

ConcepTest PowerPoints

Chapter 22

Physics: Principles with Applications, 6th edition

Giancoli

© 2005 Pearson Prentice Hall

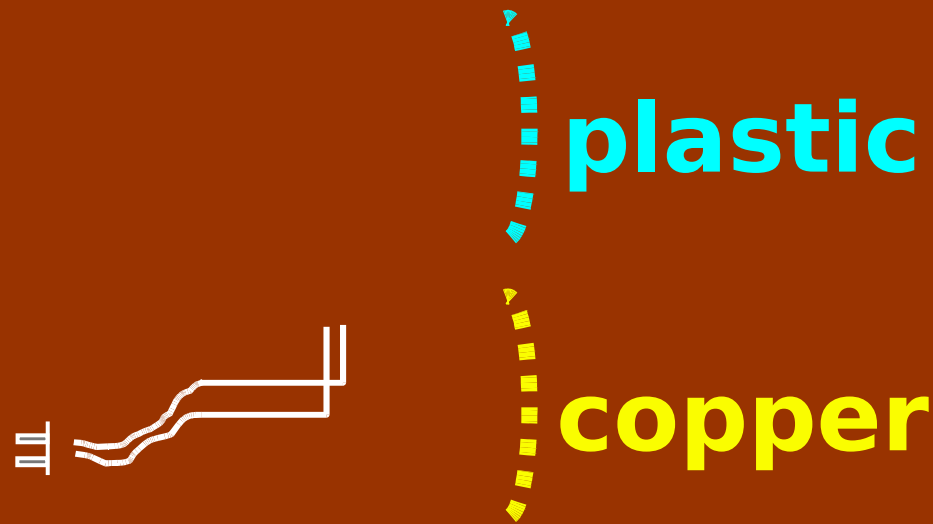
This work is protected by United States copyright laws and is provided solely for the use of instructors in teaching their courses and assessing student learning. Dissemination or sale of any part of this work (including on the World Wide Web) will destroy the integrity of the work and is not permitted. The work and materials from it should never be made available to students except by instructors using the accompanying text in their classes. All recipients of this work are expected to abide by these restrictions and to honor the intended pedagogical purposes and the needs of other instructors who rely on these materials.

ConceptTest 22.1a

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?

- 1) the **plastic** loop
- 2) the **copper** loop
- 3) **voltage is same** in both



ConcepTest 22.1a

EM Waves I

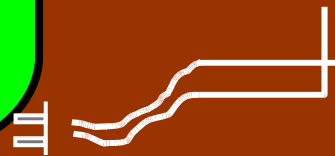
A loop with an **AC current** produces a changing magnetic field. Two loops have the same area, but one is made of **plastic** and the other **copper**. In which of the loops is the induced **voltage** greater?

- 1) the **plastic** loop
- 2) the **copper** loop
- 3) **voltage is same in both**

Faraday's law says nothing about the material:

