12th Standard Physics

Practice Question Paper – 1

Session (2020-21)

CLASS XII **SUBJECT - PHYSICS**
TIME – 3 HRS + 15 MIN READING TIME **MM-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 any one of them.

1. A straight wire carrying current I is turned into a circular loop. If the magnitude of magnetic moment associated with it is M, Find the length of wire.

2. A radio wave of frequency 90 MHz enters a ferrite rod. If $\varepsilon_r = 10^3$ and $\mu_r = 10$, then find the velocity and wavelength of the wave in ferrite.

   OR

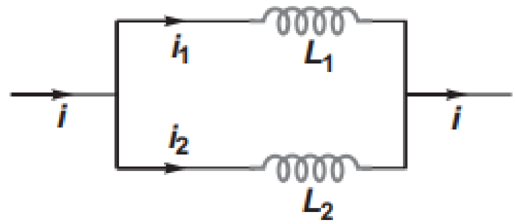
   Why X-ray are not used for RADAR purposes?

3. Two particles of equal charge after being accelerated through the same potential difference enter a uniform transverse magnetic field and describe circular paths of radii R_1 and R_2 respectively. Find the ratio of their masses (M_1 / M_2).

4. For a series L-C-R circuit with L = 2.0H,C = 32mF and R = 10 ohm. What is the Q-value of this circuit?

OR

Two inductors L_1 and L_2 are connected in parallel and a time varying current flows as shown in figure. Find the ratio of ***$i_1 : i_2$***.



5. Find the ratio of the energies of the hydrogen atom in its first to second excited states.

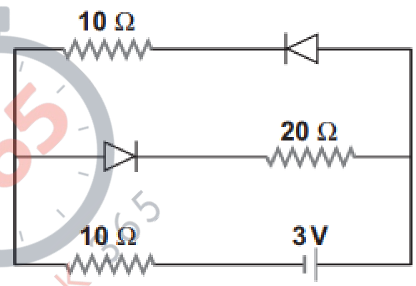
6. A proton and an α-particle are accelerated through the same potential difference. Find the ratio of their de-Broglie wavelengths.

7. In a Fusion process, It is impossible to combine two deutrons to form a He nucleus at room temperature and pressure. Why?

8. A piece of copper and other of germanium are cooled from the room temperature to 80 K, then how their resistances will vary?

OR

In the network shown, Find the current flowing through the battery of negligible internal resistance.



9. The ratio of electron and hole current in a semiconductor is 7/4 and the ratio of drift velocities of electrons and holes is 5/4, then find the ratio of concentrations of electrons and holes.

10. Give two advantages of LED's over conventional incandescent lamps.

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** An electric dipole is placed in a uniform electric field. Its equilibrium will be stable when dipole is set along the direction of electric field.

Reason In stable equilibrium energy of dipole should be least possible.

12. **Assertion** The plates of a parallel plate capacitor are connected to a battery. Charge on the plates increases on introducing a dielectric slab between the plates.

Reason Capacity increases on introducing dielectric slab and hence more charge is drawn from the battery.

13. **Assertion** A concave mirror and convex lens both have the same focal length in air. When they are submerged in water, they will still have the same focal length.

Reason The refractive index of water is less than the refractive index of air.

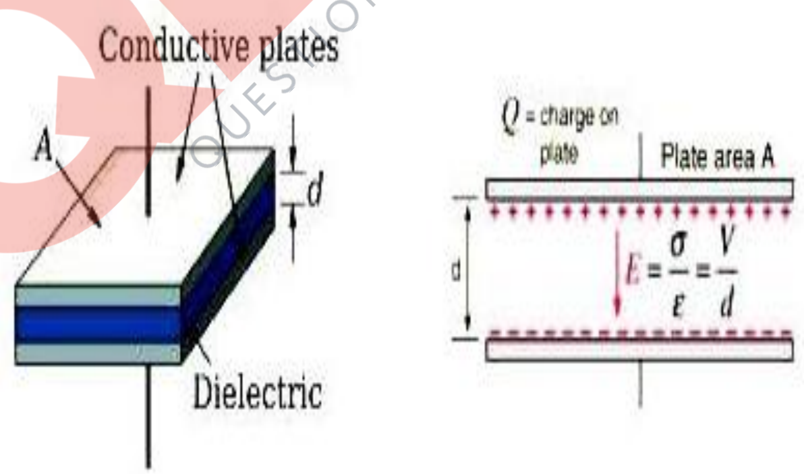
14. **Assertion** No diffraction is produced in sound waves near a very small opening.

