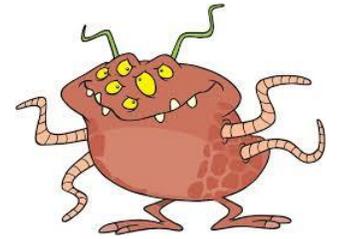


CRITICAL THINKING ACTIVITY: CREATURE FEATURES



OBJECTIVES: Students will:

- Understand the characteristics of habitable and non-habitable planets.
- Identify which conditions make Earth habitable for life.
- Understand how the conditions on Earth affect life.
- Develop knowledge of the various environments of our planet, and on at least one other world within our solar system.
- Design a life form suited for the specific environmental conditions on another planet.

MATERIALS

- Design Your Creature Flowchart
- Crayons/Markers
- Paper/Pencil
- Planet Fact Sheets
- Creature Features Body Parts sheet (Optional)

PROCEDURE:

1. Split the group into pairs or teams of up to four children. Distribute the fact sheets, paper and crayons. Make sure each group has at least one of each fact sheet.
2. Direct a discussion with the group about habitability on Earth and the environmental conditions within the solar system. During the presentation, ask students what living creatures need to exist and be sure to discuss the following:

- + a way to breath
- + a food source
- + protection from heat and/or cold
- + protection from cosmic radiation
- + a way to sense their environment
- + a way to move (based on strong/weak gravity)

3. Discuss Jupiter as an example to generate ideas. Use the fact sheet for background information.
4. Ask students to select one planet per group (Mercury, Venus or Mars). Instruct them to design an alien based on the environmental factors provided on the fact sheet for that world.
5. Have the students present their creature to the group and explain the different characteristics of their life form as well as how they would be helpful in their chosen environment.

VENUS FACT SHEET



- ✚ Venus is the hottest planet in the solar system with an average surface temperature of 462°C (863°F). Also, Venus doesn't tilt on its axis, which means there are no seasons either. .
- ✚ The pressure of Venus' atmosphere at the surface is 90 atmospheres (about the same as the pressure at a depth of 1 km in Earth's oceans). It is composed mostly of carbon dioxide (95.5%), which traps heat and has caused a "runaway greenhouse effect," which produces temperatures of more than 480°C (hot enough to melt lead) and evaporated any water billions of years ago
- ✚ The thick layer of clouds on Venus is made of sulfur dioxide and droplets of sulfuric acid. These clouds rain sulfuric acid, but the heat evaporates the rain so it never reaches the surface. It just goes back up into the higher atmosphere and turns into clouds again.
- ✚ The temperature on Venus doesn't vary much between the night and day and can reach over 500 degrees C. Venus probably once had large amounts of water like Earth but it all boiled away. Venus is now quite dry.
- ✚ The weather on Venus is extreme. The entire atmosphere of the planet circulates around quickly, with winds blowing as fast as 360 kilometers/hour. Cloud systems can travel around the planet completely in about 4 days.
- ✚ One day on Venus is longer than one year. Because of its slow rotation on its axis, it takes 243 Earth-days to complete one rotation. The orbit of the planet takes 225 Earth-days - making a year on Venus shorter than one day on Venus.
- ✚ Venus has around 81% of Earth's mass. Venus is the closest planet to Earth. Both planets also have a central core, a molten mantle and a crust.
- ✚ Most of Venus' surface consists of gently rolling hills and a few wide plains, highlands and mountain ranges.
- ✚ The atmospheric pressure of Venus is 92 times stronger than Earth's. This pressure is the same as being around

1,000 km under Earth's oceans.

- + Venus has a very weak magnetic field. The solar wind penetrates deeply into its atmosphere. It ejects millions of tons of gas from the atmosphere each year.
- + Venus is only slightly smaller than Earth (95% of Earth's diameter, 80% of Earth's mass).

MARS FACT SHEET



- + **Mars is the fourth planet from the Sun** and last of the terrestrial planets and is around 227,940,000 km from the Sun. **It takes Mars 687 Earth days to orbit the Sun.**
- + The **atmosphere** of **Mars** is very thin and less than 1% of Earth's. It does not protect the **planet** from the Sun's radiation and doesn't do much to hold heat at the surface. It consists of 95% carbon dioxide, 3% nitrogen, 1.6% argon, and the remainder is tiny amounts of oxygen, water vapor, and other gases. Temperatures on Mars never exceed 20° C because it has a "runaway greenhouse effect" and lost most of its atmosphere along ago.
- + Mars experiences weather patterns. The primary form of this weather consists of high winds, dust storms, frost, and fog.
- + **The landmass of Mars and Earth is very similar.** Even though Mars is just 15% the volume and 10% the mass of Earth, it actually has a similar landmass because water covers about 70% of Earth's surface. There are volcanoes, mountains, plains and deserts on Mars.
- + **The surface gravity of Mars is about 37% the gravity found on Earth.** This means that on Mars you could in theory jump 3x higher than you could on Earth.
- + The atmospheric pressure is only about 1% of that found at sea level on Earth. That is the equivalent pressure found at 35 km above the Earth's surface.
- + The orbit of Mars is the most unusual of the eight planets and because of it Mars experiences huge dust storms. The orbit path is more stretched out than many of the other planets and results in fierce dust storms that cover the entire planet and can last for many months.

