Step 1: Common Elements
What are the common elements in the pictures?
1.  
2.  
3.  
4.  
5.  
6.

Step 2: Zoom in on a Penny
What are the two elements that a penny is composed of?

Step 3: Atomic Models
List the three subatomic particles that make up atoms. Give the mass and charge of each one.

<table>
<thead>
<tr>
<th>Particle</th>
<th>Mass</th>
<th>Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Step 4: Build Atoms Yourself
1. How many electrons can fall in the first shell? ____ second? ________
2. What is the element called when all particles are used in the atom? ________
3. What is this elements atomic mass: ____________ atomic number? __________

Step 5: Build More Atoms
1. If the nucleus of an atom were the size of a basketball, where would the nearest electron shell be?
2. Which particle controls what element an atom is? __________________________
3. What do you get when you change the number of neutrons in the nucleus? ______________
4. Try to cluster the electrons together or move them into another level. Describe the behavior of the model electrons.

Step 6: Reading the Periodic Table
To answer the questions below click on the link at the bottom of page 6 and click on the specific element
1. How much does a ton of oxygen approximately cost? ______________
2. When was neon discovered? ___________________
3. Before 1925 was aluminum called? ____________________
4. What is the symbol for iron? __________
5. What is the term used to express the amount of gold present? ______________
Chapter 8

Earth Chemistry

Review
Choose the best response. Write the letter of that choice in the space provided.

1. Color and hardness are examples of an element’s
   a. physical properties.  
   b. chemical properties.  
   c. atomic structure.  
   d. molecular properties.

2. A substance that cannot be broken down into a simpler form by ordinary chemical means is
   a. a mixture.  
   b. a gas.  
   c. an element.  
   d. a compound.

3. The smallest unit of an element is
   a. a molecule.  
   b. an atom.  
   c. an ion.  
   d. an electron.

4. Particles in atoms that do not carry an electrical charge are called
   a. neutrons.  
   b. nuclei.  
   c. protons.  
   d. ions.

5. The number of protons in the nucleus indicates the atom’s
   a. mass number.  
   b. electrical charges.  
   c. isotope.  
   d. atomic number.

6. The mass number of an atom is equal to its
   a. total number of protons.  
   b. total number of electrons and protons.  
   c. total number of neutrons and protons.  
   d. total number of neutrons.

7. Atoms of the same element that differ in mass are
   a. ions.  
   b. isotopes.  
   c. neutrons.  
   d. molecules.

8. A material with a definite shape and volume is a
   a. compound.  
   b. liquid.  
   c. gas.  
   d. solid.

9. A liquid does not have a definite
   a. shape.  
   b. volume.  
   c. chemical formula.  
   d. mass.

10. If a gas is not confined, the space between its particles will
    a. decrease slowly.  
    b. decrease rapidly.  
    c. increase.  
    d. not change.
Chapter 8

Choose the best response. Write the letter of that choice in the space provided.

11. Atoms of two or more elements that are chemically united form
   a. a mixture.   b. a nucleus.   c. an ion.   d. a compound.

12. An atom does not easily lose or gain electrons if it has
   a. many protons.   b. a filled outer energy level.   c. many energy levels.   d. few neutrons.

13. A molecule of water, or H₂O, has one atom of
   a. hydrogen.   b. helium.   c. oxygen.   d. osmium.

14. A material that contains two or more substances that are not chemically combined is
   a. a mixture.   b. a compound.   c. an ion.   d. a molecule.

Critical Thinking

Read each question or statement and answer it in the space provided.

1. Oxygen combines with hydrogen to form water. Is this process a result of the physical or chemical properties of oxygen?

2. What distinguishes an atom of one element from atoms of all other elements?

3. Why do isotopes of an element have different mass numbers?
Chapter 8
Read each question or statement and answer it in the space provided.

4. The mercury in a thermometer has a volume that varies with temperature. It takes the shape of the glass tube that holds it. Is the mercury in a thermometer a solid, a liquid, or a gas?

5. Calcium chloride is an ionic compound. Carbon dioxide is a covalent compound. Which of these compounds would you expect to have a lower melting point? Explain your answer.

6. Is a diatomic molecule more likely to be held together by a covalent bond or an ionic bond? Explain why you think this is so.

