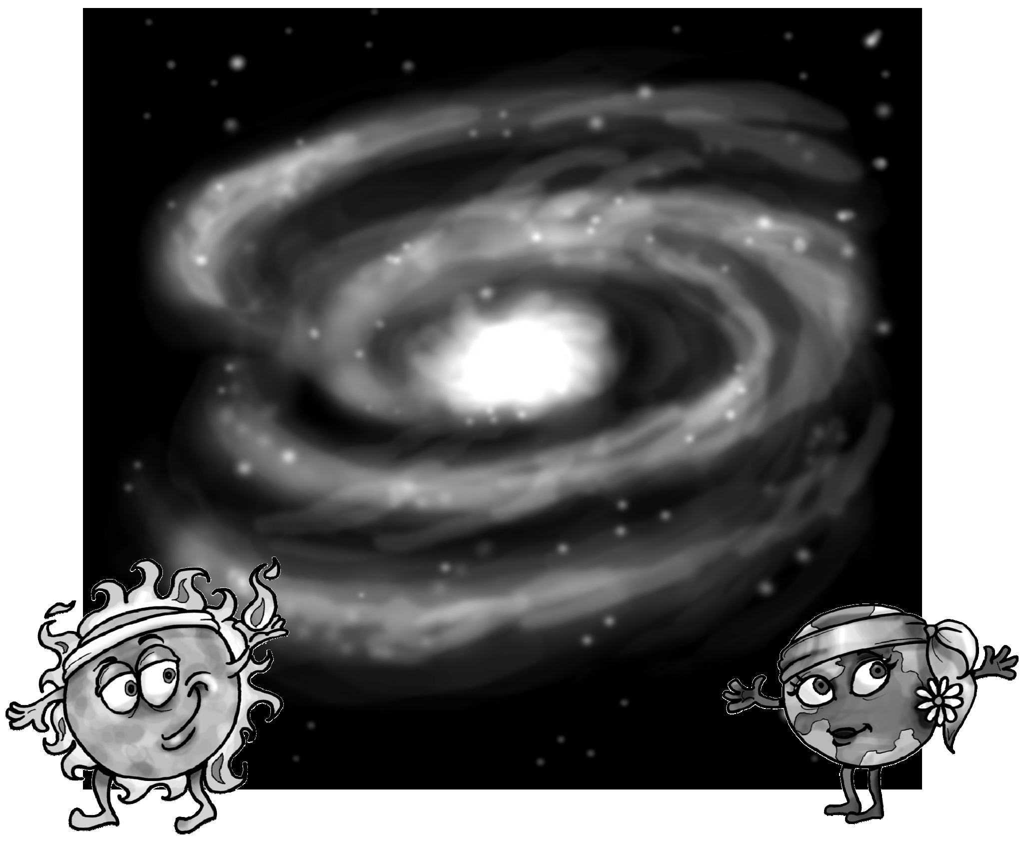
PLANET PARADE



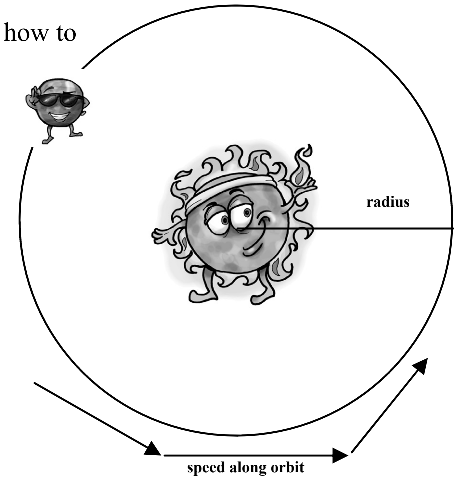
Supplemental Activities Packet

This packet contains classroom activity suggestions and worksheets to reinforce concepts from the Playbook® story and to go beyond the story into the content areas of Language Arts, Math, Science, Social Studies, Art, Health, etc., as well as Character Development.

