

ConcepTest PowerPoints

Chapter 22

Physics: Principles with Applications, 6th edition

Giancoli

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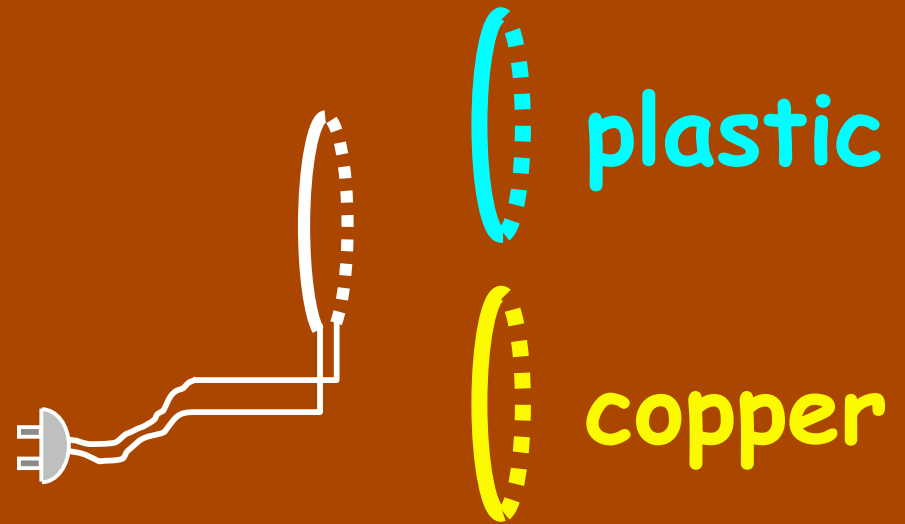
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ConceptTest 22.1a

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



ConceptTest 22.1a

EM Waves I

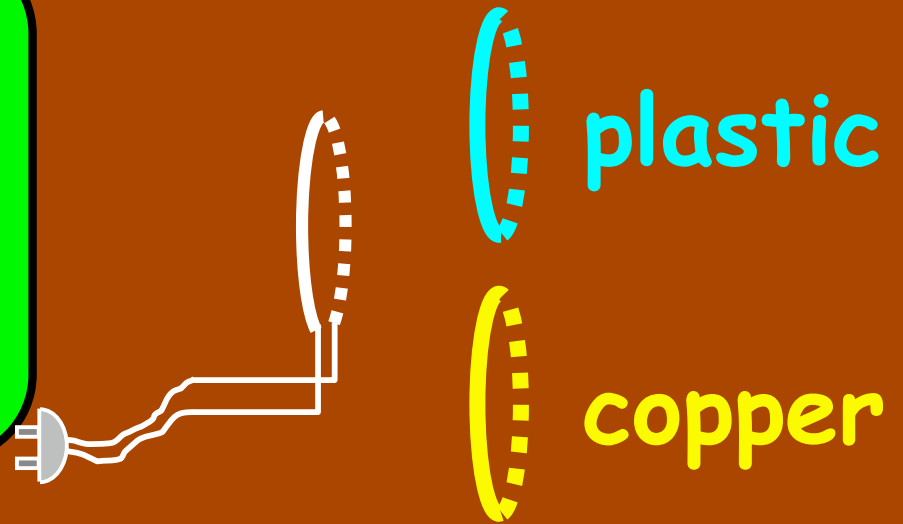
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- 2) the copper loop
- 3) voltage is same in both

Faraday's law says nothing about the material:

