

Photoelectric Effect

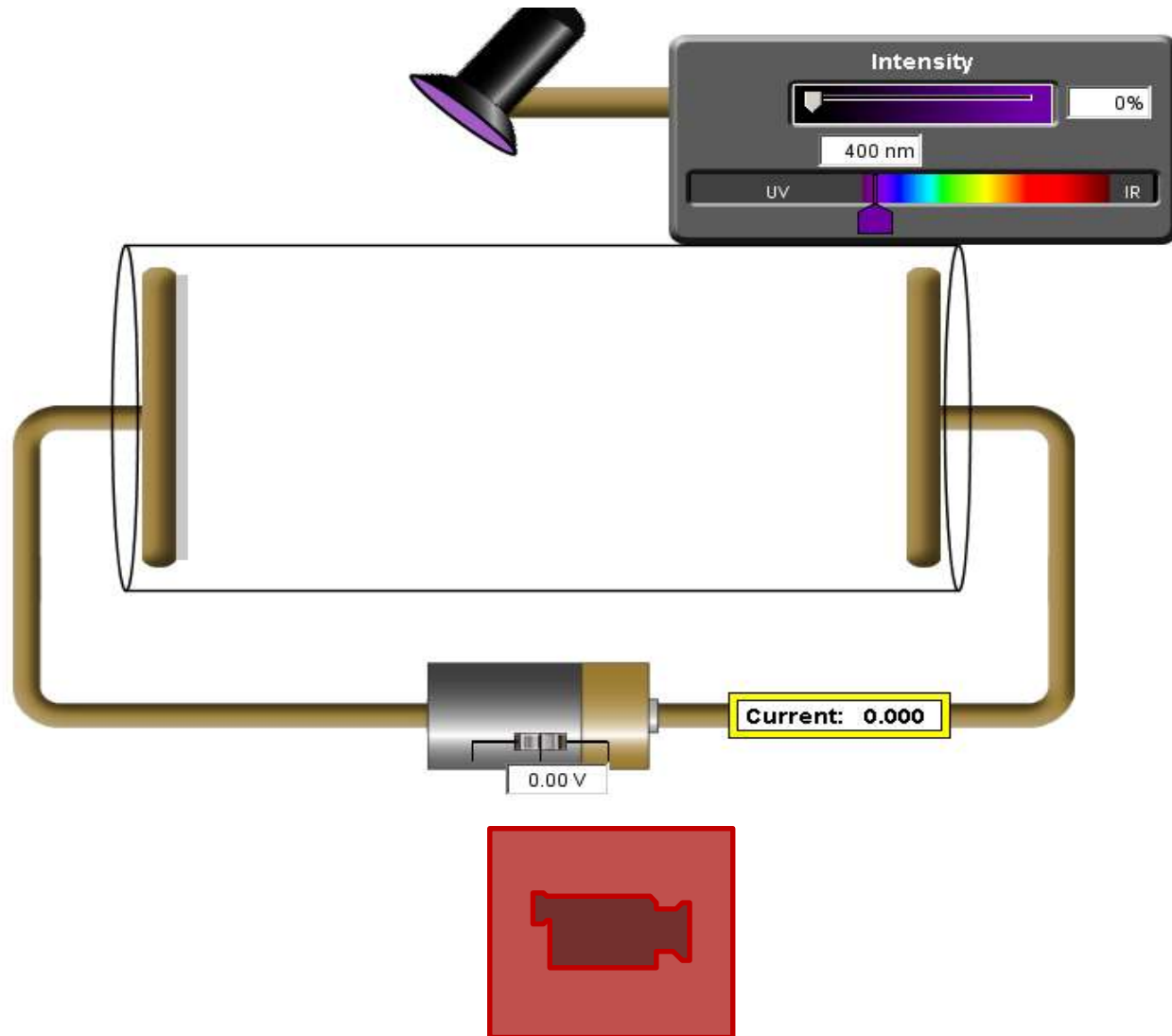
Factors

Photoelectric Effect: Factors affecting

WHETHER EMISSION OCCURS

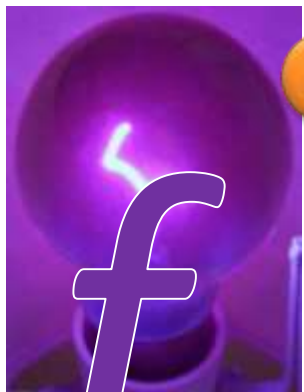
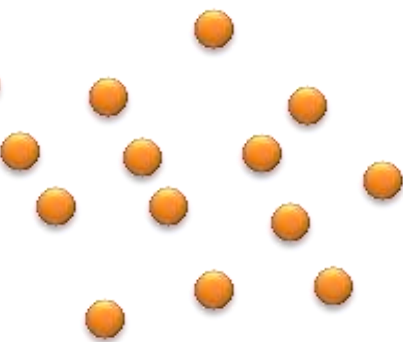
1. How does the frequency of light affect whether photoelectric emission occurs?

