Today Oct. 1 Sections 5.1-5.4

Tomorrow: -lab expt. 6

- problem club with Ali

Suppose 3.44g Al is placed in 215mL of 0.240M Cu^{2+}, what is the limiting reagent and how many moles of the excess reagent remain?

$$2Al_{(s)} + 3Cu^{2+}_{(aq)} \rightarrow 2Al^{3+}_{(aq)} + 3Cu_{(s)}$$

$$\frac{3.44\,g\,Al}{} \bigg| \frac{mol\,Al}{26.98\,g\,Al} = 0.128\,mol\,Al \qquad \frac{0.24\,mol\,Cu^{2+}}{L} \bigg| .215\,L = 0.0516\,mol\,Cu^{3+}$$

LR? ÷2 0.064 mol ÷3 0.0172

Cu is limiting

excess reagent?

$$\frac{0.0516\,mol\,Cu^{2+}}{} \bigg| \frac{2\,mol\,Al}{3\,mol\,Cu^{2+}} = 0.0344\,mol\,Al\ \text{used}$$

0.128 mol Al

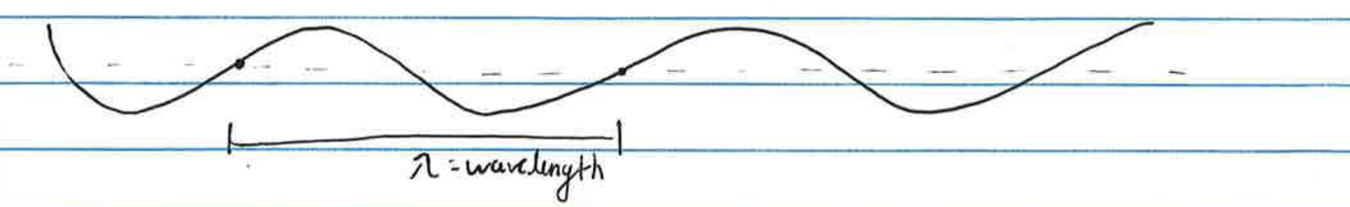
− 0.0344 mol Al used

0.0936 mol Al left over

Visible spectrum:

V I B G Y O R

380nm 780nm



light spectrum

γ-rays	X-rays	ultraviolet	visible	infrared	microwave	radio
10^{-12} m	10^{-10} m	10^{-8} m		10^{-5} m	10^{-3} m	~1m

high Energy — low energy

$E \propto \frac{1}{\lambda}$ smaller wavelength = high energy

$c = 3.0 \times 10^8 \, m/s = 3.0 \times 10^8 \, m \cdot s^{-1}$

ν = frequency = $\frac{waves}{s}$

$\nu \cdot \lambda = c$

$(m)\ (\frac{1}{s}) = \frac{m}{s}$

$E = h\nu$

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

$h = 6.626 \times 10^{-34} \, J \cdot s$

} tiny world equations

A wave has a wavelength of 7.80×10^{-7} m. What is E?

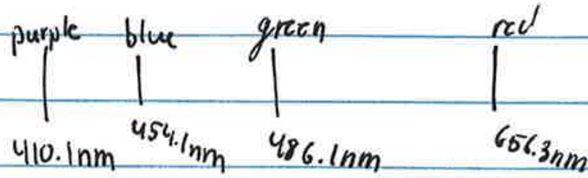
$$E = \frac{hc}{\lambda} = \frac{6.626 \times 10^{-34} \, J \cdot s \,\Big|\, 3.0 \times 10^8 \, m}{\Big|\, s \,\Big|\, 7.80 \times 10^{-7} \, m} = 2.55 \times 10^{-19} \, J$$

↑ energy of single photon

Tiny world for one thing $\xrightarrow{\times N_a}$ Big world ($\xleftarrow{\div N_a}$)

$$\frac{2.55 \times 10^{-19} \, J \,\Big|\, 1 \times 10^{-3} \, kJ \,\Big|\, 6.023 \times 10^{23}}{\Big|\, 1 J \,\Big|\, mol} = 154 \, kJ/mol$$

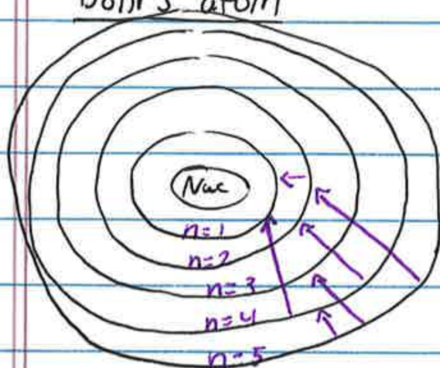
hydrogen spectrum



$E \propto \frac{1}{\lambda}$ $\qquad \frac{1}{\lambda} = R\left(\frac{1}{n_a^2} - \frac{1}{n_b^2}\right)$

$n_B > n_A$ (integers)

<u>Bohr's atom</u>



lots of combinations of how the electrons can fall

$$\frac{1}{\lambda} = R\left(\frac{1}{n_f^2} - \frac{1}{n_i^2}\right)$$

R ↑ $1.097 \times 10^{-2}\ nm^{-1}$; n_f ↑ 2 ; n_i ↑ $3, 4, 5, 6, \ldots \infty$

$$\frac{1}{\lambda} = 1.097 \times 10^{-2}\ nm^{-1}\left(\frac{1}{2^2} - \frac{1}{3^2}\right)$$

$\lambda = 656nm$

going $2 \rightarrow 1$ $\lambda = 122nm$ (not in visible spectrum - in UV)