Dan Carlson
Science Methods
Solo Unit
4 December 2007

GRADE 8	III. EARTH AND SPACE SCIENCE	A. Earth Structure and Processes	The student will identify Earth's composition, structure and processes.	1. The student will explain how earthquakes, volcanoes, sea-floor spreading and mountain building are evidence of the movement of crustal plates. 2. The student will describe how features on the Earth's surface are created and constantly changing through a combination of slow and rapid processes of weathering, erosion, sediment deposition, landslides, volcanic eruptions and earthquakes. 3. The student will describe the various processes and interactions of the rock cycle. 4. The student will interpret successive layers of sedimentary rocks and their fossils to document the age and history of the Earth. 5. The student will recognize that constructive and destructive Earth processes can affect the evidence of Earth's history. 6. The student will classify and identify rocks and minerals using characteristics including but not limited to density, hardness and streak.

Unit includes:
- Notes for teacher presentations
- Note handouts for student participation
- Lab exercises
- Unit quiz

Additional recommended Materials
- Rock Cycle poster
- Geological Map of the Earth
- Rock and mineral kits
- Hardness kit

Additional recommended projects
- Poster projects
  - Mountain Building
  - Minnesota Geology
  - Plate boundaries and movement
- Field Trip ideas
  - Science Center of Bemidji or Minnesota
  - College/University Geology program tour

Chapter 21
Minerals and Rocks

Geology – The study of planet Earth – its composition, structure and history.

I. Minerals – A naturally occurring, crystalline, inorganic substance (element or compound) that possesses a fairly definite chemical composition and a distinctive set of physical properties. Oxygen and silicone make up 75% of Earth's crust, and of the 2000 different minerals only 20 are considered common.

A. Silicates
1. Most rock-forming minerals are composed mainly of oxygen and silicon.
2. The fundamental silicon-oxygen compound is silicon dioxide, or silica, SiO_2.
3. In silica, the oxygen-to-silicon ratio is 2 to 1.
4. the ratio in the silicates is greater than 2 to 1, such as, SiO_4.
5. Feldspars are the most abundant minerals in Earth's crust.
   a. Plagioclase feldspar – contains oxygen, silicon, aluminum, and calcium or sodium.
   b. Potassium feldspar – contains oxygen, silicon, aluminum and potassium.

B. Non-silicate minerals
1. Constitute less than 10% of Earth's crust
2. They include valuable native elements such as gold and silver, and gemstones, such as diamonds and sapphires.
3. Ores of useful metals such as iron, copper, nickel, and tin.
4. Most Common non-silicates
   a. Carbonate minerals – calcite
   b. Oxide minerals – iron
   c. Sulfide minerals – chalcopyrite ($CuFeS_2$)

C. Identifying Minerals.
1. Classification of mineral based on physical and chemical properties of substances.
2. Distinguishes between different forms of mineral composed of the same element or compound.
   a. Example: Graphite and diamond – both composed of just carbon atoms
3. Physical identification is most common since chemical identification is expensive.
4. Definitions
   a. Crystal Form – the size and shape of the crystal faces
   b. hardness – comparative property that refers th the ability to resist scratching.
      i. Mohs' scale of hardness based on ten minerals from talc, the softest at a hardness value of 1, to diamond, the hardest at a value of 10.
   c. Cleavage – the tendency of some minerals to break along definite smooth planes.
   d. Fracture – the way in which a mineral breaks.
   e. Color – property of reflecting light of one or more wavelengths.
   f. Streak – the color of the powder of a mineral
   g. Luster – appearance of the mineral's surface in reflected light.
   h. Specific Gravity – a ratio of a mineral sample's weight to the weight of an equal volume of water.

II. Rocks – a natural and substantial part of Earth's crust.

A. Three classifications of rocks
1. Igneous
2. Sedimentary
3. Metamorphic

B. The Rock Cycle
1. Uniformitarianism
   a. Ancient rocks formed in the same way as modern rocks
   b. The foundation of Geology

c. The present is the key to the past.

2. Rocks are continuously being formed, broken down, and reformed as a result of igneous, sedimentary and metamorphic processes.

III. Igneous Rocks (80% of Earth's crust) – formed when molten material from far beneath Earth's surface cools and solidifies.

- Magma – molten material below Earth's surface.
- Lava – magma that reaches Earth's surface.

A. Igneous Rocks and Plate Tectonics

1. Plate Tectonics – Earth's crust is divided into plates.
2. Lithosphere – Earth's thin outer crust.
3. Asthenosphere – semi-molten layer below the lithosphere.
4. Plate movement boundaries
   a. Convergent boundary – where plates are pushing against one another, such as the western coast of South America
   b. Divergent boundary – where plates are moving apart – Atlantic Ridge
   c. Transform Boundary – where plates slide past each other – San Andreas Fault.

