Ch. 1-4 Review

1. Explain the difference between the terms “macroscopic” and “microscopic”.

2. Chemistry is a study of matter and its changes. List at least three chemical changes that are a part of your everyday life.

3. In Section 1.3 the statement is made that it is worthwhile for scientists, auto mechanics, doctors, politicians, and poets to take a scientific approach to their professions. Discuss how each of these people could use a scientific approach in his/her profession.

4. Give three examples of when you have used the scientific method (outside of school) in the past month. Discuss how a hypothesis can become a theory.

5. True or false: If a theory proves correct over a long period of time, it becomes a law. Explain your answer.

6. Make 5 qualitative and 5 quantitative observations about the room you are in.

7. Differentiate between a “personal theory” and a “scientific theory”. Using microscopic drawings (molecular level), show the difference between a gaseous element and a gaseous compound. Explain your drawings.

8. Heat is applied to an ice cube. Eventually, only steam is present. Draw a molecular level representation of this process. What happens to the size of the molecules? What happens to the total mass of the sample?

9. When you are in the room next to your kitchen, you can smell soup cooking. Why is this? Which of the following is true about the state of an individual atom?
   a) An individual atom can be a solid.
   b) An individual atom can be a liquid.
   c) An individual atom can be a gas.
   d) The state of the atom depends on which element it is (for example, an iron atom is solid, but a helium atom is gaseous).
   e) An individual atom cannot be a solid, liquid, or gas.

10. Using microscopic drawings (molecular level), show the difference between an atomic element and a molecular element. Explain your drawings. The boiling of water is a (explain)
   a. physical change because the water disappears.
   b. physical change because the gaseous water is chemically the same as the liquid.
   c. chemical change because heat is needed for the process.
   d. chemical change because hydrogen and oxygen gases are formed.
   e. chemical and physical change.

11. Air is a mixture consisting mainly of nitrogen and oxygen gases. Make microscopic drawings showing the differences between a mixture of nitrogen and oxygen gases, and a compound consisting of nitrogen and oxygen. Discuss your drawings.

12. Use molecular level drawings for each of the following to show the difference between a heterogeneous mixture and a homogeneous mixture. Label your drawings.
13. We use terms such as “heterogeneous mixture” and “homogeneous mixture” but not “heterogeneous compound” or “homogeneous compound”. Why not?

14. Why would a chemist find fault with the phrase “pure orange juice”?

15. Make molecular level drawings to accompany Figure 2.18. The text uses words and letters as analogies to compounds and elements. Explain this analogy. Also, in the English language the letter “E” is the most common. Which element is analogous to the letter “E”? Explain.

16. Explain what the formula of water, H$_2$O, tells us in your own words.

17. What is the difference between 2N and N$_2$?

18. Is there a difference between a homogeneous mixture of hydrogen gas and oxygen gas in a 2:1 ratio and a sample of water vapor? Explain. Use microscopic sketches. Explain how Dalton’s theory explains the law of constant composition.


20. Suppose you could see atoms. How would a carbon atom appear to be different from a nitrogen atom? How would they be alike? In Section 3.3 of your text, the five main ideas of Dalton’s atomic theory are listed. Explain each of these five ideas. Which of these are still generally accepted? Which are no longer accepted? Why not?

21. An ion is formed (explain):
   1. by either adding or subtracting protons from the atom
   2. by either adding or subtracting neutrons from the atom
   3. by either adding or subtracting electrons from the atom
   4. all of the above
   5. two of the above

22. A certain ion with 27 electrons has a charge of 2+. Which ion is it?
   a. Mn$^{2+}$  b. Co$^{2+}$  c. Cu$^{2+}$

23. An element forms an ionic compound with chlorine having the formula XCl$_2$. The ion of element X has a mass number of 89 and 36 electrons. Identify the element X and tell how many neutrons it has.

24. Which of the following did Dalton not discuss in his atomic theory? Explain.
   • Isotopes, ions, protons, electrons, neutrons

25. Why is the term “sodium chloride molecule” incorrect but the term “carbon dioxide molecule” correct?

26. Knowing the number of protons of a neutral atom enables you to determine which of the following (there may be more than one answer)?
   • the number of neutrons
   • the number of electrons
   • the name of the atom
What other information would you need to find the remaining items?
27. The formulas \( \text{CaCl}_2 \) and \( \text{CoCl}_2 \) look very similar. What is the name for each compound? Why do we name them differently?

28. The formulas \( \text{MgO} \) and \( \text{CO} \) look very similar. What is the name for each compound? Why do we name them differently?

29. Explain how you use the periodic table to tell you that there are two chloride ions for every magnesium ion in magnesium chloride and one chloride ion for every sodium ion in sodium chloride. Then write the formulas for calcium oxide and potassium oxide and explain how you got them.

30. What is the general formula for an ionic compound formed by elements in the following groups? Explain your reasoning and provide an example for each (name and formula).
   a. Group 1 with group 7
   b. Group 2 with group 7
   c. Group 1 with group 6
   d. Group 2 with group 6

31. Explain any problems with each of the given names. Then, identify the formula for each compound with the given name (there may be more than one possible answer) and provide the systematic name for this compound (name each of the possible formulas from an incorrect name)

<table>
<thead>
<tr>
<th>name</th>
<th>problem</th>
<th>formula</th>
<th>systematic name</th>
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<tbody>
<tr>
<td>barium dichloride</td>
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<tr>
<td>carbon oxide</td>
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<td>copper(II) sulfate</td>
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<td>iron oxide</td>
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<td>sulfur hexafluoride</td>
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<td>magnesium phosphide</td>
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<tr>
<td>calcium(II) nitrate</td>
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32. If you dissolve 10 “units” of iron(III) chloride, there will be_____particle(s) in solution. The formula for iron(III) chloride is______________.

33. If you dissolve 5 “units” of Pb(NO₃)₂, there will be___particle(s) in solution. The name of Pb(NO₃)₂ is__________________________.

34. If you dissolve 8 molecules of HCl, there will be_____particle(s) in solution. The name of HCl is______________________________.

35. If you dissolve 7 “units” of K₂Cr₂O₇, there will be___________particle(s) in solution. The name of K₂Cr₂O₇ is______________________________.

36. If you dissolve 6 “units” of calcium hydroxide, there will be______particle(s) in solution. The formula for calcium hydroxide is__________________.

37. If you dissolve 3 “units” of Cs₂SO₃, there will be_______particle(s) in solution. The name of Cs₂SO₃ is______________________________.

38. If you dissolve 2 “units” of barium phosphate, there will be_______particle(s) in solution. The formula for barium phosphate is__________________.

39. If you dissolve 1 “unit” of NH₄SCN, there will be___particle(s) in solution. The name of NH₄SCN is______________________________.

40. If you dissolve 4 “units” of copper(I) chloride, there will be______particle(s) in solution. The formula for copper(I) chloride is__________________.

41. If you dissolve 4 “units” of copper(II) chloride, there will be______particle(s) in solution. The formula for copper(II) chloride is__________________.