Study Guide - Unit 0+1

① a) P b) C c) P

② $(x)\,mL = \frac{.5000\,g \mid 1\,mL}{13.58\,g} = \boxed{.03682\,mL}$

③ a) $3.5 \cdot 10^{14}$
b) $8.21 \cdot 10^{-9}$

④ a) $4.000 \cdot 10^{6}$
b) 3.682
c) 7.252

⑤ a) $\frac{.75\,kg \mid 1000\,g \mid 1000\,mg}{1\,kg \mid 1\,g} = \boxed{7.5 \cdot 10^{5}\,mg}$

b) $\frac{.52\,nm \mid 1\,m \mid 1\,km}{1 \cdot 10^{9}\,nm \mid 1000\,m} = \boxed{5.2 \cdot 10^{-11}\,km}$

⑥ $\frac{|48.45\,g/mol - 52.9\,g/mol|}{52.9\,g/mol} = \frac{4.45}{52.9} = \boxed{8.4\%}$

⑦ a represents isotopes. Both are the same elements but w/ different # neutrons

⑧ a) $^{171}_{79}Au$: $79\,p^{+}$ $92\,n^{\circ}$ $79\,e^{-}$
b) $^{79}_{35}Br^{-}$: $35\,p^{+}$ $44\,n^{\circ}$ $36\,e^{-}$

⑨ lead (II) nitride — PCl_5
sulfur hexafluoride — $KHCO_3$
ammonium carbonate — Fe_2O_3

(10) a) 52.00g cmpd − 43.74g C = 8.26g H

b) %C: $\frac{43.74\text{g C}}{52.00\text{g cmpd}}$ = 84.12% C

%H: $\frac{8.26\text{g H}}{52.00\text{g cmpd}}$ = 15.9 %H

c) 31.00g · .8412 = 26.08g C

31.00g · .159 = 4.93 g H

d) $\frac{84.12\text{g C}}{12.01\text{g}} \left| \frac{1\text{ mol}}{} \right. = \frac{7.004\text{ mol C}}{7.004} = 1 \quad .4$

$\frac{15.9\text{ g H}}{1.008\text{g}} \left| \frac{1\text{ mol}}{} \right. = \frac{15.8\text{ mol H}}{7.004} = 2.25 \quad .4$

C_4H_9

e) $\frac{MF}{EF} = \frac{114\text{ g/mol}}{57.11\text{ g/mol}} = 2$ MF = C_8H_{18}

(11) $32.59\text{g } H_2O \left| \frac{2.016\text{g H}}{18.016\text{g } H_2O} \right| \frac{1\text{ mol H}}{1.008\text{ g H}} \left| \frac{6.022\cdot10^{23}\text{ atom}}{1\text{ mol H}} \right. =$ $2.179\cdot10^{24}$ atom H

↖ %H in H_2O

(12) a) released

b) $\Delta E = -R_H \left(\frac{1}{n_f^2} - \frac{1}{n_i^2}\right) = -(2.18\cdot10^{-18}\text{ J})\left(\frac{1}{5^2} - \frac{1}{3^2}\right)$

$= -1.55\cdot10^{-19}$ J/photon

c) $\frac{1.55\cdot10^{-19}\text{ J}}{\text{photon}} \left| \frac{6.022\cdot10^{23}\text{ photon}}{1\text{ mol}} \right. = -9.34\cdot10^{4}$ J/photon

d) $E = h\nu$ $\quad \nu = \frac{E}{h} = \frac{1.55\cdot10^{-19}\text{ J}}{6.626\cdot10^{-34}\text{ J s}} = 2.34\cdot10^{14}$ Hz

$c = \nu\cdot\lambda$ $\quad \lambda = \frac{c}{\nu} = \frac{2.998\cdot10^{8}\text{ m/s}}{2.34\cdot10^{14}\text{ 1/s}} = 1.28\cdot10^{-6}\text{ m} \left| \frac{1\cdot10^{9}\text{ nm}}{1\text{ m}} \right.$