B. Igneous Rock Texture and Composition

1. Intrusive and extrusive igneous rocks are classified by their texture, or physical appearance, and their mineral composition.
   a. Intrusive – igneous rocks formed below the Earth's surface
   b. Extrusive – igneous rocks formed above the Earth's surface – lava.
2. Grain size determined by rate of cooling of magma
   a. Fine-grained – cooled fast, such as basalt
   b. course-grained – cooled slow, such as granite

IV. Igneous Activity

A. Plutons – intrusive igneous rocks formed below the surface of Earth by solidification of magma.

B. Products of Volcanic Eruptions

1. What comes out of a volcano?
   a. Gases
   b. Lava
   c. Tephra – solids expelled from a volcano

C. Eruptive Style

1. Peaceful
   a. Magma is relatively low viscosity (hot)
   b. Low silica content
   c. Hawaiian Island's Hotspot
2. Explosive
   a. Magma is relatively high viscosity (cool)
   b. High silica content
   c. Mt. St. Helens eruption in 1980

D. Volcanic Structures

1. Fissure eruptions
   a. Lava flows from a long fracture
   b. Rare – only one in last 200 years in Iceland
   c. Form flood basalts
2. Shield volcano
   a. Frequently repeated lava flows
   b. Mauna Loa on Hawaii.
3. Strato volcano, or composite volcano
   a. Eruption of both lava and Tephra
   b. More steeply sloping
   c. Eruptions are more violent – Mt. St. Helens

4. Cinder Cones
    a. Volcanic eruption of mostly Tephra
5. Caldera
    a. Circular depressions formed from the collapse of the volcano's chamber

E. Historic Eruptions
1. Tambora, just east of Java, in 1815
    a. The largest known eruption.
    b. Enough volcanic material to change the weather around the world.
2. Mt. Pele'e, Martinique in the Caribbean Sea
    a. 1902 eruption devastated the island.
    b. Estimated 28,000 – 40,000 people killed.
3. Mt. St. Helens
    a. May 18th, 1980 in the state of Washington
    b. Days later we had dust falling here in northern Minnesota.

V. Sedimentary Rocks
- Rocks whose components have been derived from the wearing away of older rocks.
- Rain, wind, and ice break up rock and these particles are carried away as sediment.
- This sediment is redeposited and builds up in layers, or strata.

A. The origins of Sedimentary Rocks
1. Lithification – the transformation of sediment into a sedimentary rock.
    a. Sediment is compacted by the weight of overlaying material and eventually cemented together by silica, calcium carbonate, or iron oxide.
2. Sediments are classified into two main groups.
    a. Detrital sediments
        i. Composed of solid fragments from preexisting rock.
        ii. Classified based on size of components.
            (Show Breccia and Shale samples)
    b. Chemical sediments
        i. Composed of minerals that were transported to the sea in solution.
        ii. Classified into two groups
            a. Organic – skeletal and shell matter
            b. Inorganic – evaporated water leaves behind its sediments. (Leave a glass of water out to evaporate)

B. Sedimentary Characteristics and Structures
1. Smaller particles may be carried farther away from shore, while larger particles are deposited sooner.
2. Bedding, or stratification, is the layering that develops at the time the sediment is deposited.

VI. Metamorphic Rocks
A. Metamorphism is the process by which the structure and mineral content of a rock are changed while the rock remains in a solid state.
B. Three types of metamorphism.
1. Contact metamorphism – change is brought about by heat with very little pressure involved.
2. Shear metamorphism – rocks which are changed more by pressure than temperature.
3. Regional metamorphism – change is from both high temperature and high pressure.

Chapter 22
Structural Geology

I. Continental Drift and Sea Floor Spreading
A. Continental Drift – All of the continents were once connected and have been drifting either apart or together.

1. Pangaea – The single giant continent that broke apart into our current continents.
2. Evidence of Pangaea
    a. Biological evidence – same fossils found in South America and Africa
    b. Continuity of geological features – jigsaw puzzle
    c. Glacial Evidence – An ice sheet like that of Antarctica covered India, Australia and southern South America and southern Africa.

B. Seafloor Spreading
1. Mid-ocean Ridge – A ridge caused by seafloor spreading
2. Seafloor spreading – The seafloor spreads open and magna fills in the gap creating a ridge.
3. Deep-sea trenches
    a. The lowest places on Earth.
    b. Where the seafloor descends back into the mantle.

II. Plate Tectonics – The lithosphere is not a solid piece but a series of solid sections called plates that interact with each other.

III. Earthquakes and Earth's Interior. (Has anyone ever experienced an earthquake?)

A. The causes of Earthquakes
1. Explosive volcanic eruptions
2. Explosions caused by humans
3. Most are associated with plate movement
    a. Faults – rock on one side has moved with respect to rock on the other side of the fracture

B. Measuring an Earthquake
1. Epicenter – the location of the source of the earthquake.
2. Seismic waves – the energy released from an earthquake moving away form its center.
3. Richter Scale – measures the energy released
4. Mercalli Scale – measures the damage done

C. Earth's Interior – Earthquakes give valuable information to science about the interior of the earth.
1. Two types of seismic waves are produced by earthquake vibrations.
    a. Surface Waves travel along the outer layer of Earth.
    b. Body Waves travel through Earth.
        i. Primary Body Waves, P-waves, are compression waves which can travel through any material.
        ii. Secondary Body Waves, S-waves, are shear waves which only travel through solids.
    c. These waves allow seismologists to locate the source of earthquakes.
2. Four layers to Earth
    a. Inner Core – solid iron ball 1230 km thick
    b. Outer Core – metallic liquid 2240 km thick
    c. Mantle – rocky liquid 2930 km thick
        i. Asthenosphere – upper 700 km of Mantle
    d. Crust – rocky outer layer in which we live called the Lithosphere

IV. Crust Deformation and Mountain Building

A. Crust Deformation
1. Folding – rock is compressed until it begins to buckle and fold.
2. Faulting – fracturing leading to movement of material.

