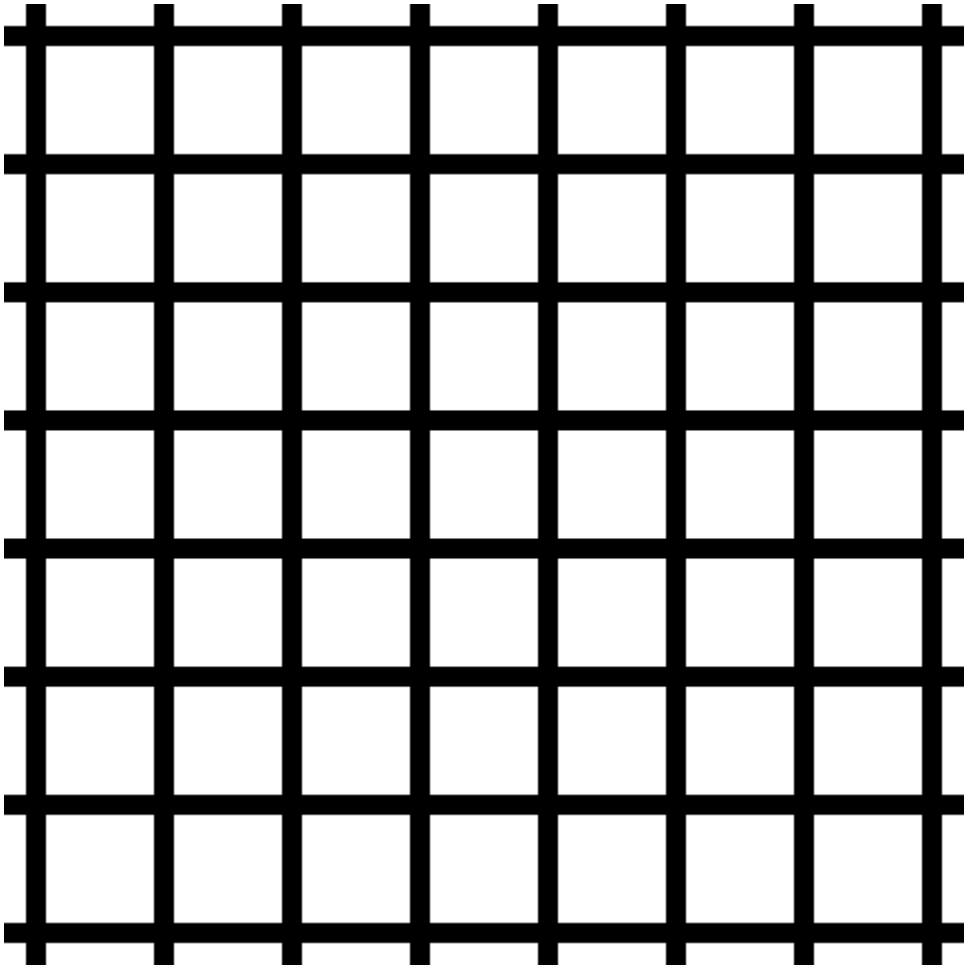
SCIENCE 10F

ASTRONOMY

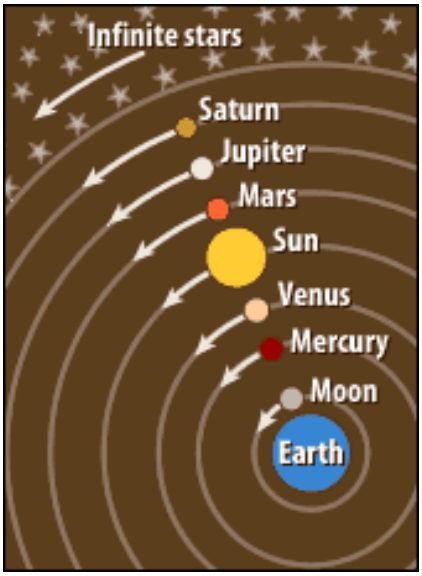
Optical Illusions



Question: Why are there optical illusions in your astronomy booklet?

The Early History of Astronomy

Ancient people saw seven celestial bodies moving through the stars: _____, _____, _____, _____, _____, _____, and _____. Five of these objects were considered to be ‘special stars’ through the constellations. These objects were considered to be special stars which they called _____.



Ptolemy (100-200 AD): Determined the positions of many of the brightest stars. He has summarized the **geocentric** model of the solar system, which stated that _____ is motionless and everything revolves around it. The problem was that the planets seemed to loop backwards, and if they were making perfect circles around the Earth that wouldn’t happen. We call this strange phenomenon _____ _____.

Aristarchus (310 – 320 BC): Proposed that all of the planets, including the Earth, revolved around the _____, and that the Earth rotates on an _____ once a day. This is called the _____ model.

The sun centered model of the solar system accounts for the wacky movement of the planets. In this model, retrograde motion is an _____ _____, which makes it seem as if the planets go backward. What is actually happening is that the planets are moving in different sized orbits at different speeds, so they catch up and pass each other, making it look like they are moving in opposite directions when it's really the same.

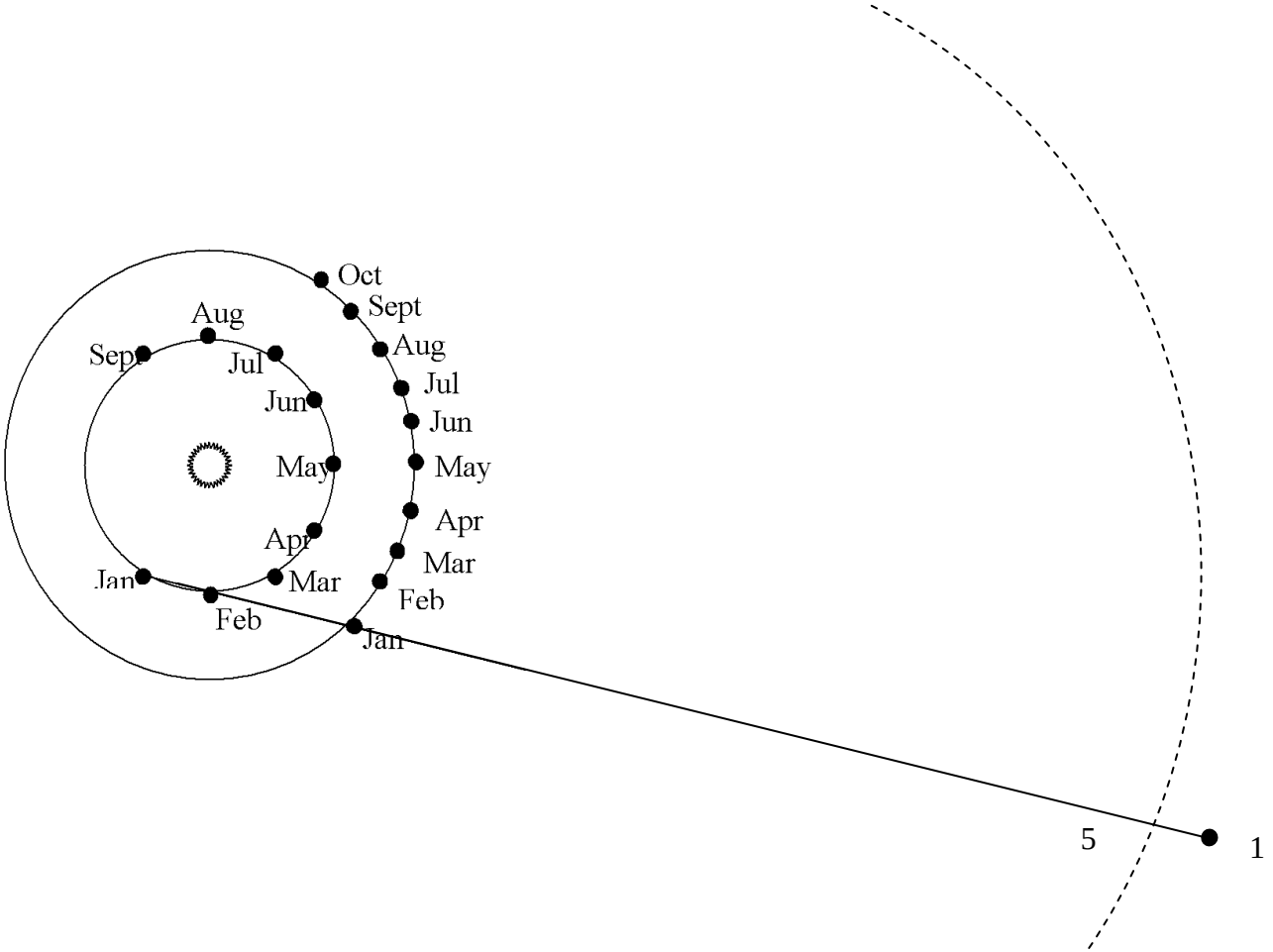
ACTIVITY- Retrograde Motion Name _____

"Backward" Motion of Planets

Planets tend to move across the sky in an easterly direction. Occasionally, something strange occurs. A planet appears to slow down and begin moving backward toward tht west. In this activity you are going to find out why this happens. The diagram below represents a part of our solar system. Earth and Mars are shown at several positions in their orbits around the sun. Each position is labeled with the name of the month when the planet will be located there.

