RAVI MATHS TUITION & TEST PAPERS , WHATSAPP 8056206308

8. Electromagnetic Waves PREVIOUSLY ASKED

12th Standard

Physics

Multiple Choice Question 6 x 1 = 6

1) which of the following electromagnetic waves has smaller wavelengths?

(a) X-rays (b) Microwaves (c) γ -rays (d) Radiowaves

2) During the propagation of electromagnetic waves in a medium

(a) electric energy density is equal to the magnetic energy density

(b) both electric and magnetic energy density are zero

(c) electric energy density is doubled off the magnetic energy density

(d) electric energy density is half of the magnetic energy density

3) The condition of which a microwave oven heats up a food item containing water molecules most efficiently is:

(a) Infrared waves produce heating in a microwave oven

(b) The frequency of microwave must match the resonant frequency of the water molecules

(c) The frequency of microwave has no relation with natural frequency of water molecules

(d) microwaves are heat waves, so they always produce heating

4) The phase difference between electric field E and magnetic field B in an electromagnetic wave propagating along Z-axis is

(a) zero (b) π (c) $\frac{\pi}{2}$ (d) $\frac{\pi}{4}$

5) The electromagnetic radiations used to kill germs in water purifiers are called

(a) infrared waves (b) X-rays (c) gamma rays (d) ultraviolet rays

6) An electromagnetic wave is produced by

(a) a stationary charge (b) a chargeless particle (c) an accelerating charge

(d) a charge moving with constant velocity

2 Marks 66 x 2 = 132

7) Is the steady electric current the only source of a magnetic field? Justify your answer.

8) Write down Maxwell's equation for the steady electric field.

9) Write the following radiation in ascending order in respect of their frequencies: X-rays, microwaves, UV rays and radio waves.

10) How are radio waves produced?

11) (i) How are X-rays produced? Give any two uses of X-rays.
(ii) The thin ozone layer on top of the stratosphere is crucial for human survival. Why?

12) How are microwaves produced?

13) Arrange the following electromagnetic waves in the order of their increasing wavelength:
(a) γ rays
(b) Microwaves
(c) x-rays
(d) Radiowaves

14) Name the electromagnetic waves used for studying crystal structure of solids. what is its frequency range?

15) Which part of electromagnetic spectrum has largest penetration power

16) Which part of electromagnetic spectrum is absorbed from sunlight by ozone layer?

17) Name the part of electromagnetic spectrum whose wavelength lies in the range of $10^{-10} m$. Give its one use

18) Why does galvanometer show a momentary deflection at the time of charging or discharging a capacitor? Write the necessary expression to explain this observation?

19) Which of the following, If any, can act as a source of electromagnetic waves?
(i) A charge moving with a constant velocity
(ii) A charge moving with a circular orbit
(iii) A charge at rest
Give reason

20) Identify the parts of the electromagnetic spectrum which is
(i) suitable for radar systems used in aircraft navigation
(ii) Adjacent to the frequency end of the electromagnetic spectrum
(iii) Produced by bombarding a metal target with high-speed electrons

21) Find the wavelength of electromagnetic waves frequency in $4 \times 10^9\ Hz$ free space. give its two application.

22) Which waves are used in radar system? Give their frequency range and mention the source of their production

23) (i) An electromagnetic wave is travelling in a medium with a velocity v = $v\hat{i}$. Draw a sketch showing the propagation of the electromagnetic wave indicating the direction of the oscillating electric and magnetic fields.
(ii) How are the magnitudes of the electric and magnetic fields related to velocity of the electromagnetic wave?

24) When an ideal capacitor is charged by a DC battery, no current flows. However, when an AC source is used, the current flows continously. How does one explain this, based on the concept of displacement current?

25) A capacitor made of two parallel plates each of the plate A and separationd, is being chrged by an external AC source. Show that the displacement current inside the capacitor is capacitor.

26) Calculate the displacement currecnt between the square plates of side 1 cm of a capcitor, if electric field between the plates is changing at the rate of 3 x 10^6 V m^{-1} s^{-1}.

27) A capacitor of capacitance, C is being vharged by connecting it across a DC sourse along with an ammeter. Will the ammeter show a momentry deflection during the process of chargings? If so,how would you explain this momentry deflection and the resulting continuity of current in the circuit? Write the expression for the current inside the capacitor?

28) What are the direction of electric and magnetic field vectors relative to each other and relative to the direction of propagation of electromagnetic waves?

29) A plane electromagnetic wave travels in vacuum along z-direction. What can you say about the direction of electric and magnetic field vectors?

30) How are the magnitudes of the electric and magnetic fields related to the velocity of the EM wave?

31) (a) How are electromagnetic waves produced?
(b) How do you convince yourself that electromagnetic waves carry energy and mimentum?
(c) Draw a skctch of linearly polarised elcctromagnetic waves propagating in the z-direction. Indicate the directions of the oscillating electric and magnetic fields.

