1. Consider the following balanced reaction equation. How many **<u>moles</u>** of oxygen are required to produce 3.27 moles of carbon dioxide if excess C_3H_7SH is present?

$$C_3H_7SH(l) + 6\ O_2(g) \rightarrow 3\ CO_2(g) + SO_2(g) + 4\ H_2O\ (g)$$

A. 1.28 moles
C. 6.54 moles
B. 3.08 moles
D. 8.89 moles

2. Consider the following balanced reaction equation. How many **<u>grams</u>** of nitrogen dioxide are formed when 22.3 g of dinitrogen pentoxide decompose?

$$2\ N_2O_5(g) \rightarrow 4\ NO_2(g) + O_2(g)$$

A. 19.0 g
C. 21.1 g
B. 23.8 g
D. 28.4 g

3. How much carbon remains after 155.8 g of SiO_2 react with 78.3 g of carbon according to the balanced reaction equation below?

$$SiO_2(s) + 2\ C(s) \rightarrow Si(l) + 2\ CO(g)$$

A. 4.25 g
C. 16.0 g
B. 8.75 g
D. 23.1 g

4. According to the balanced reaction equation below, what is the **limiting reactant** when 136.4 grams of ammonia (NH_3) react with 211.4 g of carbon dioxide?

$$2\ NH_3(aq) + CO_2(aq) \rightarrow CH_4N_2O(aq) + H_2O(l)$$

A. NH_3
C. CO_2
B. CH_4N_2O
D. H_2O

5. What volume of 0.124 M $NaC_2H_3O_2$ solution contains 0.857 moles of $NaC_2H_3O_2$?

A. 111 mL
C. 5.91×10^3 mL
B. 223 mL
D. 6.91×10^3 mL

6. What volume of 4.54 M sodium hydroxide solution is diluted to prepare 85.0 mL of 0.289 M sodium hydroxide solution?

A. 5.41 mL
C. 7.28 mL
B. 7.89 mL
D. 10.6 mL

7. Which of the following is a non-electrolyte in aqueous solution?

A. lithium hydroxide
C. hydrobromic acid
B. table sugar ($C_{12}H_{22}O_{11}$)
D. acetic acid

8. Which of the following pair(s) of aqueous reactants will produce a precipitate when combined?

I. $Pb(NO_3)_2(aq) + AgC_2H_3O_2(aq) \rightarrow$

II. $NaI(aq) + Ca(OH)_2(aq) \rightarrow$

III. $K_2SO_4(aq) + Ba(NO_3)_2(aq) \rightarrow$

IV. $AgNO_3(aq) + NaBr(aq) \rightarrow$

A. I
C. I, II, and III
B. III
D. III and IV

9. Give the **complete molecular equation** for the reaction that occurs when aqueous solutions of nitric acid (HNO_3) and barium hydroxide are mixed:

A. $HNO_3(aq) + BaOH(aq) \rightarrow BaNO_3(aq) + H_2O(l)$

B. $2\ HNO_3(aq) + Ba(OH)_2(aq) \rightarrow Ba(NO_3)_2(aq) + 2\ H_2O(l)$

C. $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

D. $3\ HNO_3(aq) + B(OH)_3\ (aq) \rightarrow B(NO_3)_3(aq) + 3\ H_2O(l)$

10. What is a common method used to determine the concentrations of acids and bases?

A. combustion
C. distillation
B. filtration
D. titration

11. What is the concentration of a LiOH solution if 28.2 mL of a 2.355 M H_2SO_4 solution is required to neutralize a 25.0-mL sample of the LiOH solution?

A. 5.31 M
C. 2.74 M
B. 2.31 M
D. 7.62 M

12. What is the **reducing agent** in the following reaction?

$$Zn(s) + 2\ MnO_2(s) + 2\ H_2O(l) \rightarrow Zn(OH)_2\,(aq) + 2\ MnO(OH)(aq)$$

A. Zn
C. $Zn(OH)_2$
B. MnO_2
D. MnO(OH)

13. What is the oxidation number of the chlorine atom in $NaClO_4$?

A. +1
C. −1
B. +7
D. −2

14. Which represents a pressure of 888 torr?

A. 1.04 atm
C. 2.23 atm
B. 1.17 atm
D. 3.08 atm

15. Boyle's law states that for a constant number of particles at a constant temperature, the volume of an ideal gas depends on pressure. Which of the following is a mathematical description of Boyle's law?

