

# RUSD Packet

## HS Science Earth and Space



**Student full name** \_\_\_\_\_ **HS** \_\_\_\_\_

**Teacher** \_\_\_\_\_ **Day and block** \_\_\_\_\_

**Counselor** \_\_\_\_\_ **Academy** \_\_\_\_\_

# Earth and Space

## **Purpose Of The Packet**

Summer brain drain is a real thing and it generally takes about a month to get back in the academic swing of things in the fall. If we go back to school this year, we will not have the luxury of taking that month to get used to school again. This packet will help keep your mind and skills sharp.

If we do not go back to school, your teacher will issue you a second semester grade based on the evidence of your understanding shown by completion of this packet and the grade you had in Infinite Campus as of March 13th.

For two semester long classes: There is also material from the first semester included in this packet. Your teacher may choose to use successful completion of the review and enrichment activities to improve your first semester grade if you had a failing grade.

## **How The Packet Will Be Set Up**

Each assessment will start with some basic review of the concept(s) needed to complete the activity. A review or enrichment assessment will follow. Each review and assessment will minimally supply a technology free option and some will also include a technology option. Each assessment will also include a time length for expected completion. A 1 Day activity should take you between 30 and 45 minutes to complete. A 2 Day activity should take you two days of work assuming you work between 30 and 45 minutes each day. You may choose to work double the time and complete a 2 Day assessment in one day. Each assessment will also include a rubric for you to use to make sure you include all of the information necessary to show your understanding of the topic.

## **Where Do I Start**

This packet is going out to every student taking this course across the district. Start with what you know! The packet is the best representation of what MOST classes had covered as of the March 13th shut down. If your teacher had not covered a specific topic, you are not expected to teach it to yourself. But you may choose to try it to challenge yourself! If you are unsure if you have covered a topic, please contact your teacher.

## **How Do I Turn In My Work?**

You may turn in your work digitally to your teacher based on their instructions. If you do not have access to technology at home, the district will come out with instructions on how to turn in your work on paper.

Earth and Space Science RUSD Packet of Evidence Outline					
Topic	Lesson	Page #	<b>Paper Option</b> Please write all answers in the packet. Do not take packet apart	Completed put check	
Continental Drift	review	4-6	Milky Way Continental Drift	<input type="checkbox"/>	
Plate Tectonic	review	7-10	Plate Tectonic	<input type="checkbox"/>	
Earthquake Volcano	review	11-13	Earthquake & volcano	<input type="checkbox"/>	
Identifying Minerals	review	14-17	Identifying Minerals	<input type="checkbox"/>	
Human Impact	review	18-19	Human Impact Webquest.	<input type="checkbox"/>	
Sustainability	Review and evaluation	20-25	Sustainability	<input type="checkbox"/>	
Electromagnetic Spectrum	Review and evaluation	26-27	Electromagnetic Spectrum	<input type="checkbox"/>	
Spectroscope	review	28-29	Spectroscope	<input type="checkbox"/>	
Doppler Effect	review	30-31	Doppler Effect	<input type="checkbox"/>	
Universe	Review	32-33	The Universe	<input type="checkbox"/>	
				<input type="checkbox"/>	

Name:

# Milky Way Plate Tectonics

Period:

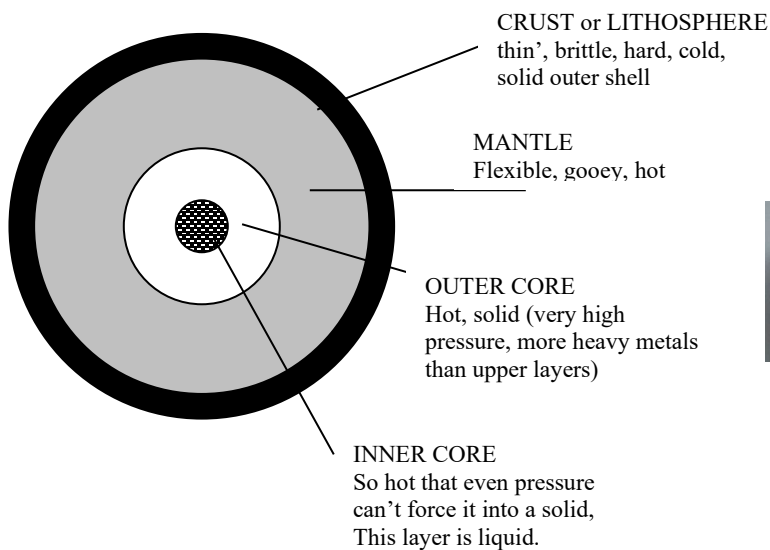
## Pre-lab

Safety and precautions:

- \*CLEAN UP after yourself
- \* you only get 1 bar, so use it wisely.
- \* Eat your bar only when instructed to do so.

The three layers of the Milky Way will be a model for plate tectonics today-

### EARTH'S LAYERS



### LAYERS OF A MILKY WAY

If you cut a Milky Way in 1/2...



NOUGAT: solid, not very flexible

Question 1: Fill out the table below:

Milky Way layer	Earth layer
Chocolate	
	Mantle
Nougat	

Question 2: If the earth were a milkyway bar, plates of plate tectonics would be made out of \_\_\_\_\_.

Question 3: Which Earth layer is missing from the Milky Way model?

Show this  
completed page  
to instructor for  
Milky Way bar

### DIVERGENT BOUNDARY:

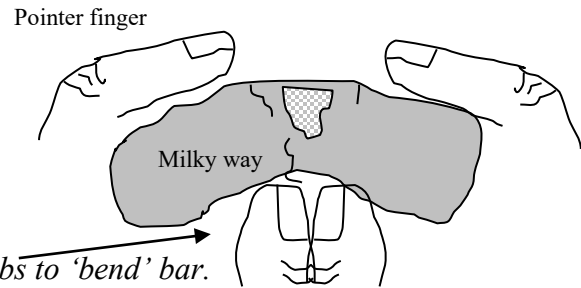
*Unwrap the candy bar.*

*Hold bar with two hands.*

*Gently push up in middle of bar with thumbs to 'bend' bar.*

*DO NOT separate bar into two halves.*

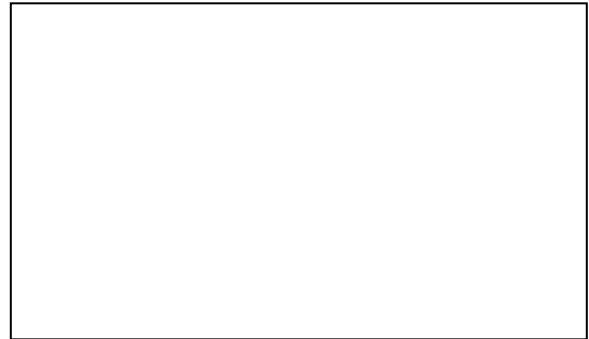
*Set bar down to answer questions.*



Question 4: Draw a quick sketch of your 'model' from the side.

Question 5: Which layer 'cracked'?

\_\_\_\_\_



Question 6: When the top layer cracks, this makes a 'hole' to fill in.

What layer would be most likely to fill this hole? \_\_\_\_\_

Question 7: Why would there be earthquakes at a divergent boundary?

Question 8: In what layer would earthquakes happen? \_\_\_\_\_

### CONVERGENT BOUNDARY

*Holding Milky Way in both hands,*

*return to as close to original bar as possible.*

*(Flat, straight).*

*Push in from the ends of the bar to force plates together.*

*It might work best to put fingers on edges of bar,*

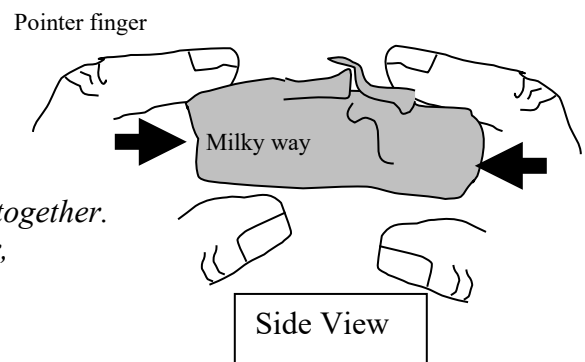
*not on top & bottom.*

*Try to keep bar in a straight line.*

*The top layer should do one of two things:*

*1) form mountains*

*2) one chocolate layer will subduct under the other one*



Question 9: Draw a quick sketch of your model from the side.



