

## Equations & Stoichiometry – Practice Questions

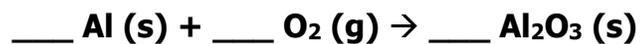
- Which substance has the greatest molecular mass?  
(1)  $\text{H}_2\text{O}_2$                       (2)  $\text{NO}$                       (3)  $\text{CF}_4$                       (4)  $\text{I}_2$
- What is the gram formula mass of  $\text{Ca}(\text{OH})_2$ ?  
(1) 29 g                      (2) 34 g                      (3) 57 g                      (4) 74 g
- What is the total number of moles of atoms present in 1 gram formula mass of  $\text{Pb}(\text{C}_2\text{H}_3\text{O}_2)_2$ ?  
(1) 9                      (2) 14                      (3) 3                      (4) 15
- The percent by mass of carbon in  $\text{HC}_2\text{H}_3\text{O}_2$  is equal to  
(1)  $\frac{12}{60} \times 100$                       (2)  $\frac{24}{60} \times 100$                       (3)  $\frac{60}{24} \times 100$                       (4)  $\frac{60}{12} \times 100$
- What is the empirical formula of  $\text{C}_3\text{H}_6$ ?  
(1)  $\text{CH}$                       (2)  $\text{CH}_2$                       (3)  $\text{CH}_3$                       (4)  $\text{CH}_6$
- The name of the compound  $\text{KClO}_2$  is potassium  
(1) hypochlorite                      (3) chlorate  
(2) chlorite                      (4) perchlorate
- Which formula is correct for ammonium sulfate?  
(1)  $\text{NH}_4\text{SO}_4$                       (2)  $(\text{NH}_4)_2\text{SO}_4$                       (3)  $\text{NH}_4(\text{SO}_4)_2$                       (4)  $(\text{NH})_3(\text{SO}_4)_2$
- The molecular formula of a compound is represented by  $\text{X}_3\text{Y}_6$ . What is the empirical formula of this compound?  
(1)  $\text{X}_3\text{Y}$                       (2)  $\text{X}_2\text{Y}$                       (3)  $\text{XY}_2$                       (4)  $\text{XY}$
- The number of moles of molecules in a 12.0-gram samples of  $\text{Cl}_2$  is  
(1)  $\frac{12.0}{35.5}$  mole                      (2)  $\frac{12.0}{71.0}$  mole                      (3) 12.0 moles                      (4)  $12.0 \times 35.5$  moles
- What is the total number of moles of sulfur atoms in 1 mole of  $\text{Fe}_2(\text{SO}_4)_3$ ?  
(1) 1                      (2) 15                      (3) 3                      (4) 17
- Given the unbalanced equation:



What is the coefficient of  $\text{Al}_2(\text{SO}_4)_3$  when the equation is completely balanced using the smallest whole-number coefficients?

- (1) 1                      (2) 2                      (3) 3                      (4) 4

12. Given the unbalanced equation:



When this equation is correctly balanced using smallest whole numbers, what is the coefficient of O<sub>2</sub> (g)?

- (1) 6                      (2) 2                      (3) 3                      (4) 4

13. Given the reaction:



What is the total number of moles of NO produced when 1.0 mole of O<sub>2</sub> is completely consumed?

- (1) 1.0 mole              (2) 1.2 moles              (3) 0.80 mole              (4) 4.0 moles

14. Given the equation:



What is the total number of moles of HCl (g) produced when 3 moles of H<sub>2</sub> (g) is completely consumed?

- (1) 5 moles              (2) 2 moles              (3) 3 moles              (4) 6 moles

## Formulas, Equations & Stoichiometry Review – Cut from Jan 2007 – Jan 2008 Exams

1. Which equation shows conservation of atoms?

- (1)  $\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}$
- (2)  $\text{H}_2 + \text{O}_2 \rightarrow 2 \text{H}_2\text{O}$
- (3)  $2 \text{H}_2 + \text{O}_2 \rightarrow 2 \text{H}_2\text{O}$
- (4)  $2 \text{H}_2 + 2 \text{O}_2 \rightarrow 2 \text{H}_2\text{O}$

2. Which substance can be broken down by a chemical change?

- (1) antimony
- (2) carbon
- (3) hexane
- (4) sulfur

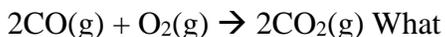
3. What is the gram formula mass of  $\text{Ca}_3(\text{PO}_4)_2$ ?

