# Lesson: Mineral Recipes

## Overview

**By definition, a mineral has a definite chemical composition, similar to a recipe. In this activity students will learn the composition of rock forming and Saskatchewan resource minerals. Students will investigate the chemical formulas, sort minerals and metals into groups, describe the properties of several of the minerals, identify the elements in the compounds, and determine the number of atoms of each, and will be able to associate minerals with the resource being mined in Saskatchewan.**

**Source:** The idea for this lesson comes from the Make Five activity by E. McHenry. It has been adapted for Saskatchewan schools by the SMA.

**Duration: One – two classes**

### Materials:

- Mineral Cards
- Blocks
- "Recipe box" – a box large enough to hold all cubes
- Mineral Groups handout
- Discussion Questions.

### Instructional Method:

- Game
- Discussion questions

### Notes to Teacher:

If you have mineral samples in the classroom, have them available to the students to conduct hardness tests on, in question 7.


## Learning Outcomes and Indicators

### Science 9 Atoms and Elements

**AE9.1 Distinguish between physical and chemical properties of common substances, including those found in household, commercial, industrial, and agricultural applications**

d. Investigate common materials and describe them in terms of their physical properties such as smell, colour, melting point, boiling point, density, solubility, ductility, crystal shape, conductivity, hardness, lustre, texture, and malleability.

e. Classify substances found in household, commercial, industrial, and agricultural applications based on their physical and/or chemical properties.

k. Provide examples to illustrate that scientific and technological activity related to chemistry takes place in a variety of individual and group settings within Saskatchewan. (indirect)

**AE9.3 Demonstrate an understanding of the classification of pure substances (elements and compounds), including the development and nature of the Periodic Table.**

a. Differentiate between elements, compounds, and mixtures (mechanical mixtures and solutions), with reference to the terms homogenous and heterogeneous.

d. Identify examples of common elements (e.g., first 18 elements and K, Ca, Fe, Ni, Cu, Zn, I, Ag, Sn, Au, W, Hg, Pb, and U), and compare their atomic structure and physical and chemical properties.

g. Write and interpret chemical symbols or formulae of common elements and compounds and identify the elements and number of atoms of each in a given compound (e.g., He, Na, C, $H_2O$, $H_2O_2$, CO, $CO_2$, $CaCO_3$, $SO_2$, FeO, $NO_2$, $O_3$, $CH_4$, $C_3H_8$, $NH_3$, $NaHCO_3$, KCl, HCl, $H_2SO_4$, ZnO, and NaCl).

Source: **Saskatchewan Evergreen Curriculum**

**Other:**

- Students will learn the elements and chemical formulas of some of Saskatchewan's mineral resources.

## Background Information

Common minerals are made up of the abundant elements in the Earth's crust. We can express the chemical composition of minerals by a chemical formula, although all minerals exhibit some chemical variation. Pure minerals (those with a chemical composition exactly the same as the chemical formula) are rarely found in nature.

Minerals can form by any of the following processes: Precipitation from a fluid ($H_2O$ ) during hydrothermal processes and metamorphism within the earth; as a result of evaporation, weathering, or biological activity at the earth's surface; sublimation from vapour at a volcanic vent; or crystallization of molten rock (magma) either below or at the Earth's surface.

Whatever the process, a particular mineral cannot form unless the chemical ingredients necessary to make the mineral are present. Thus, the most common minerals are made of the most abundant elements found in their environment.

The elements oxygen, silicon, aluminum, iron, calcium, sodium, potassium, and magnesium make up over 98% of the Earth's crust. The most common minerals found in the crust are the silicates and the oxides, with the aluminosilicates (feldspars and clay minerals) the most common.

The chemical composition of a mineral is an integral part of its definition and of interest to geologists because it provides clues to the nature of the processes responsible for the formation of the mineral.
The chemical classification of the minerals allows us to describe and discuss minerals that share many common properties and to understand the origin of property differences among various mineral groups (See Mineral Groups handout).

## Vocabulary

| | |
|---|---|
| silicates | sulphides |
| sulphates | halides |
| carbonates | native elements |
| oxides | |

## THE ACTIVITY

**Mineral Recipes**

(Game, Question sheet) (one class)

**Preparation:**

1. Print the cubes on cardstock . Cut out the dice patterns and fold and glue(tape) into cubes. *(Another option is to purchase blank wooden cubes and write the letters on each side )*

2. Place cubes into the "Recipe Box"

3. Cut apart the 22 mineral cards.

## The Activity

**Introduction**

1. Place the mineral cards on the table, face up. Each player will have a turn rolling all six dice at once. The goal is to roll the ingredients to form a mineral.

   *For example, if the first player rolls: Cu, Fe, S, U, Au, Cl, he/she should notice that CuFeS are the ingredients of chalcopyrite. Therefore, that player picks up the chalcopyrite card. The player could also pick up the gold card Au. If the next player rolls Ca, C, and WILD, SO4, U, Zn he/she could make the wild card into O, and be eligible to pick up calcite. A player may be able to create more than one mineral in a turn.*

2. The first player to collect five cards wins the game.

3. After the students have played a round or two of the mineral recipe game, hand out the question sheet.

## Assessment Method and Evidence:

✓ **Mineral Recipe game**

- Students will be able to describe the physical properties of the minerals (colour, crystal system,

hardness, lustre, streak, metallic/non-metallic, crystal system (shape), specific gravity, other properties such as smell, magnetism, malleability, conductivity)

- Students will be able to associate the chemical composition of some of Saskatchewan's minerals with the metal resource that mining companies are exploring for or mining.

