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CREATING AND SETTING EXAMPLES FOR FUTURE...

CLASS XII : SAMPLE QUESTION PAPER - 1
SUBJECT: PHYSICS (042)

Time Allowed: 3 Hours **Maximum Marks: 70**

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 fivequestions 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 mA^{-1} vi. $h = 6.63 \times 10^{-34}$ J s

vii. $\varepsilon_0 = 8.854 \times 10^{-12}$ C^{2}N^{-1} m^{-2} viii. Avogadro's number = 6.023×10^{23} per gram mole

SECTION — A

The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

1. In a *p-n* junction diode, change in temperature due to heating

(a) affects only reverse resistance (b) affects only forward resistance

(c) does not affect resistance of *p-n* junction (d) affects the overall *V - I* characteristics of *p-n* junction

2. A positively charged particle is released from rest in a uniform electric field. The electric potential energy of the charge

(a) remains a constant because the electric field is uniform.

(b) increases because the charge moves along the electric field.

(c) decreases because the charge moves along the electric field.

(d) decreases because the charge moves opposite to the electric field.

3. A monochromatic beam of light passes from a denser medium into a rarer medium. As a result

(a) Velocity increases (b) Velocity decreases

(c) Frequency decreases (d) Wavelength decreases

4. If the maximum kinetic energy of emitted photoelectrons from a metal surface of work function 2.5 eV, is 1.7 eV. If wavelength of incident radiation is halved, then stopping potential will be

(a) 2.5 V (b) 6.7 V (c) 5.9 V (d) 1.1 V

5. Relation between magnetic moment and angular velocity is

(a) $M \propto \omega$ (b) $M \propto \omega^2$ (c) $M \propto \sqrt{\omega}$ (d) None of these

6. Light of wavelength 6000 Å in air enters a medium of refractive index 1.5. What will be its frequency in the medium?
(a) 5×10^{14} Hz
(b) 3×10^{12} Hz
(c) 7×10^{15} Hz
(d) 9×10^{13} Hz

7. The lowest Bohr orbit in hydrogen atom has
(a) the maximum energy
(b) the least energy
(c) infinite energy
(d) zero energy

8. Match column I and column II according to the measure of their stabilities.

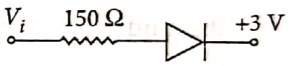
Column I		Column II	
(A)	A = 10, B.E = 100	(P)	Most stable nuclei
(B)	A = 5, B.E = 60	(Q)	Moderately stable nuclei
(C)	A = 6, B.E = 66	(R)	Least stable nuclei

(a) (A) → (R); (B) → (P); (C) → (Q)
(b) (A) → (R); (B) → (Q); (C) → (P)
(c) (A) → (P); (B) → (Q); (C) → (R)
(d) (A) → (P); (B) → (R); (C) → (Q)

9. Conductivity of semiconductors
(a) is maximum at 0 K
(b) decreases with increase in temperature
(c) increases with increase in temperature
(d) is maximum at 300 K

10. Two point charges placed in a medium of dielectric constant 5 are at a distance r between them, experience an electrostatic force 'F'. The electrostatic force between them in vacuum at the same distance r will be
(a) $5F$ (b) F (c) $F/2$ (d) $F/5$

11. In the circuit shown assume the diode to be ideal.
When V_i increases from 2 V to 6 V, the change in the current is (in mA)



(a) zero (b) 20 (c) 80/3 (d) 40

12. In a certain double slit experimental arrangement, interference fringes of width 1 mm each are observed when light of wavelength 5000 Å is used. Keeping the setup unaltered, if the source is replaced by another of wavelength 6000 Å, the fringe width will be
(a) 1.2 mm (b) 0.5 mm (c) 1 mm (d) 1.5 mm

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 (A) :** The product of magnetic susceptibility and absolute temperature for a paramagnetic substance is a constant.
Reason (R) : The magnetic susceptibility of a paramagnetic material does not depend on temperature.

14. **Assertion (A) :** A reflecting type telescope is preferred in astronomy.
Reason (R) : Weight of the mirrors are less as compared to the lenses.

15. **Assertion (A) :** It is essential that all the lines available in the emission spectrum will not be available in the absorption spectrum.
Reason (R) : The spectrum of hydrogen atom is only absorption spectrum.

16. **Assertion (A) :** V - I characteristic of p-n diode is same as that of any other conductor.
Reason (R) : p-n diode behave as conductor at room temperature.

SECTION B

17. (I) *P*, *Q*, *R* and *S* are four resistance wires of resistances 2, 2, 2 and 3 ohms respectively. Find out the resistance with which *S* must be shunted in order that bridge may be balanced.

