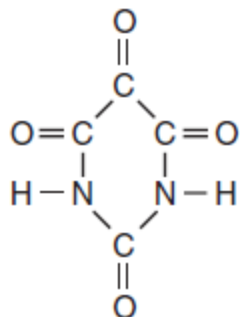# Stoichometry After School Regents Review Practice

1. Which formula is an empirical formula?

    A) $N_2O_4$  **B) $NH_3$**  C) $C_3H_6$  D) $P_4O_{10}$

2. Given the formula for a compound:



    Which molecular formula and empirical formula represent this compound?

    A) $C_2HNO_2$ and $CHNO$
    B) $C_2HNO_2$ and $C_2HNO_2$
    C) $C_4H_2N_2O_4$ and $CHNO$
    **D) $C_4H_2N_2O_4$ and $C_2HNO_2$**

3. Which substances have atoms of the same element but different molecular structures?

    A) $He(g)$ and $Ne(g)$     **B) $O_2(g)$ and $O_3(g)$**
    C) $K(s)$ and $Na(s)$        D) $P_4(s)$ and $S_8(s)$

4. A compound has the empirical formula $CH_2O$ and a gram-formula mass of 60. grams per mole. What is the molecular formula of this compound?

    A) $CH_2O$                  **B) $C_2H_4O_2$**
    C) $C_3H_8O$                D) $C_4H_8O_4$

5. Given the balanced equation representing a reaction:

    $2Na(s) + Cl_2(g) \rightarrow 2NaCl(s) + energy$

    If 46 grams of Na and 71 grams of $Cl_2$ react completely, what is the total mass of NaCl produced?

    A) 58.5 g                   **B) 117 g**
    C) 163 g                    D) 234 g

6. What is the gram-formula mass of $Ca(OH)_2$?

    A) 29 g/mol                 B) 54 g/mol
    C) 57 g/mol                 **D) 74 g/mol**

7. What is the gram-formula mass of $Fe(NO_3)_3$?

    A) 146 g/mol                B) 194 g/mol
    C) 214 g/mol                **D) 242 g/mol**

8. What is the total number of moles of oxygen atoms in 1 mole of $N_2O_3$?

    A) 1        B) 2        **C) 3**        D) 5

9. One mole of $O_2$ has approximately the same mass as one mole of

    A) $CH_4$    **B) S**        C) LiH    D) $Cl_2$

10. What is the percent composition by mass of nitrogen in $(NH_4)_2CO_3$ (gram-formula mass = 96.0 g/mol)?

    A) 14.6%                     **B) 29.2%**
    C) 58.4%                     D) 87.5%

11. Which quantity can be calculated for a solid compound, given only the formula of the compound and the Periodic Table of the Elements?

    A) the density of the compound
    B) the heat of fusion of the compound
    C) the melting point of each element in the compound
    **D) the percent composition by mass of each element in the compound**

12. Which compound has the *smallest* percent composition by mass of chlorine?

    A) HCl   **B) KCl**   C) LiCl   D) NaCl
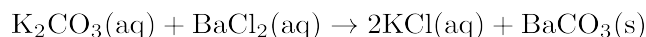
13. Given the balanced equation:

    $2KI + F_2 \rightarrow 2KF + I_2$
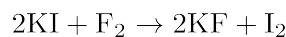
    Which type of chemical reaction does this equation represent?

    A) synthesis
    B) decomposition
    **C) single replacement**
    D) double replacement

14. Given the balanced equation representing a reaction:

$$K_2CO_3(aq) + BaCl_2(aq) \rightarrow 2KCl(aq) + BaCO_3(s)$$

Which type of reaction is represented by this equation?

A) synthesis                 B) decomposition
C) single replacement       **D) double replacement**

15. Which change results in the formation of different substances?

    **A) burning of propane**
    B) melting of $NaCl(s)$
    C) deposition of $CO_2(g)$
    D) solidification of water

16. Which terms identify types of chemical reactions?

    A) decomposition and sublimation
    **B) decomposition and synthesis**
    C) deposition and sublimation
    D) deposition and synthesis

17. Given the word equation:

sodium chlorate $\rightarrow$ sodium chloride + oxygen

Which type of chemical reaction is represented by this equation?