7. What happens to the chemical properties of a substance when it becomes part of a mixture?
Chapter 8

Application

Read each question or statement and answer it in the space provided.

1. How many neutrons does a potassium atom have if its atomic number is 19 and its mass number is 39?

   

2. The atomic number of calcium is 20, and the atomic number of copper is 29. Which has more electrons, a calcium atom or a copper atom? How do you know?

   

3. A helium atom has two electrons in its first and only energy level. Would you predict that helium easily forms compounds with other elements? Why or why not?

   

4. The chemical formula of glucose (sugar) is C₆H₁₂O₆. How many atoms of each element does a molecule of glucose contain?

   

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Please go to my E-notes page labeled “Geology I” and click on “Wildfire.”
With your partner(s) please answer all of the questions below by going through each step on the website.

1. **ES0201 Wildfire!**
   In the year 2000, how much did the U.S. spend on fighting forest fires? ______________________

2. **ES0201 Fire Science and the Scientific Method**
   What are the steps involved in approaching a problem like wildfires scientifically?
   _______________________ . _______________________ . _______________________ .
   _______________________ . _______________________ . _______________________ .

3. **ES0201 Conditions That May Affect Fire Potential**
   What would be the scientific approach to managing firefighting resources efficiently?
   ________________________________________________________________________________
   ________________________________________________________________________________

4. **ES0201 Relative Greenness**
   What does a high percentage relative greenness mean? ________________________________

   What does a low percentage relative greenness mean? ________________________________

   Rate the potential for a wildfire for each of the fire sites, using a scale of 1 to 5. Assign a 1 to an area you believe is not likely to burn; assign a 5 to an area you think is almost certain to burn. (You can assign the same rating to several sites if they all have the same potential for fire. Rate each site independently of the others rather than ordering them from lowest to highest risk).
   A _________  B _________  C_________  D _________  E _________

5. **E0201 Departure from Average Greenness**
   Examine the values at each site, and rate the risk of fire from 1 to 5 based on how much drier or greener than normal the site is. Use 1 to indicate a low potential for a fire; use 5 to indicate a high potential for fire.
   A _________  B _________  C_________  D _________  E _________

6. **ES0201 Live Moisture**
   What does a low live moisture level mean? ________________________________

   What does a high live moisture level mean? ________________________________

   Rate the risk of fire at each from 1 to 5 based on the live moisture level:
   A _________  B _________  C_________  D _________  E _________

7. **ES0201 Temperature**
   Record your fire potential rating for each site based on its temperature.
   A _________  B _________  C_________  D _________  E _________

8. **ES0201 Relative Humidity**
   What is relative humidity?
   ________________________________

   Record your fire potential rating for each site based on its relative humidity.
   A _________  B _________  C_________  D _________  E _________
9. **ES0201 Wind Speeds**
How can wind speed strengthen a wildfire?

Record your fire potential rating for each site based on its wind speed.

<table>
<thead>
<tr>
<th>Site</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>_______</td>
</tr>
<tr>
<td>B</td>
<td>_______</td>
</tr>
<tr>
<td>C</td>
<td>_______</td>
</tr>
<tr>
<td>D</td>
<td>_______</td>
</tr>
<tr>
<td>E</td>
<td>_______</td>
</tr>
</tbody>
</table>

Add all the ratings for each site to come up with a total for each

<table>
<thead>
<tr>
<th>Site</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>_______</td>
</tr>
<tr>
<td>B</td>
<td>_______</td>
</tr>
<tr>
<td>C</td>
<td>_______</td>
</tr>
</tbody>
</table>

Divide each total by six to come up with an average rating of the fire potential at each site

<table>
<thead>
<tr>
<th>Site</th>
<th>Average Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>_______</td>
</tr>
<tr>
<td>B</td>
<td>_______</td>
</tr>
<tr>
<td>C</td>
<td>_______</td>
</tr>
</tbody>
</table>

According to your ratings, which of the five sites has the highest risk of fire? Which site has the lowest risk?

____________,  ____________

10. **ES0201 Fire Danger**
Describe how well or how poorly your fire potential ratings correlate with the national fire danger map.

_____________________________________________________________________________________

11. **ES0201 Improving the Model**
Of the six conditions you rated, which do you think are the most important predictors of fire? Which do you think are least important? Describe your reasoning.

