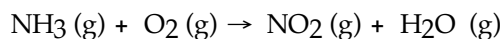Name_____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) When the following equation is balanced, the coefficients are _____.   1) _____

   NH_3 (g) + O_2 (g) → NO_2 (g) + H_2O (g)
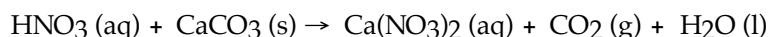
   A) 1, 3, 1, 2   B) 4, 7, 4, 6   C) 4, 3, 4, 3   D) 1, 1, 1, 1   E) 2, 3, 2, 3

2) When the following equation is balanced, the coefficient of Al is _____.   2) _____
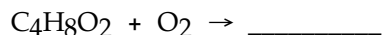
   Al (s) + H_2O (l) → $Al(OH)_3$ (s) + H_2 (g)

   A) 3   B) 5   C) 4   D) 1   E) 2

3) When the following equation is balanced, the coefficient of HNO_3 is _____.   3) _____

   HNO_3 (aq) + $CaCO_3$ (s) → $Ca(NO_3)_2$ (aq) + CO_2 (g) + H_2O (l)

   A) 4   B) 1   C) 3   D) 5   E) 2

4) What is the coefficient of O_2 when the following equation is completed and balanced?   4) _____

   $C_4H_8O_2$ + O_2 → _____

   A) 3   B) 2   C) 5   D) 6   E) 1

5) There are _____ hydrogen atoms in 25 molecules of $C_4H_4S_2$.   5) _____
   A) 1.5×10^{25}
   B) 3.8×10^{24}
   C) 6.0×10^{25}
   D) 100
   E) 25

6) How many grams of hydrogen are in 46 g of CH_4O?   6) _____
   A) 184   B) 5.8   C) 0.36   D) 2.8   E) 1.5

7) There are _____ molecules of methane in 0.123 mol of methane (CH_4).   7) _____
   A) 2.04×10^{-25}
   B) 2.46×10^{-2}
   C) 5
   D) 0.615
   E) 7.40×10^{22}

8) A 22.5-g sample of ammonium carbonate contains _____ mol of ammonium ions.   8) _____
   A) 2.14   B) 0.468   C) 0.288   D) 0.234   E) 3.47

9) What is the empirical formula of a compound that contains 27.0% S, 13.4% O, and 59.6% Cl by   9) _____
   mass?
   A) SO_2Cl B) $SOCl_2$ C) $SOCl$ D) S_2OCl E) $ClSO_4$

10) What is the empirical formula of a compound that contains 49.4% K, 20.3% S, and 30.3% O by   10) _____
   mass?
   A) KSO_4 B) KSO_2 C) K_2SO_3 D) KSO_3 E) K_2SO_4

11) A compound contains 40.0% C, 6.71% H, and 53.29% O by mass. The molecular weight of the   11) _____
   compound is 60.05 amu. The molecular formula of this compound is _____.
   A) CHO_2 B) $C_2H_4O_2$ C) $C_2H_3O_4$ D) CH_2O E) $C_2H_2O_4$

12) A compound that is composed of carbon, hydrogen, and oxygen contains 70.6% C, 5.9% H, and   12) _____
   23.5% O by mass. The molecular weight of the compound is 136 amu. What is the molecular
   formula?
   A) C_4H_4O B) $C_8H_8O_2$ C) $C_9H_{12}O$ D) $C_5H_6O_2$ E) C_8H_4O

13) A compound is composed of only C, H, and O. The combustion of a 0.519-g sample of the   13) _____
   compound yields 1.24 g of CO_2 and 0.255 g of H_2O. What is the empirical formula of the
   compound?
   A) $C_2H_6O_2$ B) $C_2H_6O_5$ C) C_3H_3O D) CH_3O E) C_6H_6O

14) Combustion of a 0.9835-g sample of a compound containing only carbon, hydrogen, and oxygen   14) _____
   produced 1.900 g of CO_2 and 1.070 g of H_2O. What is the empirical formula of the compound?
   A) $C_4H_{10}O$
   B) C_2H_5O
   C) $C_4H_{10}O_2$
   D) $C_4H_{11}O_2$
   E) $C_2H_5O_2$

15) Calcium carbide (CaC_2) reacts with water to produce acetylene (C_2H_2):   15) _____

   $$CaC_2 \text{ (s)} + 2H_2O \text{ (g)} \rightarrow Ca(OH)_2 \text{ (s)} + C_2H_2 \text{ (g)}$$
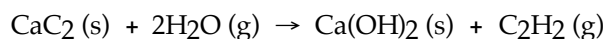
   Production of 13 g of C_2H_2 requires consumption of _____ g of H_2O.
   A) 4.5
   B) 9.0
   C) 4.8×10^{-2}
   D) 18
   E) 4.8×10^2

16) Magnesium and nitrogen react in a combination reaction to produce magnesium nitride: 16) _____

$$3 \, Mg \; + \; N_2 \; \rightarrow \; Mg_3N_2$$
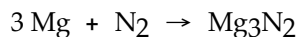
In a particular experiment, a 9.27–g sample of N_2 reacts completely. The mass of Mg consumed is _____ g.