Activities range in age appropriateness and skill level so that teachers can choose activities that best suit their particular students. An Answer Key is provided on the last page.

Name___________________________

CALCULATING PLANETS



<u>How Long is Each Planet's Year Compared to Earth's?</u> In this section you will learn how to determine the length of each planet's year relative to a year on Earth. You need to know the planet's speed relative to Earth's and the planet's distance from the sun relative to Earth's. The diagram below shows the two numbers you need to know to find out how long each planet takes to revolve around the sun. Use this formula!

Radius of Orbit *(r)* /Orbital Speed *(s)* = Length of Year *(y)*
(all relative to that of Earth)

Example: **Mercury**

Radius of Orbit	Orbital Speed
0.387	1.607

0.387 / 1.607 = *y*

***y* = 0.2408**

Mercury's year is 0.2408 of an Earth year.

If the planet's year is shorter than Earth's year, you will want to know how many Earth days long it is. Multiply the number of Earth years by 365 to find out the length of the planet's year in Earth days.

0.2408 x 365 = about 88

Mercury's year is about 88 Earth days long. It takes 88 days to complete one orbit around the sun.

<u>How Big is Each Planet Compared to Earth?</u>

To find out how much bigger or smaller in circumference a planet is relative to the size of our Earth, use the following calculation.

Divide the planet's distance around (miles) by Earth's distance around (miles) and convert the number into a percentage.

Example: **Mercury** 9,523 / 24,874 = 0.382 **0.382 = about 38% Mercury is about 38% the size of Earth.**

Directions: Calculate the length of each planet's (or dwarf planet's) year in Earth years using the guidelines above and the chart below. Write your answers in the Length of Year column of the chart. Then calculate the size of each planet relative to Earth by percentage and write your answers in the Size column. Show your work for all calculations on a separate sheet of paper. Move to the next activity sheet, "Racing Around the Sun," and record all your answers there as well, as indicated.

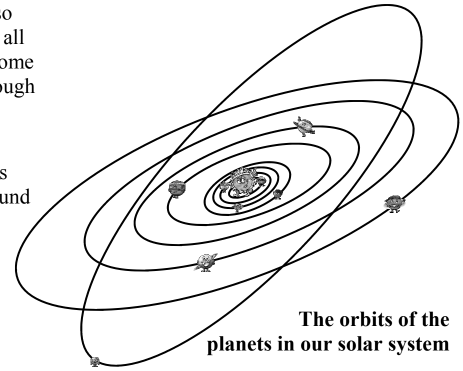
Bonus Activity: For the planets whose <u>days</u> are longer than an Earth day, you may find it helpful to convert hours (displayed in the chart below) to Earth days. On a separate sheet of paper, calculate each planet's day length in Earth days. Record your answers on the "Racing Around the Sun" activity in days instead of hours when the length of day is longer than one Earth day.

Planet	Radius of Orbit *(relative to Earth's)*	Orbital Speed *(relative to Earth's)*	Length of Year *(Earth days or Earth years)*	Length of Day *(Earth hours)*	Number of Moons	Distance From Sun *(miles)*	Distance Around *(miles)*	Size *(relative to Earth)*
Mercury	0.387	1.607	88 days	1407.6	0	35,984,030	9,523	38%
Venus	0.723	1.174		5832.5	0	67,239,750	23,629	
Earth	1.0	1.000		24	1	92,958,591	24,874	
Mars	1.524	0.802		24.7	2	141,638,663	13,259	
Jupiter	5.203	0.434		9.9	63	483,780,029	272,953	
Saturn	9.539	0.323		10.7	62	890,728,497	212,253	
Uranus	19.18	0.228		17.2	27	1,787,534,383	99,790	
Neptune	30.06	0.182		16.1	13	2,798,386,666	96,686	
Pluto	39.52	0.159		153.3	3	3,650,034,176	4,502	

Name_____________________________

RACING AROUND THE SUN: ALL ABOUT ORBITS!