Procedure

1. In the diagram below, draw a line from each Earth position through the Mars position for the same month. Extend the line approximately 1 cm past the dashed line. Place a dot at the end of the line and label the dots in order, with the dot on the January line being number 1, the dot on the February line being number 2, and so on. Note: If paths cross draw the lines slightly long and place the dots slightly farther away than you did for the other lines. Notice that the line for January is already drawn and the dot is labeled.
2. Using a pencil, start with the dot labeled "1" and carefully connect the dots in order (This line represents the path the planet Mars would follow in its orbit around the sun as seen from Earth.)



The dots that you put at the ends of the lines represent the positions where an observer on Earth would see Mars for the month indicated on the diagram. The line you drew connecting the dots represents the path Mars appears to follow.

Critical Thinking and Application

1. a. What movement does Mars actually experience from January through August?

b. To an observer on Earth, what movement does Mars appear to experience during that time period?

2. During which months does Mars appear to be moving backward in its orbit?

3. Carefully observe what is happening to Earth and Mars in their orbits when Mars seems to loop "backward." What causes Mars to seem to move backward in its orbit?

4. a. Do you think that to an observer on Earth all the planets visible in the night sky would appear at some point to go backward?

b. Explain your answer to question 4a.

5. Why would it be very difficult to observe Mercury and Venus to see if they experience such backward motion?

DATE: NAME: CLASS:

CHAPTER 13
SKILL BUILDER

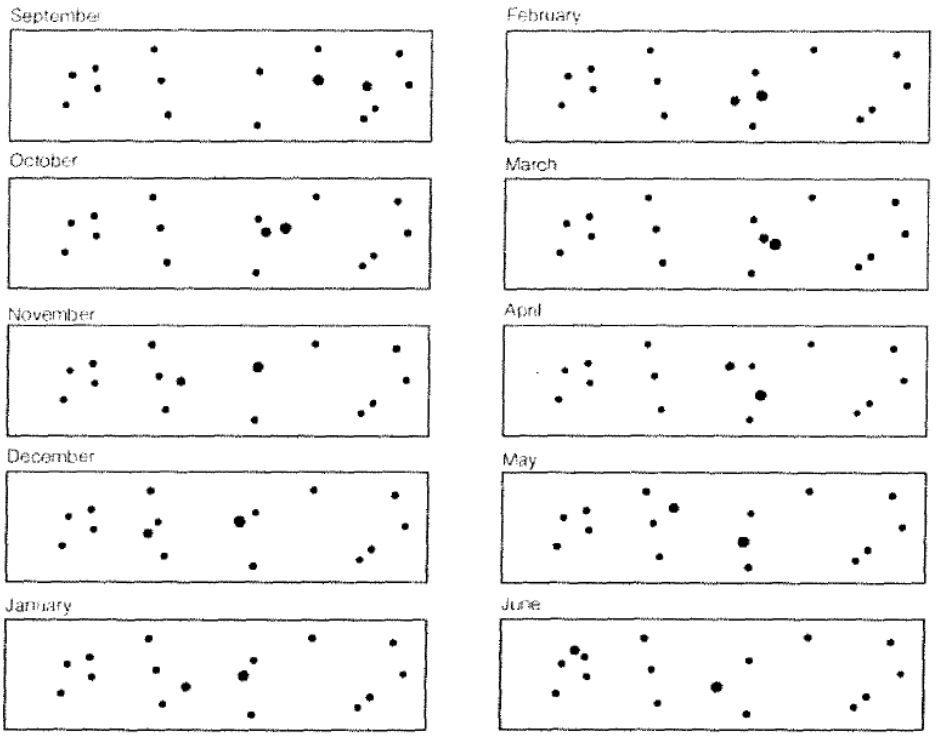
Motions of Mars and Jupiter

BLM 13-15

Goal • Trace the path made by the monthly position of two planets to see them retrograde and pass each other in the sky.

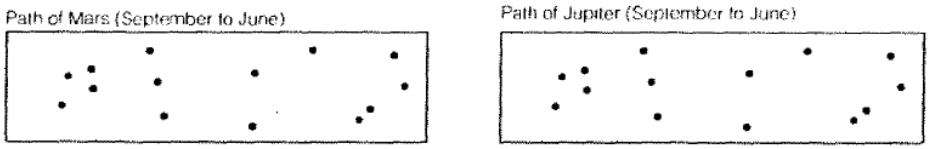
Introduction

The diagrams below show the positions of Mars and Jupiter against a background of stars from September until June. Jupiter is the larger (brighter) of the planets.



What to Do

1. Find Mars and Jupiter in each picture and transfer each to its summary picture below. Connect the dots to see the motions of Mars and Jupiter over a typical 10-month period.



Analyze

2. In which months was each planet retrograding?

3. How could you find out a more precise date for when each planet changed direction?

The History of Astronomy

1. Why did ancient people study the stars?

2. What did the ancients think was in the centre of the universe?

3. Provide three examples of old observatories?

4. The sun rises at different spots every day, what causes this movement?

5. What times of the year are marked in the stone hedge?

6. How did the Greeks see the universe?

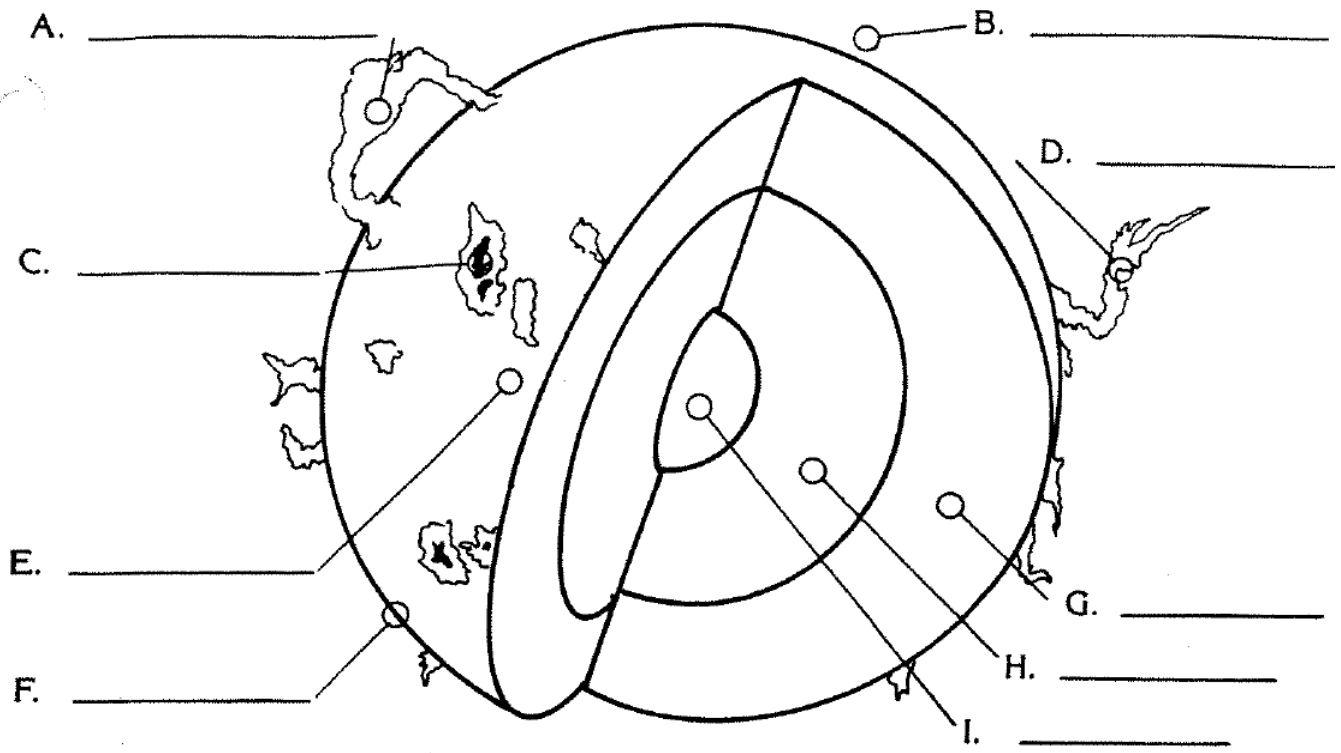
7. What observation indicated that the earth could be round?