Question 10: Which type of convergent boundary/ies would form mountains from plates pushing each other up?

Oceanic-Oceanic      Oceanic-Continental      Continental-Continental

Question 11: Which type of convergent boundary/ies would force one plate under another plate?

Oceanic-Oceanic      Oceanic-Continental      Continental-Continental

Question 12: Your model (candy bar) formed which type of convergent boundary?

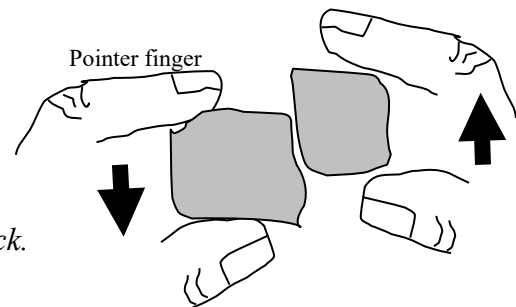
Oceanic-Oceanic      Oceanic-Continental      Continental-Continental

Question 13: Which type of boundary might have deeper earthquakes, divergent or convergent?  
(*hint: Which type of boundary FORCES crust DOWN into the mantle*).

### TRANSFORM BOUNDARY

*Again, return Milky Way to 'original position' - as best as possible.*

*With fingers & thumbs on long edges of bar, slide your right hand forward, pull your left hand back.*

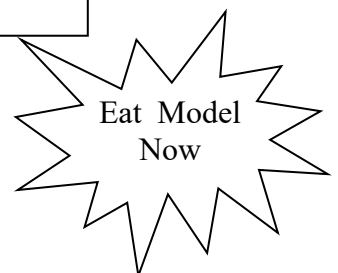


Question 14: Draw a quick sketch of your model.



Question 15: Add ★ s along the edges where you'd expect the most earthquakes to your drawing.

Question 16: Are earthquakes at transform boundaries shallow or deep? Why?



# Plate Tectonics Review

Name\_\_\_\_\_ Class\_\_\_\_\_ Date\_\_\_\_\_

## True or False:

*Write true if the statement is true or false if the statement is false.*

- \_\_\_\_\_ 1. In geology, stress is the force per unit area that is placed on rock.
- \_\_\_\_\_ 2. Tension is the major type of stress at transform plate boundaries.
- \_\_\_\_\_ 3. Sedimentary rocks that do not have horizontal layers have been deformed.
- \_\_\_\_\_ 4. In an anticline, the youngest rocks are at the center.
- \_\_\_\_\_ 5. In a normal fault, the footwall drops down relative to the hanging wall.
- \_\_\_\_\_ 6. A rock's response to stress depends only on the type of stress.
- \_\_\_\_\_ 7. Basin-and-range landforms result from tension pulling crust apart.
- \_\_\_\_\_ 8. Confining stress always causes folds or faults.
- \_\_\_\_\_ 9. The oldest layers of sedimentary rock are on always the bottom unless rock layers have been disturbed.
- \_\_\_\_\_ 10. Left-lateral and right-lateral faults are two types of dip-slip faults.

## Passage Reading

*Read this passage based on the text and answer the questions that follow.*

### Stress and How It Changes Rock

Stress is force applied to an object. In geology, stress is the force per unit area that is applied to rock. A rock's response to stress depends on many factors. The factors include the type of rock, the surrounding temperature and pressure, the type of stress, and the length of time the rock is under stress. In response to stress, rocks may either deform (change shape) or fracture (break). If stress is removed from rocks that have deformed, they may or may not return to their original shape. If they do return to their original shape, the change in shape is called elastic deformation. If they do not return to their original shape, the change in shape is called plastic deformation.

Four types of stress that can act on rock are: confining stress, compression, tension, and shear.

- Confining stress is stress that is applied to a deeply buried rock by the weight of all the material above it. Because the rock cannot move, it cannot deform or fracture.
- Compression is stress that squeezes rocks together. It causes rocks to deform by folding or to fracture. Compression is the major type of stress at convergent plate boundaries.
- Tension is stress that pulls rocks apart. Rocks under tension lengthen or break apart. Tension is the major type of stress at divergent plate boundaries.
- Shear is stress that occurs when forces are parallel but applied in opposite directions. Shear stress is the major type of stress at transform plate boundaries.

## Questions

1. How is stress defined in geology?
2. What factors determine a rock's response to stress?
3. Compare and contrast elastic and plastic deformation of rock.
4. Identify and describe the four types of stresses that can act on rock.

## Multiple Choice

*Circle the letter of the correct choice.*

1. The most common stress on rocks at convergent plate boundaries is
  - a. shear.
  - b. tension.
  - c. compression.
  - d. confining stress.
2. A rock is more likely to fracture if
  - a. it is located on the surface.
  - b. it is deep within the crust.
  - c. stress is applied gradually.
  - d. two of the above
3. A simple bend in rock layers so they are no longer horizontal is called a
  - a. compression.
  - b. monocline.
  - c. strain.
  - d. fault.



4. In a syncline the
  - a. youngest rocks are on the outside.
  - b. folded rocks may form a dome.
  - c. folded rocks may form a basin.
  - d. two of the above
5. When rocks suddenly move along a fault, the energy released is a(n)
  - a. deformation.
  - b. earthquake.
  - c. anticline.
  - d. uplift.
6. Which of the following statements about dip-slip faults is false?
  - a. The faults' dip is inclined relative to the horizontal.
  - b. The faults may be normal faults or reverse faults.
  - c. The faults occur because of shear stress.
  - d. The faults may uplift mountain ranges.
7. A thrust fault
  - a. is a type of reverse fault.
  - b. has a nearly vertical dip.
  - c. is a strike-slip fault.
  - d. two of the above

## Matching

*Match each definition with the correct term.*

### Definitions

- \_\_\_\_\_ 1. fracture in which there is no movement of rocks
- \_\_\_\_\_ 2. break in rock
- \_\_\_\_\_ 3. stress that pulls rocks apart
- \_\_\_\_\_ 4. bend in rock due to compression
- \_\_\_\_\_ 5. stress that squeezes rocks together
- \_\_\_\_\_ 6. change in the shape of rock due to stress
- \_\_\_\_\_ 7. fracture in which blocks of rock move

### Terms

- a. compression
- b. tension
- c. deformation
- d. fracture
- e. fold
- f. fault
- g. joint

## Fill in the Blank

*Fill in the blank with the appropriate term.*

1. Stress on a deeply buried rock that cannot deform is called \_\_\_\_\_ stress.
2. \_\_\_\_\_ deformation occurs when rock returns to its original shape after stress is removed.
3. \_\_\_\_\_ deformation occurs when rock does not return to its original shape after stress is removed.
4. A fold in rock that bends upward is called a(n) \_\_\_\_\_.
5. A fold in rock that bends downward is called a(n) \_\_\_\_\_.
6. The distance rocks move along a fault is known as the fault's \_\_\_\_\_.
7. The angle a fault makes with the horizontal surface of Earth is termed the fault's \_\_\_\_\_.

## Critical Writing

*Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.*

Compare and contrast the two major types of faults and the conditions under which they occur.

