Test 11

CLASS : XII **SUBJECT: PHYSICS**

TIME: 3 hrs **M.M: 70**

General Instructions:

1. **There are 35 questions in all. All questions are compulsory**
2. **This question paper has five sections: Section A, Section B, Section C, Section D and Section E. All the sections are compulsory.**
3. **Section A contains fifteen MCQ and three Assertion-Reason of 1 mark each, Section B contains seven questions of two marks each, Section C contains five questions of three marks each, section D contains three long questions of five marks each and Section E contains two case study based questions of 4 marks each.**
4. **There is no overall choice. However, an internal choice has been provided in section B, C, D and E. You have to attempt only one of the choices in such questions.**
5. **You may use the following values of physical constants where ever necessary.**

c = 3 X 10^8 m/s

h = 6.63 X 10^{-34} Js

e = 1.6 X 10^{-19} C

μ_o = 4π X 10^{-7} TmA^{-1}

ε_o= 8.854 X 10^{-12} $C^2N^{-1}m^{-2}$

$\frac{1}{4\pi\varepsilon_o}$ = 9 X 10^9 Nm^2C^{-2}

m_e = 9.1 X 10^{-31} kg

mass of neutron = 1.675 X 10^{-27} kg

mass of proton = 1.673 X 10^{-27} kg

Avogadro's number = 6.023 X 10^{23} per gram mole

Boltzmann constant = 1.38 X 10-23 JK^{-1}

Section- A

1. The unit of electric potential is volt and it is equal to:

   (a) Joule/Coulomb (b) joule. Coulomb (c) Coulomb/joule (d)None of these

2. The magnetic field in a plane electromagnetic wave is given by:

   $$B_y = 2 \times 10^{-7} \sin(0.5 \times 10^3 + 2\pi \times 23.9 \times 10^9\ t)\ T$$

   The frequency of the wave is:

   (a) $0.5 \times 10^3 Hz$ (b) $2\pi \times 0.5 \times 10^3 Hz$
   (c) $23.9 \times 10^9 Hz$ (d) $2\pi \times 23 \times 10^9 Hz$

3. Which of the material is most suitable for making connecting wires:

   (a) Nichrome (b) Tungsten (c)Copper (d)Manganese

4. The phase difference between electric field and magnetic field in an electromagnetic wave is:

   (a) π (b) zero (c) $\frac{\pi}{2}$ (d) $\frac{\pi}{4}$

5. If the magnetic field is parallel to positive Y-axis and charged particle is moving along positive X-axis. The Lorentz force acts along negative Z -axis. The charge particle can be:

   (a) an electron (b) a proton (c) an alpha particle (d) both (b) and (c)

6. Which of the following is true for a conductor:

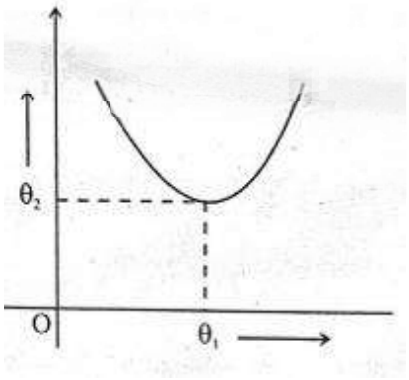
   (a) Inside a charged conductor, electrostatic field is zero
   (b) At the surface of a charged electrostatic potential is zero
   (c) The interior of a conductor can have excess charge in static situation
   (d) Electrostatic potential is constant throughout the volume of the solid conductor

7. The A proton and an α-particle have the same de Broglie wavelength. What is same for both of them?

   (a) Mass (b) Energy (c) Frequency (d) Momentum

8. Plot of an angle θ_1 versus angle θ_2 is given for a triangular prism. The angle θ_1 & θ_2 respectively known as :

   (a) angle of incidence and angle of reflection
   (b) angle of incidence and angle of emergence
   (c) angle of incidence and angle of prism
   (d) angle of incidence and angle of deviation



9. A 44mH inductor is connected to 220V , 50Hz ac supply. The net power absorbed over a complete cycle will be:

   (a) 0W (b)4.4W (c)2400W (d)1100W

10. Threshold wavelength for a metal having work function W0 is λ. What is the threshold wavelength for a metal having work function 2 W0?