B. Mountain Building
1. Volcanic Mountains – built by volcanic eruptions
2. Fault-block Mountains – giant pieces of Earth's crust are tilted and uplifted.
3. Fold Mountains – folded rock strata

Chapter 23
Surface Processes

I. Weathering – the physical disintegration and chemical decomposition of rock at or near Earth's surface.
  A. Physical weathering – the physical disintegration or fracture of rock, primarily as a result of pressure.
    1. Frost wedging – water runs into cracks of rock and freezes breaking up the rock. (our roads in Minnesota)
    2. Occurs in temperate climates (like ushere in MN)
  B. Chemical Weathering
    1. Involves a chemical change in the rocks composition
    2. Requires heat and moisture
    3. Occurs in hot, moist climates

II. Erosion – the wearing away of soil and rock by weathering and downstream movement of soil and rock fragments.
  A. Streams – any flow of water occurring between well-defined banks
    1. Stream Load – the material transported by a stream
      a. Dissolved Load – dissolved water-soluble minerals carried by the stream
      b. Suspended Load – fine particles which are too light to sink
      c. Bed Load – course particles and rocks that are rolled and bounced along the bottom.
  B. Glaciers – large masses of ice.
    1. Formed over a number of years when more snow falls than melts
    2. The snow is compacted into solid ice and slides downhill when enough ice has formed
    3. Material is carved out by these glaciers
  C. Wind
    1. Generally associated with desert regions
    2. Dust storms – small particles are carried by the wind
  D. Waves – shoreline erosion
  E. Mass Wasting – the down slope movement of soil and rock under the direct influence of gravity.
    1. Fast Mass Wasting
      a. Land Slides – mass wasting of large blocks of weathered material.
      b. Mudflows – movement of large masses of material saturated by rains or ice melt.
    2. Slow Mass Wasting
      a. Slump – down slope movement of a large unbroken mass that carves its way down a hillside
      b. Creep – slow particle-by-particle movement of weathered debris down a slope.

III. Ground Water – Hydrological Cycle of Redistribution (draw on board)
  A. Groundwater Mechanics
    1. 98% of earth's water is saltwater.
    2. Of the 2% of freshwater, most is frozen in Greenland and Antarctic ice sheets.
    3. 0.6% of freshwater is ground water.
    4. Water Table is the level of ground saturation.
  B. Groundwater depletion and contamination
    1. We have been using excess groundwater and also contaminating the sources that are good.
    2. Bottled water is a very common item now.

Chapter 24
Geological Time

I. Fossils – any remnant or indication of prehistoric life preserved in rock.
  A. Paleontology – the study of fossils which is of interest to biologists and geologists also.
    1. Evidence preserved in several ways
      a. Original remains – includes insects in amber, mammals in ice, and shark teeth and shells

b. Replaced remains – the bones or shells of a buried organism can be slowly replaced by other minerals.

c. Molds and casts of remains – an imbedded bone or shell is dissolved and leaves a hollow mold which may fill with other material to form a cast.

d. Trace fossils – imprint by a moving animal including footprints, burrowing and etc.

II. Relative Geological Time – Geological events are recorded in the rocks and are placed in chronological order without regard for the actual dates.

A. Superposition – in a sequence of undisturbed sedimentary rocks, lavas, or ash, each layer is younger than the layer beneath it and older than the layer above it.

B. Units of Geological Time

1. Eons – the largest units of geological time
2. Eras – subdivisions of Eons
    a. Paleozoic era – age of ancient life
    b. Mesozoic era – age of reptiles
    c. Cenozoic era – age of mammals
3. Periods – subdivisions of Eras

III. Radiometric Dating (Absolute geological time) – the determination of age by using radioactivity (use of half-lives which we will cover in the next summer session)

A. Carbon Dating – dating organic remains by measuring the amount of Carbon-14 in an ancient sample

IV. The Age of Earth – Geologists are confident that they now have an accurate value for Earth's age at 4.6 billion years old.

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V. Geologic Time Scale – Relative geological time and absolute geological time are combined to give the geological time scale.

Special Properties of Minerals
Science 1110
Lab 19

Name and Section
1. _____
2. _____
3. _____
4. _____
5. _____

I. INTRODUCTION:

There are many techniques used by geologists to identify different rock and mineral samples. We will explore a few of those techniques in this lab.

MINERAL IDENTIFICATION:

1. COLOR: Some minerals are characterized by there color. A few of them are listed here. Please enter the distinguishing color for the mineral.

Sulfur_____ Azurite_____ Malachite_____ Orpiment_____

2. STREAK: This is the color of the powder of the mineral. Using the streak plate identify the color of the powder of the following minerals.

