

FOURTH EDITION
PHYSICS
JAMES S. WALKER

ConcepTest Clicker Questions
Chapter 25

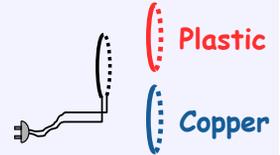
Physics, 4th Edition
James S. Walker

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Question 25.1a EM Waves I

A loop with an AC current produces a changing magnetic field. Two loops have the same area, but one is made of plastic and the other copper. In which of the loops is the induced voltage greater?

- a) the plastic loop
- b) the copper loop
- c) voltage is same in both



Question 25.1a EM Waves I

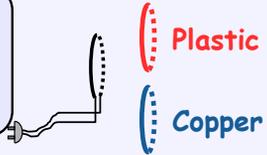
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Faraday's law says nothing about the material:

$$\mathcal{E} = N \left| \frac{\Delta \Phi_m}{\Delta t} \right|$$

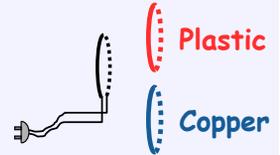
The change in flux is the same (and N is the same), so the induced emf is the same.



Question 25.1b EM Waves II

In which of the loops is the induced current greater?

- a) the plastic loop
- b) the copper loop
- c) current is same in both

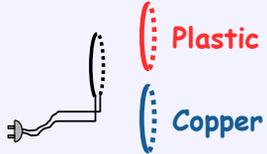


Question 25.1b EM Waves II

In which of the loops is the induced current greater?

- a) the plastic loop
- b) the copper loop
- c) current is same in both

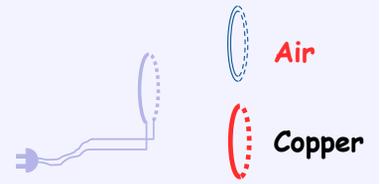
Remember that $I = \Delta V / R$ (Ohm's law), and copper has smaller resistance, so the copper loop has the greater current.



Question 25.1c EM Waves III

A loop with an AC current produces a changing magnetic field. Consider a copper loop, and next to it imagine a loop of air of equal size. In which of the loops will the induced electric field be greater?

- a) the plastic loop
- b) the copper loop
- c) electric field is same in both

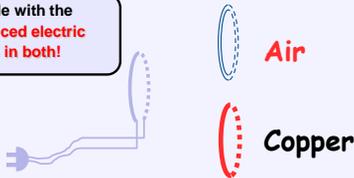


Question 25.1c EM Waves III

A loop with an AC current produces a changing magnetic field. Consider a copper loop, and next to it imagine a loop of air of equal size. In which of the loops will the induced electric field be greater?

- a) the plastic loop
- b) the copper loop
- c) electric field is same in both

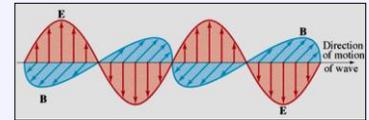
Just as in the example with the plastic loop, the induced electric field will be the same in both!



Question 25.2 Oscillations

The electric field in an EM wave traveling northeast oscillates up and down. In what plane does the magnetic field oscillate?

- a) in the north-south plane
- b) in the up-down plane
- c) in the NE-SW plane
- d) in the NW-SE plane
- e) in the east-west plane

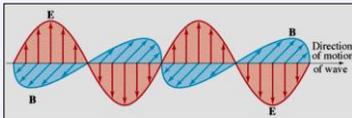


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The magnetic field oscillates perpendicular to BOTH the electric field and the direction of the wave. Therefore the magnetic field must oscillate in the NW-SE plane.



Question 25.3 TV Antennas

Before the days of cable, televisions often had two antennae on them, one straight and one circular. Which antenna picked up the magnetic oscillations?

- a) the circular one
- b) the straight one
- c) both equally; they were straight and circular for different reasons

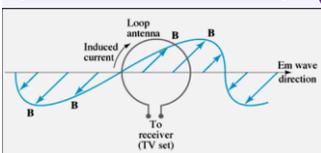


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The varying B field in the loop means the flux is changing and therefore an emf is induced.



Question 25.4 Radio Antennas

If a radio transmitter has a vertical antenna, should a receiver's antenna be vertical or horizontal to obtain the best reception?

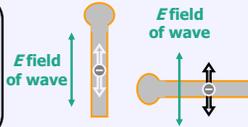
- a) vertical
- b) horizontal
- c) doesn't matter

Question 25.4 Radio Antennas

If a radio transmitter has a vertical antenna, should a receiver's antenna be vertical or horizontal to obtain the best reception?

- a) vertical
- b) horizontal
- c) doesn't matter

If a wave is sent out from a vertical antenna, the electric field oscillates up and down. Thus, the receiver's antenna should also be vertical so that the arriving electric field can set the charges in motion.



Question 25.5 Heat Insulation

Imagine you are an alien from another planet with infrared eyes. What do you see when you look around the room?

- a) bright spots where the bodies are and dark elsewhere
- b) dark spots where the bodies are and bright elsewhere
- c) the same as what we see, only everything looks red
- d) the same as what we see, except that red is invisible

Bodies are sources of heat and therefore emit infrared radiation. An alien with an instrument to detect infrared would see these sources as bright spots.



Infrared photo of a building to check the heat insulation – where are the problem spots in this case?

Question 25.6 Superman

Since Superman is from the planet Krypton, his eyes are sensitive to the entire electromagnetic spectrum. Does that mean he can use X-ray vision to see that Lois Lane is being kidnapped in the other room?

- a) yes, no problem
- b) nope, he can't
- c) need more information

X-ray vision means that Superman's eyes can receive X-rays, but not send them! So what would have to happen for him to see Lois Lane being kidnapped?

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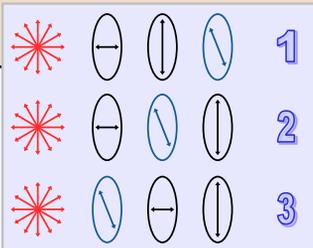
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Question 25.7 Polarization

If unpolarized light is incident from the left, in which case will some light get through?

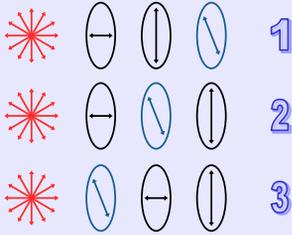


- a) only case 1
- b) only case 2
- c) only case 3
- d) cases 1 and 3
- e) all three cases

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- d) cases 1 and 3
- e) all three cases



In cases 1 and 3, light is blocked by the adjacent horizontal and vertical polarizers. However, in case 2, the intermediate 45° polarizer allows some light to get through the last vertical polarizer.