_________________________________________________________________________________

_________________________________________________________________________________

How could you modify the rating system to give more weight to the most important predictors?

_________________________________________________________________________________

_________________________________________________________________________________
<table>
<thead>
<tr>
<th>Element Name</th>
<th>Element Symbol</th>
<th>Atomic Number</th>
<th>Atomic Mass (Listed)</th>
<th>Atomic Mass (Rounded)</th>
<th>Number of Protons</th>
<th>Number of Electrons</th>
<th>Number of Neutrons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon</td>
<td>N</td>
<td>8</td>
<td>20.179</td>
<td>108</td>
<td>74</td>
<td>79</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>82</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>92</td>
</tr>
</tbody>
</table>
Geology I Student Notes

Chapter I and 8

Vocabulary:
Please number and identify each term below on a separate sheet of paper, the first column will be your first vocabulary assignment (For those that are *, please illustrate).

Biosphere*
Astronomy*
Hypothesis
Experimentation
Scientific Methods
Theory
Atom*
Atomic Number*
Chemical Property
Compound
Electron*
Electron Cloud
Ion*
Ionic bond*
Mass Number*
Matter
Neutron*
Nucleus
Proton *
Smog*
Ecology
Observation
Variable
Chemical Bond
Covalent Bond*
Energy Level
Gas*
Isotope
Mixture
Periodic Table*
Solid*
Geology
Scientific Law
Alloy
Chemical Formula
Diatominc
Gas
Liquid*
Molecule
Physical Property
Solution

Chapter 1 Intro to Earth Science

1.1. What is Earth Science?
1. How did ancient people explain natural phenomena such as Earthquakes?
   - Myths and legends- earthquakes due to __________________________________________
2. What assumption is needed to discover new theories in the earth Sciences?
   - A scientist needs to use careful __________________________________________
3. What does geology deal with?
   - Origin, history and structure of the solid Earth and __________________________________________
4. List six different fields in oceanography?
   1. Waves
   2. ________________
   3. Ocean Currents
   4. __________________________________
   5. Mineral Deposits
   6. ______________________
5. List at least 6 tools that a meteorologist would use?
   1. ________________
   2. Air gauge
   3. ________________
   4. Satellites
   5. Radar
   6. Computer data
6. What is the oldest field of Earth Science? ______________________
7. What type of training would an ecologist need?
   - A strong background in _____________________________
8. Why might the study of Earth Science contribute to the survival of the biosphere?
   - Many fields of Earth Science (climate, volcanoes, earthquakes, hydrology) deal directly with the survival _____________________________

1.2. Scientific Method
1. Summarize the general flow of steps of the Scientific Method:
   1. ________________
   2. ________________
   3. ________________
   4. __________________
   5. __________________
   6. __________________
2. How is a variable used in a controlled experiment?
   - A variable is a factor in an experiment that can be ____________, only one variable can be tested at a time, this is why scientists will also run a ____________________________ where a variable is not being changed

1.3. Birth of a Theory: The Big Bang
1. How is a theory different from a hypothesis?
   - A hypothesis has been tested over and over becomes a ____________________________
   - A consensus of scientists agree with the hypothesis and the theory provides a general
     explanation that are consistent with ______________________________

2. How is a theory different from a scientific law?
   - A law differs from a theory by when a law is tested over and over and is proven correct every
     time it is tested, it is never ________________________________

3. What is our best evidence that the Universe is expanding?
   - Galaxies showing _________________ in their spectra, this would be the known facts that
     support the Big Bang Theory

Chapter 8 Earth Chemistry

8.1 Matter

1. What is matter defined as?
   - Anything that takes up ______________________________________

2. What are the two major distinguishing features of matter, how are they different?
   - ____________________- characteristics that can be observed without changing the composition
     of the substance (density, color, hardness, freezing point, etc.)
   - ____________________- characteristics that describe how a substance interacts with other
     substances to produce different kinds of matter, (iron and oxygen interact to produce rust)

3. How is an element different than matter?
   - ____________________ cannot be broken down into a simpler form, matter can

4. How many elements occur naturally on Earth, what are the two most abundant?
   - ____________ elements occur naturally
     - ____________ (27.7%) and ____________ (46.6%) are the two most abundant

5. How many atoms fit into the thickness a single page, how are they related to elements?
   - Smallest form of an _______________, it would take over a million atoms lined to equal the
     thickness of _____________________