**Multiple Choice** – Choose the best answer.

1. What is a vibration of Earth produced by the rapid release of energy within the lithosphere called?
  - a. fault
  - b. epicenter
  - c. volcano
  - d. earthquake
2. What is lava underneath Earth's surface called?
  - a. lava
  - b. magma
  - c. mantle
  - d. asthenosphere
3. What type of volcano is tall and has the most violent and explosive eruptions?
  - a. cinder cone
  - b. stratovolcano (composite)
  - c. supervolcano
  - d. shield volcano
4. What is the name of the place beneath Earth's surface where an earthquake starts?
  - a. fault
  - b. focus
  - c. epicenter
  - d. wave front
5. Which type of waves shake particles at right angles to the wave's direction of travel?
  - a. P waves
  - b. S waves
  - c. surface waves
  - d. body waves
6. What process occurs when an earthquake's shaking turns loose soil into mud?
  - a. landslide
  - b. seismic shaking
  - c. tsunami
  - d. liquefaction
7. What is the name of the long horseshoe-shaped belt of volcanoes that circles the Pacific Ocean called?
  - a. Ring of Flame
  - b. Ring of Fury
  - c. Ring of Fire
  - d. Ring of Hawaii
8. What is the location on the surface of Earth where an earthquake is centered called?
  - a. fault
  - b. focus
  - c. epicenter
  - d. wave front

9. What type of volcanoes are the largest and are produced by the accumulation or runny basaltic lava?
- cinder cone
  - stratovolcano (composite)
  - supervolcano
  - shield volcano
10. What is a break in the lithosphere where movement has occurred called?
- fold
  - fault
  - focus
  - earthquake
11. Which type of seismic wave arrives first at a seismograph?
- S wave
  - P wave
  - Surface wave
  - Electromagnetic wave
12. What is the name of an earthquake that occurs after a major earthquake?
- aftershock
  - mainshock
  - postshock
  - foreshock
13. The name of the instrument that records earthquakes is called...
- seismogram
  - seismograph
  - anemometer
  - Richter scale
14. What scale do scientists today most often use to express the magnitude of an earthquake?
- moment magnitude scale
  - Richter scale
  - lithospheric scale
  - seismic scale
15. Which of the following is a benefit of volcanoes?
- fertile soil
  - increase of infrastructure development
  - decreased tourism
  - renewable wind energy

**Fill in the Blank with Word Bank** – Write the correct answer on the line.

Word Bank		
P waves	Hot spots	focus
vent	seismic waves	cinder cone
shield		

16. The point within Earth where an earthquake starts is called the \_\_\_\_\_.
17. Energy released during an earthquake travels in \_\_\_\_\_.
18. This type of wave, called \_\_\_\_\_, are the fastest type of wave and the first to be detected.
19. Large broad volcanoes with runny lava are classified as \_\_\_\_\_ volcanoes.
20. Magma travels from the chamber to the crater in a long tube called the \_\_\_\_\_.
21. A \_\_\_\_\_ volcano only erupts once in its lifetime.
22. Volcanoes that occur away closer to the middle of a plate and away from plate boundaries are called \_\_\_\_\_.

**True or False** – Write T for True and F for False.

23. \_\_\_\_\_ Molten rock beneath Earth's surface is called lava.
24. \_\_\_\_\_ A seismogram is created by a seismograph.
25. \_\_\_\_\_ The largest volcanoes are cinder cone volcanoes.
26. \_\_\_\_\_ The scale used by scientists to measure the magnitude of an earthquake is called the Richter Scale.
27. \_\_\_\_\_ Volcanoes can form underwater.
28. \_\_\_\_\_ Large amounts of gases are released during a volcanic eruption.

**Short Answer**

29. How can earthquake damage and loss of life be reduced in the event of an earthquake?

30. Compare body waves and surface waves.

31. Using a slinky or string simulate a body wave and surface waves. Draw what each would look like. Which of these would cause the most damage in the event of an earthquake and why?

Figure 6-11 Properties of some minerals.

Mineral Name	Color	Streak	Luster	Hardness	SpG	Cleavage	Remarks
apatite	green or brown	white	glassy	5	3.2	1-poor	used in making fertilizer
biotite	black	colorless	glassy, shining	2½-3	3.1	1-perfect	black mica, fractures in very thin plates
calcite	colorless, white	colorless	glassy, pearly	3	2.7	3-rhomb. perfect	rock forming mineral
cinnabar	red	bright red	glassy, earthy	2-2½	8.1	2-perfect	mercury ore
corundum	brown, pink, blue	none	sparkling, dull	9	4.0	none	gem stone, used as an abrasive
diamond	grayish-black	none	sparkling, dull	10	3.5	4-perfect	gem stone, industrial saws
feldspar	white, gray, flesh-red	white	glassy	6	2.5 to 2.7	2-good 90°	common rock-forming minerals
fluorite	light purple, yellow, green	colorless	glassy	4	3.2	4-perfect	used in steel and glassmaking
galena	lead gray	gray-black	metallic	2½	7.6	cubic	lead ore
graphite	steel gray to iron black	black to gray-black	metallic, earthy	1-2	2.2	1-perfect	feels greasy, used as a lubricant
gypsum	colorless, white, gray	colorless	silky-	2	2.3	1-perfect	used in making plaster of Paris
halite	white, red, blue	colorless	translucent glassy,	2½	2.2	cubic perfect	common salt, tastes salty
hornblende	dark green to black	colorless to gray	glassy	5-6	3.2	2-perfect 120°-60°	an amphibole, a common rock miner
magnetite	iron black	black	metallic	5½-6	5.2	none	magnetic
muscovite	tan, green, yellow, white	colorless	glassy, silky	2-2½	2.8	1-perfect	white mica, flakes in thin sheets
olivine	olive to gray, green, brown	colorless	glassy	6½-7	3.4	1-poor	green rock-forming mineral
pyrite	pale brass, yellow	green or brown-black	metallic	6-6½	5.0	none	"fool's gold"
pyroxene	black, dark green	black or dark green	glassy, dull	5-6	3.3	2-poor to good	accessory in igneous rocks
quartz	colorless, white	none	glassy	7	2.6	none	gem stone, common rock-forming mineral
talc	white, green, gray	colorless	glassy, pearly	1	2.8	1-perfect	greasy feel, used in talcum powder
topaz	yellow, pink, blue, green	none	glassy	8	3.5	1-perfect	gem stone

**Directions:** Determine the identity of your samples by comparing their properties with the descriptions listed in the key. Start at the left and work to the right while progressively narrowing the possibilities.

# Mineral Identification Key

Metallic luster

Black, green-black  
or dark green streakBrown or  
white streak

Nonmetallic, light-colored

Scratches  
glass

Does not scratch glass

Nonmetallic, dark-colored

Scratches glass

Does not  
scratch  
glass

Cleavage

No  
cleavage

Cleavage

Cleavage

No  
cleavage

Cleavage


No  
cleavage

Black; strongly magnetic; hardness, 6	Magnetite
Lead-pencil black; smudges fingers; hardness, 1 to 2	Graphite
Brass yellow; cubic crystals; hardness, 6 to 6.5	Pyrite
Brass yellow, may be tarnished purple; hardness, 3.5 to 4	Chalcopyrite
Shiny gray; very heavy; cubic cleavage; hardness, 2.5	Galena

Yellow-brown to dark brown, may be almost black; hardness, 5 to 5.5	Limonite
Yellow-brown; streak white to pale yellow; resinous luster; hardness, 3.5 to 4	Sphalerite
Red to brown streak; hardness 5.5 to 6.5	Hematite

Pink to bluish gray to green; 2 cleavage planes at right angles; hardness, 6	Orthoclase
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Glassy luster; crystals are 6-sided when present; hardness, 7; shell-like fracture	Quartz
Glassy luster; shades of green and yellow; hardness, 6.5 to 7	Olivine

Colorless to white; salty taste; cubic cleavage; hardness, 2.5	Halite
White or yellow to colorless; hardness, 3; double image seen when crystal is placed on printed page 	Calcite
White to transparent; hardness, 2	Gypsum
Green to white; feels soapy; hardness, 1	Talc
Colorless to light yellow; hardness, 2 to 2.5; cleavage in flat sheets	Muscovite
White, yellow, purple, or green; 8-sided cleavage; hardness, 4	Fluorite

Black; cleavage with 2 planes at 90° angles; hardness, 5 to 6	Augite
Black; cleavage with 2 planes at 60° angles; hardness, 5 to 6	Hornblende

Gray, brown, blue-gray, pink, white, red; 6-sided crystals; hardness, 9	Corundum
Reddish brown; fracture resembles poor cleavage; brittle; hardness 6.5 to 7.5	Garnet

Brown to black; hardness 2.5 to 3	Biotite
Shades of green; hardness, 2 to 2.5	Chlorite

Green, brown, blue, or purple; shell-like fracture; hardness, 5	Apatite
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# Sweet 16 Mineral Identification Tournament



Do your students eagerly fill out their “March Madness” tournament brackets? Have some fun and inspire your students with March Madness mineralogy! This activity combines the popularity of “bracketology” with a review of the characteristics of minerals. Knowledge of the physical and chemical properties of minerals will help students determine the winner of the Sweet 16 Mineral Identification Tournament!

