PRACTICE QUESTION PAPER PHYSICS -2
CLASS - XII

General Instructions

(1) There are 33 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.
(3) All the sections are compulsory.
(4) Section A contains sixteen questions, twelve MCQ and four Assertion Reasoning based of **1** mark each, Section B contains five questions of two marks each, Section C contains seven questions of three marks each, Section D contains two case study-based questions of four marks each and Section E contains three long answer questions of five marks each.
(5) There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, one question in each CBQ in Section D and all three questions in Section E. You have to attempt only one of the choices in such questions.
(6) Use of calculators is not allowed.
(7) You may use the following values of physical constants where ever necessary

i. $c = 3 \times 10^8$ m/s
ii. $m_e = 9.1 \times 10^{-31}$ kg
iii. $m_p = 1.7 \times 10^{-27}$ kg
iv. $e = 1.6 \times 10^{-19}$C
v. $\mu_0 = 4\pi \times 10^{-7}$ T m$\mathbf{A^{-1}}$
vi. $h = 6.63 \times 10^{-34}$ J s
vii. $\varepsilon_0 = 8.854 \times 10^{-12}\mathbf{C^2N^{-1}m^{-2}}$
viii. Avogadro's number $= 6.023 \times \mathbf{10^{23}}$ per gram mole

SECTION : A **(16×1 = 16)**

1. An electric dipole is placed at an angle of 30° with an electric field of intensity $2 \times 10^5 NC^{-1}$. It experiences a torque equal to 4 Nm . Calculate the charge on the dipole if the dipole length is 2 cm .
   (a) 8 mC (b) 4mC (c)8μC (d)2mC
2. A hollow metal sphere of radius 5 cm is charged such that the potential on its surface is 10 V. The potential at the centre of the sphere is
   (a) zero
   (b) 10 V
   (c) same as at a point 5cm away from the surface
   (d) same as at a point 25cm away from the surface
3. The distance at which the magnetic field on axis as compared to the magnetic field at the centre of the coil carrying current I and radius R is $\frac{1}{8}$, would be
   (a) R (b) $\sqrt{2}$R (c) 2 R (d) $\sqrt{3}$R
4. The magnetic susceptibility of magnetic materials A and B are -0.085 and 0.9853 respectively, then
   (a) A is diamagnetic and B is paramagnetic
   (b) A is paramagnetic and B is ferromagnetic
   (c) A is paramagnetic and B is diamagnetic
   (d) A is ferromagnetic and B is diamagnetic
5. The magnetic flux through a circuit of resistance R changes by an amount $^{\Delta\phi}$ in time Δt, Then the total quantity of electric charge Q, which passing during this time through any point of the circuit is given by
   (a) $Q = \frac{\Delta\phi}{\Delta t}$ (b) $Q = \frac{\Delta\phi}{\Delta t} \times R$ (c) $Q = -\frac{\Delta\phi}{\Delta t} + R$ (d) $Q = \frac{\Delta\phi}{R}$
6. Electromagnetic waves travelling in a medium having relative permeability $\mu_r = 1.3$ and relative permittivity $E_r = 2.14$. The speed of electromagnetic waves in medium must be
   (a) 1.8×10^8 ms^{-1} (b) 1.8×10^4 ms^1 (c) 1.8×10^6 ms^1 (d) 1.8×10^2 ms^{-1}

7. The quantity $\sqrt{\mu_0 \varepsilon_0}$ represents
   (a) speed of sound (b) speed of light in vacuum
   (c) speed of e.m. waves (d) inverse of speed of light in vacuum
8. A convex lens is dipped in a liquid, whose R.I. is equal to that of R.I. of material of the lens. Then its focal length will:
   (a) become zero (b) become infinite (c) reduce (d) increase
9. The refracting angle of a prism is A and the refractive index of material of prism is cot (A/2). The angle of minimum deviation is
   (a) $180° - 3A$ (b) $180° + 2A$ (c) $90° - A$ (d) $180° - 2A$
10. An object is placed at a distance of 40 cm from a concave mirror of focal length 15 cm . If the object is displaced through a distance of 20 cm towards the mirror, the displacement of the image will be:
   (a) 30 cm away from the mirror (b) 36 cm away from the mirror
   (c) 30 cm towards the mirror (d) 36 cm towards the mirror
11. The kinetic energy of the electron in an orbit of radius r in a hydrogen atom is (e= electron charge) as
   (A) $\frac{e^2}{r^2}$ (B) $\frac{e}{r}$ (C) $\frac{e^2}{2r}$ (D) $\frac{e^2}{r^3}$
12. When p-n junction diode is forward biased then
   (a) both the depletion region and barrier height are reduced
   (b) the depletion region is widened and barrier height is reduced
   (c) the depletion region is reduced and barrier height is increased
   (d) Both the depletion region and barrier height are increased

