1. An atom with an electron configuration of 1s² 2s² 2p³ has how many valence electrons?

   Khan Academy: [Electron Configurations](#); ChemTutor: [Atomic Structure](#)

   a. 2  
   b. 3  
   c. 4  
   d. 5  
   e. 7

2. The ________ sublevel of an atom has a total of five orbitals.

   Khan Academy: [Quantum Numbers and Orbitals](#); ChemTutor: [Atomic Structure](#)

   a. s  
   b. p  
   c. d  
   d. f  
   e. g

3. You give a child a balloon, and he goes outside with it to play in the snow. Soon, he returns crying. What happened?

   Khan Academy: [Ideal Gas Equation](#); ChemTutor: [Gases](#)

   a. The balloon expanded and burst.  
   b. The balloon froze solid.  
   c. The balloon shrank.  
   d. The balloon dissolved.  
   e. The child forgot Charles’ Law.

4. What kind of bonding occurs in the compound potassium oxide?

   Khan Academy: [Types of Chemical Bonds](#)

   a. ionic  
   b. nonpolar covalent  
   c. polar covalent (double bond)  
   d. polar covalent (single bond)  
   e. None of the above

5. A gas with a temperature of 21.0°C and a volume of 10.0 L is compressed to 5.00 L. What will be the new temperature?

   Khan Academy: [Ideal Gas Equation](#); ChemTutor: [Gases](#)

   a. 10.5 °C  
   b. 420. °C  
   c. 42.0 °C  
   d. –126 °C  
   e. 315 °C
6. Which of the following sublevels does not exist as written?
   Khan Academy: Quantum Numbers and Orbitals
   a. 3f
   b. 6f
   c. 2s
   d. 5d
   e. 8s

7. What is the molecular shape of PH₃?
   Khan Academy: Hybridization and Hybrid Orbitals
   a. tetrahedral
   b. trigonal planar
   c. bent
   d. linear
   e. trigonal pyramidal

8. What is the percent by mass concentration of sodium bromide in a solution which contains 50.0 g of sodium bromide in 200.0 g of water?
   ChemTutor: Solutions
   a. 40.0 %
   b. 20.0 %
   c. 25.0 %
   d. 33.3 %
   e. 50.0 %

9. How many milliliters of 6.00 M HCl solution would be required to prepare 2.00 L of 0.140 M HCl by dilution?
   ChemTutor: Solutions
   a. 420 mL
   b. 168 mL
   c. 85.6 mL
   d. 46.7 mL
   e. 30.0 mL

10. What is the molar concentration of 2000. mL of aqueous solution containing 135 g of glucose, C₆H₁₂O₆?
    ChemTutor: Solutions; Khan Academy: Introduction to the Atom
    a. 12.15 M
    b. 0.750 M
    c. 67.5 M
    d. 0.667 M
    e. 0.375 M
11. What is the formula of copper (II) sulfate pentahydrate?

   ChemTutor: Compounds

   a. Cu₂(SO₄)₂ · 5 H₂O
   b. Cu₂(SO₄) · 5 H₂O
   c. CuSO₄ · 6 H₂O
   d. CuSO₄ · 5 H₂O
   e. None of the above

12. What is the electron configuration for the nitride ion?

   Khan Academy: Electron Configurations; ChemTutor: Compounds

   a. 1s² 2s² 2p¹
   b. 1s² 2s² 2p³
   c. 1s² 2s² 2p⁵
   d. 1s² 2s² 2p⁶
   e. None of the above

13. A tank has a pressure of 30.0 atm at a temperature of 22.0°C. After heating, the temperature rises to 35.0°C. What is the new pressure?

   Khan Academy: Ideal Gas Equation; ChemTutor: Gases

   a. 54.3 atm
   b. 31.3 atm
   c. 28.7 atm
   d. 47.7 atm
   e. 30.6 atm

14. Which pair is immiscible?

   ChemTutor: Solutions; Khan Academy: Solubility

   a. ethanol and water
   b. water and octane, C₈H₁₈
   c. isopropyl alcohol and water
   d. acetic acid and water
   e. octane and oil

15. How many grams of sodium hydroxide are required to prepare 250.0 mL of a 6.00 M solution?

   ChemTutor: Solutions; Khan Academy: Introduction to the Atom

   a. 1.50 g
   b. 0.0375 g
   c. 0.600 g
   d. 3.75 g
   e. 60.0 g
16. 5.60 L of a gas at STP has a mass of 13.0 g. What is the molar mass of the gas?

   a. 33.2 g/mol
   b. 66.4 g/mol
   c. 26.0 g/mol
   d. 52.0 g/mol
   e. none of the above