Talc_____ Ilmenite_____ Hematite_____ Galena_____

3. HARDNESS: The ability to scratch another mineral is used to comparatively determine the hardness of a mineral. Using the hardness kit provided determine the hardness of the following minerals.

Copper_____ Magnetite_____ Halite_____

4. Other Features that distinguish a mineral from others.

a. Place a piece of calcite on this lab sheet and look through it. What do you see? _____

b. What special property does magnetite have? _____

c. Some minerals have colors that we are unable to see except with the use of an ultraviolet light source. Using the mineral samples and ultraviolet light in the back room, identify the phosphorescent color of the following minerals.

Mineral	Color
Hackmanite (1)	_____
Scapolite (2)	_____
Opalite (3)	_____
Flourite (10)	_____
Aragonite (14)	_____

Science 1110
Experiment 10 and 11

Mineral Identification

Name _____

1. _____
2. _____
3. _____
4. _____
5. _____

Science 1110
Experiment 17 and 18

Rock Identification

Name _____ Section _____

1. _____
2. _____
3. _____
4. _____
5. _____

Seismic Waves and Epicenters of Earthquakes
Science 1110
Lab 20

Name and Section
1. _____
2. _____
3. _____
4. _____
5. _____

I. INTRODUCTION:

The purpose of this lab is to locate the epicenter of an earthquake based on the measurement of P and S seismic waves at three different locations on the globe.

What type of waves are P-waves? Transverse or Longitudinal

What type of waves are S-waves? Transverse of Longitudinal

PROCEDURE:

1. Measure the slope of the surface L wave on figure 1 and determine the wave speed.

Speed (mph) = 1/(slope) x 60 Slope = _____ Speed = _____mph

2. Which wave travels fastest: P or S or L? Which wave would arrive first: P or S?

3. Determine the time P and S waves arrive at each city using plots in figure 2. Enter this data in the table below.

4. Calculate the time difference between when the P and S waves arrive and enter in the table below

5. Match the time difference for each city with the corresponding difference in the arrival of the P and S waves in figure 1 to determine the distance in miles from the epicenter and enter the value in the data table below.

CITY	Time of P	Time of S	Difference (minutes)	Distance (miles)
Sitka				
Charlotte				
Honolulu				

6. We now know how far from each of the three cities the earthquake occurred. We can use this information to determine the epicenter of the earthquake. Use the provided compass and your calculated distance to draw a circle around each city in figure 3 using the scale at the bottom of figure 3. Where the three circles intersect will be the location of the epicenter of the earthquake.