Why do Planets Move Around the Sun?
Gravity is the force that attracts objects together and keeps the planets pulled around the sun. Gravity is also what keeps you standing on the surface of Earth instead of floating off into space. Gravity controls the way all objects move in space. As you discovered in the story, all planets do not have equal gravity which caused some problems when Pluto tried to take on all of Jupiter's moons! Pluto was too small, so his gravity was not enough to keep all those large moons in orbit. The sun has the greatest gravity of all which is why the planets are drawn to it.



The orbits of the planets in our solar system

Most objects in our solar system move predictably in two distinct ways: rotation and revolution. **Rotation** is when an object spins around it's own axis, like a spinning top, and **revolution** is when an object moves around a larger object in an orbit. Note: Earth rotates along a line that is tilted rather than vertical.

In the story, you learned that each planet has a different length day and year, and sometimes a planet's day can be longer than its year! This is because a day is determined by the length of time it takes for a planet to rotate (or spin) one time, and its year is determined by how long it takes to revolve around the sun. These lengths of time can be very different based on speed of motion and distance traveled.

PART A: What happens to us when the Earth rotates and revolves?
Use the information you learned above and critical thinking to answer the questions below.

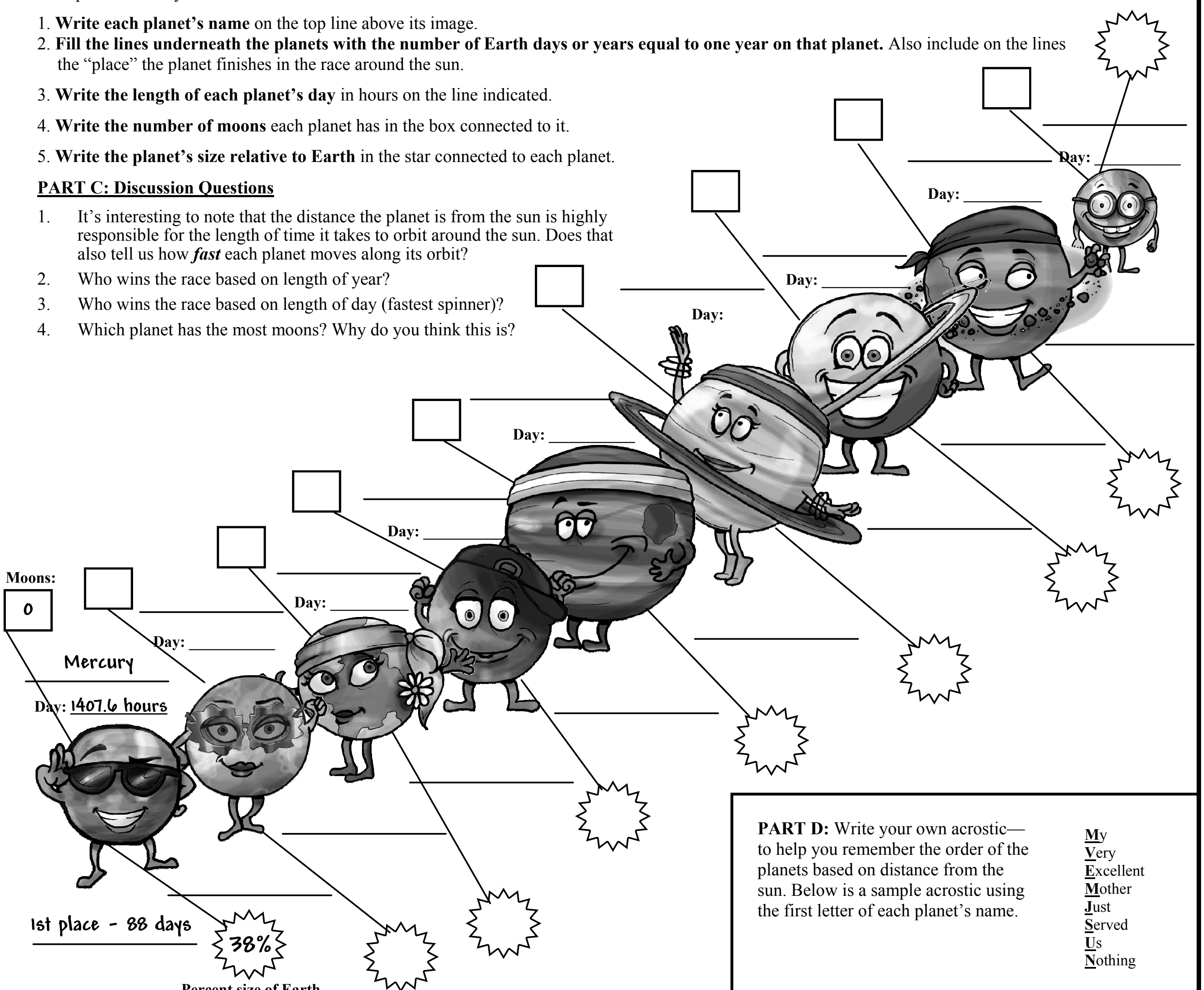
1. Why does the sun rise and set every day? ______________________________
2. Why is it summer in the southern hemisphere when it is winter in the northern hemisphere and vice verse? ______________________________