Reason For diffraction to take place the aperture of opening should be of the same order as wavelength of the waves.

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.

15. Capacitance is the ratio of the change in the electric charge of a system to the corresponding change in its electrical potential. Capacitor consists of two metal plates which are filled with dielectric. When a voltage is applied to these plates an electric current flows charging up one plate with a positive charge with respect to the supply voltage and the other plate with an equal and opposite negative charge. The generalized equation for the charge stored in a capacitor is given by q=CV, where C is the capacitance of the capacitor.



(i) The capacitance of a capacitor does not depend on

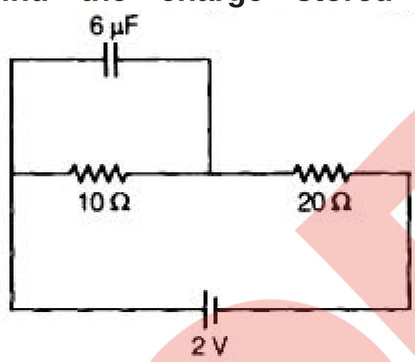
a. Area of plates

b. Separation between the plates
c. Applied potential difference
d. Dielectric constant

(ii) **A parallel plate air capacitor with no dielectric between the plates is connected to the constant voltage source. How would capacitance and charge change if dielectric of dielectric constant K=2 is inserted between the plates. C_0 and Q_0 are the capacitance and charge of the capacitor before the introduction of the dielectric.**

a. $C=C_0/2$; $Q=2Q_0$
b. $C=2C_0$; $Q=Q_0/2$
c. $C=C_0/2$; $Q=Q_0/2$
d. $C=2C_0$; $Q=2Q_0$

(iii) **Find the charge stored in the capacitor in the given circuit**



a. 3 μC
b. 6 μC
c. 8 μC
d. 4 μC

(iv) **The capacitance is a circuit component that opposes the change in the circuit ___________**

a. current
b. voltage
c. impedance
d. None of the above.

(v) **Amount of energy stored in a capacitor of 5μF when it is charged to a potential of 100 V.**

a. 2.5 J
b. 2.5×10^{-3} J
c. 25×10^{-3} J
d. 250×10^{-3} J

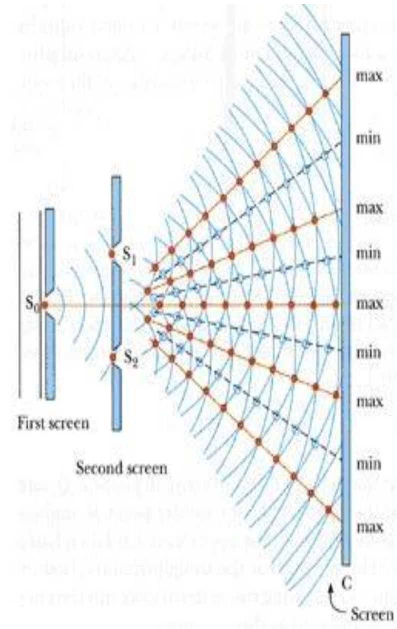
16. In YDSE, intensity of light from two slits is proportional to their width, and also to the square of amplitudes of light from the slits, *i.e.*,

$$\frac{I_1}{I_2} = \frac{\omega_1}{\omega_2} = \frac{a^2}{b^2}$$

At points, where crest of one wave falls on crest of the other and through falls on trough, intensity of light is maximum. Interference is said to be constructive. At points, where crest of one wave falls on trough of the other, resultant intensity of light is minimum. The interference is said to be destructive.

$$\frac{I_{max}}{I_{min}} = \frac{(a+b)^2}{(a-b)^2}$$

For sustained interference, the two sources must be coherent. Two independent sources cannot be coherent.



