Name ______________________ Date __________ Class __________

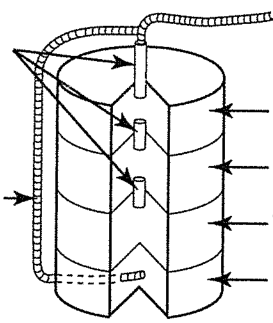
Enrich

Atoms, Bonding, and the Periodic Table

Read the passage, look at the diagram, and study the table. Then use a separate sheet of paper to answer the questions that follow.

The Rockets' Red Glare

The basic fireworks unit is called a shell, and it is packed with chemicals that produce light, smoke, and noise when they burn. The effects depend on which chemicals are packed into the shell and how they are arranged.



A simple shell is shown at the right. When the gunpowder at the bottom of the shell is lit, it explodes and lifts the shell into the air. By the time the shell has reached the high point of its path, a second fuse ignites the other chemicals. Some shells explode all at once. Others are made of smaller shells that burst apart and explode separately. Time delays can be used to make a shell explode in stages.

The table below lists some chemicals and the effects they produce.

Element	Effect
strontium or lithium	red color
barium	green color
copper	blue color
sodium	yellow color
magnesium or aluminum	white color
potassium or sodium	whistling sound
potassium and sulfur	white smoke

1. To which groups of the periodic table do the majority of the elements listed in the table above belong? Why do you think elements in these groups are used in making fireworks?
2. Which group of elements could you not use in making fireworks? Explain your answer.
3. Why would you want to have two or more separate fuses in a rocket?
4. Solutions of magnesium, barium, and strontium are each clear and colorless. Predict what might happen if a drop of each solution was held in the flame of a lab burner.

Place the outside corner, the corner away from the dotted line, in the corner of your copy machine to copy onto letter-size paper.

Name ______________________ Date ____________ Class ____________

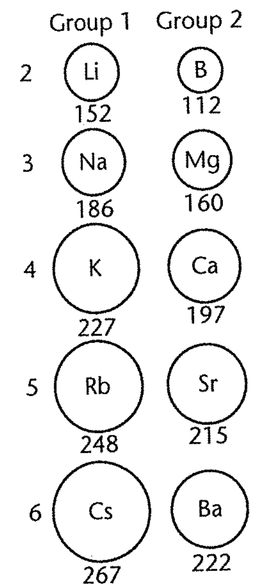
Enrich

Ionic Bonds

Read the passage and look at the diagram to its right. Then use a separate sheet of paper to answer the questions that follow.

Pulling Away Electrons

You know that the metals in Group 1 and 2 are quite reactive. They combine easily with certain other elements to form compounds. Atoms from Group 1 react by losing one electron; atoms from Group 2 lose two electrons. It takes energy to remove an electron from an atom. Some atoms hold their electrons tighter than other atoms do. Also, an individual atom holds some of its electrons tighter than other electrons.



The size of an atom's radius affects how tightly it holds its electrons. The larger the radius of an atom, the farther away from the nucleus some of its electrons are. The electron held the least tightly is easiest to remove. To remove yet another electron requires more energy than was needed to remove the first. The figure below compares the atomic radii of the elements in Groups 1 and 2. The number underneath each element represents the atomic radius measured in picometers (pm).

1. What do you notice about atomic radius as you look down a group? As you look across a period from Group 1 to Group 2?
2. Which element would you expect to be the most reactive in Group 1? In Group 2? Explain your answer.
3. Within each period, which element of the two groups would you expect to be more reactive? Explain your answer.
4. Across the periodic table, atomic radius continues to decrease through Group 17. How does this fact help explain why the metals in Groups 3 through 13 are less reactive than the metals in Group 1 and 2?

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Enrich

Covalent Bonds

Read the passage and look at the diagrams next to it. Then use a separate sheet of paper to answer the questions that follow the passage.

Oil Spills

Each year over 907,000 metric tons of crude oil are spilled in Earth's oceans. This is enough oil to fill 100 school gymnasiums! It is important to clean up crude oil as soon after a spill as possible, because spilled crude oil has negative effects on the environment. Oil on ocean surfaces is harmful to ocean life because it blocks sunlight and reduces the level of dissolved oxygen in the water. In addition, many birds and fish die from contact with crude oil because the oil damages feathers and gills.

Two methods used to clean up oils spills are

1. A floating barrier is placed around the spill to keep it from spreading. Because oil floats on water, the oil can be skimmed off the top of the water. Skimming the top of the water using a net with extremely small holes allows the water to escape but not the oil.
2. Chemicals that act like detergents are sprayed onto the surface of the spill. These chemicals break up the oil into tiny droplets. The small particles of oil spread over a large area have less effect on marine life than larger particles.

Figure 1
Detergent Molecule

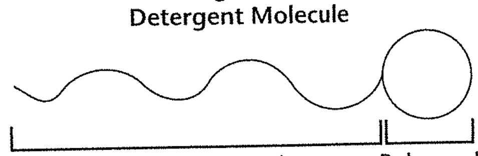
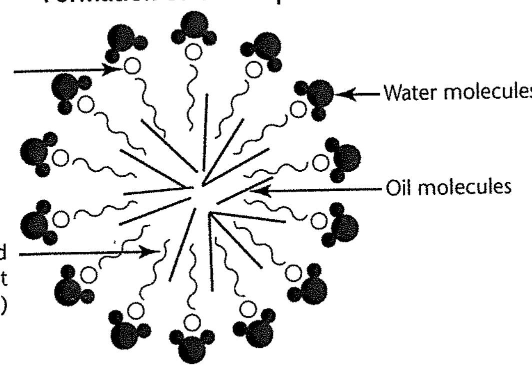


Figure 2
Formation of Oil Droplets



Both of these methods work because of the chemical properties of oil molecules. Oil molecules are nonpolar, so they will not mix with polar water molecules. Detergents are long molecules that have a polar end and a nonpolar end, like the molecule shown in Figure 1. The polar end of the detergent attracts water molecules, and the nonpolar end attracts oil molecules. Figure 2 shows how detergent molecules cause the formation of droplets of water, detergent, and oil molecules.

1. Explain how the nonpolar character of oil molecules helps when removing oil from water using nets and float barriers.
2. The long "tail" on a detergent molecule is made up mostly of carbon atoms bonded to other carbon atoms. Why would you expect the tail to be nonpolar?
3. How does detergent sprayed on an oil spill break up the spill?

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Enrich

Bonding in Metals

Read the passage and look at the table below it. Then use a separate sheet of paper to answer the questions that follow the table.

How Hard?

Some metals, such as copper and gold, are also minerals. A mineral is a naturally occurring solid that has a crystal structure and a definite chemical composition. Their crystal structure makes minerals hard. Nonetheless, there is considerable variation among minerals in hardness. Talc is the softest mineral, and diamond is the hardest. Mohs Scale of Hardness, which is shown below, is used to classify minerals and other substances according to their hardnesses. An object on the scale will scratch anything with a lower number, but will be scratched by anything with a higher number. The table includes some everyday objects in parentheses for comparison.

Mineral (Object)	Hardness
talc	1
(asphalt)	1.3
gypsum	2
(fingernail)	2.5
calcite	3
(copper coin)	3
fluorite	4
apatite	5

Mineral (Object)	Hardness
(knife blade)	5.5
feldspar	6
(steel file)	6.5
quartz	7
topaz	8
corundum	9
diamond	10

1. Which minerals will scratch quartz? How do you know?
2. According to the information in the table, do you think that you could scratch a copper coin with a knife blade? Explain your answer.
3. How could you determine the hardness rating for a mineral not listed on the scale?