Ch. 7 HW ~~5, 8, 10, 12, 15, 33, 34~~ B7.1, B.7.2 (p. 301), ~~37, 49, 50, 61, 64, 82, 90, 96~~

5 (a) ↑ ν C → B → A

(b) ↑ energy C → B → A

(c) ↑ amplitude B → C → A

(d) A more likely, higher ν, higher energy

(e) C more likely to be IR, lower ν than B

(8) $93.5\ MHz \times \frac{1\times10^{6}\ Hz}{1\ MHz} =$

$c = \lambda\nu$

$3.0\times10^{8} = \lambda(93500000)$

$\lambda = 3.21\ m$

$3.21\ m \times \frac{1\ nm}{1\times10^{-9}\ m} = \boxed{3.21\times10^{9}\ nm}$

$3.21\times10^{9}\ nm \times \frac{10\ \text{Å}}{1\ nm} = \boxed{3.21\times10^{10}\ \text{Å}}$

(10) $\lambda = 1.3\ \text{Å}$ $\quad E = \frac{hc}{\lambda}$

$E = ?$

$1.3\ \text{Å} \times \frac{1\ nm}{10\ \text{Å}} \times \frac{1\ m}{1\times10^{9}\ nm} = 1.3\times10^{-10}\ m$

$E = \frac{6.626\times10^{-34}(3.0\times10^{8})}{1.3\times10^{-10}}$

$\boxed{E = 1.53\times10^{-15}\ J}$

(12) Decreasing energy ∴ UV > IR > Microwave

high ν = high E

(15) Co-60 $\quad E = 1.33\ MeV \quad 1\ eV = 1.602\times10^{-19}\ J \quad ?\nu \quad ?\lambda$

$1.33\ MeV \times \frac{1{,}000{,}000\ eV}{1\ MeV} \times \frac{1.602\times10^{-19}\ J}{1\ eV} = 2.13\times10^{-13}\ J$

$E = \frac{hc}{\lambda} \quad 2.13\times10^{-13} = \frac{6.626\times10^{-34}(3.0\times10^{8})}{\lambda}$

$\boxed{\lambda = 9.33\times10^{-13}\ m}$

$c = \lambda\nu$

$3.0\times10^{8} = (9.33\times10^{-13})(\nu)$

$\nu = \boxed{3.22\times10^{20}\ s^{-1}}$

(33) $436\ nm \times \frac{1\ m}{1 \times 10^{9}\ nm} = 4.36 \times 10^{-7}\ m$ $\quad E = \frac{hc}{\lambda} = \frac{6.626 \times 10^{-34}(3.0 \times 10^{8})}{4.36 \times 10^{-7}}$

$\boxed{E = 4.56 \times 10^{-19}\ J}$

(34) (a)
A absorb 2 → 5
B emit 6 → 1 ✓
C absorb 3 → 6
D absorb 1 → 5 ✓
E emit 5 → 3 ✓
F emit 4 → 1 ✓

(b) $E < F < B$

(c) order of increasing λ, which means decreasing energy
D < A < C
D: wavelength shortest → highest energy
A: electrons closer to nucleus, more difficult to jump them up
C: least energetic

(37) Particles are too big to observe incredibly small wavelength

(49) (a) 1s — 1 orbital
(b) 4d — 5 orbitals
(c) 3p — 3 orbitals
(d) $n = 3$, $\ell = 0, 1, 2$ — 9 orbitals
$\ell = 0$: 0 (s); $\ell = 1$: $-1, 0, 1$ (p); $\ell = 2$: $-2, -1, 0, 1, 2$ (d)

(50) (a) 5f — 7 orbitals
(b) 4p — 3 orbitals
(c) 5d — 5 orbitals
(d) $n = 2$ $\ell = 0, 1$ — 4 orbitals
$\ell = 0$: 0 (s); $\ell = 1$: $-1, 0, 1$ (p)

