7th Grade Chemistry Test #3 Study Guide

**IMPORTANT:** You must enter the room with your own working non-graphing calculator for the test.

Test format: 50 minutes, multiple choice, cumulative.

**Test Dates:**

<table>
<thead>
<tr>
<th>Tuesday April 16, 2019</th>
<th>Wednesday April 17, 2019</th>
<th>Thursday April 18, 2019</th>
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<tbody>
<tr>
<td>7Hg</td>
<td>7B and 7Pb</td>
<td>7Zr</td>
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**HOW TO PREPARE:**

- Check that you have all the notes packets and they’re filled out accurately. Organize in chronological order.
  - Lesson 1: Lab Safety and Equipment
  - Lesson 2: Unit Conversions
  - Lesson 3: Significant Digits and Scientific Notation
  - Lesson 4 Parts 1,2: Properties of Matter
  - Lesson 5: Mixture Separation Techniques
  - Lesson 6: Periodic Table and Atomic Theory
  - Lesson 7: Modern Atomic Theory & Intro to Electron Configuration
  - Lesson 8: Electron Configuration
  - Lesson 9: Periodic Trends
  - Lesson 10: Ionic Bonds
  - Lesson 11: Covalent Bonding
  - Lesson 12: Chemical Reactions
  - Lesson 13: Ionic Equations, Intro to the Mole
  - Lesson 14: Stoichiometry
  - Lesson 15: Limiting and Excess Reactants
  - Lesson 16: Theoretical, Actual, and Percent Yield

- Review HW assignments 7.1 – 7.26

- Make flashcards for vocabulary, polyatomic ions.

- Visit [www.chemistrywithdrjames.com](http://www.chemistrywithdrjames.com) for lesson presentations, extra practice, videos, Quizlet, etc.

- Review Study Guide for Tests 1, 2 and PreComp. They’re on the website if you need another copy.

- Review previous quizzes and tests.

- Go through the topics list below as you study – make sure you’re confident in all these areas.

- Complete the supplemental practice problems at the end of this guide. Visit during student hours for assistance and to check answers.

- Complete additional practice problems at the end of Lesson 9 notes packet.

- Reference free online textbook [https://openstax.org/details/books/chemistry](https://openstax.org/details/books/chemistry)
Topics Covered:
All calculations will be rounded to the proper number of significant digits. Refer to Lesson 3 for rules.

Types of Matter
Definitions: element, compound, mixture, pure substance, homogeneous mixture, heterogeneous mixture, solute, solvent, solution
1. Identify an element or compound given a description or a picture
2. Recognize the different types of mixtures (homogeneous or heterogeneous) given a description or picture
3. Mixture separation techniques: centrifugation, filtration, crystallization, chromatography, distillation

Periodic Table
1. Electron Configuration
   Definitions: orbitals, sublevel, electron cloud, energy level, electron shell, Hund’s rule, Pauli Exclusion Principle, Aufbau Principle, valence electron, isotope, valence electron, core electron
   a. Electron Box Diagrams & Longhand electron configuration of elements 1-20, including ions.
   b. Match the electron configuration of the neutral element with the electron configuration of the ion it will form
   c. Given the element name and the symbol or the electron configuration, identifying the most likely ion formed by that element
   d. Determine the number of valence electrons from a neutral element’s electron configuration
   e. Lab: Flame test
2. Periodic Trends
   Definitions: ionization energy, atomic radius, ionic radius, electronegativity, effective nuclear charge
   a. List element in order of decreasing or increasing ionization energy, atomic radius, ionic radius, or electronegativity
   b. Choose the atom with the larger/smaller radius when choosing between a cation vs. its neutral element and an anion vs. its neutral element. You need to understand the reasoning for this trend.

