

NAME

THE EARTH IN SPACE

THE BIBLICAL PERSPECTIVE

Read the account of creation in Genesis, chapter one.

1. Describe what the earth was like in the beginning before God began creation.



The earth was formless and empty.

2. Describe what the universe looked like before God began to create.



Darkness was over the surface of the deep (universe) and the Spirit of God was hovering over the waters.

3. What was the first thing God created?



God first created light. He separated the light from the darkness. He called the light 'day' and the darkness he called 'night'.

4. Where did this come from?



The light probably came from God's own presence because the sun and none of the stars had yet been made.

5. What does this tell us about the nature of God?



It tells us that God wants to be among his creation. He wants to be with his people. He is not a distant God, but one who is closely involved in all of life. It also tells us that he goes before us. Whatever situation we will encounter in life, God will already be there to meet us.

6. What started as a result of God creating day and night on that first day?



Although God is timeless, without beginning and end, he did set in motion the beginning of time as we know it.

7. What did God create on the second day and what was its purpose?



On the second day God created an expanse between the waters in the universe. He wanted to separate water from water. He created the 'sky' to separate the water under the expanse from the water above it. This is our atmosphere.

8. What did God create on the third day?



He gathered the water under the sky into one place, and let dry ground appear. He called the dry ground 'land' and the water he called 'seas'. The Lord made the land produce vegetation: seed-bearing plants and trees with the ability to bear fruit.

9. What did God create on the fourth day?

 God placed lights in the expanse of the sky. He made two great lights - the greater light to govern the day and the lesser light to govern the night. He also made stars.

10. What was God's purpose for creating lights in the expanse of the sky?

 The lights in the expanse of the sky (the sun and the moon) were made to separate day from night and to serve as signs to mark appointed times, seasons, days and years. The sun and the moon were made to give light on the earth, to govern the day and night, and to separate light from darkness.

11. What did God create on the fifth day?

 God created water creatures and birds that fly across the sky.

12. What did God create on the sixth day?

 God made the animals that live on the land: livestock, creatures that move along the ground and wild animals. He also made man.

13. In Genesis 1: 26 God says, "Let us make man in our image, in our likeness... ." What did God mean when He said us and our ?

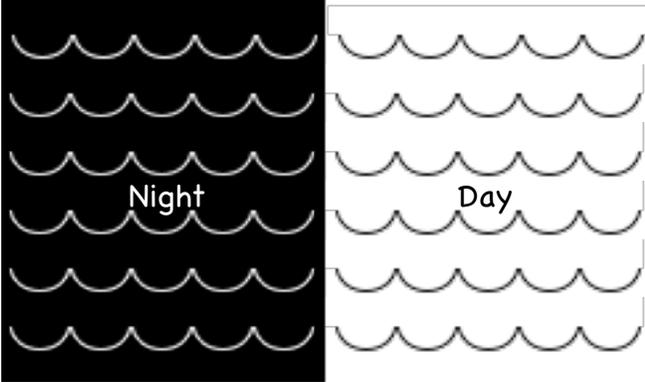
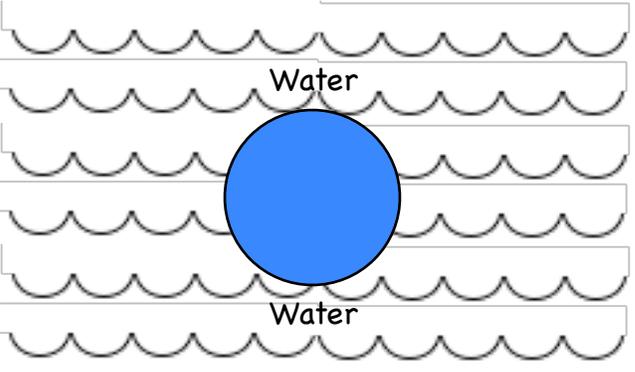
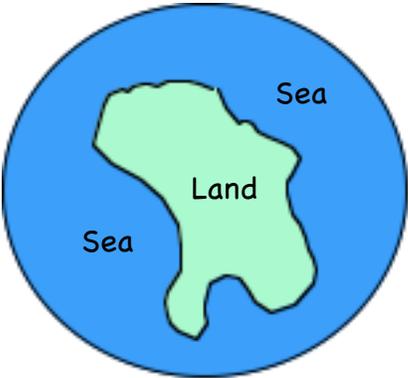
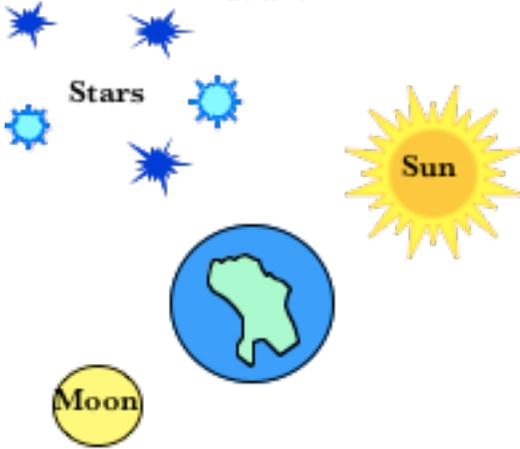
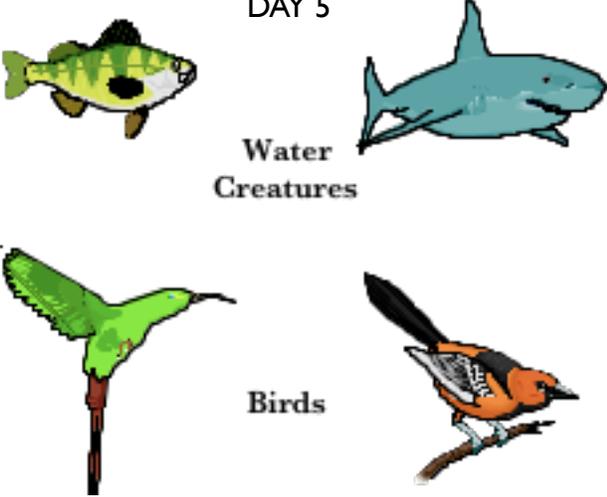
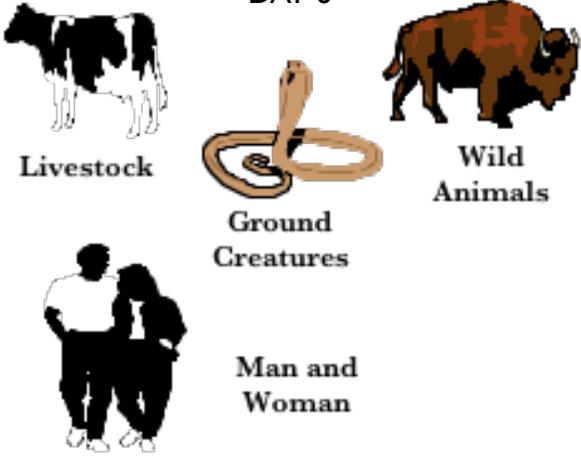
 Although God is one, he forms a trinity that includes God the father, God the Son and God the Holy Spirit. Most likely God was referring to this trinity when he said 'us' and 'our'.

14. What message is God sending us by resting on the seventh day?

 God is telling us that there is a time for work and a time for rest. He knows that our bodies and minds need rest from the daily work we do. For six days we can work, but we need to rest every seventh day to maintain physical, spiritual and mental health.



15. Draw diagrams of what the universe may have looked like after each day of creation. The space is small so don't worry about fitting everything in. Focus on the creations of each day and label them.

<p style="text-align: center;">DAY 1</p> 	<p style="text-align: center;">DAY 2</p> 
<p style="text-align: center;">DAY 3</p> 	<p style="text-align: center;">DAY 4</p> 
<p style="text-align: center;">DAY 5</p> 	<p style="text-align: center;">DAY 6</p> 

16. Read Isaiah 51:6. What will eventually happen to the heavens?

 **The heavens will vanish like smoke. God's righteousness & salvation will last forever.**

17. Read Isaiah 51: 6. What will eventually happen to the earth?

 **The earth will wear out like a garment.**

18. Read Psalm 19: 2. How often does God speak to us through His creation?

 **Day after day and night after night.**

19. Read Psalm 19: 1-4. What do you think God is trying to say through His creation?

 **God is telling us that He, alone, is the creator.**

20. Read Romans 1: 18-21. Why does man not have an excuse for not knowing God?

 **Creation tells us that God exists.**

 **Signs of God's existence are everywhere.**



THE SPHERICAL EARTH

Read pages 156 & 157

1. What was the common belief in the 15th century with regard to the shape of the earth?

 Most people believed that the earth was flat.

