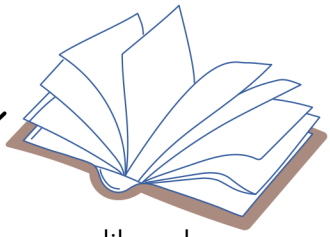
LAW OF SUPERPOSITION Review Reading



The Relative Ages of Rocks

To us (humans), a year seems like a very long period of time. (Even a few minutes can seem like a long time when you are waiting for food to cook or paint to dry!) The Earth has been around for a **very** long time- such a huge amount of time that its hard to even imagine! Scientists date the age of the Earth at **4.6 billion years old**. We call the Earth's history **geologic time**. Humans like us are relatively new in the geologic time- modern humans have only been around for about 300,000 years. For a long time scientists wondered what life was like on Earth before humans were there to take records. They also wanted to know when the first lifeforms were found on Earth and what the oceans, continents, and atmosphere were like at different points in geologic time. One way that scientists can learn about the past on Earth is by studying fossils. **Fossils** are the preserved remains of once living things. There are fossils of animals like dinosaurs but also insects, plants, and even bacteria. Fossils can be molds of living things in rock, insects trapped in amber, footprints or nests, or many other kinds of remains. A person that studies fossils is called a **paleontologist**. So how do paleontologists know how old fossils are? How do they know which animal came first when looking at two fossils? Scientists can use **radiometric dating** to determine the absolute age of a rock- how much time has passed since the rock formed. This method relies on naturally radioactive elements in rocks which decay over time. However, without taking a fossil to a lab you can quickly determine which rocks and fossils are the oldest and youngest just by looking at the layers of rock; this is called **relative age**. Relative age is the age of a rock or fossil compared to the rocks around it. When we find relative age we can say that a rock or fossil is younger or older than another and we can estimate the age. Scientists usually use a mixture of both relative age principles (like the law of superposition) and radiometric dating in order to learn about what life was like on Earth millions or billions of years ago.

How can we find the relative age of a rock layer or fossil?

Imagine you are stacking a cake with four layers. What layer do you stack first? The bottom one right? If you try to stack the top layer first it will fall through the air and land at the bottom. Strata (rock layers) are exactly like the layers of a cake. Sediments are pieces of rock and they pile up in layers on the ground. Over time, and as they are buried more deeply, they are compacted into layers of rock. **The Law of Superposition** states that the oldest rock layers are at the bottom of the pile and the newest or youngest rock layers are at the top of the pile. The same is true for the fossils found in the rock layers. The fossils at the bottom of strata are older than the fossils found on top. There are a few other things to keep in mind as you look at strata and try to determine the relative ages of fossils or rocks. Fossils are usually found in layers of sedimentary rock. Sometimes magma will come up to the surface through layers of rock or strata. We call this an **igneous intrusion**. Igneous means a rock cooled from magma or lava and intrusion means it happens underground (INside the Earth). When you see an igneous intrusion you know that it is YOUNGER than the rock layers it cuts through (even if its close to the bottom). Think about it- the rock had to exist before the intrusion could come alone and break in. Sometimes lava will flow from a volcano on the surface of the Earth. We call this an **igneous extrusion** (EXiting the Earth on the surface). Extrusions are easier to date- since they happen on the surface the law of superposition usually still applies. Sometimes rock layers can be cracked by Earthquakes. We call a crack or break in the Earth's crust a **fault**.

LAW OF SUPERPOSITION *Reading Continued*

The fault is younger than the rock layers it cuts through. The fault is just a crack so the rock had to exist before it could get cracked. Sometimes scientists will have an unconformity in the fossil record. An **unconformity** is where a layer of rock is missing due to erosion (worn away rock).

Index Fossils

Index fossils are one way that scientists can find the relative age of a rock layer. **Index fossils** are the preserved remains of organisms that:

1.) lived around the world or had a large habitat

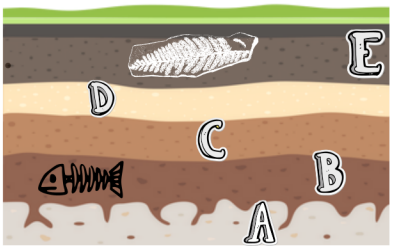
2.) are easy to recognize

3.) lived for a relatively short period of time before they went extinct (their species completely died out)

Scientists can use index fossils as markers of specific time periods. For example the trilobite is an index fossil. Trilobites were like prehistoric horseshoe crabs and they filled the Earth's oceans for a few hundred million years. If you find a trilobite fossil then you know the age of the rock layer it was found in. Index fossils act like markers of known points in geologic time.