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

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

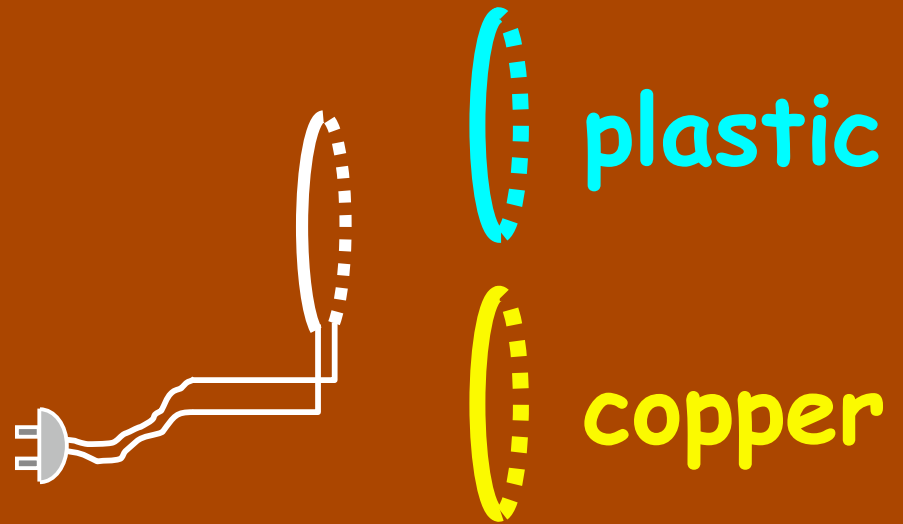


ConceptTest 22.1b

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



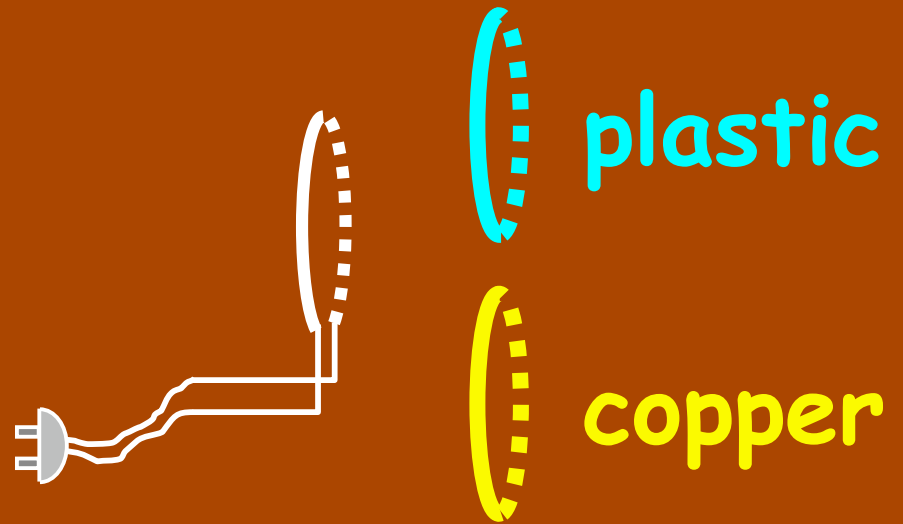
ConceptTest 22.1b

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.