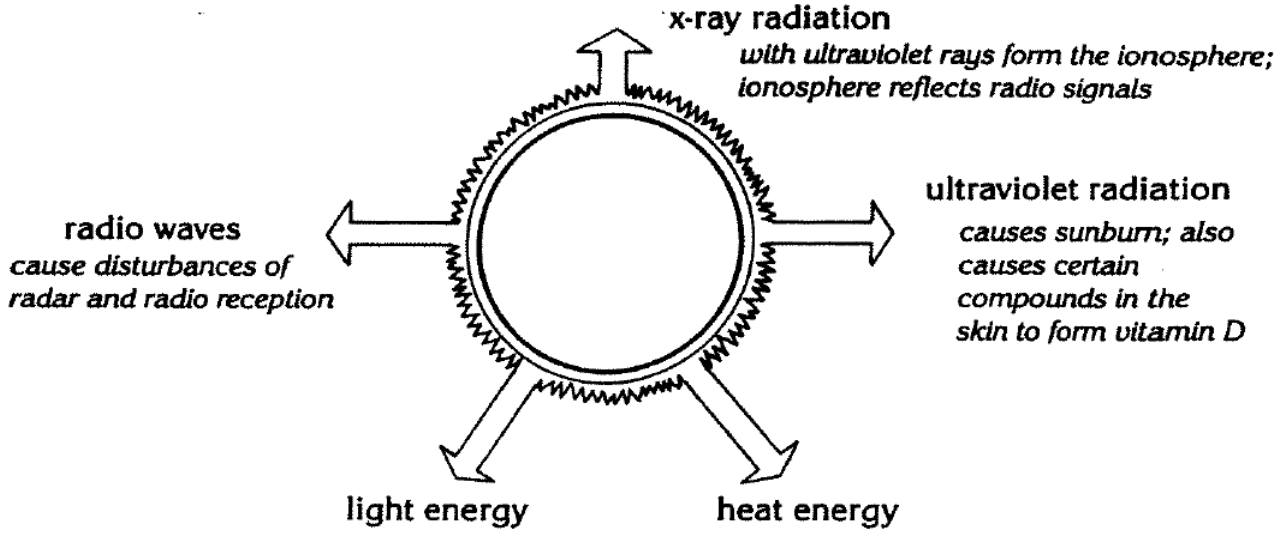
8. What did Kepler discover?

9. What did Newton discover?

10. What are all stars organized into?

The Sun





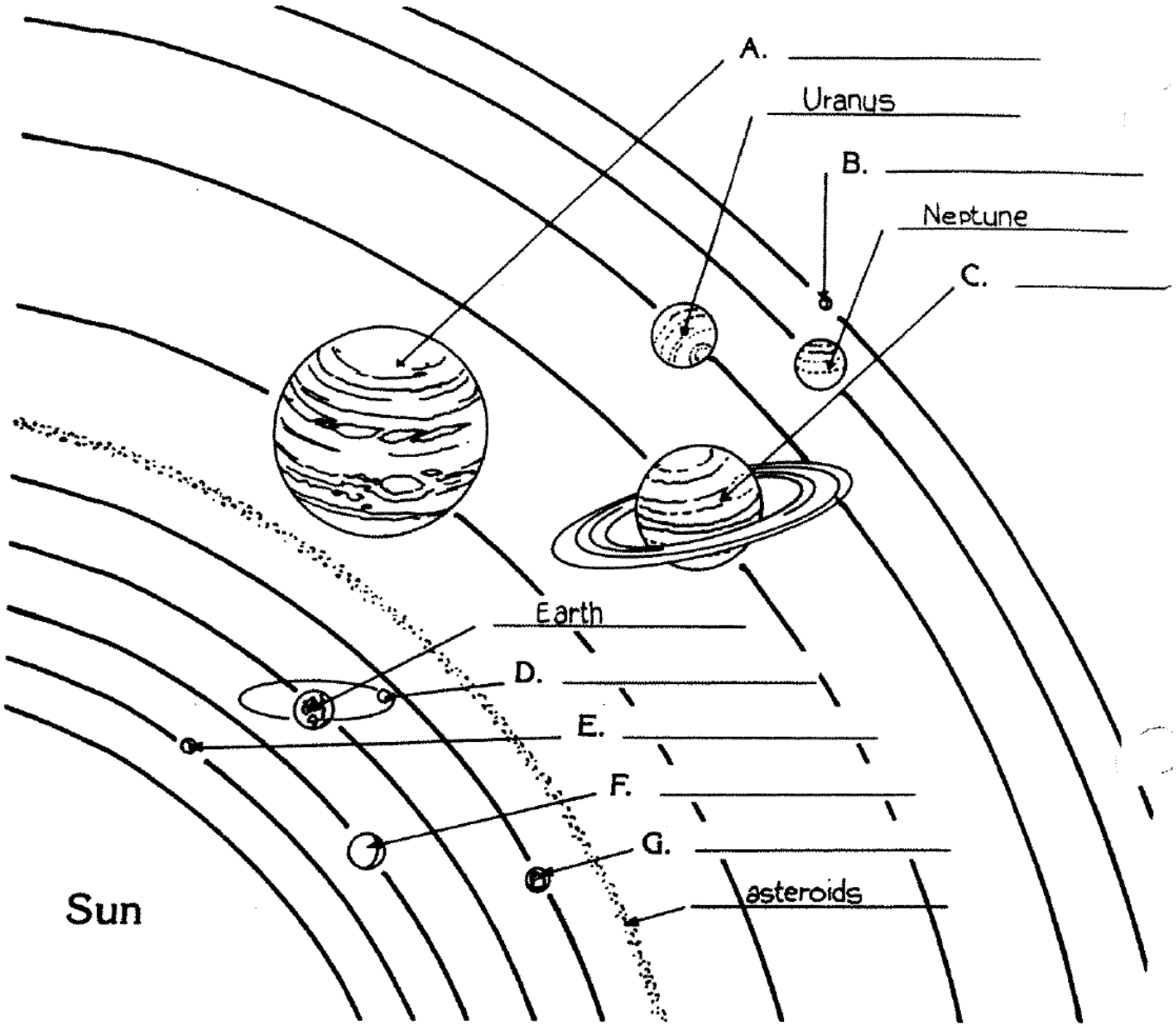
1. Identify and label on lines A-I the features of the sun's interior and exterior.
2. Name two ways energy from the sun affects the Earth.

_____ _____

What is one effect of ultraviolet radiation on humans? _____

4. ..ny is oil sometimes referred to as "liquid sunshine"? _____

Our Solar System

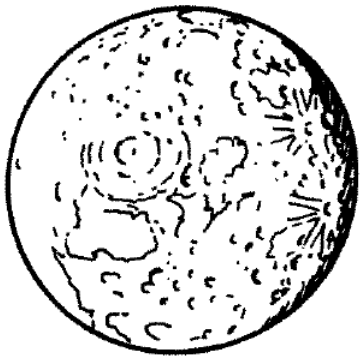


Identify and label above.

1. the ringed planet _____
2. the Earth's nearest natural satellite _____
3. the farthest planet from the sun _____
4. the two planets between which the belt of asteroids orbit _____
5. Earth's nearest neighbors—Mars and _____
6. the planet with the smallest orbit around the sun _____

Mercury and Venus

Mercury



harsh landscape; no air or water; no natural satellites

Distance from sun: 57,900,000 km
Diameter: 4,878 km
Revolution time: 88 days
Rotation: 59 days
Surface temperatures: 430°C on day side to – 170°C on night side

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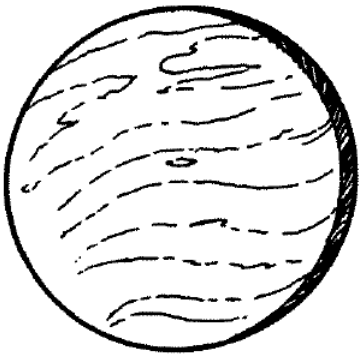
Venus



harsh landscape; heavy cloud cover; strong surface winds; seen in phases; referred to as a "star"; no natural satellites

Distance from sun: 108,200,000 km
Diameter: 12,100 km
Revolution time: 225 days
Rotation: 243 days
Surface temperature: 470°C

Is it Mercury or Venus? Write your answer in the space.

_____ 1. often hidden in the sun's glare

_____ 2. sometimes called the "morning star" or "evening star"

_____ 3. has a wide range in temperature on its surface

_____ 4. seen in phases like the moon

_____ 5. except for the sun and moon, the brightest object in the sky

_____ 6. has very long periods of day and night due to rotation time

Earth and Mars

Earth

one-fourth of surface covered by land, three-fourths by water; atmosphere mostly of nitrogen and oxygen; supports intelligent life; one natural satellite

Distance from sun: 149,600,000 km
Diameter: 12,756 km
Revolution time: 365¼ days
Rotation: 23.93 hours
Surface temperature:
varies, averages around 15°C

Mars

one of two moons

varied surface conditions—deserts, craters, valleys, volcanoes, great dust storms, polar ice caps; thinner atmosphere than Earth; two natural satellites

Distance from sun: 227,900,000 km
Diameter: 6,787 km
Revolution time: 687 days
Rotation: 24¼ hours
Surface temperature:
varies, averages around −50°C

Is it Earth or Mars? Write your answer in the space.

