UP Board Class 12 Physics Code 346 BU 2023 Question Paper

Time Allowed :3 Hours	**Maximum Marks :**70	**Total questions :**35

General Instructions

Instruction:

i) *All* questions are compulsory. Marks allotted to each question are given in the margin.

ii) In numerical questions, give all the steps of calculation.

iii) Give relevant answers to the questions.

iv) Give chemical equations, wherever necessary.

1. a) Electromagnetic waves are produced by

(i) a static charge

(ii) a moving charge with constant velocity

(iii) an accelerating charge

(iv) chargeless particle

---

b) Planck's constant has the same dimensions

(i) force × time

(ii) force × distance

(iii) force × speed

(iv) force × distance × time

---

c) Two ideal batteries of same emf (E = E) and same internal resistance (r = r) are connected in parallel. Their equivalent emf is E and internal resistance is r. The correct option is

(i) the equivalent emf E is E = E - E and r = r - r

(ii) the equivalent emf E is E = E + E and r = r + r

(iii) the equivalent emf E is E = E = E but r ¡ r, r' ¡ r

(iv) the equivalent emf E is E = E but r ¿ r, r' ¿ r

---

d) When an impurity is doped into intrinsic semiconductor, the conductivity of the semiconductor

(i) becomes zero

(ii) increases

(iii) decreases

(iv) remains the same

---

e) Let i_e, i_c, and i_b represent the emitter current, the collector current, and the base current respectively in a transistor then

(i) i_c is slightly smaller than i_e

(ii) i_c is slightly greater than i_e

(iii) i_b is much greater than i_c

(iv) i_b is much greater than i_e

---

f) Mark out the correct option:

(i) A voltmeter should have small resistance

(ii) A voltmeter should have large resistance

(iii) An ammeter should have large resistance

(iv) An ammeter should have small resistance but it should be greater than the resistance of galvanometer

---

2.(a) If the energy of an atom in its ground state is -54.4 eV, then find its ionising potential.

2.b) A concave lens has two surfaces of equal radii 30 cm and refractive index 1.5. Find its focal length.

2.c) What is meant by mass number of a nucleus? How is it different from atomic number?

2.d) Give an equation related to nuclear fusion.

2.e) Find the energy stored in a capacitance of 10 F when it is charged to a potential difference of 2 volts.

2.f) In a Boolean expression $Y = AB + BA'$, if $A = 1$, $B = 1$, then find the value of Y.

3. a) Show that N/C and V/m are the units of the same physical quantity. Name that physical quantity.

b) The kinetic energy of a charged particle decreases by 10 joules as it moves from a point at potential 200 volt to a point at potential 250 volt. Find the charge on the particle.

c) Write down two difficulties of Rutherford's atomic model.

d) Define work function. Write its unit.

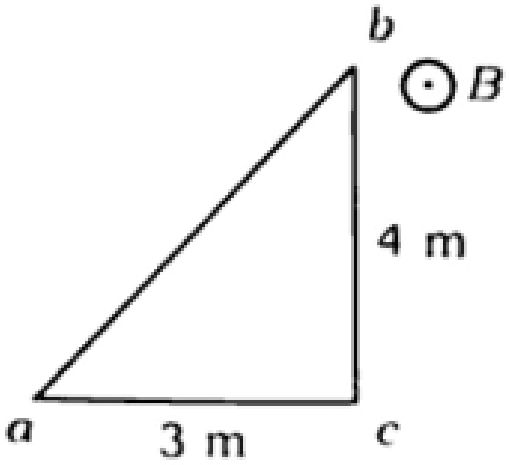
4. a) Write an expression of refractive index of a liquid relative to air in terms of velocity of light in liquid and in air. Derive the formula of apparent depth of an object placed in liquid.

b) The work function of a photoelectric material is 4.0 eV. Find the wavelength of light for which the stopping potential is 2.5 volt.

c) Derive the formula for the intensity of magnetic field produced at the centre of a current carrying circular loop.

d) A light ray going through a prism with the angle of prism 60°, is found to have minimum deviation of 30°. What is the refractive index of the prism material?

c) A right-angled triangle ABC, made from a metallic wire, moves at a uniform speed of 2.0 m/s in its plane as shown in the figure. A uniform magnetic field $B = 0.5$ T exists in the perpendicular direction to the plane. Find the induced emf in the segments BC, AC, and AB.



---

5. a) A point object is placed at a distance of 15 cm from a convex lens. The image is formed on the other side of the lens at a distance of 30 cm from the lens. When a concave lens is placed in contact with the convex lens, the image shifts away further by 30 cm. Calculate the focal lengths of the two lenses.

