

Elements, Compounds, and Reactions

Unit Summary

In this unit, you have extended your understanding of matter. You have learned that matter can take different forms, and that the structure of matter helps explain how elements can combine to form compounds. Compounds can be placed in various groups depending on different classification schemes. Elements and compounds can also undergo chemical change at different rates, and chemical change can be described by chemical equations.

Create a mind map (concept map) that relates these ideas. Use sketches, diagrams, and text to show how the ideas interconnect. Check the chapter reviews to make sure that you have included all of the major concepts in your map.

Many of these questions are in the style of the Science 10 Provincial Exam. The following icons indicate an exam-style question and its cognitive level.

K Knowledge **U** Understanding and Application **HMP** Higher Mental Processes

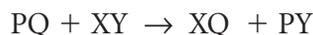
Review Key Ideas and Vocabulary

- K** 1. Which subatomic particles are responsible for chemical bonding?
- protons
 - electrons
 - neutrons
 - nucleons
- K** 2. In a Bohr diagram, how many electrons fill each shell?
- 2, 2, 2
 - 2, 2, 8
 - 2, 8, 8
 - 8, 8, 8
- K** 3. Which of the following describes the atomic number of an element?
- It is equal to the mass of the nucleus.
 - It is the number of protons in the nucleus.
 - It is the number of electrons in the nucleus.
 - It is the number of neutrons in the nucleus.
- K** 4. What appears on the Periodic Table, in order, when reading it from left to right?
- metals, metalloids, non-metals
 - metalloids, metals, non-metals
 - alkali metals, noble gases, halogens
 - alkali metals, halogens, alkaline earths
- K** 5. What determines the number of electrons transferred when an atom becomes an ion?
- the ion charge balance
 - the number of protons in the nucleus
 - the number of valence electrons in the first shell
 - the number of valence electrons of the nearest noble gas
- K** 6. What is the smallest particle of a covalently bonded compound?
- ion
 - atom
 - electron
 - molecule

- K** 7. How is a Lewis diagram different from a Bohr diagram of an atom?
- All electrons are shown.
 - Only valence electrons are shown.
 - Electrons are drawn in pairs when possible.
 - The nucleus contains important information.

- K** 8. When you balance a chemical equation, what are you balancing or making equal between the reactants and products?
- the number of subscripts
 - the number of coefficients
 - the number of atoms of each element
 - the number of molecules of each compound

- K** 9. Which reaction type does this general equation represent?



- synthesis
 - combustion
 - single replacement
 - double replacement
10. Write the chemical symbols for the following particles:
- fluorine atom
 - oxygen ion
 - oxygen molecule
 - potassium ion
11. Draw Bohr diagrams for atoms of the following elements:
- lithium
 - aluminum
 - carbon
 - neon
12. Write the chemical formulas for the seven elements that exist as diatomic molecules.
13. What does the crisscross method for writing chemical formulas actually do?
14. How are ionic compounds different from molecular compounds in their composition?

15. Ionic compounds can be classified as acids, bases, or salts. Match the following:

(a) acids	(i) release OH^- ions in solution
(b) bases	(ii) release ions other than H^+ or OH^- in solution
(c) salts	(iii) release H^+ ions in solution

- K** 16. Which of the following applies only to acids and not to bases or salts?

- They turn litmus red.
- They turn phenolphthalein pink.
- Their solutions conduct electricity.
- They react with metals to form oxygen gas.

- K** 17. What is the Arrhenius definition of a base?

- It tastes sour.
- It turns phenolphthalein pink.
- It releases H^+ ions in solution.
- It releases OH^- ions in solution.

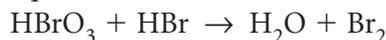
18. Make a sketch of the pH scale and label the acidic, basic, and neutral sections.

19. State a modern definition of an organic compound.

20. Write a statement that describes the Law of Conservation of Mass for chemical reactions.

21. In order to react, what must colliding reactant molecules have and how can this be achieved?

- K** 22. Which of the following sets of ordered coefficients will correctly balance the skeleton equation below?



- 1, 5, 3, 3
- 1, 2, 1, 1
- 2, 4, 6, 3
- 2, 4, 3, 2

- K** 23. Which of the following factors does not increase the rates of all chemical reactions?

- adding oxygen
- adding a catalyst
- increasing the concentration of reactants
- increasing the surface area of a solid reactant

Use What You've Learned

- U 24.** Which of the following is a chemical property?
- Water boils at 100 °C.
 - Acids have a sour taste.
 - Sugar dissolves in water.
 - Copper turns green when exposed to water and air.

25. An atom has 6 protons and 8 neutrons.

- Identify the element.
- Explain how that number of neutrons is possible.
- Draw a Bohr diagram of this atom.

