

CHAPTER-8
Electromagnetic Wave
ASSIGNMENT-2

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MARK QUESTIONS

Q1.If the amplitude of the magnetic field is 3×10^{-6} tesla, then the amplitude of the electric field for a electromagnetic waves is

- (a) 100 V/m (b) 300 V/m (c) 600 V/m (d) 900 V/m

Q2.In an electromagnetic wave travelling in free space the rms value of the electric field is 3 V/m. The peak value of the magnetic field is,

- (a) 1.414×10^{-8} T (b) 1.0×10^{-8} T (c) 2.828×10^{-8} T (d) 2.0×10^{-8} T

Q3.The direction of propagation of electromagnetic waves is along

- (a) E (b) B (c) $E \cdot B$ (d) $E \times B$

Q4.In an electromagnetic wave:

- (a) power is transmitted along the magnetic field
(b) power is transmitted along the electric field
(c) power is equally transferred along the electric and magnetic field
(d) power is transmitted in a direction perpendicular to both the fields.

Q5.Why are infrared waves called heat waves. Explain. What do you understand by the statement “Electromagnetic waves transport momentum”? **(CBSE 2018)**

ASSERTION REASON TYPE QUESTIONS

Q6.**Assertion:** Infrared radiation plays an important role in maintaining the average temperature of earth.

Reason: Infrared radiations are sometimes referred to as heat waves

Q7. **Assertion:** When a charged particle moves in a circular path, it produces electromagnetic waves.

Reason: Charged particle has acceleration.

Q8. **Assertion:** Sound waves cannot travel in vacuum but light can travel in vacuum

Reason : Sound waves are longitudinal waves and they cannot be polarised but electromagnetic waves are transverse and they can be polarised.

CASE STUDY BASED QUESTIONS

Q9. The electromagnetic spectrum consists of visible light, x-rays, gamma rays, microwaves, ultraviolet rays, radio waves and infrared waves. The waves used in radio and television communication are the radio waves having frequency range 500 kHz to 1000MHz. In the ultrahigh frequency bands cellular phones use the radio waves to transmit the voice. Microwaves are the waves having short wavelengths. In aircraft navigation, for the radar system microwaves are used due to their short wavelength. Infrared waves are also called heat waves. Infrared radiation has the most importance in maintaining earth's surface temperature through the greenhouse effect. The infrared waves have vast applications in real life such as infrared detectors that are used for military purposes and also to see the growth of crops. The waves which are visible to the human eye are the visible rays. Visible rays are having frequency range as 4×10^{14} Hz to 7×10^{14} Hz. The huge source of ultraviolet light is the sun. Ultraviolet rays have wavelength range from 4×10^{-7} m to 6×10^{-10} m. X-rays are the rays having most importance in medical applications which have a wavelength range 10nm to 10^{-4} nm. X-rays are used to destroy the living tissue and organisms in the medical field. Then gamma rays are the rays having wavelength range as 10^{-10} m to 10^{-14} m which are the high frequency radiations mostly produced in nuclear reactions. Gamma rays are also used to destroy cancer cells in the medical field.

(I) The TV waves range from _____ which are the radio waves.

- (a) 54Hz to 890Hz (b) 54 MHz to 890 MHz
(c) 500 kHz to 1000 MHz (d) 1000 Hz to 1000 KHz

(II) The domestic application of microwaves used is

- (a) electric induction (b) water heater (c) TV (d) microwave oven

(III) The part of the electromagnetic spectrum which is detected by human eye is having wavelength range as

- a) 900 – 400 nm b) 200 – 400 mm c) 700 – 400 mm d) 700 – 400 nm

(IV) Why are infrared waves also called heat waves?

(V) How does the ozone layer in the atmosphere play a protective role?

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MARKS QUESTIONS

Q10. Why are infrared radiations also referred as heat waves? Write the name of radiations which lie next to infrared radiations in the electromagnetic spectrum. (CBSE2020)

Q11. A plane electromagnetic wave travels in vacuum along z-direction. What can you say about the directions of its electric and magnetic field vectors? If the frequency of the wave is 30 MHz, what is its wavelength?

Q12. (a) Identify the part of EM spectrum used in (i) RADAR (ii) Eye surgery. Write the frequency range. **(CBSE 2019)**

(b) Prove that the average energy density of oscillating Electric field is equal to that of oscillating magnetic field?

3 MARKS QUESTIONS

Q13. Answer the following questions.

- (i) Show, by giving a simple example, how EM waves carry energy and momentum.
- (ii) How are microwaves produced? Why is it necessary in microwaves ovens to select the frequency of microwaves to match the resonant frequency of water molecules?
- (iii) Write two important uses of infrared waves.

Q14. Name the parts of the electromagnetic spectrum which is

- (i) suitable for RADAR systems in aircraft navigations.
- (ii) used to treat muscular strain.
- (iii) used as a diagnostic tool in medicine. Write in brief, how these waves can be produced?

Q15. (i) Arrange the following electromagnetic waves in the descending order of their wavelengths.

- (a) Microwaves (b) Infrared rays (c) Ultraviolet radiation (d) g-rays
- (ii) Write one use each of any two of them

Q16. Explain the Maxwell's modification of Ampere's circuital law.

Q17. Discuss the source and propagation of electromagnetic waves.