_____ 1. Revolution and rotation cause this planet to have four different seasons within 52 weeks.

_____ 2. Tremendous dust storms frequently rage across the surface of this planet.

_____ 3. Phobos and Deimos are its natural satellites.

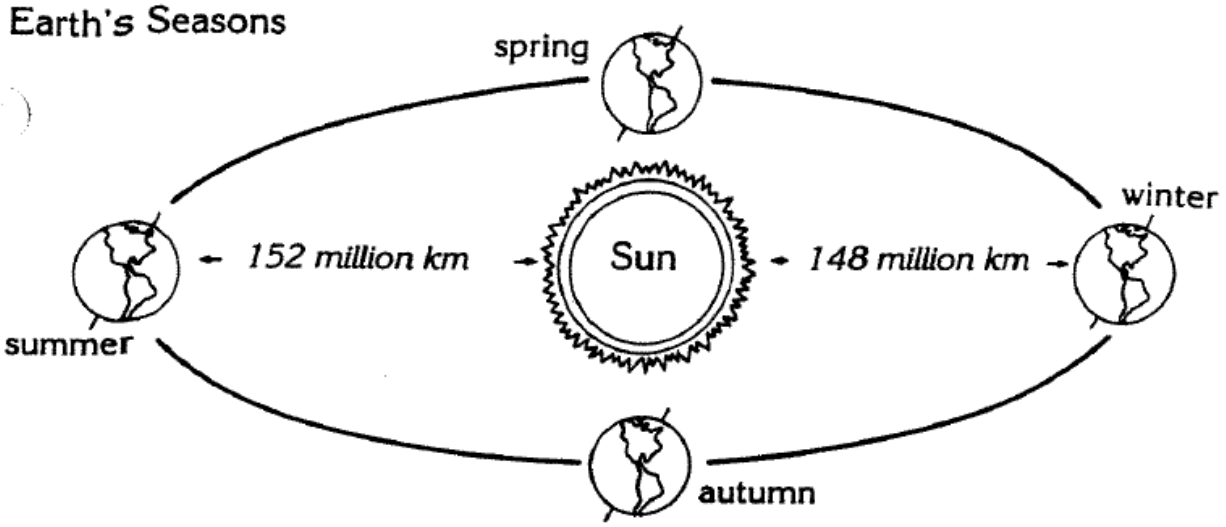
_____ 4. Most of this planet is covered with water.

_____ 5. It is the third planet in distance from the sun.

_____ 6. Its polar ice caps grow in size during the winter and shrink in the summer.

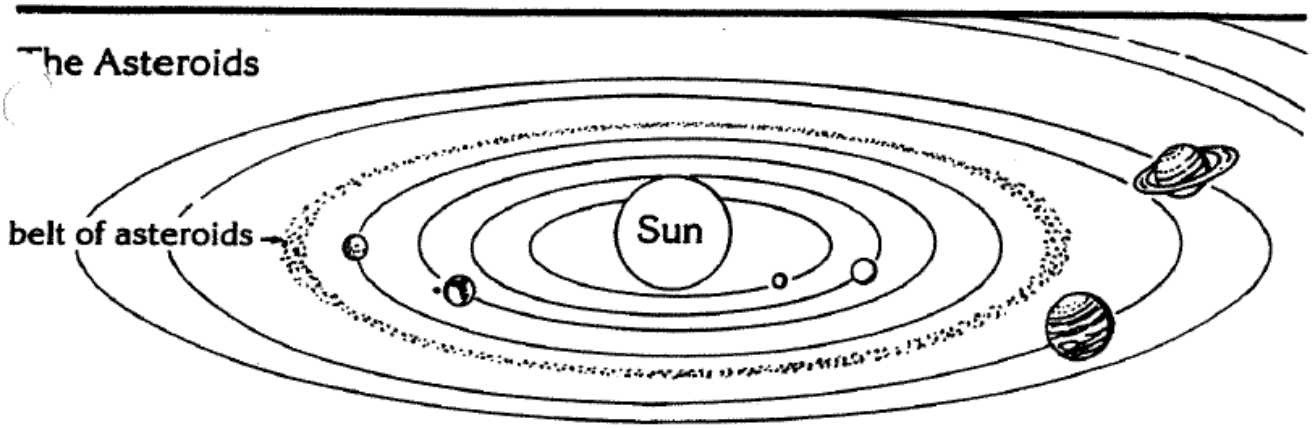
Earth's Seasons and the Asteroids in Space

Earth's Seasons



Tilt of the Earth is 23½ degrees from the perpendicular. Earth revolves around sun. In Northern Hemisphere: summer—Earth tilts toward sun and receives strong, direct sun rays, high temperatures; winter—Earth tilts away from sun and receives weak, slanted sun rays, lower temperatures; spring and autumn—Earth tilts neither toward nor away from sun, moderate temperatures.

The Asteroids



Asteroids are orbiting pieces of rock of different size and brightness.

1. The Earth is closer to the sun by _____ million km during the season of _____.
2. The Earth's axis is _____ as the Earth revolves around the _____.
3. _____ rays from the sun cause _____ temperatures than do slanted rays.
4. In the Southern Hemisphere, the seasons are _____ those in the Northern Hemisphere.
5. The belt of asteroids is found between the planets _____ and _____.

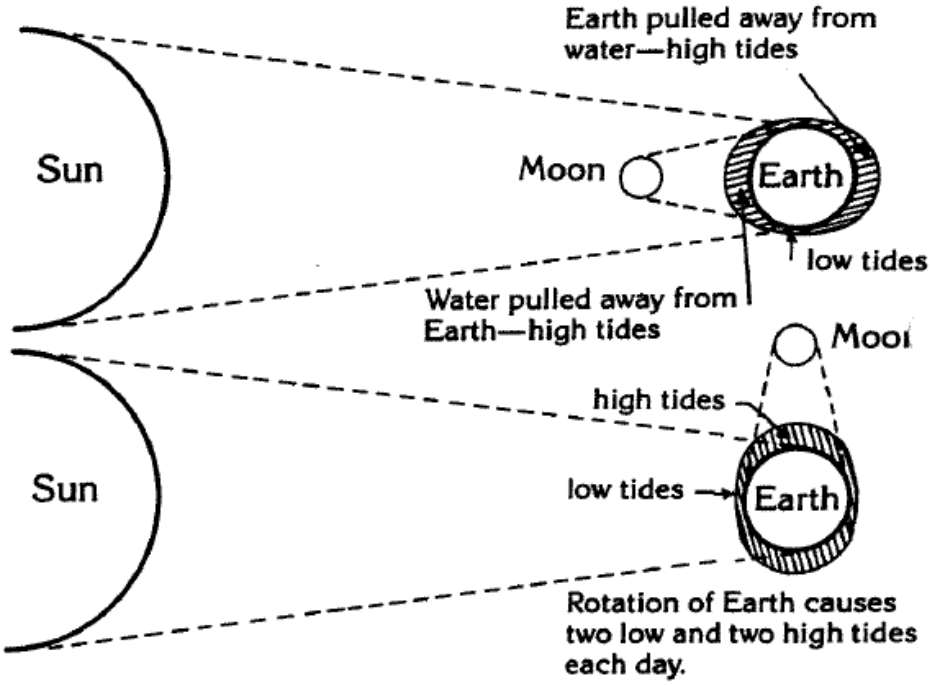
   Asteroids also _____ around the sun as do the planets.

Our Moon and Tides

Tides

Spring Tides—Gravity from the sun and moon pulls together on Earth.

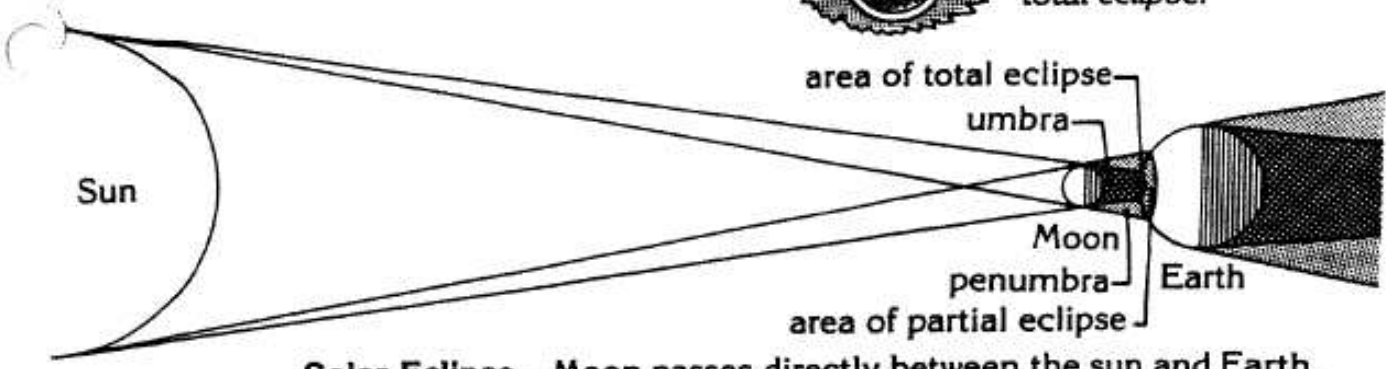
Neap Tides—Gravity from the sun and moon pulls against each other.



1. On lines A-D, label the parts of the moon's surface.
   Sea of Clouds Sea of Tranquility Copernicus Sea of Serenity
2. "Sea Areas" appear dark because they do not reflect as much _____ as do the _____ ranges.
3. Mountains are jagged because the moon has no _____ or _____ to cause weathering or erosion.
4. The _____ of the sun and moon is the main cause of tides on Earth.
5. When there are high tides, there are also _____ tides somewhere on Earth, _____ times a day.