PART B: So who wins the race? Use your answers from "Calculating Planets" to fill in the missing information about each planet as shown with the example of Mercury.

1. **Write each planet's name** on the top line above its image.
2. **Fill the lines underneath the planets with the number of Earth days or years equal to one year on that planet.** Also include on the lines the "place" the planet finishes in the race around the sun.
3. **Write the length of each planet's day** in hours on the line indicated.
4. **Write the number of moons** each planet has in the box connected to it.
5. **Write the planet's size relative to Earth** in the star connected to each planet.

PART C: Discussion Questions

1. It's interesting to note that the distance the planet is from the sun is highly responsible for the length of time it takes to orbit around the sun. Does that also tell us how ***fast*** each planet moves along its orbit?
2. Who wins the race based on length of year?
3. Who wins the race based on length of day (fastest spinner)?
4. Which planet has the most moons? Why do you think this is?



PART D: Write your own acrostic—to help you remember the order of the planets based on distance from the sun. Below is a sample acrostic using the first letter of each planet's name.

My
Very
Excellent
Mother
Just
Served
Us
Nothing

Name____________________________

EARTH INSIDE AND OUT! PART 1 - BENEATH EARTH'S SURFACE

In ***Planet Parade***, you learned how important different characteristics of each planet are to the way they function in the solar system. You know some of Earth's important characteristics, like the water found on its surface, and the oxygen in its atmosphere. Now let's look at some of Earth's properties that aren't as easily observed—what's deep beneath our feet! Earth is made up of several main layers, as well as some smaller ones nearest the surface.

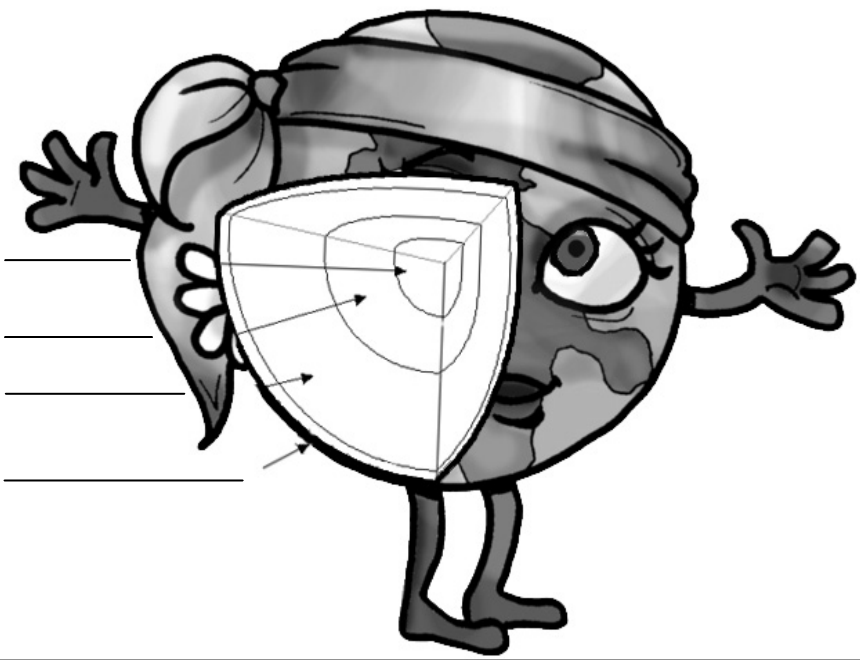
Lithosphere: This is the outermost and thinnest layer of Earth. It contains the **crust,** which is the cool solid rocky surface, and the **upper mantle**, which is warmer and denser but still solid rock, and is much cooler than the deeper layers.