2. Why did people think this way?

 They thought that way simply because when they looked across open spaces of land the land, itself, looked flat. If looking on a prairie, the line where land meets sky looks straight. Because it looked flat.

3. When were scientists first able to take pictures from space?

 The technology needed to take pictures from space didn't exist until the 1960's.

4. When did secular scientists first begin to think of the earth as being round?

 Around 600 BC, philosophers in ancient Greece began to think about the earth being round.

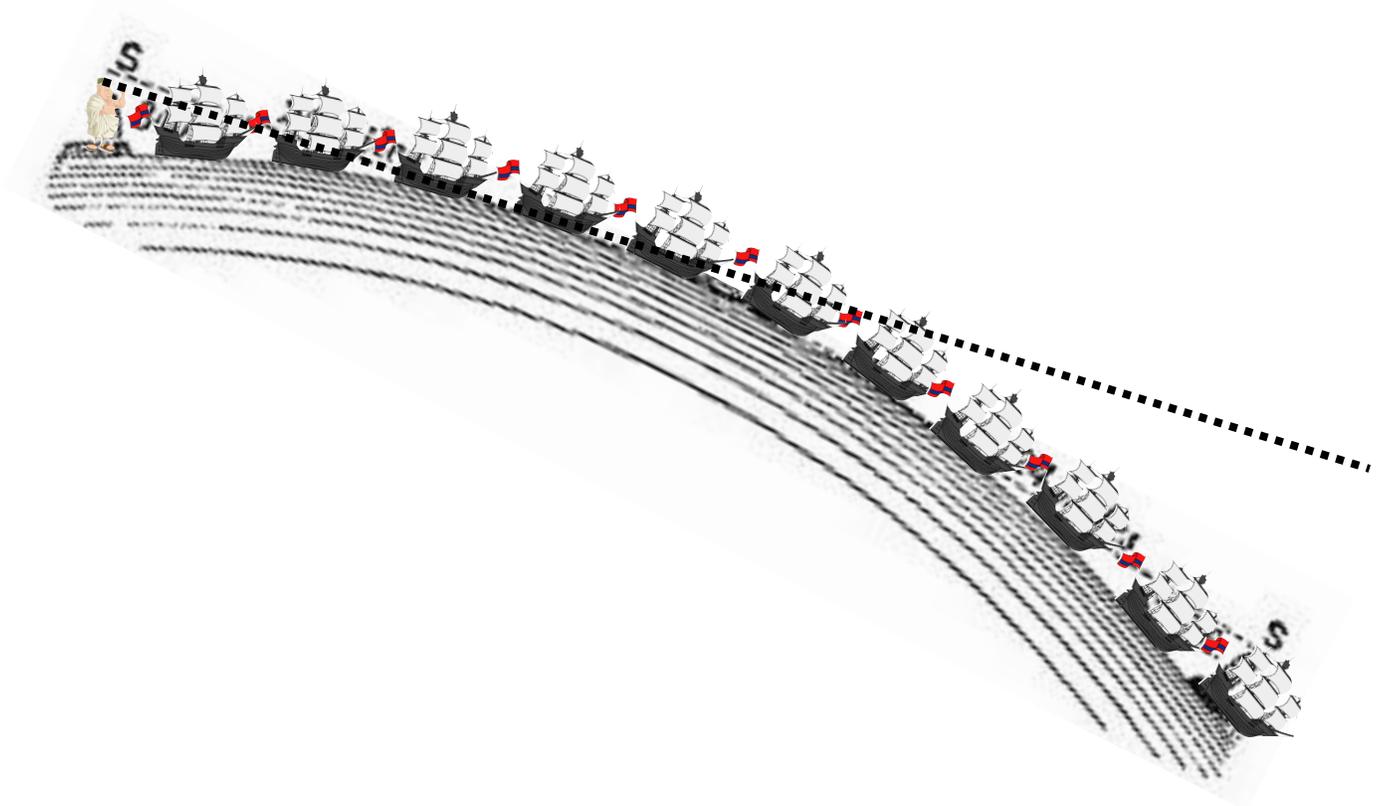
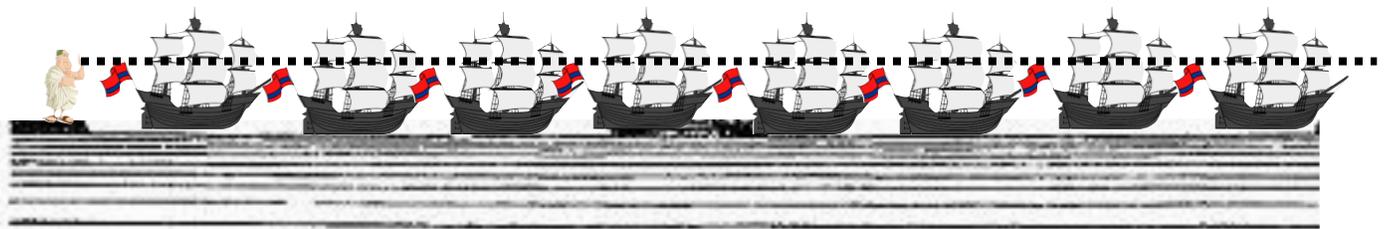


INFERRING A SPHERICAL EARTH

Read pages 158 - 161

1. About 500 BC, Pythagoras inferred that the earth was round? Explain his thinking.

 Pythagoras was watching ships sail out to sea. When they disappeared into the horizon they did not disappear from view all at once. If the earth were flat, the ships should have disappeared all at once. Since parts of the ships disappeared from view at different times, with the tallest part disappearing last, he inferred the earth was curved. Since the sun and the moon were curved and spherical, he decided that the earth must be like them and spherical too.