✓ **Mineral Recipe Table**

- Students will be able to list the names of some of Saskatchewan's minerals that mining companies are exploring for or mining.
- Students will classify common minerals and minerals mined in Saskatchewan into their mineral and metal groups based on their chemical properties.
- Students will be able to differentiate elements and compounds as being homogenous or heterogeneous.
- Students will be able to identify minerals containing the common elements (K, Ca, Fe, Cu, Zn, Au, Pb, and U), and compare their atomic ionic charge in relation to their "recipe" or chemical formula.
- Students will note that most minerals (except native elements) are ionic compounds in which positively charged metallic ions are combined with negatively charged non-metallic ions.
- Students will be able to write and interpret chemical symbols or formulae of several common Saskatchewan elements and compounds and identify the number of atoms of each element in a given compound (e.g., Na, C, $H_2O$, $CaCO_3$, $SO_4$, FeO, $O_3$, , KCl, HCl, , and NaCl).

## Extension:

1. Create new minerals using the dice. Make sure the atomic charges are balanced. Go to Wikipedia and insert the formula to determine if it is a real mineral. Check the list on the right for "Other names"

## Resources

**McHenry, E.** Make Five Game available at: http://www.ellenjmchenry.com/homeschool-freedownloads/earthscience-games/makefive.php

**Mineral Groups:**

**Mineralogy 4 Kids:**
http://www.mineralogy4kids.org/?q=mineral-group

**Rocksandminerals4u**
http://www.rocksandminerals4u.com/mineral_classification.html

### Photo images:

**Wikipedia**: barite, zircon, hematite, milky quartz, corundum, talc, diamond, graphite, thenardite.

**Zircon microscope image**: "Zircon microscope". Licensed under CC BY-SA 3.0 via Wikimedia Commons - http://commons.wikimedia.org/wiki/File:Zircon_microscope.jpg#mediaviewer/File:Zircon_microscope.jpg

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**Pyrite:** "Pyrite-Chalcopyrite-Sphalerite-40297" by Rob Lavinsky, iRocks.com – CC-BY-SA-3.0. Licensed under CC BY-SA 3.0 via Wikimedia Commons - http://commons.wikimedia.org/wiki/File:Pyrite-

**Chalcopyrite-Sphalerite-**
40297.jpg#mediaviewer/File:Pyrite-Chalcopyrite-Sphalerite-40297.jpg

**Uraninite**: "Uraninite-usa32abg" by Rob Lavinsky, iRocks.com – CC-BY-SA-3.0. Licensed under CC BY-SA 3.0 via Wikimedia Commons - http://commons.wikimedia.org/wiki/File:Uraninite-usa32abg.jpg#mediaviewer/File:Uraninite-usa32abg.jpg

**Arsenopyrite:** "Arsenopyrite, Panasqueira Mine, Portugal" by JJ Harrison (jjharrison89@facebook.com) - Own work. Licensed under CC BY-SA 3.0 via Wikimedia Commons - http://commons.wikimedia.org/wiki/File:Arsenopyrite,_Panasqueira_Mine,_Portugal.jpg#mediaviewer/File:Arsenopyrite,_Panasqueira_Mine,_Portugal.jpg

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**Sphalerite**: "Sphalerite-Dolomite-Chalcopyrite-165227" by Rob Lavinsky, iRocks.com – CC-BY-SA-3.0. Licensed under CC BY-SA 3.0 via Wikimedia Commons - http://commons.wikimedia.org/wiki/File:Sphalerite-Dolomite-Chalcopyrite-165227.jpg#mediaviewer/File:Sphalerite-Dolomite-Chalcopyrite-165227.jpg

**Sylvite:** "Mineral Silvina GDFL105" by Luis Miguel Bugallo Sánchez (Lmbuga Commons)(Lmbuga Galipedia)Publicada por/Publish by: Luis Miguel Bugallo Sánchez - Own work. Licensed under CC BY-SA 3.0 via Wikimedia Commons - http://commons.wikimedia.org/wiki/File:Mineral_Silvina_GDFL105.jpg#mediaviewer/File:Mineral_Silvina_GDFL105.jpg

**SMA:** Calcite, fluorite, gypsum, chalcopyrite, galena, coal, potash

**The Encyclopedia of Saskatchewan: Sodium Sulphate:** http://esask.uregina.ca/entry/saskatchewan_minerals.html

## Background Information: Mineral Groups

**Silicates:** Silicate minerals are formed from the silicon-oxygen tetrahedron. This structure is in fact a compound anion. As a unit it carries a negative charge . It is composed of atoms with individual negative and positive charges. At the center of the structure is the silicon ion with a positive four charge. Surrounding the silicon are four oxygen ions, each of which carries a negative two charge. Thus, taken together, the structure has a net negative four charge (+4 + (4 x –2)) = (+4 + (-8)) = -4.

**Non-silicates:** These minerals are composed of chemical structures other than the silicon-oxygen tetrahedron. The native elements, oxides, sulphides, sulphates, halides, and carbonates are organized based on their anionic chemistry.

**Native Elements:** Native element minerals are those with chemical formulae consisting of a single element. Other minerals of this class include native sulfur, gold, silver, copper and carbon. Two important native element minerals can form from the element carbon, graphite and diamond. Minerals such as these, with identical chemical composition, but different appearance and other properties are called polymorphs.