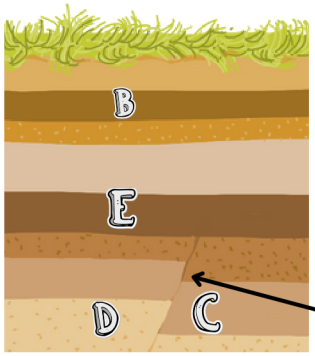
This is a LOT of info so let's do some practice problems!

In normal sedimentary rock strata, the law of superposition states that the layers on the bottom are the oldest and the layers on the top are the newest. So if we look at the image below which layer is the youngest? _____ Which layer is the oldest? _____ Which is older B or C?_____ Which animal was alive first, the land plant or the fish? _____**When you have written down your answers flip the page to check them!**



Answers:

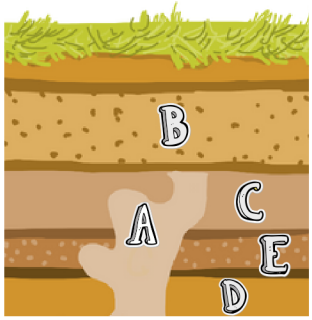
E is the youngest; A is the oldest; B is is older than C The fish came before the land plant



There is a fault (break) in this cross section labeled A. The rock layers are older than the fault that cuts though them. If there is an unbroken layer of rock above the fault, that means that that layer came after the earthquake or movement that created the fault and moved the rock layers. **Put the letters of labeled layers in order- oldest to youngest- and then check your answers.**

Answers:

D is oldest, then C and then A. E is younger than A because A doesn't cut through E. B is the youngest



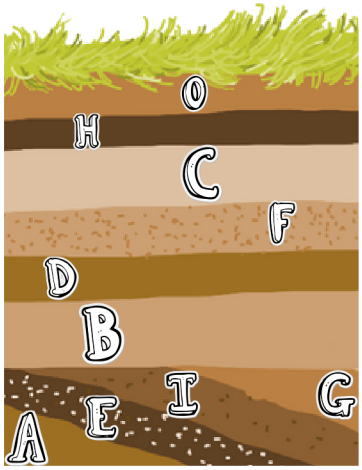
In this cross section there is an igneous intrusion (magma has bubbled up into the strata). The intrusion is younger than the rock layers (or faults) it cuts through. Look to see if the top of the intrusion is eroded away- that means the layer on top is younger than the intrusion. **Put the letters of labeled layers in order- oldest to youngest- and then check your answers.**

Answers:

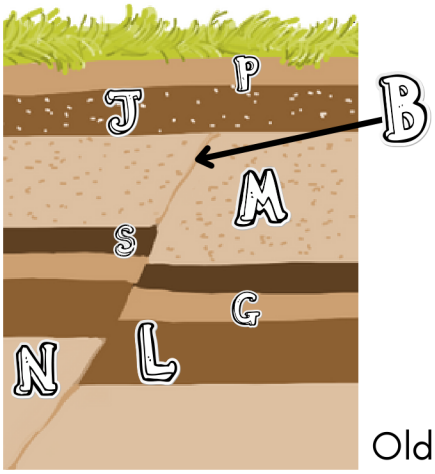
D is oldest, then E and then C. A is next because it cuts through C but not B-meaning B came last of the labeled layers.

LAW OF SUPERPOSITION *Practice*

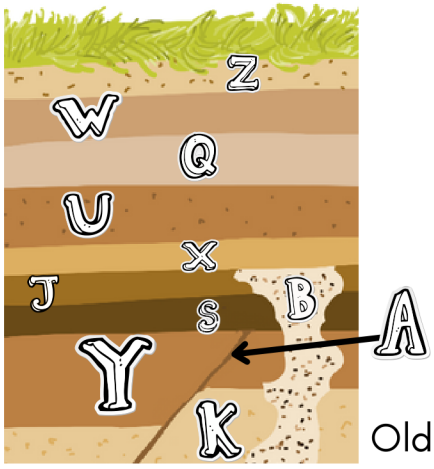
Use the law of superposition reading to complete the practice questions below. **For each cross section, put the labeled layers in order from oldest to youngest.**



Oldest rock layer-> _____-> youngest



Oldest rock layer-> _____-> youngest



Oldest rock layer-> _____-> youngest

LAW OF SUPERPOSITION *Reading Questions*

1.) How old is the Earth and how long have modern humans been around?

