

# ConcepTest PowerPoints

## Chapter 22

*Physics: Principles with Applications, 6<sup>th</sup> edition*

Giancoli

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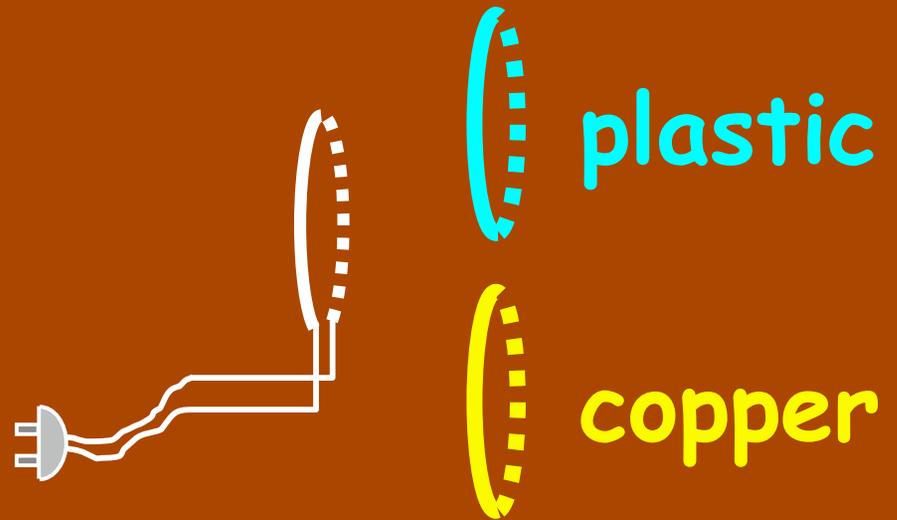
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## ConceptTest 22.1a

## 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

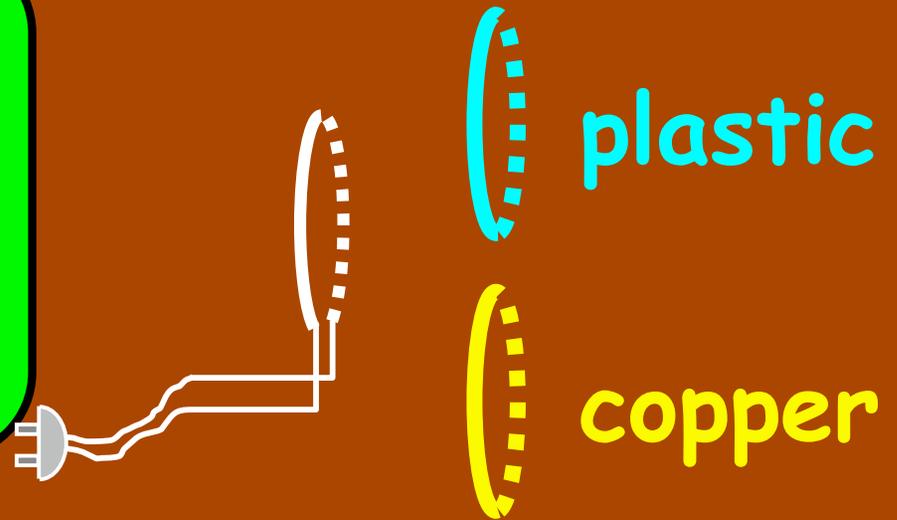
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Faraday's law says nothing about the material:

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

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

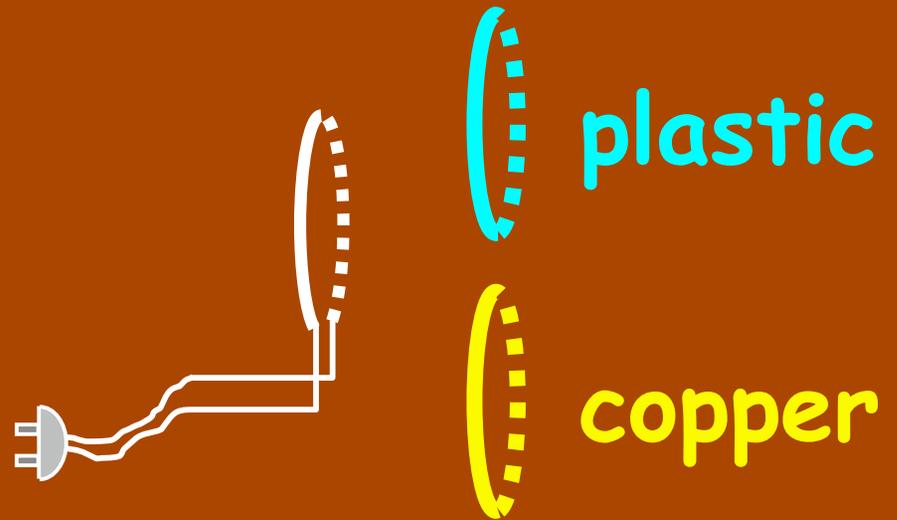


## ConceptTest 22.1b

## 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



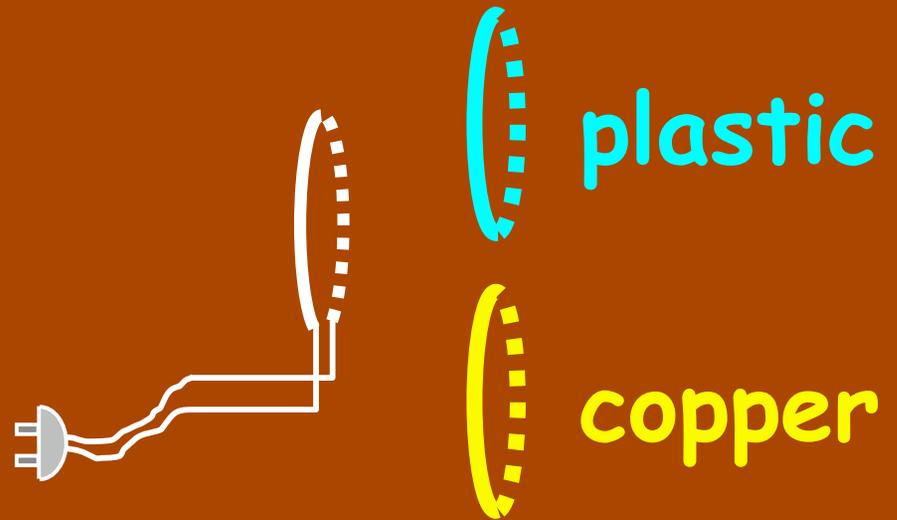
## ConceptTest 22.1b

## 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.



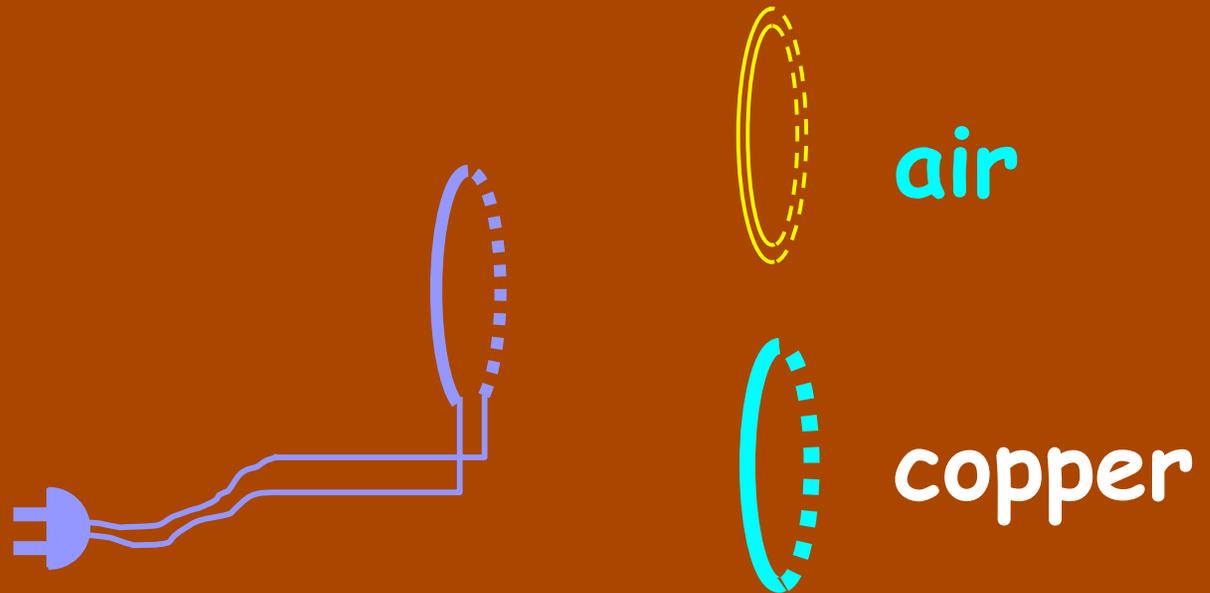
## ConceptTest 22.1c

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

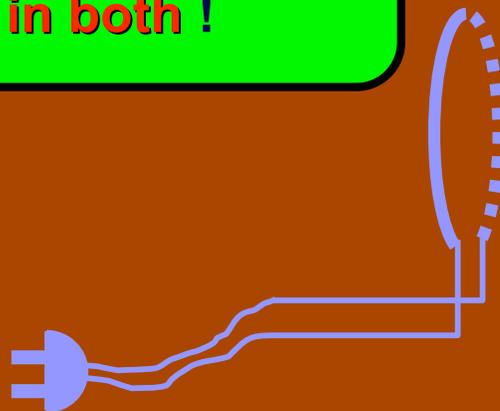