Effect of f on emission

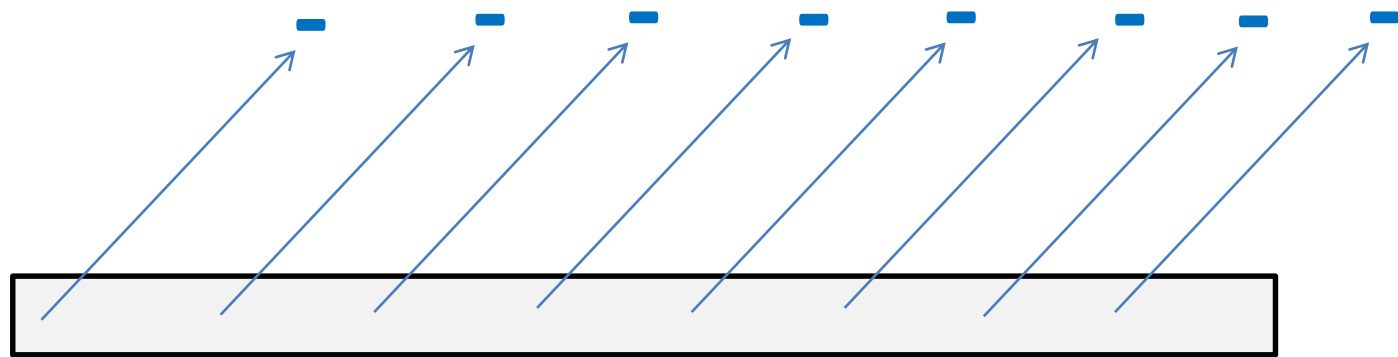


1. Photoelectric emission only occurs when light of a metal's cut-off frequency, or higher, shines on that metal.







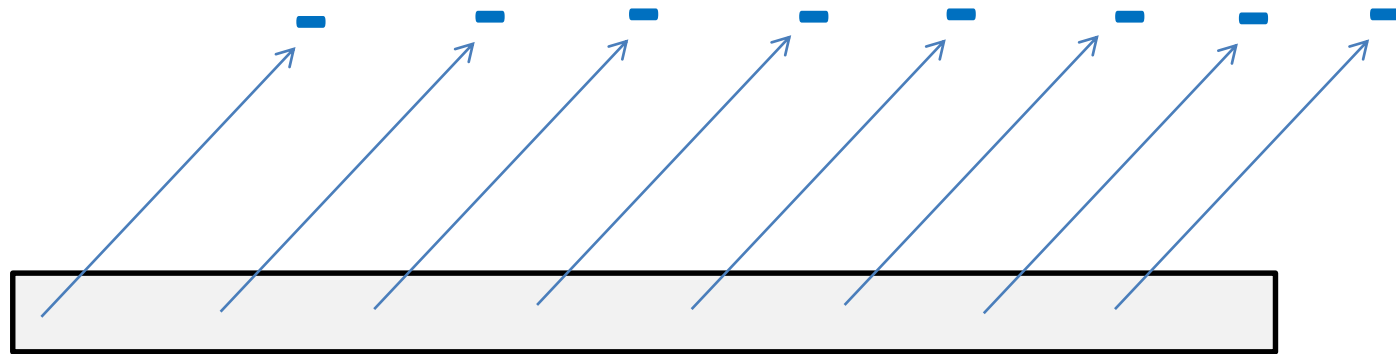




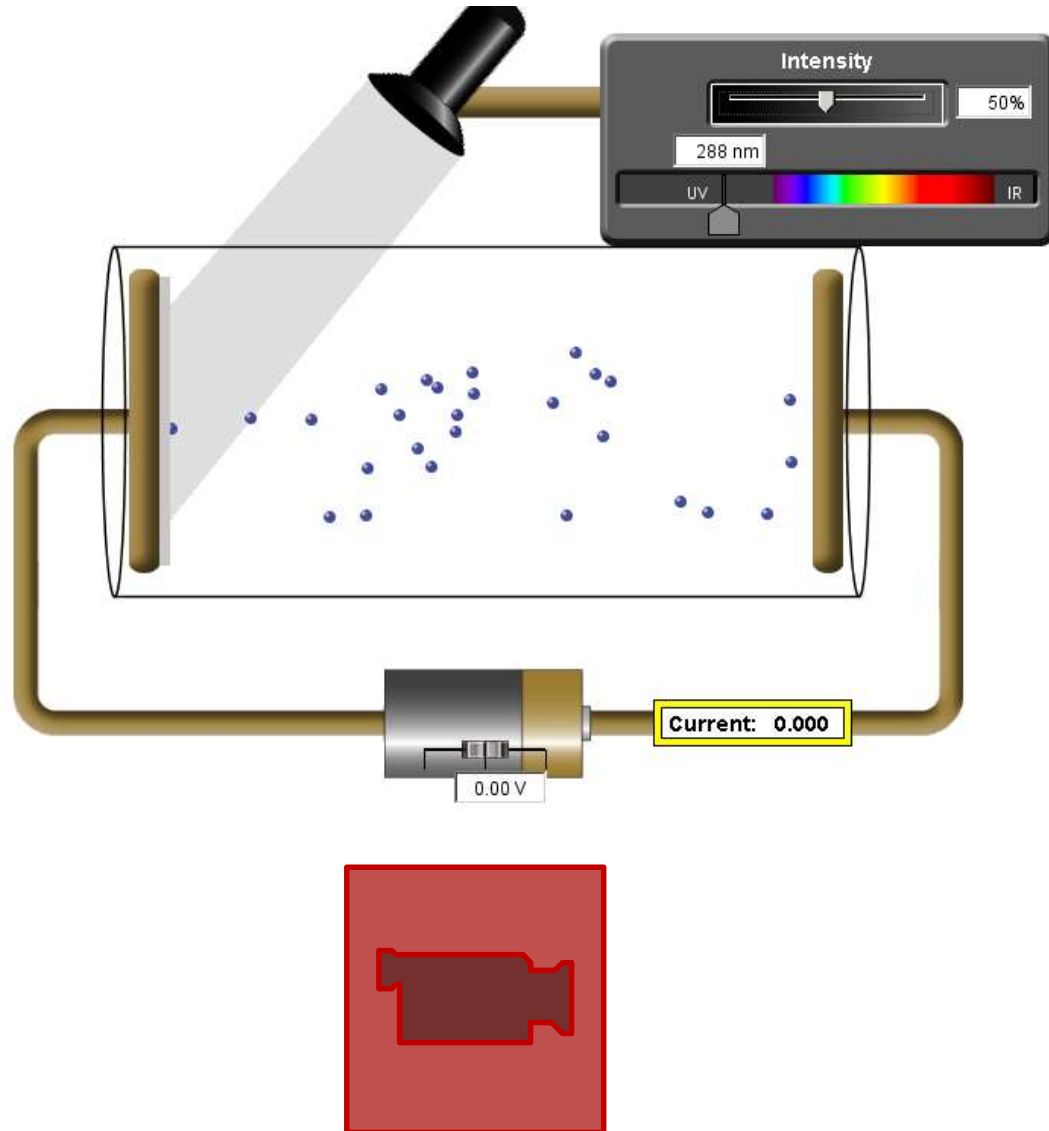
photoelectric emission **X**



photoelectric emission **✓**



Zn's cut-off wavelength