- ✚ Mars is the only other planet besides Earth that has polar ice caps. Water ice has also been found under the Martian ice caps.
- ✚ Mars has seasons like Earth, but they last twice as long. This is because Mars is tilted on its axis by about 25.19 degrees, and the tilt of the Earth is 22.5 degrees.
- ✚ Mars has no magnetic field and is bombarded every day by a strong solar wind.

EARTH FACT SHEET



- ✚ Earth is located 93,000,000 miles from the Sun.
- ✚ This planet has an average global temperature of 55.4 F.
- ✚ The atmosphere of Earth is made up of Nitrogen (78%), Oxygen (21%), water vapor (4%) and trace amounts of other gases such as carbon dioxide, argon,
- ✚ Gases in the atmosphere, like water vapor (clouds), carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) act as a natural blanket by preventing the sun's heat energy from radiating back into space,
- ✚ Earth's "greenhouse effect" helps warm the Earth's surface by as much as 33°C, and without it, our planet would be too cold for humans to survive.
- ✚ Its axis is tilted at an average 23.5 degrees to the plane of its orbit, which gives Earth the 4 seasons.
- ✚ Liquid water is plentiful on the surface and may have come from ancient comet impacts. About 70% of the surface of the planet is covered by water.

- ✚ A solar wind from the Sun hits the planet every day causing all kinds of disturbances.
- ✚ The solar wind never hits earth directly, thanks to its magnetic field. The field acts like a huge umbrella, deflecting most of the solar wind back into space.
- ✚ Earth turns on its axis every 24 hours and revolves around the Sun once every 365 days.
- ✚ Earth is the densest planet in the solar system.
- ✚ Earth is the only place in the Solar System where water can be present in its three states: solid, liquid and gas.
- ✚ Earth is composed of: iron (32%), oxygen (30%), silicon (15%), magnesium (14%), sulfur (3%), nickel (2%), calcium (1.5%), aluminum (1.4%) and small amounts of other elements.

MERCURY FACT SHEET



- ✚ Mercury is about 58,000,000 km from the Sun.
- ✚ Because the planet is so close to the sun, Mercury's surface temperature can reach a scorching 840 degrees F (450 degrees Celsius).
- ✚ This planet doesn't have a real atmosphere to trap any heat. At night temperatures can drop to minus 275 F (minus 170 C), a temperature swing of more than 1,100 degrees F (600 degree C), the greatest in the solar system.
- ✚ Spacecraft discovered water ice in the craters around its north pole, where regions may be permanently shaded from the heat of the sun.
- ✚ Mercury takes 88 days to revolve around the Sun.
- ✚ Mercury's surface resembles the surface of Earth's Moon. It is scarred by many impact craters from

collisions with meteoroids and comets.

- ✚ Mercury is about 1/3 the size of Earth, has a very weak gravitational force and for that reason has no moons.
- ✚ Mercury is the second densest planet after Earth, with a huge liquid iron core.
- ✚ Although Mercury's magnetic field is just 1 percent the strength of Earth's, it is very active. The magnetic field in the solar wind – the charged particles streaming off the sun – sometimes touches Mercury's field, and creates powerful magnetic tornadoes that send the fast, hot plasma of the solar wind down to the planet's surface.
- ✚ Instead of an atmosphere, Mercury has a thin layer made up of atoms blasted off the surface by the solar wind and striking micrometeoroids.
- ✚ While there are large areas of smooth terrain, there are also round-shaped scarps or cliffs, some hundreds of miles long and soaring up to a mile high, formed as the planet's interior cooled and contracted over the billions of years since Mercury formed.

Design Your Own Creature Flowchart

TASK: Review the environmental factors that make the Earth habitable and compare them to other worlds within our Solar System. Use creative thinking to design an alien life form suited for specific environmental conditions on an extra-terrestrial world within our Solar System. **You must explain how the creature is adapted to its environment.** Draw **OR** build a model of your creature. (Refer to the information on the FACT SHEET for your planet or research it on the Internet.)

ADAPTATIONS:

- How will the creature cope with the temperature?
- How will it breathe? (Consider the atmosphere.)
- What senses will your alien have? (Consider touch, taste, sight,

DESIGN:

1. **Start with a basic outline of the creature's physical characteristics as they match up with the conditions on the planet.** Whether it's a quick sketch or a short description, you must have a basic concept to start out with.
2. **Start adding detail. "Engineer" the creature's body and lifestyle based on its environment.** What kind of physical parts does it have? How do they insure its survival on the planet? There's a saying that "form follows function", and it's true--so a flying alien will probably be very slim and lightly built, a swimming one might be streamlined like a dolphin or shark, one that lives on the plains might have thick hoof-like nails or long legs for traveling long distances.
3. **Draw OR build a model of your alien. You can use any drawing or art materials. If you're up to drawing your alien, do some sketches.** Drawings make life a little easier. Making a drawing can give your imagination a jump-start if you're having trouble describing your alien. The opposite is also true--if putting your pencil to paper just isn't working out, try writing out an explanation of what makes your alien