    (a) 4λ (b) 2 λ (c) λ/2 (d) λ/4

11. When a forward bias is applied to a p-n junction, it

(a) raises the potential barrier. (b) reduces the majority carrier current to zero.
(c) lowers the potential barrier. (d) None of the above.

12. Two point charges +2C and +6C repel each other with a force of 12 newton. If a charge of – 4C is given to each of these charges the force now is

(a)Zero (b)4 N (attractive) (c)12 N (attractive) (d)8 N (repulsive)

13. In photoelectric effect, the K.E of photoelectrons emitted is proportional to

(a) Intensity of incident beam (b) frequency of incident beam
(c) Velocity of incident beam (d) work function of photocathode.

14. If V_G, V_X, V_M are the speed of gamma rays, X-rays and microwaves respectively in vacuum then:

(a) $V_G > V_X > V_M$ (b) $V_G < V_X < V_M$

(c) $V_G > V_X < V_M$ (d) $V_G = V_X = V_M$

15. For a closed surface the Gauss's law is_____
(a) independent of shape of the surface
(b) Independent of size of the surface
(c) Both a and b.
(d) None of these.

For question numbers 16, 17, and 18, 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 but 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

16. Assertion(A): As work function of a material increases by some mechanism, it requires greater energy to eject the electrons from its surface.

Reason(R): A plot of stopping potential (V) versus frequency (v) for different materials, has greater slope for metals with greater work functions

17. Assertion(A): Nuclear force is same between neutron-proton, proton-proton & neutron-neutron.

Reason(R):Nuclear force is charge independent.

18. Assertion(A): In a metallic wire if we increase the temperature of wire the resistance of the wire also increases.
Reason(R): On increasing the temperature thermal velocity of electrons increases and relaxation time period decreases in this way number of collision increases.

Section- B

19. Draw a plot showing the variation of binding energy per nucleon with mass number Write two important conclusions that you can draw from this plot.

20. Draw the circuit diagram of full wave rectifier adnd also draw its input and output wave forms.

OR

How is forward biasing different from reverse biasing in a p-n junction diode?

21. Use Kirchhoff's rule to obtain balance condition in Wheatstone bridge.

22. Three identical specimen of magnetic material Nickle, antimony and aluminium are kept in uniform magnetic field. Draw the modification of filed lines in each case. Which magnetic property distinguish this behaviour of magnetic field lines?

23. de Broglie wavelength associated with an electron accelerated through a potential difference V is λ. What will be de Broglie wavelength when the accelerating potential is increased to 4 V?

Or

Work function of Sodium is $2.3eV$. Does Sodium show Photoelectric emission for orange light ($\lambda = 6800\text{Å}$)

24. A convex lens of focal length f dipped in the trasparenbt liquid of refractive index μ_l. If refractive index of liquid is more than that of glass. Show that the focal length of lens increases in liquid.

Or

Establish the relation $\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$ for two co-axial thin lens in contact with each other.

25. Using bio savart law, find the expression for magnetic field at the centre of a circular loop .

Section- C

26. What do you mean by power of a lens? Give its unit also. A converging lens has a focal length of 20 cm when immersed in water. What is its nature and power? (Absolute refractive index of glass = 1.5 and absolute refractive index of water = 1.33)

Or

A point object is placed in front of a convex refracting surface. Derive the expression for u , v and R for this surface.

27. Define drift velocity of electron. Using drift velocity deduce Ohm's Law.

28. The Biot-Savart law for magnetic field has certain similarities as well as differences with coulomb's law for electrostatic field. Write any three such points for similarities and differences.

29. A circular coil of radius 10 cm 500 turns and resistance 2 ohm is places with the plane perpendicular to a magnetic field $3 \times 10^{-5} T$. It is rotated about vertical diameter through $180°$ in 0.25 s. Estimate the magnitude of average emf induced in the coil.

30. Find the ratio of longest & shortest wavelengths of Balmer series.

Or

Using Bohr's postulates of atomic model, derive the expression of radius of nth orbit. Hence find the Bohr's radius.

Section- D

31.

a) Draw a labelled diagram showing the formation of image at least distance of distinct vision by a compound microscope. Hence obtain expression for its magnifying power.

b) A small object is placed at a distance of 3.0 cm from a magnifier of focal length 4.0 cm. Find:

i. The position of image formed
ii. The linear magnification produced.