$$\text{frequency of light} = \frac{\text{speed of light}}{\text{wavelength of light}}$$

$$f = \frac{c}{\lambda}$$

$$f = \frac{3 \times 10^8 \text{ m} \cdot \text{s}^{-1}}{\lambda}$$

f if $\lambda = 288 \text{ nm}$ ($288 \times 10^{-9} \text{ m}$)

$$f = \frac{c}{\lambda}$$

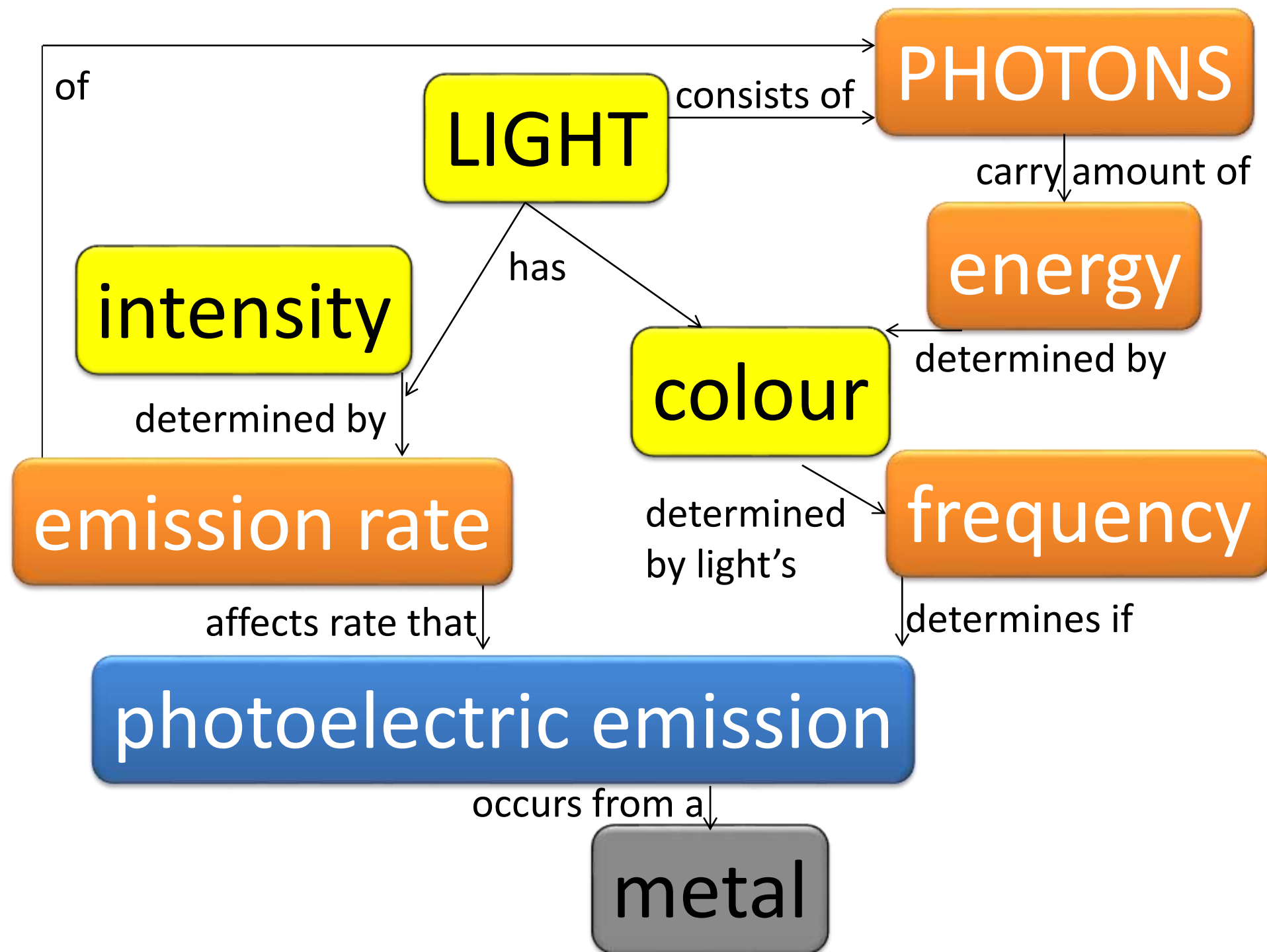
$$f = \frac{3 \times 10^8 \text{ m} \cdot \text{s}^{-1}}{288 \times 10^{-9} \text{ m}}$$