A loop with an **AC current** produces a changing magnetic field.

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## 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



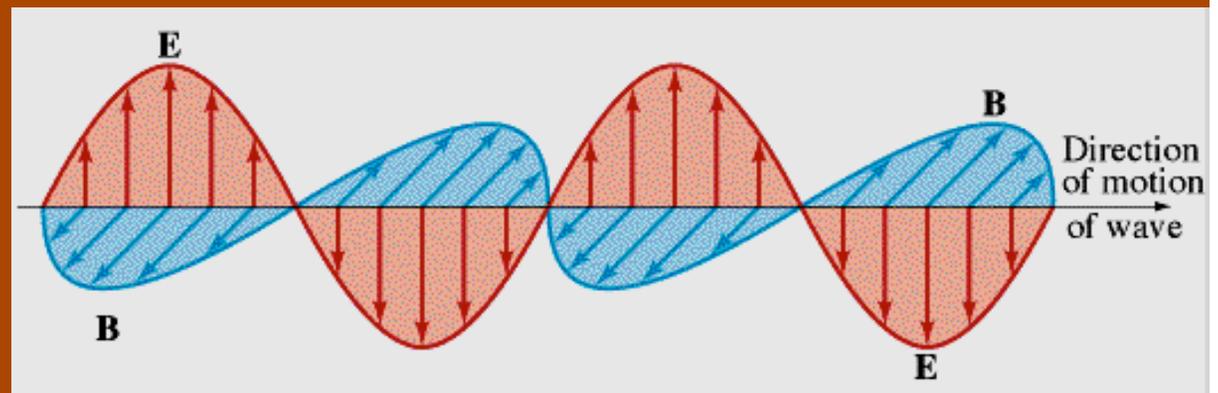
copper

## 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.



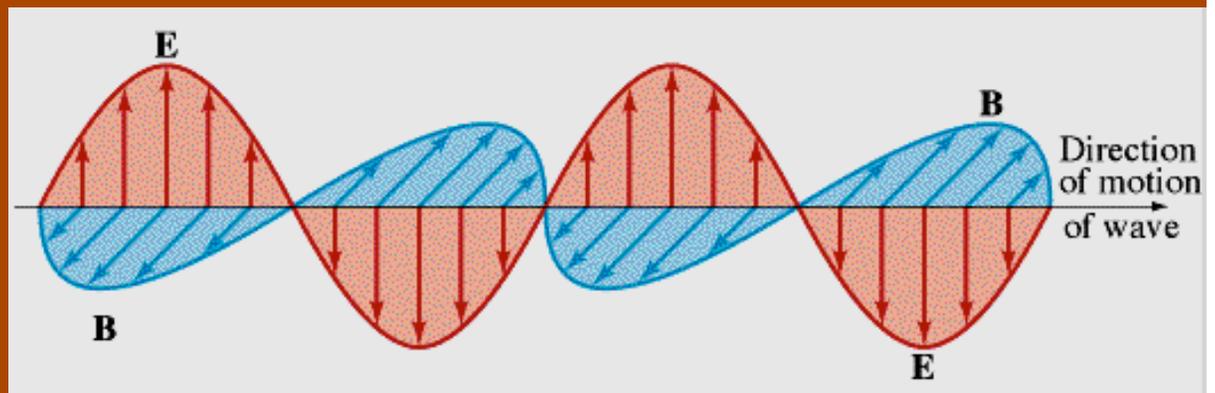
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The magnetic field oscillates perpendicular to **BOTH** the electric field and the direction of the wave. Therefore the magnetic field must oscillate in the NW-SE plane.

