

Welcome to Class 8: Earth Habitability

Remember: sit only in the first 10
rows of the room

What are we going to discuss today?

How can plate tectonics be important for regulating the Earth's temperature?

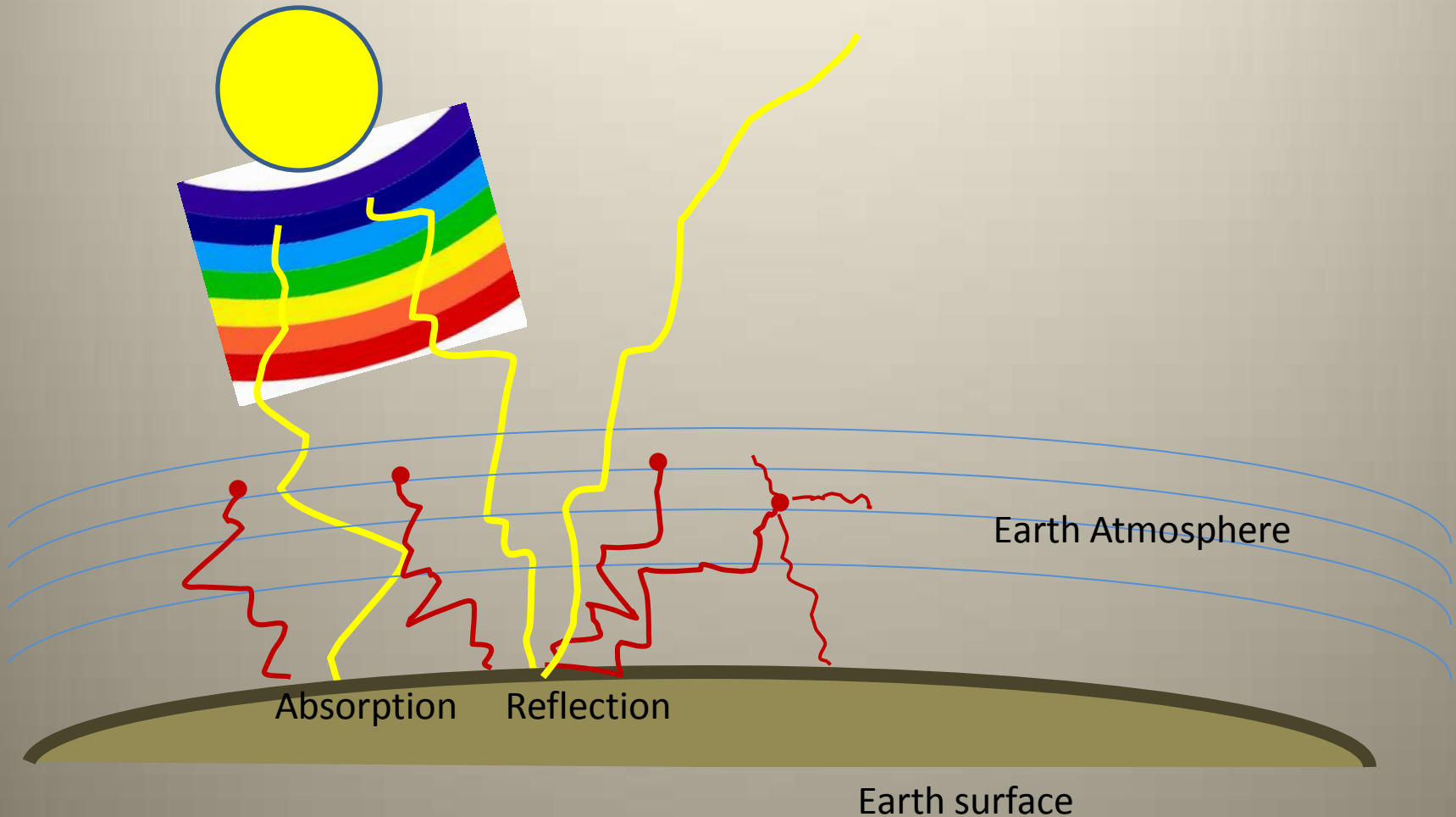
What is it that makes Earth habitable for life?



Map out the ``greenhouse effect''

- 1) Who are the `major players'? What will we need to include in our diagram?
- 2) Where is the initial energy generated?
- 3) How is that energy transported and where does it 'land'?
- 4) Now where is the energy? What does it do?
- 5) How is *that* energy transported and where does it 'land'?
- 6) What is trapped by the atmosphere and what escapes?

Does yours look something like this?



Are greenhouse gases bad?

