^9\ Nm^2C^{-2}$
Mass of electron = 9.1×10^{-31} kg
Mass of proton = 1.673×10^{-27} kg
Mass of neutron = 1.675×10^{-27} kg
Avogadro's number = 6.023×10^{23} per gram mole
Boltzmann's constant = 1.38×10^{-23} Jk^{-1}
Rydberg's constant = 1.097×10^7 m^{-1}

Section A

All question are compulsory. In case of internal choices, attempt any one of them.

1 Name the physical constant having unit Am. 1

2 Name the part of electromagnetic spectrum suitable for radar system used in aircraft navigation. 1

OR

Is the ratio of speed of ultra-violet rays and infra-red rays in vacuum more than, less than or equal to one.

3 An electron moving with a velocity of 10^7 m/s enters a uniform magnetic field of 1T, along a direction parallel to the field, what would be its trajectory in this field? 1

4 Can you step-up dc voltage using transformer? 1

5 What is the least wavelength of Balmer series? 1

OR

Calculate highest wavelength of Lyman series.

6 Out of microwaves, ultra-violet rays and infra-red rays which radiation will be most effective for emission of electrons from a metallic surface? 1

7 In the nuclear decay reaction, identify 'X'. 1

$$_1^1H \rightarrow _0^1n + X$$

OR

Write the energy equivalent of 1 amu in MeV.

8 What is the net charge on n-type semiconductor? 1

OR

Name the type of semiconductor when pure semiconductor (Ge) is doped with boron.

9 How does the width of depletion region change in p-n junction in forward biased? 1

10 What is the ratio of number of electrons to the number of holes in intrinsic semiconductor? 1

For question numbers 11, 12, 13 and 14, two statements are given – one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below

(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true R is not the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

11 Assertion:
Electrons move from a region of lower potential to a region of higher potential
Reason:
Since an electron has a negative charge 1

12 Assertion:
An electrical bulb starts glowing instantly as it is switched on.
Reason:
Drift speed of electron in a metallic wire is very large. 1

13 Assertion:
Static crashes are heard on radio, when lightning flesh occurs in the sky.
Reason:
Electromagnetic waves having frequency of radio wave range, interfere with radio waves.1

14 Assertion:
The pattern and position of fringes always remain same even after introduction of transparent medium in a path of one of the slits.
Reason:
The central fringe is bright or dark depends on the initial phase difference between two coherent sources. 1

Section B

Question 15 and 16 are case-study based questions and are compulsory. Attempt any 4 sub parts from each question. Each question carries 1 mark.

15 **Colours of a thin film**

An important characteristics of light waves is to interfere with one another. In daily life interference is demonstrated by the light reflected from a film of oil floating on water. Another example is the soap bubble reflects a variety of beautiful colours when illuminated by natural or artificial light source. These beautiful colours are produced due to interference between the light reflected from the inner surface of bubble and the outer surface both constructively and destructively. The bright colours are seen in soap bubble due to constructive interference.

(i)The colours in thin film of oil floating on water surface is due to

(a)interference
(b)diffraction
(c)polarization
(d)scattering of light

(ii)For constructive interference, the path difference between light waves interfering will be

(a)integral multiple of $\lambda/2$
(b)odd integral multiple of $\lambda/2$
(c)even integral multiple of $\lambda/2$
(d)none of the above

(iii)Interference can be produced by

(a) a single light source
(b) two independent light sources
(c)two coherent sources of light
(d)none of the above

(iv)In interference of light, the intensity of all maxima is

(a)different
(b)same
(c)depends on wavelength of light
(d)none of the above

(v)Interference of light shows:

(a) wave nature of light
(b)particle nature of light
(c)dual nature of light
(d)none of the above

16 **Heating effects of electric current and its applications**

Before we go to school or to attend any function, we ensure that our clothes are not crimped, for this we use an iron to straighten our clothes. The electric iron is the most basic example of heating effects of electric current in our daily life. There are many such other devices on this effect.

Electric bulb: the filament of bulb is generally made of tungsten metal, having high melting point

Electric iron: the element of electric iron is made of alloys having high melting point. Electric heater and geyser work on the same mechanism.