**Oxides:** Oxide minerals are those whose anionic composition is based upon divalent oxygen $O^{-2}$. Oxygen in this state is commonly combined with various metallic elements at or near the Earth's surface. One of the most abundant oxide minerals is hematite, an iron oxide with chemical composition $Fe_2O_3$. More commonly known as "rust", hematite commonly stains the surfaces of weathered rocks, giving them their characteristic tan, red, or brown color.

**Sulfides and Sulfates:** These minerals contain the element sulfur. The sulfides are characterized by divalent sulfur as their anion – $S^{-2}$. Sulfide minerals include important metal ore minerals such as galena (lead sulfide PbS) and sphalerite (zinc sulfide ZnS). The iron sulphide, pyrite (FeS) is commonly called "fools gold". The sulfates, on the other hand, contain the compound anion $SO_4^{-2}$. Sulfate minerals include the important evaporite minerals gypsum and anhydrite, both calcium sulfates.

**Halides:** These minerals are formed from several different, but chemically similar anions of which chlorine (Cl) and fluorine (F) are the most common. The evaporite mineral halite (NaCl) is the most common halide, and is the mineral that gives its name to the class. Other minerals of this class include the potassium chloride mineral, sylvite (KCl) as well as the calcium fluoride mineral, fluorite ($CaF_2$). These minerals are lumped into a single group because chlorine and fluorine have nearly identical mineral-forming properties.

**Carbonates:** Carbonate minerals have as their anionic structure the compound anion $CO_3^{-2}$. These common rock-forming minerals are found in modern seashells and corals as well as the rocks, limestone and dolostone. Calcite $CaCO_3$, is the most abundant and important of the carbonate minerals.

## Minerals Table Answer Sheet

| Mineral Name | Mineral formula (indicate ionic charge) | | Mineral Group | Metal Group | Hardness | Homogeneous OR Heterogeneous |
|---|---|---|---|---|---|---|
| | Metals | Non-metals | | | | |
| Barite | Ba | $SO_4$ | Sulphate | Alkaline | 3 -3.5 | Heterogeneous |
| Zircon | Zr | $SiO_4$ | Silicate | Transitional | 7.5 | Heterogeneous |
| Hematite | $Fe_2$ | $O_3$ | Oxide | Transitional | 5.5 – 6.5 | Heterogeneous |
| Quartz | | $SiO_2$ | Silicate | | 7 | Heterogeneous |
| Corrundum | Al2 | $O_3$ | Oxide | Other | 9 | Heterogeneous |
| Calcite | Ca | $CO_3$ | Carbonate | Alkaline | 3 | Heterogeneous |
| Fluorite | Ca | $F_2$ | Halide | Alkaline | 4 | Heterogeneous |
| Talc | $Mg_3$ | $Si_4O_{10}(OH)_2$ | Silicate | Alkaline | 1 | Heterogeneous |
| Feldspar | (K, Na, Ca)Al | $Si_3O_8$ | Silicate | Alkali/Alkaline | 5 | Heterogeneous |
| Gypsum | Ca | $SO_4 * 2H_2O$ | Sulphate | Alkaline | 2 | Heterogeneous |
| Diamond | C | | Native element | Transitional | 10 | Homogeneous |
| Gold | Au | | Native element | Transitional | 2.5 | Homogeneous |
| Pyrite | Fe | $S_2$ | Sulphide | Transitional | 6 – 6.5 | Heterogeneous |
| Chalcopyrite | CuFe | $S_2$ | Sulphide | Transitional | 3.5 | Heterogeneous |
| Galena | Pb | S | Sulphide | Other | 2.5 | Heterogeneous |
| Sylvite | K | Cl | Halide | Alkali | 2 | Heterogeneous |
| Halite | Na | Cl | Halide | Alkali | 2 – 2.5 | Heterogeneous |
| Uraninite | U | $O_2$ | Oxide | Rare Earth | 5 - 6 | Heterogeneous |
| Arsenopyrite | FeAs | S | Sulphide | Transitional/Other | 5.5 - 6 | Heterogeneous |
| Bornite | $Cu_5Fe$ | $S_4$ | Sulphide | Transitional | 3 -3.25 | Heterogeneous |
| Sphalerite | ZnFe | S | Sulphide | Transitional | 3.5 - 4 | Heterogeneous |
| Thenardite | $Na_2$ | $SO_4$ | Sulphate | Alkali | 2.5 | Heterogeneous |

## Mineral Recipe Questions Answers

Using the background information and the table provided:

1. Indicate which mineral group each mineral belongs to. (see table)

2. You will see that most of the minerals are made up of a metal and a non- metal component. Indicate which metal groups the metal belongs to. (see table)

3. Choose 8 of the minerals, create a table and describe their physical properties of colour, hardness, lustre, streak, metallic/non-metallic, crystal system (shape), specific gravity, other properties such as smell, magnetism, malleability, conductivity.

