

Standards Practice

Conservation of Matter and Stoichiometry



Read each question, and choose the best answer. Then, on your answer sheet, mark the answer choice that you think is best.

3. a. Students know how to describe chemical reactions by writing balanced equations.

- Equations can be balanced because
 - energy in equals energy out.
 - matter is neither created nor destroyed.
 - atoms break down easily.
 - molecules are virtually inseparable.
- Which is a correct balanced chemical equation?
 - $2\text{Zn (s)} + \text{HCl (aq)} \rightarrow 2\text{ZnCl}_2 + \text{H}_2 \text{ (g)}$
 - $\text{Zn (s)} + 2\text{HCl (aq)} \rightarrow \text{ZnCl}_2 + 2\text{H}_2 \text{ (g)}$
 - $\text{Zn (s)} + 2\text{HCl (aq)} \rightarrow \text{ZnCl}_2 + \text{H}_2 \text{ (g)}$
 - $2\text{Zn (s)} + 2\text{HCl (aq)} \rightarrow 2\text{ZnCl}_2 + \text{H}_2 \text{ (g)}$
- Which is a correct balanced chemical equation?
 - $2\text{Al} + 3\text{CuSO}_4 \rightarrow 3\text{Cu} + \text{Al}_2(\text{SO}_4)_3$
 - $6\text{Al} + 3\text{CuSO}_4 \rightarrow 3\text{Cu} + 3\text{Al}_2(\text{SO}_4)_3$
 - $\text{Al} + 2\text{CuSO}_4 \rightarrow 2\text{Cu} + \text{Al}_2(\text{SO}_4)_3$
 - $3\text{Al} + 3\text{CuSO}_4 \rightarrow 3\text{Cu} + \text{Al}_2(\text{SO}_4)_3$
- Balance the following equation. In this equation, ? should be replaced by
$$\text{Mg} + ?\text{AgNO}_3 \rightarrow \text{Mg}(\text{NO}_3)_2 + 2\text{Ag}$$
 - 1.
 - 2.
 - 3.
 - 4.
- Balance the following equation. In this equation, ? should be replaced by
$$4\text{Fe} + ?\text{O}_2 \rightarrow 2\text{Fe}_2\text{O}_3$$
 - 1.
 - 2.
 - 3.
 - 4.
- Balance the following equation. In this equation, ? should be replaced by
$$\text{C}_3\text{H}_8 + 5\text{O}_2 \rightarrow 3\text{CO}_2 + ?\text{H}_2\text{O}$$
 - 1.
 - 2.
 - 3.
 - 4.

3. b. Students know that the quantity one mole is set by defining one mole of carbon 12 atoms to have a mass of exactly 12 grams.

- Twelve grams of carbon equals
 - 0.1 mol.
 - 0.5 mol.
 - 1 mol.
 - 2 mol.
- Why is setting a standard for the quantity of 1 mol important?
 - The quantity is needed to determine the volume of a solid.
 - The quantity is needed to determine ionic composition.
 - The quantity is needed to set proportions for the conservation of mass.
 - The quantity is needed to determine a molecule's energy constant.
- If one mole of carbon-12 has a mass of 12 g, what should be the mass of 1 mol of the isotope carbon-13 (atomic number = 6; atomic mass = 13)?
 - 6 g
 - 7 g
 - 12 g
 - 13 g
- If the quantity of 1 mol of carbon is 12, what can be said about the quantity of 1 mol of lithium?
 - 1 mol of lithium should also be 12 g.
 - 1 mol of lithium should be 3 g (atomic number).
 - 1 mol of lithium should be 4 g (number of neutrons).
 - 1 mol of lithium should be 7 g (atomic weight).

1 mole = the element's atomic mass or better known as Molar mass

$$1 \text{ mole} = 12 \text{ g C}$$

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3. c. Students know one mole equals 6.02×10^{23} particles (atoms or molecules).

