Name: _____

Period: _____

Practice for Lenses, Magnification, and Photoelectric Effect.

1. The threshold frequency for a photovoltaic cell is 7.14×10^{14} Hz.
   A. What minimum wavelength of light is necessary?

   B. Calculate the work function for this metal.

   C. How much kinetic energy would each electron have if 600 nm light is used?

   D. How much kinetic energy would each electron have if 360 nm light was used?

2. The work function corresponds to 575 nm light. Calculate the kinetic energy of the electrons if 280 nm is used.

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3. A 2.8cm object is 34 cm to the left convex lens. An image comes into focus 16 cm to the right of the lens.
   A. Is the image real or virtual?
   B. Is the image magnified or reduced?
   C. Where is the image relative to f and C?
   D. Calculate the focal length, magnification of the lens, and height of the image.

4. A convex lens has a focal length of 12 cm. The object is at 8 cm.
   A. What is the radius of curvature?
   B. Describe the image, including relative size, location, and type of image.

5. An object is 8 cm to the left of a convex lens that has a radius of curvature of 10 cm. If the image is 9.4 cm tall, how far away from the lens is image and how tall is the object?

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Practice for Lenses, Magnification, and Photoelectric Effect.

1. The threshold frequency for a photovoltaic cell is 7.14×10^{14} Hz.
   A. What minimum wavelength of light is necessary?

   $\lambda = \frac{c}{f} = \frac{3E8}{7.14E14} = 4.2\times10^{-7}$ m

   420 nm

   B. Calculate the work function for this metal.

   $W = hf = 6.63\times10^{-34}(7.14\times10^{14}) =$

   4.73×10^{-19} J

   C. How much kinetic energy would each electron have if 600 nm light is used?

   not enough E for work function

   $E = \frac{hc}{\lambda} = 3.32\times10^{-19}$ J

   D. How much kinetic energy would each electron have if 360 nm light was used?

   $E_{360nm} = \frac{hc}{\lambda} = 5.53\times10^{-19}$ J

   $-4.73\times10^{-19} = 7.89\times10^{-20}$ J

2. The work function corresponds to 575 nm light. Calculate the kinetic energy of the electrons if 280 nm is used.

   $E = h\frac{c}{\lambda} - \frac{hc}{\lambda} =$

   inc. 280nm — work 575nm

   $= (7.10E-19) - (3.46E-19)$

   $= 3.64\times10^{-19}$ J

Remember: the work function (which corresponds to the "threshold frequency") is the minimum energy to get an electron out of the atom (like the ball getting up the hill). If you have exactly the work function's amount of energy, then the electron gets out, but without any KE (or KE = 0). If you have more than the work function, then the electron is out and has excess KE. How much KE? Subtract the work function from the energy of the photon.

EX1: The work function is 2.5 eV. An incoming photon (quantum of energy) has 2.5 eV of energy. Then the electron gets out and has no KE.

EX2: The work function is 3eV and the incoming photon has 4 eV of energy. KE = 4ev—3eV = 1eV of KE afterwards.

3. A 2.8cm object is 34 cm to the left convex lens. An image comes into focus 16 cm to the right of the lens.
   A. Is the image real or virtual? (on R side)
   B. Is the image magnified or reduced? q < p
   C. Where is the image relative to f and C? betwn C+F
   D. Calculate the focal length, magnification of the lens, and height of the image.

   $\frac{1}{34} + \frac{1}{16} = \frac{1}{f}$

   $.0919 = \frac{1}{f}$

   $f = \frac{1}{.0919}$

   $f = 10.9$ cm

   $M = \frac{-q}{p} = \frac{-16}{34} = -.47$

   $M = \frac{h'}{h}$

   $h' = Mh = -.47(2.8)$

   $= -1.32$ cm

4. A convex lens has a focal length of 12 cm. The object is at 8 cm.
   A. What is the radius of curvature? 24cm
   B. Describe the image, including relative size, location, and type of image.

   virtual, magnified, on left side + farther than obj.

   p =

5. An object is 8 cm to the left of a convex lens that has a radius of curvature of 10 cm. If the image is 9.4 cm tall, how far away from the lens is image and how tall is the object?

   $\frac{1}{8} + \frac{1}{q} = \frac{1}{5}$

   $\frac{1}{q} = \frac{1}{5} - \frac{1}{8}$

   $\frac{1}{q} = .325$

   $q = 1/.075 = 13.3$ cm

   $\frac{-q}{p} = \frac{h'}{h}$

   $h = \frac{ph'}{-q} = \frac{8(9.4)}{-13.3}$

   $= -5.65$ cm