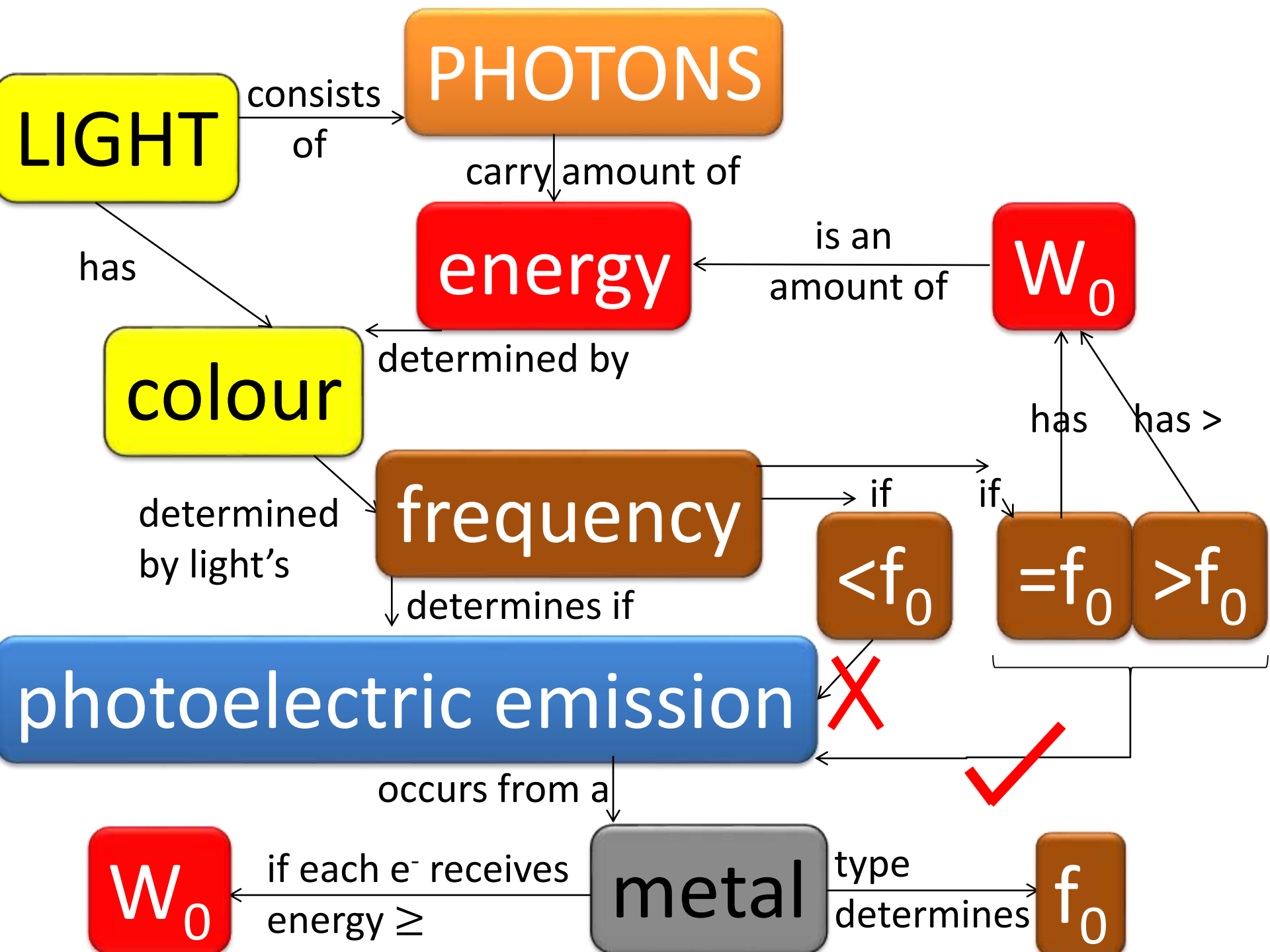
$$f = 1,04 \times 10^{15} \text{ s}^{-1}$$

