PHYSICS

A Highly Simulated Practice Question Paper for CBSE Class XII Examination

Time : 3 hrs | Max. Marks : 70

General Instructions

1. All questions are compulsory. There are 33 questions in all.
2. This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
3. **Section A** contains ten very short answer questions and four assertion reasoning MCQs of 1 mark each, **Section B** has two case based questions of 4 marks each, **Section C** contains nine short answer questions of 2 marks each, **Section D** contains five short answer questions of 3 marks each and **Section E** contains three long answer questions of 5 marks each.
4. There is no overall choice. However internal choice is provided. You have to attempt only one of the choices in such questions.

SECTION-A

All questions are compulsory. In case of internal choices, attempt anyone of them.

1. Two lenses are in contact having powers of 5D and −3 D. Find the focal length of this combination.

Or

A concave lens of focal length 5 cm produces an image $\frac{1}{4}$ times than that of the size of the object. Calculate the distance of the object from the lens.

2. Electromotive force of primary cell is 2.4 V. When cell is short-circuited, then current becomes 4 A. What is the internal resistance of cell?

3. Two identical induction coils, each of inductance L joined in series are placed very close to each other such that the winding direction of one is exactly opposite to that of other. Find the net inductance.

Or

A copper loop and a silver loop are removed from a magnetic field in the same time-interval. In which loop will the induced emf and induced current be greater?

4. What is the electric field intensity at a point between two parallel plates with like charges of same surface charge densities (σ)?

Or

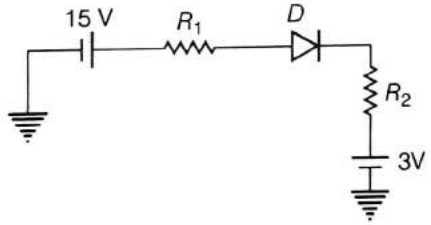
A parallel plate capacitor is made by stacking n equally spaced plates connected alternatively. If the capacitance between any two adjacent plates is C, then find the resultant capacitance.

5. What changes occur in electrical conductivity of a pure semiconductor, on heating?

6. What is the number of neutrons in a $_{84}Po^{218}$ nucleus?

7. A platinum wire has resistance of 10Ω at 0°C and of 20Ω at 273°C. Find the temperature coefficient of resistance of platinum wire.

8. In the following diagram, is the junction diode forward biased or reverse biased?

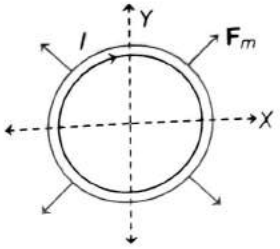


9. What is the electrostatic potential at the surface of a silver nucleus of diameter 12.4 fermi? Atomic number (Z) for silver is 47.

10. A circular coil of 30 turns and radius 8 cm carrying a current of 6 A is suspended vertically in a uniform horizontal magnetic field of magnitude 1 T. The field lines make an angle 60° with the normal of the coil. Calculate the magnitude of the counter torque that must be applied to prevent the coil from turning.

Or

A conducting loop carrying a current I is placed in a uniform magnetic field pointing into the plane of the paper as shown in figure. What changes occur in the loop?



For question numbers 11, 12, 13 and 14, 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.

11. Assertion Susceptibility is defined or the ratio of intensity of magnetisation I to magnetic intensity H.

Reason Greater the value of susceptibility smaller value of intensity magnetisation I.

12. Assertion Inductance coil are made of copper.

Reason Induced current is more in wire having less resistance.

13. Assertion Atoms of each element are stable and emit characteristic spectrum.

Reason The spectrum provides useful information about the atomic structure.

14. Assertion The applied voltage (in forward bias of a p-n junction) mostly drops across the depletion region and the voltage drop across the p-side and n-side of the junction is negligible.