## Review of Concepts

- Luster
- Crystal shapes
- Chemical composition
- Hardness

## Tournament Rules

The rules for filling out the tournament bracket are summarized below.

- First round: The mineral with metallic luster advances to the second round.
- Second round: The mineral with iron in its chemical formula wins.
- Semifinals: The mineral with a cubic crystal form advances to the finals.
- Final round: The mineral that can scratch the other in a hardness test is declared the winner!

## NGSS Alignment

This laboratory activity relates to the following Next Generation Science Standards (2013):

### Disciplinary Core Ideas: Middle School

MS-PS1 Matter and Its Interactions  
PS1.A: Structure and Properties of Matter  
ES-ESS2 Earth's Systems  
ESS2.A: Earth's Materials and Systems

### Disciplinary Core Ideas: High School

HS-PS1 Matter and Its Interactions  
PS1.A: Structure and Properties of Matter  
ES-ESS2 Earth's Systems  
ESS2.A: Earth's Materials and Systems

### Science and Engineering Practices

Asking questions and defining problems  
Constructing explanations and designing solution

### Crosscutting Concepts

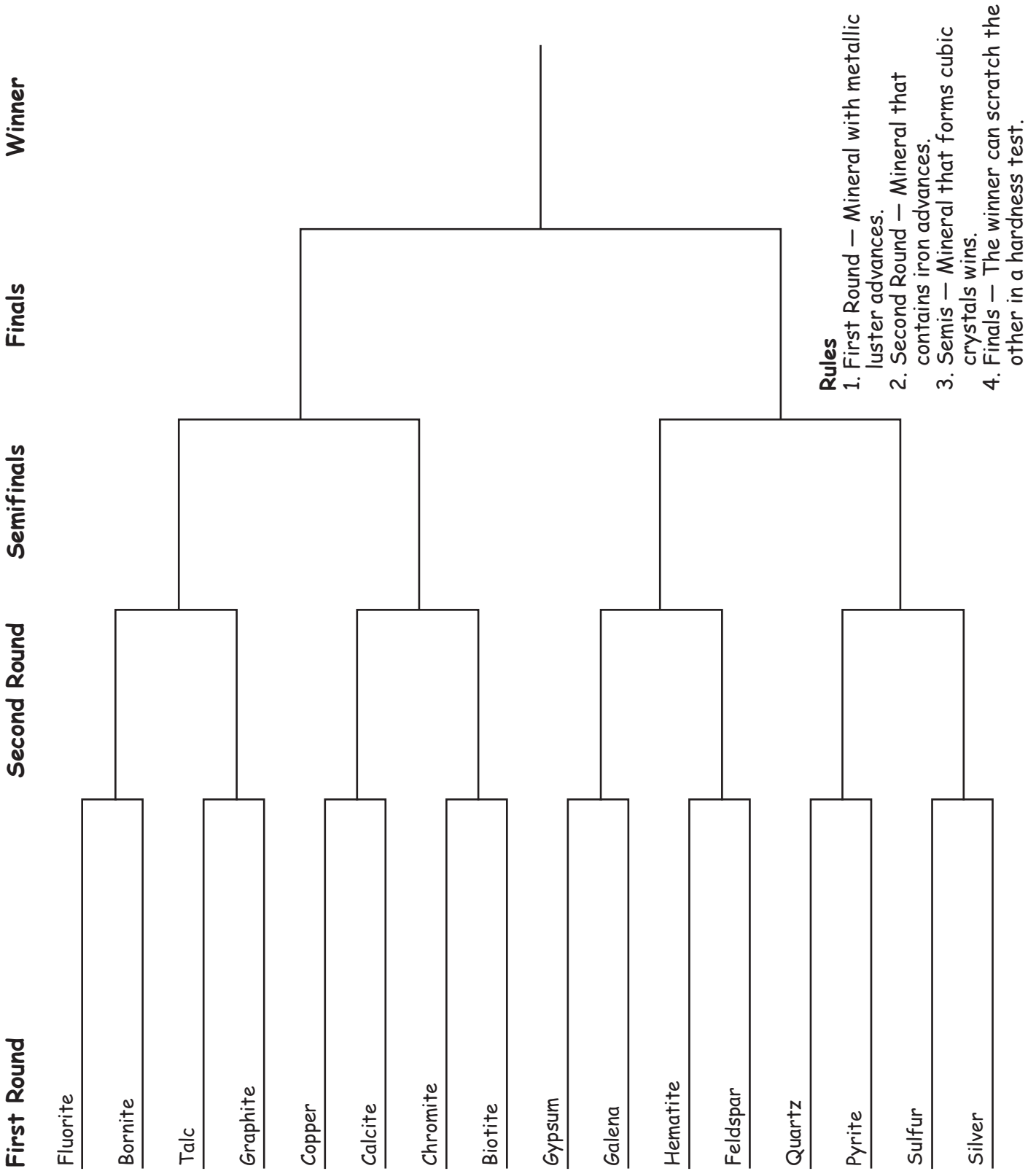
Patterns  
Structure and function

## Tips

- On the Mohs hardness scale, pyrite is listed as 6–6.5 and chromite has a hardness of 5.5.
- The crystal system of bornite is tetragonal and hematite forms hexagonal crystals.
- Set out samples of each type of mineral for reference.



# Sweet 16 Mineral Identification Tournament



**Part A – Man**

Use the link below to watch the “Man” video by Steve Cutts. As you watch, answer the questions below.

Full URL: <https://www.youtube.com/watch?v=WfGMYdalCIU>

Tiny URL: <http://tinyurl.com/cb5t8oa>

1. What does man use as boots? \_\_\_\_\_
2. What does he use as a coat? \_\_\_\_\_
3. What happens to the rabbits? \_\_\_\_\_
4. What is your reaction to the movie? \_\_\_\_\_
5. What is the writer’s purpose of this movie? \_\_\_\_\_

**Part B – The Growing Human Population**

Use the link below to watch the Human Population Through Time video by the American Museum of Natural History. As you watch, answer the questions below.

Full URL: [https://www.youtube.com/watch?v=PUwmA3Q0\\_OE&t=202s](https://www.youtube.com/watch?v=PUwmA3Q0_OE&t=202s)

TinyURL: <https://tinyurl.com/y2rku8us>



6. About how long ago did modern humans evolve in Africa? \_\_\_\_\_
7. About how long ago did humans begin migrating across the globe? \_\_\_\_\_
8. What was the human population by the year 1 AD? \_\_\_\_\_
9. How many people does one dot on the map represent? \_\_\_\_\_
10. Stop the video at year 1100. Write down three observations in the spaces below.
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
  - c. \_\_\_\_\_

11. Approximately how many millions of people lived in North America before the Europeans arrived? \_\_\_\_\_
12. How many more billion people were there in 2015 than in 1950? \_\_\_\_\_
13. How many billions of people are expected to populate Earth in 2100? \_\_\_\_\_
14. Why is it predicted that the human population will level off? \_\_\_\_\_
15. How many years did it take the human population to reach 1 billion people? \_\_\_\_\_
16. How many years did it take the human population to go from 1 billion to 7 billion? \_\_\_\_\_
17. What are some choices that we can make today to reduce our impact of population growth on the environment? \_\_\_\_\_

**Part C - Impacts of the Human Population**

Use the link below to watch the Human Population Impacts video from Bozeman Science. As you watch, answer the questions below. Full URL: <https://www.youtube.com/watch?v=Z1haK55QKJ8&list=PLlIVwaZQkS2qK4Z6xBVDRak8an1-kqsgm&index=15>

Tiny URL: <https://tinyurl.com/h5ojwdd>

18. Which hemisphere of the Earth releases the most Carbon dioxide into the atmosphere? Why? \_\_\_\_\_
19. What happens to Carbon dioxide (CO<sub>2</sub>) levels in the Summer months? Why? \_\_\_\_\_
20. What happens to Carbon dioxide (CO<sub>2</sub>) levels in the Winter months? Why? \_\_\_\_\_
21. What is an ecological footprint? \_\_\_\_\_
22. What does the I, P, A, and T stand for in the equation I = PAT? \_\_\_\_\_
23. Circle or underline. The bigger the population is the (larger/smaller) the environmental impact.

