Chemistry 11

Stoichiometry Practice Test

Name: Key
Date:
Block:

__B__ 1. A reaction between magnesium and chlorine takes place. Which of the following is the correct unbalanced reaction?

A. $Mg + Cl \rightarrow MgCl_3$
B. $Mg + Cl_2 \rightarrow MgCl_2$
C. $Mg_2 + Cl_2 \rightarrow MgCl_3$
D. $Mg + Cl_2 \rightarrow Mg_2Cl$

__B__ 2. Complete the following reaction:

$$Na + S_8 \rightarrow$$

A. NaS
B. Na_2S
C. NaS_2
D. NaS_3

__B__ 3. When the following equation is balanced, what will the coefficient be for fluorine?

$$\underline{2}\ AlCl_3 + \underline{3}\ F_2 \rightarrow \underline{2}\ AlF_3 + \underline{3}\ Cl_2$$

A. 2
B. 3
C. 4
D. 5

__A__ 4. When the following equation is balanced, what will the coefficient be for chlorine?

$$\underline{2}\ CH_4 + \underline{\quad}\ Cl_2 \rightarrow \underline{2}\ CH_3Cl + \underline{\quad}\ H_2$$

A. 1
B. 2
C. 3
D. 4

__C__ 5. The following unbalanced chemical equation is given.

$$2\ C_2H_6 + \underline{7}\ O_2 \rightarrow 4\ CO_2 + 6\ H_2O$$

How many moles of ethane, C_2H_6, reacts with 14 moles of oxygen?

A. 1
B. 2
C. 4
D. 8

6. Explain your answer to the question above:

$$14\ mol_{O_2} \times \frac{2\ mol\ C_2H_6}{7\ mol_{O_2}} = 4\ mol_{C_2H_6}$$

__D__ 7. The following chemical equation is given.

$$2\ Ag^+ + S_2O_8{}^{?} \rightarrow Ag_2S_2O_8$$

What is the ionic charge on the S_2O_8 ion?

A. 1+
B. 1-
C. 2+
D. 2-

Ag^{+} $S_2O_8^{2-}$

$Ag_2S_2O_8$

__B__ 8. A reaction between $C_3H_8O_2$ and oxygen would produce:

Combustion!

A. $C_3H_6O + H_2O$
B. $CO_2 + H_2O$
C. A salt and water
D. Impossible to predict

hydrocarbon

Acid Base

__C__ 9. Hydrochloric acid and sodium hydroxide react to produce

OH

Neutralization!

A. An explosion
B. $CO_2 + H_2O$
C. A salt and water
D. Impossible to predict

B ___ 10. The equation to calculate percent purity is:

A. $\frac{\text{Impure mass}}{\text{Pure mass}}$

B. $\frac{\text{Pure mass}}{\text{Impure mass}}$

C. $\frac{\text{Excess Yield}}{\text{Limiting Yield}}$

D. $\frac{\text{Limiting Yield}}{\text{Excess Yield}}$

B ___ 11. A substance that reacts with another substance and is completely reacted and consumed is called the:

A. A theoretical reactant
B. A limiting reactant
C. An excess reactant
D. A standard reactant

A ___ 12. Consider the following reaction:

$$2\ H_2 + O_2 \rightarrow 2\ H_2O$$

2.0 mol of H_2 reacts with 2.0 mol of O_2. What is the limiting reactant?

A. H_2
B. O_2
C. H_2O
D. The limiting reactant does not exist

13. Show your work for the question above:

$2.0\text{ mol } H_2 \times \frac{2\text{ mol } H_2O}{2\text{ mol } H_2} = 2.0\text{ mol } H_2O$ ← limiting

$2.0\text{ mol } O_2 \times \frac{2\text{ mol } H_2O}{1\text{ mol } O_2} = 4.0\text{ mol } H_2O$

A ___ 14. After completing and balancing the reaction below, the mole ratio of potassium to oxygen in the chemical equation below is:

$$4\ K + O_2 \rightarrow 2\ K_2O$$

A. 4 to 1
B. 4 to 2
C. 2 to 3
D. 1 to 1

C ___ 15. A sample of cobalt (II) chloride has 94.0% purity. If the total sample weighs 15604g, what is the mass of pure cobalt (II) chloride?

A. 16600g
B. 15604g
C. ~~14668g~~ 14700g
D. 94.0g

$94.0\% = \frac{x}{15604g} \times 100\%$

$x = 0.94 \times 15604g = 14668 = 14700g$

D ___ 16. A sample of sodium metal has 0.200% purity. If only 13.5g of the sample reacts, what is the total mass of the sample? pure

A. 0.027g
B. 0.200g
C. 13.5g
D. 6750g

$0.200\% = \frac{13.5g}{x} \times 100\%$

$x = \frac{13.5g}{0.00200}$

C ___ 17. A reaction is expected to produce 94.0g of a product. However, only 17.0g is recovered at the end of the experiment. What was the percent yield?