OR

(II) An aluminium wire of diameter 0.24 cm is connected in series to a copper wire of diameter 0.16 cm. The wires carry an electric current of 10 A. Find out current density in the aluminium wire.

18. Define mass defect of nucleus. How is it related to the binding energy of the nucleus?

19. How are wrist watches protected from powerful magnets?

20. What is the shape of the wavefront in each of the following cases:

(a) Light diverging from a point source.

(b) Light emerging out of a convex lens when a point source is placed at its focus.

21. How does the mutual inductance of a pair of coil change when

(i) the number of turns of each coil is decreased

(ii) the distance between the coils is increased

(iii) a thin iron sheet is placed between the two coils and other factors remaining the same?

SECTION C

22. A thin metallic wire of resistance 100 Ω is immersed in a calorimeter containing 250 g of water at 10°C and a current of 0.5 ampere is passed through it for half an hour. If the water equivalent of the calorimeter is 10 g, find the rise of temperature.

23. (a) What is excitation of electron?

(b) What is the difference in energy for a hydrogen atom with its electron in the ground state and a hydrogen atom with its electron in the $n = 3$ state?

24. (a) A potential difference of 250 volt is applied across the plates of a capacitor 10 pF. Calculate the charge on the plates of the capacitor.

(b) Distinguish between a dielectric and a conductor.

25. A coil of cross-sectional area *A* lies in a uniform magnetic field *B* with its plane perpendicular to the field. In this position the normal to the coil makes an angle of 0° with the field. The coil rotates at a uniform rate to complete one rotation in time *t*. Find the average induced emf in the coil during the interval when the coil rotates from

(i) 90° to 180° position and

(ii) 270° to 360° position

OR

(a) Write SI unit of magnetic flux. Is it a scalar or a vector quantity?

(b) When is the magnetic flux taken as positive or negative?

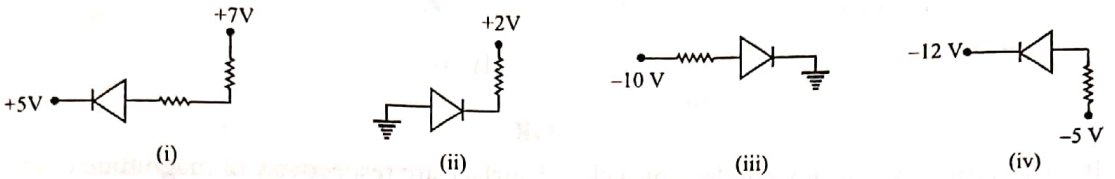
26. A device *X* is connected across an AC source of voltage $V = V_0 \sin \omega t$. The current through *X* is given as $I = I_0 \sin\left(\omega t + \frac{\pi}{2}\right)$.

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

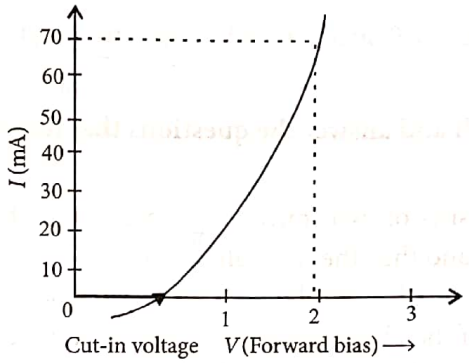
(b) Draw the phasor diagram for the device *X*.

27. (a) What is displacement current?
(b) What is the cause of formation of displacement current?
(c) You are given a 2 μF parallel plate capacitor. How would you establish an instantaneous displacement current of 1 mA in the space between its plates?

28. (a) In the following diagrams, indicate which of the diodes are forward biased and which are reverse biased?



(b) The *V-I* characteristic of a silicon diode is given in the figure. Calculate the diode resistance in forward bias at $V = +2$ volts.



SECTION D

Case Study Based Questions

29. **Read the following paragraph and answer the questions that follow.**

Gauss's Law

Gauss's law gives the net flux of an electric field in a closed surface. According to this law, the surface integral of electrostatic field $\vec{E}$ produced by any source over any closed surface S enclosing a volume V in vacuum *i.e.*, the total electric flux over the closed surface S in vacuum, is $1/\varepsilon_0$ times the total charge (Q) contained inside S. The charges inside S may be point charges or even continuous charges. There is no contribution to total electric flux from the charges outside S. Further, the location of Q inside S does not affect the value of surface integral. The surface chosen to calculate the surface integral is called Gaussian surface, while selecting such a surface, we shall avoid charges on S itself.

Gauss's law is based on inverse square dependence of E on distance *i.e.*, $E \propto \frac{1}{r^2}$.