How much warmer is the Earth because of its greenhouse gases?

30 °F → 59 °F (or about 30 °F warmer!)



What are the important greenhouse gases on Earth?

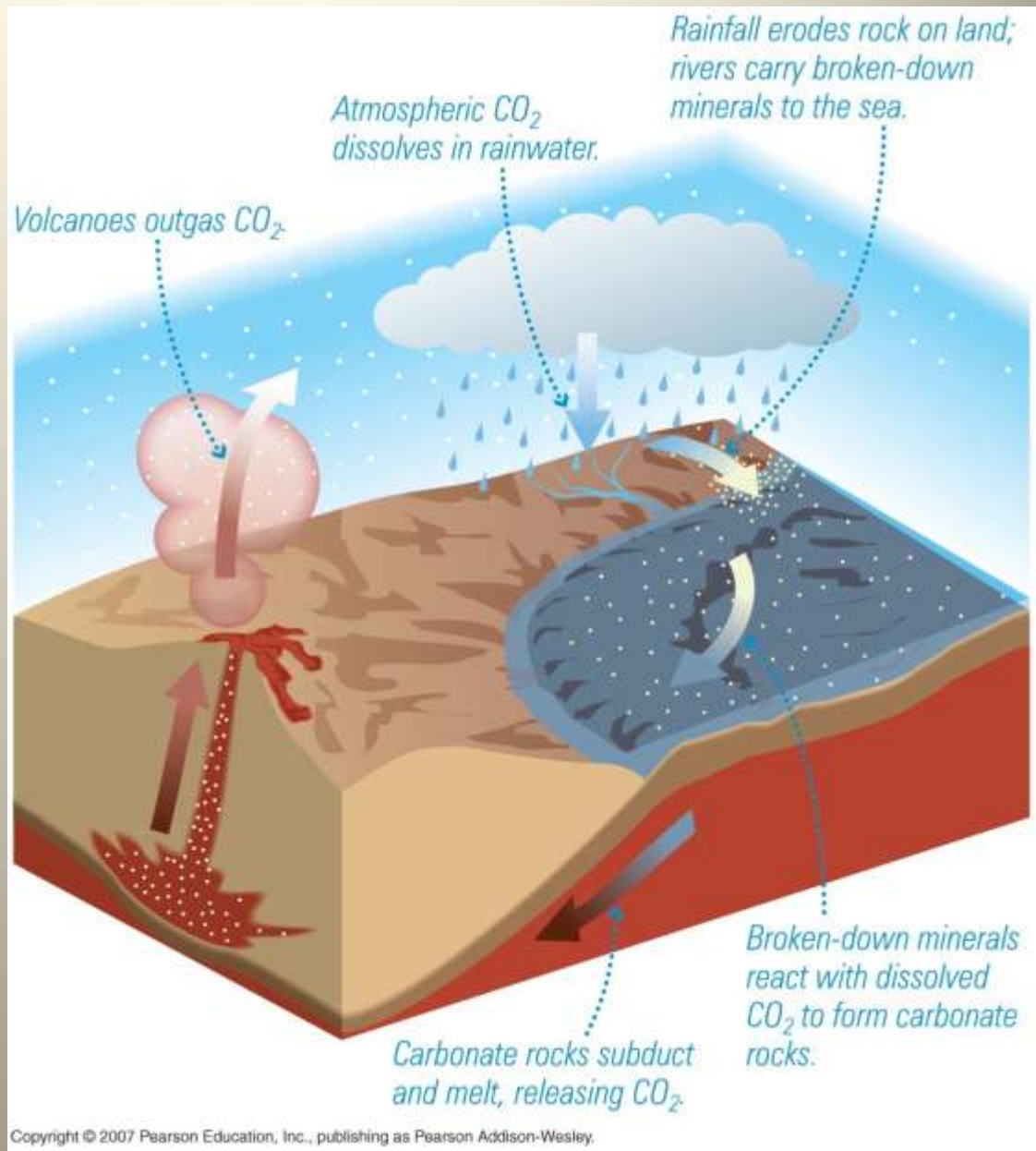
Water (H₂O) Carbon Dioxide (CO₂)
Methane (CH₄ <- extremely effective)

PRS: The earth's greenhouse effect is driven by the fact that _____.

1. Infrared light can not pass through the Earth's atmosphere.
2. The Sun's radiation heats the Earth.
3. The atmosphere blocks all forms of radiation.
4. All of the above.