2.) What is a paleontologist and what are some examples of fossils?

3.) What is the difference between absolute and relative ages? How do we find each kind of 'age'?

4.) What is the law of superposition? How could you use the law of superposition to find the age of a fossil?

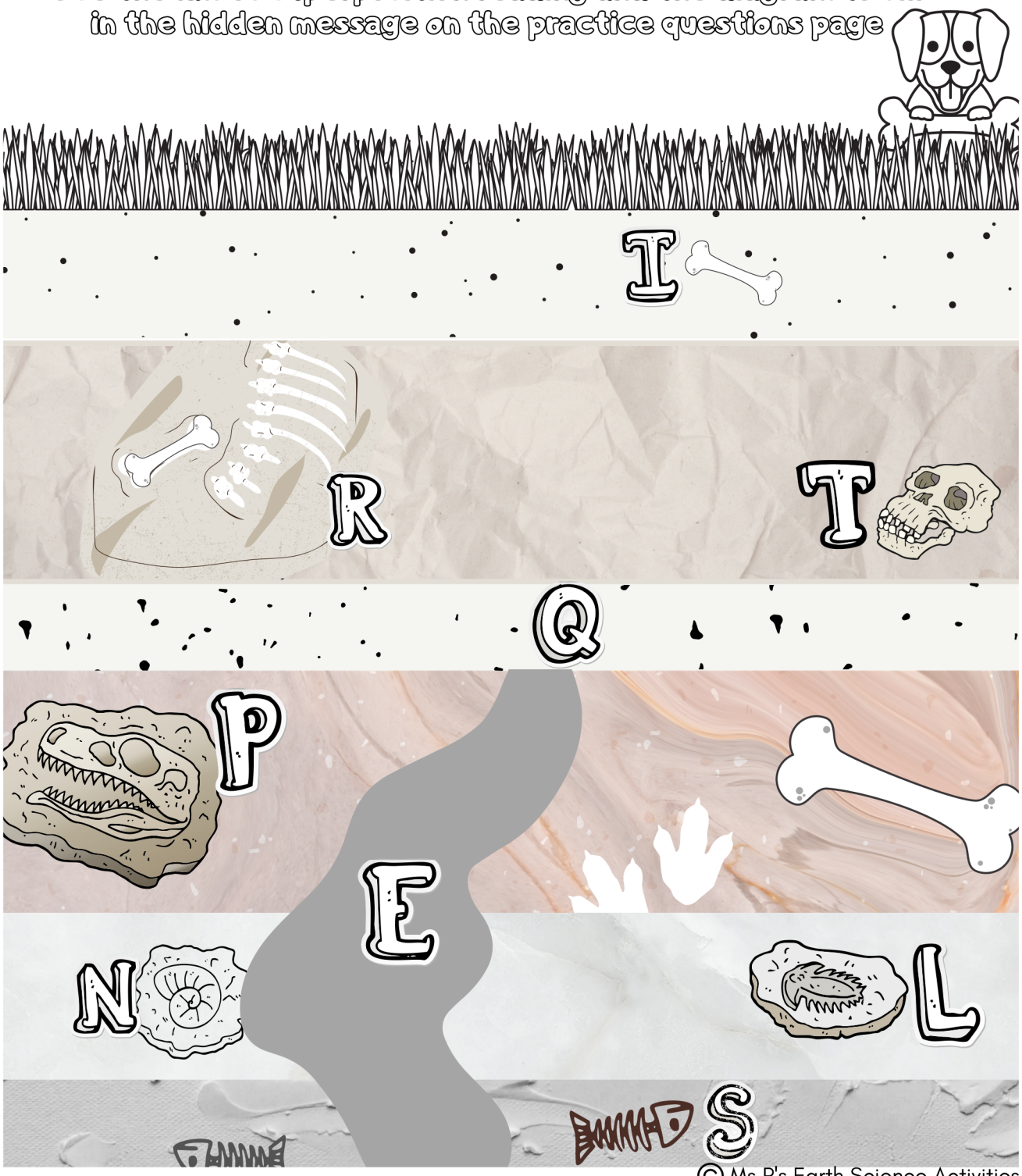
5.) What is the difference between an igneous intrusion and an igneous extrusion? (Which is which?)

