Assignment #3 Stoichiometry WS A ANSWER KEY

~~Chemistry~~

Name KEY

Period _____ Date _____

Chemical Reactions

STOICHIOMETRY WORKSHEET A

1. Nitrogen gas reacts with hydrogen gas, forming ammonia gas.

(a) Write the balanced equation for the reaction.

$N_2 + 3H_2 \rightarrow 2NH_3$

(b) Find the molar masses of the substances in the reaction.

N_2: 28g H_2: 2g NH_3: 17g

(c) Find the moles of NH_3 (g) formed when 5.00 moles of H_2 (g) reacts.

GIVEN: 5.0 mol H_2

DESIRED: ? mol NH_3

WORK: $\frac{5.00\,mol\,H_2}{1} \left| \frac{2\,mol\,NH_3}{3\,mol\,H_2} \right.$

ANSWER: 3.3 mol NH_3

(d) Find the moles of H_2 (g) required when 3.5 grams of N_2 (g) reacts.

GIVEN: 3.5g N_2

DESIRED: ? mol H_2

WORK: $\frac{3.5g\,N_2}{1} \left| \frac{1\,mol\,N_2}{28g\,N_2} \right| \frac{3\,mol\,H_2}{1\,mol\,N_2}$

ANSWER: 0.375 mol H_2

(e) Find the grams of H_2 (g) needed to form 21.1 moles of NH_3 (g).

GIVEN: 21.1 mol NH_3

DESIRED: ? g H_2

WORK: $\frac{21.1\,mol\,NH_3}{1} \left| \frac{3\,mol\,H_2}{2\,mol\,NH_3} \right| \frac{2g\,H_2}{1\,mol\,H_2}$

ANSWER: 63.3g H_2

(f) Find the moles of NH_3 (g) produced at STP when 9.62 grams of N_2 (g) is used.

GIVEN: 9.62g N_2

DESIRED: ? mol NH_3

WORK: $\frac{9.62g\,N_2}{1} \left| \frac{1\,mol\,N_2}{28g\,N_2} \right| \frac{2\,mol\,NH_3}{1\,mol\,N_2}$

ANSWER: 0.69 mol NH_3

2. Solid potassium chlorate decomposes to form solid potassium chloride and oxygen gas.

(a) Write the balanced equation for the reaction.

$2KClO_3 \rightarrow 2KCl + 3O_2$

(b) Find the molar masses of the substances in the reaction.

$KClO_3$: 122g KCl: 74g O_2: 32g

(c) Find the mass of KCl (s) produced when 42.0 moles of $KClO_3$ (s) decomposes.

GIVEN: 42 mol $KClO_3$

DESIRED: ? g KCl

WORK: $\frac{42\,mol\,KClO_3}{1} \left| \frac{2\,mol\,KCl}{2\,mol\,KClO_3} \right| \frac{74g\,KCl}{1\,mol\,KCl}$

ANSWER: 3108g KCl

Find the moles of O_2 (g) produced at STP when 42.0 grams of $KClO_3$ (s) decomposes.

GIVEN: $42\,g\,KClO_3$

DESIRED: $?\,mol\,O_2$

WORK: $\frac{42\,g\,KClO_3}{1} \left| \frac{1\,mol\,KClO_3}{122\,g\,KClO_3} \right| \frac{3\,mol\,O_2}{2\,mol\,KClO_3}$

ANSWER: $0.52\,mol\,O_2$

3. Zinc metal is placed in a solution of hydrochloric acid to form hydrogen gas and aqueous zinc chloride.

(a) Write the balanced equation for the reaction.

$$Zn + 2HCl \rightarrow H_2 + ZnCl_2$$

(b) Find the mass of Zn (s) required to produce 12.6 L of H_2 (g) at STP.

GIVEN: $12.6\,L\,H_2$

DESIRED: $?\,g\,Zn$

WORK: $\frac{12.6\,L\,H_2}{1} \left| \frac{1\,mol\,H_2}{22.4\,L\,H_2} \right| \frac{1\,mol\,Zn}{1\,mol\,H_2} \left| \frac{65\,g\,Zn}{1\,mol\,Zn} \right.$

ANSWER: $36.5\,g\,Zn$

(c) Calculate the moles of HCl (aq) required to produce 12.6 grams of H_2 (g) a STP.

