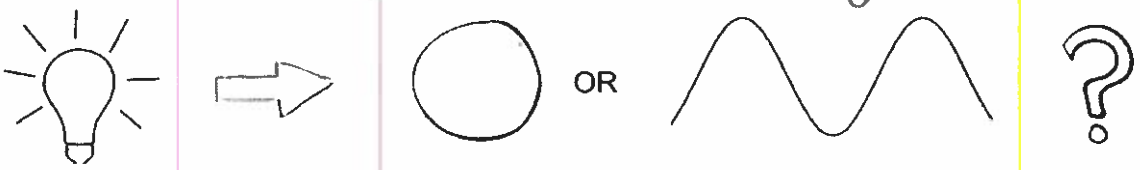
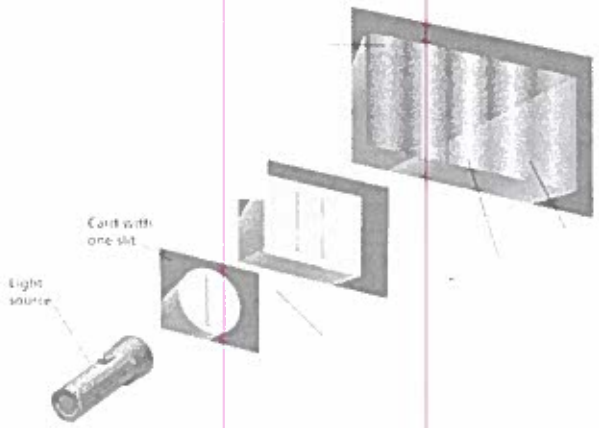
Wave Particle Duality of Light - 2019 Name: Key Per:



1. What behaviors in the image suggest that light is a wave? Explain.



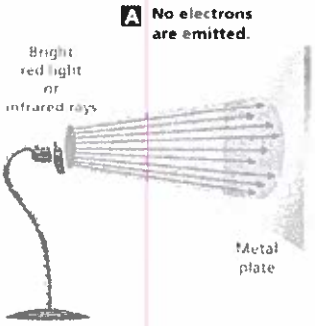
The light bends as it passes through the slits (diffraction) and shows light bands (constructive interference) and dark bands (destructive interference).

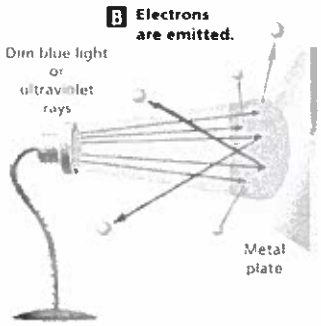
2. What behavior suggests that light is a particle?
photoelectric effect

3. What do you call a "particle" of light? photon

4. What is the photoelectric effect?
emission of e^- from a metal caused by light striking the metal.

5. Why are electrons emitted in image B (blue light) and not in image A (red light)?





Blue light has ↑ f and therefore the photons carry more E. This E is enough to cause the metal to emit e^-, even if the light is dim.

The red light, no matter how matter how bright, doesn't cause e^- to be emitted from this metal surface, because red light doesn't have enough E. The E in the photons are proportional to the f of the light.

6. What is a real-life application of the photoelectric effect?
Solar E
photomultiplier tubes

* solar E is prod by photovoltaic cells. These cells are made of semi-conducting material which prod elect. when exposed to sunlight.
  ↳ SOLAR POWERED CALCULATOR or SATELLITE THAT ORBITS EARTH

* Photo-multiplier tubes - convert sm. intensities of light to electrical currents that can be analyzed. The e^- hit CCD (charged coupled device) where they are stored, processed, and an image is read. (digital video & still cameras)

* Automatic Garage Door Safety feature - as long as the beam of light strikes the photocell, the photoelectric effect generates e^- to prod. current. If someone blocks it, the current is interrupted & the door stops & opens up.