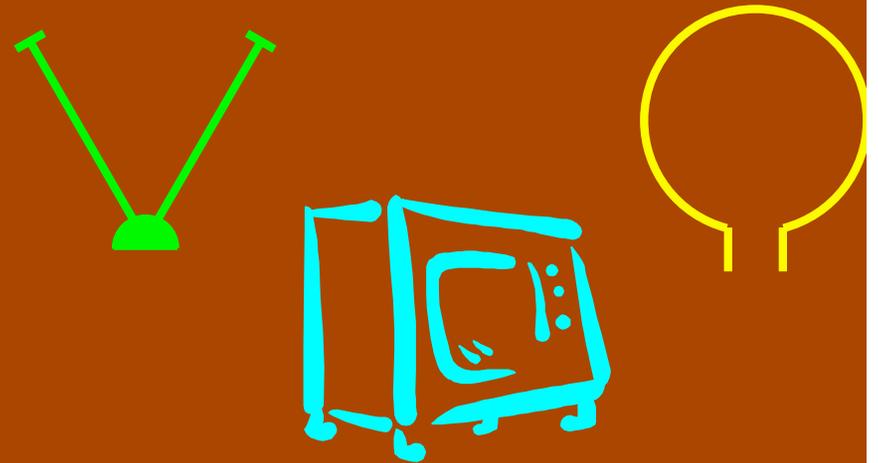


## ConceptTest 22.3

## 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.



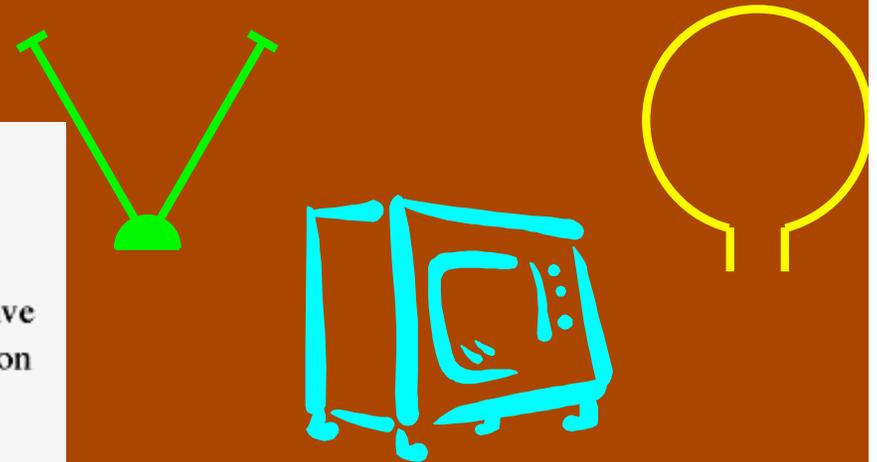
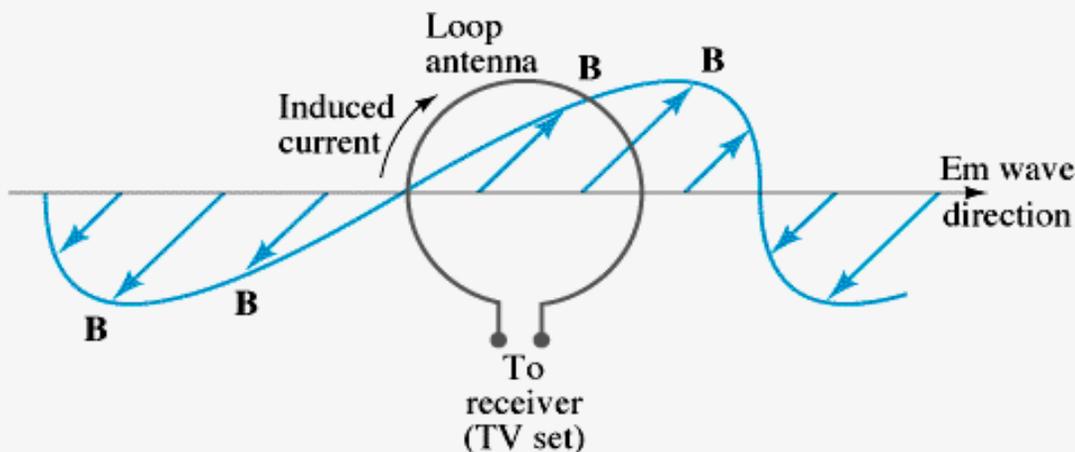
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- 3) both equally, they were straight and circular for different reasons.

