South Pasadena • AP Chemistry

Name KEY

Period ____ Date ___/___/___

4 • Chemical Equations and Stoichiometry

PRACTICE TEST

1. Balance the following equation: BALANCE H's FIRST.

$2\ NH_3 + \frac{7}{2}\ O_2 \rightarrow 2\ NO_2 + 3\ H_2O$

The balanced equation shows that 1.00 mole of NH_3 requires ___ mole(s) of O_2. 2 : $\frac{7}{2}$ ≈

a) 0.57 c) 1.33
b) 1.25 d) 1.75 1 : $\frac{7}{4}$ = 1.75

2. Write a balanced equation for the combustion of acetaldehyde, CH_3CHO.

$CH_3CHO + \frac{5}{2}O_2 \rightarrow 2CO_2 + 2H_2O$

When properly balanced, the equation indicates that ___ mole(s) of O_2 are required for each mole of CH_3CHO. 1 : $\frac{5}{2}$

a) 1 c) 2.5
b) 2 d) 3

3. Balance the following equation with the SMALLEST WHOLE NUMBER COEFFICIENTS possible. Select the number that is the sum of the coefficients in the balanced equation: BALANCE O's FIRST

$2\ KClO_3 \rightarrow 2\ KCl + 3\ O_2$ 2+2+3=7

a) 5 b) 6 c) 7 d) 8

4. Write a balanced equation for the combustion of propane, C_3H_8.

$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

When properly balanced, the equation indicates that 5 moles of O_2 are required for each mole of C_3H_8.

a) 3 b) 3.5 c) 5 d) 8

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

5. What is the **total** mass of products formed when 16 grams of CH_4 is burned with excess oxygen? 16g = 1 mol CH_4

a) 80 g c) 36 g
b) 44 g d) 32 g

1 mol CO_2 = 44.0 g
2 mol H_2O = 36.0 g
80.0 g

6. Calculate the mass of hydrogen formed when 25 g of aluminum reacts with excess hydrochloric acid.

$2Al + 6HCl \rightarrow 2\ AlCl_3 + 3\ H_2$

a) 0.41 g c) 1.2 g
b) 0.92 g d) 2.8 g

$25\ g\ Al \times \frac{1\ mol\ Al}{27\ g\ Al} \times \frac{3\ mol\ H_2}{2\ mol\ Al} \times \frac{2\ g\ H_2}{1\ mol\ H_2} =$ ESTIMATE: A LITTLE LESS THAN 3.0

7. How many grams of the mixed oxide, Fe_3O_4, are formed when 6.00 g of O_2 react with Fe according to

$3Fe + 2O_2 \rightarrow Fe_3O_4$

3 × 55.85 = 167.6
4 × 16.0 = 64.0
231.6

a) 43.4 c) 174
b) 86.8 d) 21.7

$6.00\ g\ O_2 \times \frac{1\ mol\ O_2}{32.0\ g\ O_2} \times \frac{1\ mol\ Fe_3O_4}{2\ mol\ O_2} \times \frac{231.6\ g\ Fe_3O_4}{1\ mol\ Fe_3O_4} =$

ESTIMATE: $\frac{(3)(230)}{(32)(2)} \approx (.1)(230)$

8. For the reaction:

$2MnO_2 + 4KOH + O_2 + Cl_2 \rightarrow 2KMnO_4 + 2KCl + 2H_2O$

there is 100. g of each reactant available. Which reagent is the limiting reagent? [Molar Masses: MnO_2=86.9; KOH=56.1; O_2=32.0; Cl_2=70.9] TRY ALL 4

a) MnO_2 c) O_2
b) KOH d) Cl_2

MnO_2: $100\ g \times \frac{1\ mol}{86.9\ g\ MnO_2} \times \frac{2\ mol\ H_2O}{2\ mol\ MnO_2} = 1.15\ mol\ H_2O$

KOH: $100\ g \times \frac{1\ mol}{56.1\ KOH} \times \frac{2\ mol\ H_2O}{4\ mol\ KOH} = .891\ mol\ H_2O$

O_2: $100\ g \times \frac{1\ mol}{32\ g\ O_2} \times \frac{2\ mol\ H_2O}{1\ mol\ O_2} = 6.25\ mol\ H_2O$

Cl_2: $100\ g \times \frac{1\ mol}{71.0\ g\ Cl_2} \times \frac{2\ mol\ H_2O}{1\ mol\ Cl_2} = 2.8$