INFERRING A SPHERICAL EARTH

Read pages 158 & 161

2. About 400 BC, Anaxagoras inferred that the earth was round? Explain his thinking.

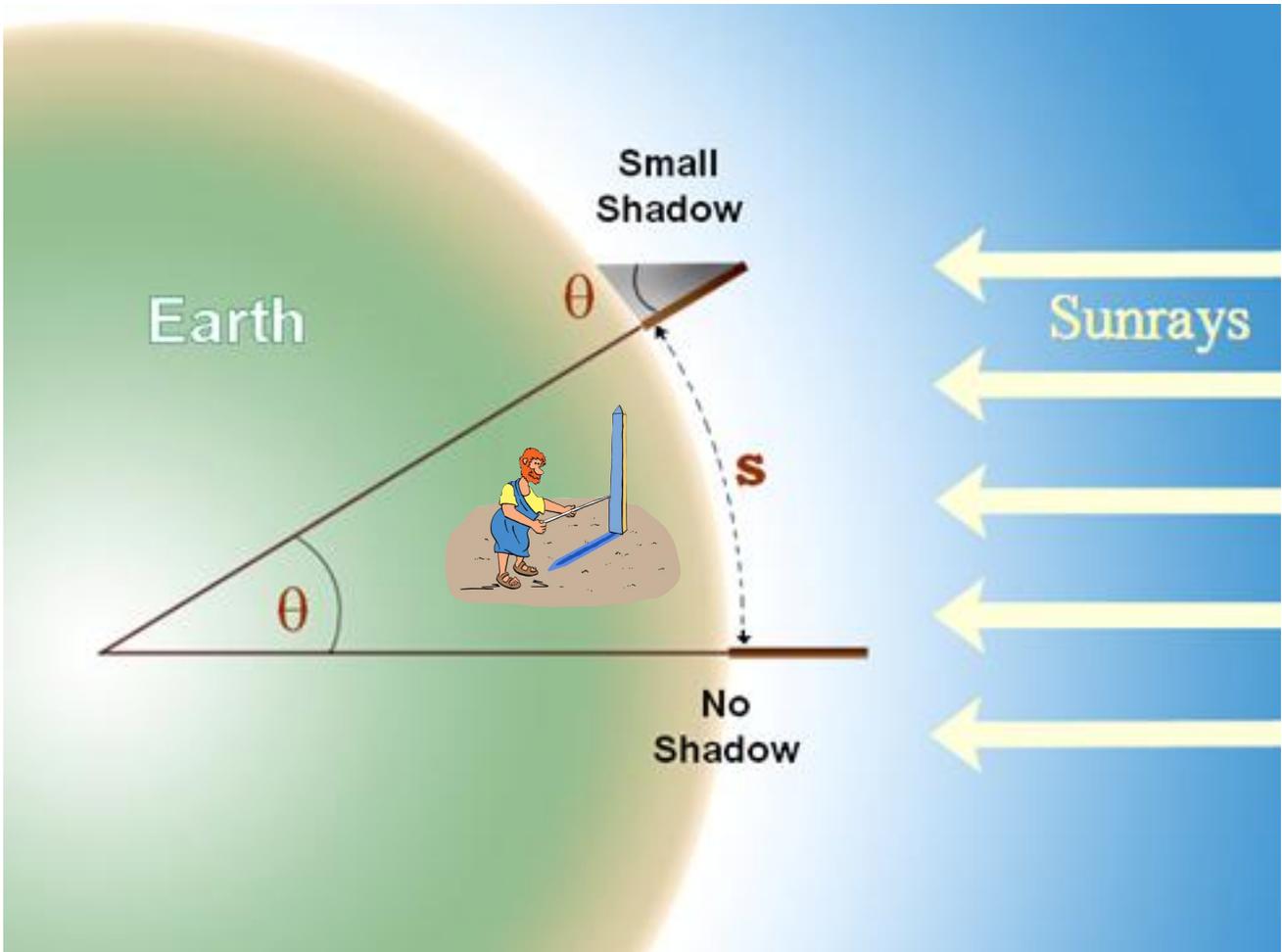


Anaxagoras was interested in the moon. In particular, he liked watching eclipses of the moon. He had concluded that eclipses happen when the earth moves between the sun and the moon. This blocks off some of the sun's light that shines on the moon. When this happens, part or all of the moon is left in total darkness. He saw that the dark area on the moon was curved and he concluded that the dark area was really the earth's shadow. When he saw the shadow of the earth on the moon and noticed that it had a curved shape, he inferred that the earth must be spherical.



3. About 200 BC, Eratosthenes inferred that the earth was round. Explain his thinking.

 Two sticks were placed in the ground at a distance. One cast a shadow, the other did not. Because of this, Eratosthenes inferred the earth was round.



4. About 700 BC, Isaiah spoke about the earth. Copy Isaiah 40:22 below.

 He sits enthroned above the circle of the earth, **and its people are like grasshoppers.**

THE SPINNING EARTH

Read pages 162 - 167

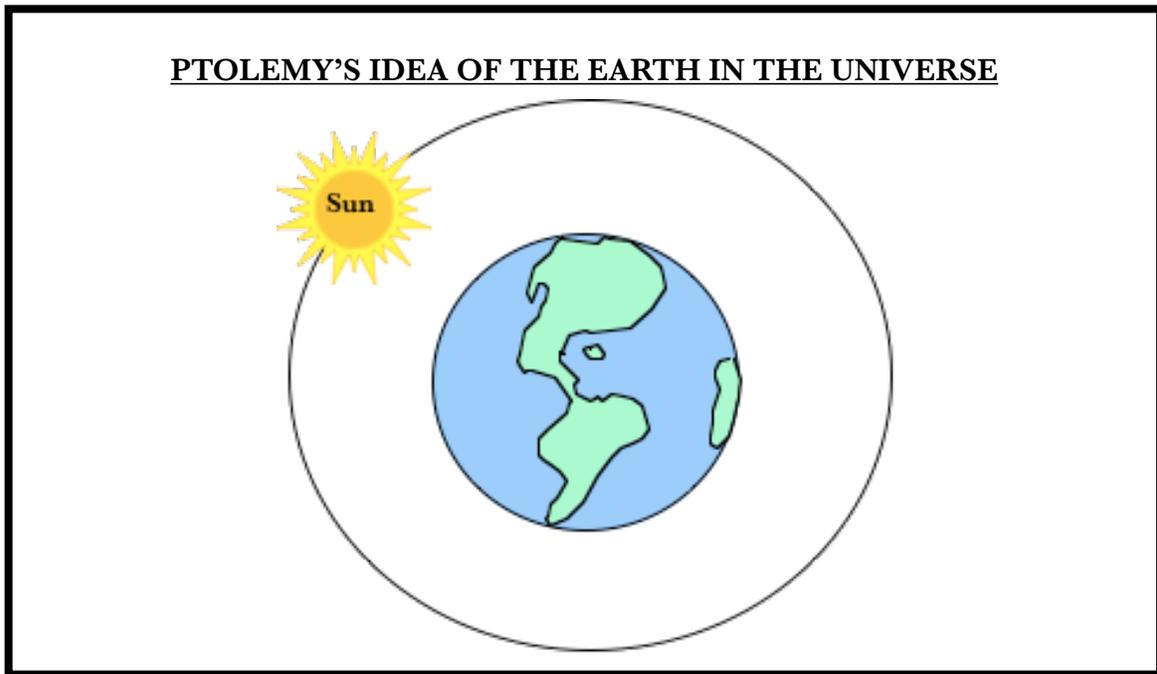
1. Which early culture was interested in explaining how the sun moved?

 **The ancient Greeks were interested in how the sun moved.**

2. What was the early belief about the relationship between the sun's movement and the earth?

 **The early belief was that the sun moved around the earth. Not only did the Greeks believe this but many other cultures did as well.**

3. Ptolemy was a second geographer who thought the earth was the centre of the universe. Draw a picture of how Ptolemy saw the earth in this context.



4. When did people begin to realize that there could be another explanation for why the sun appeared to move across the sky?

 **It wasn't until after the 1500s that people began to realize there could be another explanation for why the sun appeared to move across the sky.**

DAYTIME & NIGHTTIME

Read pages 164 - 165

Complete the activity and answer the questions

WHAT DID YOU OBSERVE?

1. What did you do to change your Earth model from daytime to nighttime?

 **The earth model was spun.**

2. When the axis of your Earth model was straight up and down, were the lengths of daytime and nighttime equal or different?

 **The lengths of daytime and nighttime were equal.**

3. What about when the axis of your earth model was tilted?

 **The lengths of daytime and nighttime were different.**

WHAT DO YOU THINK?

1. On the real Earth, are the lengths of daytime and nighttime equal or are they different?

 **The lengths of daytime and nighttime are different.**

2. How are the real Earth and Sun positioned in space?

 **The real earth's axis is tilted.**

3. What evidence are you using for your answer?

 **The lengths of daytime and nighttime in Winnipeg are different. The days are longer in the summer and shorter in the winter.**

4. Write down Job 26:7.

 **He spreads out the northern skies over empty space; he suspends the earth over nothing.**

5. What is the imaginary 'rod' that the earth spins on called?

 Scientists usually call this imaginary rod an axis.

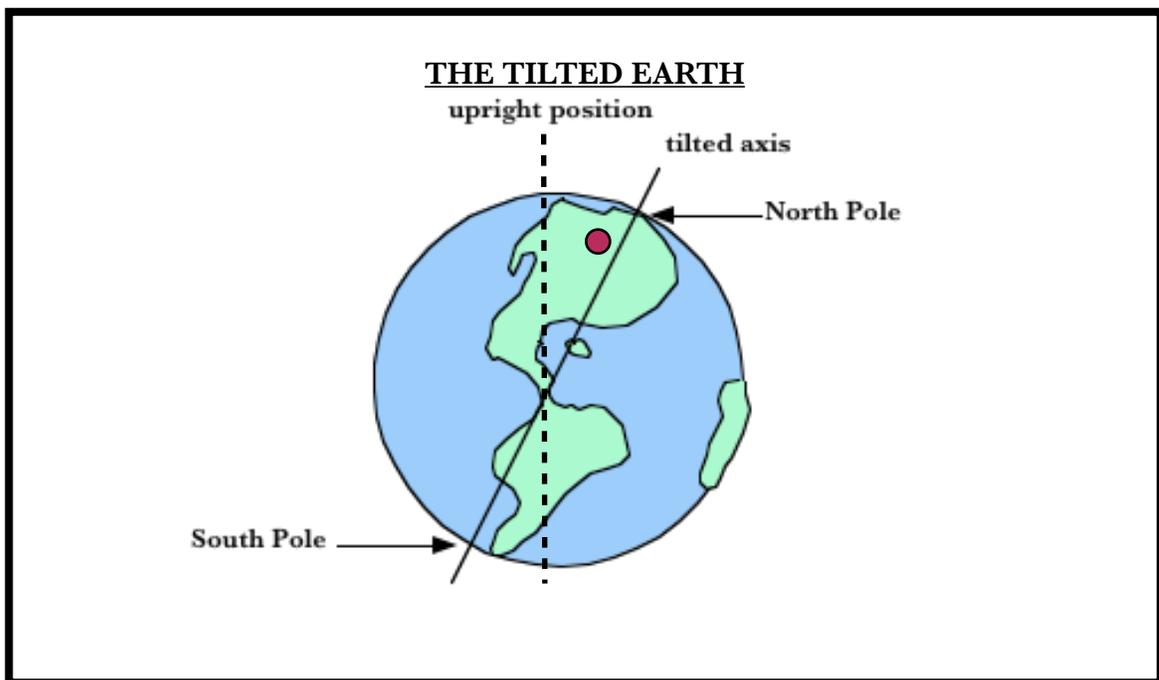
6. What does the earth "rotating on its axis" mean?