Chemical Bonding
1. Ionic Bonding
   Definitions: Bohr model, electron shells, valence electrons, transition metal, cation, anion
   a. Bohr Models – recognize correct model for an atom or ion
   b. Name compounds given the formula (Binary I, II, with and without polyatomic ions)
   c. Write the chemical formula given the name of a compound (Binary I, II, with and without polyatomic ions)
   d. Given a formula, predict the formula for another compound with an element in the same group
      i. Example: If KClO₃ is potassium chlorate, what is sodium chlorate? Ans: NaClO₃
2. Covalent Bonding
   Definitions: covalent bond, lone pair, single covalent bond, double covalent bond, polar, nonpolar
   a. Lewis structures - be able to recognize images and also interpret word descriptions
   b. Understand how valence electrons are represented in Lewis structures.
   c. Polar vs. nonpolar molecules

Conservation of Matter
Definitions: products, reactants, total ionic equation, law of conservation of matter
1. Chemical Reactions
   a. Identify a chemical equation from a word description.
   b. Identify total ionic equations.
   c. Balance chemical equations
2. Stoichiometry
Definitions: molar ratio, molar equivalent, molar mass, mole, Avogadro’s number, actual yield, theoretical yield, percent yield
a. Given a balanced equation...
   • calculate the number of moles of one substance given the moles of another (mole – mole ratio)
   • calculate moles of one substance to grams of another (mole – gram conversion)
   • calculate grams of one substance to grams of another (gram – gram conversion)
   • convert any direction: moles – grams – number of particles
b. Identify the limiting reactant given moles of each reactant, grams of each reactant, or a particle diagram.
c. Calculate theoretical yield (start calculation with limiting reagent)
d. Calculate % yield given actual yield
e. Labs: Stoichiometry Balloon Races, Determination of CO₂

PRACTICE QUESTIONS:
More practice can be found in lesson note packets.

Types of Matter
1. A cup of sand is poured into a sample of water in a beaker. This could be classified as
   a. an element
   b. a compound
c. a homogeneous mixture
d. a heterogeneous mixture

2. Which of these choices refers to matter that could be separated by physical methods?
   a. O₂ (g)
   b. NaCl (s)
c. NaOH (aq)
d. CO₂ (g)

3. Soda beverages are chemical mixtures containing water, sugar, caffeine, and dyes. Which statement best describes the resulting mixture?
   a. The mixture is homogeneous and can be separated by filtration.
   b. The mixture is homogeneous and cannot be separated by filtration.
   c. The mixture is heterogeneous and can be separated by filtration.
   d. The mixture is heterogeneous and cannot be separated by filtration.

4. An example of a homogenous mixture is
   a. salt water
   b. carbon monoxide
c. sugar
d. carbon dioxide

5. Two grams of potassium chloride are completely dissolved in a sample of water in a beaker. This solution is classified as
   a. an element
   b. a compound
c. a homogeneous mixture
d. a heterogeneous mixture

6. When sample X is passed through a filter paper a white residue, Y, remains on the paper and a clear liquid, Z, passes through. When liquid Z is vaporized, another white residue remains. Sample X is best classified as
   a. an element
   b. a compound
c. a heterogeneous mixture
d. a homogeneous mixture
7. Any substance composed of two or more elements that are chemically combined in a fixed proportion is
   a. a mixture  c. an isotope
   b. a solution  d. a compound

8. Differences in which property allow the separation of a sample of sand and seawater by filtration?
   a. concentration of ions  c. density of sample
   b. volume of sample  d. particle size

9. Which substance can be decomposed by chemical means?
   a. tungsten  c. antimony
   b. krypton  d. methane

10. Which mixture can be separated by using the equipment shown?
    a. NaCl (aq) and SiO$_2$ (s)
    b. NaCl (aq) and C$_6$H$_{12}$O$_6$ (aq)
    c. CO$_2$ (aq) and NaCl (aq)
    d. CO$_2$ (aq) and C$_6$H$_{12}$O$_6$ (aq)