$$\mathcal{E} = -N \frac{\Delta \Phi_B}{\Delta t}$$

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



plastic

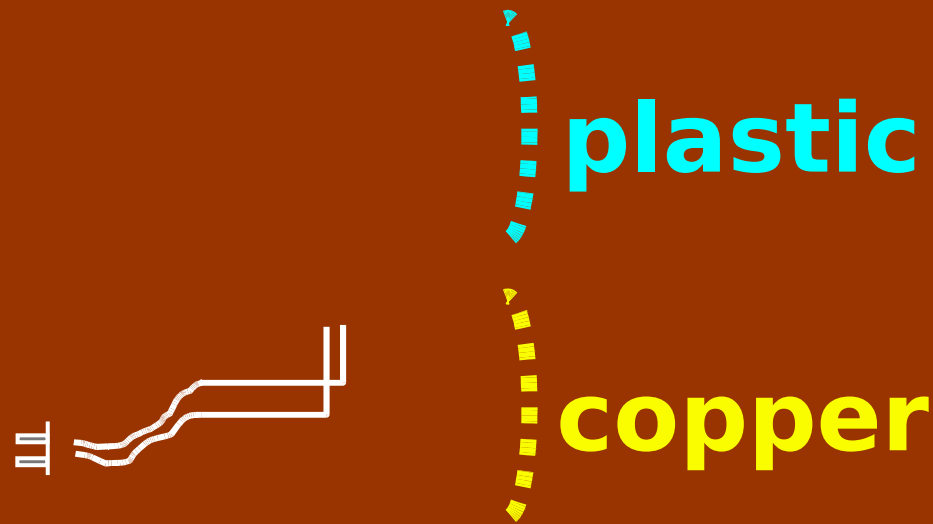
copper

ConceptTest 22.1b

EM Waves II

In which of the loops is the induced current greater?

- 1) the plastic loop
- 2) the copper loop
- 3) current is same in both



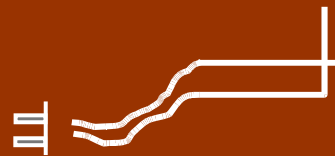
ConceptTest 22.1b

EM Waves II

In which of the loops is the induced current greater?

- 1) the plastic loop
- 2) the copper loop
- 3) current is same in both

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



plastic
copper

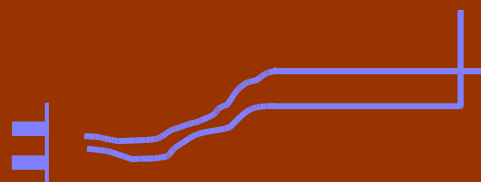
ConceptTest 22.1c

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**?

EM Waves III

- 1) the **plastic** loop
- 2) the **copper** loop
- 3) **Electric field is same** in both



air



copper

ConceptTest 22.1c

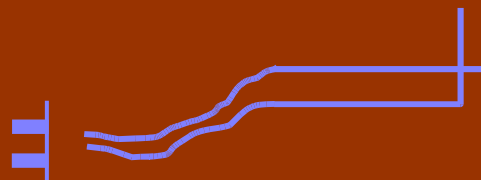
A loop with an **AC current** produces a changing magnetic field.

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**?

EM Waves III

- 1) the plastic loop
- 2) the copper loop
- 3) 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** !



air



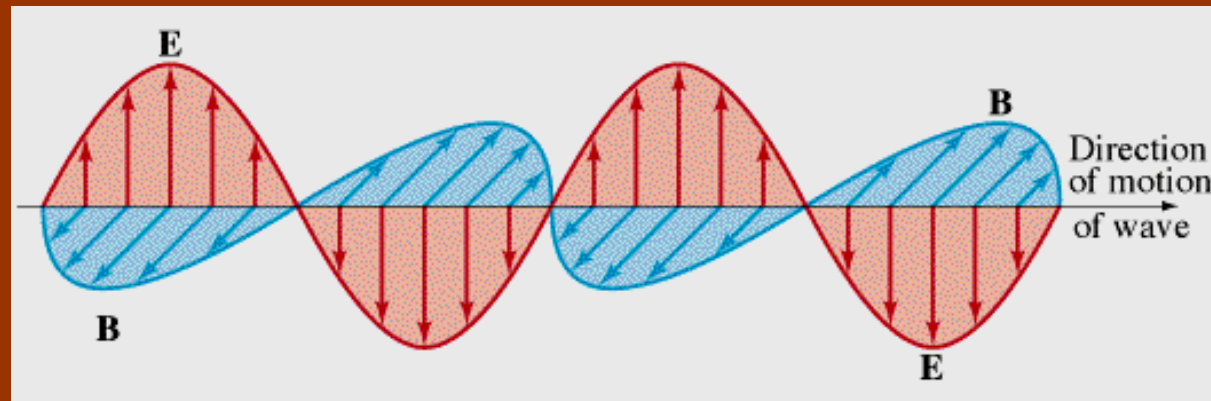
copper

ConceptTest 22.2

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

Oscillations

- 1) In the north-south plane.
- 2) In the up-down plane.
- 3) In the NE-SW plane.
- 4) In the NW-SE plane.
- 5) In the east-west plane.



