

CHAPTER-8
Electromagnetic Wave
ASSIGNMENT-1

1 MARK QUESTIONS

- Q1. What is displacement current?
- Q2. What are electromagnetic waves?
- Q3. State the Maxwell's law of induction.
- Q4. Which of the following is false for electromagnetic waves:
- (a) transverse (b) non-mechanical waves
(c) longitudinal (d) produced by accelerating charges
- Q5. If the magnetic monopole exists, then which of the Maxwell's equation to be modified?
- (a) $\oint \mathbf{E} \cdot d\mathbf{S} = q / \epsilon_0$ (b) $\oint \mathbf{B} \cdot d\mathbf{S} = 0$
(c) $\oint \mathbf{E} \cdot d\mathbf{l} = -d\phi_B / dt$ (d) $\oint \mathbf{E} \cdot d\mathbf{l} = \mu_0(I_c + I_d)$
- Q6. Which of the following is NOT true for electromagnetic waves?
- (a) They transport energy
(b) They have momentum
(c) They travel at different speeds in air depending on their frequency
(d) They travel at different speeds in medium depending on their frequency
- Q7. Why can light travel in vacuum, whereas sound cannot do so?
- Q8. Is displacement current, like conduction current, a source of magnetic field?
- Q9. Expand the acronym LASER and RADAR.
- Q10. Which of the following statement is **NOT true** about the properties of electromagnetic waves?
- (a) These waves do not require any material medium for their propagation
(b) Both electric and magnetic field vectors attain the maxima and minima at the same time
(c) The energy in electromagnetic wave is divided equally between electric and magnetic fields
(d) Both electric and magnetic field vectors are parallel to each other.
- Q11. Do Electromagnetic waves carry energy and momentum? **(CBSE2017)**
- Q12. Identify the EM waves whose wavelength vary as
- (a) $10^{-12}\text{m} < \lambda < 10^{-8}\text{m}$

(b) $10^{-3}\text{m} < \lambda < 10^{-1}\text{m}$

Write one use for each.

(CBSE2017)

Q13. Name the Electromagnetic radiations used for

(i) Water purification (ii) Eye surgery

(CBSE 2018)

Q14. How is displacement current produced between plates of parallel plates during charging?

(CBSE 2020)

ASSERTION REASON TYPE QUESTIONS

Directions: In each of the following questions, a statement of Assertion (A) is given followed by a corresponding statement of Reason (R) just below it. Of the statements, mark the correct answer as:

(A) If both assertion and reason are true and reason is the correct explanation of assertion.

(B) If both assertion and reason are true but reason is not the correct explanation of assertion.

(C) If the assertion is true and the reason is false.

(D) If both assertion and reason are false.

Q15. **Assertion:** Electromagnetic waves are transverse in nature.

Reason: The electric and magnetic fields are perpendicular to each other and perpendicular to the direction of propagation.

Q16. **Assertion:** The electromagnetic wave is transverse in nature.

Reason: Electromagnetic waves propagate parallel to the direction of electric and magnetic fields.

Q17. **Assertion:** The velocity of electromagnetic waves depends on electric and magnetic properties of the medium.

Reason: Velocity of electromagnetic waves in free space is constant.

CASE STUDY BASED QUESTIONS

Q18. LASER

Electromagnetic radiation is a natural phenomenon found in almost all areas of daily life, from radio waves to sunlight to x-rays. Laser radiation – like all light – is also a form of electromagnetic radiation. Electromagnetic radiation that has a wavelength between 380 nm and 780 nm is visible to the human eye and is commonly referred to as light. At wavelengths longer than 780 nm, optical radiation is termed infrared (IR) and is invisible to the eye. At wavelengths shorter than 380 nm,

optical radiation is termed ultraviolet (UV) and is also invisible to the eye. The term “laser light” refers to a much broader range of the electromagnetic spectrum than just the visible spectrum, anything between 150 nm up to 11000 nm (i.e. from the UV up to the far IR). The term laser is an acronym which stands for “light amplification by stimulated emission of radiation”.

Einstein explained the stimulated emission. In an atom, an electron may move to a higher energy level by absorbing a photon. When the electron comes back to the lower energy level it releases the same photon. This is called spontaneous emission. This may also so happen that the excited electron absorbs another photon, releases two photons and returns to the lower energy state. This is known as stimulated emission.

Laser emission is therefore a light emission whose energy is used, in lithotripsy, for targeting and ablating the stone inside the human body organ.

Apart from medical usage, lasers are used for optical disk drives, printers, barcode readers etc.

(I) What is the full form of LASER?

- (a) Light amplified by stimulated emission of radiation
- (b) Light amplification by stimulated emission of radiation
- (c) Light amplification by simultaneous emission of radiation
- (d) Light amplified by synchronous emission of radiation

(II) The “stimulated emission” is the process of:

- (a) release of a photon when an electron comes back from higher to lower energy level.
- (b) release of two photons by absorbing one photon when the electron comes back from higher to lower energy level.
- (c) absorption of a photon when an electron moves from lower to higher energy level.
- (d) None of the above

(III) What is the range of amplitude of LASER?

- (a) 150 nm – 400 nm
- (b) 700 nm – 11000 nm
- (c) Both the above
- (d) None of the above

(IV) Lithotripsy is:

- (a) an industrial application.
- (b) a medical application.
- (c) laboratory application.
- (d) process control application.

(V) LASER is used in:

- (a) optical disk drive.
- (b) transmitting satellite signal.
- (c) radio communication.
- (d) ionization.

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