Introduction: Your Mission

Congratulations! You have been invited to be part of a crew of scientists chosen to explore an extrasolar planet. An extrasolar planet is a planet outside of our solar system. That means you will be going far away from Earth, out of our solar system and into deep space. The goal of the mission is to discover life outside of Earth. No one has ever traveled this far out into space before, and you have been selected from among thousands of applicants because of your unique qualities and scientific knowledge.

Your first step is to meet the other members of your crew and to decide on who will perform the different roles required for this adventure. Then you and your crewmates will choose the type of planet that you will be exploring.

You and your crewmates should read the descriptions of the different roles and decide who will do what. Everyone must perform a role and contribute to the group’s success. Your group should discuss these roles and have everyone select a role that they are comfortable with. If two or more people want the same position then the crew members may want to vote.

The roles are as follows:

If there are 3 people in the crew: technician, mission recorder, and group commander.
If there are 4 people in the crew: technician, engineer, mission recorder, and group commander
If there are 5 people in the crew: technician, engineer, mission recorder, communications officer, and group commander

Here are the different positions:

**Technician:** The technician is responsible for all the equipment. She or he will get the supplies from the teacher and bring them to the group. It is the technician’s responsibility to make sure that all supplies and equipment are used correctly, to report any damaged or missing supplies to the teacher, and to return all equipment and supplies when the crew has completed a lesson. When there are fewer than 4 crew members, the technician will also do the engineer’s job.
**Engineer:** The engineer is responsible for computing. When the crew needs to use computers to complete a lesson, the engineer will enter any necessary information into the computer and report the results back to the crew.

**Mission Recorder:** The mission recorder will keep track of the results of all the experiments performed by the crew. He or she is responsible for recording the group’s discoveries, conclusions and opinions on the forms and worksheets that the crew works on during this mission. When there are fewer than 5 crew members, the mission recorder will also do the communications officer’s job.

**Communications Officer:** The communications officer will speak for the crew to people back on Earth. This person will report the results of different experiments performed and any discoveries made by the crew. They will need to listen to the other crew member’s ideas and summarize them when reporting to class.

**Group Commander:** The group commander’s responsibility is to ensure that the mission is completed successfully. The commander must ensure that the other group members have a say in all decisions. She or he will see that all instructions are read to and understood by the other group members. The commander must make sure that the other group members perform their responsibilities and may need to fill in for other members when they are missing. Finally, the commander may need to make final decisions if the group can not agree. The group commander should be well respected by the other group members, make good decisions and be able to inspire the other group members to give their best efforts.

Record the names of your crew on the Planet Preference Survey.

Finally, decide on a name for your group and record that at the top of the Planet Preference Survey.

You are now ready for your first assignment—deciding what type of planet to explore!

**Choose Your Planet**

Now that your crew is assembled you need to decide what type of planet or moon you want to explore. You will use the Planet Preference Survey to select different physical characteristics of your planet.
There are several things you need to think about as you make your selections. Recall that water can exist as a solid (ice), a liquid or a gas (water vapor). Most scientists think that all living things need some water in a liquid state in order to survive. Since you goal is to discover life, you will want to find liquid water somewhere on the planet that you explore. On Earth water is usually a liquid between 0ºC and 100ºC, or 32ºF and 212ºF, so you might want to explore a planet with an average surface temperature in this range.

However, you don’t want your planet to be an exact copy of Earth. How difficult can it be to discover life on a planet like Earth? Anyone can do that! The planet you explore will be dozens of light years away. If you are going to travel that far, you might as well make it a little challenging. The trick will be to make your planet enough like Earth to make life on it a possibility but different enough from Earth to make traveling that far to explore it worth the effort.

**Question #1: What type of star will your planet orbit?**

Stars produce most of their energy by smashing hydrogen atoms together to form helium atoms. The size of the star determines how much energy it gives off and long it lasts.

Stars have life cycles. They are born, live for a while giving off heat and light, and then die violent deaths. **Low mass** stars do not give off as much heat as larger stars, but they last a long time, tens to hundreds of billions of years. **Solar type** stars are similar to our Sun. They are more massive than low mass stars but less massive than high mass stars. These stars are very common in our galaxy. They give off more heat than low mass stars but they do not last as long. Our Sun, for example, has a total life span of around 10 billion years. **High mass** stars give off the most heat, but they do not last very long. Usually their total life cycle is less than 1 billion years, sometimes much less. Earth is 4.6 billion years old. If we were orbiting a high mass star, our Sun would have burnt out over 3.5 billion years ago.

Decide with your group which type of star you would like to orbit and mark your choice on the Planet Preference Survey.

**Question #2: What is the age of the star you are orbiting, in billions of years?**

Most astronomers think that the Earth formed fairly quickly after the birth of the Sun. You should assume that your planet is almost, but not exactly, the same age as your star. Decide with your group how old your star is and mark your choice on the Planet Preference Survey. You may enter a fraction or a decimal if you want your star to be less than 1 billion years old. For example, if
your planet is 200 million years old you would enter 0.2, because 0.2 times 1 billion equals 200 million. Your star can not be over 13.6 billion years old, however, because our universe is only 13.7 billion years old and there are no stars older than 13.6 billion years old.

**Question #3: How far from your star is your planet?**

Decide with your group how far from your star your planet will be and mark your choice on the Planet Preference Survey. Keep in mind that moving farther away from your star will make your planet colder, assuming all other factors are the same. That is why Pluto, which is 40 times as far away from the Sun as Earth, is so much colder than Earth.

**Question #4: What type of object do you want to explore?**

Examples of the different types of objects are given. A brown dwarf is a large, gaseous object almost, but not quite, massive enough to become a star. It gives off some light and heat, but very little—not enough to warm a moon or planet. Currently we do not know of any moons orbiting brown dwarfs, but there’s no reason why moons can’t orbit them. Decide with your group which type of object you would most like to explore and mark your choice.

**Question #5: What type of surface do you want on your planet?**
**Question #6: What type of atmosphere do you want?**

Both the surface and the atmosphere have an effect on the average surface temperature of your planet. We will look more closely at how they affect it in later lessons. For now, just decide which you think would be the most interesting to explore and mark your choice.