4. On the table indicate whether the mineral is an element or compound by indicating whether it is homogeneous or heterogeneous. (see table)

5. Saskatchewan is abundant in mineral resources. Some are currently being mined, some have been mined in the past and others could be mined in the future. List the minerals associated with each type of mining project below.

| Potash-Salt | Uranium | Gold | Copper | Lead - Zinc | Diamonds | Sodium Sulphate |
|---|---|---|---|---|---|---|
| Sylvite | Uraninite | Native gold | chalcopyrite | Galena | Diamond | Thenardite |
| Halite | | Arsenopyrite | bornite | Sphalerite | | |
| | | | | | | |

6. Identify the elements and number of atoms of each in the compounds listed below.

| Compound/element name | Formula | Element: number of atoms in compound |
|---|---|---|
| **Sodium** | Na | Na: 1 |
| **Carbon** | C | C: 1 |
| **Water** | $H_2O$ | H: 2 O: 1 |
| **Calcite (calcium carbonate)** | $CaCO_3$ | Ca:1 C: 1 O:3 |
| **Sulphate** | $SO_4$ | S: 1 O: 4 |
| **Sylvite** | KCl | K: 1 Cl: 1 |
| **Halite** | NaCl | Na: 1 Cl: 1 |
| **Pyrite** | $FeS_2$ | Fe: 1 S: 2 |
| **Galena** | PbS | Pb:1 S: 1 |
| **Uraninite** | $UO_2$ | U: 1 O:2 |
| **Quartz** | $SiO_2$ | Si: 1 O:2 |

7. Many of the minerals listed are minerals used to define Moh's scale of mineral hardness. If you have access to mineral samples determine conduct the scratch test to determine/confirm the hardness for those minerals available to you.

Using the information provided on the mineral cards, search for the hardness of the other Saskatchewan minerals and fill in the blanks below.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| talc | gypsum | calcite | fluorite | feldspar | feldspar | quartz | tourmaline | corrundum | diamond |

gold
galena
sylvite
halite
thenardite

Barite
chalcopyrite
bornite
sphalerite

hematite pyrite
uraninite
arsenopyrite

zircon

## Extension 1:

**Other mineral recipes using the cubes.**

| | | | | |
|---|---|---|---|---|
| $BaCO_3$ | Witherite | | FeS | troilite |
| $BaF_2$ | Frankdicksonite | | | |
| $ZrO_2$ | Baddeleyite | | | |
| $Fe_2SiO_4$ | Fayalite | | | |
| $Fe_2O_3$ | Ferric oxide - rust | | | |
| $NaAlSi_3O_8$ | albite | | | |
| $KAlSi_3O_8$ | orthoclase | | | |
| $KAlSi_3O_8$ | microcline | | | |

## MINERAL PROPERTIES

| MINERALS | COLOR | LUSTER Metallic/non-metallic | STREAK | Crystal system | HARDNESS | Specific gravity | OTHER |
|---|---|---|---|---|---|---|---|
| Graphite | Iron black | Sub-metallic | Lead gray | Hexagonal | 1.5-2 | 1.9 – 2.3 | Conductive |
| Diamond | Colourless – yellow, brown | Adamantine | Colourless | Cubic (Isometric) | 10 | 3.52 | Rare, blue, pink, red coloured |
| Calcite | Colorless | Vitreous | White | Trigonal | 3 | 2.71 | Bubbles vigorously in HCl acid |
| Pyrite (Fool's gold) | Brassy yellow | Metallic | Greenish black | Isometric Usually forms cubes | 6-6.5 | 4.95-5.10 | Parallel striations on crystal faces. Tarnishes brassy yellow. Heavy Conductive |
| Chalcopyrite | Brass yellow | Metallic | Greenish black | Tetragonal | 3.5-4 | 4.1 -4.3 | Brittle Conductive |
| Quartz | White, pink, purple, | Glassy | White, | Trigonal, Hexagonal Prismatic – six sides | 7 | 2.59 – 2.63 | Conchoidal fracture–like rock chops on the windshield Transparent to translucent |
| Feldspar (Potassium) | Salmon Pink | Vitreous to pearly | White | Monoclinic | 6 | 2.55 – 2.63 | Twinning simple |
| Bornite | Copper red, purple, bronze | Metallic, irridescent | Grey-black | Orthorhombic | 3 -3.25 | 5.07 | Called peacock ore |
| Uraninite | Black – brown black | Sub metallic, greasy, dull | Brown-black to olive green | Isometric | 5-6 | 10.63 – 10.95 | Radioactive |
| Thenardite | White, greyish white | Crystals are vitreous or resinous | White | Orthorhombic | 2.5 | 2.68 | Generally forms crusts, aggregates. Fluorescent, dissolves in water |
| Talc | White, Pale green | Dull to pearly | White | Monoclinic, triclinic | 1 | 2.58 – 2.83 | Soapy feel |
| Arsenopyrite | Steel grey – silvery white | Metallic | Black | Monoclinic | 5.5-6 | 5.9-6.2 | Garlic odour when struck |
| Sphalerite | Brown, red, green , black, yellow | Resinous, greasy | Brownish – white, pale yellow | Isometric | 3.5 - 4 | 3.9-4.2 | Smells like rotten eggs when scratched |
| Hematite | Steel grey, red- brown to red on weathered surface | Metallic (fresh surface) | Reddish | Trigonal | 5.5 – 6.5 | 5.26 | Popular in jewelry. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Halite | Colorless, blue | Glassy | White | Cubic | 2 - 2.5 | 2.17 | Salty taste, dissolves in water. Transparent to translucent. |
| Galena | Grey | Metallic | Lead grey | Cubic/Isometric | 2.5 – 2.75 | 7.2 – 7.6 | Tarnishes blue-grey, heavy, conductive |
| Gypsum (Selenite) | Colourless to white, tan, pink,grey | Pearly, vitreous | White | Monoclinic elongated prismatic crystals | 2 | 2.32 | Often twinned, sometimes forms rosettes (desert rose) |
| Sylvite | Colourless to white, red | Vitreous | White | Isometric | 2 | 1.99 | Bitter taste |
| Gold | Gold | Metallic | | Cubic | 2.5 | 19.32 | Malleable |
| Corrundum | Colourless, blue, red, yellow, grey | Adamantine to vitreous | White | Trigonal | 9 | 3.95-4.1 | Blue-saphire, red - ruby |
| Fluorite | Colourless, green, purple | Vitreous | White | Isometric | 4 | 3.15-3.18 | May be fluorescent |
| zircon | Red-brown, green blue, colourless | Vitreous, greasy | White | Tetragonal | 7.5 | 4.6-4.7 | Fluorescent and radioactive |
| Barite | Colourless, white, pale blue, yellow,grey, brown | Vitreous, pearly | White | Orthorhombic | 3 – 3.5 | 4.3 - 5 | |