- (1) 248 g/mol
- (2) 263 g/mol
- (3) 279 g/mol
- (4) 310 g/mol

4. In which compound is the ratio of metal ions to nonmetal ions 1 to 2?

- (1) calcium bromide
- (2) calcium oxide
- (3) calcium phosphide
- (4) calcium sulfide

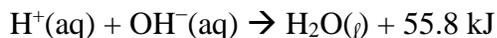
5. Given the balanced equation representing a reaction:



What is the mole ratio of  $\text{CO}(\text{g})$  to  $\text{CO}_2(\text{g})$  in this reaction?

- (1) 1:1
- (2) 1:2
- (3) 2:1
- (4) 3:2

6. Given the balanced equation representing a reaction:



In this reaction there is conservation of

- (1) mass, only
- (2) mass and charge, only
- (3) mass and energy, only
- (4) mass, charge, and energy

7. Which polyatomic ion contains the greatest number of oxygen atoms?

- (1) acetone
- (2) carbonate
- (3) hydroxide
- (4) peroxide

8. Which formula represents an ionic compound?

- (1)  $\text{H}_2$
- (2)  $\text{CH}_4$
- (3)  $\text{CH}_3\text{OH}$
- (4)  $\text{NH}_4\text{Cl}$

9. What is the total number of different elements present in  $\text{NH}_4\text{NO}_3$ ?

- (1) 7
- (2) 9
- (3) 3
- (4) 4

10. Which formula represents lead (II) chromate?

- (1)  $\text{PbCrO}_4$
- (2)  $\text{Pb}(\text{CrO}_4)_2$
- (3)  $\text{Pb}_2\text{CrO}_4$
- (4)  $\text{Pb}_2(\text{CrO}_4)_3$

11. Which particle diagram represents a sample of one compound, only?

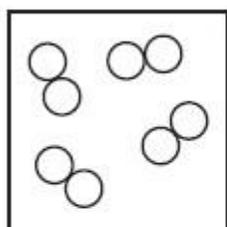
(1)  $\frac{5 \text{ grams O}_2}{1 \text{ gram C}_3\text{H}_8}$

(3)  $\frac{10 \text{ grams O}_2}{11 \text{ grams C}_3\text{H}_8}$

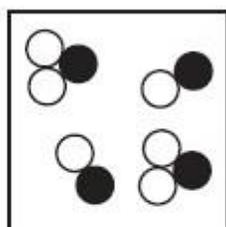
(2)  $\frac{5 \text{ moles O}_2}{1 \text{ mole C}_3\text{H}_8}$

(4)  $\frac{10 \text{ moles O}_2}{11 \text{ moles C}_3\text{H}_8}$

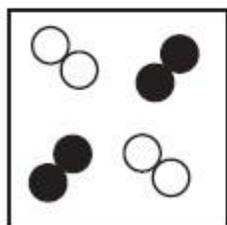
Key	
○	= atom of one element
●	= atom of a different element



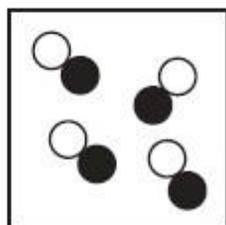
(1)



(3)



(2)



(4)

12. An atom in the ground state contains a total of 5 electrons, 5 protons, and 5 neutrons. Which Lewis electron-dot diagram represents

this



(1)



(2)



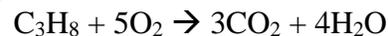
(3)



(4)

atom?

13. Given the balanced equation representing the reaction between propane and oxygen:



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

14. Which substance can be decomposed by chemical means?

- (1) tungsten (3) krypton  
 (2) antimony (4) methane

15. 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>?

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

16. Element X reacts with iron to form two different compounds with the formulas FeX and Fe<sub>2</sub>X<sub>3</sub>.

To which group on the Periodic Table does element X belong?

- (1) Group 8 (3) Group 13  
 (2) Group 2 (4) Group 16

17. The molar mass of Ba(OH)<sub>2</sub> is

- (1) 154.3 g (3) 171.3 g  
 (2) 155.3 g (4) 308.6 g

18. Given the balanced equation representing a reaction:

$\text{H}_2\text{SO}_4(\text{aq}) + 2\text{KOH}(\text{aq}) \rightarrow \text{K}_2\text{SO}_4(\text{aq}) + 2\text{H}_2\text{O}(\ell)$  Which type of reaction is represented by this equation? (1) decomposition

- (2) neutralization
- (3) single replacement
- (4) synthesis

19. A hydrated compound contains water molecules within its crystal structure. The percent composition by mass of water in the hydrated compound  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$  has an accepted value of 20.9%. A student did an experiment and determined that the percent composition by mass of water in  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$  was 21.4%.

