General Chemistry Chapter 4 Pre-Test

1.) 4 Na (s) + O_2 (g) → 2 Na_2O (s)
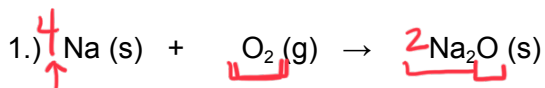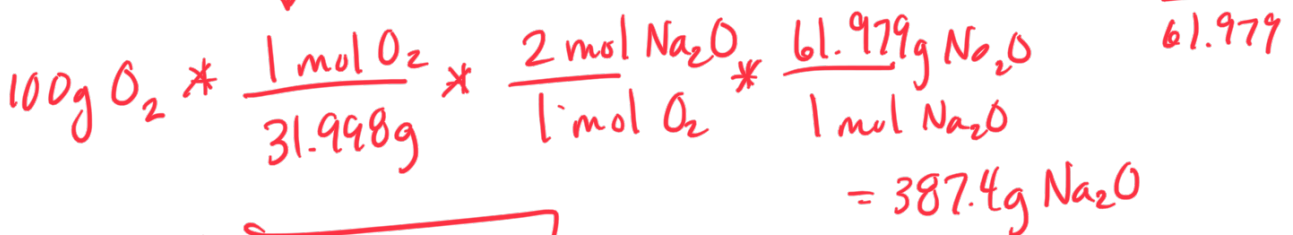
(18 pts total) Balance the equation. If you begin with 60 g of sodium and 100 g of oxygen

a) (8 pts) Identify the limiting reagent. Show work.

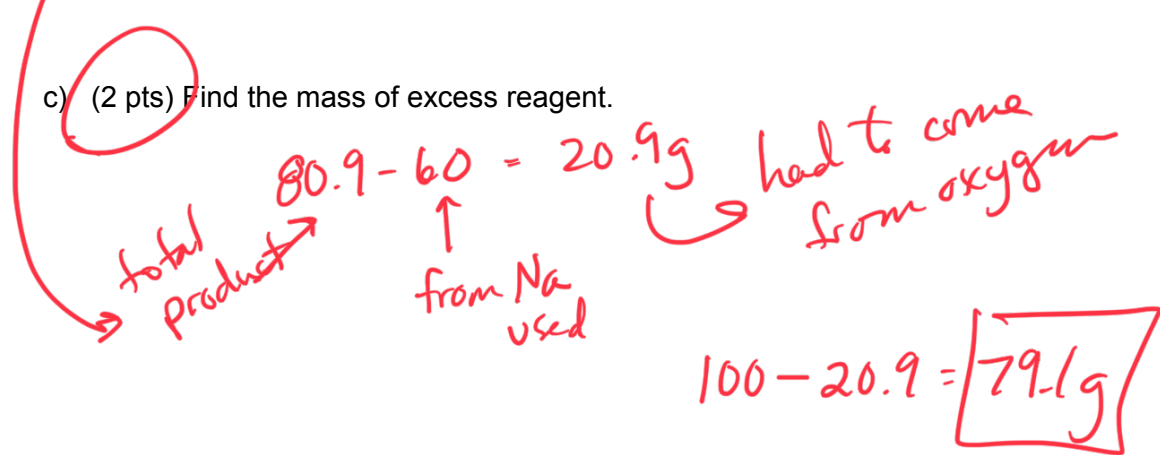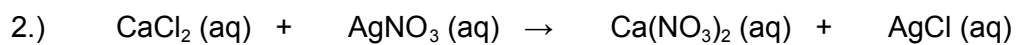$$60g \ Na * \frac{1 \ mol \ Na}{22.99g \ Na} * \frac{2 \ mol \ Na_2O}{4 \ mol \ Na} * \frac{61.979g \ Na_2O}{1 \ mol \ Na_2O} = 80.9g$$

