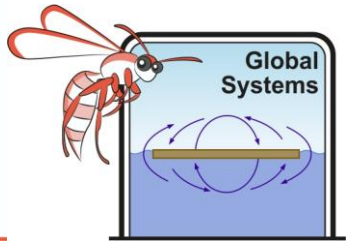
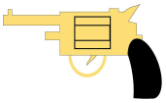


Methane Clathrates - Student Activity

Methane clathrates are methane gas (CH_4) held within a scaffolding of ice crystals. They are held frozen in sinks in permafrost areas. There are concerns that warming temperatures will release this greenhouse gas into the atmosphere.



Methane clathrates are also held under great pressure in ocean deeps. Just as global warming could cause the release of methane from permafrost areas, warming oceans will cause a decrease in pressure at depth releasing methane. Methane is a "greenhouse gas" and will cause further unstoppable warming and release. Geologists cause this cascade effect ***"The methane gun".***

Will the release of methane from ocean beds result in positive or negative feedback? Explain your answer. _____

_____

Why do you think the scientists use the image of a gun for the release of methane? _____

_____

Aim **To demonstrate that pressure can cause a gas to become denser**

The Cartesian Diver, named after the French philosopher René Descartes demonstrates that under pressure gas volume decreases and its density increases.

Materials

- Used cool drink bottle
- Small tube sealed at one end or a plastic transfer pipette cut off about 5cm from the bulb
- Plasticine or clay
- Option – permanent ink pen to draw face and arms on the diver. (This diver is a mermaid!)

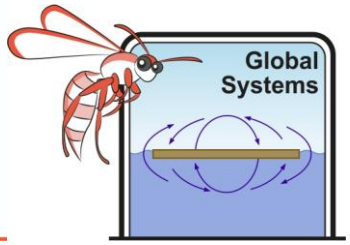
Method

1. Fill bottle with water to about 4cm from the top.
2. Half fill the tube/diver with water
3. Add an open collar of plasticine to the neck of the tube to create negative buoyancy
4. Drop diver open end down into the bottle. Adjust plasticine collar until the diver floats just below the surface
5. Seal the bottle. If the cap leaks then seal with the fleshy pad at the base of your thumb as demonstrated in the picture
6. Squeeze the sealed bottle
7. Observe
8. Repeat

Observations

_____

_____

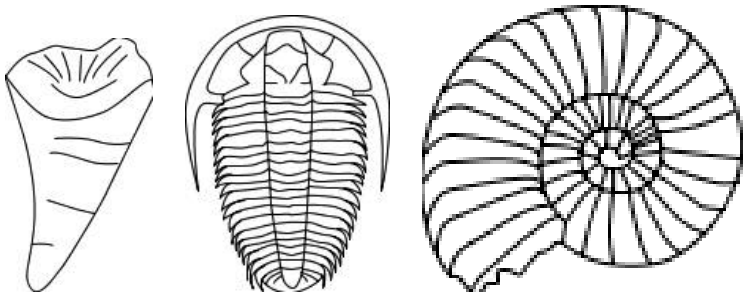


Methane Clathrates - Student Activity

Conclusion

Why do you think the position of the diver/mermaid changed? _____

_____



Rugose coral, trilobite and ammonite. – All extinct

Geologists have suggested that one of the factors causing major extinctions such as the "Great Dying" between Permian and Triassic times was the release of methane clathrates from the sea. Enormous volcanic basaltic rock outpourings from fissure eruptions like those in Iceland today built 5km high mountains called the Siberian Traps. Volcanic rock in Siberia and Iceland has been compared by many geologists and are similar. Volcanic activity would have been accompanied by venting of huge volumes of carbon dioxide forcing global warming. Studies of other rocks from this time in China have shown major abnormalities in the ratio of carbon-12 to carbon-13 and to carbon-14. Four fifths of the abnormally large amount of carbon-12 can be explained from volcanic venting but one fifth does not have a known source. Other scientists have found that methane produced at depth anaerobically by bacteria contains high amounts of carbon – 12. Perhaps high CO_2 levels produced global warming and warm seas could no longer retain methane at depth. The gas would have risen and would have entered the atmosphere causing further lethal global warming. The high levels of CO_2 would have used up free oxygen starving marine and land plants.

This was the greatest extinction of all time (The Great Dying). 96% of all marine species died and 70% of all terrestrial species. It was the only known mass extinction of insects. It took 20 to 30 million years for coral reefs to reform and forests to be re-established.

Evidence for this theory lies with the rocks deposited at this time. The ratio of ^{13}C to ^{12}C indicates that methane from bacterial breakdown produced a very high proportion of the carbon found in the rocks.

From the information above:

Which information could be considered as primary data?

_____

Which information would be secondary data?

_____

Which would be considered as proxy data and what conclusions could be made from these?

_____

_____