## Minerals Table

| MINERALS | COLOR | LUSTER Metallic/non-metallic | STREAK | Crystal system | HARDNESS | Specific gravity | OTHER |
|---|---|---|---|---|---|---|---|
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## Mineral Recipe Questions

Using the background information and the table provided:

1. Indicate which mineral group each mineral belongs to.

2. You will see that most of the minerals are made up of a metal and a non- metal component. Indicate which metal groups the metal belongs to.

3. Choose 8 of the minerals, create a table and describe their physical properties of colour, crystal system, hardness, lustre, streak, metallic/non-metallic, crystal system (shape), specific gravity, other properties such as smell, magnetism, malleability, conductivity.

4. On the table indicate whether the mineral is an element or compound by indicating whether it is homogeneous or heterogeneous.

5. Saskatchewan is abundant in mineral resources some are currently being mined, some have been mined in the past and others could be mined in the future. List the minerals associated with each type of mining project below.

| Potash-Salt | Uranium | Gold | Copper | Lead - Zinc | Diamonds | Sodium Sulphate |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |

6. Identify the elements and number of atoms of each in the compounds listed below.

| Compound/element name | Formula | Element: number of atoms in compound |
|---|---|---|
| **Sodium** | | |
| **Carbon** | | |
| **Water** | | |
| **Calcite (calcium carbonate)** | | |
| **Sulphate** | | |
| **Sylvite** | | |
| **Halite** | | |
| **Pyrite** | | |
| **Galena** | | |
| **Uraninite** | | |
| **Quartz** | | |

7. Many of the minerals listed are minerals used to define Moh's scale of mineral hardness. If you have access to mineral samples, determine conduct the scratch test to determine/confirm the hardness for those minerals available to you. Using the information provided on the mineral cards, and the websites **http://geology.com/minerals/mohs-hardness-scale.shtml** and **wikipedia**, search for the hardness of the other Saskatchewan minerals and fill in below.

**Relative hardness scale with talc the softest at 1 and diamond the hardest mineral at 10.**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| talc | | | | | | | | | diamond |

**thenardite** **uraninite**

**BARITE $BaSO_4$**

Commonly found in limestone or hot spring deposits. Usually white or light brown. Sometimes crystallizes into rose shapes, which are popular with collectors. Used in drilling mud, paints, and in medical applications.

**ZIRCON $ZrSiO_4$**

Found in nearly all igneous rocks, although in very small amounts. Because it is so hard, it is used as a gemstone in jewelry. Also used in the age dating of rocks.

**HEMATITE $Fe_2O_3$**

Hematite is a major ore (source) of iron. The name "hematite" comes from its blood-red color ("hema" means blood). Found in alteration zones around uranium deposits.

**QUARTZ $SiO_2$**

Quartz is used in electronics, as a gemstone, and in the manufacturing of glass (where it is the main component. Quartz has a hardness of 7.

**CORRUNDUM $Al_2O_3$**

Corundum has a hardness of 9. It is so hard that it is used in industry as an abrasive (like sand paper). Blue corundum is the gemstone called sapphire, and red is ruby.

**CALCITE $CaCO_3$**

Calcite is is one of the most common minerals in the world. Optical grade calcite was used in WW2 to make gun sights. It is the main mineral in the rock limestone. Calcite hardness is 3.

**FLUORITE $CaF_2$**

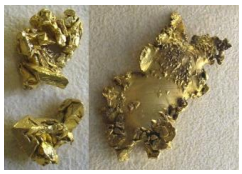
Fluorite ranges from colourless to green and purple. Under UV light it fluoresces. Fluorite has a hardness of 4 on Moh's scale. It is used as a flux in steel manufacturing and the production of hydrofluoric acid.

**TALC $Mg_3Si_4O_{10}(OH)_2$**

Talc is extremely soft with a hardness of 1. You can scratch it with your fingernail! Talc is the main ingredient in talcum powder.

