



- Chemical reactions may have a negative impact on the environment, but they can also be used to address environmental challenges.
- Chemicals react with each other in predictable ways.

This river gets its astonishing red colour from nickel tailings what is left after most of the nickel has been extracted from its ore. The colour comes from red, iron-containing compounds.

Sudbury, rich in nickel and other metals, supports industry that provides thousands of jobs and produces metal used to make countless useful items. But 100 years of metal processing has taken its toll on the area. By the late 1970s, over 100 000 ha of land in and around Sudbury had become barren due to pollution.

> People in Sudbury have been working to reclaim this land. They have used one chemical—limestone to help restore the soil to its natural levels of acidity. They have used other chemicals—fertilizers—to encourage the growth of trees and grass.

In this unit, you will learn how chemicals react. You will see how chemical reactions can result in useful products, while also sometimes damaging the environment. Chemical reactions, however, can also be used to reverse that damage.

What properties of limestone enable it to restore acidified soil?

Chapter 4 Developing Chemical Equations



Chapter 5 Classifying Chemical Reactions **Chapter 6** Acids and Bases



Get Ready for Unit 2

Concept Check

1. Complete each sentence with a word from the box below.

compound	ion	valence
element	metal	

- **a.** A(n) is a pure substance that cannot be broken down further by physical or chemical means.
- **b.** A(n) is a substance that can be broken down into elements by chemical means.
- c. Molecular compounds are formed when a non-metal bonds with a(n)
- d. electrons are those found in an atom's outermost occupied energy level.
- is an atom that has **e.** A(n) lost or gained valence electrons.
- **2.** Copy and complete the following table in your notebook.

- **3.** Identify the information listed below for the element beryllium. Refer to the periodic table below.
 - **a.** symbol
 - **b.** name of group
 - **c.** number of protons
 - **d.** number of electrons
 - **e.** atomic number
 - f. number of neutrons in an isotope with a mass number of 9
- **4.** Determine whether each statement below describes a physical property or a chemical property of an element. If the statement describes a physical property, indicate whether it is a qualitative property or a quantitative property.
 - **a.** It is a pale yellow gas at room temperature.
 - **b.** It can burn or etch glass permanently.
 - **c.** Its density is 1.695 g/L.
 - **d.** It explodes when it reacts with water.

		Electror	s Ne	eutrons	Pro	tons							13	3	+	
	Location		ins nu	ide the cleus									AI			
	Charge				posit	ive (+)							Alumin	um		
1	Relative size	smallest of these parti	cles				28		2+ 3+				E.			
1 H Hydroge 1.0	1+ m 2						Nic	kel			13	14	27.0 ^{- •}	16	17	2 H He
3 Li Lithium 6.9	1+ 4 2+ Be Beryllium 9.0	26		31			58	.7	Z		5 B Boron 10.8	6 C Carbon	7 3	8 2- 0 Oxygen 16.0	9 1- F Fluorine 19.0	10 Ne 20
11 Na Sodium 23.0	1+ 12 2+ Mg Magnesium 24.3	³ Fe	5	2 + 6	7	8	9	10	11	12	13 3+ Al Aluminum 27.0	14 Si Silicon 28.1	15 3- P Phosphorus 31.0	16 2- S Sulfur 32.1	17 1- Cl Chlorine 35.5	18 Arg 39
19 K Potassiu 39.1	1+ 20 2+ Ca Calcium 40.1	21 3 22 Sc Ti Scandium Thanlum 45.0 47		24 3+ Cr 2+ Shomir 22 0	25 2+ Mn 3+ 4+ Manganese 54.9	26 3+ Fe 2+ Iron 55.8	27 2+ Co Cobalt 58.9	28 2+ Ni ³⁺ Nickel 58.7	29 2+ Cu 1+ Copper 63.5	30 2+ Zn 2inc 55.4	31 3+ Ga Gallium 69.7	32 4+ Ge Germanium 72.6	33 3- As Arsenic 74.9	34 2- Se Selenium 79.0	35 1- Br ^{Bromine} 79.9	36 K Kny 83
37 Rb Rubidiu 85.5	1+ 38 2+ Sr Strontium 87.6	39 34 55.8 Y Yttrium Zirconium 88.9 91.2	+ 41 8+- Nib 5+ Nioblum 92.9	42 2+ Moi 3+ Molybdenum 95.9	43 7+ TC Technetium (98)	44 3+ Ru 4+ Ruthenium 101.1	45 3+ Rh 4+ Rhodium 102.9	46 2+ Pd 4+ Palladium 106.4	47 1+ Ag Silver 107.9	48 2+ Cd Cadmium 112.4	49 3+ In Indium 114.8	50 4+ Sn 2+ Tin 118.7	51 3+ Sb 5+ Antimony 121.8	52 2- Te Tellurium 127.6	53 1- I lodine 126.9	54 X Xe 13
55 Cs Cesium 132.9	1+ 56 2+ Ba Barium 9 137.3	57 3+ 72 4 La Hf Lanthanum Hafnium 138.9 178.5	+ 73 5+ Ta Tantalum 180.9	74 6+ W Tungsten 183.8	75 4+ Re 7+ Rhenium 186.2	76 3+ Os Osmium 190.2	77 3+ Ir 4+ Iridium 192.2	78 4+ Pt 2+ Platinum 195.1	79 3+ Au 1+ Gold 197.0	80 2+ Hg Mercury 200.6	81 1+ TI 3+ Thallium 204.4	82 2+ Pb 4+ Lead 207.2	83 3+ Bi ⁵⁺ Bismuth 209.0	84 2+ Po Polonium (209)	85 1- At Astatine (210)	86 R Ra (2
87	1+ 88 2+	89 3+ 104	105 Db	106 Sa	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Uub*	113 Uut*	114 Uuq*	115 Uup*	116 Uuh*		11 U

Facts about Subatomic Particles

Inquiry Check

5. Analyze Bohr-Rutherford diagrams for two compounds, and their melting points and boiling points are shown below.



melting point = 775°C; boiling point = 1500°C



melting point = 0°C; boiling point = 100°C

- **a.** What elements are represented in compound 1 and compound 2?
- **b.** Determine which diagram shows an ionic compound and which shows a molecular compound. Justify your answer.
- **c.** Determine the chemical formulas and names for the compounds.

Looking Ahead to the Unit 2 Projects

At the end of this unit, you will have an opportunity to apply what you have learned in an inquiry or research project. Read the Unit 2 Projects on pages 256-257. Start a project folder now (either paper or electronic). Store ideas, notes, news clippings, website addresses, and lists of materials that might help you to complete your project.

Inquiry Project Extract metallic copper from copper(II) carbonate.

Numeracy and Literacy Check

6. Balance Equations During a chemical reaction, atoms cannot be created or destroyed. Consider the blue and yellow spheres below as atoms. Is this equation balanced? If not, what is missing from which side?



7. Calculate The densities of three metals are given in the table below.

Density of Three Metals

Name and Symbol	Density (g/cm³)
aluminum (Al)	8.9
iron (Fe)	7.9
nickel (Ni)	2.7

One of these metals has a mass of 10 g and a volume of 1.12 cm³. Determine the identity and atomic number of the metal. Show all your work.

8. Write Complete a 3, 2, 1 organizer using the text on page 133. Include three interesting facts, two questions that you have, and one key idea in your organizer.

An Issue to Analyze Form an opinion about the retrieval of gold from e-waste.