6. List and describe the 5 parts of an atom and
   - ____________________- subatomic particle found outside of the nucleus that has a negative charge
   - ____________________- subatomic particle found in the nucleus that have a positive charge
   - ____________________- subatomic charge found in the nucleus that do not have a charge
   - ____________________- protons and neutrons are packed close together making up a small
     region at the center of an atom
   - ____________________- the rest of the atom outside of the nucleus where electrons are found

7. What does the atomic number determine in an atom, where does it appear on the periodic table?
   - The total number of _____________ in an atom- top number in box of each element on the
     periodic table, the atom is naturally neutral, so the atomic number also equals=

8. What does the mass number determine in an atom, where does it appear on the periodic table?
   - The total number of ___________________________ in an atom, the bottom number in the box
     of each element on the periodic table

9. Why are electrons ignored when calculating the atomic mass?
   - Electrons have very little mass, one proton mass = ________________________ in mass

10. What subatomic particles do atoms always have the same amount of, what can differ?
   - The number of protons are always ___________________________, neutrons can differ, they are
     called ______________________(have a different mass number)
-Hydrogen has isotopes called ______________ (1 proton and electron, no neutron),
______________ (1 proton, electron and neutron, different mass number) and
_____________ (1 proton and electron, 2 neutrons, what is its atomic number and mass number?)

11. How is matter classified, how are these forms different?
- __________- definite shape and volume
- __________- definite volume but not a definite shape
- __________- does not have a definite shape or volume

8.2 Combination of Atoms
1. How is a compound different than a molecule?
   - A compound is two or more ______________ chemically united, the
     ______________ is the smallest unit of a compound (water molecule- two hydrogen and
     one oxygen atoms)
2. What type of atoms give up electrons relatively easy?
   - Atoms with 1-3 electrons in the outermost level usually elements with ______________
     (examples Aluminum (Al), Copper (Cu), Gold (Au))
   - Atoms such as Carbon (C), Nitrogen (N) and Oxygen (O) have 4-6 electrons and don’t
     ______________
3. How is a chemical bond produced?
   - The interaction of electrons from the ______________ of two or more atoms
4. How is an ionic bond different than a covalent bond?
   - ______________ - electrons are transferred from one atom to another producing an ionic
     compound
     - Both atoms become electrically charged and are called ions (Sodium becomes positive
     and Chlorine becomes negative= NaCl)
     - ______________ - electrons are shared based on the attraction between atoms
     - A water molecule is an example of a covalent bond
   - Ionic bonds are far stronger than covalent bonds
5. How are various molecules and compounds represented?
   - By a ______________: H₂O, NaCl
6. How is a mixture different than a compound or element, what are some examples?
   - Mixtures contain two or more substances that are not ______________
     - Examples: rocks, mixture of gases in atmosphere (smog), soil
7. How is a solution different than a mixture, what are some examples?
   - Solution is a mixture in which one substance is uniformly dispersed in another substance
     - Examples: ______________, ______________ such as brass (zinc and copper) and bronze
     (copper and tin)
ACTIVITY 1.2: Role of the Geologist

Objective: To summarize the magazine article "Role of Geologists in Wise Use of Earth."

Materials: Article "Role of Geologists in Wise Use of Earth," writing instrument, and ACTIVITY 1.2 form.

Procedure: One of the first problems you may encounter in any course is reading the text material, not because it is difficult reading but because you do not stop to realize what you have read. An easy method to overcome this is to stop a moment after reading each paragraph and try to summarize the general idea of the paragraph in a few words. For practice, carefully read "Role of Geologists in Wise Use of Earth." Then, in the blanks numbered for each consecutive paragraph in the article, write in a few words what you feel is the main idea of each paragraph.

1. 
2. 
3. 
4. 
5. 
6. 
7. 
8. 
9. 
10. 
11. 
12. 
13. 

Below, in two or three sentences, give the general idea of the whole article.
Role of Geologists in Wise Use of Earth

Mason L. Hill
Whitney, California

The science of geology is becoming more important to mankind as demands increase for more natural resources and less environmental hazards. Therefore, more people should have a better understanding of this subject and its applications and limitations in solving important human problems. And more geologists must be trained to further study and apply this science for the benefit of man.