32) Name the em waves which are suitable for radar system used in aircraft navigation. Write the range of frequency of these waves.

33) To which part of the electromagnetic spectrum does a wave of frequency 5×10^{19} Hz belong?

34) Arrange the following electromagnetic waves in order of increasing frequency:
γ rays, microwaves, infrared rays and ultraviolet rays.

35) Draw a sketch of a plane electromagnetic wave propagating along the z-direction. Depict clearly the directions of electric and magnetic fields varying sinusoidally with z.

36) How are microwaves produced? Why is it necessary in microwave ovens to select the frequency of microwaves to match the resonant frequency of water molecules?
Write two important uses of infra-red waves.

37) Arrange the following electromagnetic radiatios in ascending order to their frequencies:
(i) Microwaves
(ii) Radio waves
(iii) X-rays
(iv) Gamma rays
Write two uses of any one of these.

38) How are infrared waves produced? Why are these referred to as 'heart waves'? Write their one important use.

39) Find the wavelength of electromagnetic waves frequency in 5×10^{19}Hz in free space. Give its two application.

40) The charging current for a capacitor is 0.25 A. What is the displacement current across its plates?

41) Write two uses for microwaves.

42) Write two uses of infrared rays.

43) Write two uses of X-rays.

44) Arrange the following in descending order of wavelength.
X-rays, radio waves, blue light, infrared light.

45) Which part of the electromagnetic spectrum is used in satellite communication?

46) In what way, are the directions of the electric and magnetic field vectors representing an electromagnetic wave related to each other?

47) Express the velocity of propagation of an electromagnetic wave in terms of the peak value of the electric and magnetic fields.

48) Name the electromagnetic radiation which can be produced by a klystron or a magnetron valve.

49) How is the speed of electromagnetic waves in vacuum determined by the electric and magnetic fields?

50) Identify the electromagnetic waves whose wavelengths vary as
(i) $10^{-12}\text{m} < \lambda < 10^{-8}$ m
(ii) $10^{-3}\text{m} < \lambda < 10^{-1}$ m
Write one use for each.

51) (i) Arrange the following electromagnetic waves in the descending order of their wavelengths
(a) Microwaves
(b) Infrared rays
(c) Ultraviolet radiation
(d) γ-rays
(ii) Write one use each of any two of them

52) Explain briefly how electromagnetic waves are produced by an oscillating charge. How is the frequency of EM waves produced related to that of the oscillating charge?

53) Name the constituent radiation of electromagnetic spectrum which is used for
(i) aircraft navigation
(ii) studying the crystal structure
Write the frequency range for each.

54) How are infrared rays produced? Write their two important uses.

55) Name the electromagnetic radiations having the wavelength range from 1 mm to 700 nm. Give its two important applications.

56) Name the electromagnetic radiation having the wavelength range from 10^{-1} m to 10^{-3} m. Give its two important applications.

57) Name the electromagnetic radiations having the wavelength range from 1 nm to 10^{-3} nm. Give its two important applications.

58) Identify the different types of electromagnetic radiations, which are used
(i) to kill germs,
(ii) for physical therapy.

59) Considering the case of a parallel plate capacitor being charged, show how one is required to generalize Ampere's circuital law to include the term due to displacement current.

60) For a .plane electromagnetic wave, propagating along the z-axis, write the two (possible) pairs of expression for its oscillating electric and magnetic fields. How are the peak values of these (oscillating) fields related to each other?

61) To which part of the electromagnetic spectrum does a wave of frequency 3 x 10^{13} Hz belong?

62) A e.m. wave, Y_1, has a wavelength of 1cm while another e.m. wave, Y_2, has a frequency of 10^{15} Hz. Name these two types of waves and write one useful application for each.

63) Do electromagnetic waves carry energy and momentum?

64) An electromagnetic wave exerts pressure on the surface on which it is incident. Justify.

65) Name the electromagnetic waves used in LASIK eye surgery and why?

66) Name the electromagnetic radiations used for (i) water purification and (ii) eye surgery.

67) (a) Why are infrared waves often called heat waves? Explain.
(b) What do you understand by the statement, "electromagnetic waves transport momentum"?

68) Green light of mercury has a wavelength 5 x 10^{-5} crn.
(i) What is the' frequency in MHz and period in second in vacuum?
(ii) What is the wavelength in glass, if refractive index of glass is 1.5?

69) The speed of an electromagnetic wave in a material medium is given by $v = \frac{1}{\sqrt{\mu\varepsilon}}$ μ being the permeability of the medium and ε its permittivity. How does its frequency change?

