You are a scientist working as part of a team, investigating factors that affect life on Mars and Earth. The other scientists on your team have designed some simulations and videos and collected some data to help with your investigation.

Q1. a) Using Simulation 1, **identify one difference** between Earth and Mars and consider how it might impact life on Mars.

Simulation 1 - My observations and findings:

Q1. b) Explain why some planets do not have water and why water might be found in different states on different planets, by **applying your observations from part a)** and examining the **first three columns** of **Table 1**. (Note: 0K = -273.15°C)

Q2. a) **Investigate another difference** between Earth and Mars, by examining the mass and core composition data of different planets, as outlined in **Table 1.**

Q2. b) The weight of an object is calculated by

$$W = mg$$

where W = weight in N, m = mass in kg and g = acceleration due to gravity in m/s^2
On Mars g = 3.7 m/s^2 but on Earth g = 9.81 m/s^2.
Calculate the weight of the objects on Mars by completing Table 2.

Table 2.

Object	Mass (kg)	Weight on Mars (N)	Weight on Earth (N)
Tennis Ball	0.06		0.5886
Football	0.43		4.2183
Car	1500		14715
The International Space Station	444,615		4,361,673.15

Q3. a) Working in groups to act it out, model the behaviour of water molecules when water is boiled in a kettle. Demonstrate your model for the other groups in your class and consider these questions:

1. **How would you describe** the movement of the water molecules?
2. Where are the molecules of water getting their energy?
3. **What happens** to the water molecules when the temperature reaches the boiling point of water?
4. **How could you apply** this model to molecules in a planet's atmosphere?

Q3. b) An atmosphere is made up of gases that orbit a planet. *Escape Velocity* is the velocity that a gas molecule in an atmosphere must have in order to overcome the pull towards the planet and leave the planet's orbit. The value of the *Escape Velocity* **depends on the mass of a planet**. Working in groups to act it out, **model the behaviour** of a molecule of Carbon Dioxide that reaches *Escape Velocity* and 1) leaves the atmosphere of Mars, and 2) leaves the atmosphere of Earth.

Q3. c) Using your model and video 1 and 2 , investigate how molecules in the atmosphere of a planet might get enough energy to reach *Escape Velocity*.

Q3. d) Examine **Table 1** carefully. **Why do you think** molecules of Carbon Dioxide might be able to escape Mars' atmosphere more easily than other planets? You may wish to use diagrams in your answer.

Q3. e) The Carbon Dioxide in the Earth's atmosphere insulates the Earth and this is contributing to the climate crisis. Given that 95% of Mars' atmosphere consists of Carbon Dioxide, why do you think Mars is not also undergoing a climate crisis?

Q3. f) In 2021, scientists discovered that the clay and rocks on the surface of Mars contain water. They think that over half of the water that used to be on Mars, billions of years ago, was absorbed into its crust.

i) What way do you think Mars might have lost the rest of its water?

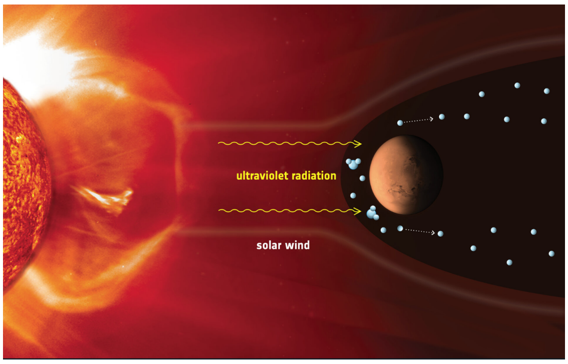
ii) What do you think would happen to **Earth's water cycle** if the Earth was the same **distance** from the Sun as Mars and had the same **atmospheric pressure** as Mars?

Q4. a) Planets in our solar system with molten iron in their cores have magnetic fields surrounding them. Examine this video and explain the role of the magnetic fields in the video.

Q4. b) Mars does not have a permanent magnetic field - how do you think this might impact the Martian atmosphere?

Q4. c) What do you think would happen to **Earth's Carbon cycle** if Earth had no magnetic field?

Image Source: ESA Mars Image



Q5. Using your observations in Q1 - Q4, fill Table 3 with the **similarities and differences** that you have identified between Earth and Mars.

Table 3.

Similarities	Differences