   A) 13.9   B) 24.1   C) 8.04   D) 0.92   E) 16.1
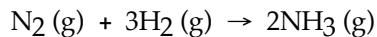
17) The combustion of ammonia in the presence of excess oxygen yields NO_2 and H_2O: 17) _____

$$4 \, NH_3 \, (g) \; + \; 7 \, O_2 \, (g) \; \rightarrow \; 4 \, NO_2 \, (g) \; + \; 6 \, H_2O \, (g)$$
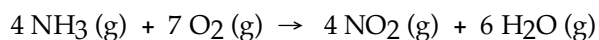
The combustion of 28.8 g of ammonia consumes _____ g of oxygen.
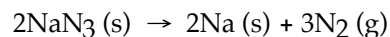
   A) 54.1   B) 28.8   C) 108   D) 15.3   E) 94.7

18) Under appropriate conditions, nitrogen and hydrogen undergo a combination reaction to yield ammonia: 18) _____

$$N_2 \, (g) \; + \; 3H_2 \, (g) \; \rightarrow \; 2NH_3 \, (g)$$

A 7.1–g sample of N_2 requires _____ g of H_2 for complete reaction.
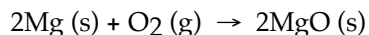
   A) 1.2   B) 0.51   C) 17.2   D) 1.5   E) 0.76

19) Automotive air bags inflate when sodium azide decomposes explosively to its constituent elements: 19) _____

$$2NaN_3 \, (s) \; \rightarrow \; 2Na \, (s) + 3N_2 \, (g)$$

How many moles of N_2 are produced by the decomposition of 2.88 mol of sodium azide?

   A) 1.92   B) 1.44   C) 4.32   D) 0.960   E) 8.64
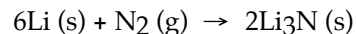
20) Magnesium burns in air with a dazzling brilliance to produce magnesium oxide: 20) _____

$$2Mg \, (s) + O_2 \, (g) \; \rightarrow \; 2MgO \, (s)$$

When 4.00 g of magnesium burns, the theoretical yield of magnesium oxide is _____ g.

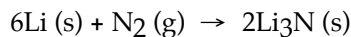   A) 4.00   B) 13.3   C) 6.63   D) 0.165   E) 3.32

21) Lithium and nitrogen react to produce lithium nitride: 21) _____

$$6Li \, (s) + N_2 \, (g) \; \rightarrow \; 2Li_3N \, (s)$$

How many moles of N_2 are needed to react with 0.500 mol of lithium?

   A) 0.167   B) 0.0833   C) 1.50   D) 0.500   E) 3.00

22) Lithium and nitrogen react to produce lithium nitride: 22) _____

$$6Li\ (s) + N_2\ (g) \rightarrow 2Li_3N\ (s)$$

How many moles of lithium nitride are produced when 0.450 mol of lithium react in this fashion?
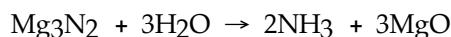
   A) 1.35   B) 0.900   C) 0.150   D) 0.225   E) 0.0750

23) What mass in grams of hydrogen is produced by the reaction of 4.73 g of magnesium with 1.83 g   23) _____
of water?

$$Mg\ (s) + 2H_2O\ (l) \rightarrow Mg(OH)_2\ (s) + H_2\ (g)$$
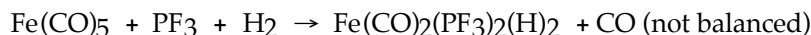
   A) 0.0162   B) 0.219   C) 0.0485   D) 0.102   E) 0.204

24) How many moles of magnesium oxide are produced by the reaction of 3.82 g of magnesium   24) _____
nitride with 7.73 g of water?

$$Mg_3N_2 + 3H_2O \rightarrow 2NH_3 + 3MgO$$

   A) 0.429   B) 0.0756   C) 0.0378   D) 4.57   E) 0.114

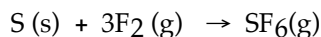25) Pentacarbonyliron ($Fe(CO)_5$) reacts with phosphorous trifluoride (PF_3) and hydrogen, releasing   25) _____
carbon monoxide:

$$Fe(CO)_5 + PF_3 + H_2 \rightarrow Fe(CO)_2(PF_3)_2(H)_2 + CO\ \text{(not balanced)}$$

The reaction of 5.0 mol of $Fe(CO)_5$, 8.0 mol of PF_3 and 6.0 mol of H_2 will release _____ mol of CO.

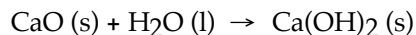   A) 6.0   B) 15   C) 24   D) 12   E) 5.0

26) Sulfur and fluorine react in a combination reaction to produce sulfur hexafluoride: 26) _____

$$S\ (s) + 3F_2\ (g) \rightarrow SF_6(g)$$

The maximum amount of SF_6 that can be produced from the reaction of 3.5 g of sulfur with 4.5 g of fluorine is _____ g.

   A) 16   B) 5.8   C) 3.2   D) 12   E) 8.0

27) Calcium oxide reacts with water in a combination reaction to produce calcium hydroxide: 27) _____

$$CaO\ (s) + H_2O\ (l) \rightarrow Ca(OH)_2\ (s)$$

A 4.50–g sample of CaO is reacted with 4.34 g of H_2O. How many grams of water remains after completion of reaction?

   A) 0.00892   B) 0.161   C) 1.04   D) 0.00   E) 2.90