(i) **The light waves from two coherent sources are represented by $y_1 = a_1 \sin \omega t$ and $y_2 = a_2 \sin(\omega t + \pi/2)$**
The resultant amplitude will be
a. a_1
b. a_2
c. $a_1 + a_2$
d. $\sqrt{a_1^2 + a_2^2}$

(ii) **The ratio of intensities in the interference pattern in the above question will.**
a. 9:1
b. 4:1
c. 2:1
d. 1:4

(iii) **The amplitudes of light waves from two slits are in the ratio 3:1. Widths of slits are in the ratio**
a. 1:9
b. 1:3
c. 9:1
d. 3:1

(iv) **The widths of two slits in YDSE are in the ratio 1 4: . The ratio of amplitudes of light waves from two slits will be**

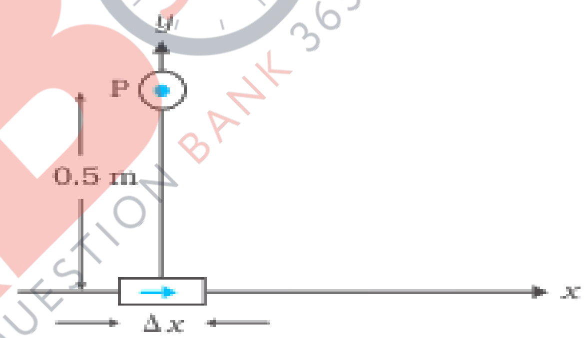
a. 9:1
b. 4:1
c. 1:2
d. 1: 1.4

(v) Two independent sources emit light waves given by
$y_1 = a_1 \sin \omega t$ and $y_2 = a_2 \sin(\omega t + \pi/2)$
Will you observe interference pattern?
a. Yes
b. No
c. Sometimes
d. Cannot say

Section – C

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

17. An element $\Delta l = \Delta x\, \boldsymbol{i}$ is placed at the origin and carries a large current i = 10 A. What is the magnetic field on the y-axis at a distance of 0.5 m. Δx = 1 cm.



18. In Young's double-slit experiment using monochromatic light of wavelength λ , the intensity of light at a point on the screen where path difference is λ , is K units. What is the intensity of light at a point where path difference is λ /3?

OR

Draw 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.

19. Derive the expression of potential due to a short dipole at any arbitrary point.

OR

What do you understand by equipotential surface? What is the net work done when a charge is moved along an equipotential surface and why?

20. Explain the working of a solar cell with the help of diagram.

21. A long solenoid with 15 turns per cm has a small loop of area 2.0 cm^2 placed inside the solenoid normal to its axis. If the current carried by the solenoid changes steadily from 2.0 A to 4.0 A in 0.1 s, what is the induced emf in the loop while the current is changing?

22. In a Young's double-slit experiment, the slits are separated by 0.28 mm and the screen is placed 1.4 m away. The distance between the central bright fringe and the fourth bright fringe is measured to be 1.2 cm. Determine the wavelength of light used in the experiment.

23. Differentiate between p type and n type semiconductor.

24. Define the terms magnetic meridian and geographic meridian.

OR

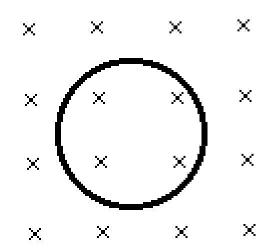
Vertical component of earth's magnetic field at a place is $\sqrt{3}$ times the horizontal component. What is the value of angle of dip at that place?

25. Draw the ray diagram of astronomical telescope in normal adjustment.

Section -D

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

26. A conducting circular loop is placed in a uniform magnetic field B = 0.04T with its plane perpendicular to the field. Somehow, the radius of the loop starts shrinking at a constant rate of 2mm/s. Find the induced current in the loop at an instant when the radius is 2cm.



27. Write the principle and working of an ideal voltmeter. Name it. How can the sensitivity of this instrument be increased?