26. Write the name of the elements described below.

- 7 protons and 8 neutrons
- 92 protons and mass number 240
- atomic number 84 and 126 neutrons

27. Explain why an ion cannot exist on its own.

28. Match each of the following elements with its nearest noble gas (from the choices given) and the number of valence electrons it would have when bonding is complete. You may use matching items more than once.

(a) Al	(i) He	(A) 2 valence electrons
(b) H	(ii) Ne	(B) 8 valence electrons
(c) Li	(iii) Ar	
(d) Mg		
(e) S		

29. Draw Bohr diagrams for the ions of magnesium and phosphorus.

- U 30.** Which of the following does *not* represent a molecule?
- CO₂
 - NH₃
 - H₂O
 - NaCl

U 31. Why do molecular compounds have relatively low melting points?

- Attractive forces between molecules are relatively weak.
- Attractive forces between atoms are relatively weak.
- Attractive forces between molecules are relatively strong.
- Attractive forces between atoms are relatively strong.

32. First, classify each of the following compounds as ionic or molecular. Then, write the chemical formula for each compound.

- beryllium nitrate
- ammonium carbonate
- lead(II) fluoride
- aluminum selenide
- carbon tetrachloride

33. First, classify each of the following compounds as ionic or molecular. Then, write the chemical name for each compound.

- RbCl
- (NH₄)₃P
- N₃Br₆
- Ti₂O₃
- Sr₃(PO₄)₂

34. First, classify each of the following compounds as ionic or molecular. Then, write the chemical formula or name depending on what is given.

- KCl
- calcium nitrate
- N₂O₄
- lead(IV) sulfide
- Ba(ClO₄)₂

35. Describe the results you would expect from electrical conductivity tests on ionic and molecular solutions.

36. Write either the acid name or chemical formula, depending on what is given.

- (a) HCl
- (b) perchloric acid
- (c) H_2SO_4
- (d) chlorous acid
- (e) HNO_2

37. Draw Lewis diagrams for ions of the following elements:

- (a) Cl
- (b) O
- (c) Ca

38. Draw Lewis diagrams of atoms for the following elements:

- (a) O
- (b) N
- (c) C
- (d) B

39. Draw Lewis diagrams of the following molecules:

- (a) BCl_3
- (b) CF_4
- (c) H_2O

40. Given that strontium chloride is a white crystalline solid with a high melting point, predict two properties of the compound barium chloride. Refer to the position of relevant elements in the Periodic Table to explain your predictions.

41. Balance the following skeleton equations. Then, classify the equations according to reaction type.

- (a) $\text{Ba} + \text{HCl} \rightarrow \text{BaCl}_2 + \text{H}_2$
- (b) $\text{Al} + \text{S} \rightarrow \text{Al}_2\text{S}_3$
- (c) $\text{Sr}(\text{NO}_3)_2 + \text{NaOH} \rightarrow \text{NaNO}_3 + \text{Sr}(\text{OH})_2$
- (d) $\text{Mg} + \text{H}_3\text{PO}_4 \rightarrow \text{Mg}_3(\text{PO}_4)_2 + \text{H}_2$
- (e) $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$
- (f) $\text{C}_{10}\text{H}_{22} + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$

42. Predict the products of the following reactions, then balance the equations. Classify the equations according to reaction type.

- (a) $\text{Ba} + \text{O}_2 \rightarrow$
- (b) $\text{C}_5\text{H}_{12} + \text{O}_2 \rightarrow$
- (c) $\text{Ba}(\text{NO}_3)_2 + \text{KOH} \rightarrow$
- (d) $\text{Al} + \text{ZnSO}_4 \rightarrow$
- (e) $\text{H}_2\text{SO}_4 + \text{Sr}(\text{OH})_2 \rightarrow$
- (f) $\text{NaCl} \rightarrow$

Think Critically

43. Write out and number your own set of rules on how to place electrons in a Bohr diagram. Provide an example diagram with your rules.

HMP 44. When hydrogen chloride gas and ammonium hydroxide gas react, a white solid forms. What is the white solid?

- A. HCl
- B. H_2O
- C. NH_4Cl
- D. NH_4OH

45. When acids and bases are transported to industrial plants, there is a potential hazard for spills along the route. When spills occur, groups trained to deal with hazardous materials spring into action. Use the Internet to learn how these groups deal with these kinds of spills.

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HMP 46. Which of the following will increase the percentage of collisions that are effective, thereby increasing reaction rate?

I	adding a catalyst
II	increasing temperature
III	increasing concentration of reactants

- A. I only
- B. I and II only
- C. I and III only
- D. I, II, and III

Reflect on Your Learning

47. Write a short essay on “Chemical Reactions in My World” to share what you have learned. Give examples of reactions that are important to you and classify them according to reaction type. Where possible, provide chemical equations with your examples. In many cases, Internet research will be helpful.

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