For Questions 13 to 16, two statements are given -one labelled Assertion (A) and other labelled Reason (R). Select the correct answer to these questions from the options as given below.
A. If both Assertion and Reason are true and Reason is the correct explanation of Assertion.
B. If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
C. If Assertion is true but Reason is false.
D. If both Assertion and Reason are false.

13. **Assertion:** When current through a bulb is increased by 2% power increases by 4%
   Reasoning: Current passing through the bulb is $\propto \frac{1}{\text{resistance}}$
14. **Assertion :** Two photons of equal wavelength must have equal linear momentum.
   Reason : Two photons of equal linear momentum will have equal wavelength
15. **ASSERTION:** According to Bohr's atomic model the ratio of angular momenta of an electron in first excited state and in ground state is 2:1.
   REASON: In a Bohr's atom the angular momentum of the electron is directly proportional to the principal quantum number.
16. **Assertion (A):**Thermonuclear fusion reactions may become the source of unlimited power for mankind.
   Reason (R): A single fusion event involving isotopes of hydrogen produces more energy than energy from nuclear fission of $^{235}_{93}U$

[SECTION - B] **[05X2=10]**

17. Two electric bulbs have the following specifications
   (i) 100 W at 220 V
   (ii) 1000 W at 220 V.
   Which bulb has higher resistance? What is the ratio of their resistance?
18. Define neutral point. Draw lines of force when two identical magnets are placed at a finite distance apart with their N-poles facing each other. Locate the neutral points.
19. An particle and *a* proton are accelerated by same potential difference. Find ratio of their de Broglie wavelengths.

OR

19 The wavelength $\lambda$of a photon and the de Broglie wavelength of an electron of mass m have the same value. Show that the energy of the photon is 2λmc/h times the kinetic energy of the electron, where c and h have their usual meanings.

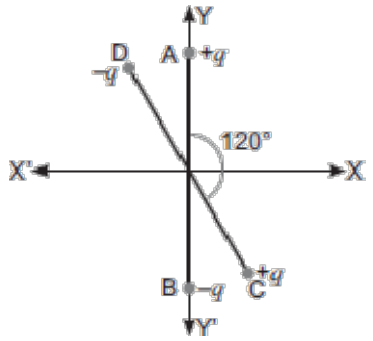
20. A nucleus with mass number A = 240 and BE/A = 7.6 MeV breaks into two fragments each of A = 120 with BE/A = 8.5 MeV. Calculate the released energy

21. What is the focal length of a convex lens of focal length 30cm in contact with a concave lens of focal length 20cm ? Is the system a converging or a diverging lens? Ignore thickness of the lenses.

[SECTION - C] **(07x3=21 marks)**

22. (a) "The outward electric flux due to charge +Q is independent of the shape and size of the surface which encloses it." Give two reasons to justify this statement.
(b) Two identical circular loops ' 1 ' and ' 2 ' of radius R each have linear charge densities $-\lambda$ and $+\lambda$C/m respectively. The loops are placed coaxially with their centres R$\sqrt{3}$ distance apart. Find the magnitude and direction of the net electric field at the centre of loop ' 1 '.