 It means that the earth spins (rotates) as if it had a rod running through it between the North and South Poles.

7. At what angle is the earth tilted?

 The earth's axis is tilted at an angle of 23.5 degrees from an upright position.

8. Draw the diagram on Page 166 to show the tilt of the earth. Place the following labels in their correct position: North Pole, South Pole, upright position, tilted axis.



9. In which direction does the earth rotate?

 The earth rotates in a counterclockwise direction.

10. Explain why we experience daytime.

 We experience daytime light when the earth's rotation spins us so we face toward the sun.

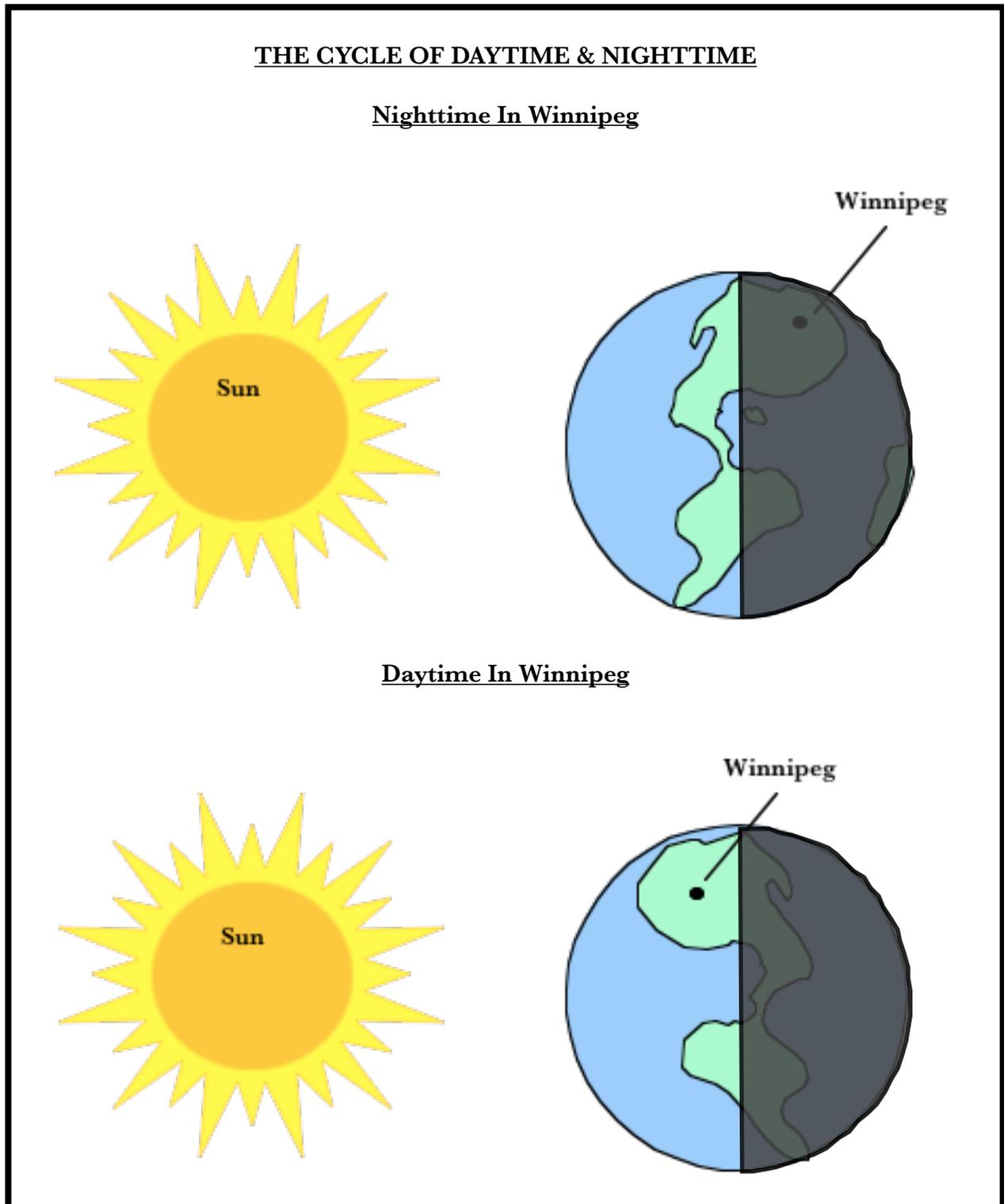
11. Explain why we experience nighttime.

 We experience nighttime darkness when the earth's rotation spins us so we face away from the sun.

12. How long does it take the earth to go through one cycle of daytime and nighttime?

 The time it takes for the earth to go through one cycle of daytime and nighttime is 23 hours, 56 minutes and 4 seconds. We usually round this number off to 24 hours.

13. Draw the diagram on page 167 that shows the cycle of daytime and nighttime.



SEASON REASONING

Read pages 170 to 171. Conduct the activity and answer the questions.

What Did You Observe At Position A?

1. Is the earth's axis pointing toward or away from the sun?

 **The earth's axis is pointing toward the sun.**

2. Is the northern part of the Earth tilted toward or away from the sun?

 **The northern part of the earth is tilted toward the sun.**

3. Which part of the Earth's surface is facing the light most directly?

 **The northern part of the earth is facing the sun most directly**

What Did You Observe At Position B?

1. Is the earth's axis pointing toward or away from the sun?

 **The earth's axis is not pointing toward the sun, nor away from it.**

2. Is the northern part of the Earth tilted toward or away from the sun?

 **The northern part of the earth is not pointing toward the sun, nor away from it.**

3. Which part of the Earth's surface is facing the light most directly?

 **The middle part of the earth (the equator) is facing the sun most directly**

SEASON REASONING

Read pages 170 to 171. Conduct the activity and answer the questions.

What Did You Observe At Position C?

1. Is the earth's axis pointing toward or away from the sun?

 **The earth's axis is pointing away the sun.**

2. Is the northern part of the Earth tilted toward or away from the sun?

 **The northern part of the earth is tilted away the sun.**

3. Which part of the Earth's surface is facing the light most directly?

 **The southern part of the earth is facing the sun most directly**

What Did You Observe At Position D?

1. Is the earth's axis pointing toward or away from the sun?

 **The earth's axis is not pointing toward the sun, nor away from it.**

2. Is the northern part of the Earth tilted toward or away from the sun?

 **The northern part of the earth is not pointing toward the sun, nor away from it.**

3. Which part of the Earth's surface is facing the light most directly?

 **The middle part of the earth (the equator) is facing the sun most directly**

SEASON REASONING

Read pages 170 to 171. Conduct the activity and answer the questions.

What Do You Think?

1. Which part of the earth's surface is receiving the most heat in position A? B? C? D?



A - **The Northern Part**

B - **The Equator**



C - **The Southern Part**

D - **The Equator**

2. What is the temperature like in the hemispheres when the earth is in position A?



Northern: **The temperature is warmer.**



Southern: **The temperature is colder.**

3a. What season is it for people in the northern hemisphere when the earth is in position A? What's your evidence?



