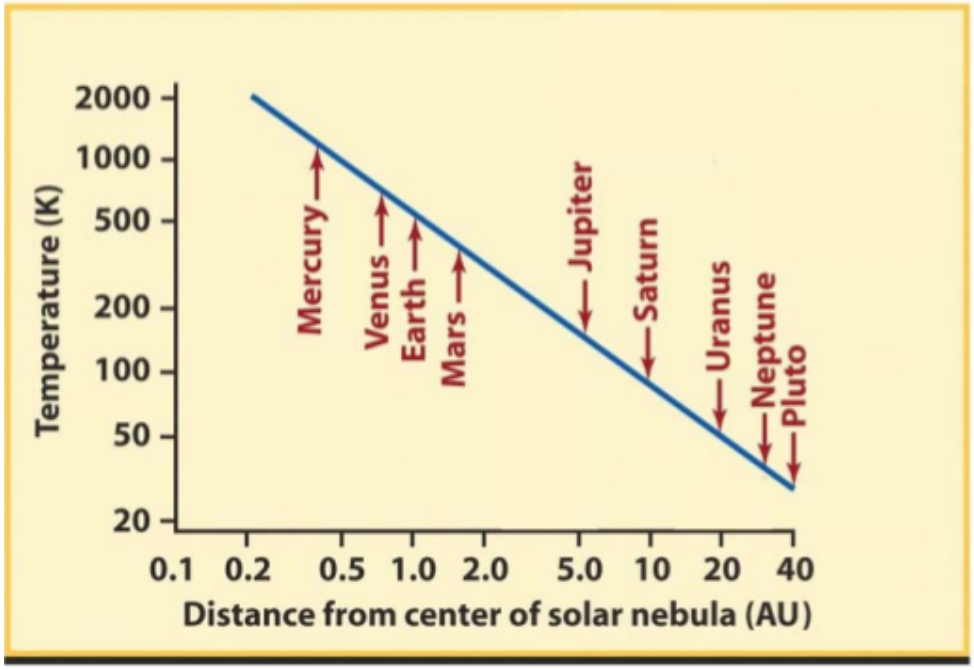
Tutorial: Investigating the formation temperatures of the planets

The following graph shows how the temperature in the solar nebula depended on the distance away from the Sun. Use the information in this graph and the table below to answer the questions.

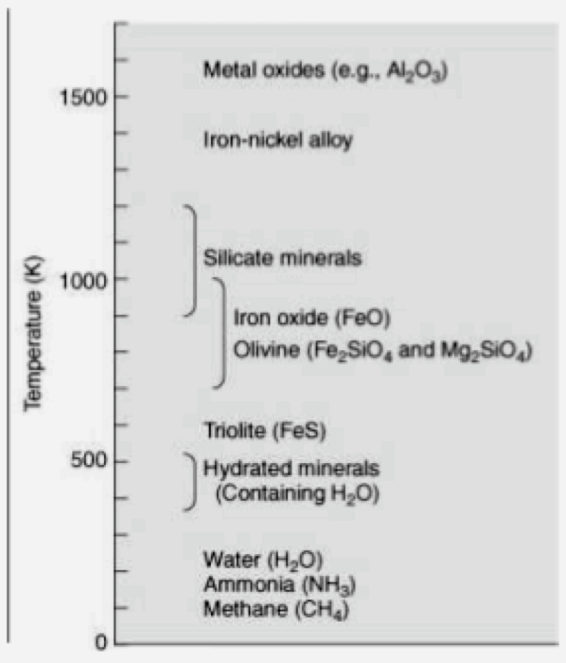


Familiar Conditions	Temperature		
	Fahrenheit	Celsius	Kelvin
Severe Earth cold	-100	-73	199
Water Freezes	32	0	273
Room Temperature	72	22	296
Human Body	98.6	37	310
Water Boils	212	100	373

1. During the formation of the solar system
   a. What was the temperature at the location of the Earth? _____
   b. What was the temperature at the location of Mars? _____
   c. Which planets formed at temperatures hotter than the boiling point of water?
   d. Which planets formed at temperatures cooler than the freezing point of water?

2. Considering your answer to 1.c., what would you expect these planets to be made of?

3. Considering your answer to 1.d., what would you expect these planets to be made of?



4. Shown here is the condensation sequence for different materials. These are the approximate temperature at which those compounds "freeze" (form a solid). Use this information and the temperature-distance information for planet formation above to make a list of what each planet was probably comprised of shortly after its formation.

Mercury:

Venus:

Earth:

Mars:

Jupiter:

Saturn:

Uranus:

Neptune:

Pluto:

5. Is it likely that a large, Jupiter-like planet would have formed at the location of Mercury, 0.4 astronomical units from the Sun? Explain your reasoning.

6. How would your answer to #5 change if you read a convincing report that a newly discovered planet orbiting a nearby star was only 0.05 astronomical units away from its star, and it has a mass of 45% or more than that of Jupiter (and is most likely gaseous)?