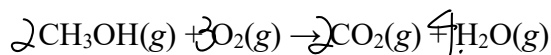


## Chapter 3 Homework

### Part A Multiple choice--Select the one that is best in each case.

A.

1. When the following equation is balanced, the coefficients are \_\_\_\_\_.



- A) 2, 3, 2, 4
- B) 4, 6, 4, 8
- C) 2, 3, 2, 5
- D) 1, 1, 1, 2
- E) 1, 2, 1, 2

D

2. Which of the following are combustion reactions?

- 1)  $\text{CH}_4(g) + 2\text{O}_2(g) \rightarrow \text{CO}_2(g) + 2\text{H}_2\text{O}(l)$  ✓
- 2)  $\text{CaO}(s) + \text{CO}_2(g) \rightarrow \text{CaCO}_3(s)$  ✗
- 3)  $2\text{Mg}(s) + \text{O}_2(g) \rightarrow 2\text{MgO}(s)$  ✓
- 4)  $\text{PbCO}_3(s) \rightarrow \text{PbO}(s) + \text{CO}_2(g)$  ✗

- A) 1, 2, and 3
- B) 1 only
- C) 1, 2, 3, and 4
- D) 1 and 3
- E) 2, 3, and 4

$$131.293 + 18.998 \times 10$$

C

3. The molecular weight of xenon tetrafluoride is \_\_\_\_\_ amu.

- A) 150.29
- B) 75.99
- C) 207.28
- D) 601.15
- E) 169.29

A

4. Calculate the percentage(%) by mass of carbon in dimethylsulfoxide( $\text{C}_2\text{H}_6\text{SO}$ ), rounded to four significant figures.

- A) 30.74
- B) 41.03
- C) 30.7
- D) 20.51
- E) 7.69

$$\frac{12 \times 2}{12 \times 2 + 6 + 32 + 16} \times 100$$

E

5. Which of the following samples contains the fewest sodium ions?

- A) 1 mol sodium oxide  $\text{Na}_2\text{O}$  2
- B) 45 g sodium fluoride  $\text{NaF}$   $\frac{45}{23+19} = 1.07$
- C) 1 mol sodium nitrite  $\text{NaNO}_2$  1
- D) 1 mol sodium sulfate  $\text{Na}_2\text{SO}_4$  2
- E) 50 g sodium chloride  $\text{NaCl}$   $\frac{50}{23+35} = 0.86$

$$\frac{12 \times 2}{24} + \frac{6}{31} + \frac{32}{78} + \frac{16}{78}$$

A

6. What is the total number of atoms in 0.139 mol of sulfur dioxide?

- A)  $2.51 \times 10^{23}$
- B)  $8.37 \times 10^{22}$
- C)  $6.02 \times 10^{23}$
- D) 0.139
- E) 0.417



$$3 \times 0.139 = 0.417$$

$$\frac{35 \times 2}{2 + 35 \times 2} = \frac{3}{4}$$

$$560 = 3x + 420$$

$$\frac{12 \times 2}{12} + \frac{6}{20} + \frac{32}{18} + \frac{16}{20}$$

C

7. The compound  $\text{XCl}_4$  contains 75.0% Cl by mass. The atomic mass of X is \_\_\_\_\_.

- A) 25.3
- B) 75.2
- C) 47.3
- D) 50.8
- E) 48.3

E

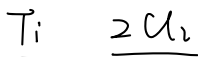
8. A 2.203-g sample of a compound known to contain only carbon, hydrogen, and oxygen was burned in oxygen to produce 4.401 g  $\text{CO}_2$  and 1.802 g  $\text{H}_2\text{O}$ . A separate experiment shows that it has a molar mass of 88.1 g/mol. What is the molecular formula of the compound?

- A)  $\text{C}_2\text{H}_4\text{O}$
- B)  $\text{C}_3\text{H}_4\text{O}_3$
- C)  $\text{C}_3\text{H}_{12}\text{O}$
- D)  $\text{C}_4\text{H}_4\text{O}_2$
- E)  $\text{C}_4\text{H}_8\text{O}_2$

$$12 + 2 = 14$$

$$\text{C:H} = \frac{1}{2} : \frac{1}{2}$$

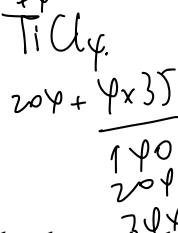
$$\frac{12 \times 4}{24} + \frac{8 \times 1}{8} + \frac{16}{16} = 4$$



### Chapter 3 Homework

B 9. If 3.00 g of titanium metal is reacted with 6.00 g of chlorine gas,  $\text{Cl}_2$ , to form 7.7 g of titanium(IV) chloride in a combination reaction, what is the percent yield of the product?

- A) 65%
- B) 96%
- C) 48%
- D) 86%
- E) 70%



$$\frac{3}{204} \times 344 = 0.0622$$

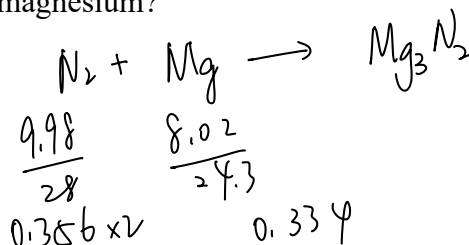
$$\frac{6}{70.9} = 0.08$$

62

$\text{Cl}_2$  sufficient!

E 10. What is the theoretical yield of magnesium nitride by the reaction of 9.98 g of nitrogen with 8.02 g of magnesium?