Mantle: This is the largest layer, making up roughly 80% of Earth's volume. It is very hot and mostly made of molten (liquid) rock. The mantle is the source of lava brought to the surface by volcanic eruptions.

Outer Core: The outer core is hotter still, and consists of dense liquid metal made up of mostly iron and nickel.

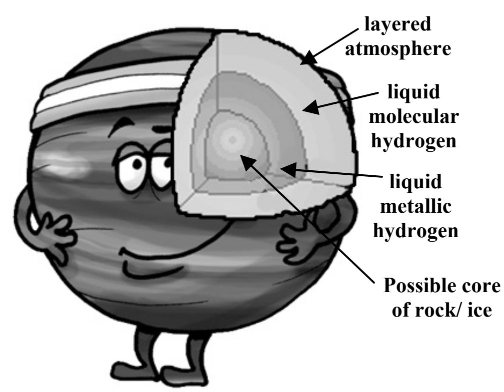
Inner Core: The inner core is a very dense, solid ball of iron and nickel, the hottest layer of Earth. You might wonder why the inner core is solid instead of liquid if it is hotter than the outer core. This is because pressure changes the temperature at which a material will melt, and the pressure is so high in the center of the earth that the core cannot melt.

PART A: Based on the descriptions above, label each of the main layers of Earth on the lines to the left of the arrows indicating each layer. Then, use the Internet to research how many kilometers deep each layer reaches and write it on the arrow line pointing to each layer.



What About Gas Planets?

Earth's neighbors in the first half of the solar system, closet to the sun, look very much like Earth inside. They have variations of rocky crusts, molten mantles, and metal cores. The gas giants, like Jupiter and Saturn, are quite different!



PART B: On the lines below, compare and contrast rocky planets and gas planets, starting with the differences between the materials they are typically made of and how those might affect visitors to the planet.