Calculate the percent error of the student's experimental result. Your response must include *both* a correct numerical setup and the calculated result. [2]

20. Write the empirical formula for the compound  $\text{C}_8\text{H}_{18}$ . [1] \_\_\_\_\_  
\_\_\_\_\_

**Base your answers to questions 21 through 23 on the information below.**

Some dry chemicals can be used to put out forest fires. One of these chemicals is  $\text{NaHCO}_3$ . When  $\text{NaHCO}_3(\text{s})$  is heated, one of the products is  $\text{CO}_2(\text{g})$ , as shown in the balanced equation below.



21. Show a correct numerical setup for calculating the percent composition by mass of carbon in the product  $\text{Na}_2\text{CO}_3$ . [1]

22. Identify whether the reaction is endothermic or exothermic. [1] \_\_\_\_\_  
\_\_\_\_\_

23. Determine the total number of moles of  $\text{CO}_2(\text{g})$  produced when 7.0 moles of  $\text{NaHCO}_3(\text{s})$  is completely reacted. [1]

moles

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24. Balance this chemical equation: [1]



**Base your answers to questions 25 through 27 on the information below.**

Rust on an automobile door contains  $\text{Fe}_2\text{O}_3\text{(s)}$ . The balanced equation representing one of the reactions between iron in the door of the automobile and oxygen in the atmosphere is given below.



25. Identify the type of chemical reaction represented by this equation. [1]

26. Determine the gram-formula mass of the product of this reaction. [1]

27. Write the IUPAC name for  $\text{Fe}_2\text{O}_3$ . [1]

**Base your answers to questions 28 through 30 on the information below.**

Ozone gas,  $\text{O}_3$ , can be used to kill adult insects in storage bins for grain without damaging the grain. The ozone is produced from oxygen gas,  $\text{O}_2$ , in portable ozone generators located near the storage bins. The concentrations of ozone used are so low that they do not cause any environmental damage. This use of ozone is safer and more environmentally friendly than a method that used bromomethane,  $\text{CH}_3\text{Br}$ . However, bromomethane was more effective than ozone because  $\text{CH}_3\text{Br}$  killed immature insects as well as adult insects.

Adapted From: *The Sunday Gazette* (Schenectady, NY) 3/9/03

28. Determine the total number of moles of CH<sub>3</sub>Br in 19 grams of CH<sub>3</sub>Br (gram-formula mass = 95 grams/mol). [1]

29. Given the balanced equation for producing bromomethane:



Identify the type of organic reaction shown. [1] \_\_\_\_\_

30. Based on the information in the passage, state *one* advantage of using ozone instead of bromomethane for insect control in grain storage bins. [1]

**Base your answers to questions 31 through 33 on the information below.**

A hydrate is a compound that has water molecules within its crystal structure. The formula for the hydrate CuSO<sub>4</sub>•5H<sub>2</sub>O(s) shows that there are five moles of water for every one mole of CuSO<sub>4</sub>(s). When CuSO<sub>4</sub>•5H<sub>2</sub>O(s) is heated, the water within the crystals is released, as represented by the balanced equation below.



A student first masses an empty crucible (a heat-resistant container). The student then masses the crucible containing a sample of CuSO<sub>4</sub>•5H<sub>2</sub>O(s). The student repeatedly heats and masses the crucible and its contents until the mass is constant. The student's recorded experimental data and calculations are shown below.

Data and calculation before heating:

mass of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}(\text{s})$ and crucible	21.37 g
– mass of crucible	19.24 g
<hr/>	
mass of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}(\text{s})$	2.13 g

Data and calculation after heating to a constant mass:

mass of $\text{CuSO}_4(\text{s})$ and crucible	20.61 g
– mass of crucible	19.24 g
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mass of $\text{CuSO}_4(\text{s})$	1.37 g

Calculation to determine the mass of water:

mass of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}(\text{s})$	2.13 g
– mass of $\text{CuSO}_4(\text{s})$	1.37 g
<hr/>	
mass of $\text{H}_2\text{O}(\text{g})$	0.76 g

31. Identify the total number of significant figures recorded in the calculated mass of  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}(\text{s})$ . [1]
32. In the space below, use the student's data to show a correct numerical setup for calculating the percent composition by mass of water in the hydrate. [1]
33. Explain why the sample in the crucible must be heated until the constant mass is reached. [1]