It's summer. This is when we have our warmest temperatures.

3b. What season is it for people in the southern hemisphere when the earth is in position A? What's your evidence?



It's winter. This is when they have their coldest temperatures.

4. What season is it for people in the northern and southern hemispheres when the earth is in position B? In position C? In position D?



B - **It's spring in the northern hemisphere and fall in the southern hemisphere.**

Evidence - **The earth orbits in a counter-clockwise position.**



C - **It's winter in the northern hemisphere and summer in the southern hemisphere.**

Evidence - **The northern hemisphere is tilted away from the sun. The southern hemisphere is tilted toward the sun.**



D - **It's fall in the northern hemisphere and spring in the southern hemisphere.**

Evidence - **The earth orbits in a counter-clockwise position.**

THE ORBITING EARTH

Read pages 168 to 173

1. If you live in the northern hemisphere like we do, during what month is the earth farthest away from the sun?

 **The earth is farthest away from the sun during the month of June.**

2. If you live in the northern hemisphere like we do, during what month is the earth closest to the sun?

 **The earth is closest to the sun in December.**

3. What arrangement of the earth and sun could explain why the northern hemisphere is warmest when the earth and sun are farthest apart?

 **Because the earth is tilted on its axis, it has an affect on temperature during different times of the year. During our summer months the earth is tilted toward the sun. Even though we are farther away from the sun during this time we are still warmest because the sun shines on our part of the earth more directly.**

4. Why do we have more hours of daylight in the summer?

 **We have more hours of daylight in the summer because the northern hemisphere is tilted toward the sun during that time and therefore it receives more direct sunlight.**

5. When the earth's axis does not point toward the sun nor away from it, what is the comparison of daytime and nighttime at the beginning of these seasons?

 **The amount of daytime and nighttime hours is approximately the same when the earth's axis does not point toward the sun nor away from it.**

6. What is the shape of the earth's travels around the sun?

 **The earth travels around the sun in an oval-shaped path.**

7. What is this path called?

 **The path of the earth traveling around the sun is called an orbit.**

8. How long does it take the earth to travel one full cycle around the sun?

 **It takes the earth 365 days and 6 hours to travel one full cycle around the sun.**

9. How many days are there in a leap year?

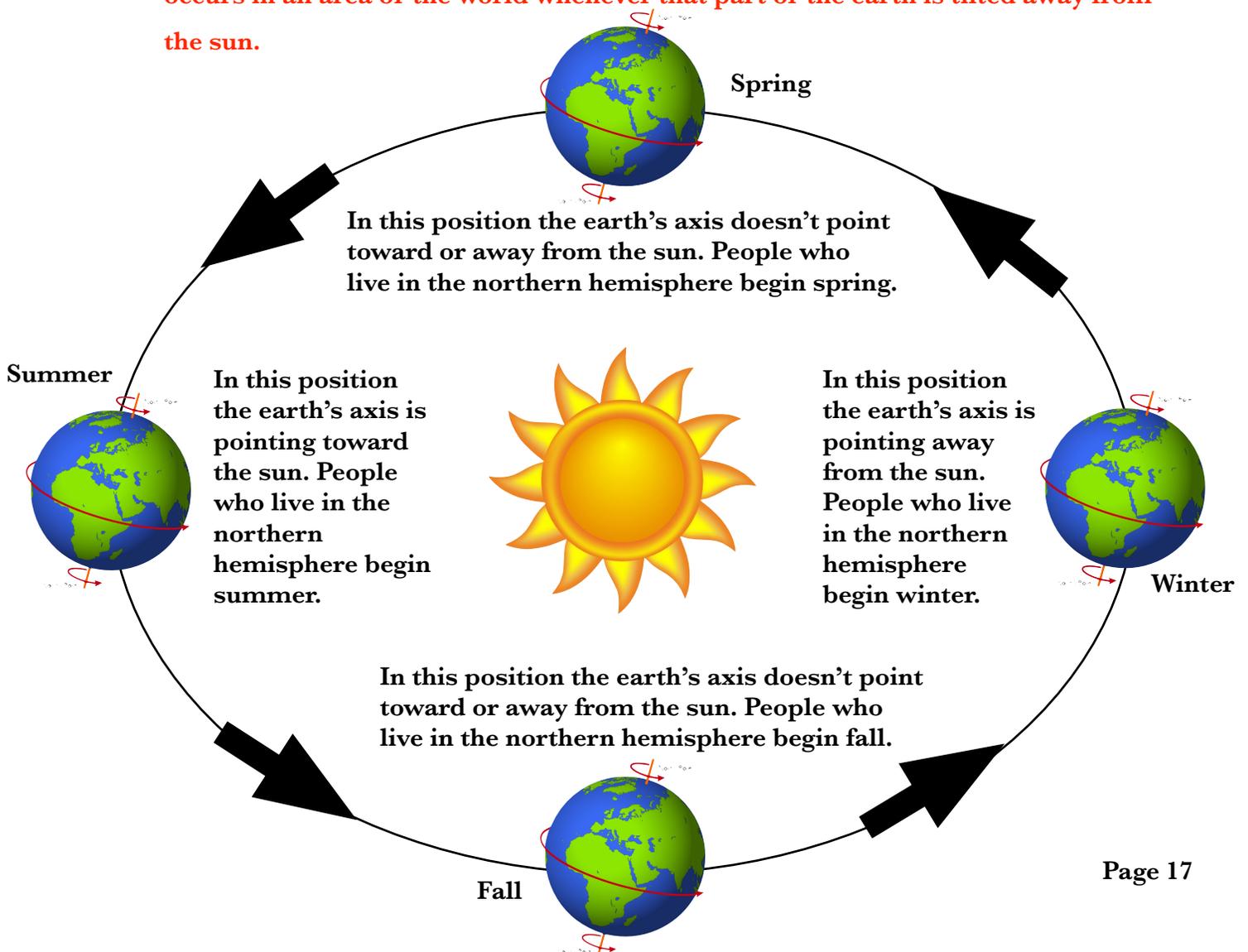
 There are 366 days in a leap year.

10. Why do we have leap years?

 Leap years make up for the extra 6 hours in each year that we don't account for in our calendars. Because it takes 365 days and 6 hours for the earth to travel once around the sun, those six hours are saved up until they make a 24 hour period. Therefore, every four years, the hours that were saved make up the extra day in a leap year.