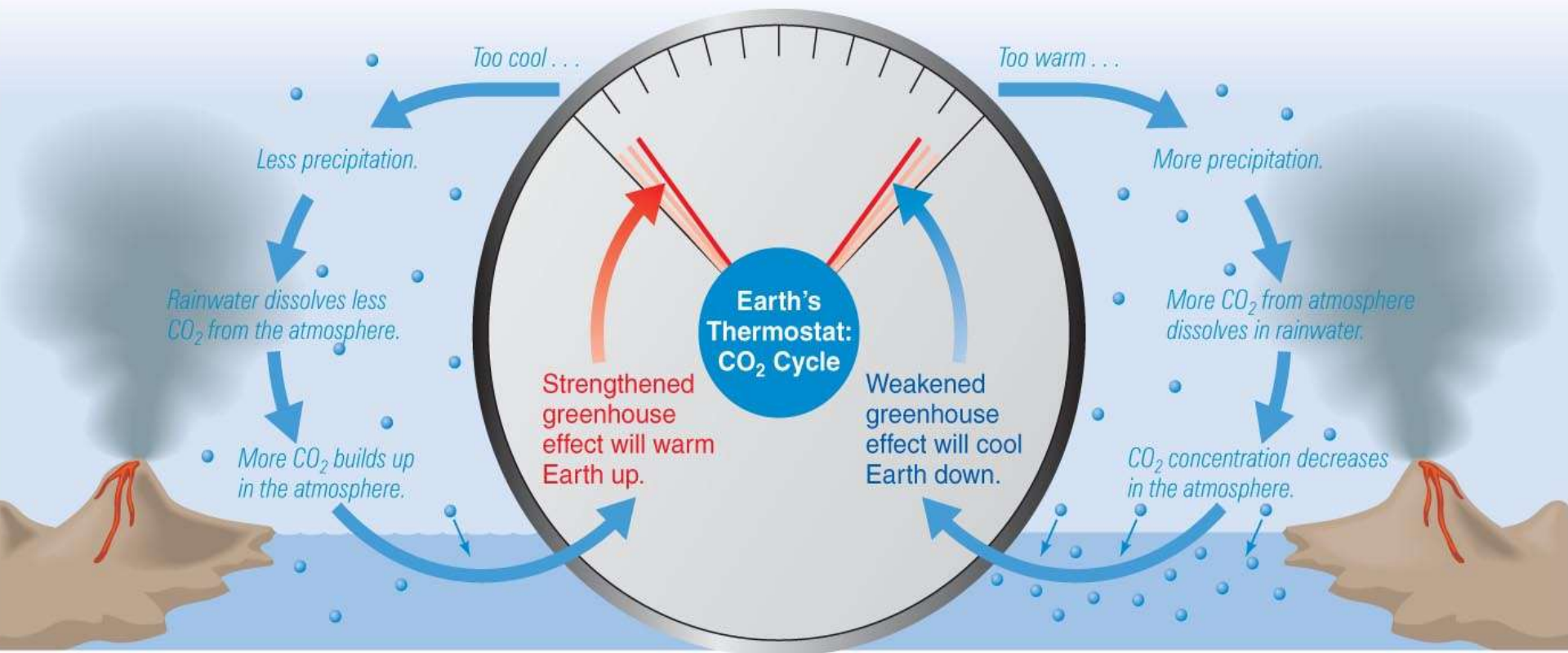
Here is the CO₂ Cycle

What does it do?



The CO₂ cycle

Regulates Earth's temperature through a negative feedback process



Let's simplify the CO₂ Cycle

1. Draw a triangle. (you should be getting good at this by now)
2. In the three corners label the three primary conditions or locations one finds CO₂ on Earth.
3. Draw arrows moving the CO₂ from one spot to the next and label how that motion occurs.
4. Can the cycle go both ways or only one way?
5. Take the condition where atmospheric temperatures increase.
How does this change the precipitation (rain) level?
6. Follow all the way through the cycle.
7. What will happen to global temperatures at the end of the cycle?
8. Take the condition where atmospheric temperatures decrease.
9. How does this change the precipitation (rain) level?
10. Follow all the way through the cycle.
11. What will happen to global temperatures at the end of the cycle?