7. What is the Latitude _____ and Longitude _____of the epicenter?

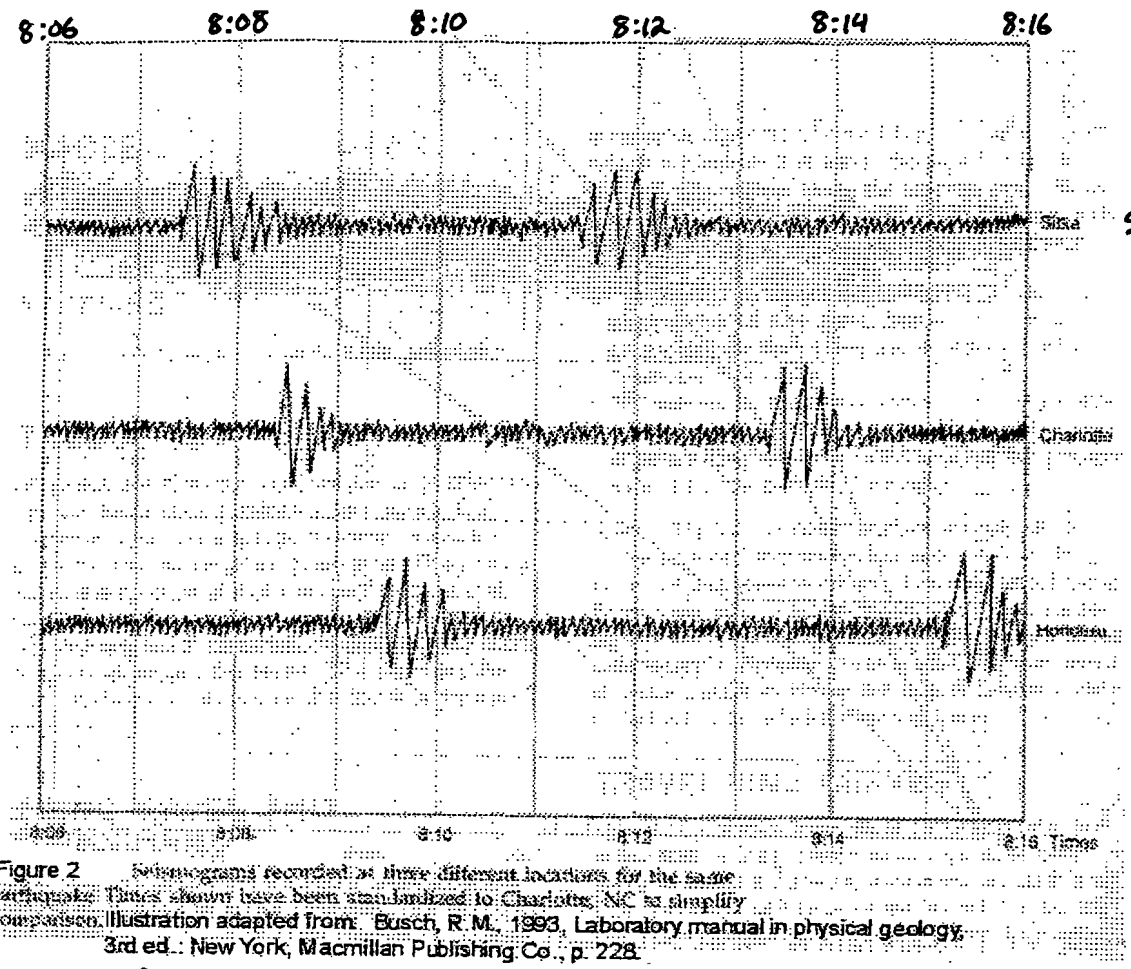


Figure 2 Seismograms recorded at three different locations for the same earthquake. Times shown have been standardized to Charlotte, NC to simplify comparison. Illustration adapted from: Busch, R.M., 1993, Laboratory manual in physical geology, 3rd ed.: New York, Macmillan Publishing Co., p. 228.

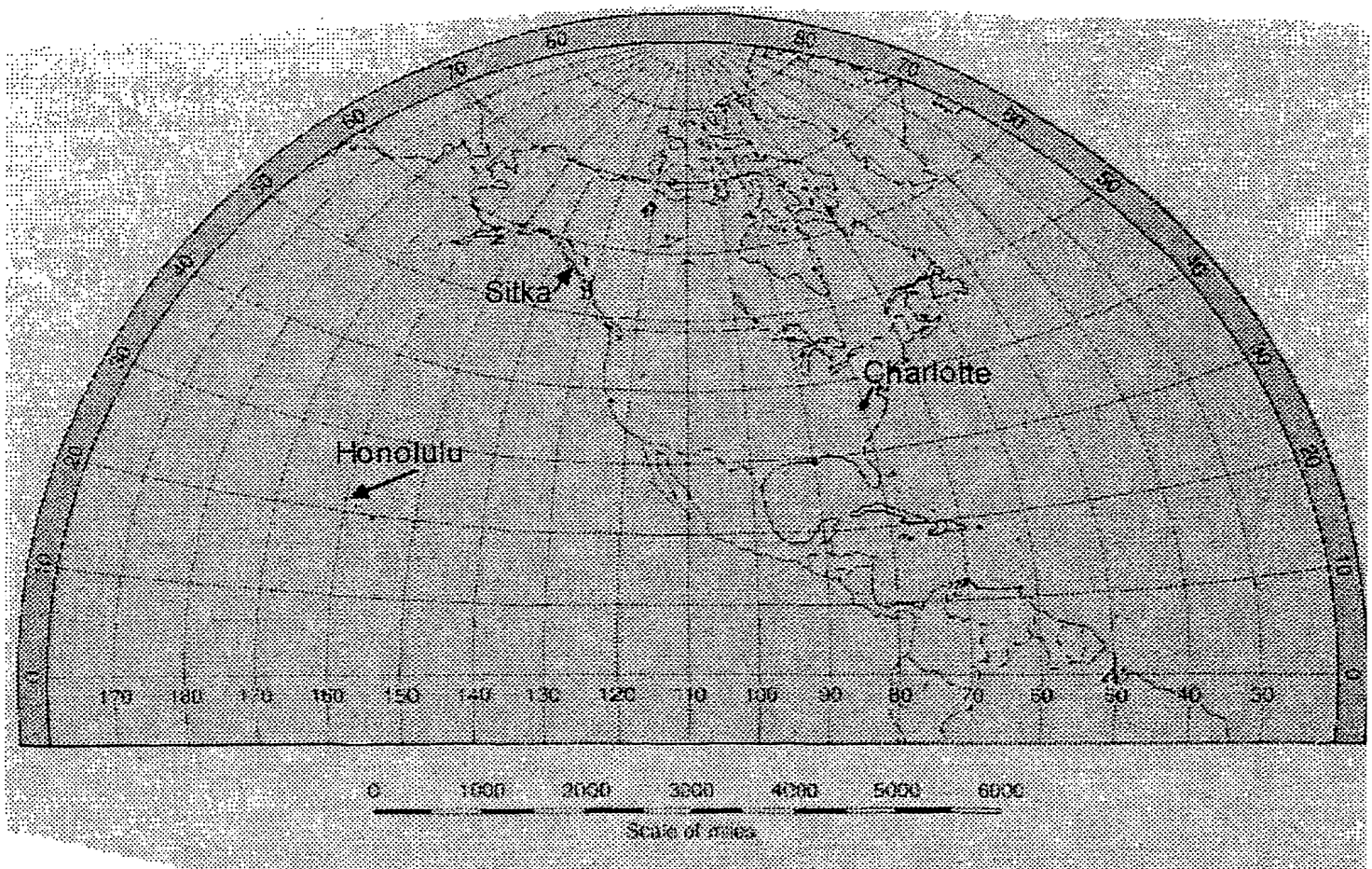


Figure 3 Map of Earth, for use in plotting data and locating the earthquake's epicenter. Illustration adapted from: Busch, R.M., 1993, Laboratory manual in physical geology, 3rd ed.: New York, Macmillan Publishing Co., p. 230

Seismic Waves and Epicenters of Earthquakes
Science 1110
Lab 20

Name and Section
1. _____
2. _____
3. _____
4. _____
5. _____

I. INTRODUCTION:

The purpose of this lab is to locate the epicenter of an earthquake based on the measurement of P and S seismic waves at three different locations on the globe.