Electric fuse: it is used to the electric appliance from high voltage. It is made of metal or alloys of metals.

(i)The melting point of a fuse wire is kept

(a)low
(b)high
(c)no need to set melting point
(d)none of the above

(ii)The device in which heating effect of current is used

(a)LED bulb (b)electric fan
(c)refrigerator (d)geyser

(iii)Electric fuse wire is working on …….

(a)regulation of voltage in circuit (b) regulation of current in circuit
(c)chemical effect of electric current (d)heating effect of electric current

(iv)When a metallic conductor is heated then the atoms in the metal vibrate with

(a)low amplitude and frequency (b)low amplitude and greater frequency
(c)greater amplitude and frequency (d)greater amplitude and low frequency

(v)What are the special features of a heating wire?

(a)high resistance and high melting point (b)high resistance and low melting point
(c)low resistance and low melting point (d)low resistance and high melting point

Section C

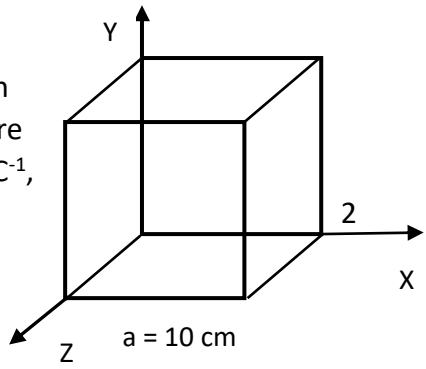
17 An electron revolves in a circular orbit of radius r with angular speed ω. Using the expression of the magnetic field due to a circular current loop, deduce an expression for the magnetic field at the centre of the electron orbit. 2

18 An equiconvex lens of focal length f is cut vertically into two equal halves. Find the focal length of each half of lens. 2

OR

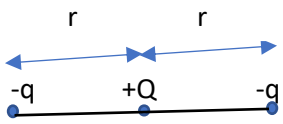
The radii of curvature of the faces of a double convex lens are 10 cm and 15 cm. Its focal length is 12 cm in air. What is the refractive index of the glass?

19 Electric field in figure is directed along positive X-axis and given by $E_x = 5Ax + 2B$, where E is in NC^{-1} and x is in metre, A and B are constants with dimensions. Taking A = 10 $NC^{-1}m^{-1}$ and B = 5 NC^{-1}, calculate the electric flux through the cube of side a = 10cm.



OR

Three charges -q, +Q and -q are placed at equal distances on a straight line as shown in figure. If the potential energy of the system of three charge is zero, find the ratio Q/q



20 Draw a circuit diagram showing the use of a p-n junction as a full wave rectifier. Draw its input and output wave forms. 2

21 A circular coil of radius 7 cm and 20 turns rotates about its vertical diameter with an angular speed of 50 rad/s in a uniform horizontal magnetic field of magnitude 3 x 10-2 T, calculate the maximum value of induced current in the coil, if the coil forms a closed loop of resistance 10 Ω. 2

22 A beam of light consisting of two wavelengths, 650 nm and 520 nm, is used to obtain interference fringes in a Young's double slit experiment. The distance between the two

slits is 2 mm and the distance between the plane of slits and the screen is 1.2 m. What is the least distance from the central maximum where the bright fringes due to both the wavelengths coincide? 2

23 Draw a circuit diagram to show how a photodiode is biased. Draw its characteristics curves for two different illumination intensities I_1 and I_2 ($I_2 > I_1$). 2

24 A biconvex lens of glass of refractive index 1.5 having focal length 20 cm is placed in a medium of refractive index 1.65. Find its focal length in that medium. What should be the value refractive index of a medium in which the lens should be placed so that it acts as a plane sheet of glass? 2

25 A coil of N turns and radius R carries a current I. It is unwound and rewound to make another coil of radius R/2, the current remaining the same. Calculate the ratio of the magnetic moments of the new coil and the original coil. 2

