UP Board Class 12 Physics 2024 (Code 346 FY) Question Paper

General Instructions

(i) This question paper contains 9 questions. All questions are compulsory.

(ii) It has multiple-choice questions as well as questions that need a written answer.

(iii) Attempt every question; detailed solutions are provided in the companion solutions booklet.

1(a). A wire is stretched to double of its original length. The value of its resistivity becomes:

(A) 4 times

(B) 8 times

(C) 16 times

(D) unchanged

1(b). The refracting angle of a prism of refractive index $\sqrt{3}$ is equal to its angle of minimum deviation. The value of angle of minimum deviation is:

(A) 30°

(B) 45°

(C) 60°

(D) 120°

1(c). The unit of $\sqrt{LC}$ is (where L is inductance and C is capacitance)

(A) hertz

(B) henry

(C) farad $\times$ henry

(D) second

1(d). Threshold wavelength for a photoelectric cell is λ_0. If the work-function of the cathode of some other cell becomes n times that of the first cell, then threshold wavelength for the other cell will be:

(A) λ_0

(B) $n\lambda_0$

(C) λ_0/n

(D) $\lambda_0(n-1)$

1(e). In the given nuclear process, particle W is:

$$^{2}\mathrm{He}^{4} + {}_{z}X^{A} \rightarrow {}_{z+2}Y^{A+3} + W$$

(A) neutron

(B) proton

(C) electron

(D) positron

1(f). In order to pass 10\% of the main current in a galvanometer of resistance R, the required resistance of shunt should be:

(A) $R/9$

(B) $11R$

(C) $9R$

(D) $R/11$

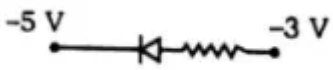
2(a). Write the expression and unit of magnetic dipole moment.

2(b). What are the microwaves? State one use of them.

2(c). What is meant by angle of polarisation?

2(d).

Whether the *p-n* junction diode is forward biased or reverse biased in the given figure.



2(e). Define 1 henry of self-inductance.

2(f). Write the definition and unit of current density.

3(a). Obtain the formula of the relationship of drift velocity and potential difference.

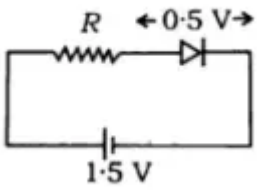
3(b). Find the ratio of de-Broglie wavelength associated with a proton and an α-particle having the same kinetic energy.

3(c).

Define the mass defect and binding energy of nucleus.

3(d).

Current of 5 mA is flowing in the given circuit. Find the value of the resistor R.



4(a). What is displacement current? A plane electromagnetic wave of 25 MHz frequency is propagating along the x-axis in vacuum. The electric field at any point in the vacuum is $\vec{E} = 6.3\,\hat{j}$ volt/metre.
What is the magnitude and direction of the magnetic field $\vec{B}$ at this point?

4(b). The equivalent capacitance is 20 μF by joining two capacitors of capacitances C_1 μF and C_2 μF in parallel. If they are joined in series, the equivalent capacitance is 4.8 μF. Find the ratio of the capacitances C_1 and C_2 ($C_1 > C_2$).

4(c). When does the force acting between two parallel and straight current carrying conductors become (i) attractive and (ii) repulsive and why?

4(d). What is meant by a resonant circuit? Write down the required conditions for the L-C-R series resonant circuit and expression for the frequency in the state of resonance.

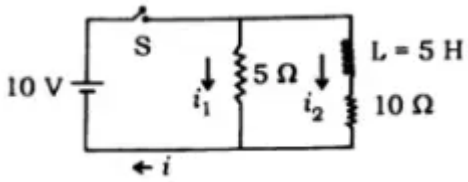
4(e).

Write down Einstein's photoelectric equation. Photons of energies 1 eV and 2.5 eV respectively are incident on a metal plate of work function 0.5 eV. If maximum kinetic energies of emitted photoelectrons are k_1 and k_2 respectively and their velocities are v_1 and v_2, then find the magnitudes of (i) k_1/k_2 and (ii) v_1/v_2.

