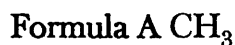
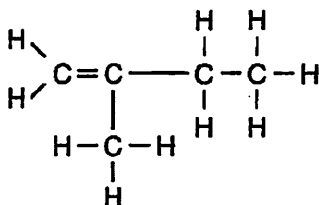


1. Given two formulas representing the same compound:



Which statement describes these formulas?

- 1) Formulas *A* and *B* are both empirical.
 - 2) Formulas *A* and *B* are both molecular.
 - 3) Formula *A* is empirical, and formula *B* is molecular.
 - 4) Formula *A* is molecular, and formula *B* is empirical.
2. Given the formula representing a hydrocarbon:



The molecular formula and the empirical formula for this hydrocarbon are

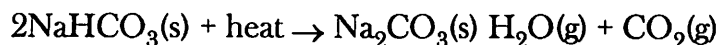
- 1) C_5H_{10} and CH
 - 2) C_5H_{10} and CH
 - 3) C_4H_8 and CH_2
 - 4) C_4H_8 and CH_3
3. The formula H_2O_2 is an example of
- 1) a molecular formula
 - 2) an empirical formula
 - 3) an ionic formula
 - 4) a structural formula
4. Which formula is both a molecular and an empirical formula?
- 1) $\text{C}_6\text{H}_{12}\text{O}_6$
 - 2) $\text{C}_2\text{H}_4\text{O}_2$
 - 3) $\text{C}_3\text{H}_8\text{O}$
 - 4) C_4H_8

5. The sum of the atomic masses of the atoms in one molecule of $\text{C}_3\text{H}_6\text{Br}_2$ is called the
- 1) formula mass
 - 2) isotopic mass
 - 3) percent abundance
 - 4) percent composition
6. The gram-formula mass of NO_2 is defined as the mass of
- 1) one mole of NO_2
 - 2) one molecule of NO_2
 - 3) two moles of NO
 - 4) two molecules of NO
7. A 1.0-mole sample of krypton gas has a mass of
- 1) 19 g
 - 2) 36 g
 - 3) 39 g
 - 4) 84 g
8. The gram-formula mass of a compound is 48 grams. The mass of 1.0 mole of this compound is
- 1) 1.0 g
 - 2) 4.8 g
 - 3) 48 g
 - 4) 480 g
9. 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 H_2O attached to one unit of MgSO_4 .]
- 1) 11
 - 2) 7
 - 3) 5
 - 4) 4
10. Which quantity of particles is correctly represented by the formula H_2SO_4 ?
- 1) 1.0 mole of ions
 - 2) 1.0 mole of molecules
 - 3) 6.0×10^{23} ions
 - 4) 6.0×10^{23} atoms
11. What is the percent composition by mass of nitrogen in NH_4NO_3 ?
- 1) 17.5%
 - 2) 35.0%
 - 3) 52.5%
 - 4) 60.0%

-
12. A sample of a compound contains 65.4 percent zinc, 12.0 percent carbon, and 48.0 percent oxygen. What is the empirical formula of this compound?
- 1) 1:1:2 3) 1:4:6
2) 1:1:3 4) 5:1:4
13. A sample of a compound contains 65.4 grams of zinc, 12.0 grams of carbon, and 48.0 grams of oxygen. What is the mole ratio of zinc to carbon to oxygen in this compound?
- 1) 1:1:2 3) 1:4:6
2) 1:1:3 4) 5:1:4
14. A compound has a molar mass of 90. grams per mole and the empirical formula CH_2O . What is the molecular formula of this compound?
- 1) CH_2O 3) $\text{C}_3\text{H}_6\text{O}_3$
2) $\text{C}_2\text{H}_4\text{O}_2$ 4) $\text{C}_4\text{H}_8\text{O}_4$
15. A substance has an empirical formula of CH_2 and a molar mass of 56 grams per mole. The molecular formula for this compound is
- 1) CH_2 3) C_4H_8
2) C_4H_6 4) C_8H_4
16. What is the percent composition by mass of sulfur in the compound MgSO_4 (gram-formula mass = 120. grams per mole)?
- 1) 20% 3) 46%
2) 27% 4) 53%
17. The percent composition by mass of nitrogen in NH_4OH (gram-formula mass = 35 grams/mole) is equal to
- 1) $\frac{4}{35} \times 100$ 3) $\frac{35}{14} \times 100$
2) $\frac{14}{35} \times 100$ 4) $\frac{35}{4} \times 100$
18. What is the percent composition by mass of hydrogen in NH_4HCO_3 (gram-formula mass = 79 grams/mole)?
- 1) 5.1% 3) 10.%
2) 6.3% 4) 50.%
-