OR

Derive the expression of equivalent emf of two cells (ε_1, r_1) and (ε_1, r_2) connected in parallel. Where ε is emf and r is internal resistance of the cells.

28. The work function of cesium metal is 2.14 eV. When light of frequency 6×10^{14}Hz is incident on the metal surface, photoemission of electrons occurs. What is the
(a) maximum kinetic energy of the emitted electrons,
(b) Stopping potential, and
(c) Maximum speed of the emitted photoelectrons?

OR

Write three properties of photons. Why wave theory of light could not explain the photoelectric effect?

29. Derive an expression for radius and velocity for an electron of Hydrogen atom for nth level.

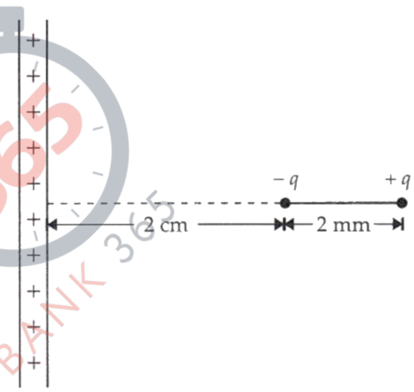
30. In the fusion reaction ${}^{2}_{1}H + {}^{2}_{1}H \longrightarrow {}^{3}_{2}He + {}^{1}_{0}n$, the masses of deuteron, helium and neutron expressed in amu are 2.015, 3.017 and 1.009, respectively. If 1kg of deuterium undergoes complete fusion, find the amount of total energy released.

Section – E

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

31. Apply Gauss's theorem to calculate the electric field of a thin infinitely long straight line of charge, with a uniform charge density of □ Cm^{-1}.

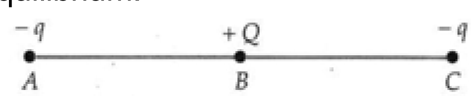
An electric dipole consists of charges $\pm 2 \times 10^{-8}$ C, separated by a distance of 2 mm. It is placed near a long line charge of density 4.0×10^{-4} Cm^{-1}, as shown in Fig., such that the negative charge is at a distance of 2 cm from the line charge. Calculate the force acting on the dipole.



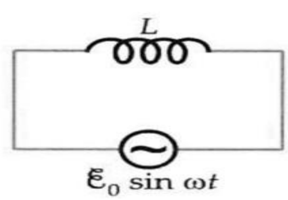
OR

Derive an expression for the potential energy of a dipole in a uniform electric field. Discuss the conditions of stable and unstable equilibrium.

Three charges - q, + Q and - q are placed at equal distances on a straight line. If the potential energy of the system of three charges is zero, find the ratio Q/q.



32. a) A sinusoidal emf is applied to a circuit containing an inductor only. Show that the current lags behind the voltage by π/2 radian. Also derive an expression for the reactance of an inductor, when connected across an a.c. source $\varepsilon = \varepsilon_0 \sin \omega t$.



b) Draw its phasor diagram.

c) If resistance is added in series to inductor what changes will occur in the current flowing in the circuit and phase angle between voltage and current

OR

Explain the principle and working of a transformer.

Write any two energy losses in a transformer. How can they be reduced?

The primary coil of an ideal step-up transformer has 100 turns and the transformation ratio is also 100. The input voltage and the power are 220 V and 1100 W respectively.

Calculate :

(i) number of turns in the secondary

(ii) the current in the primary

33. (a) Explain the phenomenon of diffraction of light at a single slit to show the formation of diffraction fringes.
(b) Show graphically the variation of intensity with angle in this diffraction pattern.
(c) Why secondary maxima are less intense than the central maximum ?

OR

(a) With the help of a ray diagram, derive an expression for its magnifying power (When the final image is formed at the least distance of distinct vision.

(b) The total magnification produced by a compound microscope is 20, while that produced by the eyepiece alone is 5. When the microscope is focused on a certain object, the distance between objective and eyepiece is 14 cm Find the focal length of objective and eyepiece, if distance of distinct vision is 20 cm.