



ROLL NO.	
NAME	
CLASS & SECTION	

APEEJAY COMMON PRE-BOARD EXAMINATION, 2019-20

14

CLASS-XII

PHYSICS

Time allowed : 3 hrs.

Maximum Marks : 70

General Instructions :

1. All questions are compulsory. There are 37 questions in total.
2. Section A contains twenty questions which are of objective type carrying one mark each, Section B contains seven questions of two marks each, Section C contains seven questions of three marks each and Section D contains three questions of five marks each.
3. There is no overall choice. However, an internal choice has been provided in two questions of one mark, two questions of two marks, one question of three marks and three questions of five mark each. You have to attempt only one of the choices in such questions
4. You may use the following values of the physical constants wherever necessary:

$$c = 3 \times 10^8 \text{ m/s}$$

$$h = 6.63 \times 10^{-34} \text{ Js}$$

$$e = 1.6 \times 10^{-19} \text{ C}$$

$$\mu_0 = 4\pi \times 10^{-7} \text{ Tm A}^{-1}$$

$$\epsilon_0 = 8.854 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$$

$$\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ Nm}^2 \text{ C}^{-2}$$

$$\text{Mass of electron} = 9.1 \times 10^{-31} \text{ Kg}$$

$$\text{Mass of neutron} = 1.675 \times 10^{-27} \text{ Kg}$$

$$\text{Mass of proton} = 1.672 \times 10^{-27} \text{ Kg}$$

$$\text{Avogadro Number} = 6.023 \times 10^{23} \text{ gram mol}^{-1}$$

$$\text{Boltzmann constant} = 1.38 \times 10^{-23} \text{ JK}^{-1}$$

P.T.O.

SECTION-A

- A proton and an electron are placed in a uniform electric field. Choose the correct option.
 - The electric forces acting on them will be equal.
 - The magnitude of the forces will be equal.
 - Their accelerations will be equal.
 - The magnitudes of their accelerations will be equal.
- The electric field and electric potential at a point are E and V respectively.
 - If $E = 0$, V must be zero.
 - If $E \neq 0$, V cannot be zero.
 - If $V = 0$, E must be zero.
 - If $V \neq 0$, E cannot be zero.
- The net resistance of an ammeter should be small to ensure that
 - It does not get overheated.
 - It does not draw excessive current.
 - It can measure large currents.
 - It does not appreciably change the current to be measured.
- A charged particle moves along a circle under the action of possible constant electric and magnetic fields. Which of the following are possible?
 - $E = 0$, $B = 0$
 - $E \neq 0$, $B \neq 0$
 - $E = 0$, $B \neq 0$
 - $E \neq 0$, $B = 0$
- Which of the following particles will experience maximum magnetic force (magnitude) when projected with the same velocity perpendicular to a magnetic field?
 - Electron
 - Proton
 - He^+
 - Li^{++}
- A bar magnet is released from rest along the axis of a very long, vertical copper tube. After some time, the magnet
 - will stop in the tube.
 - will move with almost constant speed.
 - will move with an acceleration g .
 - will oscillate.
- A rod of length l rotates with a uniform angular velocity ω about its perpendicular bisector. A uniform magnetic field B exists parallel to the axis of rotation. The potential difference between the two ends of the rod is :

- (a) zero (b) $\frac{1}{2}Bl\omega^2$
 (c) $Bl\omega^2$ (d) $2Bl\omega^2$
8. A capacitor acts as an infinite resistance for :
 (a) DC (c) AC
 (b) DC as well as AC (d) neither AC nor DC
9. The work function of a metal is $h\nu_0$. Light of frequency ν falls on this metal. Photoelectric effect will take place only if
 (a) $\nu \geq \nu_0$ (b) $\nu > 2\nu_0$
 (c) $\nu < \nu_0$ (d) $\nu < \nu_0 / 2$
10. A proton and an electron are accelerated by the same potential difference. Let λ_e and λ_p denote the de Broglie wavelengths of the electron and proton respectively.
 (a) $\lambda_e = \lambda_p$
 (b) $\lambda_e < \lambda_p$
 (c) $\lambda_e > \lambda_p$
 (d) The relation between λ_e and λ_p depends on the accelerating potential difference.

Directions (Q.11–Q.15) Fill in the blanks with appropriate answer.

11. The SI unit of electric flux is _____
12. An optical fibre is based on the phenomenon of _____
13. The susceptibility of a magnetic material is -4.2×10^{-6} . The type of magnetic material it represents is _____.
14. In Young's double slit experiment, if red light is replaced by green light keeping the other experimental factors (D and d) remains same, then fringe width will _____
15. A paramagnetic material is kept in a magnetic field. The field is increased till the magnetization becomes constant. If the temperature is now decreased, the magnetization _____

OR

Horizontal and vertical components of earth's magnetic field at a place are equal. The angle of dip at that place is _____.

Directions (Q.16 –Q.20) Answer the following

16. Write the necessary condition for obtaining stable interference pattern on the screen?
17. Which physical quantity in a nuclear reaction is considered equivalent to the Q value of the reaction?

OR

The initial concentration of a radioactive substance is N_0 and its half life is 12 hours. What will be its concentration after 36 hours?

18. An electron is accelerated through a potential difference of 100 V, find the de-Broglie wavelength associated with it.
19. A glass of refractive index 1.5 is placed in a trough of liquid. What must be refractive index of the liquid in order to make the lens disappear?
20. How does the angle of minimum deviation of a glass prism vary, if the incident Violet light is replaced with red light?

