

219 HW #1.

1.  $E = 3.145 \times 10^{-19} \text{ J}$

$$E = \frac{hc}{\lambda}$$

$$3.145 \times 10^{-19} \text{ J} = \frac{6.626 \times 10^{-34} \text{ J}\cdot\text{s} \times 3 \times 10^8 \text{ m/s}}{\lambda}$$

$$\lambda = \frac{6.626 \times 10^{-34} \text{ J}\cdot\text{s} \times 3 \times 10^8 \text{ m/s}}{3.145 \times 10^{-19} \text{ J}}$$

$$\lambda = 632 \times 10^{-9} \text{ m}$$

$$= \underline{\underline{632 \text{ nm}}}$$

2.  $E = 2.35 \text{ eV}$

$$E = 2.35 \times 1.6 \times 10^{-19} \text{ J}$$

$$= 3.76 \times 10^{-19} \text{ J}$$

$$3.76 \times 10^{-19} \text{ J} = \frac{hc}{\lambda}$$

$$3.76 \times 10^{-19} \text{ J} = \frac{6.626 \times 10^{-34} \text{ J}\cdot\text{s} \times 3 \times 10^8 \text{ m/s}}{\lambda}$$

$$\lambda = \frac{6.626 \times 10^{-34} \text{ J}\cdot\text{s} \times 3 \times 10^8 \text{ m/s}}{3.76 \times 10^{-19} \text{ J}}$$

$$\lambda = 528.6 \times 10^{-9} \text{ m}$$

$$= \underline{\underline{528.6 \text{ nm}}}$$

$$\begin{aligned}
 3. \quad E &= \frac{hc}{\lambda} \\
 E &= \frac{6.626 \times 10^{-34} \text{ J}\cdot\text{s} \times 3 \times 10^8 \text{ m/s}}{10600 \text{ nm}} \\
 &= \frac{6.626 \times 10^{-34} \text{ J}\cdot\text{s} \times 3 \times 10^8 \text{ m/s}}{1.06 \times 10^{-5} \times 1.6 \times 10^{-19} \text{ J/eV}} \\
 &= 0.117 \text{ eV}
 \end{aligned}$$

$$\begin{aligned}
 4. \quad \phi &= 4.31 \text{ eV} = E \\
 E &= \frac{hc}{\lambda} \\
 \lambda &= \frac{hc}{E} \\
 \lambda &= \frac{6.626 \times 10^{-34} \text{ J}\cdot\text{s} \times 3 \times 10^8 \text{ m/s}}{4.31 \text{ eV} \times 1.6 \times 10^{-19} \text{ J/eV}} \\
 \lambda &= 2.88 \times 10^{-7} \text{ m} \\
 &= 288 \text{ nm} \quad \text{A}
 \end{aligned}$$

$$\begin{aligned}
 8. \quad h\nu &= \phi + \frac{1}{2}mv^2 \\
 h \frac{c}{\lambda} &= \phi + \frac{1}{2}mv^2 \\
 \frac{6.626 \times 10^{-34} \text{ J} \cdot \text{s} \times 3 \times 10^8 \text{ m/s}}{1.56 \times 10^{-7} \text{ m}} - 2.46 \text{ eV} &= \frac{1}{2}mv^2 \\
 \frac{1}{2}mv^2 &= 1.27 \times 10^{-18} \text{ J} - 2.46 \text{ eV} \\
 &= (1.27 \times 10^{-18} \text{ J} \times 6.24 \times 10^{18} \text{ eV}) - 2.46 \text{ eV} \\
 &= 7.95 \text{ eV} - 2.46 \text{ eV} \\
 E_k &= \underline{5.49 \text{ eV}}
 \end{aligned}$$

$$\begin{aligned}
 6. \quad \frac{hc}{\lambda} &= \phi + E_k \\
 \phi &= E_k - \frac{hc}{\lambda} \\
 \phi &= 5.84 \times 10^{-19} \text{ J} - \frac{6.626 \times 10^{-34} \text{ J} \cdot \text{s} \times 3 \times 10^8 \text{ m/s}}{1.56 \times 10^{-7} \text{ m}} \\
 \phi &= -6.9 \times 10^{-19} \text{ J} \times 6.24 \times 10^{18} \text{ eV} \\
 &= \underline{-4.31 \text{ eV}} \quad ?
 \end{aligned}$$



7.  $E_k = e\Delta V_s$        $E_k = 3.36 \times 10^{-19} \text{ J}$

$$3.36 \times 10^{-19} \text{ J} = 1.6 \times 10^{-19} \Delta V_s$$

$$\Delta V_s = \frac{3.36 \times 10^{-19}}{1.6 \times 10^{-19}}$$

$$= \underline{2.1 \text{ V}}$$

8.  $\lambda = 488 \text{ nm}$        $\phi = 2.14 \text{ eV}$

$$\frac{hc}{\lambda} = \phi + E_k$$

$$E_k = \frac{hc}{\lambda} - \phi$$

$$E_k = \frac{6.626 \times 10^{-34} \text{ J}\cdot\text{s} \times 3 \times 10^8 \text{ m/s}}{4.88 \times 10^{-7} \text{ m}} - 2.14 \text{ eV}$$

