1. A compound has the empirical formula NO_2. Its molecular formula could be

   A) N_4O_2 B) N_2O C) N_4O_4 **D) NO_2**

2. Given the balanced equation representing a reaction:

   $$Al_2(SO_4)_3 + 6NaOH \rightarrow 2Al(OH)_3 + 3Na_2SO_4$$

   The mole ratio of $NaOH$ to $Al(OH)_3$ is

   A) 1:1 **B) 3:1** C) 1:3 D) 3:7

3. A compound contains 53% Al and 47% O by mass. What is the empirical formula of this compound?

   A) AlO B) Al_3O_2
   C) AlO_2 **D) Al_2O_3**

4. Given the reaction:

   $$2\ C_8H_{18}(g) + 25\ O_2(g) \rightarrow 16\ CO_2(g) + 18\ H_2O(g)$$

   What volume of $C_8H_{18}(g)$ will completely react to produce exactly 36 liters of $H_2O(g)$?

   A) 27 L B) 2.0 L C) 36 L **D) 4.0 L**

5. Given the reaction:

   $$(NH_4)_2CO_3 \rightarrow 2\ NH_3 + CO_2 + H_2O$$

   What is the minimum amount of ammonium carbonate that reacts to produce 1.0 mole of ammonia?

   A) 34 moles B) 17 moles
   C) 0.50 mole D) 0.25 mole

6. What is the total mass in grams of 0.75 mole of SO_2?

   A) 16 g B) 24 g C) 32 g **D) 48 g**

7. Given the balanced equation:

   $CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(\ell) + CO_2(g)$

   What is the total number of moles of CO_2 formed when 20. moles of HCl is completely consumed?

   A) 5.0 mol B) 40. mol
   C) 10. mol D) 20. mol

8. What is the formula mass of $Al_2(SO_4)_3$?

   A) 342 B) 214 C) 150 D) 123

9. Given the equation:

   $$6\ CO_2(g)\ +\ 6\ H_2O(l) \rightarrow C_6H_{12}O_6(s) + 6\ O_2(g)$$

   What is the minimum number of liters of $CO_2(g)$, measured at STP, needed to produce 32.0 grams of oxygen?

   A) 32.0 L B) 192 L
   C) 264 L **D) 22.4 L**

10. What is the molecular mass of a gas whose density is 1.25 grams per liter at STP?

    A) 17.9 B) 20.0 C) 14.0 **D) 28.0**

11. Given the incomplete equation representing a reaction:

    $$2C_6H_{14} + \underline{\qquad\qquad} O_2 \rightarrow 12CO_2 + 14H_2O$$

    What is the coefficient of O_2 when the equation is completely balanced using the smallest whole-number coefficients?

    A) 13 B) 14 **C) 19** D) 26

12. Which pair consists of a molecular formula and its corresponding empirical formula?

    A) P_4O_{10} and P_2O_5
    B) SO_2 and SO_3
    C) C_6H_6 and C_2H_2
    D) C_2H_2 and CH_3CH_3

13. Given the balanced equation representing a reaction:
    $C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(g)$

    What is the total number of moles of $O_2(g)$ required for the complete combustion of 1.5 moles of $C_3H_8(g)$?

    A) .30 mol B) 1.5 mol
    C) 4.5 mol **D) 7.5 mol**

14. What is the molecular formula of a compound that has a molecular mass of 54 and the empirical formula C_2H_3?

A) C_8H_{12} B) C_2H_3
C) C_4H_6 D) C_6H_9

15. What is the molecular formula of a compound with the empirical formula P_2O_5 and a gram-molecular mass of 284 grams?

A) P_4O_{10} B) P_5O_2
C) P_2O_5 D) $P_{10}O_4$

16. Given the unbalanced equation:

$$\_\_\ Al + \_\_\ CuSO_4 \rightarrow \_\_\ Al_2(SO_4)_3 + \_\_\ Cu$$

When the equation is balanced using the *smallest* whole-number coefficients, what is the coefficient of Al?