11. How many atoms does 1 mol of carbon-12 have?
- A. 6.0×10^{23} molecules
 B. 6.02×10^{23} molecules
 C. 9.01×10^{23} molecules
 D. 12.0×10^{23} molecules
12. Which could not be determined by knowing the number of particles of a substance that are present?
- A. the balanced equation for a reaction
 B. the ionization energy of a substance
 C. the mass of the substance (given its chemical formula)
 D. the number of moles present
13. What can be said for magnesium, which has an atomic number of 12 and an atomic weight of 24.3?
- A. One mole of magnesium will have half the number of atoms as one mole of carbon.
 B. One mole of magnesium will have the same number of atoms as one mole of carbon.
 C. One mole of magnesium will have twice the number of atoms as one mole of carbon.
 D. One mole of magnesium will have four times the number of atoms as one mole of carbon.
14. How many particles are present in 1 mol of the isotope carbon-13 (atomic number = 6; atomic mass = 13)?
- A. 3.01×10^{23} molecules
 B. 6×10^{23} molecules
 C. 6.02×10^{23} molecules
 D. 1.3×10^{24} molecules
15. How many molecules does 1 mole of NaOH have?
- A. 3.01×10^{23} molecules
 B. 6.02×10^{23} molecules
 C. 1.20×10^{24} molecules
 D. 6.02×10^{24} molecules

3. d. Students know how to determine the molar mass of a molecule from its chemical formula and a table of atomic masses and how to convert the mass of a molecular substance to moles, number of particles, or volume of gas at standard temperature and pressure.

Use the table below to answer questions 16–18.

Element	Atomic Weight (g)
Carbon (C)	12.0
Hydrogen (H)	1.0
Iron (Fe)	55.9
Nitrogen (N)	14.0
Oxygen (O)	16.0
Sodium (Na)	23.0

16. What is the weight of 1 mol of CH_3OH ?

- A. 15 g
 B. 28 g
 C. 29 g
 D. 32 g

$$\begin{array}{r} \text{C} = 12 \\ \text{H} = 4 \quad (4 \times 1) \\ \text{O} = 16 \\ \hline 32 \text{ g} \end{array}$$

17. What is the weight of 1 mol of NaNO_3 ?

- A. 53 g
 B. 69 g
 C. 85 g
 D. 101 g

$$\begin{array}{r} \text{Na} = 23 \\ \text{N} = 14 \\ \text{O}_3 = 48 \quad (3 \times 16) \\ \hline 85 \text{ g} \end{array}$$

18. What is the weight of 1 mole of Fe_2O_3 ?

- A. 103.9 g
 B. 127.8 g
 C. 143.8 g
 D. 159.8 g

$$\begin{array}{r} \text{Fe}_2 = 112 \quad (56 \times 2) \\ \text{O}_3 = 48 \quad (16 \times 3) \\ \hline 160 \text{ g} \end{array}$$

19. If 1 mol of gas has a volume of 22.4 L at standard temperature and pressure (STP), how much volume would 0.5 mol of the same gas have?

- A. 0.5 L
 B. 11.2 L
 C. 22.4 L
 D. 44.8 L

$$\frac{1 \text{ mol}}{22.4 \text{ L}} = \frac{0.5 \text{ mol}}{x}$$

$$x = 11.2 \text{ L}$$

20. How many molecules do 2 mol of HCl have?

- A. 3.01×10^{23}
 B. 6.02×10^{23}
 C. 1.20×10^{24}
 D. 6.02×10^{24}

$$1 \text{ mol} = 6.02 \times 10^{23}$$

$$2 \text{ mol} = \text{multiply by } 2$$

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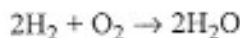
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3. e. Students know how to calculate the masses of reactants and products in a chemical reaction from the mass of one of the reactants or products and the relevant atomic masses.

21. You can use a balanced chemical equation and the atomic masses of products and reactants of the chemical equation to determine a missing mass because
- compounds always combine in the same way.
 - a chemical equation will eventually reach equilibrium.
 - matter is neither created nor destroyed.
 - a given equation will only balance in one way.

Use the following equation to answer questions 22 and 23. Hydrogen has an atomic mass of 1, and oxygen has an atomic mass of 16.