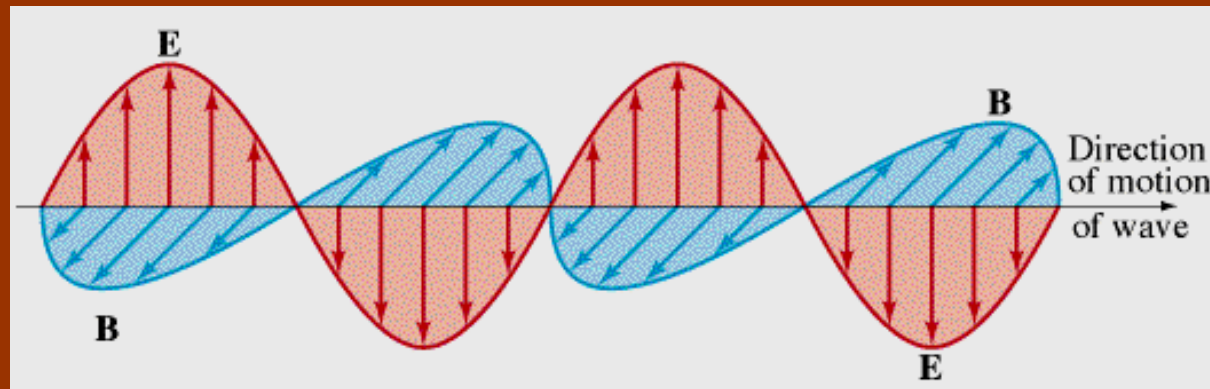
ConceptTest 22.2

Oscillations

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

- 1) In the north-south plane.
- 2) In the up-down plane.
- 3) In the NE-SW plane.
- 4) In the NW-SE plane.
- 5) In the east-west plane.

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.

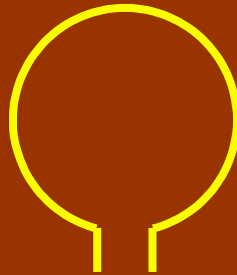
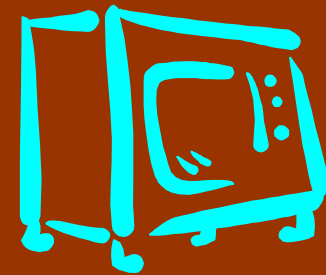
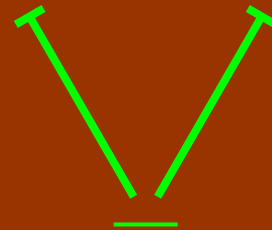


ConceptTest 22.3

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?

- 1) the circular one
- 2) the straight one
- 3) both equally, they were straight and circular for different reasons.



