Class XII | Session 2026-27
Subject - Physics
Sample Question Paper - Set 9

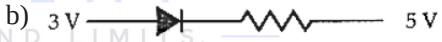
General Instructions:

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.

Section A

1. A forward biased diode is **[1]**

a) 

b) 

c) 

d) 

2. A cell of constant emf is first connected to a resistance R_1 and then connected to a resistance R_2. If power delivered in both cases is same, then the internal resistance of the cell is: **[1]**

a) $\sqrt{R_1 R_2}$

b) $\sqrt{\frac{R_1}{R_2}}$

c) $\frac{R_1 - R_2}{2}$

d) $\frac{R_1 + R_2}{2}$

3. Magnifying power of a compound microscope is high if **[1]**

a) both objective and eye-piece have long focal lengths

b) the objective has a long focal length and eye-piece has a short focal

c) the objective has a short focal length and the eye-piece has a long focal

d) both objective and eye-piece have short focal lengths

4. Which of the following has its permeability less than that of free space? **[1]**

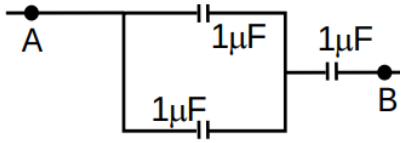
a) Copper chloride

b) Nickel

c) Aluminium

d) Copper

5. Three capacitors each of $1\mu\ F$ are connected as shown in figure. The capacitance between the point A and B: **[1]**



a) $(2/3)\mu F$

b) $(1/3)\mu F$

c) $1\mu\ F$

d) $3\mu\ F$

6. If electron velocity is $2\hat{i} + 3\hat{j}$ and it is subjected to magnetic field of $4\hat{k}$, then its **[1]**

a) path will change

b) speed will change

c) path will not change

d) both path will change and speed will change

7. Two coils are placed closed to each other. The mutual inductance of the pair of coils depends upon: **[1]**

a) the rates at which currents are changing in the two coils

b) the material of the wires of the coils

c) the currents in the two coils

d) relative position and orientation of the two coils

8. The force between two magnetic poles is F. If the distance between the poles and pole strengths of each pole are doubled, then the force experienced is: **[1]**

a) $\frac{F}{4}$

b) 2F

c) F

d) $\frac{F}{2}$

9. The refractive index of glass is 1.5. Which of the two colors red or violet travels slower in a glass prism? **[1]**

a) both red and violet travel slower at the same speed

b) red component of white light travels slower than the violet component

c) both red and violet travel faster at the different speed

d) violet component of white light travels slower than the red component

10. A point charge of $100\mu C$ is placed at $3\hat{i} + 4\hat{j}m$. Find the electric field intensity due to this charge at a point located at $9\hat{i} + 12\hat{j}m$: **[1]**

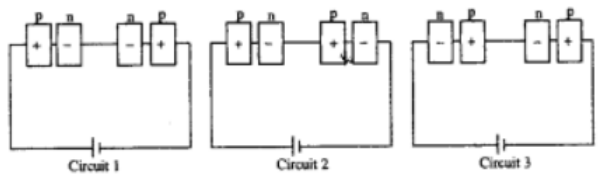
a) $4500Vm^{-1}$

b) $8000Vm^{-1}$

c) $9000Vm^{-1}$

d) $2250Vm^{-1}$

11. Two identical p-n junctions may be connected in series with a battery in three ways as shown. The potential drops across the two p-n junctions are equal in **[1]**



a) circuit 3 only

b) circuit 1 only

c) circuit 1 and 2

d) circuit 2 and 3

12. The minimum distance between an object and its real image formed by a convex lens of focal length f is: **[1]**

a) 3f

b) 4f

c) 2f d) f

13. **Assertion (A):** The photoelectrons produced by a monochromatic light beam incident on a metal surface have a spread in their kinetic energies. **[1]**

Reason (R): The energy of electrons emitted from inside the metal surface, is lost in collision with the other atoms in the metal.

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 but R is true.

14. **Assertion (A):** Electron move away from a region of lower potential to a region of higher potential. **[1]**

Reason (R): An electron has a negative charge.

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 but R is true.

15. **Assertion (A):** In Young's double slit experiment the fringes become indistinct if one of the slits is covered with cellophane paper. **[1]**

Reason (R): The cellophane paper decreases the wavelength of light.

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 but R is true.

16. A resistor, a capacitor, and an inductor are connected in series. The combination is connected across an ac source of frequency 50 Hz. **[1]**

Assertion (A): Peak current through each remains the same.

Reason (R): Average power delivered by source is equal to average power developed across the resistance.

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 but R is true.