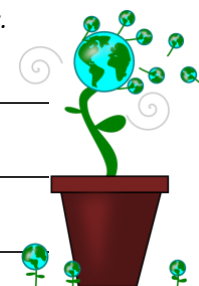
24. Although Burundi and U.A.E. have the same population of 9 million, why does Burundi have a smaller ecological impact? \_\_\_\_\_
25. As countries develop, do they have more or less of an impact on the planet? Explain. \_\_\_\_\_
- 26 What is biocapacity? \_\_\_\_\_
27. What does the line at 2.0 on the graph represent? \_\_\_\_\_
28. In worldmapper.org, where is the highest level of poverty, population, and hunger in the world? \_\_\_\_\_
29. Look at the US for income and resource use. Did the US grow larger or smaller in size? How do you think this impacts the environment? \_\_\_\_\_
30. If the economy is too big, does it have a negative or positive effect on the environment? \_\_\_\_\_

#### **Part D – World Time-lapse Activity**

Watch the world change through the course of nearly 3 decades of satellite photography. See real images of deforestation, mining, urbanization, and other behaviors resulting from increased economics and world population. Use the link below to explore the World Time-lapse imagery and information powered by Google. Follow the directions and answer the questions below as you move through the time-lapse. Full URL: <http://time.com/timelapse2016/> TinyURL: <http://tinyurl.com/jmbusm3>

31. Read the text on the screen and watch the first video. Write three observations about three different locations below.

- A. Location Name: \_\_\_\_\_  
Observation: \_\_\_\_\_
- B. Location Name: \_\_\_\_\_  
Observation: \_\_\_\_\_
- C. Location Name: \_\_\_\_\_  
Observation: \_\_\_\_\_



Read the text on the screen and watch the second video near the bottom of the page. Answer the questions below as you watch.

32. How many minutes does it take for the LandSAT satellite to orbit the earth once? \_\_\_\_\_
33. What did you notice about the Amazon Rain Forest? \_\_\_\_\_
34. What did you notice about Dubai? \_\_\_\_\_
35. Why is it important to continue the LandsAT program? \_\_\_\_\_
36. After watching the video, scroll up to the top of the screen and find the “Explore the World” search box. Search for your city. Describe any changes that you see. \_\_\_\_\_
37. Now choose any other place in the world besides where you live. Write the name of the place and the changes you observe. \_\_\_\_\_

#### **Part E - Your Ecological Footprint**

An Ecological Footprint is the impact you make on the environment. Click on the link below to complete the Ecological Footprint Calculator. Answer the questions on the website. When you are finished with the activity, answer the question below.

Full URL: <https://www.footprintcalculator.org/> TinyURL: <https://tinyurl.com/y54cegw6>

38. How many Earths would we need if everyone used resources like you do? \_\_\_\_\_
39. Is your footprint higher, lower, or close to the US average? \_\_\_\_\_
40. List four ways you can reduce your ecological footprint. \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_



# Sustainability Quarter 3 Review

Video Resource: <https://www.youtube.com/watch?v=rmQby7adocM>

Online Resource: <https://sustainabilityillustrated.com/en/sustainability-videos/>

Topics:

*“Treat the earth well: it was not given to you by your parents, it was loaned to you by your children. We do not inherit the Earth from our Ancestors, we borrow it from our Children.”*

~ Ancient American Indian Proverb

## 1. Human impacts on Earth's systems:

Humans have both positive and negative impacts on the environment. The main reason for the negative impacts are the increasing human population. The more people, places, and increasing demand on natural resources like food, water, energy, and space, the worse it is for the overall sustainability of the environment. There are four main ways humans affect the environment:

- Destruction of Habitats
  - Can alter the balance of an ecosystem.
  - Threatens the stability of the planet's ecosystems.
  - This damage can be permanent and cause a loss in biodiversity. These reductions can lead to a change in the balance of important cycles like the carbon cycle, phosphorus cycle, and the nitrogen cycle.
  - Humans destroy habitats by:
    - Deforestation- burning down or chopping down forests= less biodiversity
    - Agriculture- destroying ecosystems for farm land= less biodiversity
    - Introducing Invasive Species- bringing in species not native to an area= change in food chain/biodiversity
- Pollution
  - By definition, pollution is the introduction of any substance into the natural environment that causes adverse effects.
  - Pollutants become toxins and can be very harmful for life on the planet and be passed down the food chain. They also can cause a change in Earth's cycles.
  - Humans add pollution to the land, water, and air in a variety of ways.
  - Land Pollution: solid and chemical waste from poor disposal of waste options.
    - Incineration, landfills, composting, and recycling.
  - Water Pollution: caused by dumping waste, sewage, pesticides, fertilizers, eutrophication leading to high numbers of algae, among more.
  - Air Pollution: caused by burning waste and burning fossil fuels increasing carbon levels.
    - Acid rain, smog, ozone damage.
- Energy Resources
  - Resources can be defined as all the features of the environment that help us produce things that satisfy our needs.





- There are natural resources and human made resources.
- Energy resources are natural resources that humans access for things like electricity, heating, etc.
- There are renewable and nonrenewable resources.
- Nonrenewable resources take hundreds of thousands of years to replenish, and therefore cannot be replenished in our lifetimes, meaning once they're gone they're gone.
- Fossil fuels are nonrenewable resources, and when burned release CO<sub>2</sub>.
- We mine for fossil fuels as well as minerals, metals, etc.
- Renewable resources are ones we can reuse or that replenish quickly like alternative energy resources.
  - Wind energy, solar energy, hydro energy, geothermal energy, etc.

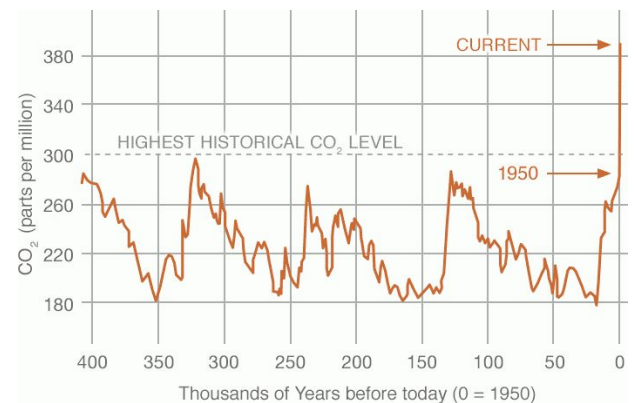
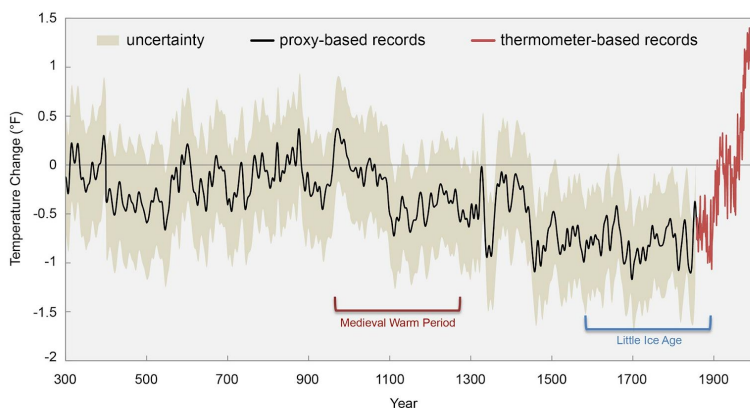


#### - Climate Change/Global Warming

- Global warming is a natural event that occurs on Earth where excess carbon dioxide, among other compounds, settles in the atmosphere and acts as greenhouse gases trapping and holding in heat.
- Global warming leads to changes in our climate systems and melting of polar ice caps.
  - This leads to rising sea levels and flooding, changes in rain and drought patterns, increases of insects and therefore disease, etc.
- Humans are increasing this warming, and therefore increasing climate change, by burning fossil fuels, deforestation- leading to less plants to take in carbon dioxide, and many other things like ocean pollution and destruction of ecosystems.