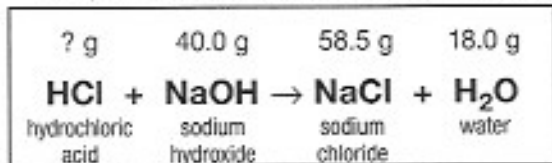
22. If 4 g of hydrogen reacts with an unlimited amount of oxygen, how many grams of water will be produced?

- 18
 - 32
 - 36
 - 40
- Handwritten:* $x \text{ g H}_2\text{O} = 4 \text{ g H}_2 \times \frac{36 \text{ g H}_2\text{O}}{4 \text{ g H}_2} = 36 \text{ g}$

23. If 8 g of oxygen reacts with an unlimited amount of hydrogen, how many grams of water will be produced?

- 9
 - 16
 - 18
 - 36
- Handwritten:* $x \text{ g H}_2\text{O} = 8 \text{ g O}_2 \times \frac{36 \text{ g H}_2\text{O}}{32 \text{ g O}_2} = 9 \text{ g}$

24. The diagram shows a chemical equation representing a chemical reaction. The name and mass of each substance involved in the chemical reaction are also shown. What mass of hydrochloric acid was used in this reaction?



- 24.0 g
 - 36.5 g
 - 48.0 g
 - 73.0 g
- Handwritten:* $x + 40 = 58.5 + 18$
 $- 40$

 $x = 36.5 \text{ g}$

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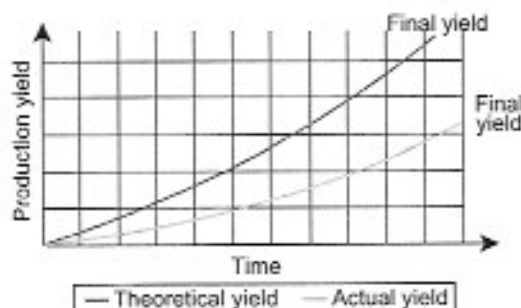
→ LAW OF CONSERVATION OF MASS

3. f. Students know how to calculate percent yield in a chemical reaction.

25. Which equation gives percent yield?

- (actual yield ÷ theoretical yield) × 100
- (theoretical yield ÷ actual yield) × 100
- (actual yield × theoretical yield) × 100
- (actual yield × theoretical yield) ÷ 100

Use the graph below to answer questions 26 and 27.



26. According to the graph, when a chemical reaction is first occurring, = BEGINNING

- there is little difference between actual yield and theoretical yield.
- there is a great difference between actual yield and theoretical yield.
- the actual yield and theoretical yield start at 100 percent.
- the actual yield and theoretical yield approach 100 percent.

27. According to the graph, as more product is produced during a chemical reaction,

- the actual yield will reach 100 percent.
- the theoretical yield will reach 0 percent.
- there will be a greater difference between actual yield and theoretical yield.
- the actual yield and theoretical yield will become equal.

28. During a chemical reaction, the

- actual yield is higher than the theoretical yield.
- calculated percent yield of product is less than 100 percent.
- theoretical yield and actual yield are equal.
- percent yield of product is more than 100 percent.

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- 3. g** Students know how to identify reactions that involve oxidation and reduction and how to balance oxidation-reduction reactions.

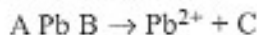
29. In a reduction reaction, a substance

- A. gains electrons.
 B. loses electrons.
 C. gains oxygen.
 D. loses oxygen.

GER = GAIN
e⁻ = REDUCED

LEO = LOSE e⁻
OXIDATION

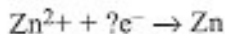
30. In the oxidation reaction shown below, which letter represents the electrons?



- A. A
 B. B
 C. C
 D. No electrons are needed.

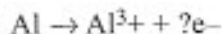
LEO

31. In the reduction reaction shown below, how many electrons are needed to balance the equation?



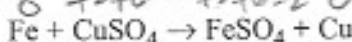
- A. 0
 B. 1
 C. 2
 D. 4

32. In the oxidation reaction shown below, how many electrons are needed to balance the equation?



- A. 1
 B. 2
 C. 3
 D. 4

33. In the reaction shown below, which is reduced?



- A. Cu
 B. Fe
 C. SO₄
 D. No element or compound is reduced.

+2 +6 -2 +2 +6 -2 0

GER =