

## **Topic:** How did water get on Earth

### **Materials:**

Computer

Books

Teachers

Parents

Tri-fold

Paper

Folder

Printer

### **Why is it important to research?**

This has been a long thought question but scientists still are not sure of one specific answer. I am researching this topic because it is fascinating and cool to research. After all, I will learn a lot I did not know. It is also important to research because then people will know how water got on exoplanets. After all, then people can see if there is an asteroid that has water heading towards an exoplanet, and check that exoplanet for life needing materials that came from the asteroids. I want to see how some planets have water. I also have some experience on this topic because I know why water is important for life (I did it for my last science fair) and I know that a habitable zone is essential for life.

### **Hypothesis:**

I think the most likely way is that asteroids/comets with water crashed into the Earth.

### **Background research:**

Last year I did properties exoplanets need to have life. One of them was water.

Most websites say that it is asteroids that brought water to us. These water-rich solar bodies are called planetesimals. These planetesimals could be comets or asteroids. One said that in the nebula where the solar system was created, big asteroids a few hundred kilometres across crashed into the Earth in their early life. They are the carbonaceous chondrite meteorites—the CMs and CIs. There is a problem. The amount of deuterium in the asteroids was not the same as the Earth's; the mantle was lighter hydrogen than the asteroids. These asteroids had water ice, but the heat of crashing into the Earth caused the water on it to melt. These planetesimals formed at the edge of the stellar nebula, where water-ice dust was abundant. These asteroids could have crashed into the Earth 4.5 to 3.8 billion years ago when the last heavy bombardment happened. The comet option was ruled out because the amount of deuterium was more on the comets than in the ocean. The asteroids had the same amount of deuterium as our oceans.

Another theory is that the rocks that made up the Earth had water. The water got out when volcanoes when degassed or outgassed H<sub>2</sub>O or water vapour. Then, it evaporated into the sky and rained down.

Another theory that some scientists have is that the planetoid, Theia, which crashed into the Earth and made the moon, had water on it. Scientists think that when it crashed into the Earth, it gave it water.

Earth also has water because it is in the Goldilocks zone. This means it is not too far from the sun for water to be ice, and not too close for water to evaporate quickly. This is important because if watery comets hit Mercury, the closest planet to the sun, the water would evaporate and not help create life. You need a specific type of habitable zone too. It needs to be the CHZ (Continuously habitable zone). This is because the water here can exist for long periods and not just short times.

A theory that I found was that when stars exploded, they gave away new elements to the universe. One of them was oxygen. The oxygen could have

combined with hydrogen, one of the most abundant elements in the universe, to make  $H_2O_2$ , called hydrogen peroxide. It is the thing that you have in your first aid kit to disinfect wounds. These elements were present in the solar cloud where the solar system was formed. The water could have gone on asteroids and the asteroids collided with the Earth or the water molecules could have crashed into the Earth by themselves, giving the Earth some water. This is how the other theories could have gotten the water.

**Extra information:**

Water was formed 4.4-4 billion years ago.

Water might have come from the volcanic outgassing, the meteorites or a combination of the two.

Scientists can see if water is in the planet's atmosphere by using spectroscopy. Using spectroscopy means that the scientists see what wavelengths specific molecules absorb. Then, they see if there are strong absorptions of that specific wavelength.

Oxygen was created by cyanobacteria that did photosynthesis. Water came before because photosynthesis requires water.

Life needs water because water can dissolve things (it is a solvent) and make chemical reactions in all cells.

**More research:**

N/A

**Conclusion:** In conclusion, stars, volcanic outgassing, planetesimals, and Theia might have given us water, or any combination of them might have given the Earth water. My hypothesis was included in the results and I still think that it is the most likely way the Earth could have gotten on the Earth. This topic was very fun to research. I learned many new things.

**Important words (Glossary):**

Chondrite: A meteorite that has a rounded granule of cosmic origin.

Carbonaceous: Consisting of, or having carbon.