Geologists are becoming more and more indispensable as six principal problems of mankind become more and more pressing. These problems can be expressed as follows: 1) population is increasing whereas mineral resources are becoming depleted, 2) conflict is increasing between the “haves” and the “have-nots”, 3) conflict is increasing between man and other forms of life, 4) competition for the use of land and water areas is intensifying, 5) pollution of air, water and land is, in places becoming intolerable, and 6) natural catastrophes are taking an increasing toll of life and property.

Apollo missions have dramatically confirmed the isolation of life on our “blue planet”. The Moon’s anhydrous and chemically unaltered igneous rocks prove that it has no concentrations of mineral deposits or fossil fuels for our exploitation.

The Earth’s population of 3.8 billion, perhaps going to 12 billion by the year 2020, places excessive pressure on the finite supply of material resources. The essential minerals of the Earth are nonrenewable because, for example, it takes thousands to millions of years to make petroleum or copper ore, whereas people, like weeds, can replenish and multiply themselves from seeds. Furthermore, fossil fuels are not even recyclable, and substitutes for most purposes are unknown or quantitatively insignificant. Geologists are the ones who know and are learning about the habitats of minerals resources, therefore more geologists are required in an effort to find these resources for both the short-term and long-term benefits of mankind.

The affluent people of the world continue to strive for more and more “goodies”, while poor people are striving even harder to get their share. This conflict means that as the population expands both the “haves” and the “have-nots” of this world, except for a few people under special circumstances, will have to get along on less and less of the material wealth of the world. However, the rate of the inevitable deterioration in living standards can be retarded by successful exploration geologists.

Much is known about endangered species and ecologic balance, but who knows the relative importance of man or natural selection in causing faunal and floral extinctions? It has been estimated that 98% of all species known to have existed during the history of the Earth have become extinct. Geologists, paleontologists and biologists can contribute to providing the proper balance between man and his activities with other forms of life on this planet.

With competition for the use of land intensifying, including increased pressures to use less desirable and inappropriate terrains, choices need to be made for single or multiple purposes versus preservation of the natural state. Geologists are the ones who know and are learning about the stability of ground under various geologic conditions and can give important advice on the best use of specific lands for specific purposes.

Pollution of air, water and land increases as the wastes resulting from the activities of people, especially the affluent, increase on this finite globe. Some of the pollutants, such as mercury and lead in organic tissues, are cumulative and nonreversible. Geologists can contribute their share of good science and technology to minimize the sources of pollution.

Disasters such as those resulting from earthquakes, volcanic eruptions and landslides become greater as more and more people congregate in areas which are especially vulnerable to geologic hazards. Geologists are the ones who know and are learning to cope with such natural catastrophes. (In the case of earthquakes, geologists can attempt to locate potential and significant earthquake-generating faults for the possible protection of life and property. Too often, however, their partly subjective and qualitative conclusions are translated into unjustified legislation and quantitative engineering.)

All in all, with the population increasing and nonrenewable resources decreasing, the long-term future of mankind appears dismal. The economic and environmental costs of required materials, perhaps especially the fossil fuels, will gradually become too great; man will be rationed and probably forced to exist under one-world dictatorship; and, if he lives that long, he may evolve into a one-race, barely surviving, with dwindling population preceding eventual species extinction.

However, this pessimistic long-term view of the future should be accepted as a challenge by optimistic people, especially geologists, to help postpone what seems inevitable as long as possible. They must try to balance: 1) supplies of minerals with the needs of people, 2) living conditions between the “haves” and “have-nots”, 3) man’s ecology with that of other life forms, 4) uses of land with conservation of nature, 5) essential activities of man with tolerable environmental pollution, and 6) geologic hazards with the protection of life and property.

In short, geologists are indispensable in attacking the principal problems of mankind on our isolated “blue planet”, because they are the ones who, by training and experience, can provide some of the best advice on the wise use of the Earth for present and future generations.

There is a challenge to educational institutions to provide more and better geologists. It is even more important to educate the general public about the subject and its applications so that the democratic process will be more effective in solving these critical problems. This probably requires some revised educational approaches in order to expose more elementary and high school students to geology. Surely these exposures will kindle the interest of many in the fascinating problems and important applications of this subject. Thus, the desire to study geology at the university level could be increased in order to provide a more knowledgeable electorate.