= 1280 nm

(13) a) Br: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$ $[Ar]\ 4s^2 3d^{10} 4p^5$

b) Cr: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^5$ $[Ar]\ 4s^1 3d^5$

c) S^{-2}: $1s^2 2s^2 2p^6 3s^2 3p^6$ $[Ne]\ 3s^2 3p^6$

(14) a) 2s b) 3p c) 3d d) All same energy

(15) a) not enough info

b) $Z = 17$

c) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$

(16) a) Si b) Co c) Ba

(17) a) O b) Na^+ c) Cl^- d) Ti^{2+}

(18) a) Sc: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^1$ Sc^{3+}: $1s^2 2s^2 2p^6 3s^2 3p^6$

b) Cr: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^5$ Cr^{2+}: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^4$

c) Ni: $[Ar]\ 4s^2 3d^8$ Ni^{3+}: $[Ar]\ 3d^7$

(19) Rb^{+1} Cs^+ Ga^{3+} At^- Se^{2-}

(20) energy required to remove e^- from ground state of gaseous atom

(21) $Mg \rightarrow Mg^+ + e^-$

$Mg^+ \rightarrow Mg^{2+} + e^-$

(22) a) Be - smaller atom, e^- have stronger attraction to nucleus, less shielding

b) Ar - Ar + Na have same shielding, but Ar has greater effective nuclear charge (Z_{eff})

(23) a) group 13

b) AF_3 (group 13 has +3 charge)

c) At least 5 e^-: the large jump btw 3rd + 4th IE indicates that the 4th IE is removing a core e^-, which would be paired in an orbital

(24) $Y^{3+} < Sr^{2+} < Rb^+ < Kr < Br^- < Se^{2-}$
(all are isoelectronic)

(25) NO - after 1st e^- is removed, the resulting cation has a smaller radius + ∴ stronger attraction to nucleus

(26) NO - different neutral atoms have diff # p^+ + ∴ diff # e^-

(27) yes: O^{2-} and F^- both have 10 e^-

(28) electron affinity - energy change when e^- added to gaseous atom

(29) $O + e^- \rightarrow O^-$ (1st e^- affinity)
$O^- + e^- \rightarrow O^{2-}$ (2nd)

(30) a) 2

b) large jump btw 2nd + 3rd IE indicates that 3rd IE removes core e^- after 2 valence e^-

c) XBr_2

(31) Rb has a low 1st IE. After 1 e^- is removed, 2nd IE is very high + not likely to occur.

(32) Elements in the same group have the same number of valence e^-, which determines how the element will react.

(33) $H^+ < H < H^-$

(34) $H^+ < He < H^-$ (He has 2 p^+ in nucleus to attract e^- where H^- only has 1 p^+)

(35) $Fe^{2+} + Co^{3+}$
$Al^{3+} + F^-$
$Sc^{3+} + Ca^{2+}$
$Cu^+ + Zn^{2+}$

(36) shielding - inner e^- that partially screen outer e^- from attraction of nucleus

(37) mass of hydrated cmpd: $40.18\,g - 32.97\,g = 7.21\,g$
mass dehydrated cmpd: $37.75\,g - 32.97\,g = 4.78\,g$
mass H_2O lost = $40.18\,g - 37.75\,g = 2.43\,g$
OR $7.21\,g - 4.78\,g =$
% H_2O: $\frac{2.43\,g\ H_2O}{7.21\,g\ hydrate} =$ **33.7% H_2O**

EF: $2.43\,g\ H_2O \mid \frac{1\ mol}{18.02\,g} = \frac{.135\ mol\ H_2O}{.0449} = 3$

$4.78\,g\ LiClO_4 \mid \frac{1\ mol}{106.39\,g} = \frac{.0449\ mol\ LiClO_4}{.0449} = 1$

$LiClO_4 \cdot 3H_2O$