Section B

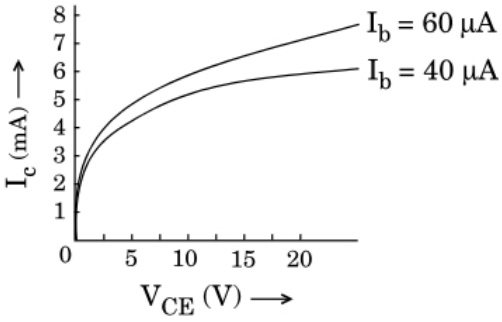
17. Find the wavelength of electromagnetic waves of frequency 5×10^{19} Hz in free space. Give its two applications. **[2]**

18. A bar magnet placed in a uniform magnetic field of strength 0.3T with its axis at 30° to the field, experiences a torque of 0.06 Nm. What is the magnetic moment of the bar magnet? **[2]**

OR

A bar magnet 30 cm long is placed in the magnetic meridian with its north pole pointing geographical south. The neutral point is found at a distance of 30 cm from its centre. Calculate the pole strength of the magnet. Given B_H = 0.34 G.

19. The output characteristics of an n-p-n transistor in common emitter configuration is as shown in the figure. **[2]**



a. Find the emitter current at V_{CE} = 10.0 V and I_b = 40 μA, and

b. Current gain β at this point.

20. Suppose you are given a chance to repeat the alpha-particle scattering experiment using a thin sheet of solid hydrogen in place of the gold foil. (Hydrogen is a solid at temperatures below 14 K). What results do you expect? **[2]**

21. Depict the field-line pattern due to a current-carrying solenoid of finite length. **[2]**

i. In what way do these lines differ from those due to an electric dipole?

ii. Why can't two magnetic field lines intersect each other?

Section C

22. A cell of emf E and internal resistance r is connected across a variable resistor R. Plot a graph showing variation of terminal voltage V of the cell versus the current I. Using the plot, show the emf of the cell and its internal resistance can be determined. **[3]**

23. a. State briefly, with what purpose was Davisson and Germer experiment performed and what inference was drawn from this. **[3]**

b. Obtain an expression for the ratio of the accelerating potentials required to accelerate a proton and an α-particle to have the same de-Broglie wavelength associated with them.

24. Draw the circuit diagram of a full wave rectifier. Explain its working showing its input and output waveforms. **[3]**

25. How are protons, which are positively charged, held together inside a nucleus? Explain the variation of the potential energy of a pair of nucleons as a function of their separation. State the significance of negative potential energy in this region? **[3]**

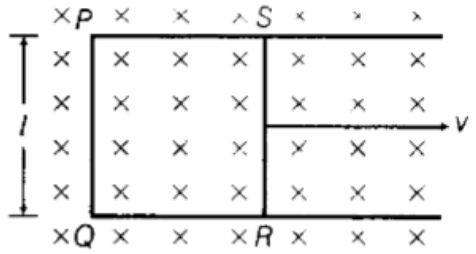
26. a. How is the stability of hydrogen atom in Bohr model explained by de-Broglie's hypothesis? **[3]**

b. A hydrogen atom initially in the ground state absorbs a photon which excites it to n = 4 level. When it gets de-excited, find the maximum number of lines which are emitted by the atom. Identify the series to which these lines belong. Which of them has the shortest wavelength?

27. Explain by drawing a suitable diagram that the interference pattern in a double-slit is actually a superposition of single-slit diffraction from each slit. **[3]**

Write two basic features that distinguish the interference pattern from those seen in a coherently illuminated single slit.

28. Figure shows a rectangular conducting loop PQRS in which arm RS of length I is movable. The loop is kept in a uniform magnetic field B directed downward perpendicular to the plane of the loop. The arm RS is moved with a uniform speed v. **[3]**



Deduce an expression for

i. the emf induced across the arm RS

ii. the external force required to move the arm and

iii. the power dissipated as heat.

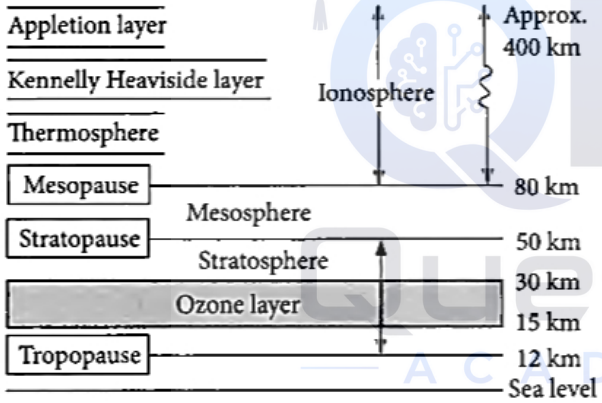
OR

Deduce an expression for the mutual inductance of two long coaxial solenoids but having different radii and different number of turns.

