

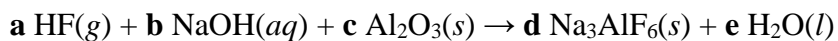
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1. A glucose molecule contains six carbons, twelve hydrogens and six oxygens. The empirical formula is CH_2O . How would you calculate the molecular mass of glucose?
- A. $1 \times 12.01 \text{ amu} + 2 \times 1.01 \text{ amu} + 1 \times 16.00 \text{ amu}$
B. $12.01 \text{ amu} + 1.01 \text{ amu} + 16.00 \text{ amu}$
C. $6 \times 12.01 \text{ amu} + 12 \times 1.01 \text{ amu} + 6 \times 16.00 \text{ amu}$
D. $12.01 \text{ amu} \times 1.01 \text{ amu} \times 16.00 \text{ amu}$
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2. A pure sample of acetylacetone ($\text{C}_5\text{H}_8\text{O}_2$) has a mass of 8.0 g. What is the **mass of oxygen** in the sample?
- A. $1.1 \times 10^2 \text{ g}$
B. 16 g
C. 2.6 g
D. 0.52 g
-

3. A compound containing only hydrogen, sulfur, and oxygen contains 32.69% sulfur and 65.26% oxygen by mass. What is its empirical formula?
- A. H_2SO_4
B. H_2SO_2
C. SO_4
D. HSO_4
-

4. A compound has the empirical formula CHO and a molar mass of 116.07 g/mol. What is its molecular formula?
- A. CHO
B. $\text{C}_2\text{H}_2\text{O}_2$
C. $\text{C}_4\text{H}_4\text{O}_4$
D. C_7O_2
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5. What is the sum of the stoichiometric coefficients, **a** + **b** + **c**, when the reaction below is balanced with the lowest set of whole number coefficients?



- A. 12
B. 15
C. 18
D. 19

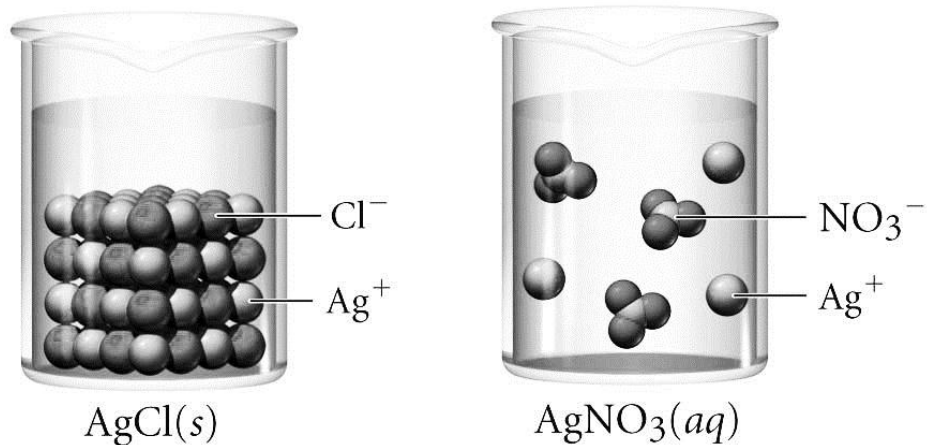
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6. What is the mass of a 0.362-mole sample of $\text{Mg}(\text{NO}_3)_2$?

- A. 53.7 g
B. 42.8 g
C. 40.9 g
D. 31.2 g

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7. When 5.00 grams of H_2 reacts with 10.0 grams of O_2 , what is the maximum amount of H_2O that can be produced?

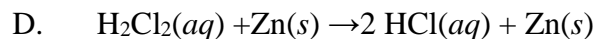
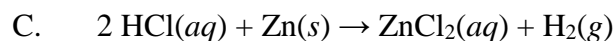
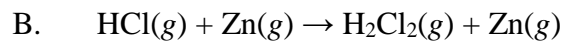
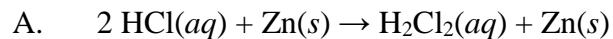
- A. 5.63 g
B. 10.0 g
C. 11.3 g
D. 44.7 g
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11. What difference between AgCl and AgNO₃ is illustrated by this figure?

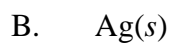
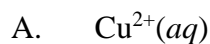
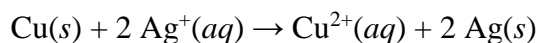


- A. AgCl is insoluble. AgNO₃ is soluble.
B. AgCl is not ionic. AgNO₃ is completely ionic.
C. AgCl is an acid. AgNO₃ is a base.
D. AgCl is an electrolyte. AgNO₃ is a non-electrolyte.
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12. Which of these compounds is **insoluble** in water?
- A. NaI
B. KI
C. MgI₂
D. PbI₂
-
13. What is the **net ionic equation** for the reaction that occurs when aqueous solutions of sodium phosphate and calcium chloride are mixed?
- A. $\text{Ca}^{2+}(aq) + \text{PO}_4^{3-}(aq) \rightarrow \text{CaPO}_4(s)$
B. $\text{Na}^+(aq) + \text{Cl}^-(aq) \rightarrow \text{NaCl}(aq)$
C. $\text{Na}^+(aq) + \text{Cl}_2^-(aq) \rightarrow \text{NaCl}_2(s)$
D. $3 \text{Ca}^{2+}(aq) + 2 \text{PO}_4^{3-}(aq) \rightarrow \text{Ca}_3(\text{PO}_4)_2(s)$
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14. A 25.00 mL sample of aqueous Ba(OH)₂ is neutralized with 45.39 mL of 0.250 M HCl. What is the concentration of the Ba(OH)₂ solution?
- A. 0.227 M
B. 0.454 M
C. 0.688 M
D. 0.910 M
-

15. Hydrochloric acid reacts with zinc in a gas-evolving reaction. Select the balanced chemical equation for this reaction.