5(a). Derive the formula for the torque acting on a current-carrying loop in a uniform magnetic field and define the magnetic dipole moment with the help of it.

5(b).

Find the magnitudes of currents i_1, i_2, and i with the help of the given circuit, when (i) just at the moment switch S is pressed and (ii) S is pressed for a long time.

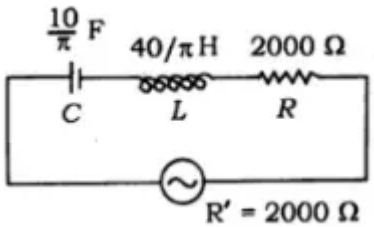


OR

In the given circuit, A.C. source is given by:

$$V = 282\sin(100\pi t) \text{ volt}$$

The internal resistance of the source is $2000\ \Omega$.

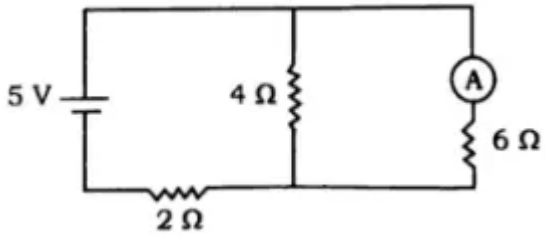


Find out:

(i) rms value of source voltage
(ii)inductive reactance of the circuit
(iii) impedance of the circuit

5(c).

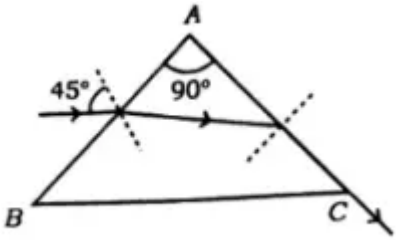
What are Kirchhoff's two laws for the electrical circuit? Find out the reading of the ammeter with the help of the given circuit, while its resistance is negligible.



5(d). Explain refraction of light by Huygens wave theory, when waves enter from denser to rarer medium.

5(e).

A monochromatic ray of light is incident at an angle of 45° on the face AB of a right-angled prism ($A = 90°$), as shown in the figure. The emergent ray is refracted tangentially from the face AC. Find out the refractive index of the prism material.



6. Obtain the formula for the intensity of electric field on the equatorial point of an electric dipole.

OR

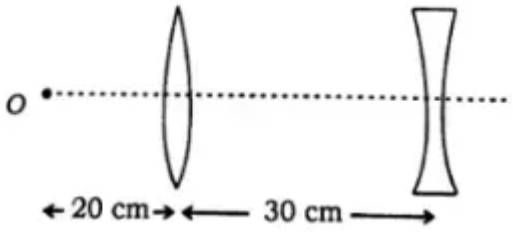
What is Gauss' law? Find the formula for the intensity of electric field produced due to a point charge with the help of it.

7.

State the required conditions for the interference of light. Find the value of maximum resultant intensity of two waves having intensities I and $4I$, when sources are (i) coherent and (ii) non-coherent.

OR

Focal length of each lens is 10 cm as shown in the given figure. Find the distance of the image of point object O from the convex lens and also draw the ray diagram. If both lenses are placed in contact, what will be the power of the combined lens?



8.

What are the Bohr's Postulates for the hydrogen atom? Write down the following for electrons in the ground state of hydrogen atom:

(i) Binding energy

(ii) Angular momentum

(iii) Total energy

OR

What is the difference between nuclear fission and nuclear fusion? Explain each of them with the help of an appropriate example. Why is in both incidents the nuclear energy released?

9. Explain the differences between *n*-type and *p*-type semiconductors. Show that both types of semiconductors are electrically neutral.

OR

Discuss the characteristics of (i) forward biasing and (ii) reverse biasing in *p*-*n* junction. Explain the cause of origin and direction of current in both conditions.