What type of waves are P-waves? Transverse or Longitudinal

What type of waves are S-waves? Transverse of Longitudinal

PROCEDURE:

1. Measure the slope of the surface L wave on figure 1 and determine the wave speed.

Speed (mph) = 1/(slope) x 60 Slope = _____ Speed = _____mph

2. Which wave travels fastest: P or S or L? Which wave would arrive first: P or S?

3. Determine the time P and S waves arrive at each city using plots in figure 2. Enter this data in the table below.

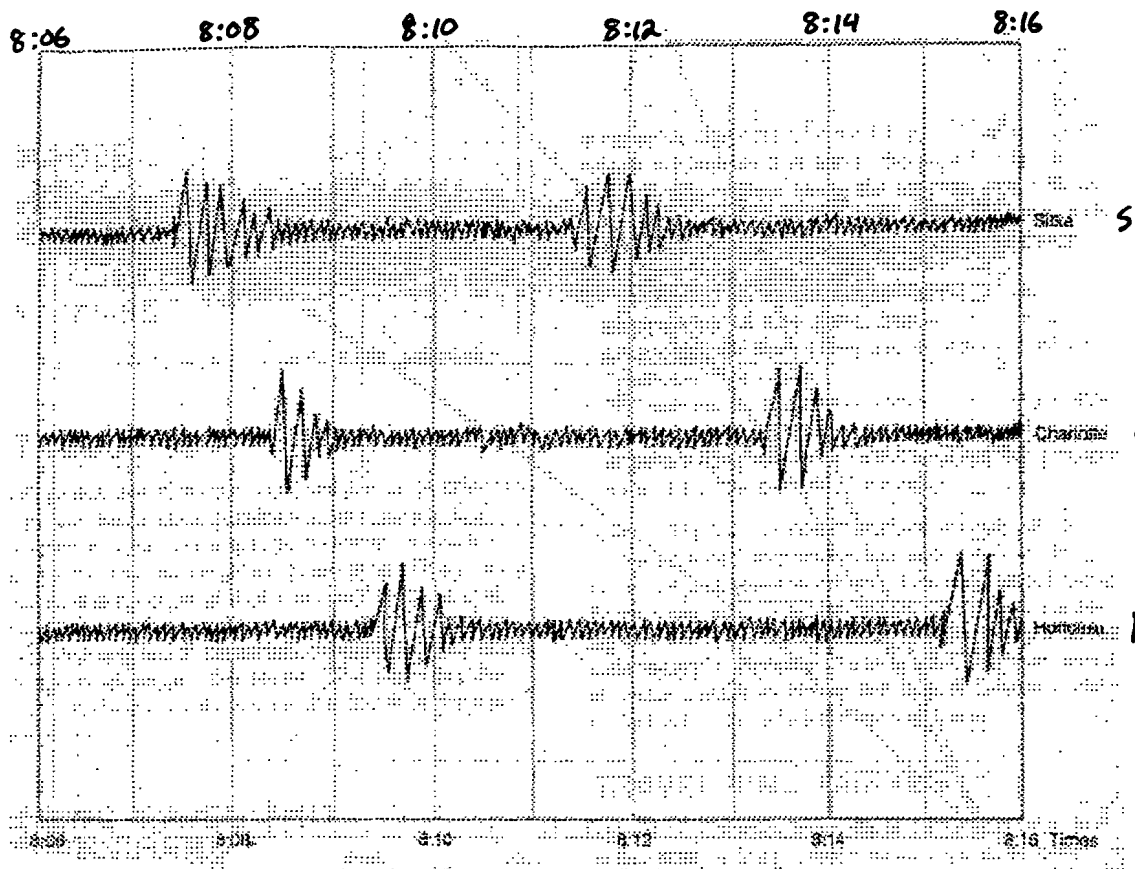
4. Calculate the time difference between when the P and S waves arrive and enter in the table below

5. Match the time difference for each city with the corresponding difference in the arrival of the P and S waves in figure 1 to determine the distance in miles from the epicenter and enter the value in the data table below.

CITY	Time of P	Time of S	Difference (minutes)	Distance (miles)
Sitka				
Charlotte				
Honolulu				

6. We now know how far from each of the three cities the earthquake occurred. We can use this information to determine the epicenter of the earthquake. Use the provided compass and your calculated distance to draw a circle around each city in figure 3 using the scale at the bottom of figure 3. Where the three circles intersect will be the location of the epicenter of the earthquake.