11. What causes the seasons to change?

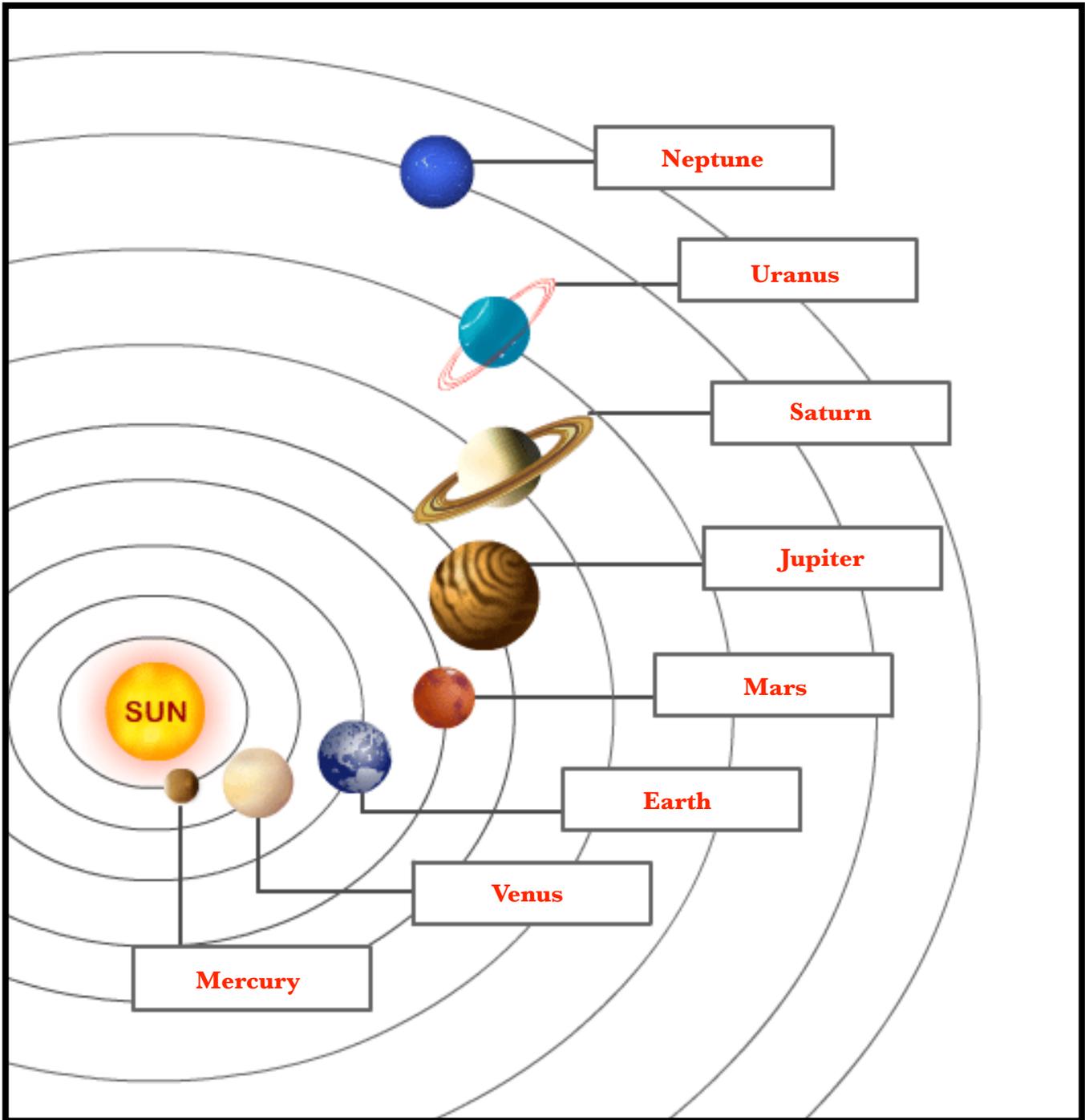
 It is the tilted axis of our earth that causes the change of seasons. Summer occurs in an area of the world whenever that part of the earth is tilted toward the sun. Winter occurs in an area of the world whenever that part of the earth is tilted away from the sun.



A FAMILY OF ORBITS

Read pages 174 to 183

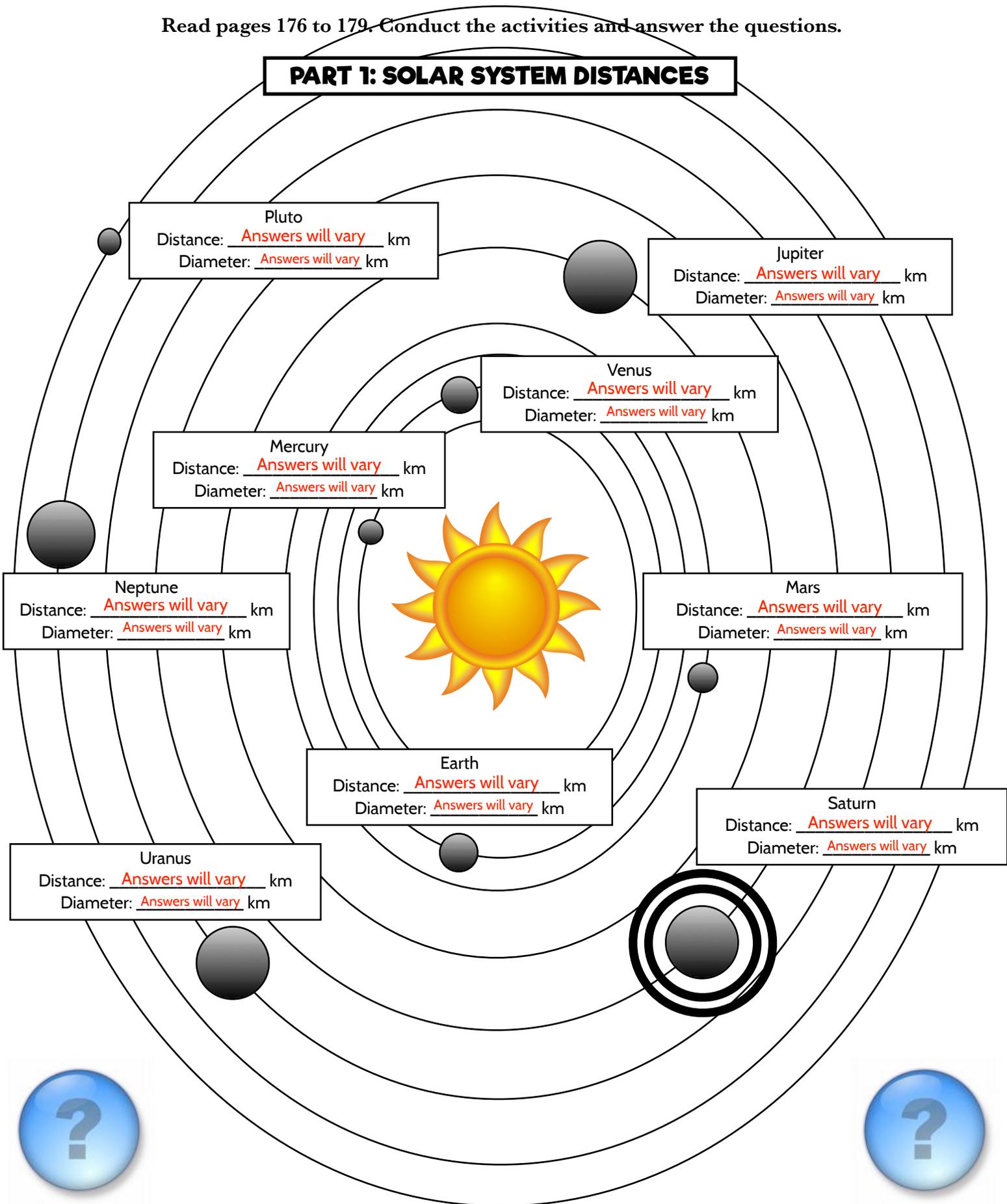
1. Label the diagram.



BRINGING THE SOLAR SYSTEM DOWN TO EARTH

Read pages 176 to 179. Conduct the activities and answer the questions.

PART 1: SOLAR SYSTEM DISTANCES



GUESS THE DISTANCE FROM THE SUN

GUESS THE DIAMETER OF EACH PLANET

-sizing up the planets - our solar system to scale

ACTUAL DISTANCES FROM THE SUN

1 m = 100 000 000 km

PLANET	DISTANCE	SCALE
Mercury	58 000 000 km	0.058 m (5.8 cm)
Venus	108 000 000 km	0.108 m (10.8 cm)
Earth	150 000 000 km	0.150 m (15.0 cm)
Mars	228 000 000 km	0.228 m (22.8 cm)
Jupiter	778 000 000 km	0.778 m (77.8 cm)
Saturn	1 427 000 000 km	1.427 m (1 m 42.7 cm)
Uranus	2 870 000 000 km	2.87 m (2 m 87 cm)
Neptune	4 497 000 000 km	4.497 m (4 m 49.7cm)
Pluto	5 900 000 000 km	5.9 m (5 m 90 cm)



What did you observe?

- How much yarn do you need for your solar system model? In other words, how long is your yarn? **5.9 meters**
- Did your model fit in the space you decided on? Why or why not? **Answers will vary**
- Are some planets grouped more closely together than others? If so, which ones?
 - * Mercury
 - * Venus
 - * Earth

What do you think?

- What do you think the Sun would look like if you were standing on Mercury?
It would look bigger.
- Choose one other planet and describe how the Sun would look from its surface.