**FELDSPAR $(K,Na,Ca)AlSi_3O_8$**

Feldspar is one of the rock forming minerals. It has a hardness of 5. Potassium feldspar ($KAlSiO_2$) and quartz are the main mineral components of the rock granite.

| | | |
|---|---|---|
| **GYPSUM (SELENITE) $CaSO_4 * 2H_2O$**<br>  <br>Gypsum is a soft mineral, with a hardness of 2. It is one of the main ingredients in plaster and plasterboard. Selenite crystals can be found growing in the soils in areas underlain by anhydrite. | **DIAMOND/GRAPHITE C**<br>   <br>Diamonds, and the "lead" in your pencil are made of the same thing: carbon. The difference is how the atoms are bonded together. Diamonds, have been found east of Prince Albert and north of Dechambault Lake. Graphite is mostly used in batteries, steelmaking, brake linings, and lubricants. Graphene which occurs in graphite might be one of the strongest substances known. | |
| **PYRITE $FeS_2$**<br>  <br>This mineral is commonly called "fool's gold" because of its golden color and metallic luster. With a hardness of 6, it is much harder than real gold. Pyrite is commonly associated with economic mineral deposits. | **CHALCOPYRITE $CuFeS_2$**<br>  <br>Chalcopyrite is brassy to golden yellow. It is the main ore of copper. Major deposits occur in volcanic rocks around Creighton and Amisk Lake. | **GOLD Au**<br>  <br>Gold is dense, soft, malleable and conductive. It often occurs in its elemental form (pure gold). Gold is found in volcanic rocks north of La Ronge and is being mined north east of La Ronge. |
| **GALENA PbS**<br>  <br>Galena is very dense (heavy) because of the lead in it. It is the most important source of lead and an important source of silver. Lead and silver are currently being mined along with copper and zinc near Creighton. | **SYLVITE KCl**<br>  <br>Sylvite<br>  <br>Potash ore<br>Sylvite is the potash mineral mined in south and central Saskatchewan. It's main use is as fertilizer. It is commonly found with halite. Sylvite is also Saskatchewan's provincial mineral. | **HALITE NaCl**<br>  <br>Halite is commonly known as table salt. In Saskatchewan it is produced as a bi-product of potash mining and also mined at Unity and Saskatoon. |