(SECTION : B)

21. Calculate the electrostatic potential energy for a system of three positive point charges placed at the corners of an equilateral triangle of side 'a'.
22. A 100 V battery is connected across a $2\mu\text{F}$ and $3\mu\text{F}$ capacitor in series. Calculate the potential difference across each capacitor and total energy.
23. How is the mutual inductance of pair of coils affected when :
 - (i) Number of turns in each coil is increased.
 - (ii) A thin iron sheet is placed between the coils.(In both the cases all the other factors remains unchanged)
24. What is Brewster's angle? Derive relation between Brewster angle and refractive index of medium which produces Plane Polarized light.

OR

Define wavefront. Draw the geometrical shape of the wavefronts when,

- (i) light diverges from a point source,
 - (ii) light emerges out of convex lens when a point source is placed at its focus.
25. Which special type of diode can act as a voltage regulator ? Give the symbol of this diode and draw the general shape of its V-I characteristics.

OR

Draw energy band diagram of p & n type semiconductors. Also write two differences between p and n type semiconductors.

26. Show diagrammatically the behaviour of magnetic field lines in the presence of
- (i) diamagnetic and (ii) paramagnetic substances.
- Also, give one example of diamagnetic and paramagnetic material.

27. Find the energy equivalent of one atomic mass unit in joules and then in MeV.

(SECTION : C)

28. What do you mean by **Displacement current**? Explain how the addition of displacement current term in the Ampere's circuital law remove the inconsistency in it.

29. A small compass needle of magnetic moment ' m ' is free to turn about an axis perpendicular to the direction of uniform magnetic field ' B '. The moment of inertia of the needle about the axis is ' I '. The needle is slightly disturbed from its stable position and then released. Prove that it executes simple harmonic motion. Hence deduce the expression for its time period.

OR

Deduce the expression of torque experienced by a rectangular loop carrying a steady current I placed in a uniform magnetic field B . Also indicate the direction of the torque acting on the loop.

30. An inductor of 200 mH , capacitor of $400 \mu\text{F}$ and a resistor of 10Ω are connected in series to ac source of 50 V of variable frequency. Calculate the

(i) angular frequency at which maximum power dissipation occurs in the circuit and the corresponding value of the effective current and

(ii) value of Q-factor in the circuit.

31. What is the effect on the interference fringes in a Young's double-slit experiment due to each of the following operations, (Explain giving reasons)

(a) The screen is moved away from the plane of the slits.

(b) The (monochromatic) source is replaced by another (monochromatic) source of shorter wavelength.

(c) The separation between the two slits is increased.

32. Light of intensity I and frequency ν is incident on a photosensitive surface and causes photoelectric emission. Justify with the help of graph, the effect on photoelectric current when

(i) the intensity of light is gradually increased

(ii) the frequency of incident radiation is increased

(iii) the anode potential is increased

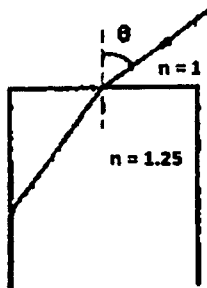
In each case, all other factors remain the same.

33. Using Gauss's theorem obtain an expression for electric field intensity due to a plane sheet of charge. What is the direction of field for positive and negative charge densities?

34. (a) Energy of electron in first excited state in Hydrogen atom is -3.4eV . Find KE and PE of electron in the ground state.
- (b) Derive an expression for the radius of n th Bohr's orbit in Hydrogen atom.

SECTION-D

35. (a) Draw a ray diagram of a compound microscope when the final image is formed at the least distance of distinct vision. Also, derive the expression for the magnifying power.
- (b) A compound microscope has an objective of focal length 1 cm and an eyepiece of focal length 2.5 cm . An object has to be placed at a distance of 1.2 cm away from the objective for normal adjustment. Find the angular magnification and the length of the microscope tube.



OR

Explain the terms spherical aberrations and chromatic aberrations. Which type of aberrations are not present in spherical mirrors? Consider the situation shown in figure. Find the maximum angle θ for which the light suffers total internal reflection at the vertical surface.

36. What are non Ohmic materials? Give two examples. Explain how the resistivity of copper changes with temperature. The resistances of an iron wire and a copper wire at 20°C are $3.9\ \Omega$ and $4.1\ \Omega$ respectively. At what temperature will the resistances be equal? Temperature coefficient of resistivity for iron is $5.0 \times 10^{-3}\ \text{K}^{-1}$ and for copper it is $4.0 \times 10^{-1}\ \text{K}^{-1}$. Neglect any thermal expansion.

OR

- (a) The resistance of an ideal ammeter and ideal voltmeter should be zero and infinite respectively. Why?
- (b) A voltmeter coil has resistance $50\ \Omega$ and a resistor of $1.15\ \text{k}\Omega$ is connected in series. It can read potential differences upto $12\ \text{volts}$. If this same coil is used to construct an

ammeter which can measure currents upto 2 A, what should be the resistance of the shunt used?

37. On the basis of Band theory of solids differentiate between conductors, Semiconductors and Insulators. Also draw the energy band diagrams for the case of conductors, insulators and semiconductors. Explain how the conductivity of an intrinsic semiconductor changes with the temperature?

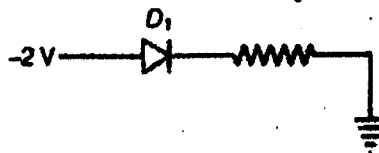
OR

Draw the forward bias and reverse bias curves of a diode. A diode acts like a copper wire in forward bias. Why? What happens to the width of the depletion layer in p-n junction when it is :

(a) forward biased

(b) reverse bias

Also, identify the type of biasing in the following circuit



BEST OF LUCK!