$$= 2.54 \text{ eV} - 2.14 \text{ eV}$$

$$= \underline{0.4 \text{ eV}}$$

9.  $h\nu = \phi + E_k$        $E_k = e\Delta V_s.$

$$\frac{hc}{\lambda} = 4.1\text{eV} + 1.6 \times 10^{-19} \times 1.7\text{V}.$$

$$\lambda = \frac{6.626 \times 10^{-34} \text{ J}\cdot\text{s} \times 3 \times 10^8 \text{ m/s}}{4.1\text{eV} \times 1.6 \times 10^{-19} + 1.7\text{V} \times 1.6 \times 10^{-19}}$$

$$\lambda = 2.14 \times 10^{-7} \text{ m}.$$

$$= \underline{214 \text{ nm}}$$

10.  $E_k = \frac{p^2}{2m}$

$$4 \times 10^{-19} \text{ J} = \frac{p^2}{9.1 \times 10^{-31} \text{ kg}} \times 2$$

$$p^2 = 4 \times 10^{-19} \text{ J} \times 9.1 \times 10^{-31} \text{ kg} \times 2.$$

$$p = \sqrt{7.28 \times 10^{-49}}$$

$$p = 8.53 \times 10^{-25} \text{ J}\cdot\text{s}$$

$$= 8.53 \times 10^{-25} \frac{\text{kg}^2 \text{ m}^2}{\text{s}^2}$$

11.  $m = 6.63 \times 10^{-23} \text{ kg}$ ,  $E_k = 5 \times 10^{-19} \text{ J}$

$$p = \sqrt{\frac{E_k}{2m}}$$

$$p = \sqrt{\frac{5 \times 10^{-19} \text{ J}}{2(6.63 \times 10^{-23} \text{ kg})}}$$

$$p = 61.41$$

$$\lambda = \frac{h}{p}$$

$$\lambda = \frac{6.626 \times 10^{-34} \text{ J}\cdot\text{s}}{61.41}$$

$$= 1.079 \times 10^{-35} \text{ m}$$

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$$E = \frac{hc}{\lambda}$$

$$E = \frac{6.626 \times 10^{-34} \times 3 \times 10^8}{2.38 \times 10^{-7}}$$

$$= 8.35 \times 10^{-19} \text{ J} \times 6.24 \times 10^{18}$$

$$= 5.21$$

$$\frac{hc}{\lambda} = 4.31 \text{ eV} + 5.21 \text{ eV}$$

$$\lambda = \frac{6.626 \times 10^{-34} \text{ J}\cdot\text{s} \times 3 \times 10^8 \text{ m/s}}{9.52 \text{ eV} \times 1.6 \times 10^{-19}}$$

$$\lambda = 1.305 \times 10^{-7} \text{ m}$$

$$= 130.5 \text{ nm}$$



13.  $n=4$  to  $n=2$ .

$$\frac{13.6}{hc} \left( \frac{1}{n_f^2} - \frac{1}{n_i^2} \right)$$

$$= \frac{13.6}{hc} \left( \frac{1}{2^2} - \frac{1}{4^2} \right)$$

$$= \frac{13.6}{hc} \left( \frac{1}{4} - \frac{1}{16} \right)$$

$$= \frac{13.6}{hc} \left( \frac{3}{16} \right)$$

$$= \frac{3 \times 13.6}{16 \times 6.626 \times 10^{-34} \times 3 \times 10^8}$$

$$= \underline{1.283 \text{ e } 25. \text{ eV}}$$

14.  $10.2 \text{ eV} = \frac{13.6}{hc} \left( \frac{1}{n_f^2} - \frac{1}{n_i^2} \right)$ 

$$\frac{10.2 \text{ eV}}{\frac{13.6}{hc}} = \frac{1}{n_f^2} - \frac{1}{1}$$

$$\frac{10.2 \text{ eV}}{\frac{13.6}{hc}} + 1 = \frac{1}{n_f^2}$$

$$n_f^2 = \frac{1}{\frac{10.2 \text{ eV}}{\frac{13.6}{hc}} + 1}$$

$$n_f = \sqrt{\frac{1}{\frac{10.2 \text{ eV}}{\frac{13.6}{hc}} + 1}}$$

$$n_f = 1.$$

$$15. \quad r = a_0 \frac{n^2}{Z}$$

$$r = 5.291 \times 10^{-11} \times \frac{2^2}{3}$$

$$r = 7.0547 \times 10^{-11} \text{ m.}$$

$$r = \underline{0.070547 \text{ nm.}}$$

$$16. \quad r = a_0 \frac{n^2}{Z}$$

$$= 5.291 \times 10^{-11} \times \frac{2^2}{11}$$

$$= 1.924 \times 10^{-11} \text{ m}$$

$$= 0.01924 \text{ nm.}$$

$$17. \text{ A. } Be^{3+} \rightarrow r = 5.291 \times 10^{-11} \times \frac{4}{4}$$

$$= 5.291 \times 10^{-11}$$

$$= 0.05291 \text{ nm.}$$

$$\text{B. } F^{8+} \rightarrow r = 5.291 \times 10^{-11} \times \frac{4}{9}$$

$$= 2.35 \times 10^{-11} \text{ m}$$

$$= 0.0235 \text{ nm}$$

$$\text{C. } Mg^{11+} \rightarrow r = 5.291 \times 10^{-11} \times \frac{4}{12}$$

$$r = 1.76 \times 10^{-11}$$

$$= 0.0176 \text{ nm}$$

$$\text{D. } O^{7+} \rightarrow r = 5.291 \times 10^{-11} \times \frac{4}{8}$$

$$r = 2.646 \times 10^{-11}$$

$$= 0.02646 \text{ nm.}$$

Answer: C



BioStats

MSE110

Phys141

Chem152

Math129

2/9 HW #1.

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