9. How many grams of nitric acid, HNO_3, can be prepared from the reaction of 92.0 g of NO_2 with 36.0 g H_2O? TRY BOTH

$3NO_2 + H_2O \rightarrow 2HNO_3 + NO$

a) 64 c) 84
b) 76 d) 116

$92.0\ g\ NO_2 \times \frac{1\ mol\ NO_2}{46.0\ g\ NO_2} \times \frac{2\ mol\ HNO_3}{3\ mol\ NO_2} \times \frac{63.0\ g\ HNO_3}{1\ mol\ HNO_3} = 84\ g\ HNO_3$

$36.0\ g\ H_2O \times \frac{1\ mol\ H_2O}{18.0\ g\ H_2O} \times \frac{2\ mol\ HNO_3}{1\ mol\ H_2O} \times \frac{63.0\ g\ HNO_3}{1\ mol\ HNO_3} = 252\ g\ HNO_3$

10. The reaction of 25.0 g benzene, C_6H_6, with excess HNO_3 resulted in 21.4 g $C_6H_5NO_2$. What is the percentage yield?

$$C_6H_6 + HNO_3 \rightarrow C_6H_5NO_2 + H_2O$$

a) 100% c) 54.3%
b) 27.4% d) 85.6%

% $\frac{21.4}{39.4} \times 100 = 54.3\%$

THEORETICAL:
$25.0\text{g } C_6H_6 \times \frac{1\text{mol } C_6H_6}{78.0\text{g } C_6H_6} \times \frac{1\text{mol } C_6H_5NO_2}{1\text{mol } C_6H_6} \times \frac{123\text{g } C_6H_5NO_2}{1\text{mol } C_6H_5NO_2} = 39.4\text{g } C_6H_5NO_2$

11. How many grams of H_2O will be formed when 16.0 g H_2 is allowed to react with 16.0 g O_2 according to (8 mol, ½ mol ∴ L.R.)

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

a) 18.0 g c) 9.00 g
b) 144 g d) 32.0 g

$16.0\text{g } O_2 \times \frac{1\text{mol } O_2}{32.0\text{g } O_2} \times \frac{2\text{mol } H_2O}{1\text{mol } O_2} \times \frac{18.0\text{g } H_2O}{1\text{mol } H_2O}$

Estimate: $\frac{(16)(2)}{(32)} = 1 \times 18$

14

1mol CO_2 ≅ 1mol C

$1.481\text{g } CO_2 \times \frac{1\text{mol } CO_2}{44.0\text{g } CO_2} = .03366\text{ mol C}$

$.303\text{g } H_2O \times \frac{1\text{mol } H_2O}{18.0\text{g } H_2O} \times \frac{2\text{mol H}}{1\text{mol } H_2O} = .03367\text{ mol H}$

C : H
1 : 1

12. When 8.00 g of H_2 reacts with 32.0 g of O_2 in an explosion, the final gas mixture will contain:

a) H_2, H_2O, and O_2 c) O_2 and H_2O only
b) H_2 and H_2O only d) H_2 and O_2 only

$2H_2 + O_2 \rightarrow 2H_2O$

from above

4 mol H_2 1mol O_2 ∴ O_2 is L.R. (no O_2 left over)

13. 1.056 g of metal carbonate, containing an unknown metal, M, were heated to give the metal oxide and 0.376 g CO_2.

$$MCO_3(s) + \text{heat} \rightarrow MO(s) + CO_2(g)$$

What is the identity of the metal M?

a) Mg c) Zn
b) Cu d) Ba

$.376\text{g } CO_2 \times \frac{1\text{mol } CO_2}{44.0\text{g } CO_2} = .008545\text{ mol } CO_2 = \text{mol } MCO_3$

molar mass of $MCO_3 = \frac{1.056\text{g}}{.008545\text{ mol}} = 123.57$

$123.57 - 60\ (CO_3) = 63.57\ M$

14. Styrene, the building block of polystyrene, is a hydrocarbon, a compound containing only C and H. A given sample is burned completely and it produces 1.481 g of CO_2 and 0.303 g of H_2O. Determine the empirical formula of the compound.

a) CH c) C_2H_3
b) CH_2 d) C_2H_5

See above Right space

Answers:

1.	D	8.	B
2.	C	9.	C
3.	C	10.	C
4.	C	11.	A
5.	A	12.	B
6.	D	13.	B
7.	D	14.	A