11. A student observed the following reaction: $\text{AlCl}_3$ (aq) + 3 NaOH (aq) $\rightarrow$ Al(OH)$_3$ (s) + 3NaCl (aq)
    After the products were filtered, which substance remained on the filter paper?
    a. NaCl  c. NaOH
    b. AlCl$_3$  d. Al(OH)$_3$

12. Petroleum can be separated by distillation because the hydrocarbons in petroleum are
    a. elements with identical boiling points  c. compounds with identical boiling points
    b. elements with different boiling points  d. compounds with different boiling points

13. The particle diagram depicts
    a. two elements
    b. two compounds
    c. one element and one compound
    d. a heterogeneous mixture

**Periodic Table**

1. If an element, X can form an oxide that has the formula X$_2$O$_3$, then element X would most likely be
   located on the Periodic table in the same group as
   a. boron  c. calcium
   b. lithium  d. magnesium

2. Which list includes elements with the most similar chemical properties?
   a. Br, Ga, Hg  c. Cr, Pb, Xe
   b. O, S, Se  d. N, O, F

3. Which elements are malleable and good conductors of electricity?
   a. iodine and silver  c. iodine and xenon
   b. tin and silver  d. tin and xenon
4. Which two characteristics are associated with metals?
   a. low first ionization energy and low electronegativity
   b. low first ionization energy and high electronegativity
   c. high first ionization energy and low electronegativity
   d. high first ionization energy and high electronegativity

5. Arsenic and silicon are similar in that they both
   a. have the same ionization energy
   b. have the same covalent radius
   c. are transition metals
   d. are metalloids

6. Compare the radius of an oxygen ion to the radius of an oxygen atom. __________________________
   ______________________________________________________________________________________

7. Why does the radius of atoms increase as you move down a group? _____________________________
   ______________________________________________________________________________________

8. How do the trends of atomic radius and first ionization energy relate to one another? ______________
   ______________________________________________________________________________________

9. Is the ionization energy of a valence electron higher or lower than the ionization energy of a core
   electron? Why? _________________________________________________________________________
   ______________________________________________________________________________________

10. Mg (s) + N₂ (g) → Mg₃N₂ (s). Explain, in terms of electrons, why an atom of the metal in this reaction
    forms an ion that has a smaller radius than its atom. __________________________________________
    ____________________________________________________________________________________

**Chemical Bonding**

1. Magnesium nitrate contains chemical bonds that are
   a. covalent, only
   b. ionic, only
   c. both covalent and ionic
   d. neither covalent nor ionic

2. What is the total number of electrons shared in the bonds between the two carbon atoms in a molecule of
   C₂H₂?
   a. 6
   b. 2
   c. 3
   d. 8

3. As a chlorine atom becomes a negative ion, the atom
   a. gains an electron and its radius increases
   b. gains an electron and its radius decreases
   c. loses an electron and its radius increases
   d. loses an electron and its radius decreases

4. Draw a Lewis Dot structure for a molecule of Bromine.
5. Explain, in terms of distribution of charge, why a molecule of Bromine is nonpolar. 

6. In Lewis dot structures, the dots represent __________________________________________.

7. Draw a Lewis structure for CO₂.

8. Draw a Lewis structure for HCN.

9. Redraw the Lewis structures for the molecules below.

   
   
   

10. Write the names or formulas for the following compounds:
    
    a. copper (II) hydroxide
    
    b. iron (III) sulfite
    
    c. carbon tetrahydride
    
    d. gold (I) chlorate
    
    e. ammonium selenide
    
    f. phosphorus pentoxide
    
    g. NH₄(CO₃)₂
    
    h. Ni(ClO)₂
    
    i. cobalt (II) fluoride
    
    j. calcium nitrite
    
    k. silver nitrate
Conservation of Matter

1. Write the ionic dissociation of the following substances. If no dissociation occurs and no ions are formed in water, write “none”.
   a. NaF (aq) _________________________________________________________________________
   b. Ag₂Cr₂O₇ (s) _______________________________________________________________________
   c. Li₂SO₄ (aq) _________________________________________________________________________
   d. H₂CO₃ (aq) _________________________________________________________________________
   e. Ba₃(PO₄)₂ (s) _______________________________________________________________________

