

1. Base your answer to the following question on Given two formulas representing the same compound:

**Formula A**  $\text{CH}_3$  **Formula B**  $\text{C}_2\text{H}_6$

Which statement describes these formulas?

- A) Formulas *A* and *B* are both empirical.  
 B) Formulas *A* and *B* are both molecular.  
 C) Formula *A* is empirical, and formula *B* is molecular.  
 D) Formula *A* is molecular, and formula *B* is empirical.
2. What is the empirical formula of a compound that has a carbon-to-hydrogen ratio of 2 to 6?  
 A)  $\text{CH}_3$     B)  $\text{C}_2\text{H}_6$     C)  $\text{C}_3\text{H}$     D)  $\text{C}_6\text{H}_2$
3. Which statement describes the composition of potassium chlorate,  $\text{KClO}_3$ ?  
 A) The proportion by mass of elements combined in potassium chlorate is fixed.  
 B) The proportion by mass of elements combined in potassium chlorate varies.  
 C) Potassium chlorate is composed of four elements.  
 D) Potassium chlorate is composed of five elements.
4. Which polyatomic ion contains the greatest number of oxygen atoms?  
 A) acetate                                  B) carbonate  
 C) hydroxide                                D) peroxide
5. What is the empirical formula of the compound whose molecular formula is  $\text{P}_4\text{O}_{10}$ ?  
 A)  $\text{PO}$     B)  $\text{PO}_2$     C)  $\text{P}_2\text{O}_5$     D)  $\text{P}_8\text{O}_{20}$
6. The chemical formula  $\text{CaCO}_3$  is an example of an expression that is  
 A) quantitative, only  
 B) qualitative, only  
 C) both quantitative and qualitative  
 D) neither quantitative nor qualitative
7. A compound has the empirical formula  $\text{CH}_2\text{O}$  and a gram-formula mass of 60. grams per mole. What is the molecular formula of this compound?  
 A)  $\text{CH}_2\text{O}$     B)  $\text{C}_2\text{H}_4\text{O}_2$     C)  $\text{C}_3\text{H}_8\text{O}$     D)  $\text{C}_4\text{H}_8\text{O}_4$
8. A compound whose empirical formula is  $\text{NO}_2$  could have a molecular mass of  
 A) 23    B) 39    C) 92    D) 120
9. What is the gram-formula mass of  $(\text{NH}_4)_3\text{PO}_4$ ?  
 A) 112 g/mol                                B) 121 g/mol  
 C) 149 g/mol                                D) 242 g/mol
10. A 1.0-mole sample of krypton gas has a mass of  
 A) 19 g    B) 36 g    C) 39 g    D) 84 g
11. What is the gram-formula mass of  $\text{Ca}_3(\text{PO}_4)_2$  ?  
 A) 248 g/mol                                B) 263 g/mol  
 C) 279 g/mol                                D) 310. g/mol

12. What is the total number of oxygen atoms in the formula  $\text{MgSO}_4 \cdot 7 \text{H}_2\text{O}$ ? [The  $\cdot$  represents seven units of  $\text{H}_2\text{O}$  attached to one unit of  $\text{MgSO}_4$  .]  
 A) 11    B) 7    C) 5    D) 4

13. One mole of  $\text{O}_2$  has approximately the same mass as one mole of

A)  $\text{CH}_4$     B) S    C) LiH    D)  $\text{Cl}_2$

14. The total number of moles represented by 20 grams of  $\text{CaCO}_3$  is

A) 1    B) 2    C) 0.1    D) 0.2

15. What is the mass in grams of 2.0 moles of  $\text{NO}_2$ ?

A) 92    B) 60.    C) 46    D) 30.

16. The percent composition by mass of nitrogen in  $\text{NH}_4\text{OH}$  (gram-formula mass = 35 grams/mole) is equal to

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

17. A hydrated salt is a solid that includes water molecules within its crystal structure. A student heated a 9.10-gram sample of a hydrated salt to a constant mass of 5.41 grams. What percent by mass of water did the salt contain?