(61) β carotene insoluble in H_2O, soluble in benzene & chloroform

(1) Dissolve β carotene in benzene at various concentrations - Known

(2) Find optimal λ of absorbance

(3) Run samples in spectrophotometer to obtain absorption curve

(4) Using equation of line determine unknown concentration

(64) minimum energy 2.0×10^{-17} J

(a) How many photons of red light needed?

$$700\text{nm}\times\frac{1\text{M}}{1\times10^{9}\text{nm}} = 7\times10^{-7}\text{m} \qquad E=\frac{hc}{\lambda}=\frac{6.626\times10^{-34}(3.0\times10^{8})}{7\times10^{-7}}$$

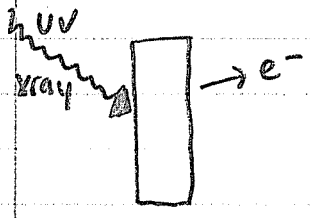
$$= 2.84\times10^{-19}\text{ J/photon}$$

$$2.0\times10^{-17}\text{J}\times\frac{1\text{ photon}}{2.84\times10^{-19}\text{J}} = \boxed{71\text{ photons needed}}$$

(b) $$475\text{nm}\times\frac{1\text{M}}{10^{9}\text{nm}} = 4.75\times10^{-7}\text{m} \qquad E=\frac{hc}{\lambda}=\frac{6.626\times10^{-34}(3.0\times10^{8})}{4.75\times10^{-7}}$$

$$E = 4.18\times10^{-19}\text{ J}$$

$$2.0\times10^{-17}\text{J}\times\frac{1\text{ photon}}{4.18\times10^{-19}\text{J}} = \boxed{48\text{ photons}}$$

(82) 

(a) $n=3 \rightarrow n=2$ $\qquad E_{3-2} = E_{31} - E_{21}$

$$\Delta E = (4.854\times10^{-17}) - (4.098\times10^{-17}) = 7.56\times10^{-18}\text{ J} = \Delta E$$

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

$$7.56\times10^{-18}\text{J} = \frac{6.626\times10^{-34}(3.0\times10^{8})}{\lambda}$$

$$\boxed{\lambda = 2.63\times10^{-8}\text{ m}}$$

82 (b) $n=4 \rightarrow n=1 = E_{42} + E_{a1}$

$1.024 \times 10^{-17} + 4.098 \times 10^{-17} = \boxed{5.122 \times 10^{-17}\ J}$

$E = \frac{hc}{\lambda}$ $\quad 5.122 \times 10^{-17} = \frac{6.626 \times 10^{-34}(3.0 \times 10^{8})}{\lambda}$

$\boxed{\lambda = 3.881 \times 10^{-9}\ m}$

(c) $5 \rightarrow 4 \quad E_{51} - E_{41}$ (↑ from part b) $\quad 5.242 \times 10^{-17} - 5.122 \times 10^{-17} = \boxed{1.2 \times 10^{-18}\ J}$

$E = \frac{hc}{\lambda}$ $\quad 1.2 \times 10^{-18} = \frac{6.626 \times 10^{-34}(3.0 \times 10^{8})}{\lambda}$

$\boxed{\lambda = 1.657 \times 10^{-7}\ m}$

90 dining room = 520nm Blue/green Mr. Green

lounge/study = lower frequencies green/yellow Col. Mustard/Scarlet

library = shortest λ violet - Plum

★ Ms. White killed in conservatory Ms. Peacock

96

Absorbance at 880nm

L1 = Absorbance
L2 = [ ]
graph
2ndstat
Stat
Cal Lin Reg

Mrs. K learning the calc

- plot in calculator
- scatter plot
- linear regression to get line of best fit + equation

$A = kc$ (c = concentration; k = slope; A = absorbance)

Phosp., Mol/L

$y = ax + b$

$y = 2.2 \times 10^{-4}(x) + (-9.92 \times 10^{-8})$

$0.55 = 2.2 \times 10^{-4}(x) + (-9.92 \times 10^{-8})$

$x = 2500$ not correct

$k = 4.5 \times 10^{-3}\ M^{-1}$ = slope

$C_{unk} = \boxed{1.2 \times 10^{-4}\ M}$ ← this is answer