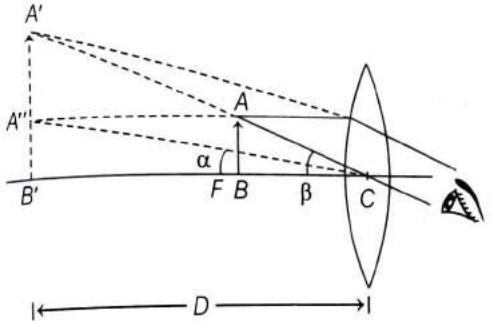
Reason Resistance of depletion region is large compared to resistance of n or p-side.

SECTION-B

Questions 15 and 16 are case study based questions and are compulsory. Attempt any 4 sub parts from each question. Each question carries 1 mark.

Simple Microscope

15. Microscope is an optical instrument which forms large image of close and minute objects. A simple microscope is a converging lens of small focal length. When an object is at a distance less than the focal length of the lens, the image obtained is virtual, erect and magnified. When the object is at a distance equal to the focal length of the lens, the image is formed at infinity.



(i) A simple microscope has a limited maximum magnification

(a) greater than 9 (b) lesser than 9

(c) equal to 9 (d) Both (b) and (c)

(ii) In order to increase the angular magnification of a simple microscope, one should increase

(a) the object size

(b) the aperture of the lens

(c) the focal length of the lens

(d) the power of the lens

(iii) The image formed by an objective of a compound microscope is

(a) virtual and diminished

(b) real and diminished

(c) real and enlarged

(d) virtual and enlarged

(iv) The distance between the second focal point of the objective f_o and first focal point of the eyepiece, i.e. f_e is called

(a) tube length

(b) focal length

(c) image distance

(d) radius of curvature

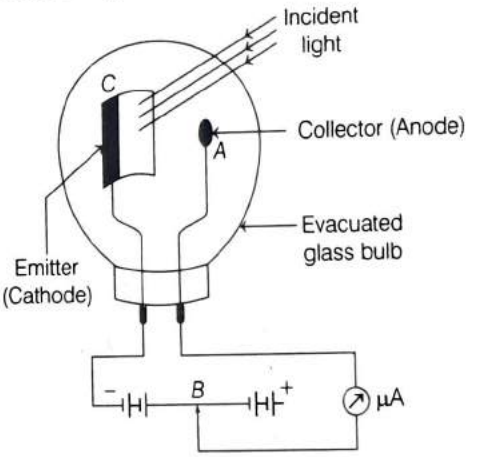
(v) For compound microscope, $f_o = 1$ cm, $f_e = 2.5$ cm. An object is placed at distance 1.2 cm from object lens. What should be the length of microscope for normal adjustment?

(a) 8.5 cm (b) 8.3 cm

(c) 6.5 cm (d) 6.3 cm

Photocell

16. Photocell is a device which converts light energy into electrical energy. It is also called an electric eye. As, the photoelectric current sets up in the photoelectric cell corresponding to incident light, it provides the information about the objects as has been seen by our eye in the presence of light.



A photocell consists of a semi-cylindrical photosensitive metal plate C (emitter) and a wire loop A (collector) supported in an evacuated glass or quartz bulb. When light of suitable wavelength falls on the emitter C, photoelectrons are emitted.

(i) A photocell cannot be used

(a) for reproduction of sound in moiton pictures

(b) in burglar alarms

(c) as a fire alarm

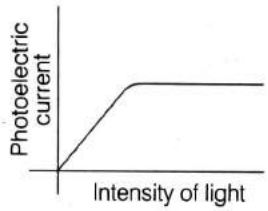
(d) to illuminate a room

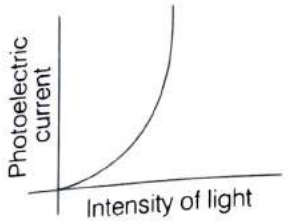
(ii) It is observed that no electrons are emitted when frequency of light is less than a certain minimum frequency. This minimum frequency depends on

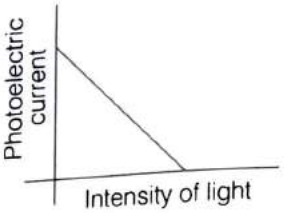
(a) potential difference of emitter and collector plates
(b) distance between collector and the emitter plate
(c) size (area) of the emitter plate
(d) material of the emitter plate