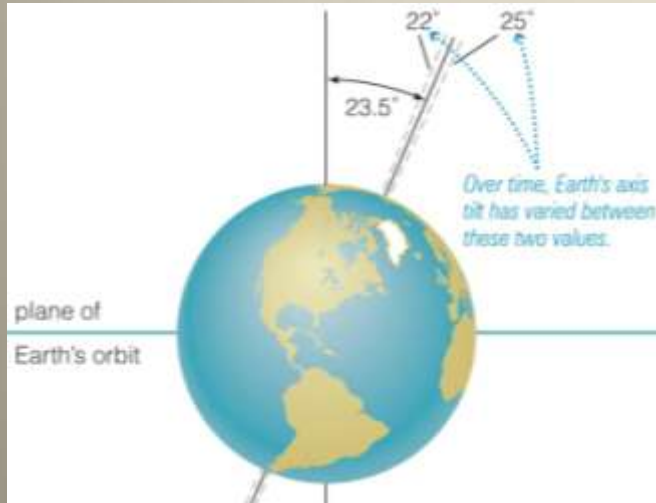
PRS: Over what time scale for temperature change is the CO₂ cycle effective?

1. 50 years
2. 1,000 years
3. 100,000 years
4. 10 million years
5. 1 billion years

PRS: If we double atmospheric greenhouse gases in 100 years, what might happen?

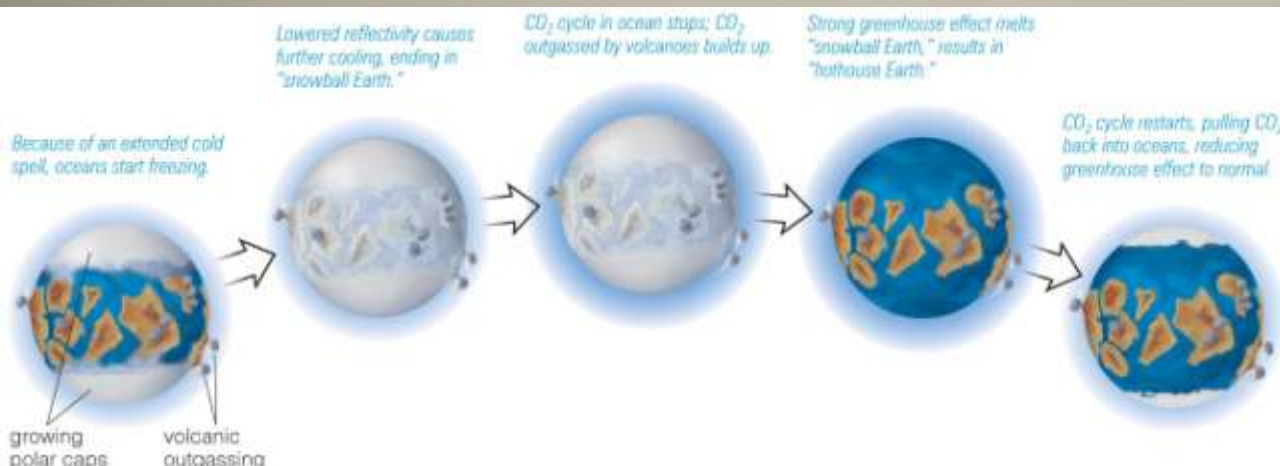
1. Average global temperatures should rise.
2. Some areas may be cooler.
3. Weather may become more extreme.
4. All of the above.

With such a good CO₂ cycle (before industry), why were there Ice Ages?



1) Changing tilt of Earth axis vs. orbital plane. When small tilt, weaker summers, and oceans stay very cold and freeze.

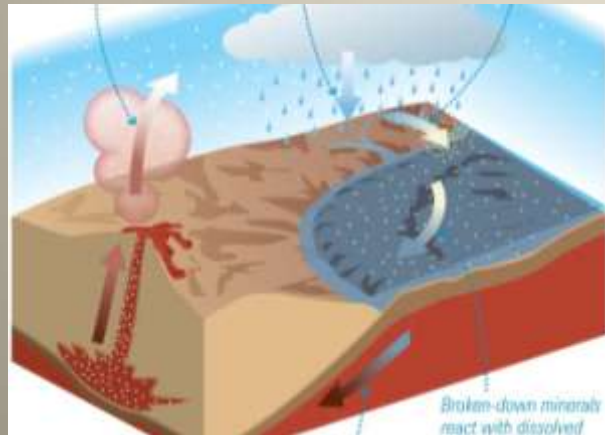
2) The CO₂ may have gone through very rapid or cataclysmic changes (extreme volcanism, meteoritic impact)



