

Class: 12
Subject: Physics
Topic: Electromagnetic Waves
No. of Questions: 31

1. Induced electric field due to changing magnetic flux are more readily observed than induced magnetic field due to changing electric field. Why?
2. Rahim was a student of science and was suffering from some disease. He was under treatment of a registered medical practitioner. The doctor sent Rahim repeatedly for x-ray examination. Rahim was hesitant for the same. He told the doctor that they had been taught that the repeated exposure to x-rays would be harmful. The doctor told him not to worry as he knew things better.
Read the above passage and answer the following question:
 - (i) For what purpose x-ray examination of a patient is required by a doctor?
 - (ii) Is the doctor right to ask Rahim for repeated x-ray examination?
 - (iii) What do you learn from this study?
3. Nitin and Rajeev were studying the effect of certain radiations on flower plants. Nitin exposed his plants to ultraviolet rays, found that his plants got damaged after a few days. Rajeev exposed his plants to infrared rays, found that his plants had a beautiful bloom, after a few days.
Read the above passage and answer the following questions:
 - (i) What is the difference between ultraviolet rays and infrared rays?
 - (ii) Why were the plants exposed to ultraviolet rays damaged and the plants exposed to infrared rays had a beautiful bloom?
 - (iii) What are the basic values you have learnt from this study?
4. During Diwali festival, Rajender brought a new microwave oven in his house and told his wife Sarika to use the same carefully. He also told her that microwave oven is to be used for slow heating of the vegetables and food articles upto moderate temperatures as that will preserve the food values. The fast cooking of food items at high temperatures will take away the food values from the food. Further, the vegetables or food items to be heated in oven are to be kept in a porcelain vessel and not in a metallic vessel.
Read the above paragraph and answer the following question:
 - (i) What is the basic principle of working of microwave oven?
 - (ii) Why is it advised to use porcelain vessel for heating the food items in microwave oven?
 - (iii) What basic values do you learn from this study?

5. Four persons went to an excursion on a hill top where temperature was quite low. One of them fell sick. The other persons put a blanket on him, collected the pieces of dry wood and ignited fire in his vicinity. After sometime the sick person felt better.

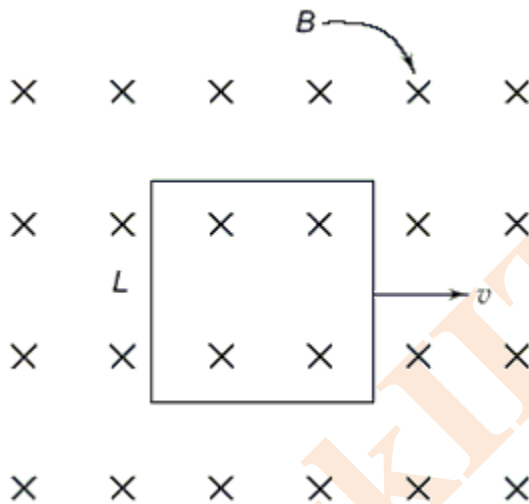
Read the above passage and answer the following questions:

- (i) What are the type of rays coming from study?
 - (ii) Why did the sick person feel better while seating near the fine?
 - (iii) What basic values do you learn from this study?
6. A parallel plate capacitor is being charged by a time varying current. Explain briefly how Amperé's circuital law is generalised to incorporate the effect due to the displacement current.
7. Answer the following questions:
- A. Long distance radio broadcasts use short wave bands. Why?
 - B. It is necessary to use satellites for long distance T.V. transmission. Why?
 - C. Optical and radio telescopes are built on the ground but X-ray astronomy is possible only from satellites orbiting the earth. Why?
 - D. The small ozone layer on top of the atmosphere is crucial for human survival. Why?
 - E. If the earth did not have atmosphere, would its average surface temperature be higher or lower than what it is now?
 - F. Some scientists have predicted that a global nuclear war on the earth would be followed by a severe 'nuclear winter' with a devastating effect on life on earth. What might be the basis of this prediction
8. A variable frequency a.c. source is connected to a capacitor. Will the displacement current increases or decrease with increase in frequency?
9. Which of the following concepts applies to both sound waves and electromagnetic waves:
- (a) Polarization and
 - (b) Intensity? Explain the same.
10. What happens to the intensity of light from a bulb if the distance from the bulb is doubled? As a laser beam travels across the length of a room, its intensity essentially remains constant. What geometrical characteristic of LASER beam is responsible for the constant intensity which is missing in the case of light from the bulb?
11. Even though an electric field \vec{E} exerts a force $q\vec{E}$ on a charged particle yet the electric field of an EM wave does not contribute to the radiation pressure (but transfers energy). Explain.