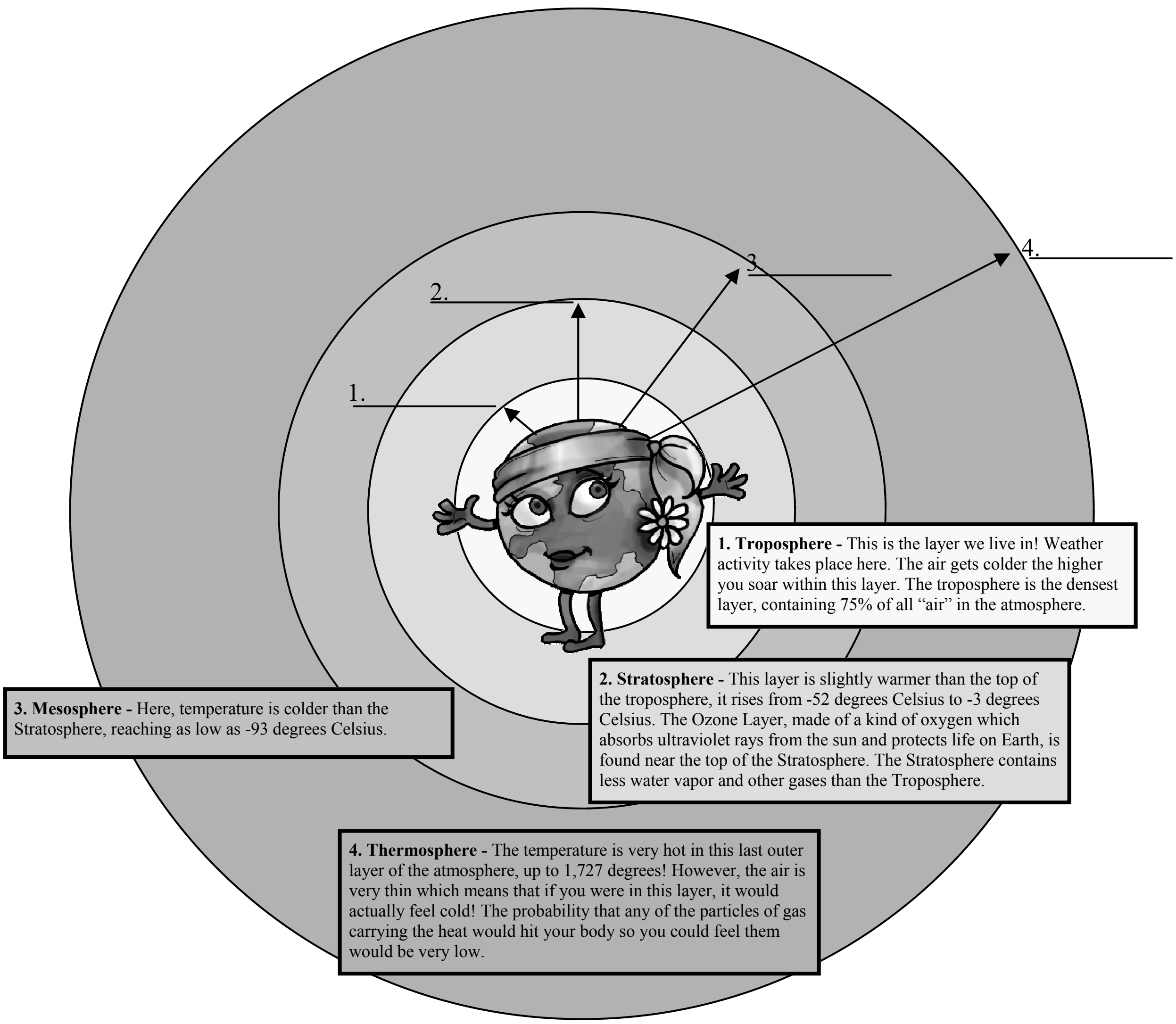
Name______________________________

EARTH INSIDE AND OUT! PART 2 - TOWARDS SPACE!

In ***Planet Parade*** you learned about the atmospheres of some of the planets in our solar system. Almost every planet has an atmosphere, but some are thinner than others and none are exactly alike! Earth's atmosphere is a very important part of what allows us to live here.

Earth's atmosphere reaches **372 miles from the surface** and is **78% nitrogen, 21% oxygen, and 1% other gases**. However, the amount of each gas present varies by distance from the surface of Earth. **Water vapor** is a significant component and can make up to 4% of the air's volume. The atmosphere is made up of different layers which each have different properties.

PART A: The diagram below shows each layer of the atmosphere in order and general (but not exact) relative height, along with some main characteristics. At your school's library or at home, use the Internet to find how many kilometers high each layer reaches and write it on the line provided.

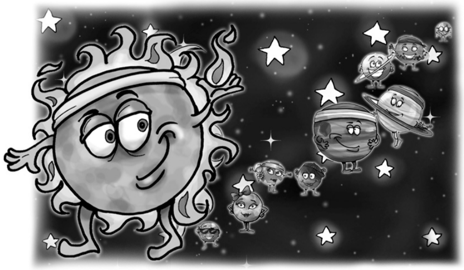


Atmospheric Mysteries

PART B: Discuss some or all of the following questions as a class and see if you can figure out the answers! If your instructor directs you to, you may also use the Internet at home or your school's library to research the questions. Number your answers and write them on a separate sheet of paper using complete sentences.