Zn's f_o and λ_o

$1,04 \times 10^{15}$ Hz

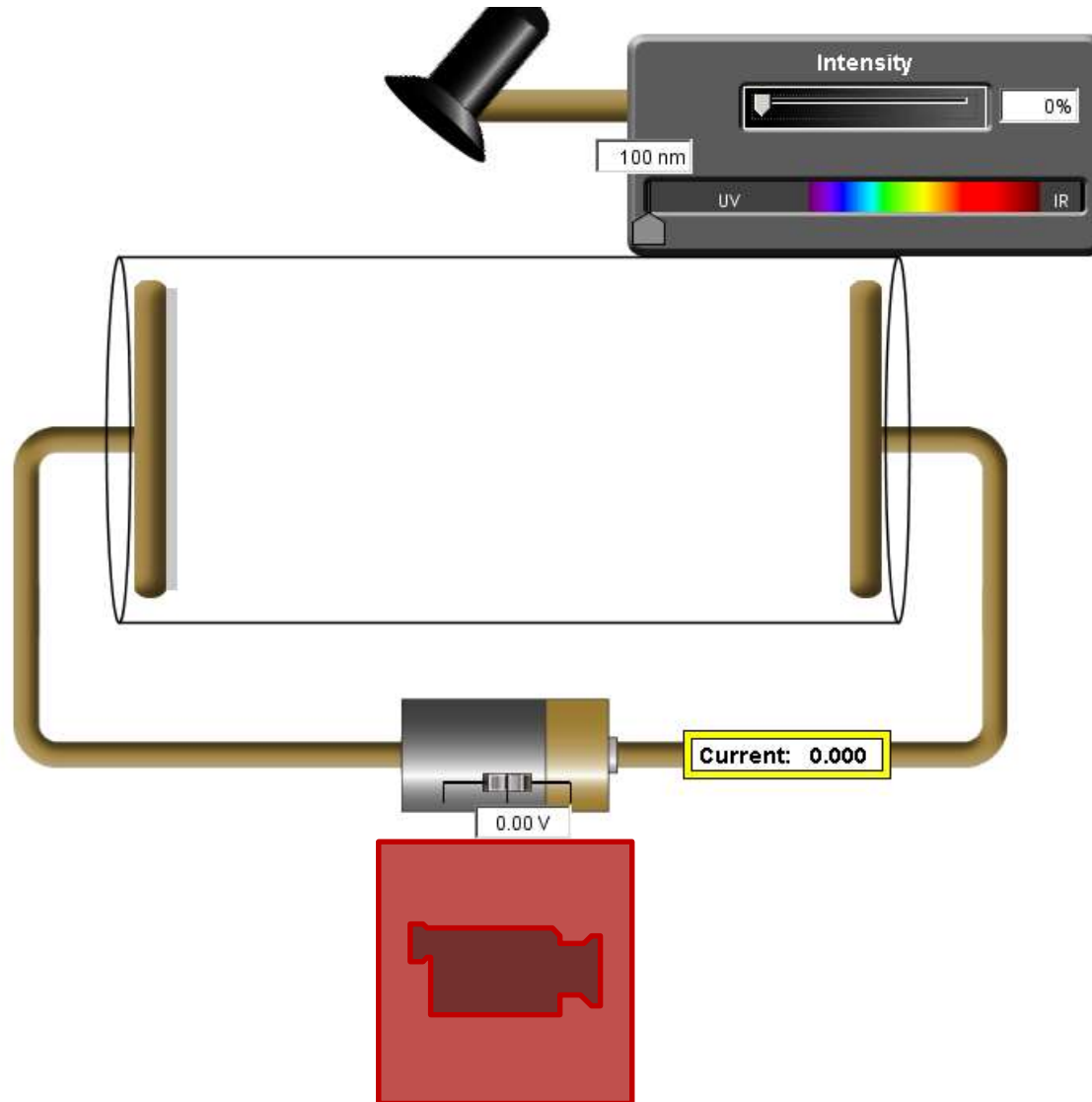




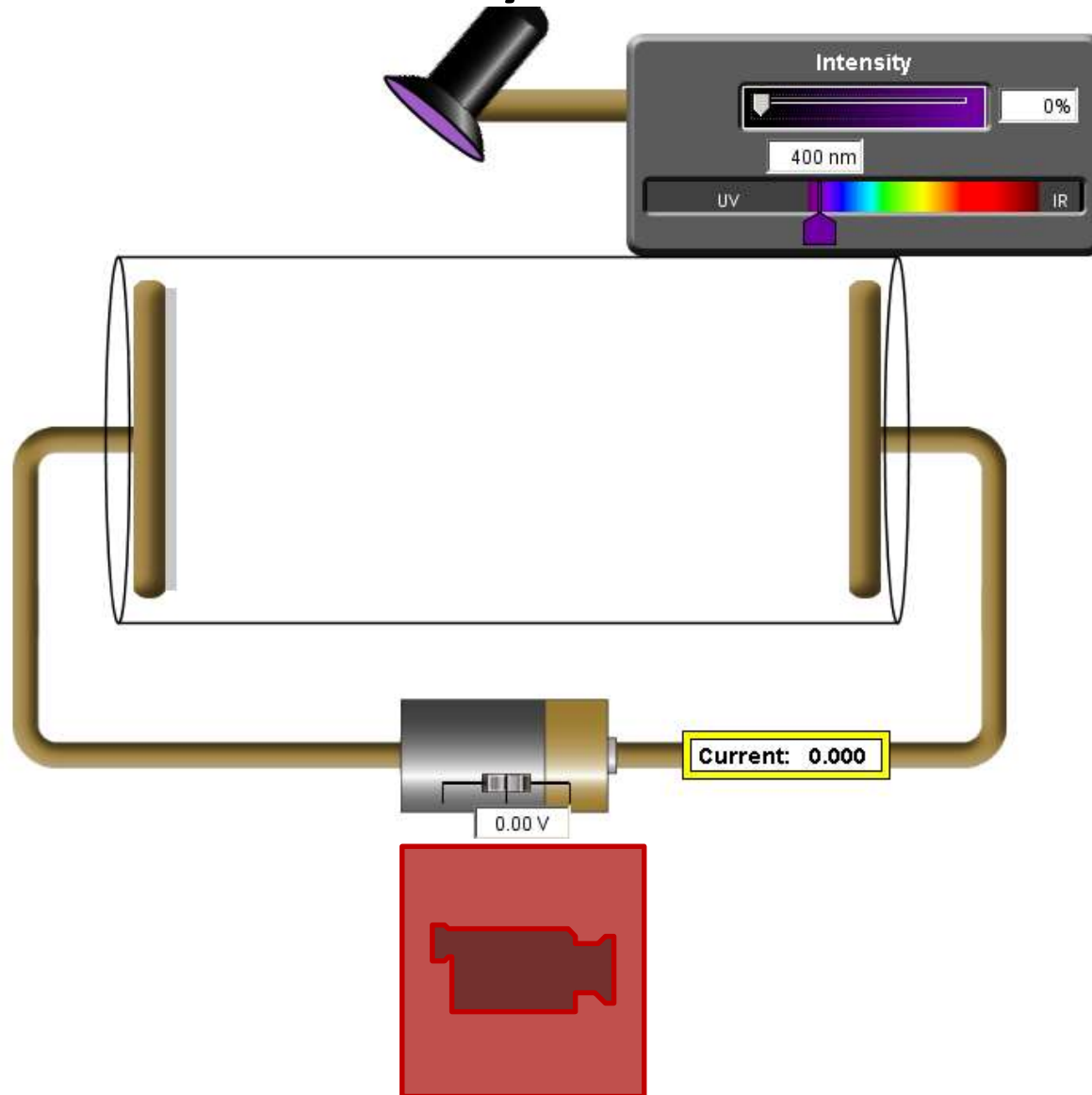


2. How does the intensity of light affect whether photoelectric emission occurs?

Effect of intensity on emission: $f > f_0$



Effect of intensity on emission: $f < f_0$



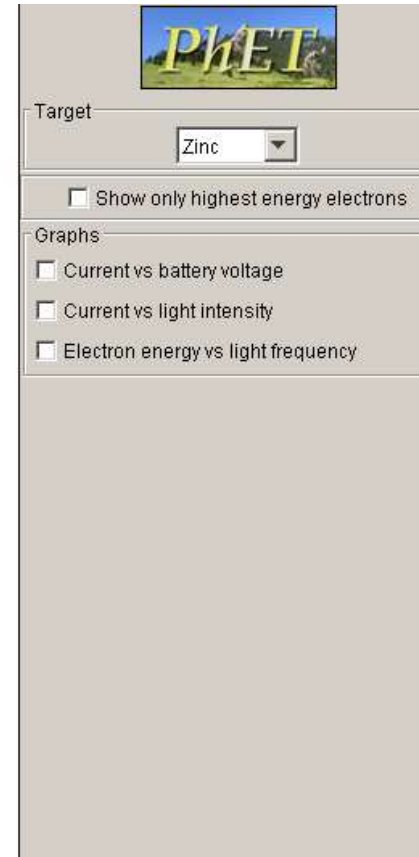