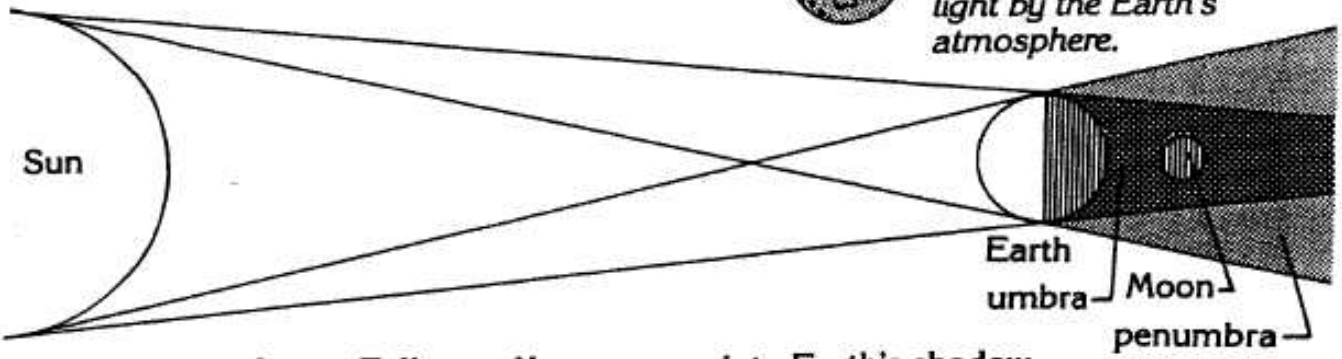
Eclipses

The sun's corona during total eclipse.



Solar Eclipse—Moon passes directly between the sun and Earth.

Total eclipse of moon shines with a dull orange glow due to scattering of light by the Earth's atmosphere.



Lunar Eclipse—Moon passes into Earth's shadow.

1. During a solar eclipse, the shadow of the _____ falls on the _____ ; in a lunar eclipse, the shadow of the _____ falls on the _____ .
2. The darkest part of a shadow is called the _____ ; the broader, outer part is called the _____ .
3. In a total solar eclipse, the sun's _____ is visible because the _____ blocks out the sunlight.
4. Why do partial eclipses of the moon occur more frequently than total solar eclipses?

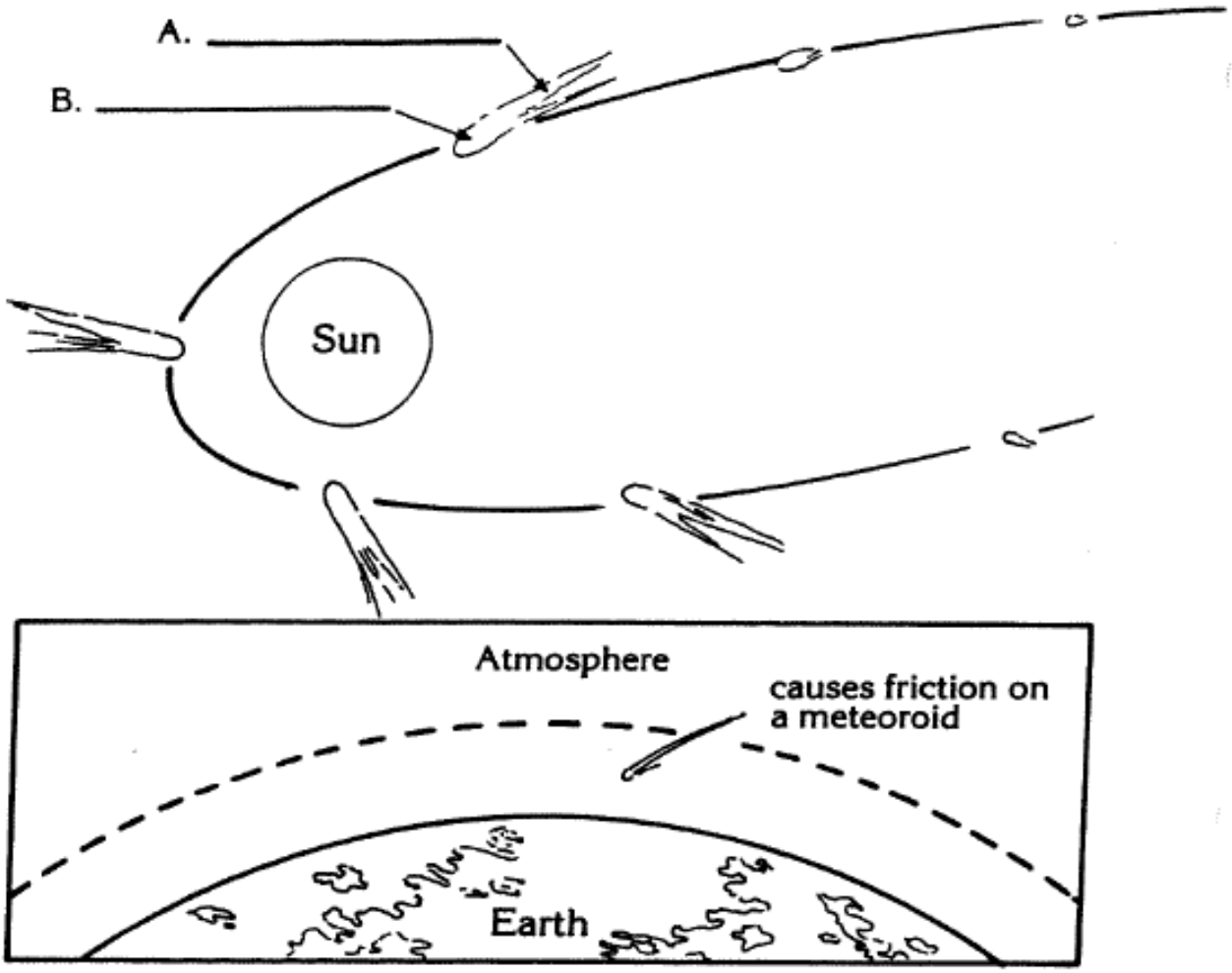
_____

_____

_____

_____

Comets and Meteors



1. Label the parts of a comet on lines A and B.

2. Why does the comet on the right side of the drawing *not* have a tail?

_____

3. The path of a comet around the sun is called its _____.

4. What causes a meteoroid to glow and become visible on Earth?

_____

5. What is the difference between a meteoroid and meteorite?

_____

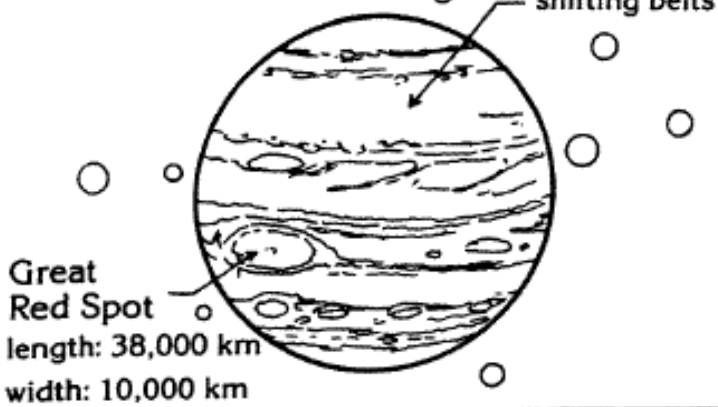
_____

6. Why do most meteors *not* land on the Earth's surface?

_____

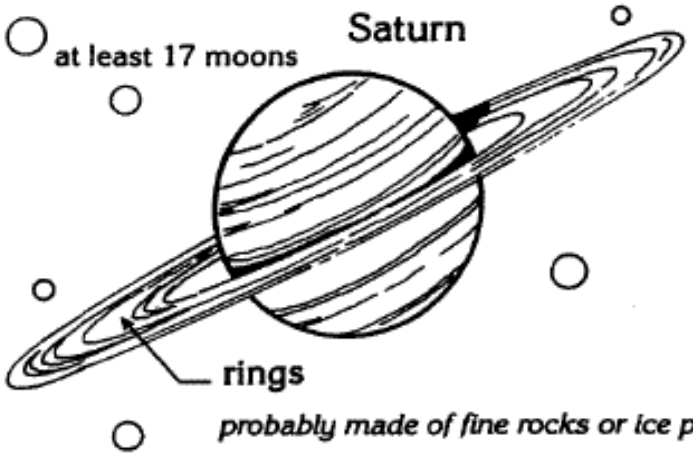
Jupiter and Saturn

Jupiter



Distance from sun: 778,300,000 km
Diameter at equator: 142,800
Revolution time: 11.86 years
Rotation: 9.9 hours
Atmosphere temperature: – 130°C

Saturn



probably made of fine rocks or ice particles

Distance from sun: 1,427,000,000 km
Diameter at equator: 120,400 km
Revolution time: 29.5 years
Rotation: 10.7 hours
Atmosphere temperature: – 185°C