16. Which species is **oxidized** in this reaction, which proceeds completely to the right?



17. What is the oxidation number of C in $\text{H}_2\text{C}_2\text{O}_4$?

A. +2

C. +4

B. +3

D. +6

18. A 48.3 mL sample of gas in a cylinder is warmed from 27.0 °C to 85.0 °C at constant pressure. What is its volume at the final temperature?

A. 15.3 mL

C. 57.6 mL

B. 40.5 mL

D. 152 mL

19. Which equation is a **correct** expression of the ideal gas law?

A. $R = \frac{nT}{PV}$

C. $T = \frac{nR}{PV}$

B. $R = \frac{PVT}{n}$

D. $n = \frac{PV}{RT}$

20. What is the **volume** occupied by 12.5 g of helium gas at standard temperature and pressure?

A. 280. L

C. 35.0 L

B. 70.0 L

D. 7.18 L

21. What is the **molar mass** of a compound if 418 mg of the compound in a 115 mL reaction vessel at 66.3 °C exerts a pressure of 743 mmHg? (The compound is completely in the gas phase.)

A. 104 g/mol

C. 26.6 g/mol

B. 37.6 g/mol

D. 0.0270 g/mol

22. Which of the following is **correct** concerning Dalton's law of partial pressures for a mixture of gases?

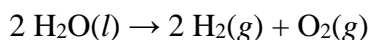
A. Partial pressures are not valid above a total pressure of 1 atm.

B. Oxygen always has the highest partial pressure.

C. The gas with the lowest mole fraction has the highest partial pressure.

D. The gas with the highest mole fraction has the highest partial pressure.

23. Consider this chemical reaction.



What mass of H_2O is required to form 1.5 L of O_2 at a temperature of 310 K and a pressure of 1.103 atm?

- | | | | |
|----|-------|----|-------|
| A. | 1.2 g | C. | 3.1 g |
| B. | 2.3 g | D. | 4.2 g |

24. Samples of gaseous CO_2 , CH_4 , Cl_2 , and NH_3 are all at 298 K. Which molecule has the **lowest** root mean square velocity (u_{rms})?

- | | | | |
|----|---------------|----|---------------|
| A. | CO_2 | C. | Cl_2 |
| B. | CH_4 | D. | NH_3 |

25. At high temperature and high pressure, a nonpolar real gas with negligible intermolecular interactions should have _____ volume than that predicted by the ideal gas law.

- | | | | |
|----|------------------------|----|-----------|
| A. | the same | C. | a smaller |
| B. | a less well determined | D. | a larger |

26. Which statement is **true**?

- A. Potential energy is due to the motion of an object.
- B. Energy is destroyed in a chemical reaction.
- C. Chemical energy is associated with the motion of a molecule.
- D. Thermal energy is associated with temperature.

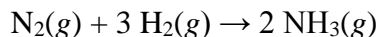
27. What is the total change in internal energy for a system that loses 15.2 joules of heat to its surroundings and has 6.30 joules of work done on it by the surroundings?

- | | | | |
|----|--------|----|--------|
| A. | -8.9 J | C. | 12.0 J |
| B. | 6.30 J | D. | 21.5 J |
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28. How much heat is required to warm the water in your 1.00 L water bottle from the temperature in your refrigerator (1.60 °C) to that in a typical classroom (23.0 °C)?
 $C_s(\text{H}_2\text{O}) = 4.18 \text{ J/g}\cdot\text{°C}$, $d(\text{H}_2\text{O}) = 1.00 \text{ g/mL}$
- A. $9.61 \times 10^4 \text{ J}$ C. 89.4 J
B. $8.94 \times 10^4 \text{ J}$ D. 4.18 J

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29. A gas-filled cylinder equipped with a moveable piston expands from 1.00 L to 3.00 L against a constant pressure of 1.60 atm. How much work is done? $101.3 \text{ J} = 1.000 \text{ L atm}$.
- A. $w = -324 \text{ J}$ C. $w = 0 \text{ kJ}$
B. $w = -3.20 \text{ J}$ D. $w = 3.20 \text{ J}$

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30. In a mixture of gases containing O₂, H₂, and N₂, O₂ has the lowest partial pressure. There is just enough N₂ to react completely with all of the H₂, forming NH₃ gas according to the equation below. After the reaction, only O₂ and NH₃ remain. Which of the following is **true**? (The temperature and volume of the system do not change.)



- A. The total pressure after the reaction is **greater** than the total pressure before the reaction.
B. The partial pressure of O₂ is **greater** than the partial pressure of NH₃ after the reaction.
C. The total pressure after the reaction is **less** than the total pressure before the reaction.
D. There are **more** moles of NH₃ after the reaction than there were moles of H₂ before the reaction.
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Answer Key:

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