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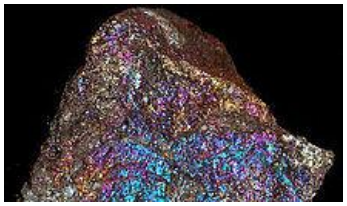
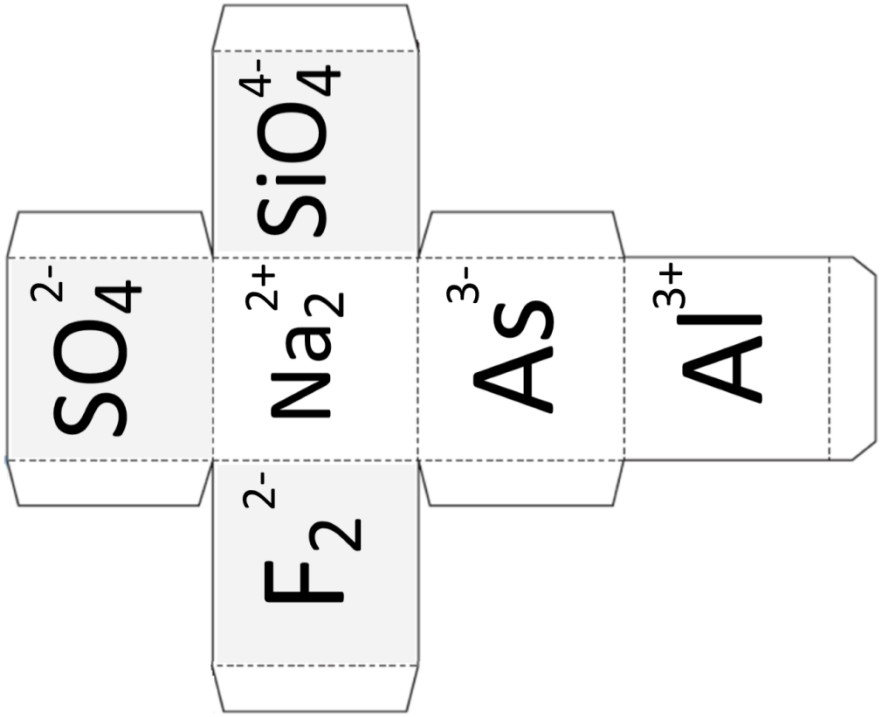
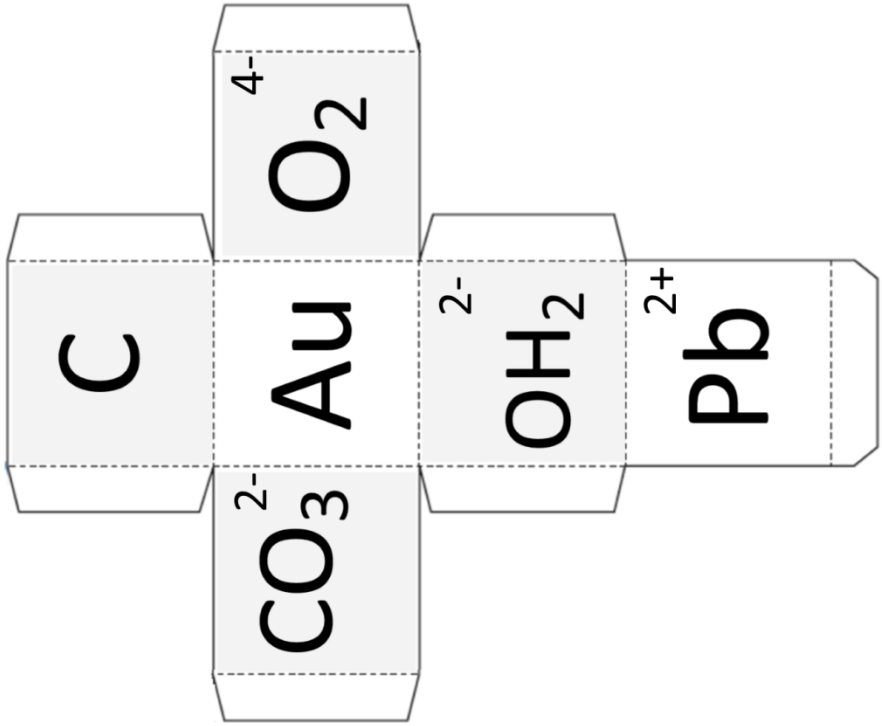
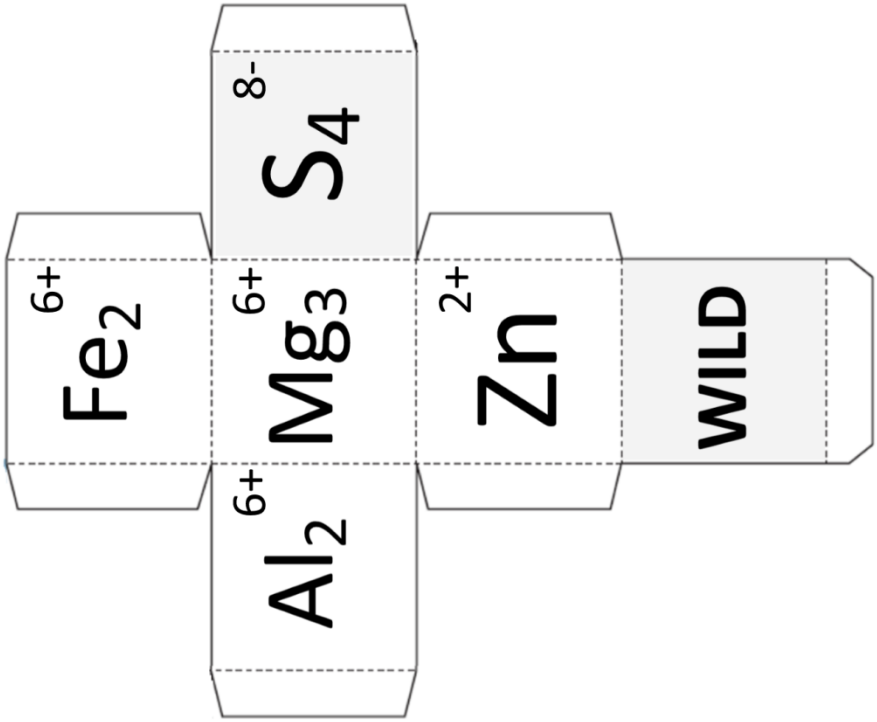
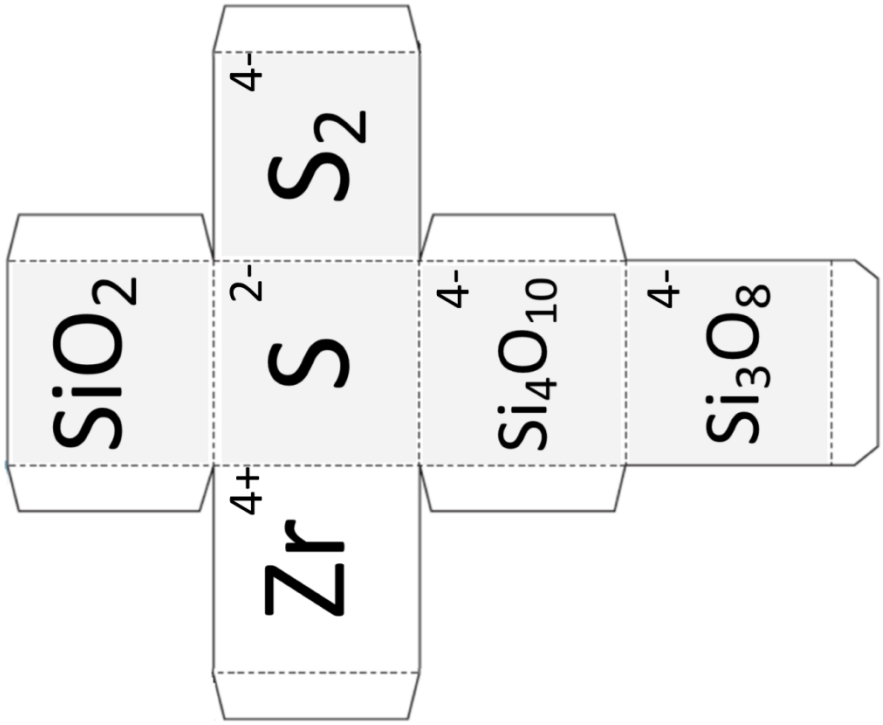
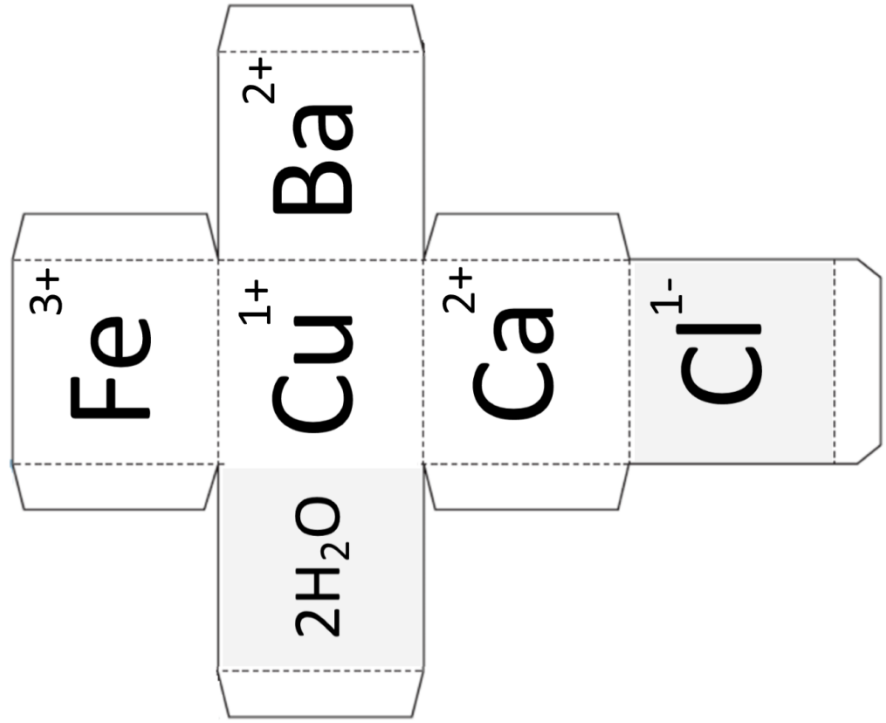
| **URANINITE $UO_2$**<br>   <br>yellowcake<br>Uraninite is a black, radioactive mineral and the major ore of uranium. The ore is processed into Uranium Oxide U3O8 (yellowcake). Saskatchewan's uranium deposits occur in the Athabasca Basin in northern Saskatchewan. | **ARSENOPYRITE FeAsS**<br>  <br>Arsenopyrite is the primary ore for arsenic. It is commonly associated with gold deposits. It is a steel grey, metallic mineral. | **BORNITE $Cu_5FeS_4$**<br>  <br>Bornite is also know as peacock ore due to its metallic shades of blues and purples. It is a major ore of copper. |
| | **SPHALERITE ZnFeS**<br>  <br>This mineral is the main ore of zinc. It is commonly found associated with galena and pyrite. When scratched it smells like rotten eggs. Sphalerite occurs in volcanic rocks and was one of the minerals mined along with chalcopyrite at Creighton. | **THENARDITE $Na_2SO_4$**<br>   <br>Sodium sulphate is at Chaplin Lake (the white mounds along the roadside). Sodium sulphate is used in detergents, pulp and paper, textiles, starch, carpet deodorizers and livestock mineral feed. |