A) 1 **B) 2** C) 3 D) 4

17. What is the empirical formula of a compound that contains 85% Ag and 15% F by mass?

A) AgF B) Ag_2F
C) Ag_2F_2 D) AgF_2

18. A compound was analyzed and found to contain 75% carbon and 25% hydrogen by mass. What is the compound's empirical formula?

A) CH B) CH_2 C) CH_3 **D) CH_4**

19. Which reaction releases the greatest amount of energy per 2 moles of product?

A) $4Al(s) + 3O_2(g) \rightarrow 2Al_2O_3(s)$
B) $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$
C) $2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$
D) $2CO(g) + O_2(g) \rightarrow 2CO_2(g)$

20. Which sample contains the same number of atoms as a gram of He?

A) 6 g of C **B) 4 g of O**
C) 7 g of Li D) 9 g of F

21. Given the unbalanced equation:

$$NaOH + H_3PO_4 \rightarrow Na_3PO_4 + H_2O$$

When the equation is correctly balanced, the coefficient of H_2O will be

A) 1 B) 2 **C) 3** D) 4

22. The percent by mass of nitrogen in $Mg(CN)_2$ is equal to

A) $\frac{28}{76} \times 100$ B) $\frac{14}{76} \times 100$
C) $\frac{14}{50} \times 100$ D) $\frac{28}{50} \times 100$

23. The percentage by mass of Br in the compound $AlBr_3$ is closest to

A) 25% **B) 90.%**
C) 75% D) 10.%

24. A student obtained the following data to determine the percent by mass of water in a hydrate.

Mass of empty crucible + cover	11.70 g
Mass of crucible + cover + hydrated salt before heating	14.90 g
Mass of crucible + cover + anhydrous salt after thorough heating	14.53 g

What is the approximate percent by mass of the water in the hydrated salt?

A) 2.5% B) 98% C) 88% **D) 12%**

25. A hydrate is a compound with water molecules incorporated into its crystal structure. In an experiment to find the percent by mass of water in a hydrated compound, the following data were recorded:

Mass of crucible + hydrated crystals before heating	7.50 grams
Mass of crucible	6.90 grams
Mass of crucible + anhydrous crystals after heating	7.20 grams

What is the percent by mass of water in the hydrate?

A) 72. % B) 96. %
C) 8.0 % **D) 50. %**

26. In terms of potential energy, *PE*, which expression defines the heat of reaction for a chemical change?

A) $PE_{products} - PE_{reactants}$
B) $\frac{PE_{reactants}}{PE_{products}}$
C) $PE_{reactants} - PE_{products}$
D) $\frac{PE_{products}}{PE_{reactants}}$

27. In a chemical reaction, the difference between the potential energy of the products and the potential energy of the reactants is equal to the

A) kinetic energy B) rate of reaction
C) activation energy **D) heat of reaction**

28. Given the unbalanced equation:

$$\_\_ Na + \_\_ H_2O \rightarrow \_\_ H_2 + \_\_ NaOH$$

When the equation is correctly balanced using the smallest whole-number coefficients, the coefficient for H_2O is

A) 1 **B) 2** C) 3 D) 4

29. The percent composition by mass of nitrogen in NH_4OH (gram-formula mass = 35 grams/mole) is equal to

A) $\frac{4}{35} \times 100$ **B)** $\frac{14}{35} \times \mathbf{100}$ C) $\frac{35}{14} \times 100$ D) $\frac{35}{4} \times 100$

30. What is the total number of oxygen atoms in the formula $MgSO_4 \cdot 7\ H_2O$? [The • represents seven units of H_2O attached to one unit of $MgSO_4$.]

A) 11 B) 7 C) 5 D) 4

Answer Key
AAAFINAL-HONORS16Q1

1. **D**
2. **B**
3. **D**
4. **D**
5. **C**
6. **D**
7. **C**
8. **A**
9. **D**
10. **D**
11. **C**
12. **A**
13. **D**
14. **C**
15. **A**
16. **B**
17. **A**
18. **D**
19. **A**
20. **B**
21. **C**
22. **A**
23. **B**
24. **D**
25. **D**
26. **A**
27. **D**
28. **B**
29. **B**
30. **A**