1. What gives Jupiter its banded appearance? _____

2. Why could a spacecraft fly through the rings of Saturn? _____

3. Why are the atmosphere temperatures of these two planets so cold? _____

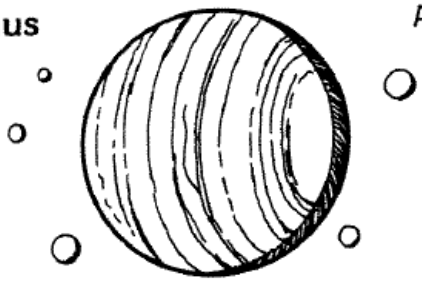
4. How does the length of the Great Red Spot compare with the diameter of Jupiter? _____

5. How much farther from the sun is the planet Saturn than planet Earth? _____

6. How does the time of rotation of Jupiter and Saturn compare with that of Earth? _____

Far Distant Planets: Uranus, Neptune, and Pluto

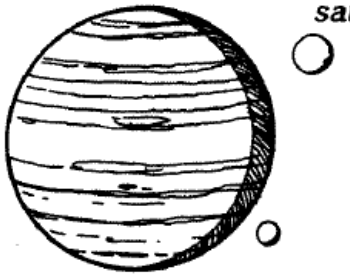
Uranus



has greenish color with narrow rings; thick atmosphere of gases; rotates on horizontal axis of about 98° from perpendicular; five natural satellites

Distance from sun: 2,870,000,000 km
Diameter: 51,800 km
Revolution time: 84 years
Rotation: about 15.6 (?) hours
Atmosphere temperature: – 215°C

Neptune



has greenish color; thick atmosphere of gases; "twin of Uranus"; two natural satellites

Distance from sun: 4,504,000,000 km
Diameter: 48,600 km
Revolution time: 165 years
Rotation: 17.9 hours
Atmosphere temperature: – 200°C

Pluto

most recently discovered planet in solar system (1930); least known planet; one natural satellite

Distance from sun: 5,900,000,000 km
Diameter: 3,000 (?) km
Revolution time: 248 years
Rotation: 6.4 days
Surface temperature: – 230°C

Is it Uranus, Neptune, or Pluto? Write your answer in the space.

_____ 1. the smallest planet in the solar system

_____ 2. both poles take a turn facing the sun during its 84-year revolution

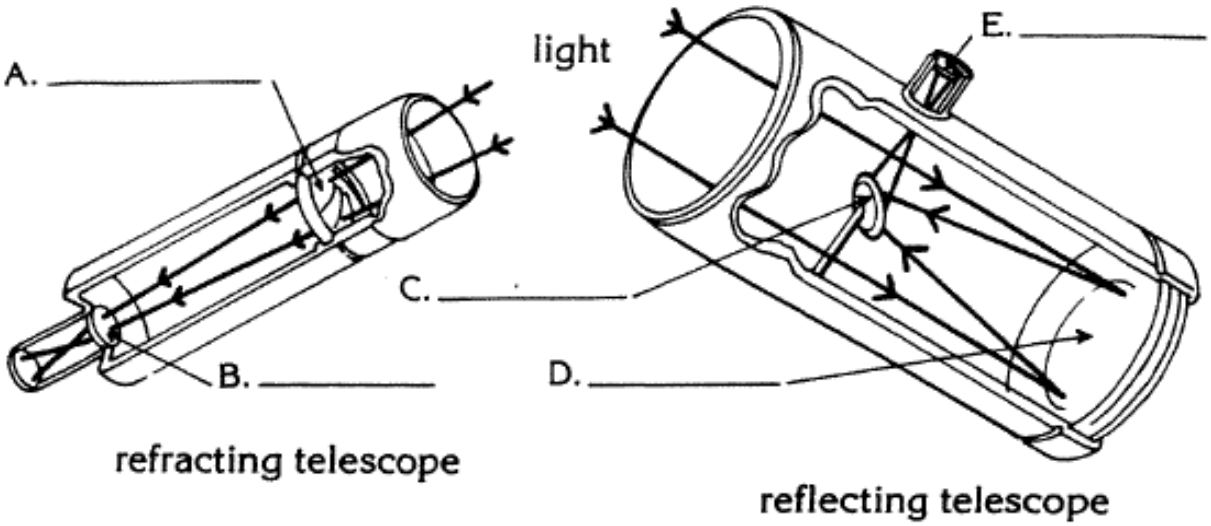
_____ 3. the most recent planet to be discovered

_____ 4. the eighth planet from the sun in the solar system

_____ 5. a gaseous planet with narrow rings about 3,030,000,000 km from Pluto

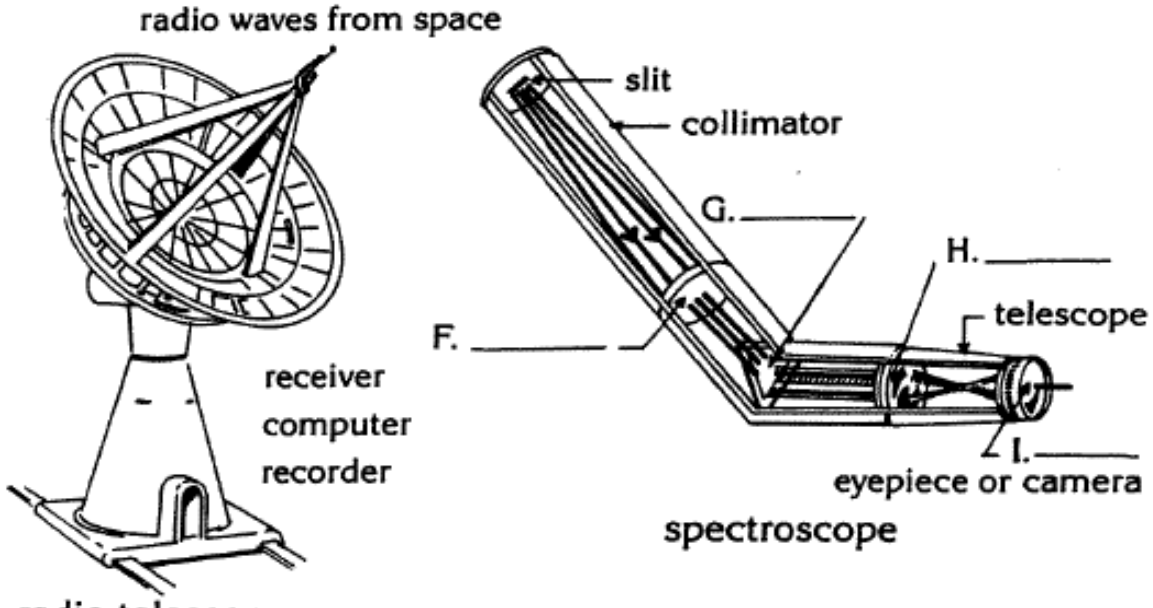
_____ 6. a greenish-colored planet with two natural satellites

Tools of the Astronomer



refracting telescope

reflecting telescope



radio telescope

spectroscope

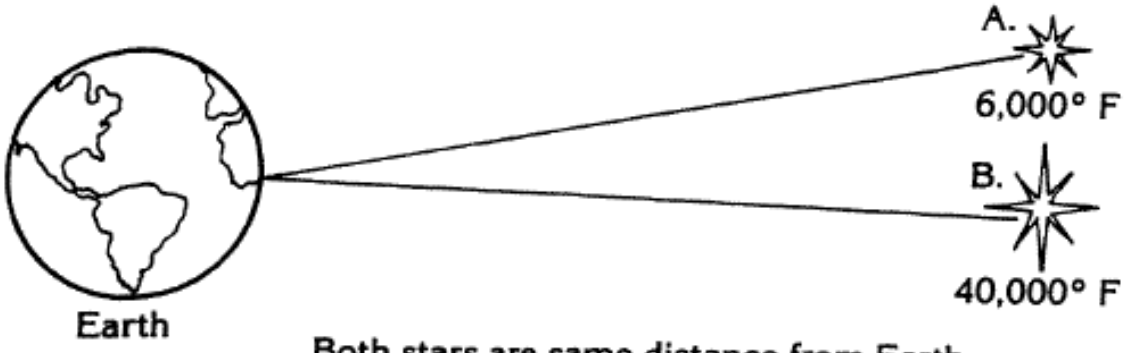
1. In the drawings above, label the parts indicated.
2. Which type of instrument does not use an optical telescope? _____
3. Describe how a spectroscope works. _____

_____

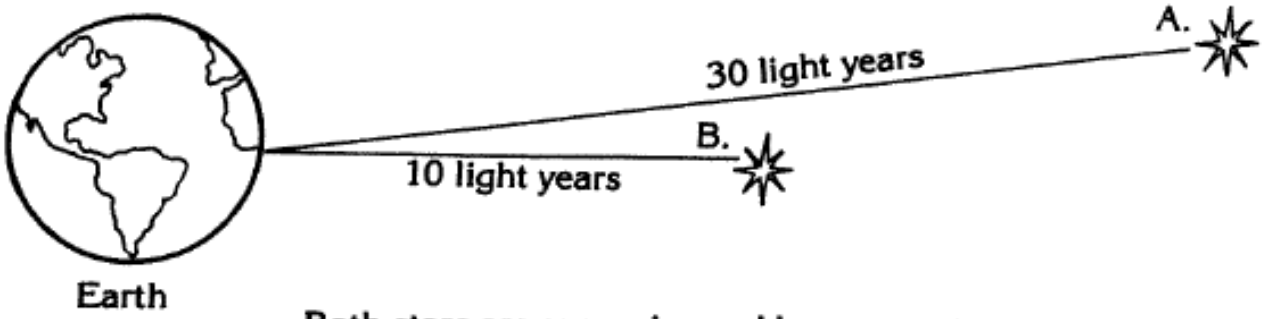
4. Which type of telescope is most often used to view distant land objects? _____

Star Brightness

A star's brightness is dependent on three factors—temperature, size, and distance from the Earth.