7. What is the Latitude _____ and Longitude _____of the epicenter?



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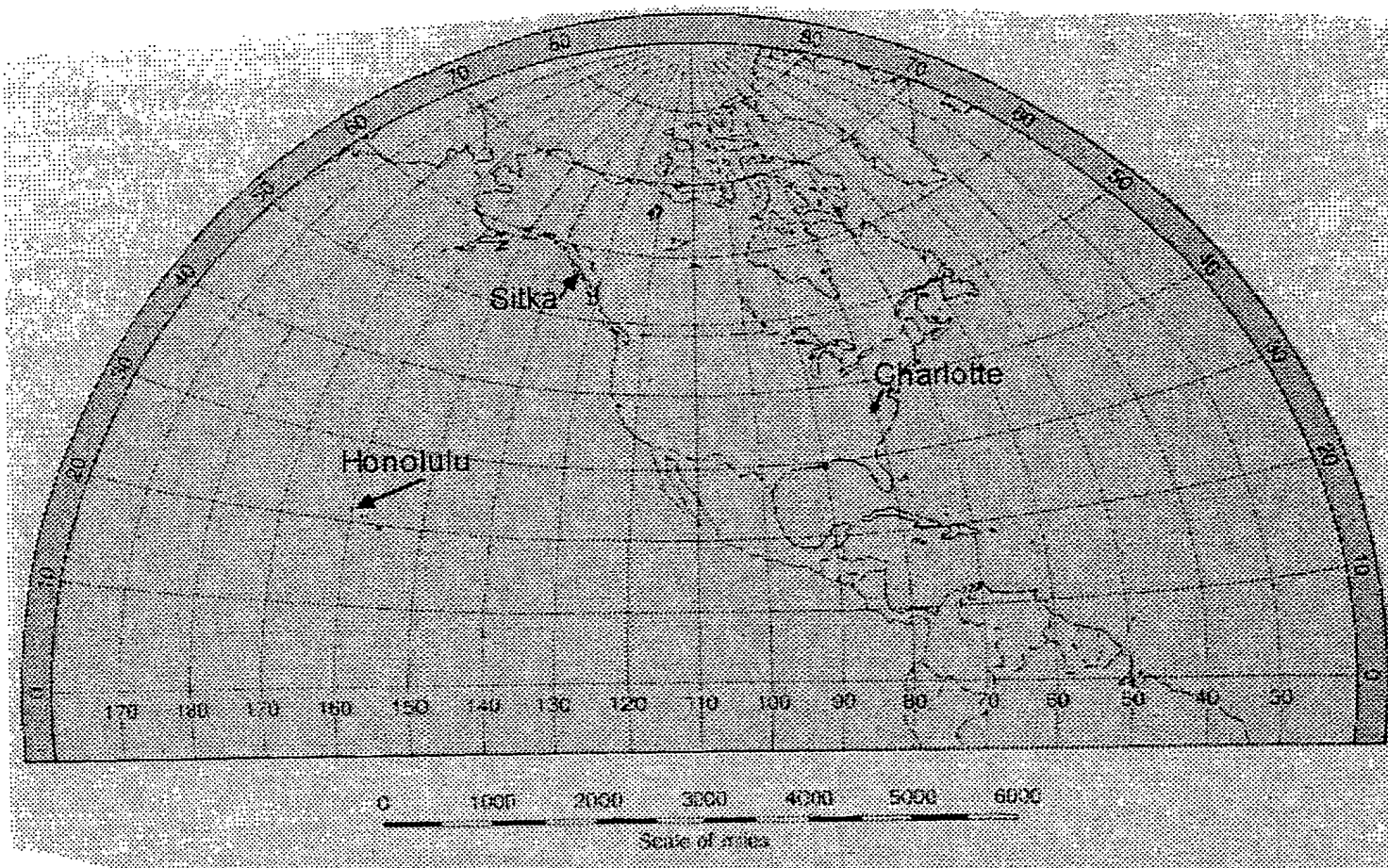

Figure 3 Map of Earth, for use in plotting data and locating the earthquake's epicenter. Illustration adapted from: Busch, R.M., 1993, Laboratory manual in physical geology, 3rd ed.: New York, Macmillan Publishing Co., p. 230

Physical Science - Exam 3

Name: _____ **Date:** _____

Read each question carefully, read each answer carefully, then place the letter of the correct answer in the blank next to the question number.

1. _____ **The two most abundant elements in Earth's crust are**
   a. oxygen and iron.
   b. silicon and oxygen.
   c. aluminum and iron.
   d. diamond and gold.

2. _____ **Feldspars are the most abundant minerals found in Earth's crust.**
   a. True
   b. False

3. _____ **Which of the following is a characteristic property of a mineral?**
   a. Naturally occurring.
   b. Crystalline.
   c. Definite chemical composition.
   d. All of the above.

4. _____ **Which of the following is <u>not</u> a classification of rocks?**
   a. Igneous.
   b. Metamorphic.
   c. Volcanic.
   d. Sedimentary.