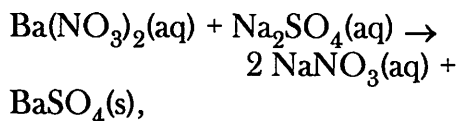
Base your answers to questions 19 and 20 on the information below.

The Solvay process is a multistep industrial process used to produce washing soda, $\text{Na}_2\text{CO}_3(\text{s})$. In the last step of the Solvay process, $\text{NaHCO}_3(\text{s})$ is heated to 300°C , producing washing soda, water, and carbon dioxide. This reaction is represented by the balanced equation below.



19. Write the IUPAC name for washing soda.
20. Identify the type of chemical reaction represented by the equation.

21. The reaction,



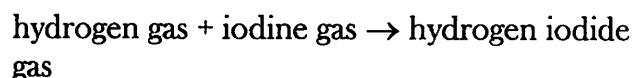
occurs (goes to completion) because a

- 1) gas is formed
 - 2) precipitate is formed
 - 3) nonionized product is formed
 - 4) soluble salt is formed
22. $\text{F}_2(\text{g}) + \text{CaBr}_2(\text{g}) \rightarrow \text{CaF}_2(\text{g}) + \text{Br}_2(\text{g})$

What type of reaction is shown above?

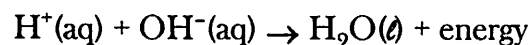
- 1) synthesis
 - 2) decomposition
 - 3) single replacement
 - 4) double replacement
23. Given the balanced equation representing a reaction:
- $$\text{Zn}(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{ZnSO}_4(\text{aq}) + \text{H}_2(\text{g})$$
- Which type of reaction is represented by this equation?
- 1) decomposition
 - 2) double replacement
 - 3) single replacement
 - 4) synthesis

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



This reaction is classified as

- 1) endothermic, because heat is absorbed
 - 2) endothermic, because heat is released
 - 3) exothermic, because heat is absorbed
 - 4) exothermic, because heat is released
25. During all chemical reactions, mass, energy, and charge are
- 1) absorbed
 - 2) conserved
 - 3) formed
 - 4) released
26. Given the balanced equation representing a reaction:

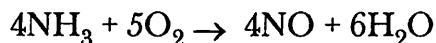


In this reaction there is a conservation of

- 1) mass, only
 - 2) mass and charge, only
 - 3) charge and energy, only
 - 4) charge, energy, and mass
27. What is the total number of moles in 80.0 grams of $\text{C}_2\text{H}_5\text{Cl}$ (gram-formula mass = 64.5 grams/mole)?

28. A balanced equation representing a chemical reaction can be written using
- 1) chemical formulas and mass numbers
 - 2) chemical formulas and coefficients
 - 3) first ionization energies and mass numbers
 - 4) first ionization energies and coefficients

29. Given the balanced equation representing a reaction:



What is the *minimum* number of moles of O_2 that are needed to completely react with 16 moles of NH_3 ?

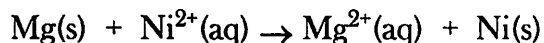
- 1) 16 mol
- 2) 20. mol
- 3) 64 mol
- 4) 80. mol

30. Given the incomplete equation:



Which compound is represented by X?

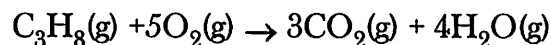
- 1) FeO
 - 2) Fe_2O_3
 - 3) Fe_3O_2
 - 4) Fe_3O_4
31. Given the balanced equation representing a reaction:



What is the total number of moles of electrons lost by Mg(s) when 2.0 moles of electrons are gained by $\text{Ni}^{2+}(\text{aq})$?

- 1) 1.0 mol
- 2) 2.0 mol
- 3) 3.0 mol
- 4) 4.0 mol

32. Given the balanced equation representing a reaction:



What is the total number of moles of $\text{O}_2(\text{g})$ required for the complete combustion of 1.5 moles of $\text{C}_3\text{H}_8(\text{g})$?