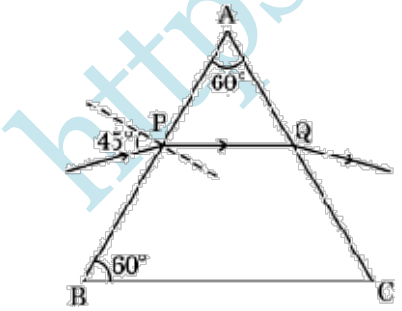
23. Two small identical electrical dipoles AB and CD each of dipole moment $\vec{p}$ are kept at an angle of 120° as shown in the figure. What is the resultant dipole moment of this combination ? If this system is subjected to electric field ($\vec{E}$) directed along +X direction, what will be the magnitude and direction of the torque acting on this?



24. A variable frequency 230 V alternating voltage source is connected across a series combination of L = 5H, C = 80μ F and R = 40Ω. Calculate
(a) Angular frequency of the source which drives the circuit in resonance
(b) Impedance of the circuit
(c) Amplitude of current at resonance.

25. (a) "If the slits in Young's double slit experiment are identical, then intensity at any point on the screen may vary between zero and four times to the intensity due to single slit". Justify the above statement through a relevant mathematical expression. (b) Draw the intensity distribution as function of phase angle when diffraction of light takes place through coherently illuminated single slit.

26. A ray of light is incident on a prism at an angle of 45° and passes symmetrically as shown in the figure, Calculate.



(a) the angle of minimum deviation,

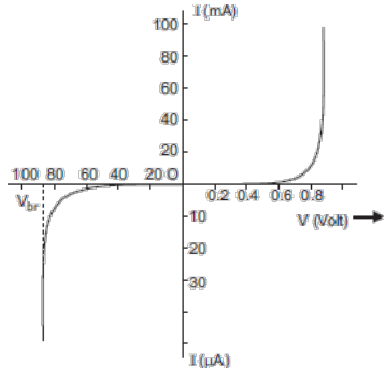
(b) the refractive index of the material of the prism, and
(c) the angle of refraction at the point P.

OR

26 A ray of light is refracted by a glass prism, Obtain an expression for the refractive index of the glass in terms of the angle of prism A and the angle of minimum deviation δm.

27. (i) Describe the working of Light Emitting Diodes (LEDs).
(ii) Which semiconductors are preferred to make LEDs and why?
(iii)Give two advantages of using LEDs over conventional incandescent low power lamps.

28. The figure below, shows the V-I characteristics of a semiconductor diode.



(i)Identify the semiconductor diode used.
(ii) Draw the circuit diagram to obtain the given characteristic of this device.
(iii) Briefly explain, how this diode can be used as a voltage regulator.

[SECTION D] **[02X4=8]**

29. Read the paragraph given below and answer questions that follows Lens is a transparent medium bunded by two refracting surfaces, at least one of which must be spherical surface. The focal length of a lens is determined by its radii of curvature and refractive index of lens and surrouding medium. Ability of a lens to converge or diverge beam of light is called power of lens.

I. A point object is placed in air at a distance 'R' in front of a convex spherical refracting surface of radius of curvalce 'R'. If the medium on the other side of surface is glass then the image is-
(a) real and formed in glass (b) real and formed in air
(c) virtual and formed is glass (d) virtual and formed is air

II. The focal length of an equiconvey lens is f. When cut into two equal pieces perpendicular to principal axis the focal length of each half is-
(a) f (b) 2f (c) f/2 (d) 4f

III. Focal length of a lens in air is 10 cm. When it is immersed in water, the focal length will become. (μ_L= 3/2, $\mu\mu_\omega$ = 4/3)
(a) 2.5 cm (b) 20 cm (c) 40 cm (d) 5 cm

IV. Two convex of focal lengths 20 cm and 30 cm are kept in contact. The focal length of combination is-
(a) 60 cm (b) 12 cm (c) 50 cm (d) 10 cm
OR
Which of the following is ture-
(a) A convey lens is always a converging lens
(b) A concave lens is always a diverging lens
(c) Both (a) and (b)
(d) Neither (a) nor (b)

30. Case Study Based Questions
When light of sufficiently high frequency is incident on a metallic surface, electrons are emitted from the

metallic surface. This phenomenon is called photoelectric emission. Kinetic energy of the emitted photoelectrons depends on the wavelength of incident light and is independent of the intensity of light. Number of emitted photoelectrons depends on intensity. (h h − ϕ) is the maximum kinetic energy of emitted photoelectrons (where ϕ is the work function of metallic surface). Reverse effect of photo emission produces X-ray. X-ray is not deflected by electric and magnetic fields. Wavelength of a continuous X-ray depends on potential difference across the tube. Wavelength of characteristic X-ray depends on the atomic number.