    A) double replacement
    B) single replacement
    **C) decomposition**
    D) synthesis

18. Given the reaction at 101.3 kilopascals and 298 K:

hydrogen gas + iodine gas $\rightarrow$ hydrogen iodide gas

This reaction is classified as

    **A) endothermic, because heat is absorbed**
    B) endothermic, because heat is released
    C) exothermic, because heat is absorbed
    D) exothermic, because heat is released

19. Which equation shows conservation of mass and energy for a reaction at 101.3 kPa and 298 K?

    **A) $2H_2(g) + O_2(g) \rightarrow 2H_2O(g) + 483.6$ kJ**
    B) $2H_2(g) + O_2(g) \rightarrow 2H_2O(l) + 285.8$ kJ
    C) $H_2(g) + O_2(g) \rightarrow H_2O(g) + 483.6$ kJ
    D) $H_2(g) + O_2(g) \rightarrow H_2O(l) + 285.8$ kJ

20. The coefficients in a balanced chemical equation represent

    A) the mass ratios of the substances in the reaction
    **B) the mole ratios of the substances in the reaction**
    C) the total number of electrons in the reaction
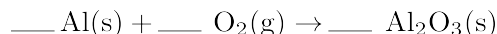    D) the total number of elements in the reaction

21. Given the incomplete equation representing a reaction:

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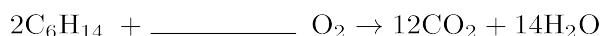
What is the coefficient of $O_2$ when the equation is completely balanced using the smallest whole-number coefficients?

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

22. Given the unbalanced equation:
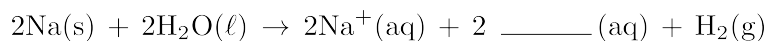
$$\underline{\hspace{0.7cm}} Al(s) + \underline{\hspace{0.7cm}} O_2(g) \rightarrow \underline{\hspace{0.7cm}} Al_2O_3(s)$$

When this equation is correctly balanced using smallest whole numbers, what is the coefficient of $O_2(g)$?

A) 6     B) 2     **C) 3**     D) 4

23. Given the incomplete equation representing a reaction:

    $$2Na(s) + 2H_2O(\ell) \rightarrow 2Na^+(aq) + 2 \text{_____}(aq) + H_2(g)$$

    What is the formula of the missing product?

    A) $O^{2-}$      B) $O_2$      **C)** $OH^-$      D) $OH$

24. Given the balanced equation representing a reaction:

    $$4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g)$$
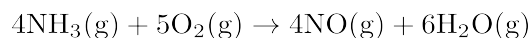
    What is the number of moles of $H_2O(g)$ formed when 2.0 moles of $NH_3(g)$ react completely?

    A) 6.0 mol      B) 2.0 mol
    **C) 3.0 mol**      D) 4.0 mol

25. Given the balanced equation representing a reaction:
    $2H_2 + O_2 \rightarrow 2H_2O + energy$

    Which mass of oxygen completely reacts with 4.0 grams of hydrogen to produce 36.0 grams of water?

    A) 8.0 g      B) 16.0 g
    **C) 32.0 g**      D) 40.0 g

26. Which sample of gas at STP has the same number of molecules as 6 liters of $Cl_2(g)$ at STP?

    A) 3 liters of $O_2(g)$      **B) 6 liters of $N_2(g)$**
    C) 3 moles of $O_2(g)$      D) 6 moles of $N_2(g)$

    Base your answers to questions **27** through **29** on the information below and on your knowledge of chemistry.

    Given the unbalanced equation showing the reactants and product of a reaction occurring at 298 K and 100. kPa:
    $$P_4(s) + Cl_2(g) \rightarrow PCl_3(l) + energy$$
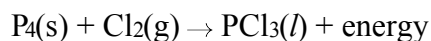
27. Show a numerical setup for calculating the percent composition by mass of chlorine in $PCl_3(l)$ (gram-formula mass = 137 g/mol).