A. 5.50%
B. 17.0%
C. ~~18.0%~~ 18.1%
D. 94.0%

18. Briefly explain your answer to the question above:

$\%\text{ yield} = \frac{\text{actual}}{\text{theoretical}} \times 100\%$

$= \frac{17.0g}{94.0g} \times 100\%$

A ___ 19. A reaction is known to only produce 90.0% yield. If the reaction is predicted to produce 90.0g, how much product will you actually produce?

A. 81.0g
B. 90.0g
C. 99.9g
D. 100.g

$90.0\% = \frac{x}{90.0g} \times 100\%$

$x = 0.900 \times 90.0g$

1. Write a **balanced** equation representing the following reactions. You only need to complete **three** equations. Indicate which equation you would like marked by a check mark in the box next to the equation. ☑

☐ Lead(IV) nitride reacts with lithium sulphide.

$$Pb_3N_4 + 6\,Li_2S \rightarrow 3\,PbS_2 + 4\,Li_3N$$

☐ Synthesis of potassium permanganate from its elements

$$K + Mn + 2\,O_2 \rightarrow KMnO_4$$

☐ Sodium sulphate and copper(II) phosphate were produced in this reaction.

$$2\,Na_3PO_4 + 3\,CuSO_4 \rightarrow 3\,Na_2SO_4 + Cu_3(PO_4)_2$$

☐ Ammonium nitride and lead(III) chlorate react together.

$$(NH_4)_3N + Pb(ClO_3)_3 \rightarrow 3\,NH_4ClO_3 + PbN$$

☐ Iodine trifluoride, oxygen gas hydrofluoric acid (HF) react together at STP to form iodine tetrafluoride and water.

$$4\,IF_3 + O_2 + 4\,HF \rightarrow 4\,IF_4 + 2\,H_2O$$

2. The equation for the reaction of aluminum metal with fluorine gas is:

$$Al + F_2 \rightarrow AlF_3$$

a. What is the balanced chemical equation?

$$2\,Al + 3\,F_2 \rightarrow 2\,AlF_3$$

b. If 102.0 L of F_2 is reacted with excess aluminum metal at STP, how much mass of the product is made?

$$102.0\,L\,F_2 \times \frac{1\,mol\,F_2}{22.4\,L\,F_2} \times \frac{2\,mol\,AlF_3}{3\,mol\,F_2} \times \frac{83.98\,g\,AlF_3}{1\,mol\,AlF_3} = \boxed{254.9\,g\,AlF_3}$$

3. Consider the following balanced reaction:

$$3\,FeCl_2 + KNO_3 + 4\,HCl \rightarrow 3\,FeCl_3 + NO + 2\,H_2O + KCl$$

If 56.8g of $FeCl_2$ reacted with 14.9g of KNO_3 and 40.0g of HCl, find the mass of water produced

$$56.8\,g\,FeCl_2 \times \frac{1\,mol\,FeCl_2}{126.75\,g\,FeCl_2} \times \frac{2\,mol\,H_2O}{3\,mol\,FeCl_2} \times \frac{18.02\,g\,H_2O}{1\,mol\,H_2O} = 5.3\cancel{8}\,g\,H_2O$$

$$14.9\,g\,KNO_3 \times \frac{1\,mol\,KNO_3}{101.11\,g\,KNO_3} \times \frac{2\,mol\,H_2O}{1\,mol\,KNO_3} \times \frac{18.02\,g\,H_2O}{1\,mol\,H_2O} = \boxed{5.31\,g\,H_2O}$$

Limiting

$$40.0\,g\,HCl \times \frac{1\,mol\,HCl}{36.46\,g\,HCl} \times \frac{2\,mol\,H_2O}{4\,mol\,HCl} \times \frac{18.02\,g\,H_2O}{1\,mol\,H_2O} = \cancel{9.88}\,g\,H_2O$$

4. 6.57 g of lead (II) acetate are reacted with 24.8 mL of 1.50 M nitrous acid (HNO_2) according to the reaction:

$$Pb(CH_3COO)_2 + 2\,HNO_2 \rightarrow Pb(NO_2)_2 + 2\,CH_3COOH$$

6.57g 24.8mL 1.50M ?g

a) What mass of lead (II) nitrite will be formed?