5. _____ **Igneous rocks are**
   a. the most abundant rocks found in Earth's crust.
   b. described as either extrusive or intrusive.
   c. classified according to their mineral composition and texture.
   d. all of the above.

6. _____ **Plutons are**
   a. intrusive igneous rocks.
   b. solids known as tephra.
   c. solidified lava.
   d. explosive volcanoes.

7. _____ **Two different minerals may be made of the same materials, just arranged differently.**
   a. True.
   b. False.

8. _____ **The color of the powder of a mineral is called its**
   a. cleavage.
   b. color.
   c. streak.
   d. luster.

9. _____ **A comparative property referring to the minerals ability to resist scratching is**
   a. cleavage.
   b. hardness.
   c. fracture.
   d. streak.

10. _____ **Molten material that reaches Earth's surface is called**
    a. magma.
    b. plutons.
    c. lava.
    d. tephra.

11. _____ **This type of rock is formed from solidification of molten material.**
    a. Igneous.
    b. Metamorphic.
    c. Sedimentary.
    d. All of these.

12. _____ **Uniformitarianism basically means the present is the key to the past.**
    a. True.
    b. False.

13. _____ **Grain size of igneous rocks is determined by the rate of cooling.**
    a. True.
    b. False.

14. _____ **Which of the following may come out of a volcano?**
    a. Gasses.
    b. Lava.
    c. Tephra.
    d. All of the above.

15. _____ **Mount St. Helens eruption in 1980 was considered a peaceful volcano event.**
    a. True.
    b. False.

16. _____ **The transformation of sediment into sedimentary rock is called**
    a. bedding.
    b. stratification.
    c. lithification.
    d. detrital.

17. _____ **Which of the following is <u>not</u> a type of metamorphism?**
    a. Contact.
    b. Shear.
    c. Regional.
    d. Foliated.

18. _____ **Larger sedimentary particles will be deposited after lighter particles.**
    a. True.
    b. False.

19. _____ **Which of the following are geological evidence supporting continental drift?**
    a. Similar biological species and fossils are found on various continents.
    b. Continuity of geological structures (jigsaw puzzle)
    c. Glacial evidence on Southern hemisphere continents
    d. All of the above

20. _____ **Plate tectonics refers to the structure of the lithosphere as a series of plates.**
    a. True.
    b. False.

21. _____ **The severity of the damage caused by an earthquake is determined by which scale?**
    a. Richter.
    b. Mercalli.
    c. Seismology.
    d. Mohs.

22. _____ **Which of the following is <u>not</u> considered a layer of the Earth?**
    a. Inner Core.
    b. Outer Core.
    c. Crust.
    d. Corona.

23. _____ **Earthquakes may <u>not</u> be caused by**
    a. humans.
    b. volcanoes.
    c. tides.
    d. plate movement.

24. _____ **Folding crust deformation is fracturing of Earth's surface leading to movement of material.**
    a. True.
    b. False.

25. _____ **The seismic waves produced by earthquakes allow seismologists to**
    a. locate the source of the earthquake.
    b. determine the damage done by the earthquake.
    c. predict the next occurrence of a major earthquake.
    d. predict the next occurrence of a major volcano.

26. _____ **The physical disintegration and chemical decomposition of rock at or near Earth's surface is called**
    a. weathering.
    b. frost wedging.
    c. mass wasting.
    d. creep.

27. _____ **Which of the following are agents that cause erosion?**
    a. Running water.
    b. Ice.
    c. Wind.
    d. All of the above.

28. _____ **What is the term for the down slope movement of soil and rock fragments by gravity?**
    a. Sheet erosion.
    b. Mass wasting.
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29. _____ **The continuous circulation of Earth's water supply is known as the _____ cycle.**
    a. aqua
    b. redistribution
    c. hydrological
    d. hydrogeology

30. _____ **Earth's water supply is composed of _____ salt water.**
   a. 2%
   b. 50%
   c. 95%
   d. 98%

31. _____ **Fossils are**
   a. any remnant or indication of prehistoric life preserved in rock.
   b. not of interest to biologists and geologists.
   c. the focus of study of paleontologists.
   d. both a and c.

32. _____ **Wind erosion is generally associated with moist, hot climates.**
   a. True.
   b. False.

33. _____ **Which of the following is <u>not</u> a means by which fossils have been preserved?**
   a. Replaced remains
   b. Trace fossils
   c. Mummification
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34. _____ **Which of the following fossils would be considered original remains?**
   a. A mosquito in amber
   b. A footprint of a T-rex
   c. A cast of a small starfish
   d. All of the above.

35. _____ **The water table is the level of ground saturation.**
   a. True.
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36. _____ **Landslides are a form of slow mass wasting.**
   a. True.
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37. _____ **Relative geological time does not regard actual dates.**
   a. True.
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38. _____ **The principle of superposition states that**
   a. shallower layers of rock will be younger than deeper layers.
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39. _____ **The largest units of geological time are called**
   a. Eras.
   b. Periods.
   c. Eons.
   d. Epochs.

40. _____ **Geologists have determined the age of the Earth to be about 4.6 billion years old.**
   a. True.
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Physical Science - Exam 3

Name: Answer Key **Date: _____**

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