



# PHYSICS

**BOOKS - OSWAAL PUBLICATION**

**PHYSICS (KANNADA ENGLISH)**

**ELECTROMAGNETIC WAVES**

**Topic 1 Displacement Current Very Short Answer  
Type Questions**

1. Write the expression for displacement current or Maxwell's displacement current.



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2. Show, by giving a simple example, how EM waves carry energy and momentum.



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3. A capacitor has been charged by a d.c. source. What are the magnitudes of conduction and displacement currents, when it is fully charged ?



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4. If  $\vec{E}$  and  $\vec{B}$  represent electric and magnetic field vectors of an electromagnetic wave, the direction of propagation of the wave is along



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5. 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?



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**Topic 1 Displacement Current Short Answer Type Questions**

1. Displacement current is given by,



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2. Explain why,

the Earth without its atmosphere would be inhospitably cold.



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3. Give reasons.

A gas exerts pressure on the walls of the container.



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4. An EM wave is travelling in a medium with a velocity  $\vec{v} = v \hat{i}$ . Draw a sketch showing the propagation of the EM wave, indicating the direction of the oscillating electric and magnetic fields.





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5. How are the magnitudes of the electric and magnetic fields related to the velocity of the EM wave?



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6. Electromagnetic waves are produced by



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7. Show, by giving a simple example, how EM waves carry energy and momentum.



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8. How does a charge  $q$  oscillating at certain frequency produce electromagnetic waves ?

Sketch a schematic diagram depicting electric and magnetic fields for an electromagnetic wave propagating along the Z-direction.



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**9.** A capacitor made of two parallel plates each of plate area  $A$  and separation  $d$ , is being charged by an external a.c. source. Show that the displacement current inside the capacitor is the same as the current charging the capacitor.



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**10.** A capacitor of capacitance ' $C$ ' is being charged by connecting it across a d.c. source along with an ammeter. Will the ammeter

show a momentary deflection during the process of charging ? If so, how would you explain this momentary deflection and the resulting continuity of current in the circuit ? Write the expression for the current inside the capacitor.



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**11.** When an ideal capacitor is charged by a d.c. battery, no current flows. However, when an ac source is used, the current flows continuously.

How does one explain this, based on the concept of displacement current ?



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**12.** A parallel plate capacitor is being charged by a time varying current. Explain briefly how Ampere's circuital law is generalized to incorporate the effect due to the displacement current.



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**13.** 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.



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**14.** Hertz, in his historical experiment, produced stationary EM waves and measured the distance between two successive nodes. Explain how this measurement enabled him to

show that EM waves travelled with the same speed as the speed of light.



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## Topic 1 Displacement Current Long Answer Type Questions

1. Draw a labelled diagram of Hertz's experiment. Explain how electromagnetic radiations are produced using this set-up?



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## Topic 2 Electromagnetic Spectrum Very Short Answer Type Questions

1. Name the electromagnetic radiations which are produced when high energy electrons are bombarded with metal target.



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2. What is the wavelength range of X-rays ?



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3. Name the EM waves which are suitable for radar system used in aircraft navigation. Write the range of frequency of these waves.



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4. To which part of the electromagnetic spectrum does a wave of frequency  $5 \times 10^{19}$  Hz belong?



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5. Arrange the following electromagnetic waves in order in increasing frequency :  $\gamma$  - rays, microwaves, infrared rays and ultraviolet rays.



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6. To which part of the electromagnetic spectrum does a wave of frequency  $5 \times 10^{11}$  Hz belong?



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7. Name the physical quantity which remains same for microwaves of wavelength 1 mm and UV radiations of  $1600 \text{ \AA}$  in vacuum.



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8. How are radio waves produced ?



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9. Which part of electromagnetic spectrum has the largest penetrating power ?



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



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## Topic 2 Electromagnetic Spectrum Short Answer Type Questions

1. Mention two applications of infrared radiation.



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2. Give two uses of UV rays.



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3. 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 ?



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4. Write two important uses of infra-red waves.



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5. Find the wavelength of electromagnetic waves of frequency  $5 \times 10^{19}$  Hz in free space.

Give its two applications.



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6. Arrange the following electromagnetic radiations 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.



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7. How are infrared waves produced ? Why are these referred to as 'heat waves' ? Write their one important use.



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