A) 3.69%    B) 16.8%    C) 40.5%    D) 59.5%

18. Base your answer to the following question on 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

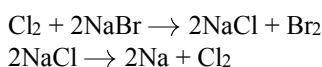
What is the percent by mass of water in the hydrate?

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

19. Which compound contains the greatest percentage of chlorine by mass?

- A) HCl    B) NaCl    C) FeCl<sub>2</sub>    D) ZnCl<sub>2</sub>

20. Given the balanced equations representing two chemical reactions:



Which type of chemical reactions are represented by these equations?

- A) single replacement and decomposition  
B) single replacement and double replacement  
C) synthesis and decomposition  
D) synthesis and double replacement

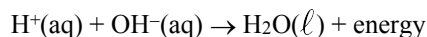
21. In which type of reaction do two or more substances combine to produce a single substance?

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

22. Which equation represents a double replacement reaction?

- A)  $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$   
B)  $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$   
C)  $\text{LiOH} + \text{HCl} \rightarrow \text{LiCl} + \text{H}_2\text{O}$   
D)  $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$

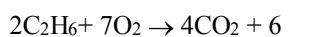
23. Given the balanced equation representing a reaction:



In this reaction there is a conservation of

- A) mass, only                      B) mass and charge, only  
C) charge and energy, only    D) charge, energy, and mass

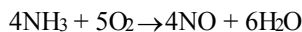
24. Base your answer to the following question on Given the incomplete equation for the combustion of ethane:



What is the formula of the missing product?

- A) CH<sub>3</sub>OH                      B) HCOOH  
C) H<sub>2</sub>O                          D) H<sub>2</sub>O<sub>2</sub>

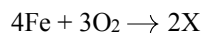
25. Given the balanced equation representing a reaction:



What is the *minimum* number of moles of O<sub>2</sub> that are needed to completely react with 16 moles of NH<sub>3</sub>?

- A) 16 mol    B) 20. mol    C) 64 mol    D) 80. mol

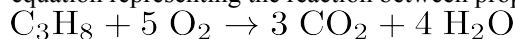
26. Base your answer to the following question on Given the incomplete equation:



Which compound is represented by X?

- A) FeO    B) Fe<sub>2</sub>O<sub>3</sub>    C) Fe<sub>3</sub>O<sub>2</sub>    D) Fe<sub>3</sub>O<sub>4</sub>

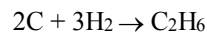
27. Base your answer to the following question on Given the balanced equation representing the reaction between propane and oxygen:



According to this equation, which ratio of oxygen to propane is correct?

- A)  $\frac{5 \text{ grams O}_2}{1 \text{ gram C}_3\text{H}_8}$                       B)  $\frac{5 \text{ moles O}_2}{1 \text{ mole C}_3\text{H}_8}$   
C)  $\frac{10 \text{ grams O}_2}{11 \text{ grams C}_3\text{H}_8}$                       D)  $\frac{10 \text{ moles O}_2}{11 \text{ moles C}_3\text{H}_8}$

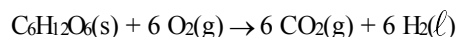
28. Base your answer to the following question on Given the balanced equation:



What is the total number of moles of C that must completely react to produce 2.0 moles of C<sub>2</sub>H<sub>6</sub>?

- A) 1.0 mol    B) 2.0 mol    C) 3.0 mol    D) 4.0 mol

29. Given the reaction:

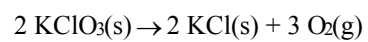


How many moles of C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>(s) are needed to produce 24 moles of carbon dioxide?

- A) 1.0 moles                      B) 12 moles  
C) 24 moles                        D) 4.0 moles

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30. Given the reaction:



What is the total number of moles of  $\text{KClO}_3(\text{s})$  needed to produce 6 moles of  $\text{O}_2(\text{g})$ ?

- A) 1      B) 2      C) 3      D) 4