Planet: **Answers will vary**

Answers will vary
- Which planets do you think would be easiest to see from earth?
Mercury, Venus, Mars, Jupiter

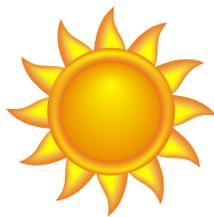
ACTUAL DIAMETER OF THE PLANETS

1 cm = 1 000 km

PLANET	DISTANCE	SCALE
Mercury	5 000 km	5 cm
Venus	12 000 km	12 cm
Earth	13 000 km	13 cm
Mars	7 000 km	7 cm
Jupiter	143 000 km	143 cm
Saturn	121 000 km	121 cm
Uranus	51 000 km	51 cm
Neptune	49 000 km	49 cm
Pluto	2 300 km	2.3 cm

SUN'S DIAMETER

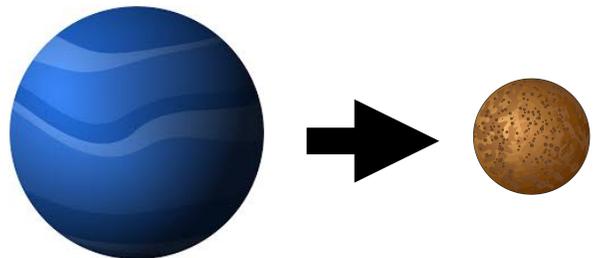
1 400 000 km



PART 2: SIZING UP THE PLANETS



List the planets in order of their size, from largest to smallest.



Jupiter

Saturn

Uranus

Neptune

Earth

Venus

Mars

Mercury

Pluto

MORE OBSERVATIONS

What did you observe?

1. Which planet is the smallest?

Pluto

2. How many planets of this size could fit across the Earth's diameter?

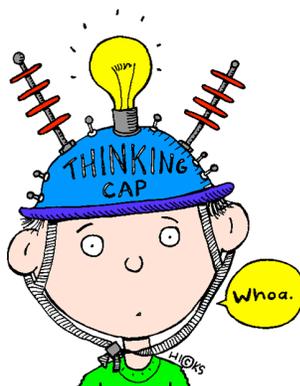
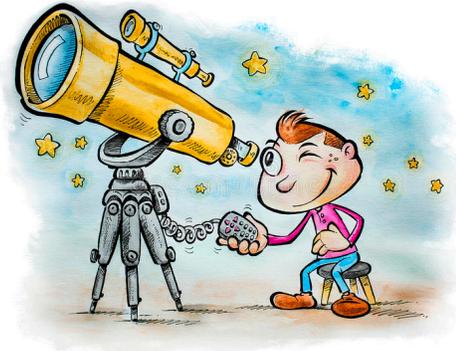
5.7

3. Which planet is the largest?

Jupiter

4. How many earths could fit across its diameter?

11



What do you think?

1. The sun has a diameter of about 1 400 000 km. Calculate how large the Sun would be using the scale of 1000 km equals 1 cm.

1 400 cm

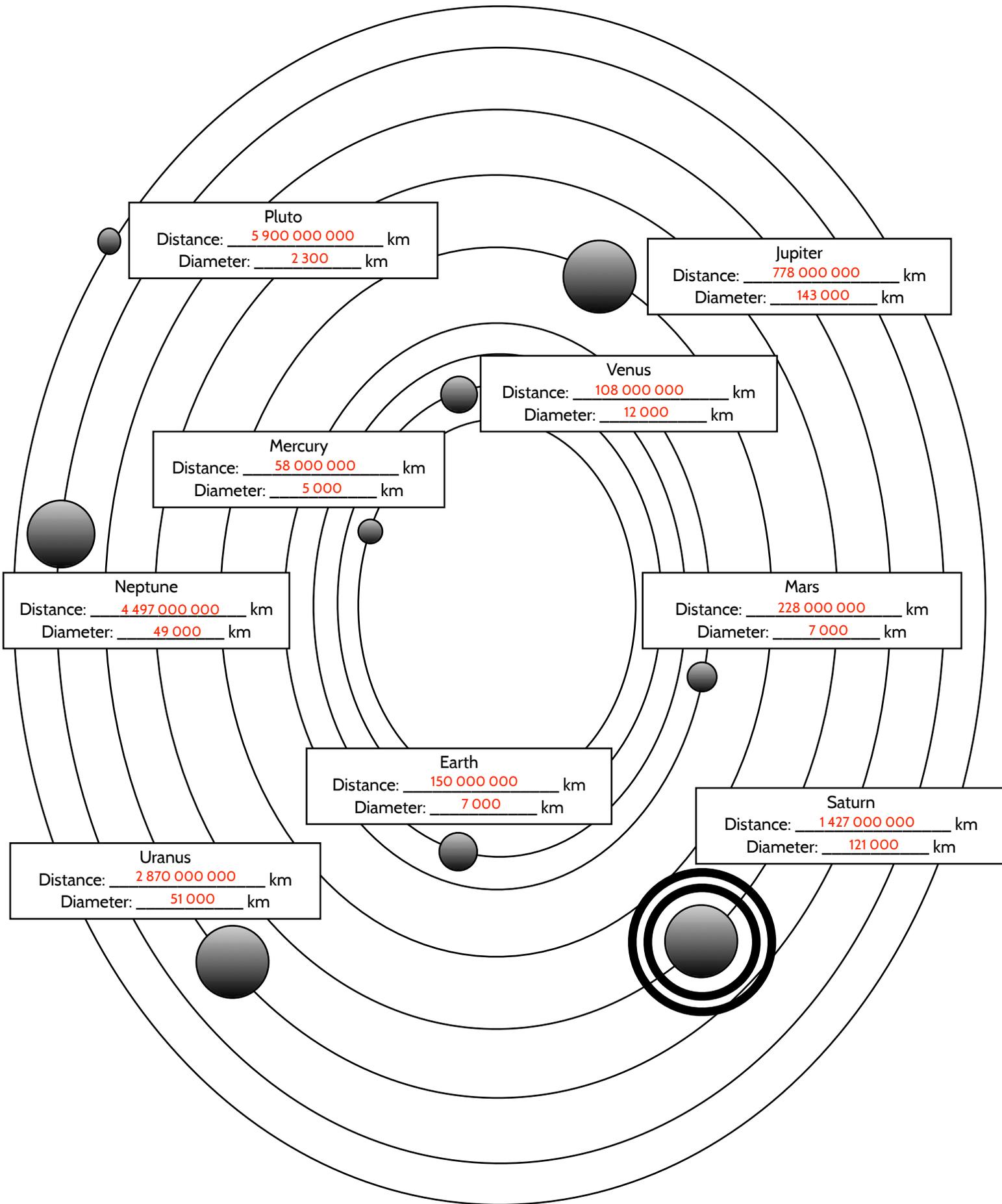
2. How many Earths could fit across the sun's diameter?

107.7

3. How many Jupiters could fit across the sun's diameter?

9.8

ACTUAL NUMBERS



2. What is the family of objects that orbit around the sun called?

 The family of objects that orbit the sun is called the solar system.

3. Explain where the word solar comes from and why it is used to describe our system of planets.

 The word solar comes from the Latin word 'sol'. It means 'sun'. It is used to describe our system of planets because the planets revolve around the sun.

4. What is the fastest orbiting planet?

 The fastest orbiting planet is Mercury.

5. What is the slowest orbiting planet?

 The slowest orbiting planet is Neptune.

6. How far away from the sun is the earth?

 The sun is 150 million km from the earth.

7. Which planets are grouped more closely than others?

 Mercury, Venus and Earth are grouped more closely together.

8. What do you think the sun would look like on Mercury in comparison to the way it would look like on earth?

 The sun would look bigger if one saw it from Mercury compared to the way it looks from earth.

9. What would the sun look like from Pluto in comparison to the way it would look like on earth?

 The sun would look smaller if one saw it from Pluto compared to the way it looks from earth.

10. Which planets would be easiest to see from earth using only your eyes?

 Mercury, Venus, and Mars would be easiest to see from earth using only your eyes.

11. How fast does the NASA space shuttle travel?



The space shuttle travels at a speed of 28 000 km per hour.

12. How long does it take the space shuttle to travel around the earth?



It takes about 90 minutes for the space shuttle to travel around the earth.

