Chapter 7 - Honors

pg 304 # 18, 20, 30, 32, 34 + 33

(18) $E = \frac{1.0\times10^{3}\ kJ}{1\ mol} \times \frac{1000\ J}{1\ kJ} \times \frac{1\ mol}{6.02\times10^{23}}$ $\quad C=\lambda\nu \quad E=h\nu \quad E=h\frac{c}{\lambda}$

$= 1.66\times10^{-18}\ J$

$1.66\times10^{-18}\ J = \frac{6.63\times10^{-34}(3\times10^{8})}{\lambda} = 1.2\times10^{-7}\ m$

120 nm = UV

(20) $3\times10^{8} = 8.11\times10^{14}\ Hz\ (\lambda) \quad \lambda = 3.70\times10^{-7}\ m$

370 nm = UV

(30) $\Delta\lambda = 656.3\ nm = 6.563\times10^{-7}\ m$

$\Delta E = h\Delta\nu \quad \Delta E = \frac{hc}{\Delta\lambda} = \frac{6.63\times10^{-34}(3\times10^{8})}{6.653\times10^{-7}} = 2.990\times10^{-19}$

(32) $\Delta E = h\nu = R_H\left(\frac{1}{n_i^2} - \frac{1}{n_f^2}\right) \quad n_i = 4 \quad n_f = 2$

$(6.63\times10^{-34})(\nu) = 2.18\times10^{-18}\ J\left(\frac{1}{16} - \frac{1}{4}\right)$

$6.63\times10^{-34}(\nu) = -4.0875\times10^{-19}$

$\nu = 6.17\times10^{14}\ Hz$

$3\times10^{8} = 6.17\times10^{14}\ (\lambda)$

$\lambda = 4.86\times10^{-7}\ m = 486\ nm$

emitted = $-\Delta E$

(34) $n_i \rightarrow n=2$ $\quad E = h\frac{c}{\lambda}$

$434\text{nm} = 434\times10^{-9}\text{m}$ $\quad E = \frac{(6.63\times10^{-34})(3\times10^{8})}{434\times10^{-9}} = 4.58\times10^{-19}\text{J}$

$-4.58\times10^{-19}\text{J} = 2.18\times10^{-18}\text{J}\left(\frac{1}{n_i^2} - \frac{1}{4}\right)$

$-0.2100917 = \frac{1}{n_i^2} - \frac{1}{4}$

$0.0399083 = \frac{1}{n_i^2}$ $\quad n_i^2 = \frac{1}{0.0399083}$

$n_i^2 \quad 25.057$

$\boxed{n_i = 5}$

(33) $E = \frac{hc}{\lambda}$ $\quad E = \frac{(6.626\times10^{-34}\text{J s})(3.00\times10^{8}\frac{\text{m}}{\text{s}})}{(589.0\times10^{-9}\text{m})}$

$E = 3.37487\times10^{-19}\text{J}$

$E = \frac{(6.626\times10^{-34}\text{J s})(3.00\times10^{8}\frac{\text{m}}{\text{s}})}{(589.6\times10^{-9}\text{m})}$

$E = 3.37144\times10^{-19}$

$\boxed{\Delta E = 4.000\times10^{-22}\text{J}}$

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#29, 33, 34, 39, 41, 42 pg 304-305 +40

(29) $\Delta E = -1\times10^{-11} - (-15\cdot10^{-19}) = 1.4\times10^{-18}\ J$

a.) $E = h\nu \qquad c = \lambda\nu \qquad \lambda = \frac{hc}{E}$

$$\lambda = \frac{(6.68\times10^{-34}\ J\cdot s)(3\times10^{8}\ m/s)}{1.4\times10^{-18}\ J} = \boxed{1.4\times10^{-7}\ m \quad 1.4\times10^{2}\ nm}$$

b) $E_3 - E_2 = -5\times10^{-19}\ J - (-10\times10^{-19}\ J) = \boxed{5\times10^{-19}\ J}$

c.) $E_1 - E_3 = (-15\times10^{-19}\ J) - (-5\times10^{-19}\ J) =$

$-10\times10^{-19}\ J$

$$\lambda = \frac{hc}{\lambda} = \frac{(6.63\times10^{-34})(3\times10^{8}\ \frac{m}{s})}{(10\times10^{-19})} = \boxed{2.0\times10^{-7}\ m \quad 2.0\times10^{2}\ nm}$$

(33) $E = \frac{hc}{\lambda} = \frac{(6.63\times10^{-34}\ J\cdot s)(3\times10^{8}\ \frac{m}{s})}{(5.890\times10^{-7}\ m)} = 3.377\times10^{-19}\ J$ ①

$$\frac{h\ c}{(5.896\times10^{-7})} = 3.373\times10^{-19}\ J$$ ②

$$\Delta E = 3.377\times10^{-19}\ J - 3.373\times10^{-19}\ J = \boxed{4\times10^{-22}\ J \quad 4.000\times10^{-22}\ J}$$

(34) $n_i \rightarrow n=2 \qquad 434nm = 4.34\times10^{-7}\ m$

$c = \lambda\nu \qquad \nu = \frac{c}{\lambda} \qquad E = \frac{hc}{\lambda}$

emitted $= -\Delta E$ $\qquad \frac{(6.63\times10^{-34})(3\times10^{8})}{4.34\times10^{-7}} = 4.58\times10^{-19}\ J$

$\Delta E = R_H\left(\frac{1}{n_i^2} - \frac{1}{n_f^2}\right)$

$$-4.58\times10^{-19}\ J = (2.18\times10^{-18}\ J)\left(\frac{1}{n_i^2} - \frac{1}{4}\right)$$

$$-0.2100917 = \frac{1}{n^2} - \frac{1}{4}$$

$$0.03990826 = \frac{1}{n^2} \qquad n^2 = 25.05747 \qquad \boxed{n_i = 5}$$

(39) $\lambda = \frac{h}{mu} = \frac{6.63\times10^{-34}\ J\cdot s}{(1.675\times10^{-27}\ kg)(7.00\times10^{2}\ m/s)} =$

$5.65\times10^{-10}\ m = \boxed{0.565\ nm}$

(41) $\lambda = \frac{h}{mu} = \frac{6.63\times10^{-34}}{(0.0124\ kg)(53.667)} = 9.96\times10^{-34}\ m =$

$\boxed{9.96\times10^{-32}\ cm}$

$12.4\ g \times \frac{1\ kg}{1000\ g} = 0.0124\ kg$

$\frac{120\ mi}{hr} \times \frac{1\ hr}{3600\ s} \times \frac{1.61\ km}{1\ mi} \times \frac{1000\ m}{1\ km} = 53.667\ m/s$

(42) $\lambda = \frac{h}{mu} = \frac{6.63\times10^{-34}}{(0.0025\ kg)(16\ m/s)} = 1.7\times10^{-32}\ m$

$\boxed{1.7\times10^{-23}\ nm}$

(40) $\lambda = \frac{6.626\times10^{-34}\ J\cdot s}{(1.673\times10^{-27}\ kg)(2.90\times10^{8}\ \frac{m}{s})}$ $\lambda = 1.37\times10^{-15}\ m$

$1.37\times10^{-15}\ m \times \frac{1\times10^{9}\ nm}{1\ m}$

$\boxed{1.37\times10^{-6}\ nm}$