28. State why this reaction is a synthesis reaction.

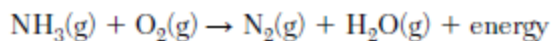29. Balance the equation below for the reaction, using the smallest whole number coefficients.

    \_\_\_\_$P_4(s)$ + \_\_\_\_$Cl_2(g) \rightarrow$ \_\_\_\_$PCl_3(l)$ + energy
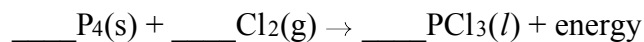
Base your answers to questions **30** and **31** on the information below and on your knowledge of chemistry.

Ammonia, $NH_3(g)$, can be used as a substitute for fossil fuels in some internal combustion engines. The reaction between ammonia and oxygen in an engine is represented by the unbalanced equation below.

$$NH_3(g) + O_2(g) \rightarrow N_2(g) + H_2O(g) + energy$$

30. Show a numerical setup for calculating the mass, in grams, of a 4.2-mole sample of $O_2$ .
    Use 32 g/mol as the gram-formula mass of $O_2$

31. Balance the equation for the reaction of ammonia and oxygen, using the smallest whole-number coefficients.

Base your answers to questions **32** and **33** on the information below and on your knowledge of chemistry.

A sample of calcium carbonate, $CaCO_3$, has a mass of 42.2 grams. Calcium carbonate has a gram-formula mass of 100. g/mol.

32. Determine the percent composition by mass of oxygen in the $CaCO_3$.

33. Show a numerical setup for calculating the number of moles in the sample of $CaCO_3$.

Base your answers to questions **34** and **35** on the information below and on your knowledge of chemistry.

The densities for two forms of carbon at room temperature are listed in the table below.

**Densities of Two Forms of Carbon**

| Element Form | Density (g/cm$^3$) |
|---|---|
| carbon (graphite) | 2.2 |
| carbon (diamond) | 3.513 |

34. A student calculated the density of a sample of graphite to be 2.3 g/cm$^3$. Show a numerical setup for calculating the student's percent error for the density of graphite.

35. Compare the number of carbon atoms in a 0.30-cm$^3$ sample of graphite and a 0.30-cm$^3$ sample of diamond.

# Answer Key
## Stoichiometry Review

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

$$\frac{3(35.5 \text{ g/mol})}{137 \text{ g/mol}} \times 100$$

$$\frac{3(35.453)}{137} \times 100$$

$$\frac{106 \times 100}{137}$$

$$\frac{3(35)}{136} \times 100$$

28.
— Two elements are chemically combined to form a compound.
— Two reactants form only one product.
— Two substances react to form one substance.

29.

_____ $P_4(s)$ + __6__ $Cl_2(g) \rightarrow$ __4__ $PCl_3(\ell)$ + energy

30.

$$4.2 \text{ mol} = \frac{x}{32 \text{ g/mol}}$$

$$(4.2 \text{ mol})\left(\frac{32 \text{ g}}{1 \text{ mol}}\right)$$

$$(32)(4.2)$$

31.

__4__ $NH_3(g)$ + __3__ $O_2(g) \rightarrow$ __2__ $N_2(g)$ + __6__ $H_2O(g)$ + energy

32. 48%

33.

$$\frac{42.2 \text{ g}}{100. \text{ g/mol}}$$

$$42.2 \text{ g} \times \frac{1.00 \text{ mol}}{100. \text{ g}}$$

$$\frac{x}{42.2} = \frac{1}{100}$$

34.

$$\frac{2.3 \text{ g/cm}^3 - 2.2 \text{ g/cm}^3}{2.2 \text{ g/cm}^3} \times 100$$

$$\frac{2.3 - 2.2}{2.2} \times 100$$

$$\frac{0.1(100)}{2.2}$$

35.
– The 0.30-cm$^3$ sample of graphite has fewer carbon atoms than the 0.30-cm$^3$ sample of diamond. – The diamond sample has more atoms. – more C atoms in the diamond