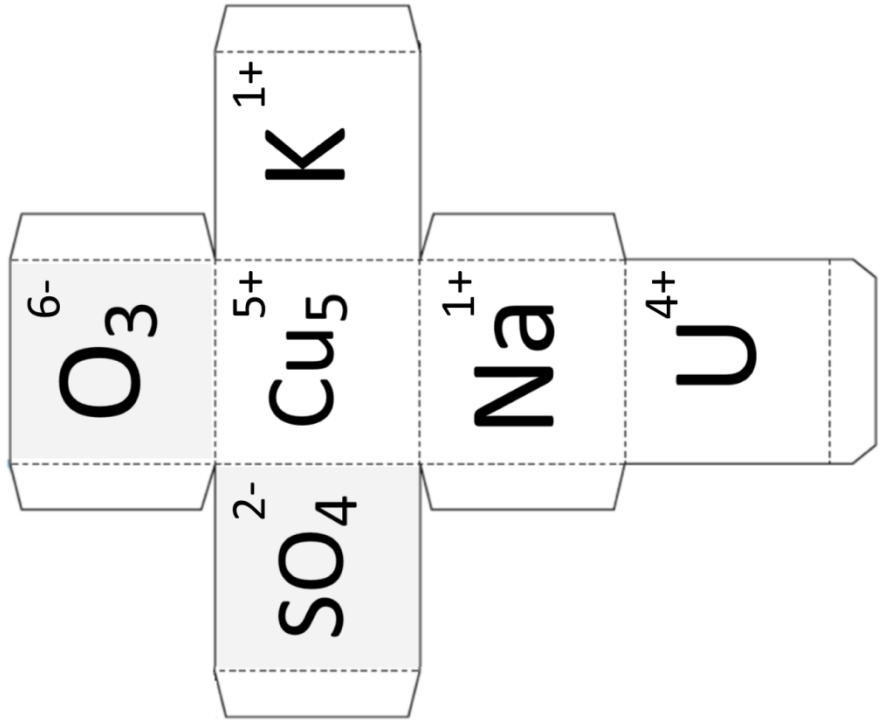

$SiO_4^{4-}$
$SO_4^{2-}$
$Na_2^{2+}$
$As^{3-}$
$Al^{3+}$
$F_2^{2-}$


$O_2^{4-}$
C
Au
$OH_2^{2-}$
$Pb^{2+}$
$CO_3^{2-}$


6+
$Fe_2$
8-
$S_4$
6+
$Mg_3$
6+
$Al_2$
2+
Zn
WILD


$SiO_2$
4-
$S_2$
2-
S
4+
Zr
4-
$Si_4O_{10}$
4-
$Si_3O_8$


3+
Fe
1+
Cu
2+
Ca
1-
Cl
2+
Ba
$2H_2O$


6-
$O_3$
5+
$Cu_5$
1+
Na
4+
U
1+
K
2-
$SO_4$