Chapter-08

Electromagnetic Wave

Very Short Answer Type Questions

01. A plane electromagnetic wave travels in a vacuum along the z-direction. What can you say about the direction of electric and magnetic field vectors? *[CBSE-2017]*

02. How is the speed of electromagnetic waves in a vacuum determined by electric and magnetic fields? *[CBSE-2017]*

03. Name the electromagnetic radiation used for (a) Water purification (b) Eye surgery.

04. Arrange the following E.M waves in the order of their increasing wavelength.

(a) γ -rays (b) Microwaves

(c) X-rays (d) Radio waves

05. State two properties of E.M waves. How can we show that E.M waves carry momentum? *[CBSE-2016]*

06. Identify the E.M waves whose wavelength varies as.

(a) $10^{-12}m < \lambda < 10^{-8}m$

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

07. Find the wavelength of E.M waves of frequency $10\times10^{9}Hz$ in free space. Give two applications. *[CBSE-2007]*

08. What is the phase relation between electric and magnetic oscillations in an e.m wave?

09. Why are microwaves used in RADAR? **[CBSE - 1999]**

10. Name the electromagnetic radiation used for detecting objects through haze and fog.

[CBSE- 1997]

11. Name the part of the electromagnetic spectrum of wavelength 10^{-2}m and mention its one application ***[CBSE - 2004]***

12. Which part of the electromagnetic spectrum has the largest penetrating power? ***[CBSE-2006]***

13. Identify the part of the electromagnetic spectrum to which the following wavelengths belong ***[CBSE-2008]***

(i) 10^{-1}m (ii) 10^{-10}m

14. A special device, like the klyston valve or the magnetron valve used for the production of electromagnetic waves. Name the waves and also write one of the applications.***[CBSE - 2008]***

15. Give a reason to show that microwaves are the better transfer of signals for long rang transmission than radio waves. ***[CBSE - 2000]***

16. What evidence is there that sound waves is not an electromagnetic wave? ***[CBSE - 1994]***

2 marks questions

17. Show that the sum of conduction current and displacement current has the same value every wherein the circuit when a parallel plate capacitor is being charged by an external source.

18. How the infrared rays is useful in maintaining the earth's temperature in the greenhouse effect? ***[CBSE - 2001]***

19. What is the displacement current? Why was this concept introduced? ***[CBSE - 1998]***

20. State Maxwell's equations. ***[CBSE - 1994]***

21. What is an electromagnetic wave? How can we express mathematically a plane electromagnetic wave propagating along the X-axis? Also, represent it graphically ***[CBSE - 1995]***

22. Explain briefly how electromagnetic waves are produced by an oscillating charge. How is the frequency of the em waves produced related to that of the oscillating charge? ***[CBSE - 1994]***

23. A plane electromagnetic wave of frequency 25 MHz travels in free space along the x-direction. At a particular point in space and time $\vec{E} = 6.3\hat{j}\,Vm^{-1}$ what is the magnetic field at this point? ***[CBSE - 2006]***

24. Identify the type of e.m waves whose method of production is associated with ***[CBSE - 1998]***

(a) a klystron valve (b) vibrations of atoms and molecules (c) decay of atomic nuclei

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Also, give the approximate range of wavelengths of each of these e.m waves. ***[CBSE - 2007]***

25. Experimental observations have shown that X - rays ***[CBSE - 2003]***

(i) Travel in a vacuum with a speed of 3×10^8 m/s

(ii) Exhibit the phenomenon of diffraction can be polarised what conclusion can be drawn about the nature of x-rays from each of these observations?

3 marks questions

26. State and explain Maxwell's modification of Ampere's circuital law. ***[CBSE - 2005]***

OR

Discuss the inconsistency in Ampere's circuital law. What modification was made by Maxwell in this law?

27. Obtain the expression for the energy density of an electromagnetic wave. In an electromagnetic wave, show that the average energy density of the electric field equals the average energy density of the magnetic field.

[CBSE - 2004]

28. The magnetic field in a plane electromagnetic wave is given by ***[CBSE - 2007]***

$B_y = 2 X10^{-7} \text{ Sin } (0.5 X 10^3 x + 1.5 x 10^{11} t) T$

(a) What is the wavelength and frequency of the wave?

(b) Write an expression for the electric field.

29. Light with an energy flux of 18 w/cm^2 falls on a non-reflecting surface at normal incidence. If the surface has an area of 20 cm^2, find the average force exerted on the surface during a 30 min span.

30. Calculate the electric and magnetic fields produced by the radiation coming from a 100 w bulb at a distance of 3m. Assume that the efficiency of the bulb is 2.5% and assume it is a point source.