13. How long would it take the space shuttle to reach Pluto?

A. Distance to Pluto: 5 750 000 000 km

B. Take off 3 zeros from A: 5 750 000

C. Speed of shuttle: 28 000 km/hr

D. Take off 3 zeros from C: 28

E. Answer B \div answer D = 205 357 hours

F. Answer E \div 24 = 8 557 days

G. Answer F \div 365 = 23 years

14. How long would it take to drive to Pluto if you traveled at a speed of 100 km/hr.?

A. Distance to Pluto: 5 750 000 000 km

B. Take off 2 zeros from A: 57 500 000

C. Speed of car: 100 km/hr

D. Take off 2 zeros from C: 1

E. Answer B \div answer D = 57 500 000 hours

F. Answer E \div 24 = 2 395 833 days

G. Answer F \div 365 = 6 564 years

15. List the planets in order from largest to smallest.

Largest: Jupiter

Saturn

Uranus

Neptune

Earth

Venus

Mars

Mercury

Smallest: Pluto

16. Consider the smallest planet. About how many planets this size could fit across the earth's diameter?

A. Diameter of earth: **13 000 km**

B. Diameter of smallest planet: **2 300 km**

C. Answer A \div Answer B = **5.6 or 6**

17. Consider the largest planet. About how many earths could fit across its diameter?

A. Diameter of largest planet: **143 000 km**

B. Diameter of earth: **13 000 km**

C. Answer A \div Answer B = **11**

18. Approximately how many earths could fit across the sun's diameter?

A. Diameter of the sun: **1 400 000 km**

B. Diameter of earth: **13 000 km**

C. Answer A \div Answer B = **108**

20. Why is Mars red?

 Mars is red because it contains rust on its surface.

21. Is Saturn the only planet with rings around it? If not, which other planets have rings?

 No. Jupiter, Uranus and Neptune also have rings.

22. Which planet has the moon, Miranda, orbiting it?

 Uranus has the moon, Miranda, orbiting it.

23. What makes the moon, Miranda, so strange?

 Its combination of very old and new features may have resulted from the moon being repeatedly shattered and pulled back together again by gravity.

24. What is so surprising about Neptune's largest moon, Triton?

 Most moons orbit their planets in the same direction that the planets rotate, but Triton orbits in the opposite direction of planet rotation.

25. Describe three of the following moons of Jupiter.

 Io: It has erupting volcanoes.

 Callisto: Its surface is the most heavily cratered in the solar system.

 Europa: Its smooth, featureless surface is marked by a network of fine lines that criss-cross one another.

26. Why can't Venus be observed directly?

 The surface of Venus can't be observed directly because it is completely surrounded by thick clouds.

27. Why can't we obtain a clear picture of Pluto?

 We can't obtain a clear picture of Pluto because it is so far away.

OUR CHANGING VIEW OF THE SOLAR SYSTEM

Read pages 184 to 191

1. What planets did the early sky watchers observe and chart the courses of?

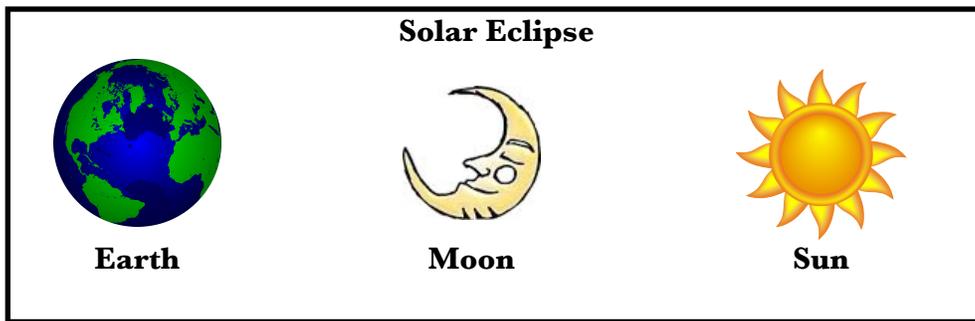
 Early sky watcher observed and charted the courses of Mercury, Venus, Mars, Jupiter and Saturn.

2. What happens during a solar eclipse?

 Solar eclipses occur when when the moon passes between the sun and the earth.

3. Label the diagram below to show a solar eclipse.

 Use the words: earth, moon, sun



4. What happens during a lunar eclipse?

 Lunar eclipses occur when the earth passes between the sun and the moon.

5. Label the diagram below to show a solar eclipse.

 Use the words: earth, moon, sun



6. Who was Galileo and how did he use the telescope differently?

 Galileo was an Italian scientist who used the telescope in a different way. He used it to watch the night sky.

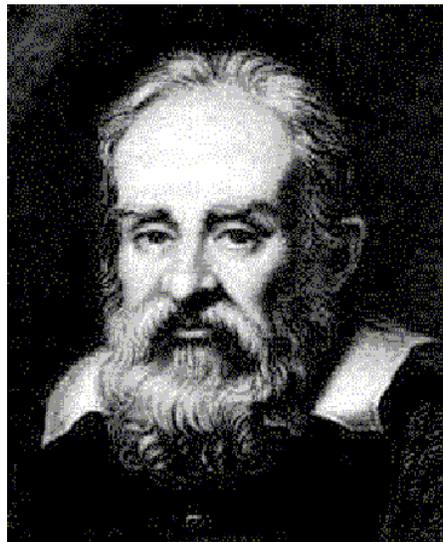
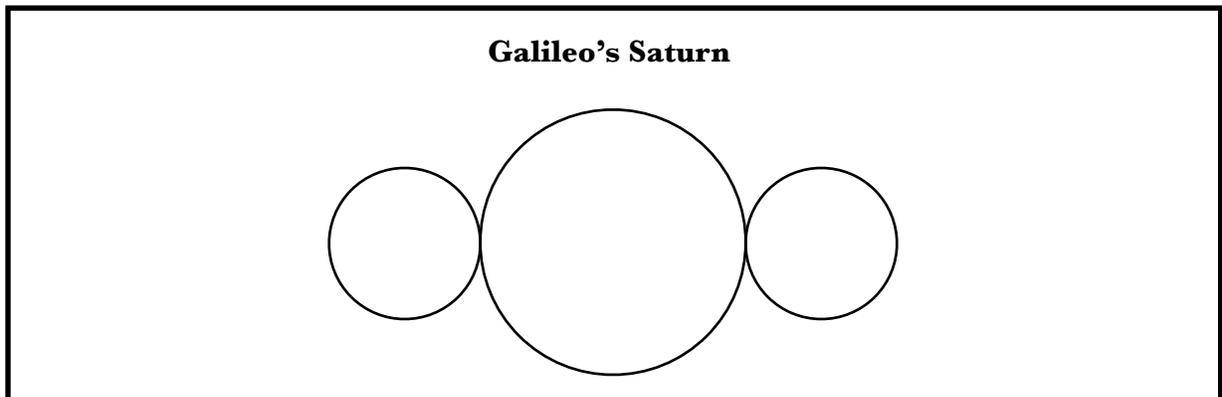
7. How did Galileo improve the design of the telescope?

 Galileo improved the telescope by making it more powerful. He designed it to better magnify distant objects and provide clearer images.

8. What was the first object Galileo observed with his telescope?

 The first object Galileo observed was the moon.

9. Galileo was the first person we know of to observe Saturn's rings. Draw a picture of how he saw and recorded them.



BEYOND THE SOLAR SYSTEM

Read pages 192 to 193

1. What are the Voyager space probes?



They are man-made space ships that have been launched into the solar system to provide scientists with information about the universe. Pictures and other data is sent back to earth as the probes encounter more of space.

2. When were the Voyager space probes launched?



The Voyager space probes were launched in 1977.

3. Approximately how long will it take the space probes to pass beyond the farthest reaches of our solar system?



It will take the space probes approximately 40 years to pass beyond the farthest reaches of our solar system.

4. Why do the space probes contain special recordings that have the sights and sounds of earth?



They contain special recordings that have the sights and sounds of earth because scientists hope to find other forms of life in the universe and this is a way of communicating to them.

5. Describe 3 things that are on these recordings.



The sounds of whales singing



Beethoven's "Fifth Symphony"



Louis Armstrong's "Melancholy Blues"



A Navajo chant



Pictures of earth from space, a snow-capped mountains, parents and children, houses, animals, trees and musical instruments



A message in mandarin Chinese, saying, "Hope everyone's well. We are thinking about you all. Please come here to visit us when you have time."

6. What is a star cluster?



A star cluster is a group of millions of stars that appear very close to one another.

7. What are nebulas?

 **Nebulas are great clouds of gas and dust that are spread throughout the universe.**

8. Our sun and the solar system are only a small part of a collection of millions of stars. What name is given to our galaxy?

 **The name given to our galaxy is the Milky Way Galaxy.**

9. About how many other galaxies are known to us at this time?

 **The Milky Way Galaxy is only one of billions of other galaxies in the universe.**

10. What is the name of another galaxy?

 **The name of another galaxy is the Andromeda Galaxy.**

Congratulations!



You are finished!!!