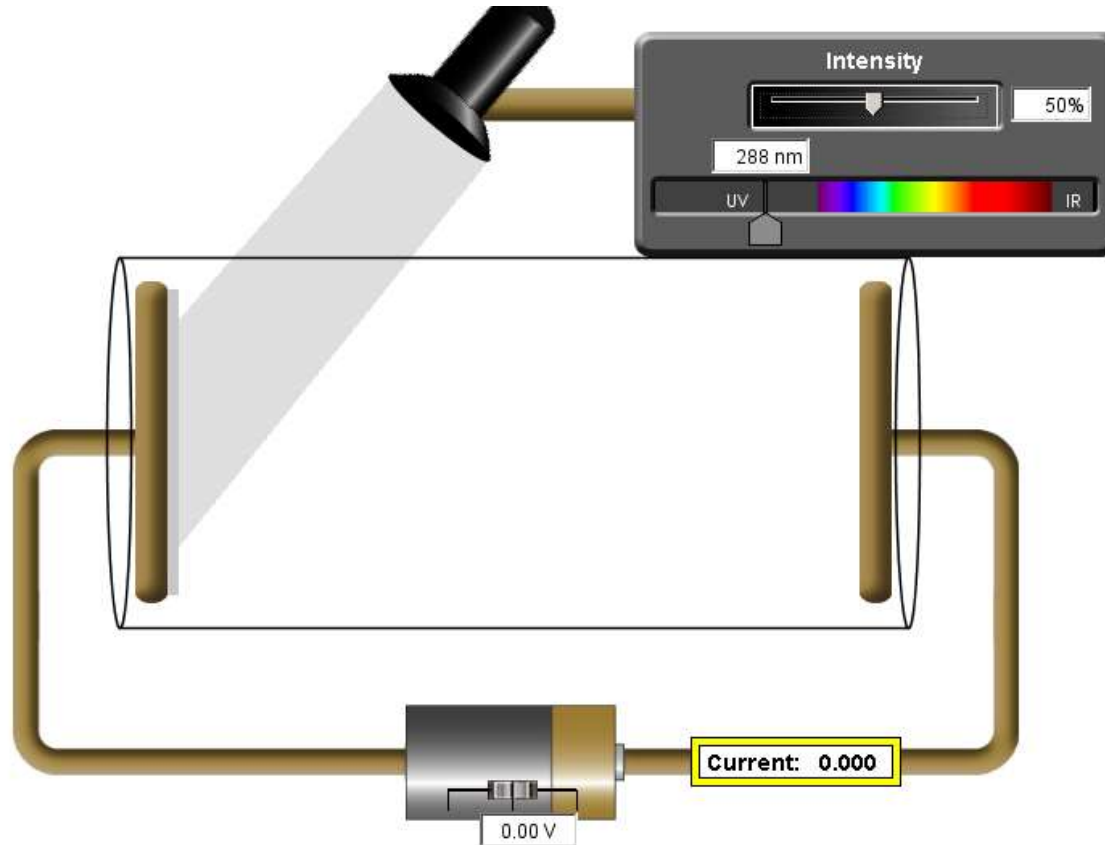
2. If the light's frequency is below the metal's cut-off frequency, photoelectric emission does not occur, regardless of the light's intensity.

2. If the light's frequency is above the metal's cut-off frequency, photoelectric emission does occur, regardless of the light's intensity.