1700 Years of Global Temperature Change from Proxy Data

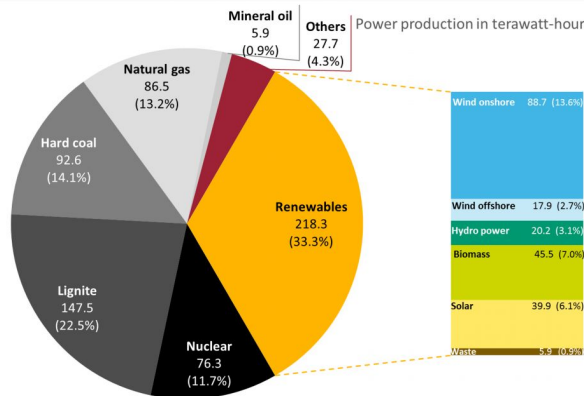


## 2. What is environmental sustainability?

Sustainability is the ability to meet the needs of the current generation without compromising the ability of future generations to meet their needs. The environment is the primary but not the only consideration within sustainability; it is important to also consider human welfare. Therefore, a sustainable society is one that protects natural resources while ensuring social justice and economic wellbeing for all.

Share of energy sources in gross German power production in 2017.

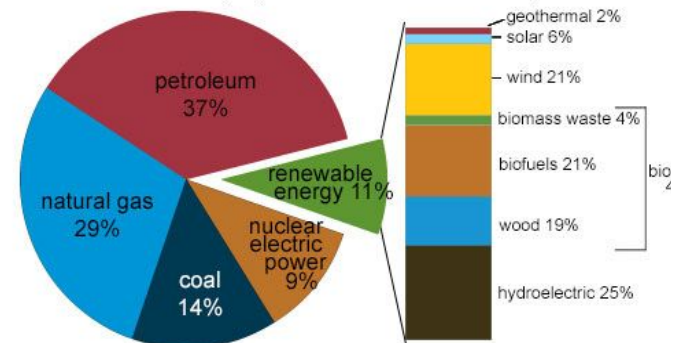
Data: AG Energiebilanzen 2018, preliminary.



U.S. energy consumption by energy source

Total = 97.7 quadrillion British thermal units (Btu)

Total = 11.0 quadrillion Btu



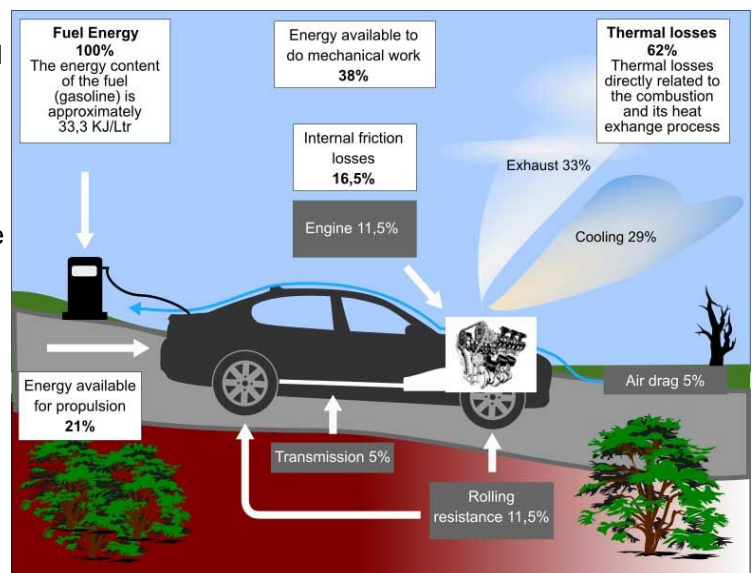
- Consumption of energy is not equal in all parts of the world. Look at the graphs comparing the U.S.'s and Germany's consumption of energy.
- Notice nonrenewable resources account for a high percentage in the U.S. compared to Germany.

- Conservation: The protection, restoration, and management of natural resources or practices.

- Saving, reducing usage, improving efficiency of resources, controlling environmental impact, and reusing are some conservation techniques

- Energy Efficiency: Using energy resources more efficiently

- If energy is the ability to do work then the amount of work produced compared to the amount of energy used is called energy efficiency.
- Energy resources do not produce 100% of the potential work that is stored in the energy source.
- Ex: Car using gasoline- some energy is converted to mechanical energy that moves the car and some is used to power things like the AC, while most of the energy is lost as heat. What other example can you think of?
- Ex 2: Add insulation to a house to reduce heat loss, so less energy is needed to heat the house.



## Sustainability Quarter 3 Assessment

Standards Covered in this Assessment:

**HS-ESS2-4:** Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate

**HS-ESS2-6:** Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.

**HS-ESS3-1:** Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

**HS-ESS3-4:** Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

**HS-ESS3-5:** Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth's systems.

**HS-ESS3-6:** Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

### Directions:

In this assessment, you will be asked to observe, identify, evaluate, and model different sustainable practices and issues within your house and neighborhood by doing a scavenger hunt. You will have options on how you can identify and show each thing, however, simply identifying will not show proficiency. You will also need to ask questions, define problems, investigate solutions, and use/interpret data to develop an overall conclusion for personally using more sustainable practices.

**Safety Practices:** Due to the epidemic at hand, please do these activities safely and use proper safety measures like gloves and masks. While out in your neighborhood, please maintain a 6 foot distance from any other people that may be outside.

**Part 1:** Find each of these items outside or around your neighborhood and take a picture or draw them in the spaces provided. After you document these items, answer the questions following.