GIVEN: $12.6\,g\,H_2$

DESIRED: $?\,mol\,HCl$

WORK: $\frac{12.6\,g\,H_2}{} \left| \frac{1\,mol\,H_2}{2\,g\,H_2} \right| \frac{2\,mol\,HCl}{1\,mol\,H_2}$

ANSWER: $12.6\,mol\,HCl$

(d) Find the moles of HCl (aq) used if 20 moles of zinc is available to react.

GIVEN:: $20\,mol\,Zn$

DESIRED: $?\,mol\,HCl$

WORK: $\frac{20\,mol\,Zn}{1} \left| \frac{2\,mol\,HCl}{1\,mol\,Zn} \right.$

ANSWER: $40\,mol\,HCl$

4. A solution of lead (II) acetate is combined with a solution of hydrochloric acid forming a lead(II) chloride precipitate and acetic acid.

(a) Write the balanced equation for the reaction.

$$Pb(C_2H_3O_2)_2 + 2HCl \rightarrow PbCl_2 + 2HC_2H_3O_2$$

(b) Find the molar masses of the substances in the reaction.

$Pb(C_2H_3O_2)_2$:	HCl:	$PbCl_2$	$HC_2H_3O_2$:
325 g	36 g	277 g	60 g

(c) Find the mass of lead(II) acetate required to react to form 25 moles of lead (II)chloride.

GIVEN: $25\,mol\,PbCl_2$

DESIRED: $?\,g\,Pb(C_2H_3O_2)_2$

WORK: $\frac{25\,mol\,PbCl_2}{1} \left| \frac{1\,mol\,Pb(C_2H_3O_2)_2}{1\,mol\,PbCl_2} \right| \frac{325\,g\,Pb(C_2H_3O_2)_2}{1\,mol\,Pb(C_2H_3O_2)_2}$

ANSWER: $8125\,g$

(d) Calculate the moles of acetic acid produced when 94.5 g of lead (II) chloride is formed.

GIVEN: $94.5\,g\,PbCl_2$

DESIRED: $?\,mol\,HC_2H_3O_2$

WORK: $\frac{94.5\,g\,PbCl_2}{1} \left| \frac{1\,mol\,PbCl_2}{277\,g\,PbCl_2} \right| \frac{2\,mol\,HC_2H_3O_2}{1\,mol\,PbCl_2}$

ANSWER: $0.68\,mol\,HC_2H_3O_2$

Nitrogen monoxide gas reacts with oxygen gas to produce nitrogen dioxide gas.

(a) Write the balanced equation for the reaction.

$2NO + O_2 \rightarrow 2NO_2$

(b) Find the molar masses of the substances in the reaction.

NO: 30g | O_2: 32g | NO_2: 46g

(c) Find the moles of NO_2 (g) formed when 5.00 moles of O_2 (g) reacts.

GIVEN: 5 mol O_2
DESIRED: ? mol NO_2

WORK: $\frac{5\text{mol}\,O_2}{1} \left| \frac{2\text{mol}\,NO_2}{1\text{mol}\,O_2} \right.$

ANSWER: 10 mol NO

(d) Find the moles of NO (g) required when 3.5 grams of O_2 (g) reacts.

GIVEN: 3.5g O_2
DESIRED: ? mol NO

WORK: $\frac{3.5\text{g}\,O_2}{1} \left| \frac{1\text{mol}\,O_2}{32\text{g}\,O_2} \right| \frac{2\text{mol}\,NO}{1\text{mol}\,O_2}$

ANSWER: 0.22 mol

(e) Find the grams of O_2 (g) needed to form 24.1 grams of NO_2 (g).

GIVEN: 24.1g NO_2
DESIRED: ? g O_2

WORK: $\frac{24.1\text{g}\,NO_2}{1} \left| \frac{1\text{mol}\,NO_2}{46\text{g}\,NO_2} \right| \frac{1\text{mol}\,O_2}{2\text{mol}\,NO_2} \left| \frac{32\text{g}\,O_2}{1\text{mol}\,O_2} \right.$

ANSWER: 8.38g O_2

(f) Find the grams of NO_2 (g) produced at STP when 9.6 g of NO (g) is used.