17. What volume of 0.62 M sodium hydroxide is required to neutralize 20.00 mL of 0.391 nitric acid?

   Word reaction with reactants only. (Students should predict products):
   Sodium hydroxide + nitric acid

   a. 23.6 mL
   b. 16.9 mL
   c. 9.03 mL
   d. 11.8 mL
   e. none of the above

18. How many moles are in 20.0 g of sodium carbonate?

   a. 1.89 mol
   b. 212 mol
   c. 2.12 x 10^3 mol
   d. 0.189 mol
   e. 18.9 mol

19. The percent of nitrogen in magnesium nitride is

   a. 27.8%
   b. 36.6%
   c. 16.1%
   d. 72.2%
   e. 63.4%

20. What is the molar concentration of 250. mL of aqueous solution containing 48.8 g of glucose, C_{6}H_{12}O_{6}?

   a. 5.12 M
   b. 0.923 M
   c. 0.271 M
   d. 1.08 M
   e. 0.195 M
21. How many grams of aluminum metal will react with 0.0500 mole of oxygen gas according to the unbalanced equation given below?

\[
\text{Aluminum} + \text{Oxygen} \rightarrow \text{Aluminum Oxide}
\]

Khan Academy: [Stoichiometry](https://www.khanacademy.org/science/chemistry/stoichiometry); ChemTutor: [Stoichiometry](https://www.chemtutor.com/stoichiometry)

- a. 1.35 g
- b. 1.01 g
- c. 4.32 g
- d. 2.06 g
- e. 1.80 g

22. For the equation given, how many grams of methane will react with 125 g of oxygen?

Word reaction with reactants only. (Students should predict products):

\[
\text{Methane (CH}_4\text{) burns in oxygen}
\]

Khan Academy: [Stoichiometry](https://www.khanacademy.org/science/chemistry/stoichiometry); ChemTutor: [Stoichiometry](https://www.chemtutor.com/stoichiometry)

- a. 39.1 g
- b. 19.5 g
- c. 15.6 g
- d. 31.3 g
- e. 62.5 g

For problems 23 - 24, Given the word reaction with reactants only (students should predict products):

phosphoric acid reacts with magnesium carbonate

23. From the balanced chemical equation the simplest whole number coefficient for the product magnesium phosphate is:

Khan Academy: [Balancing Chemical Equations](https://www.khanacademy.org/science/chemistry/balancing-chemical-equations); ChemTutor: [Reactions](https://www.chemtutor.com/reactions)

- a. 1
- b. 2
- c. 3
- d. 4
- e. none of the above

24. If 50.0 g of magnesium carbonate reacts completely with phosphoric acid, the grams of gas produced is

Khan Academy: [Balancing Chemical Equations](https://www.khanacademy.org/science/chemistry/balancing-chemical-equations); ChemTutor: [Reactions, Stoichiometry](https://www.chemtutor.com/reactions, stoichiometry)

- a. 52.2 g
- b. 26.1 g
- c. 13.1 g
- d. 50.0 g
- e. 55.0 g
25. How many molecules are in 5.8 g of acetone, C₃H₆O?
   Khan Academy: Atomic Mass and Moles; ChemTutor: Moles
   
   a. 0.10 molecules  
   b. 6.0 x 10²² molecules  
   c. 3.5 x 10²⁴ molecules  
   d. 6.0 x 10²³ molecules  
   e. none of the above

26. This reaction is an example of which of the following types?
   aluminum reacts with bromine to produce aluminum bromide
   ChemTutor: Reactions
   
   a. combination  
   b. single displacement  
   c. decomposition  
   d. gaseous  
   e. precipitation

27. What is the simplest whole number coefficient for aluminum bromide in the above reaction (#26)?
   Khan Academy: Balancing Chemical Equations; ChemTutor: Reactions
   
   a. 1  
   b. 2  
   c. 3  
   d. 4  
   e. none of the above

28. How many moles of oxygen are required for the complete reaction of 45 g of C₂H₄ when it is burned?
   Khan Academy: Balancing Chemical Equations, Stoichiometry; ChemTutor: Reactions, Stoichiometry
   
   a. 1.3 x 10⁻² mol  
   b. 0.64 mol  
   c. 112.4 mol  
   d. 4.8 mol  
   e. none of the above

29. If 14.0 g of C₂H₄ is burned and the actual yield of water is 7.84 g, the percent yield in the reaction is:
   Khan Academy: Balancing Chemical Equations, Stoichiometry; ChemTutor: Reactions, Stoichiometry
   
   a. 0.56%  
   b. 43.6%  
   c. 87.1%  
   d. 56.0%  
   e. 82.0%
Answers:

1d 2e 3c 4a 5d 6a 7e 8b 9d 10e
11d 12d 13b 14b 15e 16d 17e 18d 19a 20d
21e 22d 23a 24b 25b 26a 27b 28d 29b