A. $V \propto P$
C. $V \propto 1/P$
B. $V \propto T$
D. $V \propto 1/n$

16. Which of the following statements is **false** concerning ideal gas behavior?

A. Collisions between gas molecules are perfectly elastic.

B. Gases always behave ideally.

C. The volume of gas molecules is negligibly small compared to the volume of the container.

D. $PV/RT = 1$ at all temperatures for one mole of an ideal gas.

17. How many moles of argon are in a 5.4 L cylinder at 37 °C and 657 torr?

A. 1.7 moles
C. 1.4 moles
B. 0.53 moles
D. 0.18 moles

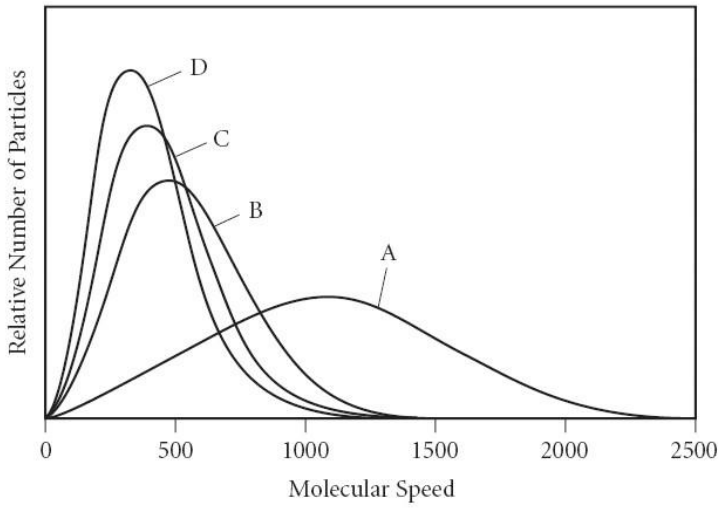
18. Which of the following samples has the **smallest** volume at STP?

A. 1.91×10^{24} atoms of Ne
C. 22 g of He
B. 5.0 moles of Cl_2
D. 200 g of CO_2

19. A 0.133-gram sample of an ideal gas occupies 164 mL at 747 torr and 298 K. What is the molar mass of the gas?

A. 4.00 g/mol
C. 83.8 g/mol
B. 39.9 g/mol
D. 20.2 g/mol

20. Which of the gases in the plot has the **smallest** density if all measurements are performed at STP?



A. A

B. B

C. C

D. D

21. When 0.583 g of neon is added to an 800.-mL bulb containing a sample of argon, the total pressure of the gases is 1.17 atm at a temperature of 295 K. How many moles of **argon** are in the bulb?

A. 0.331 moles

B. 5.78×10^{-3} moles

C. 9.78×10^{-3} moles

D. 7.78×10^{-3} moles

22. A gas mixture contains 1.25 g N_2 and 0.85 g O_2 in a 1.55 L container at 291 K. What is the mole fraction of **nitrogen** gas in the mixture?

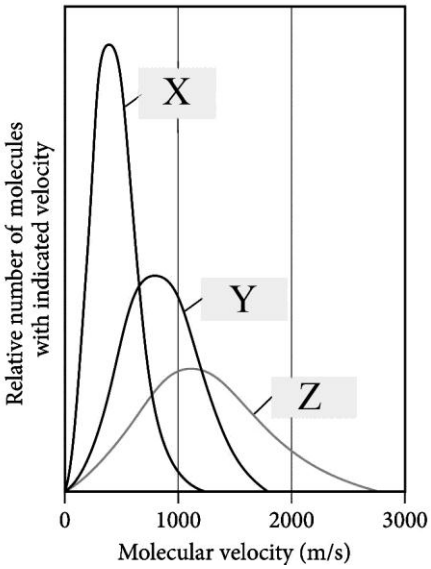
A. 0.50

B. 0.63

C. 0.84

D. 1.0

23. Which of the gas samples in the plot is at the **highest** temperature?



A. X
C. Z
B. Y
D. All are at the same temperature.

24. Under which conditions does ammonia (NH_3) behave most like an ideal gas?

A. high pressure and low temperature
C. low pressure and low temperature
B. high pressure and high temperature
D. low pressure and high temperature

25. Ammonium nitrate decomposes explosively upon heating, according to the following balanced equation:

$$2\ NH_4NO_3(s) \rightarrow 2\ N_2(g) + O_2(g) + 4\ H_2O(g)$$

What is the **total volume** of gas produced when 1.55×10^3 g of ammonium nitrate (molar mass = 80.05 g/mol) decomposes at STP? Assume ideal gas behavior.

A. 22.4 L
C. 1.52×10^3 L
B. 1.12×10^2 L
D. 2.58×10^3 L

Answer Key:

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