$$6.57\,g\,Pb(CH_3COO)_2 \times \frac{1\,mol\,Pb(CH_3COO)_2}{325.30\,g\,Pb(CH_3COO)_2} \times \frac{1\,mol\,Pb(NO_2)_2}{1\,mol\,Pb(CH_3COO)_2} \times \frac{299.22\,g\,Pb(NO_2)_2}{1\,mol\,Pb(NO_2)_2} = \cancel{6.04}\,g\,Pb(NO_2)_2$$

$$0.0248\,L\,HNO_2 \times \frac{1.50\,mol\,HNO_2}{1\,L\,HNO_2} \times \frac{1\,mol\,Pb(NO_2)_2}{2\,mol\,HNO_2} \times \frac{299.22\,g\,Pb(NO_2)_2}{1\,mol\,Pb(NO_2)_2} = \boxed{5.57\,g\,Pb(NO_2)_2}$$

Limiting

b) What mass or volume of the excess reactant will be left over?

$$0.0248\,L\,HNO_2 \times \frac{1.50\,mol\,HNO_2}{1\,L\,HNO_2} \times \frac{1\,mol\,Pb(CH_3COO)_2}{2\,mol\,HNO_2} \times \frac{325.30\,g\,Pb(CH_3COO)_2}{1\,mol\,Pb(CH_3COO)_2} = 6.05\,g\,Pb(CH_3COO)_2$$

↑ how much was actually used

Excess = Have − Used

$$= 6.57\,g - 6.05\,g = \boxed{0.52\,g\,Pb(CH_3COO)_2}$$

5. Consider the reaction: $\underline{4}$ Na + ____ $O_2 \rightarrow \underline{2}$ Na_2O

a) Sodium has a purity of 78.2%. How many grams of the product will be formed from a 56.0 g sample of sodium?

$78.2\% = \frac{x}{56.0} \times 100\% \longrightarrow 0.782 \times 56.0 = x$

$x = 43.8\,g$ pure Na

*pure produces pure!

$43.8\,g_{Na} \times \frac{1\,mol\,Na}{22.99\,g_{Na}} \times \frac{2\,mol\,Na_2O}{4\,mol\,Na} \times \frac{61.98\,g\,Na_2O}{1\,mol\,Na_2O} = \boxed{59.0\,g\,Na_2O}$

b) If the reaction has a 64.7% yield, what mass of each reactant would be needed to produce 100.0 g of the product? Assume each of the reactants are pure.

$64.7\% = \frac{100.0\,g}{x} \times 100\% \longrightarrow x = 155\,g\,Na_2O$ (theoretical)

$\underbrace{155\,g_{Na_2O} \times \frac{1\,mol\,Na_2O}{61.98\,g\,Na_2O}} \times \frac{4\,mol\,Na}{2\,mol\,Na_2O} \times \frac{22.99\,g_{Na}}{1\,mol\,Na} = \boxed{115\,g\,Na}$

$\frac{1\,mol\,O_2}{2\,mol\,Na_2O} \times \frac{32.00\,g\,O_2}{1\,mol\,O_2} = \boxed{40.0\,g\,O_2}$

6. In an experiment, 3.44 g of 90.0% pure H_2 and 6.25 g of 80.0% pure O_2 are placed in a reaction vessel. The introduction of a spark causes a violent explosion that generates water.

a) What is the balanced reaction?

$2\,H_2 + O_2 \rightarrow 2\,H_2O$

b) What is the limiting reactant?

H_2 : $90.0\% = \frac{x}{3.44\,g} \times 100\% \longrightarrow x = \text{pure } H_2 = 3.10\,g$

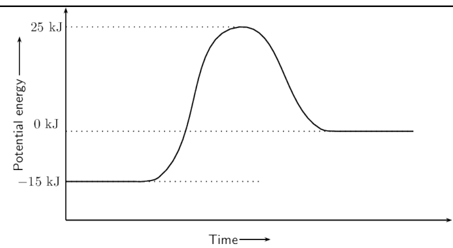
$3.10\,g \times \frac{1\,mol\,H_2}{2.02\,H_2} \times \frac{2\,mol\,H_2O}{2\,mol\,H_2} = 1.53\,mol\,H_2O$

O_2 : $80.0\% = \frac{x}{6.25\,g} \times 100\% \longrightarrow x = \text{pure } O_2 = 5.00\,g$

$5.00\,g \times \frac{1\,mol\,O_2}{32.00\,g\,O_2} \times \frac{2\,mol\,H_2O}{1\,mol\,O_2} = 0.313\,mol\,H_2O$

$\boxed{\therefore O_2 \text{ is the limiting reactant}}$

7.

Reaction:	Is the reaction endothermic or exothermic?
1. K + D + heat → G	endothermic
2. U → C ΔH = - 60 kJ	exothermic
3. F + A → T + I ΔH = 60 kJ	endothermic
4. A + C → D + 45 kJ	exothermic
5. 	endothermic