(i) Eight dipoles of charges of magnitude e are placed inside a cube. The total electric flux coming out of the cube will be

(a) $\frac{8e}{\varepsilon_0}$ (b) $\frac{16e}{\varepsilon_0}$ (c) $\frac{e}{\varepsilon_0}$ (d) zero

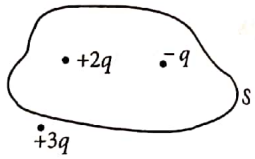
(ii) According to Gauss's theorem, the total outward normal flux over a closed surface is equal to
(a) the positive charge enclosed within the surface
(b) $1/\varepsilon_0$ times the net charge outside the surface
(c) $1/\varepsilon_0$ times the total charge enclosed within the surface
(d) the charge density on the surface.

(iii) The total electric flux emanating from a closed surface enclosing an alpha particle is

(a) $3.6 \times 10^{-8}\ Nm^2C^{-1}$ (b) $1.8 \times 10^{-8}\ Nm^2C^{-1}$

(c) $3.6 \times 10^{-6}\ Nm^2C^{-1}$ (d) $1.8 \times 10^{-6}\ Nm^2C^{-1}$

(iv) Figure shows three point charges + $2q$, $-q$ and + $3q$. What is the electric flux due to this configuration of charge through S ?



(a) $\frac{q}{\varepsilon_0}$ (b) $\frac{4q}{\varepsilon_0}$

(c) $\frac{3q}{\varepsilon_0}$ (d) 0

OR

If the electric flux entering and leaving a closed surface are respectively of magnitude ϕ_1 and ϕ_2, then the electric charge inside the surface is

(a) 0 (b) $(\phi_2 - \phi_1)\varepsilon_0$

(c) $(\phi_2 + \phi_1)\varepsilon_0$ (d) $\frac{(\phi_2 - \phi_1)}{\varepsilon_0}$

30. Read the following paragraph and answer the questions that follow.

Compound Microscope

A compound microscope consists of two converging lenses. One of them, of smaller aperture and smaller focal length is called objective and the other of slightly larger aperture and slightly larger focal length is called eye-piece. Both the lenses are fitted in a tube with an arrangement to vary the distance between them. A tiny object is placed in front of the objective at a distance slightly greater than its focal length. The objective produces the image of the object which acts as an object for the eye-piece. The eye piece, in turn produces the final magnified image.

(i) In a compound microscope the images formed by the objective and the eye-piece are respectively

(a) virtual, real (b) real, virtual

(c) virtual, virtual (d) real, real

(ii) The magnification due to a compound microscope does not depend upon

(a) the aperture of the objective and the eye-piece

(b) the focal length of the objective and the eye-piece

(c) the length of the tube

(d) the colour of the light used

(iii) Which of the following is not correct in the context of a compound microscope?

(a) Both the lenses are of short focal lengths.

(b) The magnifying power increases by decreasing the focal lengths of the two lenses.

(c) The distance between the two lenses is more than $(f_o + f_e)$.

(d) The microscope can be used as a telescope by interchanging the two lenses.

(iv) A compound microscope consists of an objective of $10x$ and an eye-piece of $20x$. The magnification due to the microscope would be

(a) 2 (b) 10 (c) 30 (d) 200

OR

The focal lengths of objective and eye-piece of a compound microscope are 1.2 cm and 3.0 cm respectively. The object is placed at a distance of 1.25 cm from the objective. If the final image is formed at infinity, the magnifying power of the microscope would be

(a) 100 (b) 150

(c) 200 (d) 250

SECTION E

31. (a) Derive the formula of magnification in terms of focal length and distance of image from the mirror.
(b) Use the mirror equation to show that an object placed between f and $2f$ of a concave mirror forms an image beyond $2f$.

OR

Show that the emergent ray from a glass slab is parallel to incident ray. Explain and drive a relation for lateral shift through a glass slab.

32. (a) Derive an expression for magnetic field inside, directed along the axis of an air cored solenoid.
(b) Sketch the magnetic field lines for a finite solenoid. How are these field lines different from the electric field lines for an electric dipole?

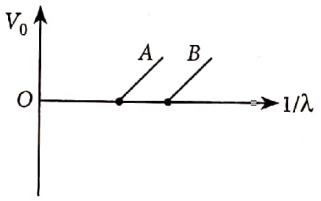
OR

(a) State Biot-Savart's law and express it in the vector form.
(b) Using Biot-Savart's law, obtain the expression for the magnetic field due to circular coil carrying a current at a point along its axis.

33. Write the conclusions of de-Broglie hypothesis.

OR

Figure shows the stopping potential (V_0) for the photo electron versus ($1/\lambda$) graph, for two metals A and B, λ being the wavelength of incident light.



(a) How is the value of Planck's constant determined from the graph?
(b) If the distance between the light source and the surface of metal A is increased, how will the stopping potential for the electrons emitted from it be effected? Justify your answer.