1. 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) 3:7   D) 1:3

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

A) Al₂O₃   B) Al₃O₂
C) AlO   D) AlO₂

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

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

4. A compound has the empirical formula NO₂. Its molecular formula could be

A) N₄O₂   B) N₂O   C) N₄O₄   **D) NO₂**

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

A) $\dfrac{28}{76} \times 100$ B) $\dfrac{14}{76} \times 100$

C) $\dfrac{14}{50} \times 100$ D) $\dfrac{28}{50} \times 100$

6. The percentage by mass of Br in the compound AlBr₃ is closest to

A) 90.% B) 25%   C) 10.% D) 75%
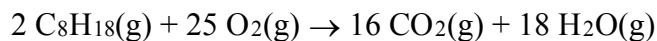
7. Which sample contains the same number of atoms as a gram of He?

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

8. What is the total number of oxygen atoms in the formula MgSO₄ • 7 H₂O? [The • represents seven units of H₂O attached to one unit of MgSO₄ .]

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

9. Given the reaction:

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

What volume of C₈H₁₈(g) will completely react to produce exactly 36 liters of H₂O(g)?

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

10. Given the balanced equation representing a reaction:
C₃H₈(g) +5O₂(g) → 3CO₂(g) + 4H₂O(g)

What is the total number of moles of O₂(g) required for the complete combustion of 1.5 moles of C₃H₈ (g)?

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

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

A) AgF₂   B) Ag₂F₂
C) AgF   D) Ag₂F

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

A) $\frac{PE_{products}}{PE_{reactants}}$

B) $\frac{PE_{reactants}}{PE_{products}}$

C) $PE_{reactants} - PE_{products}$

D) $PE_{products} - PE_{reactants}$

13. 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?

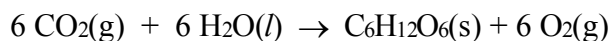A) 98%   B) 2.5% **C) 12%** D) 88%

14. What is the formula mass of Al₂(SO₄)₃?

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

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_5O_2

B) P_2O_5

C) P_4O_{10}

D) $P_{10}O_4$

16. Given the equation:

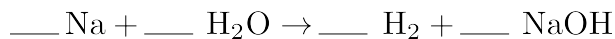$$6\ CO_2(g)\ +\ 6\ H_2O(l)\ \rightarrow\ C_6H_{12}O_6(s) + 6\ O_2(g)$$

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

A) 192 L

B) 22.4 L

C) 32.0 L

D) 264 L

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

A) P_4O_{10} and P_2O_5

B) C_2H_2 and $CH_3 CH_3$

C) SO_2 and SO_3

D) $C_6 H_6$ and C_2H_2

18. 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

19. 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) 50. %

B) 8.0 %

C) 96. %

D) 72. %

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

A) $2CO(g) + O_2(g) \rightarrow 2CO_2(g)$

B) $2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$

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

D) $4Al(s) + 3O_2(g) \rightarrow 2Al_2O_3(s)$

21. Given the incomplete equation representing a reaction:

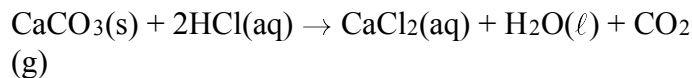$$2C_6H_{14}\ +\ \underline{\hspace{1cm}}\ O_2 \rightarrow 12CO_2 + 14H_2O$$
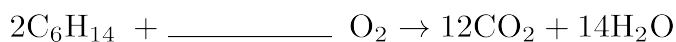
What is the coefficient of O_2 when the equation is completely balanced using the smallest whole-number coefficients?

A) 13

B) 14

C) 19

D) 26

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

A) C_6H_9

B) C_4H_6

C) C_8H_{12}

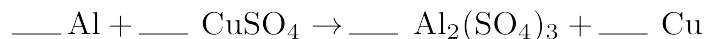D) C_2H_3

23. 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) 20. mol

B) 40. mol

C) 10. mol

D) 5.0 mol

24. Given the unbalanced equation:

$$\underline{\quad} Al + \underline{\quad} CuSO_4 \rightarrow \underline{\quad} Al_2(SO_4)_3 + \underline{\quad} Cu$$

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

25. A compound was analyzed and found to contain 75% carbon and 25% hydrogen by mass. What is the compound's empirical formula?
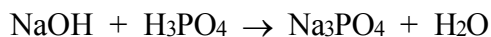
A) CH   B) CH_2 C) CH_3 **D) CH_4**

26. 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) $\frac{14}{35} \times$ 100**   C) $\frac{35}{14} \times$ 100   D) $\frac{35}{4} \times$ 100

27. 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**

28. 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

29. 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) heat of reaction   D) activation energy

30. 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) 0.50 mole**
C) 17 moles   D) 0.25 mole

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