- A) 10.3
- B) 0.330
- C) 0.356
- D) 11
- E) 11.1



$$0.110 \times 100 = 11.1$$

**Part B Short questions--Write legibly and show all work for all steps in the problem.**

11. (6 points) Carry out the following operations and express the answers with the appropriate number of significant figures.

(a)  $25.3693 + 1.78$

(b)  $0.0482 / 0.941$

(c)  $547 \times (1894 - 7.89 \times 154)$

(d)  $12.00000 \times 0.9893 + 13.00335 \times 0.0107$

12. (4 points) Name the following compounds: (a)  $\text{Cu}(\text{OH})_2$ , (b)  $\text{HBrO}_2$ , (c)  $(\text{NH}_4)_2\text{CO}_3$ , (d)  $\text{N}_2\text{O}_4$ .

13. (7 points) One of the steps in the commercial process for converting ammonia to nitric acid is the conversion of  $\text{NH}_3$  to  $\text{NO}$ :  $4 \text{NH}_3(\text{g}) + 5 \text{O}_2(\text{g}) \rightarrow 4 \text{NO}(\text{g}) + 6 \text{H}_2\text{O}(\text{g})$ . In a certain experiment, 1.75 g of  $\text{NH}_3$  reacts with 3.21 g of  $\text{O}_2$ .

(a) Which is the limiting reactant?

(b) How many grams of nitrogen monoxide and of water form?

(c) How many grams of the excess reactant remain after the limiting reactant is completely consumed?

14. (8 points) Write balanced chemical equations (indicating the states) to correspond to each of the following descriptions: (a) Phosphine,  $\text{PH}_3(\text{g})$ , combusts in oxygen gas to form water vapor and solid tetraphosphorus decaoxide; (b) barium carbonate decomposes into barium oxide and carbon dioxide gas when heated; (c) When sulfur trioxide gas reacts with water, a solution of sulfuric acid forms; (d) When solid potassium chlorate is heated, it decomposes to form solid potassium chloride and oxygen gas.

## Chapter 3 Homework Answer Sheet

Name: P. P. P.

Student ID: 12311410 Instructor:

Score:

### Part A Multiple choice (10 points)

1-5 ADCAE

6-10 ACEBE

### Part B Short questions (25 points)

11. (6 points) Carry out the following operations and express the answers with the appropriate number of significant figures.

(a)  $25.3693 + 1.78$

(b)  $0.0482 / 0.941$

(c)  $547 \times (1894 - 7.89 \times 154)$

(d)  $12.00000 \times 0.9893 + 13.00335 \times 0.0107$

(a)  $25.3693 + 1.78 = 27.1493 \approx 27.15$

(b)  $\frac{0.0482}{0.941} = 0.051222104 \approx 0.0512$

(c)  $547 \times (1894 - 7.89 \times 154)$   
 $= 547 \times (1894 - 1215.06) = 547 \times 679 = 3.71 \times 10^5$

(d)  $12.00000 \times 0.9893 + 13.00335 \times 0.0107 = 12.01$

12. (4 points) Name the following compounds: (a)  $\text{Cu}(\text{OH})_2$ , (b)  $\text{HBrO}_2$ , (c)  $(\text{NH}_4)_2\text{CO}_3$ , (d)  $\text{N}_2\text{O}_4$ .

(a) Copper (II) hydroxide.

(b) Bromous acid.

(c) Ammonium carbonate.

(d) Dinitrogen tetroxide.

13. (7 points) One of the steps in the commercial process for converting ammonia to nitric acid is the conversion of  $\text{NH}_3$  to  $\text{NO}$ :  $4 \text{NH}_3(\text{g}) + 5 \text{O}_2(\text{g}) \rightarrow 4 \text{NO}(\text{g}) + 6 \text{H}_2\text{O}(\text{g})$ . In a certain experiment, 1.75 g of  $\text{NH}_3$  reacts with 3.21 g of  $\text{O}_2$ .

(a) Which is the limiting reactant?

(b) How many grams of nitrogen monoxide and of water form?

(c) How many grams of the excess reactant remain after the limiting reactant is completely consumed?

(a)  $\text{NH}_3$  is  $\frac{1.75 \text{ g}}{17.03 \text{ g/mol}} = 0.1027 \text{ mol}$ .

$\text{O}_2$  is  $\frac{3.21 \text{ g}}{32.00 \text{ g/mol}} = 0.1003 \text{ mol}$ .

$\text{NH}_3 : \text{O}_2 = 0.1027 : 0.1003 > 4 : 5 \Rightarrow \text{O}_2$  is limited.

$$c_b) m(NO) = 0.1003 \text{ mol} \times \frac{4}{5} \times 30.01 \text{ g/mol} = 2.41 \text{ g.}$$

$$m(H_2O) = 0.1003 \text{ mol} \times \frac{6}{5} \times 18.02 \text{ g/mol} = 2.17 \text{ g.}$$

$$c_c) m(\text{left } NH_3) = (0.1027 \text{ mol} - 0.1003 \text{ mol} \times \frac{4}{5}) \times 17.03 \text{ g/mol} \\ = 0.382 \text{ g.}$$

14. (8 points) Write balanced chemical equations (indicating the states) to correspond to each of the following descriptions: (a) Phosphine,  $PH_3(g)$ , combusts in oxygen gas to form water vapor and solid tetraphosphorus decaoxide; (b) barium carbonate decomposes into barium oxide and carbon dioxide gas when heated; (c) When sulfur trioxide gas reacts with water, a solution of sulfuric acid forms; (d) When solid potassium chlorate is heated, it decomposes to form solid potassium chloride and oxygen gas.