1. Why does the moon have so many more craters than Earth?
2. What are greenhouse gases and how do they affect Earth's atmosphere? Remember to look at both the positive and the negative effects.
3. Why is Earth warmer than the moon?
4. Do you think Earth's atmosphere was the same as it is today when the planet was first formed? If not, how was it different?

Name______________________________



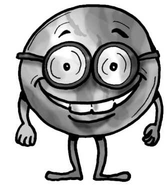
SPACE DICTIONARY

Directions: Match the following vocabulary words from the story with their definitions. Write the letter of the correct word (shown in the Word Bank) next to its definition.

A. moon	B. atmosphere	C. orbit	D. crater	E. gas giant
F. dwarf planet	G. asteroid belt	H. galaxy	I. sun	J. core

1. _____ a circular hole on the surface of a planet caused by a meteorite hitting the planet, or by a volcano
2. _____ a planet in our solar system which is made mainly of gas and liquid instead of solid materials, including Jupiter, Saturn, Uranus, and Neptune
3. _____ an area of our solar system between the paths of Mars and Jupiter where many asteroids are located; may have previously been planet that exploded
4. _____ a large group of stars held together by gravity and separate from other groups of stars; there may also be planets present
5. _____ any star that is orbited by planets; the star at the center of our solar system
6. _____ the path followed by planets around a sun or by moons around a planet; or to move around a sun or planet in a curved path
7. _____ the gas surrounding a planet; on earth, the air, containing oxygen and other components
8. _____ a round object that orbits the sun but is not required to clear other objects away from it's area
9. _____ the center of a planet, made of materials recognizably different from the outer layers; or the center of a star, where a nuclear reaction is taking place
10. _____ a smaller natural object which orbits a planet

NEW HORIZONS



New Horizons is the name of the space probe that is currently on its way to Pluto! It was **launched on January 19, 2006** and is **expected to reach Pluto in June, 2015**. The probe is about the size of a piano and is equipped with seven scientific instruments to measure characteristics such as gas composition, surface composition, temperature, and more, as well as a high-resolution telescope for collecting the best quality images.

Directions: Write a research essay about the New Horizons space probe. You may find this website helpful and fascinating: http://www.pluto.jhuapl.edu. Include the following in your essay, as well as any other details you think are important:

How is the probe specially designed for effective results?
How has the probe progressed since launch? What is its current position?
Why do scientists want to explore Pluto with a probe? What do they hope to find out?
Where will the probe go after it reaches Pluto?

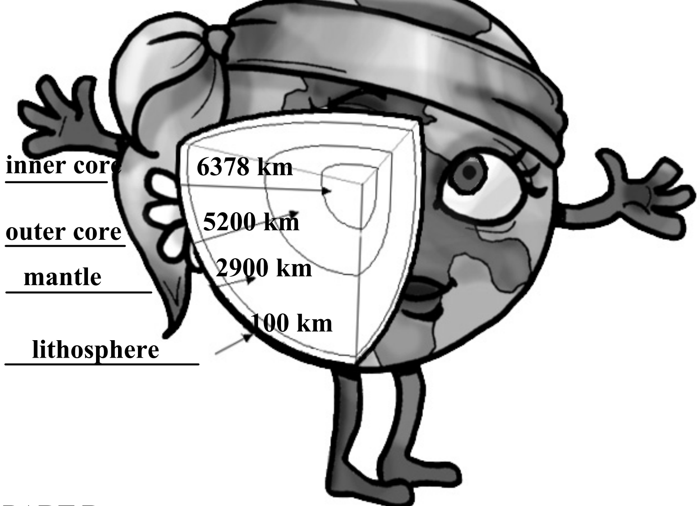
Have fun learning about this exciting mission to explore Pluto for the first time, and make sure to check out the FAQ section of the website above for some crazy facts about what visiting Pluto might be like!