Section D

29. **Read the text carefully and answer the questions:** **[4]**

Radio waves are produced by the accelerated motion of charges in conducting wires. Microwaves are produced by special vacuum tubes. Infrared waves are produced by hot bodies and molecules also known as heat waves. UV rays are produced by special lamps and very hot bodies like Sun.



(a) Solar radiation is

i. transverse electromagnetic wave

ii. longitudinal electromagnetic waves

iii. both longitudinal and transverse electromagnetic waves

iv. none of these.

a) Option (iii) b) Option (ii)

c) Option (iv) d) Option (i)

(b) What is the cause of greenhouse effect?

a) X-rays b) Ultraviolet rays

c) Infrared rays d) Radiowaves

(c) Biological importance of ozone layer is

a) It layer reduces greenhouse effect b) it stops ultraviolet rays

c) it reflects radiowaves d) none of these.

OR

Earth's atmosphere is richest in

a) ultraviolet b) X-rays

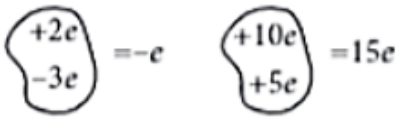
c) microwaves d) infrared

(d) Ozone is found in

a) mesosphere b) ionosphere

c) stratosphere d) troposphere

30. The smallest charge that can exist in nature is the charge of an electron. During friction, it is only the transfer of electrons that makes the body charged. Hence net charge on anybody is an integral multiple of the charge of an electron [1.6×10^{-19} C] i.e. **[4]**



q = ±ne

where n = 1, 2, 3, 4,...

Hence nobody can have a charge represented as 1.1e, 2.7e, $\frac{3}{5}$e, etc.

Recently, it has been discovered that elementary particles such as protons or neutrons are composed of more elemental units called quarks.

i. Find the number of electrons if the body has 3.2×10^{-18} C of charge.

ii. If a charge on a body is 1 nC, then how many electrons are present on the body?

iii. If a body gives out 10^9 electrons every second, how much time is required to get a total charge of 1 C from it?

iv. A polythene piece rubbed with wool is found to have a negative charge of 3.2×10^{-7} C. Calculate the number of electrons transferred.

Section E

31. a. Draw the ray diagram showing the refraction of light through a glass prism and hence obtain the relation between the refractive index μ of the prism, angle of prism and angle of minimum deviation. **[5]**

b. Determine the value of the angle of incidence for a ray of light travelling from a medium of refractive index $\mu_1 = \sqrt{2}$ into the medium of refractive index μ_2 = 1, so that it just grazes along the surface of separation.

OR

i. Write three characteristic features to distinguish between the interference fringes in Young's double-slit experiment and the diffraction pattern obtained due to a narrow single slit.

ii. A parallel beam of light of wavelength 500 nm falls on a narrow slit and the resulting diffraction pattern is observed on a screen 1 m away. It is observed that the first minima are at a distance of 2.5 mm away from the centre. Find the width of the slit.

32. a. Derive an expression for the potential energy of an electric dipole in a uniform electric field. Explain conditions for stable and unstable equilibrium. **[5]**

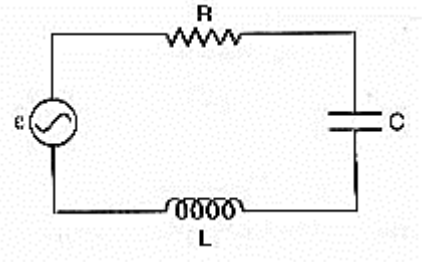
b. Is the electrostatic potential necessarily zero at a point where the electric field is zero? Give an example to support your answer.

OR

a. Deduce the expression for the energy stored in a charged capacitor

b. Show that the effective capacitance C of a series combination of three capacitors C_1, C_2 and C_3 is given by $\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$.

33. A series of LCR circuit is connected to a variable frequency 230 V source, L = 5.0 H, $C = 80\mu F$, $R = 40\Omega$ **[5]**



i. Determine the source frequency which drives the circuit in resonance.

ii. Obtain the impedance of the circuit and the amplitude of current at the resonating frequency.

iii. Determine the rms potential drops across the three elements of the circuit. Show that the potential drop across the LC combination is zero at the resonating frequency.

OR

i. Draw a labelled diagram of a step-up transformer. Obtain the ratio of secondary to primary voltage in terms of the number of turns and currents in the two coils.

ii. A power transmission line feeds input power at 2200 V to a step-down transformer with its primary windings having 3000 turns. Find the number of turns in the secondary to get the power output at 220 V.