- 1) .30 mol
- 2) 1.5 mol
- 3) 4.5 mol
- 4) 7.5 mol

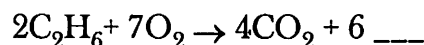
33. Which balanced equation represents a single-replacement reaction?

- 1) $\text{Mg} + 2\text{AgNO}_3 \rightarrow \text{Mg}(\text{NO}_3)_2 + 2\text{Ag}$
- 2) $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$
- 3) $\text{MgCO}_3 \rightarrow \text{MgO} + \text{CO}_2$
- 4) $\text{MgCl}_2 + 2\text{AgNO}_3 \rightarrow 2\text{AgCl} + \text{Mg}(\text{NO}_3)_2$

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

- 1) synthesis
- 2) decomposition
- 3) single replacement
- 4) double replacement

35. Given the incomplete equation for the combustion of ethane:



What is the formula of the missing product?

- 1) CH_3OH
- 2) HCOOH
- 3) H_2O
- 4) H_2O_2

36. Which chemical equation is correctly balanced?

- 1) $\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow \text{H}_2\text{O}(\text{g})$
- 2) $\text{N}_2(\text{g}) + \text{H}_2(\text{g}) \rightarrow \text{NH}_3(\text{g})$
- 3) $2\text{NaCl}(\text{s}) \rightarrow \text{Na}(\text{s}) + \text{Cl}_2(\text{g})$
- 4) $2\text{KCl}(\text{s}) \rightarrow 2\text{K}(\text{s}) + \text{Cl}_2(\text{g})$

Base your answers to questions 37 and 38 on the information below.

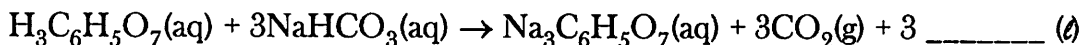
In an experiment, 2.54 grams of copper completely reacts with sulfur, producing 3.18 grams of copper(I) sulfide.

37. Determine the total mass of sulfur consumed.

38. Write the chemical formula of the compound produced.

Base your answers to questions 39 through 41 on the information below.

A tablet of one antacid contains citric acid, $\text{H}_3\text{C}_6\text{H}_5\text{O}_7$, and sodium hydrogen carbonate, NaHCO_3 . When the tablet dissolves in water, bubbles of CO_2 are produced. This reaction is represented by the incomplete equation below.



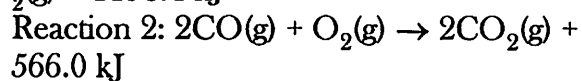
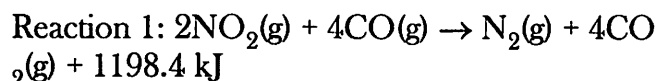
39. Determine the total number of moles of sodium hydrogen carbonate that will completely react with 0.010 mole of citric acid.

40. State evidence that a chemical reaction occurred when the tablet was placed in the water.

41. write the formula of the missing product.

-
42. Base your answer to the following question on the information below.

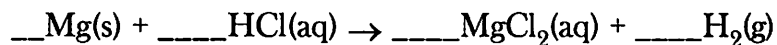
The catalytic converter in an automobile changes harmful gases produced during fuel combustion to less harmful exhaust gases. In the catalytic converter, nitrogen dioxide reacts with carbon monoxide to produce nitrogen and carbon dioxide. In addition, some carbon monoxide reacts with oxygen, producing carbon dioxide in the converter. These reactions are represented by the balanced equations below.



Determine the oxidation number of carbon in *each* carbon compound in reaction 2.

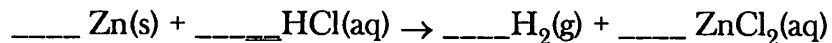
Your response must include *both* the sign and value of *each* oxidation number.

43. Balance below using the smallest whole-number coefficients.



44. Base your answer to the following question on the information below.

A 1.0-gram strip of zinc is reacted with hydrochloric acid in a test tube. The unbalanced equation below represents the reaction.



Balance the equation for the reaction of zinc and hydrochloric acid, using the smallest whole-number coefficients.

45. Determine the mass of 5.20 moles of C_6H_{12} (gram-formula mass = 84.2 grams/mole)