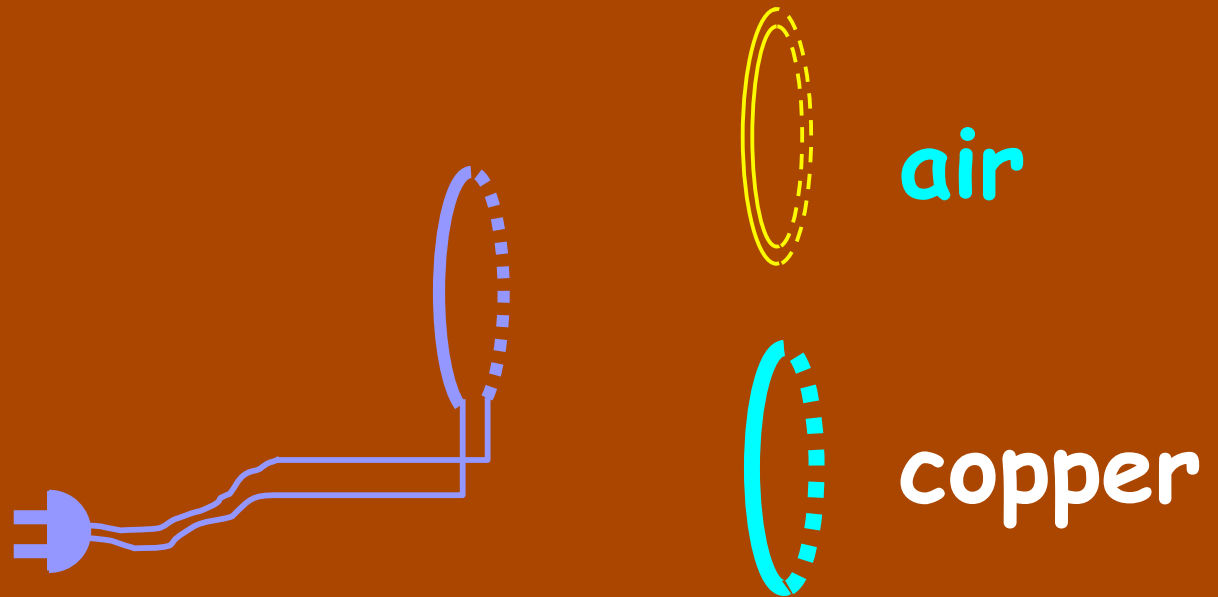
ConceptTest 22.1c

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**



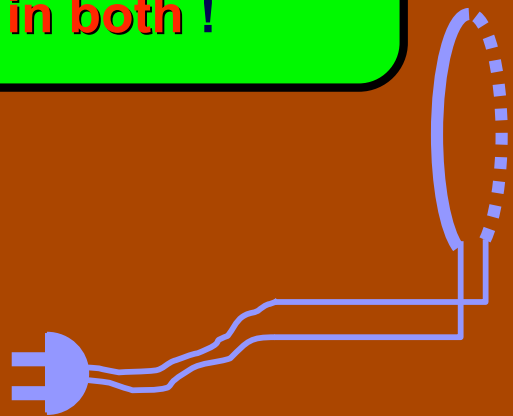
ConceptTest 22.1c

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



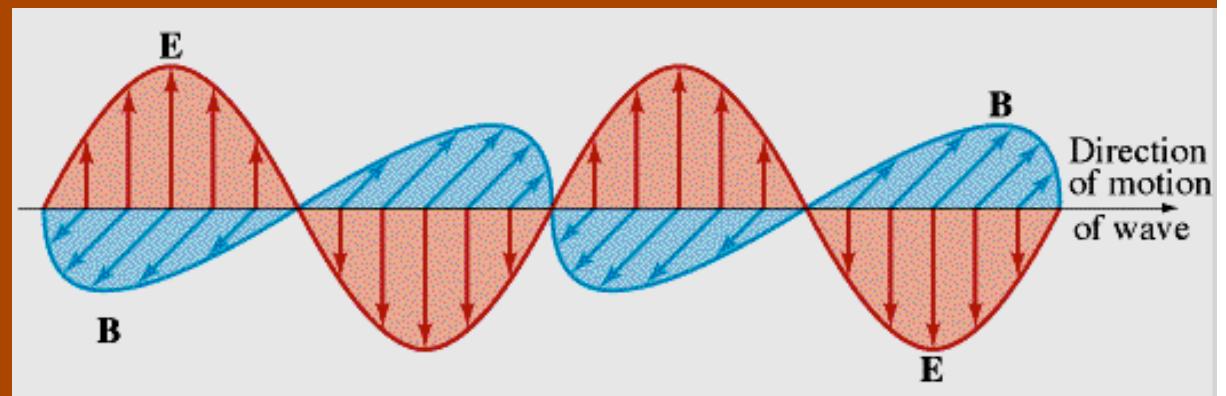
copper

ConceptTest 22.2

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.



