Start ch. 5 - Today — October 2nd

Thursday: problem club w/ Kendall (Eppley 211)

Friday: chapter 5

Over the weekend: Get ready for lab — 7:30-9pm

* prelab * two videos (Youtube)

Sunday: Problem club w/ Kendall (Eppley 211)

Assign oxidation numbers to iodine in each of these

NaI		KIO_3				I_2	NH_4IO_4				$Ba(IO)_2$			$LiIO_2$			O_2
+1	-1	+1	+5	-2		0	-3	+1	+7	-2	+2	+1	-2	+1	+3	-2	0

3e⁻ reduction

$Fe + Cr_2O_7^{2-} + H^+ \longrightarrow Fe^{3+} + Cr^{3+} + H_2O$

OX# 0 +6 -2 +1 +3 +3 +1 -2

3e⁻ oxidation

→ What was oxidized? What was reduced?

↳ Fe was oxidized — was the reducing reagent

↳ $Cr_2O_7^{2-}$ was reduced — was the oxidizing reagent

> *ONLY items to the left of the arrow can be oxidized/reduced ↳ ONLY reactants

$3Cu^{2+}(aq) + 2Al(s) \longrightarrow 3Cu(s) + 2Al^{3+}(aq)$

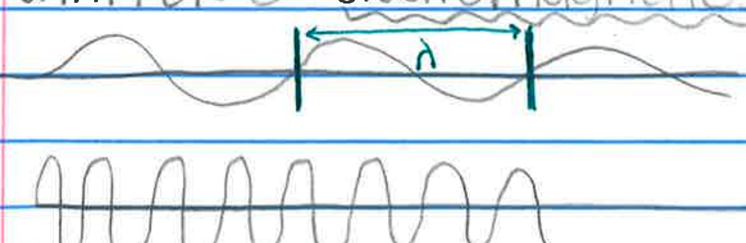
→ Suppose 4.20g Al is placed in 450 mL 0.100 M Cu^{2+}

→ What is LR?

→ What is the TY of Cu(s) in grams?

→ How much of the excess reagent is left over? (in g)

CHAPTER 5: electromagnetic spectrum



↳ shorter λ, higher ν

λ = wavelength (m)

ν = frequency (s^{-1}, $\frac{1}{s}$, $\frac{waves}{sec}$)

*red light λ = 450nm

$\lambda = \frac{450\,nm}{} \Big| \frac{1\times10^{-9}\,m}{1\,nm} = 4.5\times10^{-7}\,m$

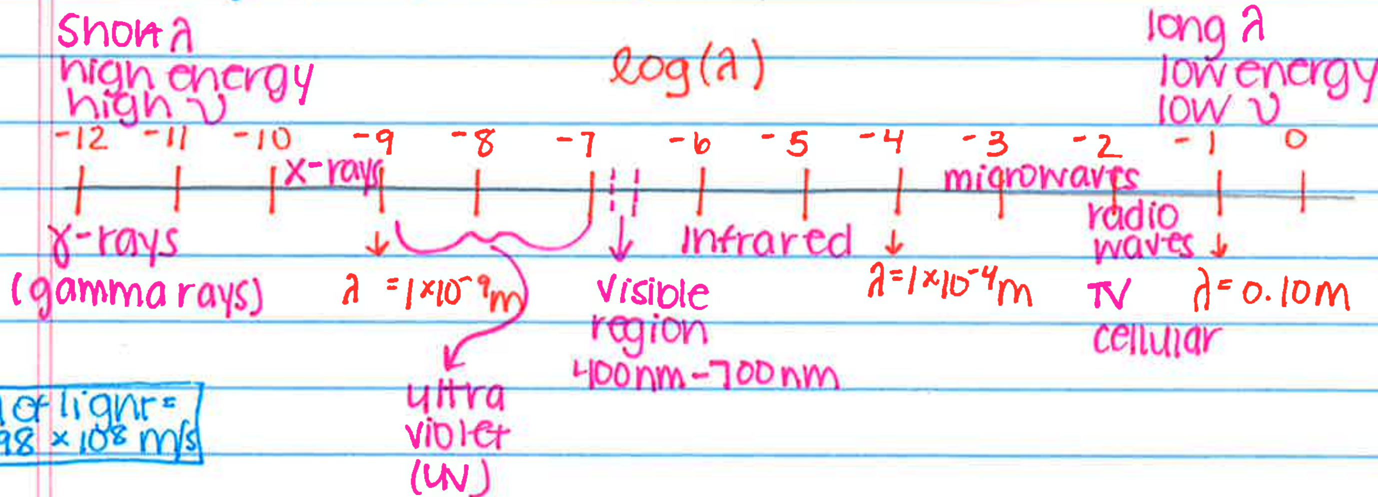
"proportional"