---

b) Draw a ray diagram for a reflecting telescope. Explain its working and compare it with a refracting telescope.

Solution:

Step 1: Ray Diagram for Reflecting Telescope.

In a reflecting telescope, a concave mirror is used to gather and focus light. The diagram is shown below:

Step 2: Working of a Reflecting Telescope.

In a reflecting telescope: 1. Light from a distant object enters the telescope and strikes the concave mirror. 2. The concave mirror reflects the light and focuses it at the focal point. 3. The eyepiece lens is placed at the focal point, and it magnifies the image formed by the mirror.

Step 3: Comparison with Refracting Telescope.

In a refracting telescope, lenses are used instead of mirrors. The light enters the objective lens, which forms an image. This image is then magnified by the eyepiece lens. Unlike the reflecting telescope, the refracting telescope uses the lens's refraction instead of reflection.

Final Answer:

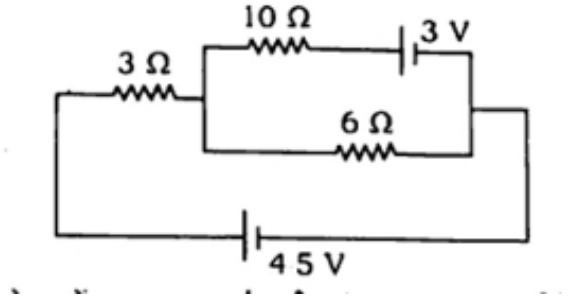
A reflecting telescope uses a concave mirror to gather and focus light, while a refracting telescope uses lenses. Reflecting telescopes are generally preferred in astronomy due to the absence of chromatic aberration.

Quick Tip

Reflecting telescopes avoid chromatic aberration, which is a common issue in refracting telescopes due to the dispersion of light through lenses.

---

c) Find the current through the 10 resistor shown in the figure.



---

d) Explain the formation of the depletion layer at the p-n junction diode. Draw the characteristic curve of a reverse-biased junction diode showing Avalanche breakdown.

OR

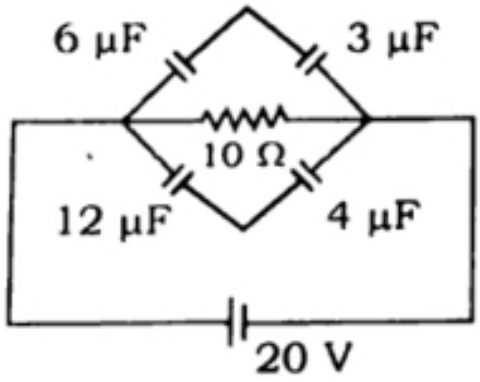
A light beam traveling in the X-direction is described by $E_y = 300\sin(\omega(t - \frac{x}{c}))$ **volt/m. An electron is constrained to move along the Y-direction with speed** 2.0×10^7 **m/s. Find the maximum magnetic force acting on the electron.**

---

e) A hydrogen atom emits ultraviolet radiation of wavelength 1025 Å. What are the quantum numbers of energy states involved in the transition?

---

6. Define capacitance of a capacitor. Find the charge on each capacitor in the circuit shown in the figure.



OR

State Gauss' theorem. Obtain the expression for the intensity of the electric field at a point due to a thin charged wire of infinite length with its help.

---

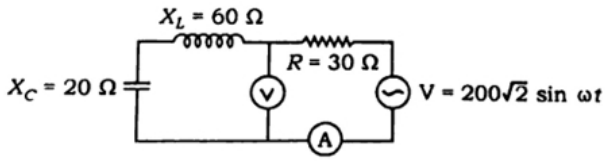
7. Define magnetic moment and write its unit. An electron is moving with the velocity 2.0×10^7 ms^{-1} in a circular orbit of radius 0.3 Å. Calculate its magnetic moment.

OR

An electron enters the region of 0.3 T magnetic field at an angle of 60° with the speed of 4×10^5 ms^{-1}. Find the radius of the helical path and the pitch (distance between two consecutive spirals) of the electron beam.

---

8. What do you mean by 'impedance' in an alternating circuit? Write its unit. Find the reading of the ammeter and voltmeter in the given circuit.



OR

What are coherent sources? In a Young's double slit experiment, the distance between two coherent sources is 2 mm, and the distance of the screen is 1.5 m. If monochromatic light of wavelength 6000 Å is used, then find the fringe width and the distance of the third dark fringe from the centre.

---

9. What is amplification? In a common emitter amplifier, collector current is increased by 1 milliampere by increasing base current by 5 μ ampere. Calculate current gain α and β.

OR

What is an oscillator? Explain the working of a transistor as an oscillator with a suitable circuit diagram.