6.) What are the traits of a good index fossil? What are index fossils used for?

Name: Date:

Law of Superposition

Use the law of superposition reading and the diagram to fill in the hidden message on the practice questions page



SUPERPOSITION Practice Questions

1 Use the diagram on the previous page to answer the following questions.

1.) Which fossil is older, T or S? _____

2.) Which fossil is older, P or L? _____

3.) Which is younger, fossil P or intrusion E? _____

4.) Which is younger, P or N? _____

5.) Which is younger, fossil R or layer Q? _____

6.) Which is older I or T? _____

7.) Which is older, intrusion E, or layer Q? _____

8.) What is the fossil in the youngest layer?_____

____ ____ ____ -- ____ ____ ____ ____ ____ !

5 7 4 6 8 2 3 1

2 Match each definition with the correct vocabulary term (use the reading for help).

1.) A break in rock on the surface due to earthquake activity: _____

2.) A missing 'puzzle piece' in strata due to erosion: _____

3.) The history of the Earth- when it formed to the present: _____

4.) The preserved remains of once living things: _____

5.) A way for scientists to find the absolute ages of rocks: _____

6.) This scientific rule says that lower rock layers are older than the rock layers on top when looking at sedimentary rock strata: _____

7.) The fossils used as markers for specific periods in time: _____

8.) An approximate age of a rock/fossil compared to others: _____

9.) A scientist who studies fossils and the history of Earth: _____