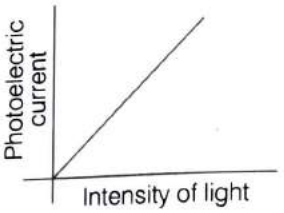
(iii) The work function of a metal used in photocell is hc/λ_0. If light of wavelength λ is incident on its surface, then the essential condition for the electron to come out from the metal surface is
(a) $\lambda \geq \lambda_0$
(b) $\lambda \geq 2\lambda_0$
(c) $\lambda \leq \lambda_0$
(d) $\lambda \leq \lambda_0/2$

(iv) Variation of photoelectric current with intensity of light for a photocell is

(a)


(b)


(c)


(d)


(v) A photon of energy 3.4 eV is incident on a metal surface of a photocell whose work function is 2 eV. Maximum kinetic energy of the photoelectron emitted by the metal surface will be
(a) 1.4 eV (b) 1.7 eV
(c) 5.4 eV (d) 6.8 eV

SECTION-C

All questions are compulsory. In case of internal choices, attempt anyone.

17. For spherically symmetrical charge distribution with charge density varying as $\rho(x) = \rho_0\left(\frac{5}{4} - \frac{x}{R}\right)$

where, $x < r$, upto $r = R$
The electric field at a distance $(r < R)$ comes out to be $E = \frac{\rho_0 r}{4\varepsilon_0}\left(\frac{5}{3} - \frac{r}{R}\right)$

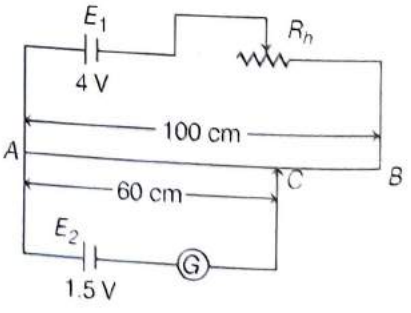
Justify the relation obtained.

18. The bombardment of lithium with protons gives rise to the following reaction

$${}^{7}_{2}\text{Li} + {}^{1}_{1}\text{H} \longrightarrow {}^{4}_{2}\text{He} + {}^{4}_{2}\text{He} + \text{Energy}$$

The atomic masses of lithium, hydrogen and helium are 7.016 amu, 1.008 amu and 4.004 amu, respectively. Find the initial energy of each helium atom. (Take, 1 amu = 931 MeV/c^2)

19. A battery E_1 of 4 V and a variable resistance R_h are connected in series with the wire AB of the potentiometer. The length of the wire of the potentiometer is 1m. When a cell of emf 1.5 V is connected between the points A and C, no current flows through the galvanometer. Length of AC = 60 cm.



(i) Find the potential difference between the ends A and B of the potentiometer.
(ii) Would the method work, if the battery E_1 is replaced by a cell of emf of 1 V?

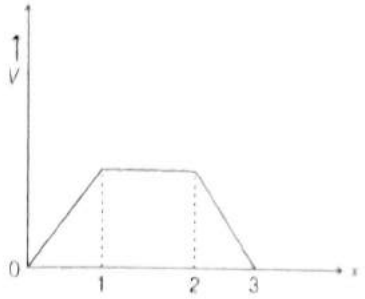
Or

(i) Two wires of equal lengths, one of copper and other of manganin have the same resistance. Which wire will be thicker?

(ii) How does the drift velocity of electrons in a metallic conductor vary with the increase in temperature?

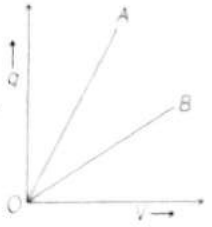
20. What are extrinsic semiconductors? Write the names and types of dopants.

21. The electric potential V as a function of distance x is shown in the figure. Construct a graph of the electric field strength E *versus* distance x.