Both stars are same distance from Earth.



Both stars are same size and have same temperatures.

1. List the two major forms of energy released from the stars. _____

2. What other forms of radiation may come from the stars? _____

_____

3. Why are stars sometimes referred to as atomic furnaces? _____

_____

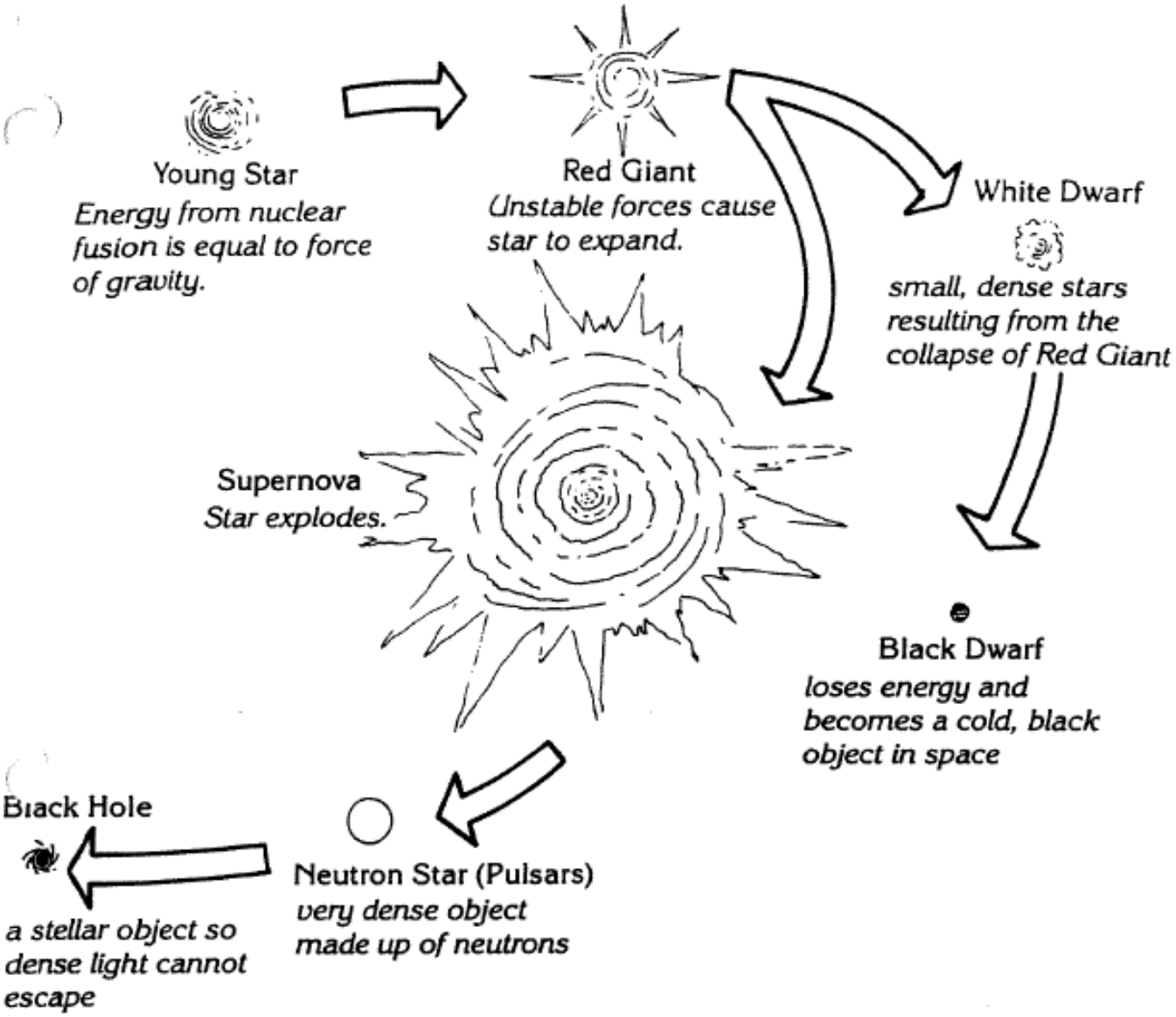
4. In the drawings above, circle stars A or B to indicate which ones would be brighter according to their temperature or distance from the Earth.

5. The surface temperature of the star Rigel is about 15,000°C. The sun has a temperature of about 6,000°C. Why does the sun appear so much brighter? _____

_____

_____

Life Cycles of Stars



1. At which life-cycle stage are stars the most stable? _____

   Why? _____

2. What type of stellar object has the greatest density? _____

   What is the evidence for this? _____

3. What is the gigantic explosion of a Red Giant called? _____

4. Some neutron stars emit pulses of radiation and are called _____.

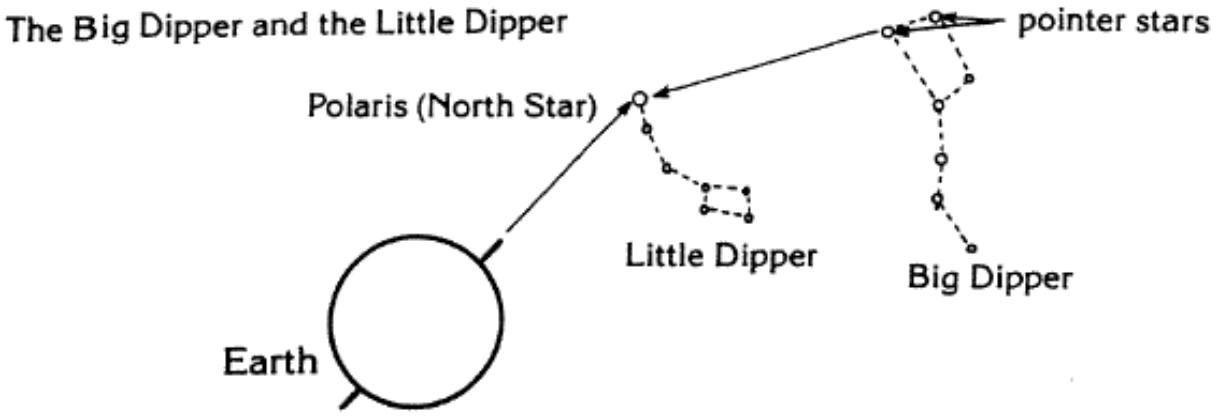
5. Which types of stars are invisible? _____

   If you were looking at the sky and a supernova explosion occurred, why would you *not* see it? _____

   _____

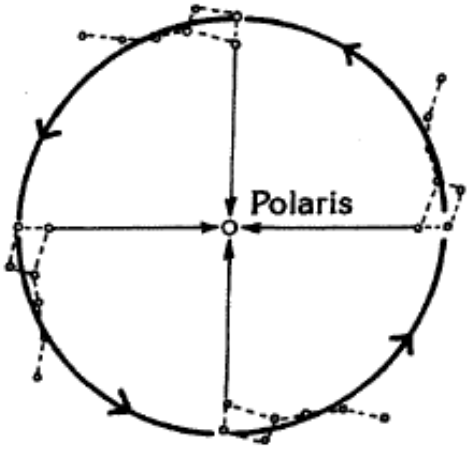
Constellations

Constellations are the groupings of stars.



Five times the distance between the Pointer Stars leads to Polaris which is almost directly over the North Pole of Earth.

The Big Dipper circles Polaris once every 24 hours.



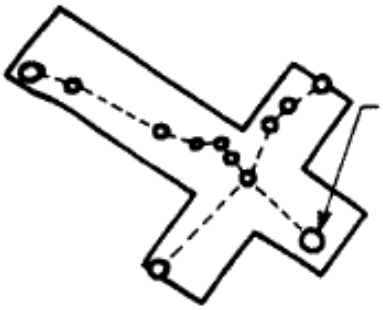
Polaris does not seem to move at all. All constellations in the Northern Hemisphere seem to revolve around Polaris because of the Earth's rotation.