10.) Magma bubbles up, breaks into rock layers, and cools: _____

VOCABULARY

A.) Igneous Intrusion

B.) Unconformity

C.) Fault

D.) Paleontologist

E.) Fossils

F.) Relative Age

G.)Index Fossils

H.)Geologic Time

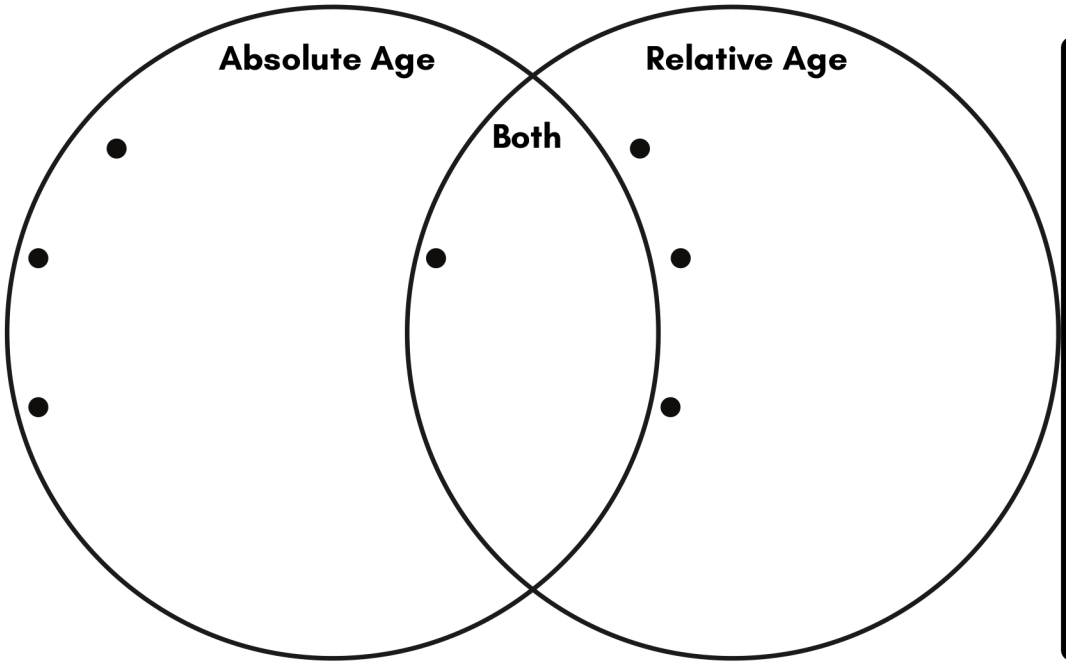
I.)Law of Superposition

J.)Radiometric dating

3 How are paleontologists like detectives? What could these jobs have in common?

LAW OF SUPERPOSITION *Extension Activity*

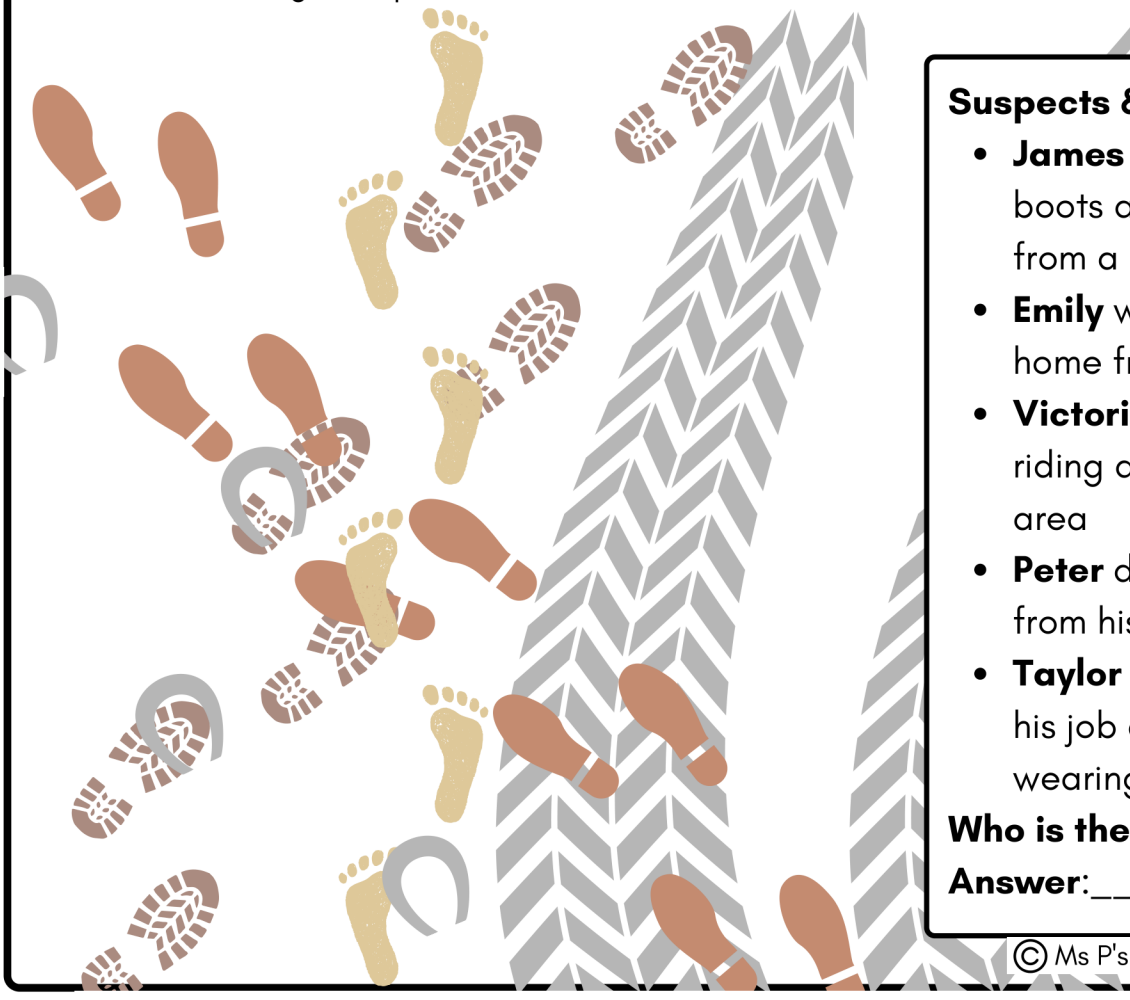
1.) Compare and contrast absolute and relative ages using the key.



Key:

- **Uses radiometric dating**
- **Used by paleontologists**
- **Finds the age of the rock in years since it formed**
- **Uses the law of superposition**
- **Uses the radioactive decay of elements**
- **Index fossils are useful for this kind of dating**
- **Completed in the field**

2.) Last night, An international jewel thief stole a precious jewel from your local museum. Luckily it also snowed last night. The detectives know that the thief was the last to leave the scene. Look through the prints and decide which tracks are the newest before the snow melts!



Suspects & Clues:

- **James** wears work boots and walks home from a construction site
- **Emily** walks barefoot home from yoga class
- **Victoria** was seen riding a horse in the area
- **Peter** drives a car home from his job in the city
- **Taylor** walks home from his job at the museum wearing work shoes.

Who is the thief??

Answer:_____