Chemistry 100 Waiver Assessment Practice

1) $.06200\,L\,H_2 \times \frac{1\,mL}{0.001\,L} = 62.00\,mL\,H_2$ — four sig figs

2) $14.538 - 2.37 = 12.168 \rightarrow 12.17$ — round to 2 decimal places
(3 decimal places; 2 decimal places)

3) protons & neutrons make up the nucleus, as the electrons orbit the nucleus.

4) ^{73}Ge ← atomic # 32
mass # = (# p+) + (# n)
$73 - 32p^+ = 41n$ $\quad 32e^-$
In a neutral atom there is a p^+ for every e^-

5) K ← atomic #19 $\quad 19e^-$ (superscripts add up to $19e^-$)
$1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$ $\quad 2+2+6+2+6+1=19$

6) As ← atomic #33 $\quad 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^3$
valence electrons
5 dots

7) Si ← atomic #14 $\quad$ each arrow represents an electron

8) Ionic bond occurs between a metal (Na) & a nonmetal (F)

9) Magnesium fluoride = $Mg^{+2} F^{-1} \rightarrow MgF_2$ (ionic bond) — electron transfer

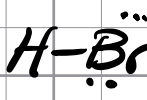
10) C (4 valence e⁻) & O (6 valence e⁻) for a covalent (share e⁻) bond.
Each element has an octet.

Note: each "—" represents a pair of shared electrons

11) Phosphorus trichloride = PCl_3 $(5+7+7+7 = 26e^-s)$

4 electrons groups & 1 lone pair on the central atom (P)

12) Hydrogen bromide = HBr $(1+7 = 8e^-s)$



straight line, therefore bond angle 180°

13) $.274 \text{ mol Fe} \times \frac{55.85 \text{ g Fe}}{1 \text{ mol Fe}} = 15.3 \text{ g Fe}$

14) $6.50 \times 10^{-11} \text{ mol As} \times \frac{6.022 \times 10^{23} \text{ atoms As}}{1 \text{ mol As}} = 3.91 \times 10^{13} \text{ atoms As}$

15) cobalt(II) nitrate $Co^{+2} NO_3^{-1} \rightarrow Co(NO_3)_2$

$$.500 \text{ g } Co(NO_3)_2 \times \frac{1 \text{ mol } Co(NO_3)_2}{182.95 \text{ g } Co(NO_3)_2} \times \frac{2 \text{ mol } NO_3^{-1}}{1 \text{ mol } Co(NO_3)_2} \times \frac{6.022 \times 10^{23} NO_3^{-1}}{1 \text{ mol } NO_3^{-1}}$$

$$= 3.29 \times 10^{21} NO_3^{-1}$$

16) sodium sulfate $Na^{+1} SO_4^{-2}$ Na_2SO_4

$$\%S = \frac{32.07 \text{ g S}}{142.05 \text{ g } Na_2SO_4} \times 100 = 22.58\% S$$

17) assume 100g of compound → divide by the smallest mole

$13.86\% N \rightarrow 13.86 \text{ g N} \times \frac{1 \text{ mol N}}{14.07 \text{ g N}} = .9893 \text{ mol N} \div .9890 \text{ mol} = 1 N$

$47.47\% O \rightarrow 47.47 \text{ g O} \times \frac{1 \text{ mol O}}{16.00 \text{ g O}} = 2.967 \text{ mol O} \div .9890 \text{ mol} = 3 O$

$38.67\% K \rightarrow 38.67 \text{ g K} \times \frac{1 \text{ mol K}}{39.10 \text{ g K}} = .9890 \text{ mol K} \div .9890 \text{ mol} = 1 K$

18) $Ba(NO_3)_2 + K_2SO_4 \rightarrow BaSO_4 + 2KNO_3$

double replacement (displacement) reaction
$AB + CD \rightarrow AD + CB$

19) $C_3H_8 + O_2 \rightarrow CO_2 + H_2O$

C_3H_8: hydrocarbon; O_2: necessary for combustion; $CO_2 + H_2O$: products for any combustion of a hydrocarbon

20) $2KClO_3 \rightarrow 2KCl + 3O_2$

21) $2HCl + Sr \rightarrow SrCl_2 + H_2$

$$2.45\,g\,HCl \times \frac{1\,mol\,HCl}{36.46\,g\,HCl} \times \frac{1\,mol\,H_2}{2\,mol\,HCl} \times \frac{2.02\,g\,H_2}{1\,mol\,H_2} = .0679\,g\,H_2$$

22) $H_2SO_4 + Ba(OH)_2 \rightarrow BaSO_4 + 2H_2O$

H_2SO_4: Acids donate H^+. The H^+ is donated to OH^- to make H_2O

23) $2Al_{(s)} + 6HNO_{3(aq)} \rightarrow 2Al(NO_3)_{3(aq)} + 3H_{2(g)}$

$HNO_{3(aq)}$: aqueous reactant; $H_{2(g)}$: gaseous product

24) $2K + Cl_2 \rightarrow 2KCl$

2.76g 2.65g

$$2.76\,g\,K \times \frac{1\,mol\,K}{39.10\,g\,K} \times \frac{2\,mol\,KCl}{2\,mol\,K} \times \frac{74.55\,g\,KCl}{1\,mol\,KCl} = 5.26\,g\,KCl$$

5.26 g KCl: amount of product produced

$$2.65\,g\,Cl_2 \times \frac{1\,mol\,Cl_2}{70.90\,g\,Cl_2} \times \frac{2\,mol\,KCl}{1\,mol\,Cl_2} \times \frac{74.55\,g\,KCl}{1\,mol\,KCl} = 5.57\,g\,KCl$$

Limiting reactant because K is the reactant that creates the least amount of product.

25) $823\ \text{mm Hg} \times \frac{1\ \text{atm}}{760\ \text{mm Hg}} = 1.08\ \text{atm}$

26) $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ ← Combined gas law; T_2 ← unknown

$$T_2 = \frac{T_1P_2V_2}{P_1V_1} = \frac{(295\text{K})(817\ \text{mm Hg})(1.85\text{L})}{(755\ \text{mm Hg})(1.33\text{L})} = 444\text{K}$$

171°C

27) $PV = nRT \rightarrow P = \frac{nRT}{V} = \frac{(.348\ \text{mol})(.0821\ \frac{\text{L atm}}{\text{mol K}})(292\text{K})}{.750\text{L}} = 11.1\ \text{atm}$

P unknown

28) $5.67\text{g } Na_2CO_3 \times \frac{1\ \text{mol } Na_2CO_3}{105.99\ \text{g } Na_2CO_3} = .0535\ \text{mol } Na_2CO_3$

molarity → $M = \frac{.0535\ \text{mol } Na_2CO_3}{.285\text{L solution}} = .188\ M\ Na_2CO_3$

29) $Co(SO_4)_2$ SO_4^{-2} two sulfates has a charge of -4, therefore cobalt must be $+4$.

30) NH_4^{+1} S^{-2} $(NH_4)_2S$

$2[(14.01\text{g/mol}) + 4(1.01\text{g/mol})] + 32.07\text{g/mol} = 68.17\text{g/mol}$