GIVEN: 9.6g NO
DESIRED: ? g NO_2

WORK: $\frac{9.6\text{g}\,NO}{1} \left| \frac{1\text{mol}\,NO}{30\text{g}\,NO} \right| \frac{2\text{mol}\,NO_2}{2\text{mol}\,NO} \left| \frac{46\text{g}\,NO_2}{1\text{mol}\,NO_2} \right.$

ANSWER: 14.72g N

6. Solid aluminum reacts with chlorine gas to produce solid aluminum chloride.

(a) Write the balanced equation for the reaction.

$2Al + 3Cl_2 \rightarrow 2AlCl_3$

(b) Find the molar masses of the substances in the reaction.

Al: 27g | Cl_2: 70 g | $AlCl_3$: 132g

(c) Find the mass of Al (s) produced when 4.2 moles of Cl_2 (g) reacts.

GIVEN: 4.2 mol Cl_2
DESIRED: ? g Al

WORK: $\frac{4.2\text{mol}\,Cl_2}{1} \left| \frac{2\text{mol}\,Al}{3\text{mol}\,Cl_2} \right| \frac{27\text{g}\,Al}{1\text{mol}\,Al}$

ANSWER: 75.6g Al

(d) How many moles of Cl_2 (g) must react to produce 12.3g of $AlCl_3$?

GIVEN: 12.3g $AlCl_3$
DESIRED: ? mol Cl_2

WORK: $\frac{12.3\text{g}\,AlCl_3}{1} \left| \frac{1\text{mol}\,AlCl_3}{132\text{g}\,AlCl_3} \right| \frac{3\text{mol}\,Cl_2}{2\text{mol}\,AlCl_3}$

ANSWER: 0.14 mol C

d calcium reacts with oxygen gas to produce solid calcium oxide.

Write the balanced equation for the reaction.

$2Ca + O_2 \rightarrow 2CaO$

(b) Find the mass of Ca (s) required to produce 10.5 moles of CaO (s).

GIVEN: 10.5 mol CaO
DESIRED: ? g Ca

WORK: $\frac{10.5\text{ mol CaO}}{1} \left| \frac{2\text{ mol Ca}}{2\text{ mol CaO}} \right| \frac{40\text{ g Ca}}{1\text{ mol Ca}}$

ANSWER: 420 g Ca

(c) Calculate the moles of O_2 (g) required to produce 27.8 grams of CaO (s).

GIVEN: 27.8 g CaO
DESIRED: ? mol O_2

WORK: $\frac{27.8\text{ g CaO}}{1} \left| \frac{1\text{ mol CaO}}{56\text{ g CaO}} \right| \frac{1\text{ mol } O_2}{2\text{ mol CaO}}$

ANSWER: 0.25 mol

(d) How many grams of O_2 (g) are required to form 3.5 moles of CaO (s)?

GIVEN: 3.5 mol CaO
DESIRED: ? g O_2

WORK: $\frac{3.5\text{ mol CaO}}{1} \left| \frac{1\text{ mol } O_2}{2\text{ mol CaO}} \right| \frac{32\text{ g } O_2}{1\text{ mol } O_2}$

ANSWER: 56 g O_2

8. Ammonia gas reacts with oxygen gas to produce nitrogen monoxide and water.

(a) Write the balanced equation for the reaction.

$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$

(b) Find the molar masses of the substances in the reaction.

NH_3:	O_2:	NO	H_2O:
17 g	32 g	30 g	18 g

(c) How many moles of NO are formed if 824g of NH_3 react?.

GIVEN: 824 g NH_3
DESIRED: ? mol NO

WORK: $\frac{824\text{ g } NH_3}{1} \left| \frac{1\text{ mol } NH_3}{17\text{ g } NH_3} \right| \frac{4\text{ mol NO}}{4\text{ mol } NH_3}$

ANSWER: 48.47 mol

(d) How many moles of oxygen are needed to react with 4.6 moles of ammonia.

GIVEN: 4.6 mol NH_3
DESIRED: ? mol O_2

WORK: $\frac{4.6\text{ mol } NH_3}{1} \left| \frac{5\text{ mol } O_2}{4\text{ mol } NH_3} \right.$

ANSWER: 5.75 mol