Given — molar mass reactant — molar ratio — molar mass product

Na: 2*22.99 = 45.98
O: 1*15.999 = 15.999
61.979
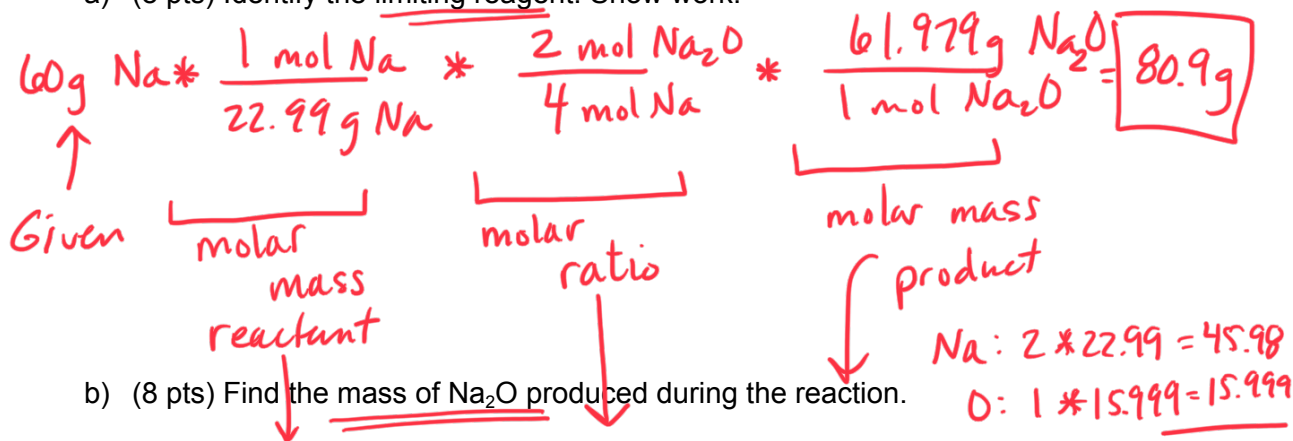
b) (8 pts) Find the mass of Na_2O produced during the reaction.

$$100g \ O_2 * \frac{1 \ mol \ O_2}{31.998g} * \frac{2 \ mol \ Na_2O}{1 \ mol \ O_2} * \frac{61.979g \ Na_2O}{1 \ mol \ Na_2O}$$

$$= 387.4g \ Na_2O$$

$80.9g \ Na_2O$ Sodium is limiting reagent

c) (2 pts) Find the mass of excess reagent.

total product → $80.9 - 60 = 20.9g$ had to come from oxygen
↑ from Na used

$$100 - 20.9 = 79.1g$$

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2.) $CaCl_2$ (aq)   + $AgNO_3$ (aq) $\rightarrow$ $Ca(NO_3)_2$ (aq)   +   AgCl (aq)
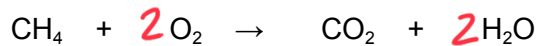
(18 pts total) If you begin with 90 g of $CaCl_2$ and 120 g of $AgNO_3$

a) (8 pts) Identify the limiting reagent.

b) (8 pts) Find the mass of AgCl produced during the reaction.

c) (2 pts) Find the mass of excess reagent.

3.) (18 pts) If you have 80 g of methane (CH_4) is reacted with 90 g of oxygen (O_2), find the liters of carbon dioxide (CO_2) produced under STP conditions.
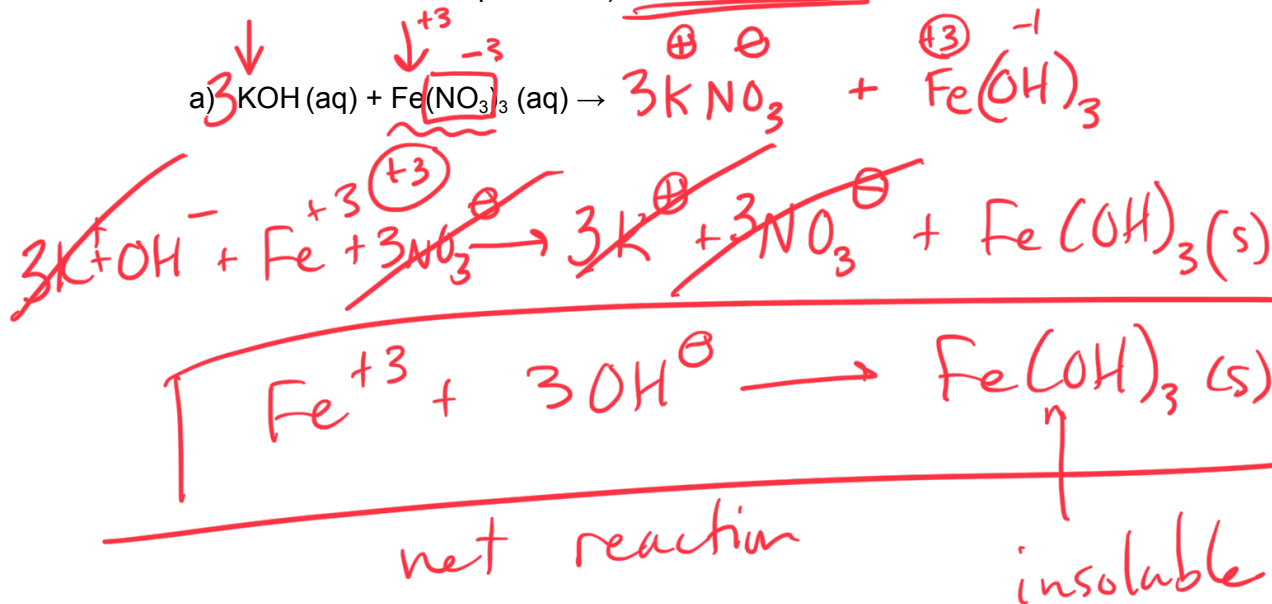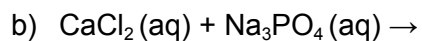
$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