$E \propto \nu$ $\quad E \propto \frac{1}{\lambda}$

October 2nd

$\lambda\nu = c \rightarrow c = 2.998\times10^{8}\,m/s$

{ ↳ shorter λ = higher ν }
{ ↳ longer λ = lower ν }



*speed of light = $2.998\times10^{8}\,m/s$

$E = h\nu \qquad h = 6.626\times10^{-34}\,J\cdot s$ (Planck's constant)

$E = \frac{hc}{\lambda} = \frac{6.626\times10^{-34}\,J\cdot s}{} \Big| \frac{2.998\times10^{8}\,m}{1\,sec} \Big| \frac{}{4.5\times10^{-7}\,m} = 4.41\times10^{-19}\,J$

↳ * for individual photons/electrons

avogadro's # = 6.02×10^{23}

Tiny world
$\lambda \quad \nu \quad (E)$
$E = h\nu = \frac{hc}{\lambda}$
↳ For individual protons/electrons

$\times N_A$ →
← $\div N_A$

Big world
(E) (kJ/mol)

$E = ?\,kJ/mol \rightarrow \frac{4.41\times10^{-19}\,J}{} \Big| \frac{6.02\times10^{23}}{1\,mol} \Big| \frac{1\,kJ}{1\times10^{3}\,J} = 265.5\,kJ/mol$

October 2nd

$$E \propto \frac{1}{\lambda} = 0.01097\ nm^{-1}\left(\frac{1}{n_f^2} - \frac{1}{n_i^2}\right)$$

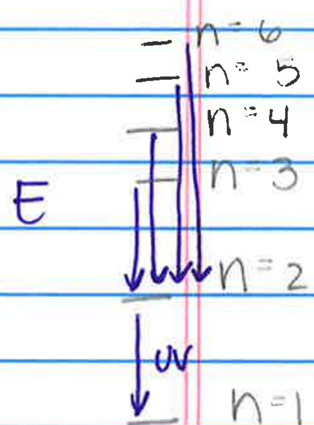
n_f: second step → N = 2

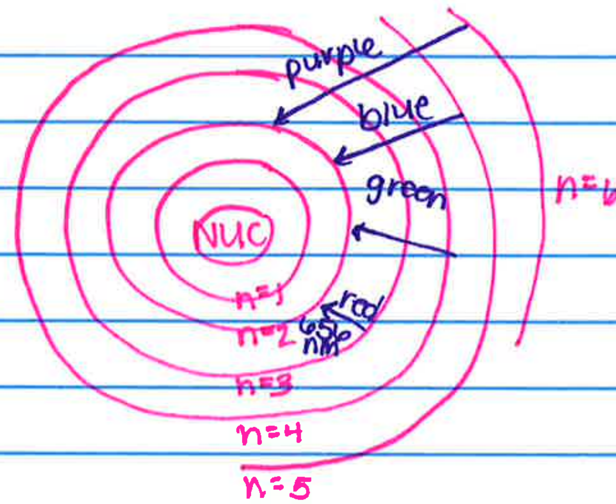
n_i: higher step n = 3, 4, 5 ...etc.