### **Items to Find:**

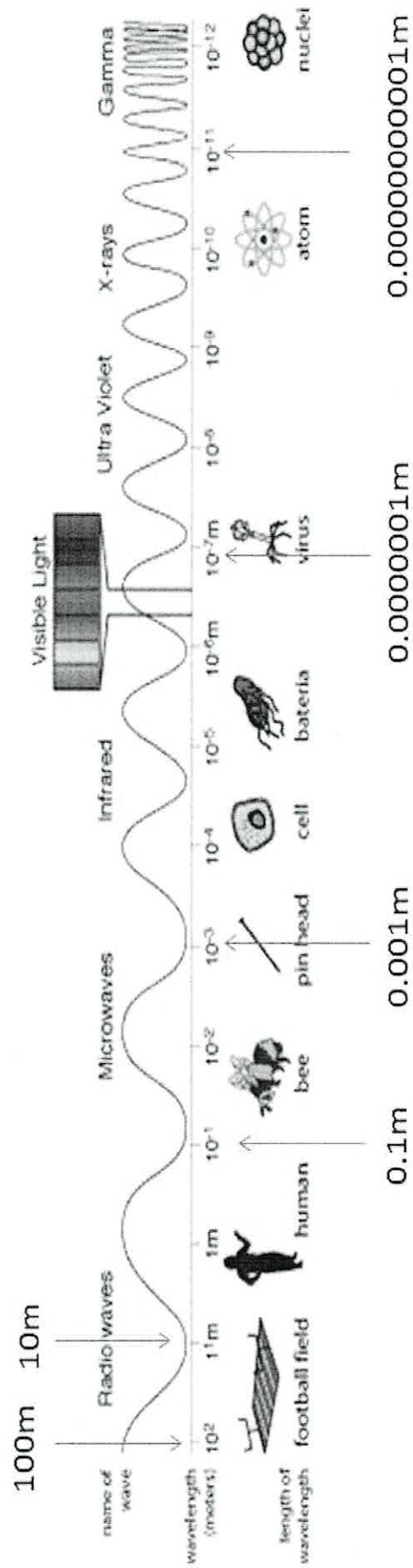
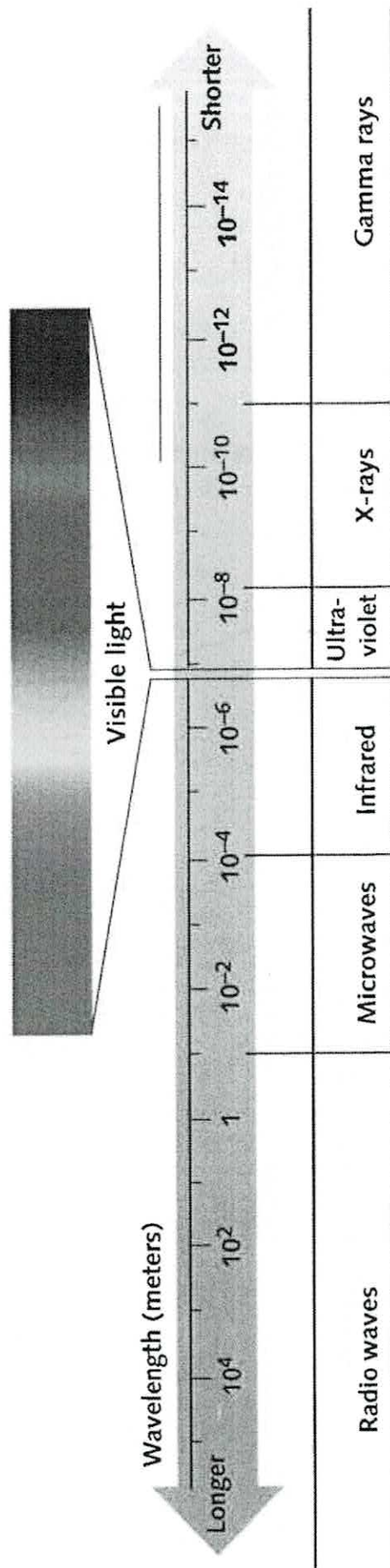
1. ☐ An example of energy efficiency
2. ☐ Any evidence of global warming
3. ☐ Evidence of sustainable waste disposal
4. ☐ A littered food scrap, landfill waste, and recyclable waste
5. ☐ A littered item that is decomposing or old
6. ☐ A farm or area with new construction
7. ☐ An example of your sustainability project topic - or any topic
8. ☐ An example of wastewater pollution
9. ☐ An animal nest or living quarters
10. ☐ A place where drinking water comes from
11. ☐ A sewer drain
12. ☐ A compost or an organic waste disposal
13. ☐ A vegetable garden
14. ☐ A form of alternative energy
15. ☐ A form of air pollution
16. ☐ A form of water pollution
17. ☐ An example of overpopulation
18. ☐ A source of fossil fuels

**Drawings or Pictures**

1	2	3
4	5	6
7	8	9
10	11	12
13	14	15
16	17	18



# The Electromagnetic Spectrum



Picture credit: NASA. Arrows & numbers added by Baldscientist.

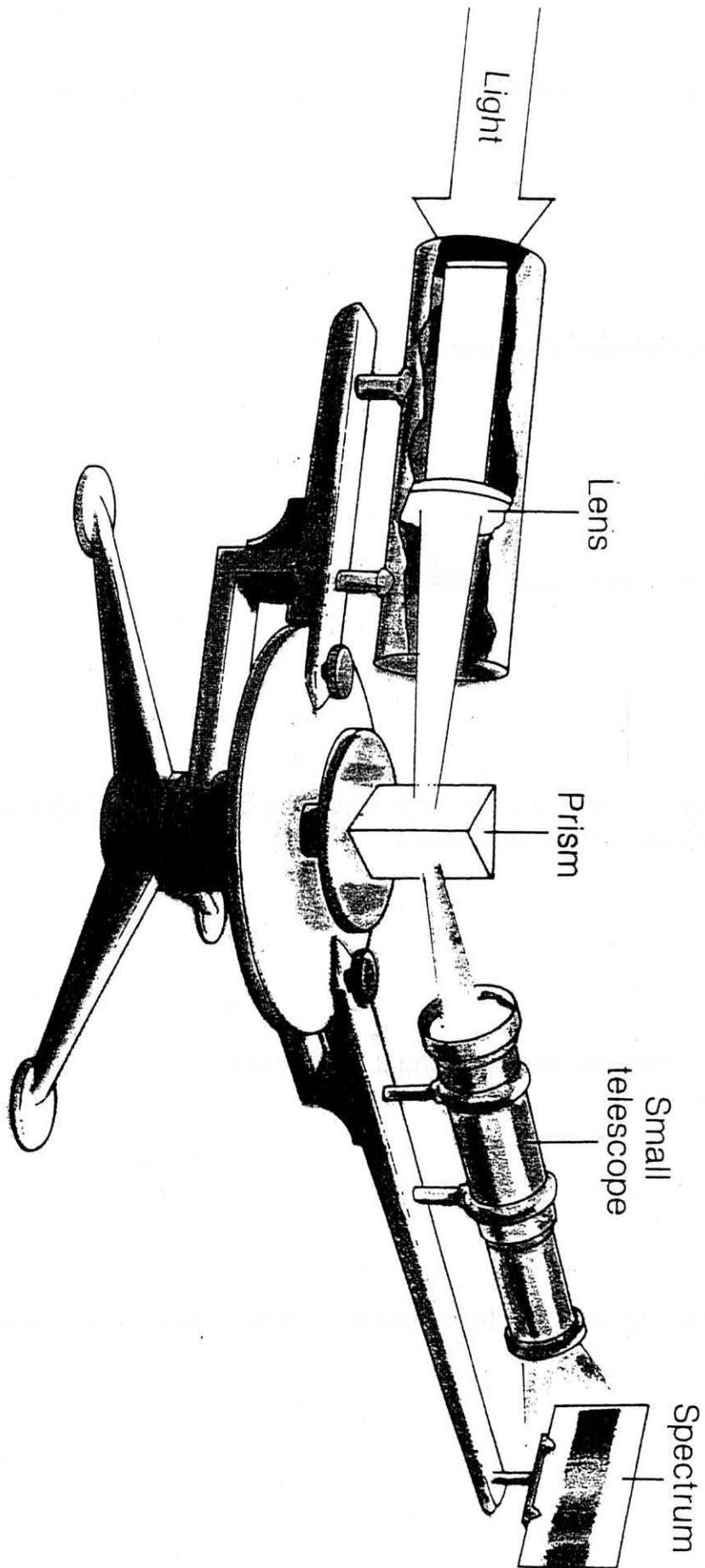
## ELECTROMAGNETIC SPECTRUM

## 3-COLUMN T-CHART

Fill in the chart with information about the different kinds of electromagnetic radiation.