12. An alternating voltage $V = V_0 \sin \omega t$ is applied across a circuit. As a result a current $I = I_0 \sin (\omega t - \pi/2)$ flows in it. The power consumed per cycle is

- a. Zero
- b. $0.5 V_0 I_0$
- c. $0.707 V_0 I_0$
- d. $1.414 V_0 I_0$

13. A conducting square loop of side L and resistance R moves in its plane with a uniform velocity v perpendicular to one of its sides. A magnetic field B , constant in space and time, pointing perpendicular and into the plane of the loop exists everywhere as shown in figure given below. The current induced in the loop is



- a. BLv/R clockwise
- b. BLv/R anticlockwise
- c. $2BLv/R$ anticlockwise
- d. Zero

14. A thin circular ring of area A is held perpendicular to a uniform magnetic field of induction B . A small cut is made in the ring and a galvanometer is connected across the ends such that the total resistance of the circuit is R . When the ring is suddenly squeezed to zero area, the charge flowing through the galvanometer is

- a. $\frac{BR}{A}$
- b. $\frac{AB}{R}$
- c. ABR
- d. $\frac{B^2 A}{R^2}$

15. A circular loop of radius R , carrying current I , lies in the x - y plane with its centre at the origin. The total magnetic flux through the x - y plane is
- directly proportional to I
 - directly proportional to R
 - inversely proportional to R
 - zero
16. A coil of inductance 8.4 mH and resistance 6Ω is connected to a 12 V battery. The current in the coil is 1.0 A at approximately the time equal to
- 500 s
 - 20 s
 - 35 ms
 - 1 ms
17. A short-circuited coil is placed in a time-varying magnetic field. Electrical power is dissipated due to the current induced in the coil. If the number of turns were to be quadrupled and the wire radius halved, the electrical power dissipated would be
- halved
 - the same
 - doubled
 - quadrupled
18. If the flux of magnetic induction through a coil of resistance R and having n turns changes from ϕ_1 to ϕ_2 , then the magnitude of the charge that passes through the coil is
- $\frac{(\phi_2 - \phi_1)}{R}$
 - $\frac{n(\phi_2 - \phi_1)}{R}$
 - $\frac{(\phi_2 - \phi_1)}{nR}$
 - $\frac{nR}{(\phi_2 - \phi_1)}$

19. metallic wheel with 8 metallic spokes each of length r is rotating at an angular frequency ω in a plane perpendicular a magnetic field B . The magnitude of the induced emf between the axle and the rim of the wheel is

- a. $\frac{1}{2} \omega r^2 B$
- b. $2 \omega r^2 B$
- c. $4 \omega r^2 B$
- d. $8 \omega r^2 B$

20. A solenoid of inductance L and resistance R is connected to a battery. The time taken for the magnetic energy to reach $\frac{1}{4}$ of its maximum value is

- a. $\frac{L}{R} \log_e(1)$
- b. $\frac{L}{R} \log_e(2)$
- c. $\frac{L}{R} \log_e(3)$
- d. $\frac{L}{R} \log_e(4)$

21. An LCR series circuit with $R = 100 \Omega$ is connected to a 200 V, 50 Hz a.c. source. When only the capacitance is removed, the voltage leads the current by 60° . When only the inductance is removed, the current leads the voltage by 60° . The current in the circuit is

- a. $\frac{2}{\sqrt{3}} \text{ A}$
- b. $\frac{\sqrt{3}}{2} \text{ A}$
- c. 1 A
- d. 2 A

22. The current in a coil of self inductance 2.0 H is increasing according to the equation $I = 2 \sin(t^2)$ ampere. The amount of energy spent during the period when the current changes from zero to 2 A is
- 2 J
 - 4 J
 - 8 J
 - 16 J
23. Which of the following electromagnetic has the longest wavelength?
- Radiowaves
 - Infrared radiation
 - Microwaves
 - X-rays
24. Which of the following electromagnetic waves is used in telecommunication?
- Radiowaves
 - Visible radiation
 - Ultraviolet rays
 - Microwaves
25. In an electromagnetic wave travelling in air, the amplitudes E_0 and B_0 of the electric and magnetic fields are related as (here c is the speed of the wave in air)
- $E_0 = cB_0$
 - $E_0 = \frac{B_0}{c}$
 - $E_0 = c^2 B_0$
 - $E_0 = B_0$
26. When a plane electromagnetic wave travels in vacuum, the average electric energy density is given by (here E_0 is the amplitude of the electric field of the wave)
- $\frac{1}{4} \epsilon_0 E_0^2$
 - $\frac{1}{2} \epsilon_0 E_0^2$
 - $2 \epsilon_0 E_0^2$
 - $4 \epsilon_0 E_0^2$

27. The speed of electromagnetic waves in vacuum is given by

- a. $\frac{1}{\mu_0 \epsilon_0}$
- b. $\frac{1}{\sqrt{\mu_0 \epsilon_0}}$
- c. $\mu_0 \epsilon_0$
- d. $\sqrt{\mu_0 \epsilon_0}$

28. Which of the following statements is false?

- a. Electromagnetic waves are transverse.
- b. Electromagnetic waves travel in free space at the speed of light.
- c. Electromagnetic waves travel with the same speed in all media.
- d. Electromagnetic waves are produced by an accelerating charge.

29. Displacement current was first postulated by

- a. Ampere
- b. Maxwell
- c. Hertz
- d. Marconi

30. In a plane electromagnetic wave, the electric field oscillates sinusoidally at a frequency of 2.0×10^{10} Hz. What is the wavelength of the wave?

- a. cm
- b. 1.5 cm
- c. cm
- d. cm

31. An electromagnetic wave is produced by oscillating electric and magnetic fields E and B. Choose the only incorrect statement from the following.

- a. E is perpendicular to B.
- b. E is perpendicular to the direction of propagation of the wave.
- c. B is perpendicular to the direction of propagation of the wave.
- d. E is parallel to B.