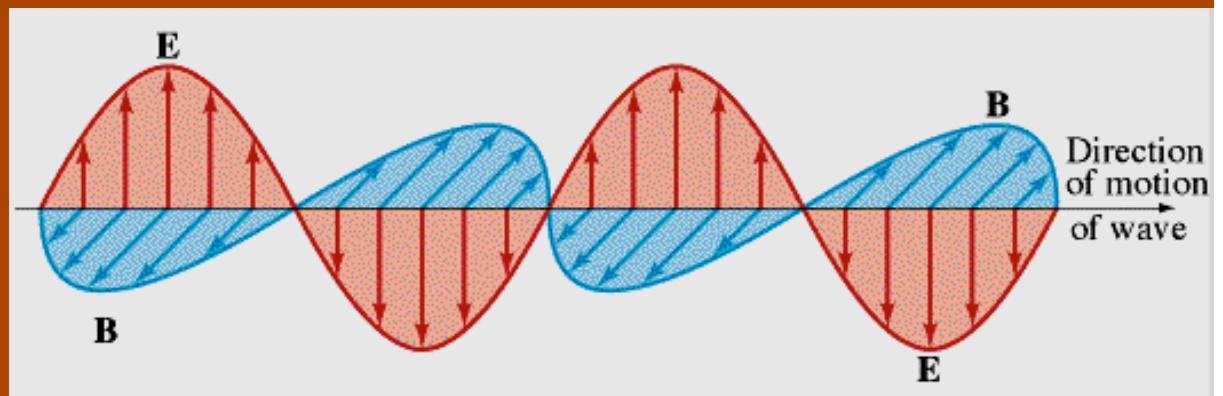
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The magnetic field oscillates perpendicular to **BOTH** the electric field and the direction of the wave. Therefore the magnetic field must oscillate in the NW-SE plane.

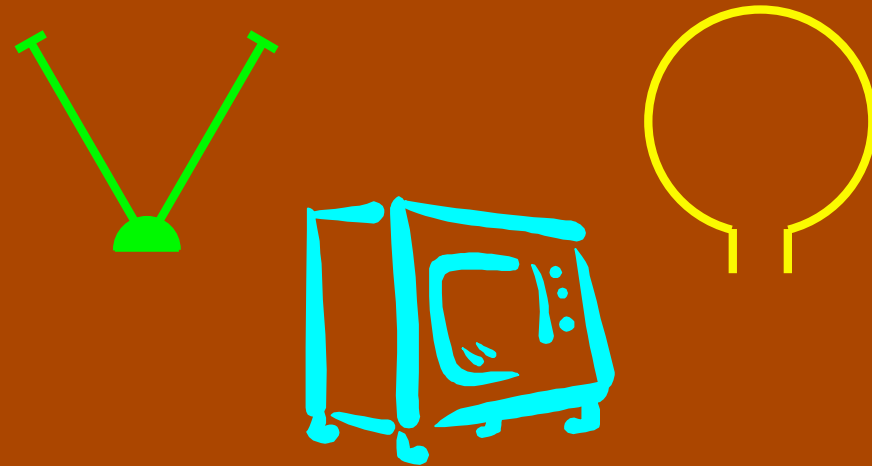


ConceptTest 22.3

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.