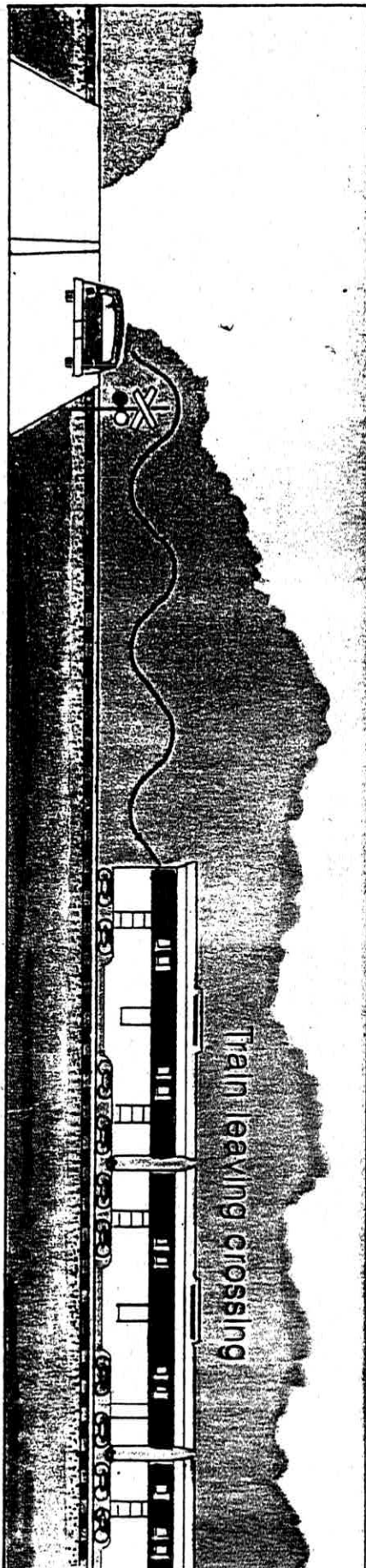
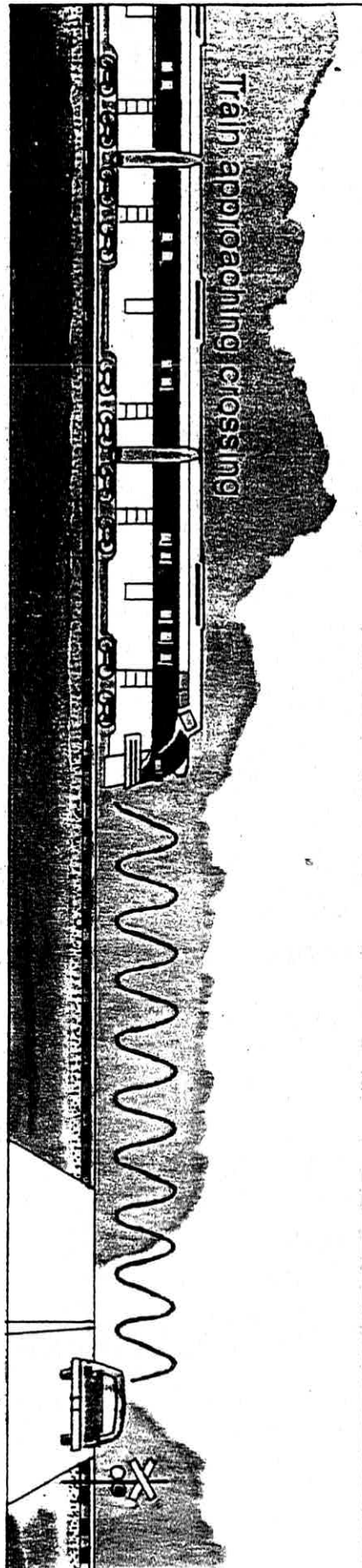
RADIATION TYPE	WHAT PRODUCES OR USES THIS TYPE OF RADIATION?	WHAT DO YOU KNOW ABOUT THIS TYPE OF RADIATION?
GAMMA RAYS		
X-RAYS		
ULTRAVIOLET LIGHT		
VISIBLE LIGHT		
INFRARED LIGHT		
MICROWAVES		
RADIO WAVES		

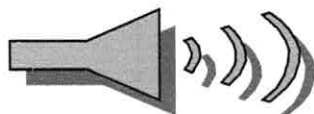
# 1 Spectroscope



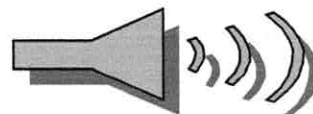
1. Name the parts of a spectroscope in the order in which light passes through them?
2. What is the purpose of the prism?
3. What do astronomers use a spectroscope for?
4. Explain how the two yellow lines produced by Sodium as its light passes through a spectroscope are like fingerprints?
5. List 3 other elements and their bright line spectra.
6. How do scientists use spectroscopes in order to determine the composition of stars?

## 2 Doppler Effect





## The Doppler Effect



1. How does the whistle pitch change as the train approaches the crossing? Why does this occur?

How does the whistle pitch change as the train leaves the crossing? Why does this occur?

2. How can you apply the Doppler Effect to the way starlight (star's spectrum) appears from the earth?

How does this help scientists understand the motion of objects (stars, etc.) in the universe?

3. If a star suddenly showed a blue shift instead of a red shift, what would this indicate?
4. As seen from the earth, is sunlight red-shifted, blue-shifted, or neither? Explain.
5. What has the Doppler Effect told astronomers about the expansion of the universe?



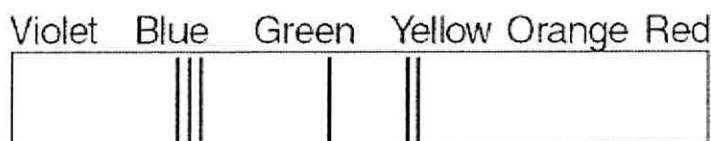
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# The Universe

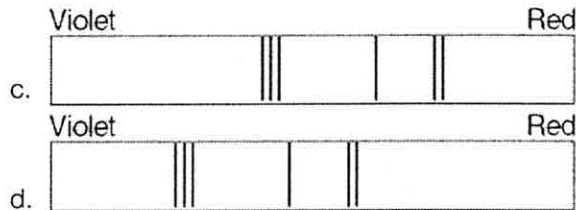
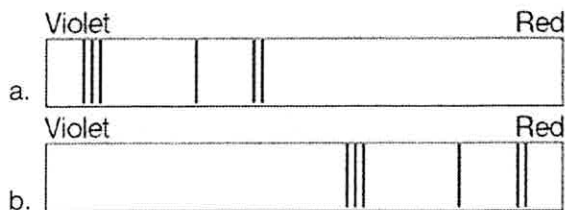
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## PART I QUESTIONS: MULTIPLE CHOICE

The diagram below shows the standard dark-line spectrum for an element. The spectral lines of the same element are observed in light from four distant galaxies.



1. Which spectral lines most likely represent the galaxy farthest from the Earth?



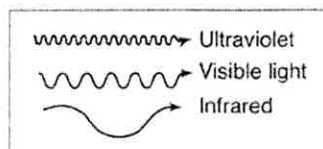
2. Based on the red-shift data on galaxies, most astronomers infer that the universe is currently
- fixed and stationary
  - moving randomly
  - contracting
  - expanding
3. Background radiation detected in space is believed to be evidence that
- the Universe is contracting
  - galaxies are evenly spaced throughout the Universe
  - the Universe began with a primeval explosion
  - all matter in the Universe is stationary
4. A comparison of the age of the Earth obtained from radioactive dating and the age of the Universe based on galactic Doppler shifts suggests that
- the Earth was formed after the Universe began
  - the Earth is immeasurably older than the Universe
  - the two dating methods contradict one another
  - the Earth is about the same age as the Universe
5. In which group are the parts listed in order from oldest to youngest?
- universe, Milky Way, solar system
  - solar system, Milky Way, universe
  - universe, solar system, Milky Way
  - Milky Way, solar system, universe

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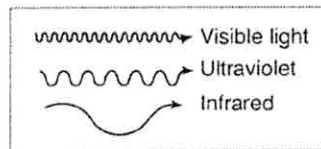
# The Universe

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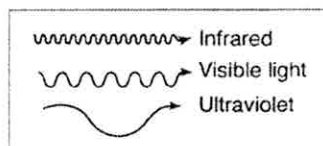
6. Which diagram represents the wavelengths of visible light, ultraviolet energy, and infrared energy?



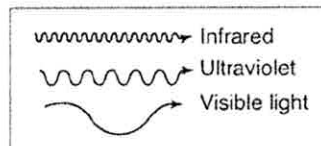
a.



c.



b.



d.

7. The red shift of light from distant galaxies provides evidence that these galaxies are
- decreasing in size
  - increasing in size
  - decreasing in distance from Earth
  - increasing in distance from Earth
8. Scientists infer that the Big Bang occurred approximately
- 4.6 billion years ago
  - 7 billion years ago
  - 9 billion years ago
  - 13.8 billion years ago
9. Evidence that the universe is expanding is best supported by the observation that the wavelengths of light from distant galaxies are shifted toward the
- red end of the spectrum because they are shortened
  - red end of the spectrum because they are lengthened
  - blue end of the spectrum because they are shortened
  - blue end of the spectrum because they are lengthened
10. Based on the red-shift data on galaxies, most astronomers infer that the universe is currently
- fixed and stationary
  - moving randomly
  - contracting
  - expanding
11. Which evidence best supports scientists' inferences about the origin and age of the universe?
- the existence of planets
  - cosmic background radiation
  - formation of star constellations
  - similar composition of Earth and the Moon