(i) Einstein's photoelectric equation is

(a) $E_{max} = hv - \phi$ (b) $E = mc^2$

(c) $E^2 = p^2c^2 + m_0{}^2c^4$ (d) $E = \frac{1}{2}mv^2$

(ii) Light of wavelength λ which is less than threshold wavelength is incident on a photosensitive material. If incident wavelength is decreased so that emitted photoelectrons are moving with some velocity then stopping potential will

(a) increase (b) decrease (c) be zero (d) become exactly half

(iii) When ultraviolet rays incident on metal plate then photoelectric effect does not occur, it occur by incident of

(a) Infrared rays
(b) X-rays
(c) Radio wave
(d) Micro wave

(iv) If frequency ($v > v_0$) of incident light becomes n times the initial frequency (v), then K.E. of the emitted photoelectrons becomes (v_0 threshold frequency).

(a) n times of the initial kinetic energy
(b) More than n times of the initial kinetic energy
(c) Less than n times of the initial kinetic energy
(d) Kinetic energy of the emitted photoelectrons remains unchanged

OR

(iv) A monochromatic light is used in a photoelectric experiment. The stopping potential

(a) Is related to the mean wavelength
(b) Is related to the shortest wavelength
(c) Is not related to the minimum kinetic energy of emitted photoelectrons
(d) Intensity of incident light

[SECTION E] **(03X5=15)**

31. (a) Using Gauss's law derive an expression for the electric field intensity at any point near a uniformly charged thin wire of charge/length λC/m.
(b) A wire AB of length L has linear charge density λ = K x λ = , where x is measured from the end A of the wire. This wire is enclosed by a Gaussian hollow surface. Find the expression for electric flux through the surface

OR

31(a) Use Gauss' law to derive the expression for the electric field vector (E) due to a straight uniformly charged infinite line of charge density λC/m.
(b) Draw a graph to show the variation of E with perpendicular distance r from line of charge.
(c) Find the work done in bringing a charge q from perpendicular distance r_1 to r_2(r_2>r_1).

32. In an LCR series combination R= 400 Ω L =100 mH and C = 1μF. This combination is connected to a 25 sin 2000 t volt voltage source . Find
(a) Calculate Inductive Reactance (X_L)
(b) Calculate Capacitive Reactance (X_C)
(c) Calculate the Impedance (Z)
(d) Calculate the Peak Value of the Circuit Current (I_0)

OR

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(a) A series LCR circuit is connected to an ac source. Using the phasor diagram, derive the expression for the impedance of the circuit. Plot a graph to show the variation of current with frequency of the source, explaining the nature of its variation.

(b) Obtain the resonant frequency and Q-factor of a series LCR circuit with L = 3.0H, C = 27μ F, and R = 7.4Ω. It is desired to improve the sharpness of the resonance of the circuit by reducing its 'full width at half maximum' by a factor of 2 . Suggest a suitable way.

33. (a) Derive lens maker's formula for a biconvex lens.

(b) point object is placed at a distance of 12cm on the principal axis of a convex lens of focal length 10cm. A convex mirror is placed coaxially on the other side of the lens at a distance of 10cm. If the final image coincides with the object, sketch the ray diagram and find the focal length of the convex mirror.

OR

33

(i)A small telescope has an objective lens of focal length 140 cm and an eyepiece of focal length 5.0 cm. What is the magnifying power of the telescope for viewing distant objects when the telescope is in normal adjustment (i.e., when the final image is at infinity)?

(ii)Draw a labeled diagram for a refracting type astronomical telescope.

How will its magnifying power be affected by increasing (a) the focal length and (b) the aperture of eyepiece? Justify your answer