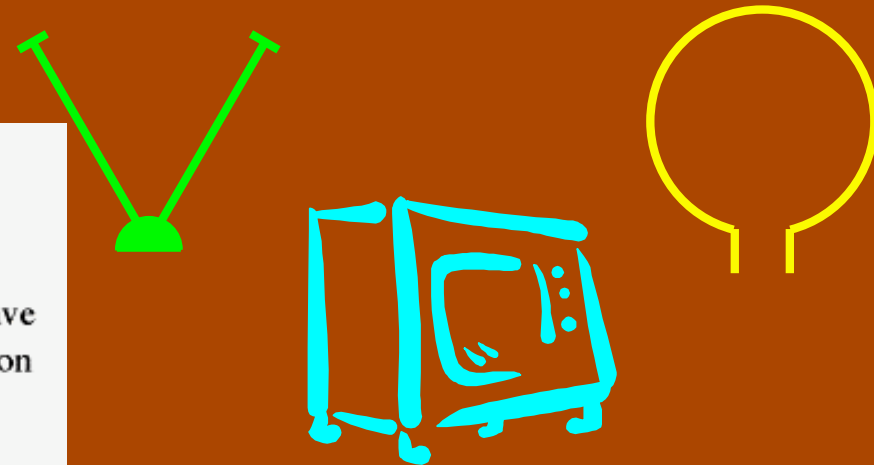
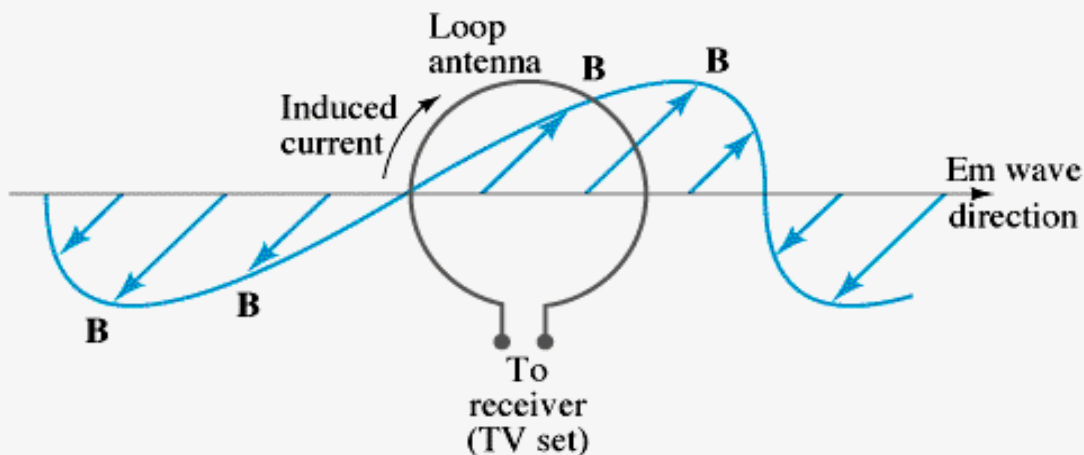
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- 3) both equally, they were straight and circular for different reasons.

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**

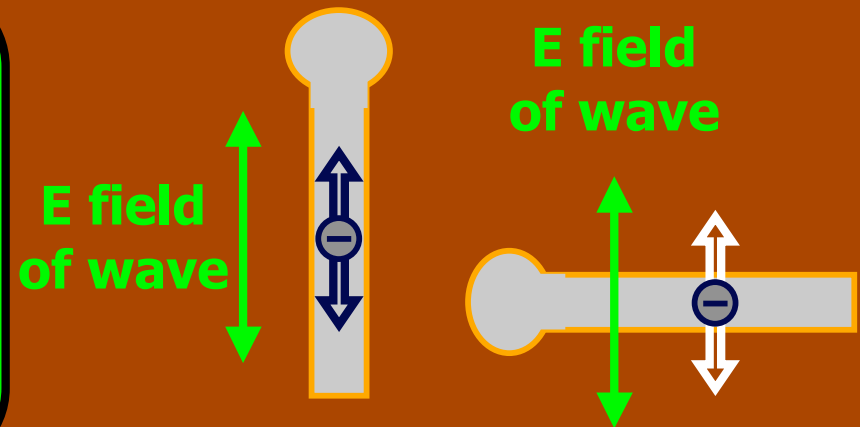
ConceptTest 22.4

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

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- 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

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?

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?