2. Light intensity does not affect whether or not photoelectric emission occurs.

3. Does the type of metal affect whether photoelectric emission occurs at a particular frequency?

Effect of metal on emission



Metal	λ_0 (nm)	f_0 (Hz)	Movie
Pt	196	$1,53 \times 10^{15}$	
Cu	263	$1,14 \times 10^{15}$	
Zn	289	$1,04 \times 10^{15}$	
Ca	427	$7,03 \times 10^{14}$	
Na	539	$5,57 \times 10^{14}$	

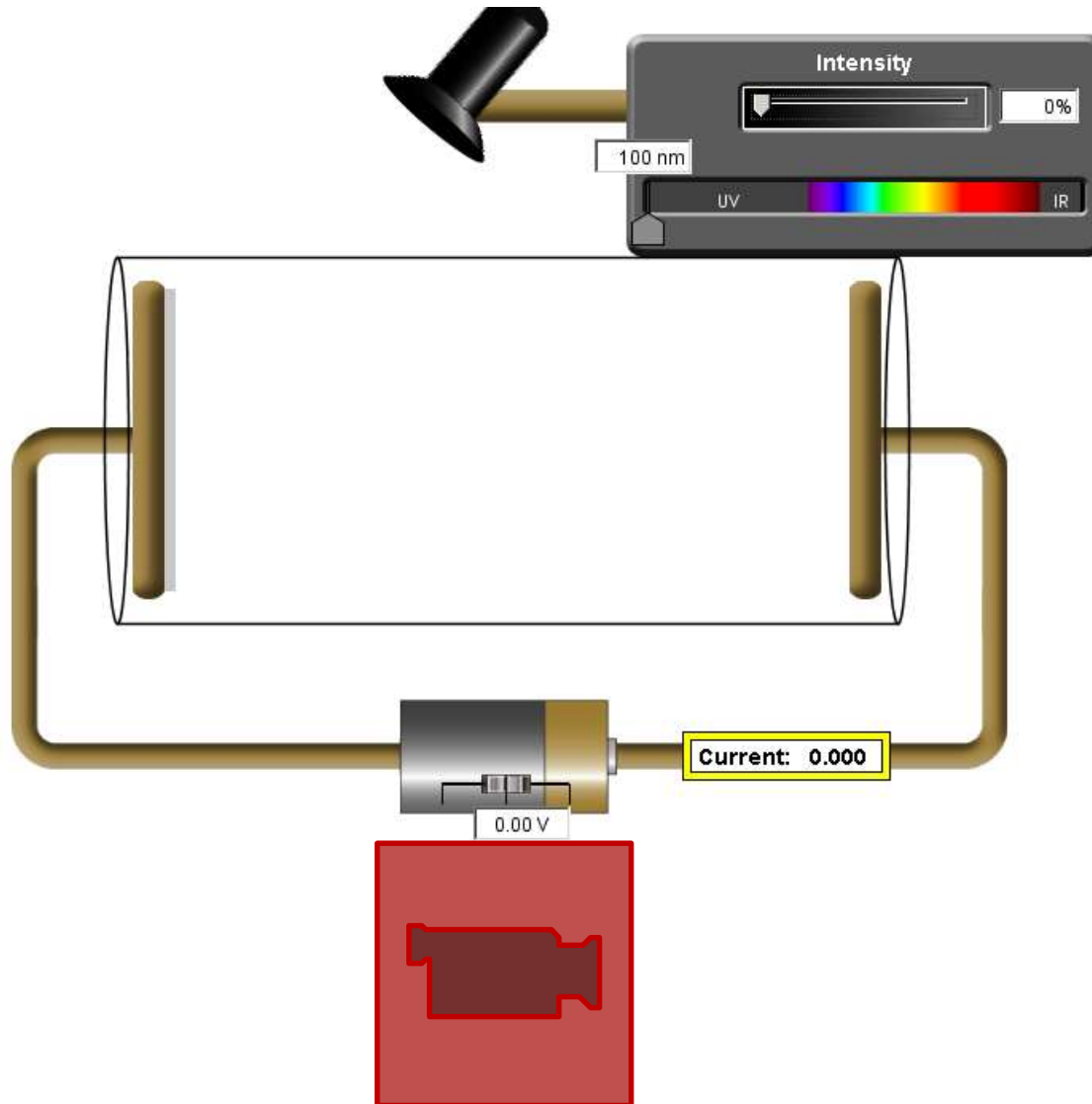
3. The type of metal does affect whether photoelectric emission occurs at a particular frequency.

Photoelectric Effect: Factors affecting

RATE OF EMISSION

4. How does the intensity of light affect the rate at which electrons are emitted during photoelectric emission?

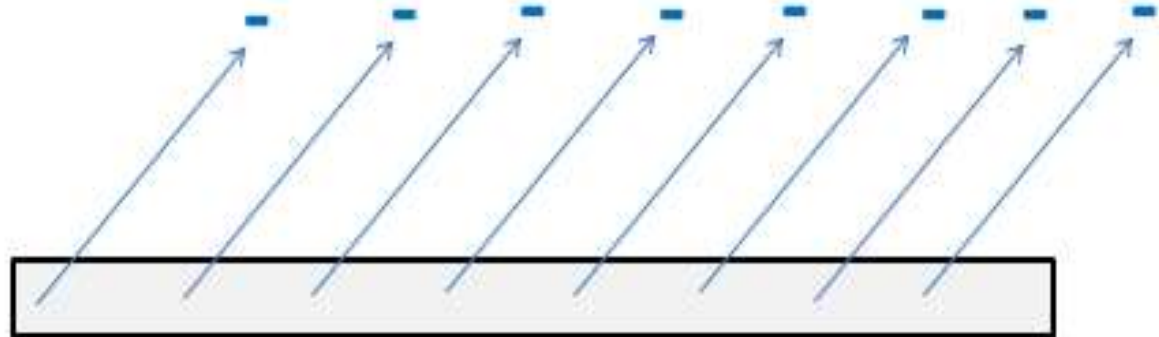
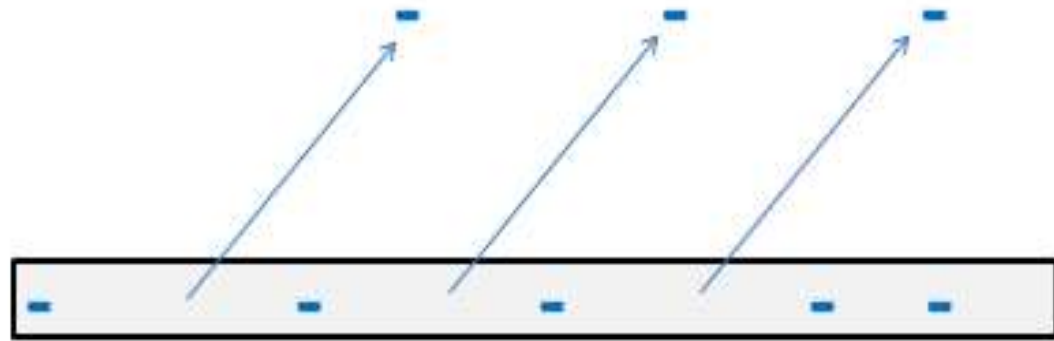
Effect of intensity on rate of emission: $f > f_0$