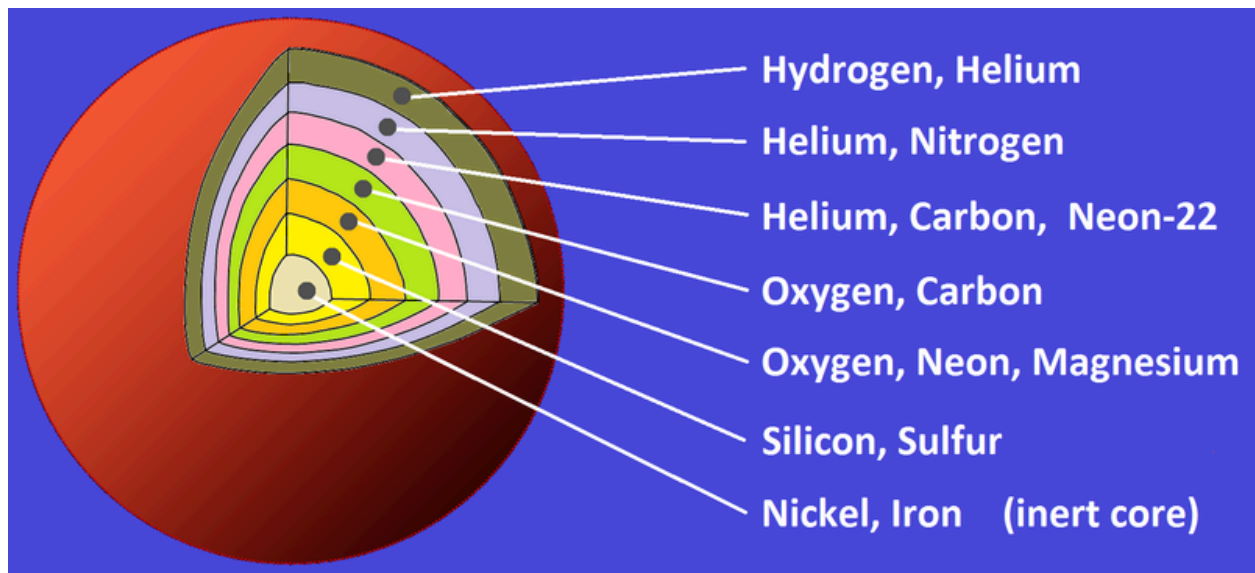
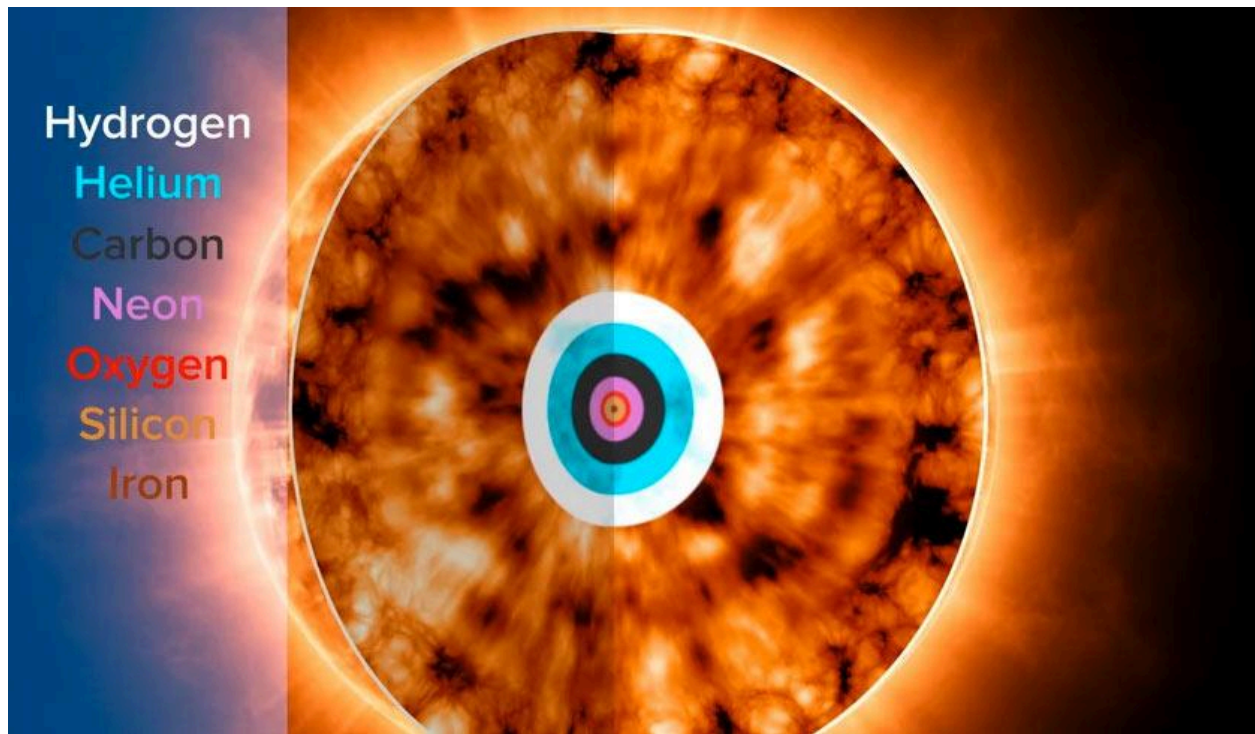
Planetesimals: A water-rich object.

Meteorite: A meteor that reaches the surface of the earth without being completely vaporized

Carbonaceous chondrite meteorites: A rich carbon meteoric stone with spheroidal mineral grains.



Nucleosynthesis: The creation of an element in stars from hydrogen.



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