70) Let the wavelengths of the electromagnetic waves used quite often for
(i) killing germs in household water purifiers,
(ii) remote sensing
(iii) treatment of cancer, be labelled as λ_1, λ_2 and λ_3 in increasing order

71) How does Ampere-Maxwell law explain the flow of current through a capacitor when it is being charged by a battery? Write the expression for the displacement current in terms of the rate of change of electric flux.

72) How are infrared waves one produced? Write their important use.

3 Marks 19 x 3 = 57

73) 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?

74) A plane electromagnetic wave of frequency 25 MHz travels in free space along the x-direction. At a particular point in space and time, $E = 6.3\hat{j}$V/m. What is B at this point?

75) Name the parts of the electromagnetic spectrum which is
(a) suitable for radar system used in aircraft navigation
(b) used to treat muscular strain
(c) use as a diagnostic tool in medicine
Write in brief, how these waves can be produced.

76) Write the expression for the generalised form of Ampere's circuital law.
Discuss its significance and describe briefly how the concept of displacement current is explained through charging/discharging of a capacitor in an electric circuit.

77) Answer the following questions.
(i) Name the electromagnetic waves which are used for the treatment of certain forms of cancer. Write their frequency range.
(ii) Thin ozone layer on top of stratosphere is crucial for human survival. Why?
(iii) Why is the amount of the momentum transferred by the electromagnetic waves incident on the surface so small?

78) How are em waves produced by oscillating charges? Draw a sketch of linearly polarized em waves propagating in the Z-direction. Indicate the directions of the oscillating electric and magnetic fields.

79) Answer the following questions:
(i) Why is the thin ozone layer on top of the stratosphere crucial for human survival? Identify to which part of electromagnetic spectrum does this radiation belong and write one important application of the radiation.
(ii) Why are infrared waves referred to as heat waves? How are they produced? What role do they play in maintaining the earth's warmth through the greenhouse effect?

80) Identify the type of waves which are produced by the following way and write one application for each:
(i) Radioactive decay of the nucleus.
(ii) Rapid acceleration and decelerations of electrons in aerials.
(iii) Bombarding a metal target by high energy electrons.

81) Answer the following questions.
(i) Name the electromagnetic waves which are produced during radioactive decay of a nucleus. Write their frequency range.
(ii) Welders wear special glass goggles while working. Why? Explain.
(iii) Why are infrared waves often called as heat waves? Give their one application.

82) (i) Which segment of electromagnetic waves has highest frequency? How are these waves produced? Give one use of these waves.
(ii) Which EM waves lie near the high frequency end of visible part of EM spectrum? Give its one use. In what way, this component of light has harmful effects on humans?

83) Write the generalized expression for the Ampere's circuital law in terms of the conduction current and the displacement current. Mention the situations when there is:
(i) only conduction current and no displacement current.
(ii) displacement current and no conduction current.

84) Write Maxwell's generalization of Ampere's circuital Law. Show that in the process of charging a capacitor, the current produced within the plates of the capacitor is $i = \varepsilon_0 \frac{d\phi_E}{dt}$ where Φ_E is the electric flux produced during charging
of the capacitor plates.

85) Give reasons for the following:
(i) Long distance radio broadcasts use short wave bands.
(ii) The small ozone layer on top of the stratosphere is crucial for human survival
(iii) Satellites are used for a long distance TV transmission.

86) Show that the sum of conductor current and displacement current has the same value everywhere in the circuit when a parallel capacitor is being charged by an external source.

87) (a) Why are infrared radiations referred to as heat waves? Name the radiations which are next to these radiations in the electromagnetic spectrum having
(i) shorter wavelength, and
(ii) longer wavelength.
(b) State the conditions under which a microwave oven heats up a food item containing water molecules.

88) Name the electromagnetic waves with their wavelength range which are used for
(i) FM radio broadcast.
(ii) detection of fracture in bones.
(iii) treatment of muscular strain.

89) Explain the following given reasons.

(i) 'Electromagnetic waves differ considerably in their mode of interaction with matter'.

(ii) Food items to be heated in microwave oven must contain water'.

(iii) 'Welders wear face mask with glasses during welding'.

90) (i) Describe briefly how electromagnetic waves are produced by oscillating charges?

(ii) Give one use of each of the following

(a) Microwaves

(b) X-rays

(c) Infrared rays

(d) Gamma rays

91) Name the electromagnetic waves, in the wavelength range 10 nm to 10^{-3} nm. How are these waves generated? Write their two uses.

5 Marks 2 x 5 = 10

92) 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 be followed by a severe 'nuclear winter' with a devastating effect on life on earth. What might be the basis of this prediction.

93) Shyam and his younger brother were at the restaurant. It was very clean there. None of the flies and insects were there. His younger brother asked him about the fluorescent UV lamp present at the corner. Shyam explained the functioning of UV lamp, how flies and insects get trapped by it?

(i) What are the values shown by Shyam?

(ii) Give the source of UV-rays.

(iii)Give the harmful effect of UV-rays.

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