Or

The graph shows the variation of charge q *versus* potential difference V for two capacitors, C_1 and C_2. The two capacitors have the same plate separation but the plate area of C_2 is double than that of C_1.



Which of the lines in the graph corresponds to C_2 & C_1 and why?

22. A small telescope has an objective lens of focal length 150 cm and an eyepiece of focal length 5 cm. If this telescope is used to view a 100 m high tower 3 km away, find the height of the final image, when it is formed 25 cm away from the eyepiece and magnification of telescope is 36.

23. (i) Name the electromagnetic waves which

(a) maintain the earth's warmth and

(b) are used in aircraft navigation.

(ii) To which regions of the electromagnetic spectrum do the following wavelength belong

(a) 250 nm (b) 1500 nm

Or

Show that the radiation pressure exerted by an EM wave of intensity I on a surface kept in vacuum is $\frac{I}{c}$.

24. Define the terms

(i) Mass defect

(ii) What is the role of shielding material in a nuclear reactor?

25. If light of wavelength, $\lambda = 4000$ Å and intensity 100 W/m^2 incident on a metal plate of threshold frequency 5.5×10^{14} Hz, what will be the maximum kinetic energy, and work function of photoelectron? (Take, $h = 6.6 \times 10^{-34}$ J-s).

SECTION-D

All questions are compulsory. In case of internal choices, attempt anyone.

26. A metallic rod of length l and resistance R is rotated with a frequency ν, with one end hinged at the centre and the other end at the circumference of a circular metallic ring of radius l, about an axis passing through the centre and perpendicular to the plane of the ring. A constant and uniform magnetic field B parallel to the axis is present everywhere.

(i) Derive the expression for the induced emf and the current in the rod.

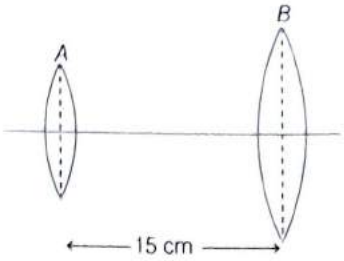
(ii) Due to the presence of the current in the rod and of the magnetic field, find the expression for the magnitude and direction of the force acting on this rod.

Or

(i) The reactance of a capacitor of capacitance C is X. If both the frequency and capacitance be doubled, then give the expression of the new reactance of circuit.

(ii) A wire of resistance R is connected in series with an inductor of reactance ωL, then derive the mathematical expression of quality factor of RL circuit.

27. Two convex lenses A and B of an astronomical telescope having focal lengths 5 cm and 20 cm, respectively are arranged as shown below



(i) Which one of the two lenses you will select as the objective lens and why?

(ii) What should be the change in the distance between the lenses to have the telescope in its normal adjustment position?

(iii) Calculate the magnitude of magnifying power of the telescope in the normal adjustment position.

28. The force experienced by a unit charge when placed at a distance of 0.10 m from the middle of an electric dipole on its axial line is 0.025 N and when it is placed at a distance of 0.2 m, the force is reduced to 0.002 N. Calculate the dipole length.

Or

A charge of 8 mC is located at the origin. Calculate the work done in taking a small charge of -2×10^{-9} C from a point P (0, 0, 3) (in cm) to a point Q (0, 4, 0) (in cm), *via* a point R (0, 6, 9) (in cm).

29. A p-n junction diode is basically a p-n junction with metallic contacts provided at the ends for the application of an external voltage. It can be biased in two ways, i.e. an external battery can be connected to it two ways. One is forward biasing in which positive terminal of the battery is connected to p-side and negative terminal to n-side of the diode. In this large amount of current passes through the diode. However, the second is reverse biasing in which positive terminal of the battery is connected to n-side and negative terminal to p-side of the diode. In this negligible amount of current passes through the diode.

Now, on the basis of above mentioned information, draw an observation in your words, when an input waveform as shown in Fig. (a) is applied to the circuit as shown in Fig. (b).