ANSWER KEY

PLANET PARADE

EARTH INSIDE AND OUT—PART 1

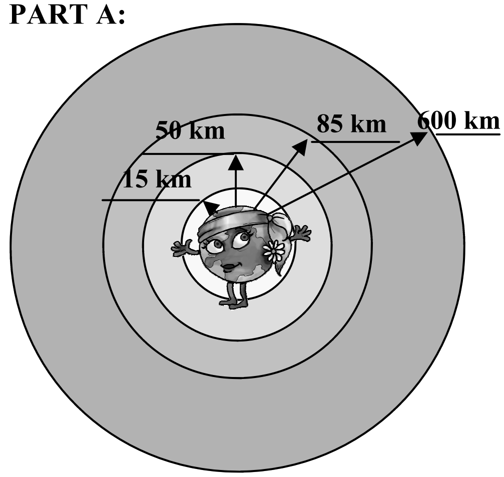
PART A:



PART B: *(Sample Answer)*
While rocky planets have a solid surface, the atmosphere and stormy winds of gas planets gradually transitions to thicker, fluid material that makes up a large portion of the planet. The only solid portion in most cases may be the core which is very small compared to the bulk of the planet. Gas planets are also many times larger than rocky planets and therefore have stronger gravitational pull. Theoretical visitors to gas planets would not be able to land on them because there is no surface. The gas storms would also be incompatible with life.

EARTH INSIDE AND OUT—PART 2

PART A:



PART B:

1. The moon has more craters because it has no significant atmosphere. On Earth, the atmosphere burns up most of the meteorites before they can hit Earth's surface.
2. Greenhouse gases include water vapor and carbon dioxide as well as several others. They absorb heat from the Earth and make the atmosphere warmer. This warmth allows life to thrive on earth. However, if the amount of greenhouse gases becomes too high the temperature of the Earth may rise too much and cause the problems of global warming.
3. Earth is warmer than the moon because the atmosphere keeps it warm, as described in question #2 above.
4. Earth's atmosphere was very different when it was new. It probably contained hydrogen and helium and no significant oxygen. The hydrogen and helium likely escaped to space because they are relatively light and Earth's gravity could not hold them.

CALCULATING PLANETS

Planet	Length of Year *(Earth days or Earth years)*	Size *(relative to Earth)*
Mercury	88 days	38%
Venus	225 days	95%
Earth	365 days	100%
Mars	687 days	53%
Jupiter	12 years	1100%
Saturn	29 years	850%
Uranus	84 years	400%
Neptune	165 years	390%
Pluto	248 years	18%

Bonus Activity:

Planet Day Lengths in Earth Days

Mercury	59 days
Venus	243 days
Pluto	6 days

SPACE DICTIONARY

1. D
2. E
3. G
4. H
5. I
6. C
7. B
8. F
9. J
10. A

RACING AROUND THE SUN - ALL ABOUT ORBITS

PART A: 1. The sun rises and sets because different parts of Earth face the sun as the Earth rotates or spins, causing night and day.

2. The seasons are opposite on each hemisphere because Earth is tilted on its axis, so as it revolves around the sun, one half of the Earth is slightly closer to the sun while the other half is slightly farther away from the sun. The distances switch as the Earth moves around the sun.

PART B: Answers provided in chart on "Calculating Planets" activity sheet and "Calculating Planets" Answer Key.

PART C: 1. Not necessarily; speed and distance from sun work together to determine who gets around the sun in the least time, however, the planets' speeds happen to be in the same order as their distances from the sun, so the slowest mover is the farthest and also takes the longest to revolve.

2. Mercury

3. Jupiter

4. Jupiter. This may be because Jupiter is so large and therefore has more gravitational pull to attract all those moons and keep them in orbit.

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