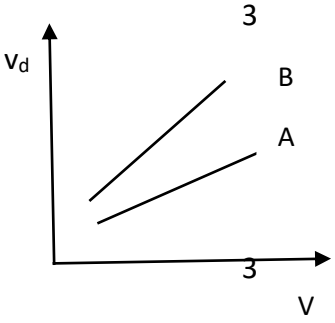
OR

Consider an atom with a single electron revolving around the nucleus in an orbit of radius r with an orbital speed v in anticlockwise direction. Obtain an expression for the magnetic moment for an atomic dipole

Section D

26 A 5m long straight metal rod is kept on a horizontal table along east-west direction. Assuming earth's magnetic field as 0.4 G and angle of dip as 60^0. Calculate induced emf in the rod when it is moved with a velocity of 10 m/s along the direction of
(i)horizontal component of earth's magnetic field
(ii)vertical component of earth's magnetic field 3

27 Variation of drift velocity (v_d) of free electrons with potential difference (V) applied across the ends of a conductor for two wires A and B of same metal and radii are shown in figure.
(a)which of them is longer in length
(b)which of them has lower resistance
(c)what does the slope foe wire A depict? 3



OR

A potential difference of V volt is applied to a conductor of length L and diameter D. How are the electric field E and resistance R of the conductor affected when in turn
(i)V is doubled (ii)L is doubled and (iii)D is doubled. 3

28 The maximum kinetic energy of the photoelectrons gets doubledwhen the wavelength of light incident on the photosensitive surface changes λ_1 to λ_2. Derive the expression for the threshold wavelength λ_o for the metal surface. 3

29 Calculate the maximum wavelength of the radiation which can ionize the hydrogen atom in ground state. If radiation of wavelength less than the maximum wavelength is absorbed by the hydrogen atom in ground state, will it ionize the hydrogen atom and provide kinetic energy to the emitted electron? 3

30 (a)The radius of a nucleus having mass number16 is 3 fm. What will be the radius of another nucleus of mass number 128?
(b)Two protons each having a kinetic energy K, are fired at each other. What must K be if the particles are brought to rest by their mutual coulomb repulsion? Assume that a proton to be a sphere of radius r = 1 fm. 3

Section E

All questions are compulsory. In each of internal choices, attempt any one.

31 State Gauss's law in electrostatics. Using this law obtain the expression for electric field due to an infinitely long straight thin charged wire with uniform linear charge density λ C/m. Draw electric field with perpendicular distance from the charged wire. 5

OR

(a)Define electric dipole moment of an electric dipole. Write its SI unit.

(b)An electric dipole is kept in a uniform electric field E. Diagrammatically represent the position of dipole in stable and unstable equilibrium and write the expression for the torque acting on the dipole and potential energy of dipole in both the cases.

32 (a)You are given three circuit elements X, Y and Z. When the element X is connected across an ac source of a given voltage, the current and voltage are in same phase. When the element Y is connected in series with X across the source, current lags behind the voltage in phase by $\pi/4$ rad and when Z is connected in series with X across the source, current leads the voltage in phase by $\pi/4$ rad. Identify the circuit elements X, Y and Z.

(b)When all the three elements are connected in series across the same source, determine the impedance of the circuit.

(c)Draw a plot of the current with the frequency of applied source and mention the significance pf this plot. 5

OR

A device X is connected across an ac source of voltage V = Vo sin ωt. The current through X is given as I = Io sin (ωt+π/2).

(a)Identify the device X and write expression for its reactance .

(b)How does the reactance of X vary with frequency of ac? Show this variation graphically.

(c)Draw graphs showing the variation of voltage and current with time over one cycle of X.

(d)Draw phasor diagram for the device X

33 (a)Draw a ray diagram showing the image formation of a distant object by a refracting telescope when final image is formed at infinity. Write formula of its magnifying power.

(b)Draw a schematic diagram of a reflecting telescope. State two advantages of reflecting telescope over refracting telescope. 5

OR

(a)Draw intensity pattern in single slit diffraction pattern. Show that the width of the central maximum in single slit diffraction experiment is twice the width of the first secondary maximum.

(b)Write two characteristic features distinguishing the diffraction pattern from interference fringes obtained in Young's double slit experiment.