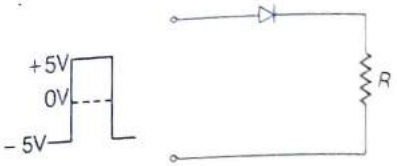
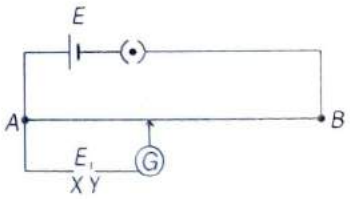


Fig. (a) Fig. (b)

30. While doing the experiment on potentiometer (figure), it was found that the deflection in the galvanometer is one sided and (a) the deflection is decreased while moving from one end A of the wire to the end B (b) the deflection is increased, while the jockey was moved towards the end B.



(i) Which terminal positive or negative of the cell E_1 is connected at X in case (a) and how is E_1 related to E?

(ii) What is the advantage of using thick metallic strips to join wires in a potentiometer?

SECTION-E

All questions are compulsory. In case of internal choices, attempt anyone.

31. Show that the refractive index of the material of a prism is given by

$$\mu = \frac{\sin\frac{(A+\delta_m)}{2}}{\sin\left(\frac{A}{2}\right)}$$

where, symbols have their usual meanings.

Or

(i) When the width of the slit is made double, how would this effect the size and intensity of the central diffraction band? Justify your answer with the help of diagram.

(ii) Write three characteristic features to differentiate between diffraction and interference.

32. (i) The coil area of a galvanometer is $25\times10^{-4}\ m^2$. It consists of 150 turns of a wire and is in a magnetic field of 0.15 T. The restoring torque constant of the suspension fibre is 10^{-6} N-m per degree.
Assuming the magnetic field to be radial, calculate the maximum current that can be measured by the galvanometer, if the scale can accommodate 30° deflection.

(ii) An electron in H-atom circles around the proton with a speed $3\times10^{6}\ ms^{-1}$ in an orbit of radius 6×10^{-11} m.
Calculate
(a) the equivalent current and
(b) magnetic field produced at the proton.
Given, charge on electron is 1.6×10^{-19} C and $\mu_0 = 4\pi\times10^{-7}$ TmA^{-1}.

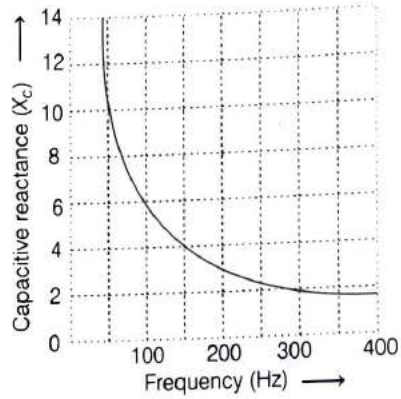
Or

(i) Write the four important properties of the magnetic field lines due to a bar magnet.

(ii) Where on the surface of earth is the vertical component of earth's magnetic field zero?

(iii) The horizontal component of the earth's magnetic field at a place is $\sqrt{3}$ times its vertical component there. Find the value of the angle of dip at that place. What is the ratio of the horizontal component to the total magnetic field of the earth at that place?

33. Figure shown below, shows how the reactance of a capacitor varies with frequency.



(i) Use the information of the graph to calculate the value of capacitance of capacitor.

(ii) An inductor of inductance L has the same reactance as the capacitor at 100 Hz. Find the value of L.

(iii) Using the same axes, draw a graph of reactance against the frequency for the inductor given in part (ii).

(iv) If this capacitor and inductor were connected in series to a resistor of $10\,\Omega$, what would be the impedance of the combination at 300 Hz?

(v) A charged 30 μF capacitor is connected to a 27 mH inductor. What is the angular frequency of free oscillations of the circuit?

Or

Draw a labelled diagram of AC generator, explain its theory and working. An armature coil consists of 20 turns of wire, each of area, $A = 0.09\ m^2$ and total resistance $15\,\Omega$ rotates in a magnetic field of 0.5T at a constant frequency $(150/\pi)$ Hz.

Calculate the value of maximum emf produced in the coil.