Class 12 Physics · Chapter 8: Electromagnetic Waves

Worksheet · 20 marks · about 40 minutes · based on NCERT

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1. The uniform electric field between the plates of a capacitor, each of area 0.020 m^2, is increasing at the rate of 2.0×10^{12} V m^{-1} s^{-1}. Taking $\varepsilon_0 = 8.85 \times 10^{-12}$ C^2 N^{-1} m^{-2}, the displacement current between the plates is [1]

(a) 35 A
(b) 0.18 A
(c) 0.35 A
(d) zero, as no charge crosses the gap

2. One common way of producing X-rays is to [1]

(a) bombard a metal target with high-energy electrons
(b) heat a filament to a very high temperature
(c) pass a current through a semiconductor diode
(d) decay radioactive nuclei

3. The displacement current through a surface across which the electric flux is Φ_E is [1]

(a) $(1/\varepsilon_0)\, d\Phi_E/dt$
(b) $\mu_0\varepsilon_0\, d\Phi_E/dt$
(c) $\varepsilon_0\, d\Phi_B/dt$
(d) $\varepsilon_0\, d\Phi_E/dt$

4. The frequency of the microwaves in a microwave oven is chosen so that [1]

(a) it matches the frequency of visible light, which food absorbs strongly
(b) the microwaves are reflected by the water in the food
(c) it matches the resonant frequency of water molecules, which take up the energy as kinetic energy
(d) it ionises the molecules of the food

5. Ritu sits all afternoon in a sunlit room behind closed glass windows, yet her skin does not tan. This is because ordinary glass [1]

(a) absorbs infrared radiation
(b) absorbs ultraviolet radiation
(c) reflects all visible light
(d) absorbs X-rays from the sun

6. Write the Ampere–Maxwell law and state what each of the two current terms on its right side stands for. [2]

7. Taking $\mu_0 = 4\pi \times 10^{-7}$ T m A^{-1} and $\varepsilon_0 = 8.85 \times 10^{-12}$ C^2 N^{-1} m^{-2}, calculate $1/\sqrt{(\mu_0\varepsilon_0)}$ and state the significance of the result. [2]

8. Name a device that produces the microwaves in a microwave oven, and explain why the oven heats food that contains water. [2]

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9. Identify the part of the electromagnetic spectrum to which each wavelength belongs, and name one detector for each: (a) 2 cm, (b) 5 μm, (c) 100 nm. [3]

10. A capacitor is being charged by a time-varying current i(t). Using two surfaces bounded by the same circular loop round the connecting wire, show that Ampere's circuital law, $\oint B \cdot dl = \mu_0 i$, gives contradictory results. How did Maxwell remove the contradiction? [3]

11. A capacitor with circular plates of radius R is being charged by a current i, the electric field between the plates being uniform. Using the Ampere–Maxwell law, obtain the magnetic field at a distance r ($r \le R$) from the axis, between the plates. How does it vary from the axis to the rim? [3]