

Free Response Questions

Answers must be in essay form. Outline form is NOT acceptable. Labeled diagrams may be used to supplement discussion, but should be explained in your essay. It is important that you read each question completely before you begin to write. Write your answer on notebook paper-1 piece of paper /essay.

1. Global temperatures throughout the Earth's history, since the origin of life, can be estimated utilizing a common, albeit primitive organism called foraminiferans. Foraminiferans incorporate calcium carbonate, CaCO_3 , in their bodies as they grow. The oxygen in CaCO_3 may be of two different isotopes, which are sensitive to temperature. The oxygen derives from water. The two isotopes are: H_2^{18}O and H_2^{16}O . H_2^{16}O has less mass and evaporates more rapidly in warm temperatures than H_2^{18}O . Consequently deposits formed during warming trends are characterized by large amounts of H_2^{18}O compared to H_2^{16}O . When it is a cool (like ice age) period on Earth, then there will be a ratio closer to parity of $\text{H}_2^{18}\text{O}:\text{H}_2^{16}\text{O}$. Using the ratio of isotopes is one way to determine trends of global temperatures, which appear to be cyclic. At the present time, global temperatures are climbing more rapidly than at any other warming period in the Earth's history.

The current rate of global temperature change is an increase of $0.5^\circ\text{C}/\text{decade}$ (up to 1980). Keep in mind this is an average, some parts of the Earth are exhibiting greater increases in temperature, while the oceans of the Earth are lagging behind the average global increase in temperature. Explain the discrepancy of the atmospheric temperatures and oceanic temperatures, using the properties of water. Predict consequences of continued increases of CO_2 in the troposphere, once again using properties of water, for plants and animals. Utilize three different properties of water. 12 points

- A. For each property, identify and define the property and explain it in terms of the physical/chemical nature of water.
- B. For each property, describe one example of how the property affects the functioning of living organisms in the future, if current trends persist.
- C. Explain hydrogen bonding of water molecules as it pertains to the property.