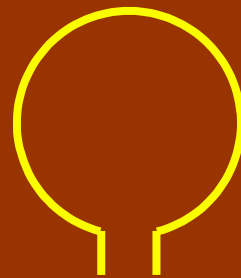
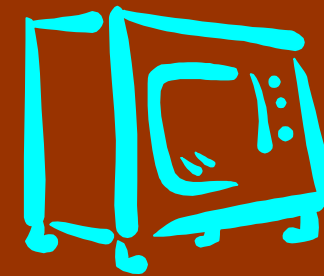
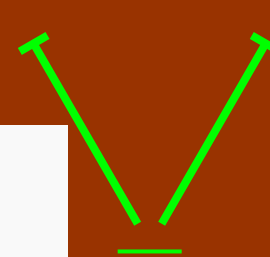
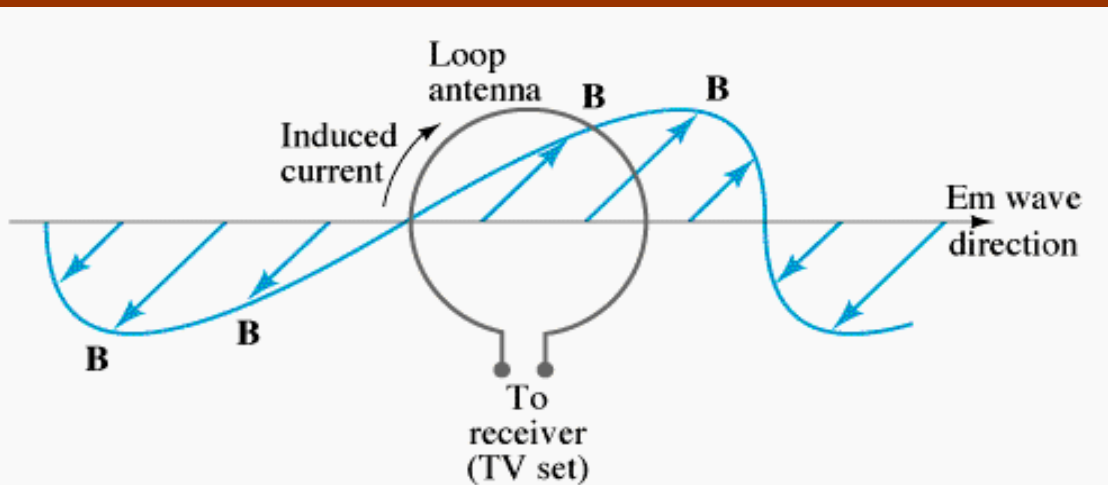
ConcepTest 22.3

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?

- 1) the circular one
- 2) the straight one
- 3) both equally, they were straight and circular for different reasons.

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



ConceptTest 22.4

Radio Antennas

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

- 1) vertical**
- 2) horizontal**
- 3) doesn't matter**

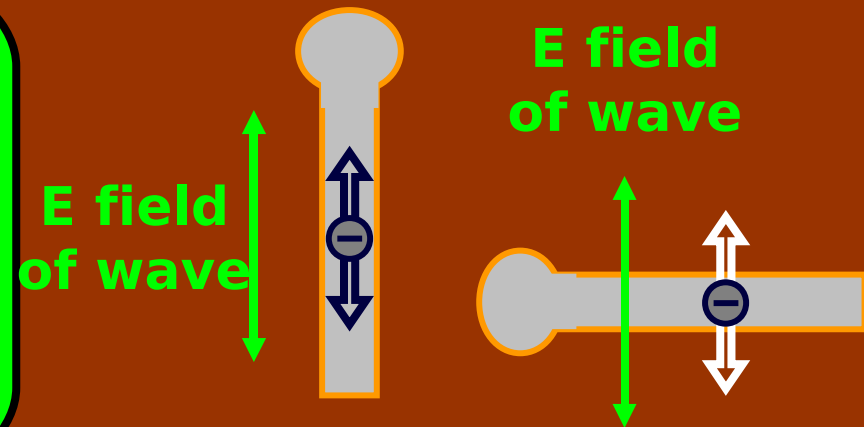
ConceptTest 22.4

Radio Antennas

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

- 1) vertical
- 2) horizontal
- 3) 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.



ConceptTest 22.5

Heat Insulation

Imagine you are an alien from another planet with *infrared eyes*.

What do you see when you look around the room?

- 1) Bright spots where the bodies are and dark elsewhere.
- 2) Dark spots where the bodies are and bright elsewhere.
- 3) The same as what we see, only everything looks red.
- 4) The same as what we see, except that red is invisible.

ConceptTest 22.5

Heat Insulation

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

- 1) Bright spots where the bodies are and dark elsewhere.
- 2) Dark spots where the bodies are and bright elsewhere.
- 3) The same as what we see, only everything looks red.
- 4) 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?



ConceptTest 22.6

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?

Superman

- 1) Yes, no problem**
- 2) Nope, he can't**
- 3) Need more information**

ConceptTest 22.6

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?

Superman

- 1) Yes, no problem
- 2) Nope, he can't
- 3) 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?