red	green	blue	purple	
n = 3 → n = 2	n = 4 → n = 2	n = 5 → n = 2	n = 6 → n = 2	
656 nm	486 nm	434 nm	410 nm	λ
longest λ, smallest E, ν			shortest λ, longest E, ν	

invisible region

$$\frac{1}{\lambda} = 0.01097\ nm^{-1}\left(\frac{1}{2^2} - \frac{1}{3^2}\right) = \boxed{656\ nm}$$





Chapter 5 Day 1 (Sections 5.1 – 5.4) (Unit 3) 2 October 2019

$h = 6.626 \times 10^{-34}$ J s $E = h\upsilon = hc/\lambda$

$c = \lambda\upsilon = 2.998 \times 10^{8}$ m/s

$\Delta E_{per\ mol\ photon} = \Delta E_{per\ photon} \times N_A$

$N_A = 6.023 \times 10^{23}\ mol^{-1}$

$E = -2.178 \times 10^{-18} J(1/n^2)$

$\Delta E = E_f - E_i = -2.178 \times 10^{-18} J(1/n_f^2 - 1/n_i^2)$

$1/\lambda = 1.097 \times 10^{-2}\ nm^{-1}(1/n_f^2 - 1/n_i^2)$

1. What is the frequency of a helium-neon laser light with a wavelength of 632.8 nm?

2a. What is the energy of a wavelength of light of 550 nm?

2b. Continuing on, what is this energy in kJ/mol?

3. The MRI body scanners used in hospitals operate with 400 MHz frequency energy. What is the wavelength of this frequency? Note: 1 Hz = 1 s^{-1} (or 1/s)

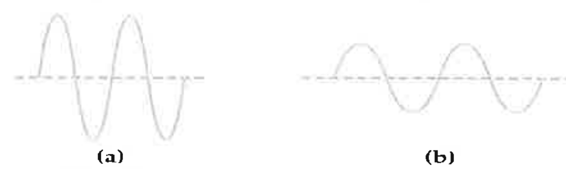
4. Arrange the following spectral regions in order of increasing wavelength:

infrared, microwave, ultraviolet, visible

5. In the Balmer series, a red line with wavelength of 486.1 results when an electron drops from the n = 4 level. What is the energy of this electron transition in kJ/mol? Make sure you indicate whether it is + or -. Hint: Look up what the Balmer series is exactly.

Questions in final exam format (multiple choice):

6. Wave (a) is on the left and (b) on the right



Wave (a) has the

A. longer wavelength and higher energy than wave (b).
B. longer wavelength and lower energy than wave (b).
C. shorter wavelength and higher energy than wave (b).
D. shorter wavelength and lower energy than wave (b).

7. According to the Balmer-Rydberg equation, electromagnetic radiation with the shortest wavelength will be emitted when an electron undergoes which of the following transitions?

A. $m = 1 \rightarrow n = 2$ B. $m = 2 \rightarrow n = 3$
C. $n = 2 \rightarrow m = 1$ D. $n = 3 \rightarrow m = 2$

8. The four lines observed in the visible emission spectrum of hydrogen tell us that

A. The hydrogen molecules they came from have the formula H_4.
B. We could observe more lines if we had a stronger prism.
C. There are four electrons in an excited hydrogen atom.
D. Only certain energies are allowed for the electron in a hydrogen atom.

Now try these problems from the book:
Section 5.1. (Electromagnetic spectrum) Problems 1,2, 26, 34, 36, 38, and 40
Section 5.2. (Tiny World and Big World Energy Conversions) Problems 3, 4, 5, 6, 42, 44, 46, 48, 50, 52, and 54.
Section 5.3. (Quantized energy, line spectra) Problems 7, 8, 56 and 57, 58, 60, 62, and 64.
Section 5.4, 5.5. (de Broglie, Heisenberg) Problems 66, 68, and 60.
Practice Test (pg 199) 1 – 9.