2. Write the total ionic equation for the following molecular equation:
   \[ 2AgNO₃ (aq) + K₂Cr₂O₇ (aq) \rightarrow Ag₂Cr₂O₇ (s) + 2KNO₃ (aq) \]

3. A novel process for obtaining magnesium from sea water involves several reactions. Write a balanced chemical equation for each step of the process.
   a. The first step is the decomposition of solid calcium carbonate from seashells to form solid calcium oxide and gaseous carbon dioxide.

   b. The second step is the formation of solid calcium hydroxide as the only product from the reaction of the solid calcium oxide with liquid water.

   c. Solid calcium hydroxide is then added to the seawater, reacting with dissolved magnesium chloride to yield solid magnesium hydroxide and aqueous calcium chloride.

   d. The solid magnesium hydroxide is added to a hydrochloric acid solution, producing dissolved magnesium chloride and liquid water.

   e. Finally, the magnesium chloride is melted and electrolyzed to yield liquid magnesium metal and diatomic chlorine gas.
4. Write the balanced equation, then outline the steps necessary to determine the information requested in each of the following.

   a. The number of moles and the mass of chlorine, Cl₂, required to react with 10.0 g of sodium metal, Na, to produce sodium chloride, NaCl.

   b. The number of moles and the mass of oxygen formed by the decomposition of 1.252 g of mercury (II) oxide.

   c. The number of moles and the mass of sodium nitrate, NaNO₃, required to produce 128 g of oxygen. (NaNO₂ is the other product.)

   d. The number of moles and the mass of carbon dioxide formed by the combustion of 20.0 kg of carbon in an excess of oxygen.

   e. The number of moles and the mass of copper (II) carbonate needed to produce 1.500 kg of copper (II) oxide. (CO₂ is the other product.)
f. The number of moles and the mass of \( \text{Br-}\text{C-}\text{Br} \) formed by the reaction of 12.85 g of \( \text{C=H} \) with an excess of \( \text{Br}_2 \).

5. Carborundum is silicon carbide, SiC, a very hard material used as an abrasive on sandpaper and in other applications. It is prepared by the reaction of pure sand, SiO\(_2\), with carbon at high temperature. Carbon monoxide, CO, is the other product of this reaction. Write the balanced equation for the reaction, and calculate how much SiO\(_2\) is required to produce 3.00 kg of SiC.

6. In an accident, a solution containing 2.5 kg of nitric acid was spilled. Two kilograms of Na\(_2\)CO\(_3\) was quickly spread on the area and CO\(_2\) was released by the reaction. Was sufficient Na\(_2\)CO\(_3\) used to neutralize all of the acid?

7. What is the limiting reactant in a reaction that produces sodium chloride from 8 g of sodium and 8 g of diatomic chlorine?

8. A student isolated 25 g of a compound following a procedure that would theoretically yield 81 g. What was his percent yield?
9. Outline the steps needed to determine the limiting reactant when 0.50 mol of Cr and 0.75 mol of H\(_3\)PO\(_4\) react according to the following chemical equation.

\[
2\text{Cr} + 2\text{H}_3\text{PO}_4 \rightarrow 2\text{CrPO}_4 + 3\text{H}_2
\]

Determine the limiting reactant.

10. How many molecules of the sweetener saccharin can be prepared from 30 C atoms, 25 H atoms, 12 O atoms, 8 S atoms, and 14 N atoms?

![Image of saccharin molecule]

11. From the image below, write a balanced equation representing the reaction. What is the limiting and excess reactants?

![Diagram showing before and after reaction]

12. Why was a universal pH indicator added to the flasks in the stoichiometry balloon experiment? ________