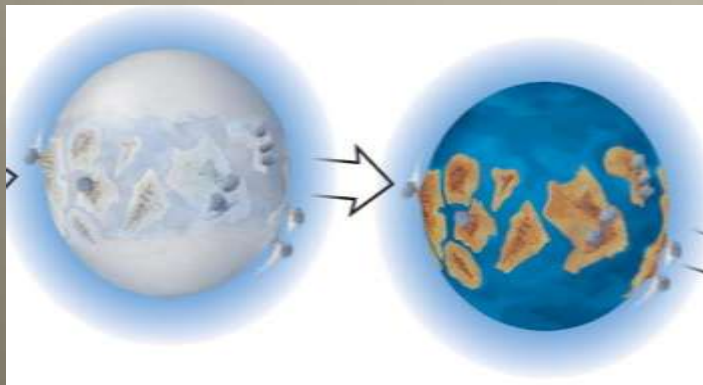
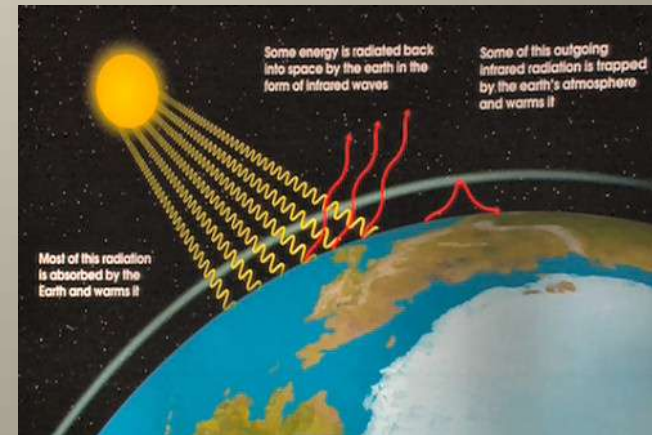
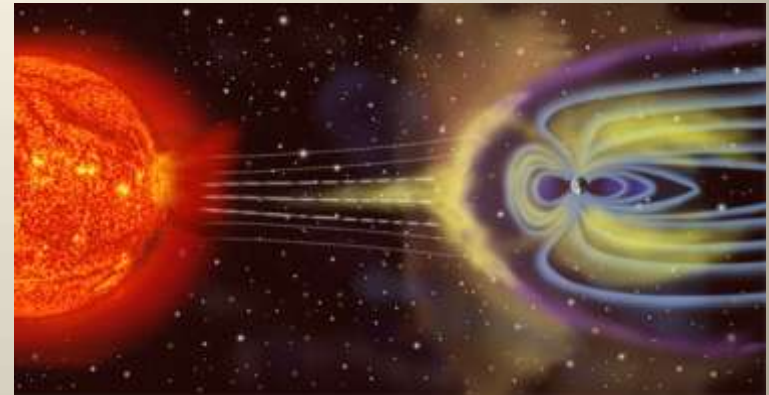
Runaway effect of growing polar caps might have lead to Snowball Earth.

The Long-Term habitability of Earth.

What makes Earth such a great place for life?



How are these related?



What is life?



Living organisms exhibit _____ in their internal structure

1. Reproduction
2. Evolutionary adaptation
3. Growth and development
4. Order

Life _____ in a way that leads to organisms that adapt to their environment

1. Reproduces
2. Grows and develops
3. Evolves
4. Responds

Life actively _____ to changes in its surroundings

1. Evolves
2. Responds
3. Develops
4. organize

Living organisms _____ their own kind.

1. Adapt to
2. Respond to
3. Reproduce
4. Utilize

Living organisms _____ to fuel their many activities

1. Use energy
2. Reproduce
3. Respond
4. Adapt
5. Develop

Living organisms _____ in patterns determined in part by heredity.

1. Reproduce
2. Adapt
3. Respond
4. Grow and develop
5. Use energy

Put all your materials on the floor and
place your PRS clicker in front of you.

Please: use just one clicker for yourself.

Take care that others can not
view your selection

1. How much warmer is our Earth due to its current greenhouse gases?

1. About 5 °F
2. About 10 °F
3. About 30 °F
4. About 50 °F

2. Where is most of the CO₂ stored on Earth?

1. In the surface rock
2. In the atmosphere
3. In the oceans
4. About equal amounts are found in all three.

3. In the CO₂ cycle, at which stage are carbonate minerals generated?

1. At the base of the ocean
2. In the atmosphere during precipitation.
3. During subduction
4. During volcanic outgassing

4. The habitability of the Earth is most strongly tied to its _____

1. Magnetic field
2. Atmosphere
3. Plate tectonics
4. Geological Activity
5. Oceans

5. When a life form actively changes to its environment, we say it is _____

1. developing

2. responding

3. evolving

4. reproducing

To do list for next class

- Refer to the class syllabus
- Read assigned pages in textbook and review study questions on objectives list
- Register and bring PRS transmitter to class
- Bring textbook to class (not mandatory)