4. Increasing light intensity increases the rate at which electrons are emitted from a metal when photoelectric emission does occur.

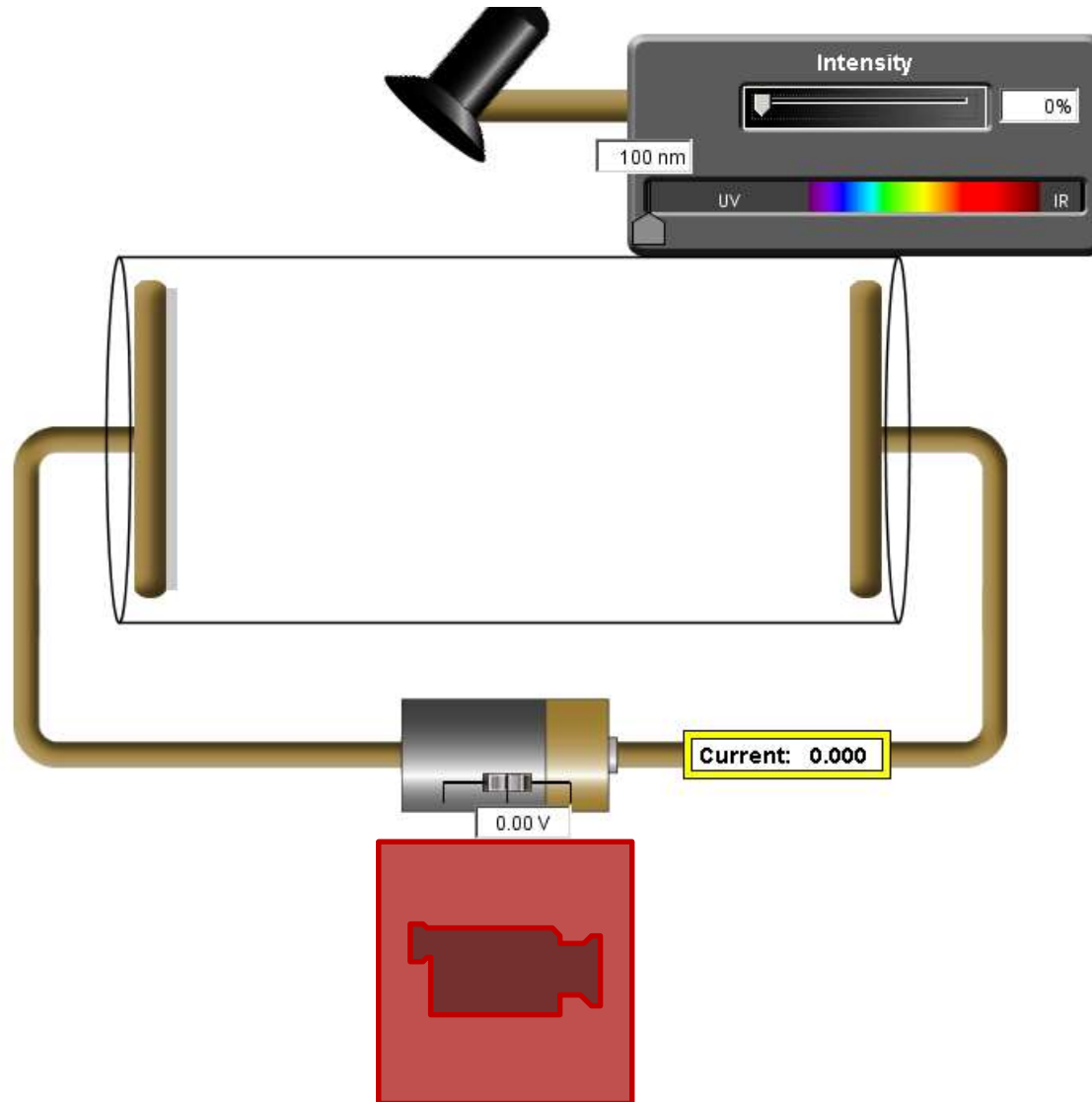






5. How does the frequency of light affect the kinetic energy of the emitted electrons during photoelectric emission?

Effect of frequency on KE of emitted electrons



4. Increasing the frequency of light, from the cut-off frequency, increases the kinetic energy of the electrons emitted during photoelectric emission.

energy photon gives

energy e^-
needs to
break free

e^- 's
kinetic
energy