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**

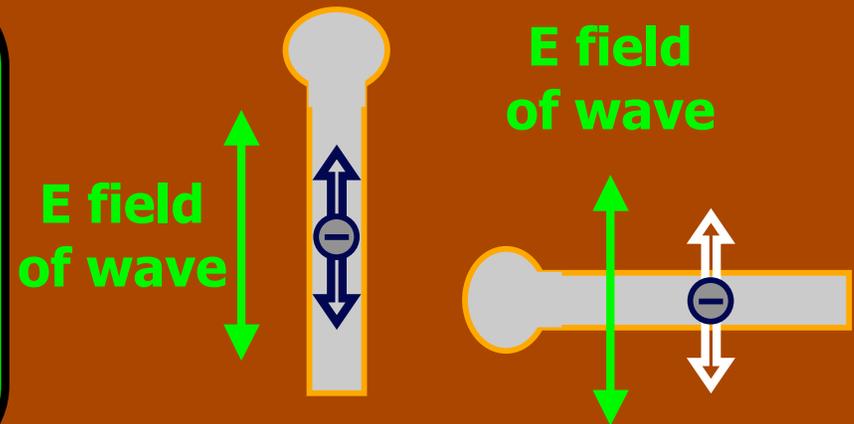
## ConceptTest 22.4

## 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

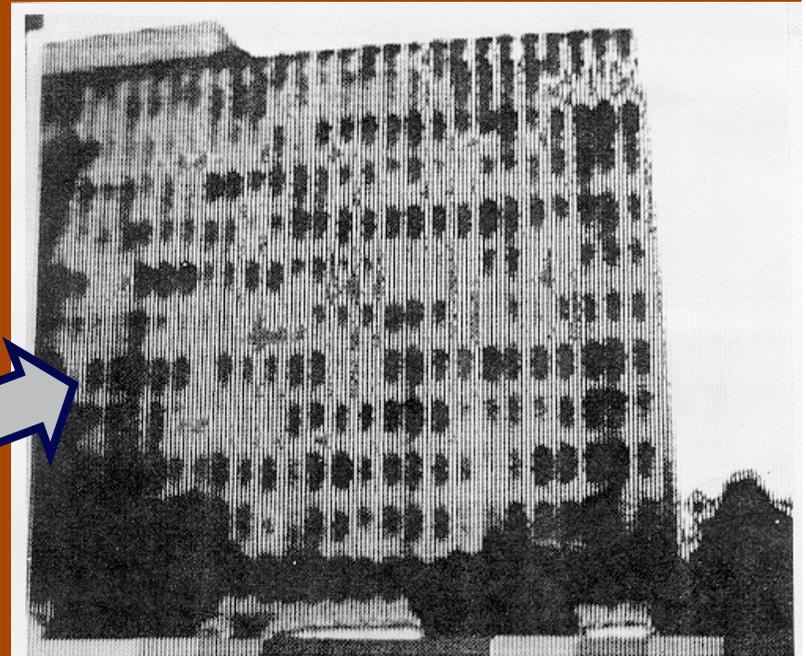
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- 4) The same as what we see, except that red is invisible.

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?