Or

a) With the help of a ray diagram explain the working of reflecting type telescope. Mention two advantages of reflecting telescope over a refracting telescope.

b) A small telescope has an objective lens of focal length 1.4 m and an eye piece of focal length 5.0 cm. calculate magnifying power of telescope when telescope is in normal adjustment.

32.

a) Derive an expression for intensity of electric field due to an electric dipole at any point on its equatorial line.

b) Two point charges $Q_A = 3\mu C$ and $Q_B = -3\mu C$ are located 20 cm apart in vacuum. Calculate electric field at the mid-point of the line joining two charges.

Or

a) Using Gauss's law, derive an expression for electric field near a infinite long straight conductor.
b) Two large metal plate are parallel and close to each other. On their inner faces, the plates have surface charge densities of opposite sign and of magnitude 17×10^{-22} C/m^2 . Calculate the electric field between the plates.

33.

a) Write the principles of working of an a.c generator. Derive and expression for induced emf in it.

b) The armature in a.c generator has 200 turns and area 0.1 m^2 Calculate the angular speed of coil , so that the peak value of induced emf is 250 V. The coil is rotated in a magnetic field of 0.25 Tesla.

Or

For an ideal conductor connected across an ac voltage source,state with reason,which of the following quantities will be zero?

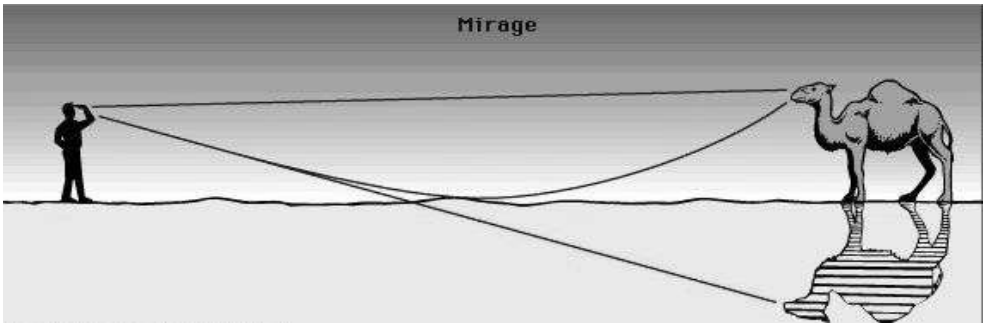
a) Instantaneous Power,

(b) Average power over full cycle of the ac voltage source

Section- E

34. Mirage:A mirage is a naturally occurring optical phenomenon in which light rays bend via refraction to produce a displaced image of distant objects or the sky. Under certain conditions, such as over a stretch of pavement or desert air heated by intense sunshine, the air rapidly cools with elevation and therefore increases in density and refractive power. Sunlight reflected downward from the upper portion of an object for example, the top of a camel in the desert—will be directed through the cool air in the normal way. Although the light would not be seen ordinarily because of the angle, it curves upward after it enters the rarefied hot air near the ground, thus being refracted to the observer's eye as though it originated below the

heated surface. A direct image of the camel is seen also because some of the reflected rays enter the eye in a straight line without being refracted. The double image seems to be that of the camel and its upside-down reflection in water. When the sky is the object of the mirage, the land is mistaken for a lake or sheet of water.



1. Write two application of TIR.

2. Write essential condition for TIR.

3. Two lens of power +5D and -3D are placed in contact. Finbd the focal length of the combination.

4. Draw the graph angle of incidence and angle pof deviation for a prism.
OR
Define critical angle and write its relation b/w refractive index.

35. p-n junction is a semiconductor diode. It is obtained by bringing p-type semiconductor in close contact with n- type semiconductor. A thin layer is developed at the p- n junction which is devoid of any charge carrier but has immobile ions. It is called depletion layer. At the junction a potential barrier appears, which does not allow the movement of majority charge carriers across the junction in the absence of any biasing of the junction. p-n junction offers low resistance when forward biased and high resistance when reverse biased.

1. What is the electric field at the middle of depletion layer of reverse biased p- n junction. [1]

2. Define potential barrier.
OR
Name the minority charge carrier in extrinsic semiconductor [1]
3. Draw the enrgy band diagram for P type and N type semiconductor. [2]