molar volume of a gas $\rightarrow$ 22.4 L/mol $= 111.7 L$

$$80g \ CH_4 * \frac{1 \ mol \ CH_4}{16.043g} * \frac{1 \ mol \ CO_2}{1 \ mol \ CH_4} * \frac{22.4 \ L}{1 \ mol \ CO_2}$$

molar mass   molar ratio   molar volume

$$90g \ O_2 * \frac{1 \ mol \ O_2}{31.998g \ O_2} * \frac{1 \ mol \ CO_2}{2 \ mol \ O_2} * \frac{22.4L}{1 \ mol \ CO_2}$$

$$\boxed{31.5L}$$

4.) (18 pts total, 6 pts each) For each reaction, 1) complete each reaction by writing the potential products. 2) Balance the reaction. 3) Consult the solubility rules and identify soluble and insoluble compounds. 4) Write the net reaction.

a) $3 KOH \ (aq) + Fe(NO_3)_3 \ (aq) \rightarrow 3K NO_3 + Fe(OH)_3$

$$3K^+OH^- + Fe^{+3} + 3NO_3^- \rightarrow 3K^+ + 3NO_3^- + Fe(OH)_3 (s)$$

$$\boxed{Fe^{+3} + 3OH^- \longrightarrow Fe(OH)_3 \ (s)}$$

net reaction   insoluble

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b) $CaCl_2$ (aq) + Na_3PO_4 (aq) →

c) Aqueous solutions of lithium sulfate and calcium nitrate are mixed...

5.) (12 pts total, 3 pts each) Find the oxidation state of each atom within the compound.

a) H_2CO_3 +2 -6

+2 + $\underline{4}$ - 6 = 0

$H \rightarrow$ +1

2(+1)   (-2)3

2 + __ - 6 = 0

$O \rightarrow$ -2

[+2] [-14]   C = +4

b) $Na_2Cr_2O_7$

2(+1)   Cr +6   (-2)7

+2 + 2( ) - 14 = 0

2 + 2x - 14 = 0

2x - 12 = 0
    +12 +12

$\frac{2x}{2} = \frac{12}{2}$ X = 6

c) NO_3^{-1}

(-2)3

N → +5

— + $\underline{-6}$ = -1

x - 6 = -1
    +6 +6

X = 5

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d) SO_4^{-2}
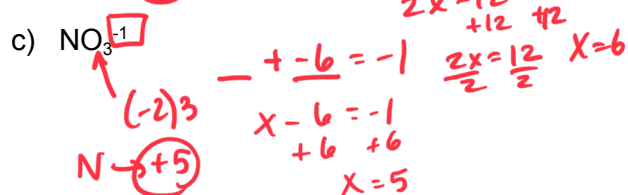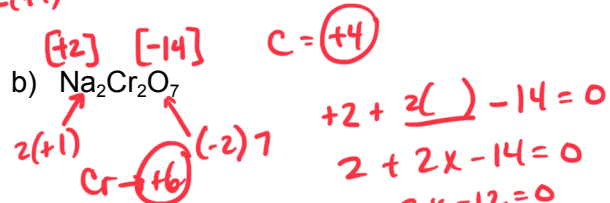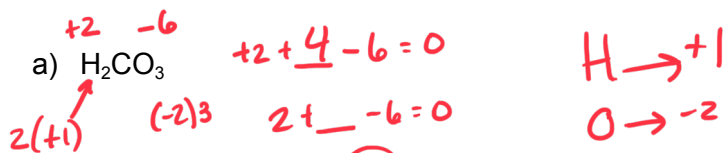
6.) (16 pts total, 8 pts each) Find the oxidation state of each atom within the reaction. Indicate which atom is reduced and which is oxidized.

oxidized is loss electrons OIL RIG

a) $Sb + HNO_3 \rightarrow Sb_2O_3 + NO + H_2O$

O +1 (-2)3 +3 (-2)3 +2 -2 +5

reduced — gained electrons

$1 + \_\_ + (-6) = 0$ $2x + (-6) = 0$

$1 + x - 6 = 0$ $2x - 6 = 0$

$x - 5 = 0$ $+6 \quad +6$

$+5 \quad +5$ $\dfrac{2x}{2} = \dfrac{6}{2}$

$\boxed{x = 5}$ $x = 3$

b) $Mg + 2HCl \rightarrow MgCl_2 + H_2$

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