1. Polaris is part of the constellation called the _____ _____.
2. To find Polaris, use the two _____ stars of the constellation called the _____ _____.
3. The rotation of all _____ seems to be around _____.
4. People in _____ America can see Polaris at night. North South
5. The Big Dipper rotates around _____ once every _____ hours.
6. In your own words, tell how to find Polaris and the direction North. _____

_____

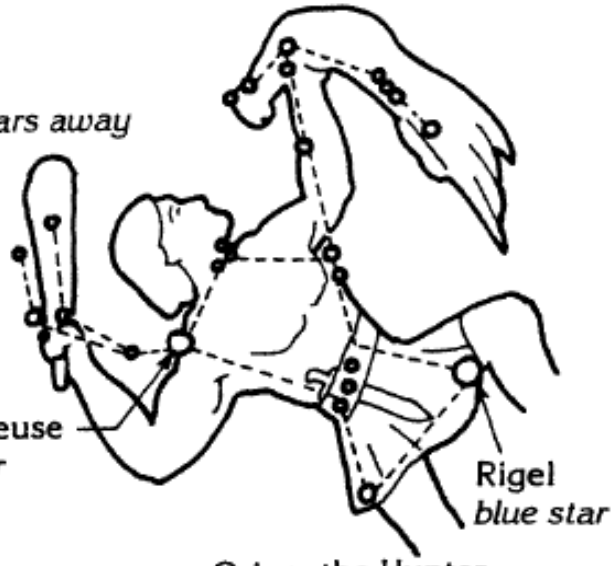
_____

Constellations



Deneb
1400 light years away

The Northern Cross
or Cygnus, the Swan
rises in spring; seen in summer sky

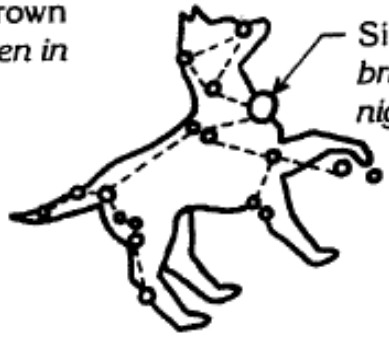


Betelgeuse
red star

Rigel
blue star

Orion, the Hunter
rises in early November

Corona, the Northern Crown
rises in late February; seen in spring



Sirius
brightest star in night sky

Canis Major, the Big Dog
seen in winter

1. The brightest night star, called _____ , is found in the constellation called _____.

2. The constellation _____ has seven very bright stars, _____ of which make up a belt.

3. Write the name of the constellation before its description.

_____ a. a feathered animal

_____ b. man's best friend

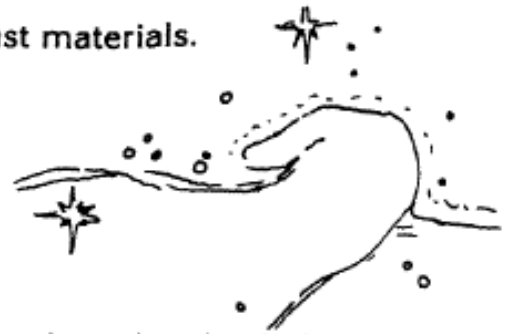
_____ c. what a king wears

_____ d. one who seeks something

Nebulae and Galaxies

Nebulae are concentrations of gases and dust materials.

ring nebula
in the constellation Lyra

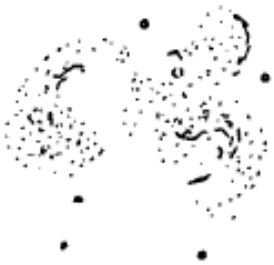


horsehead nebula
a dark nebula found in the constellation Orion

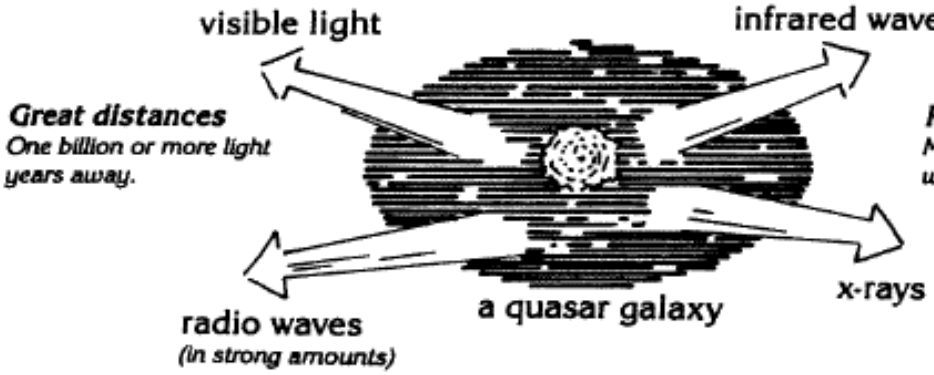
Galaxies are clusters of large numbers of stars and nebulae.

A. _____

B. _____



C. _____



Which one of the nebulae shown above would be classified as a dark nebula? _____

a bright nebula? _____

On lines A, B, and C, label the three types of galaxies.

In which types of galaxies is the concentration of stars more centrally located? _____

_____

How are quasars different from regular galaxies? _____

_____

Why were quasars first called "radio stars"? _____

A Last Look—Part I

A. In each of the following groups one item does not belong. Circle that item and in the space provided explain why it does not belong.

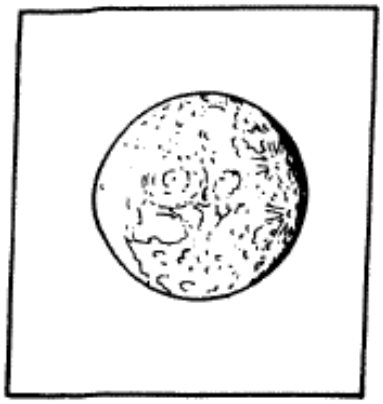
1.	radio telescope	spectroscope	refracting telescope
2.	sun	star	moon
3.	spiral	black hole	elliptical
4.	Deneb	Cygnus	Corona
5.	umbra	nebula	penumbra
6.	rotation	revolution	gravity
7.	solar flares	craters	prominences
8.	Rigel	Betelgeuse	Sirius
9.	meteoroid	meteorite	asteroid
10.	Uranus	Neptune	Mercury

B. Write the word that will make each sentence a true statement.

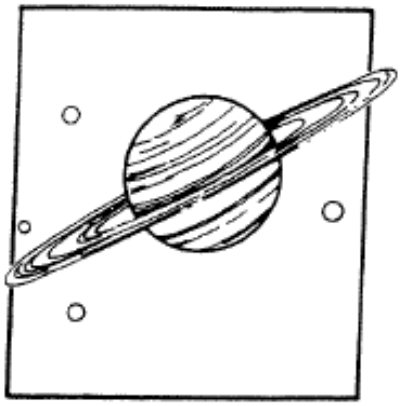
1. The Big Dipper rotates around _____ once every twenty-four hours.
2. The constellation Orion is sometimes called the _____ .
3. _____ are clusters of stars and nebulae.
4. A _____ nebula is found in the constellation Lyra.
5. The first quasars were called _____ stars.
6. The Great Red Spot is on the planet _____ .
7. _____ is the most recently discovered planet.
8. A comet's _____ forms as it nears the sun.
9. The _____ causes friction on a meteoroid and makes it glow.
10. A meteor that strikes the Earth's surface is called a _____ .

A Last Look—Part II

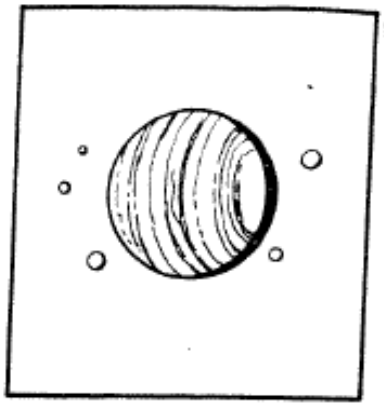
On line **a**, name the planet shown.
On line **b**, write its order of distance from the sun.



1. a. _____
   b. _____

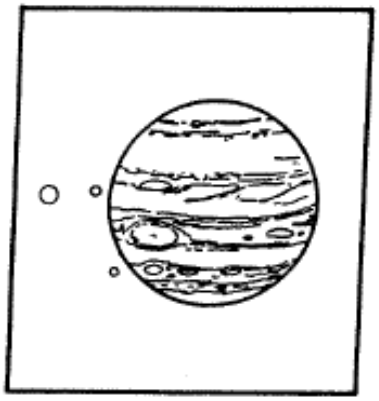


2. a. _____
   b. _____



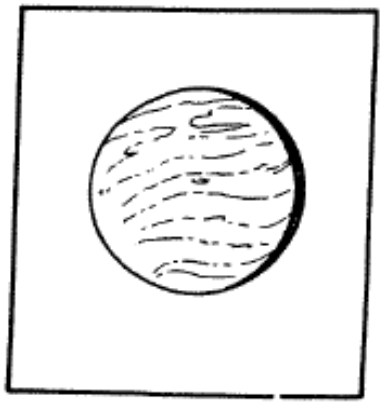
3. a. _____
   b. _____

4. a. _____
   b. _____

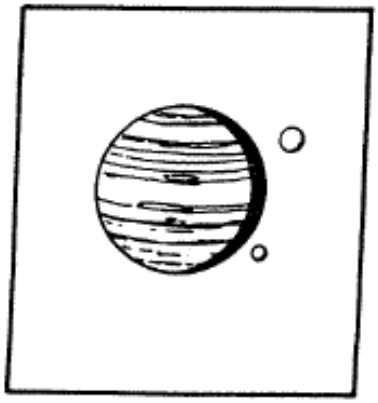


5. a. _____
   b. _____

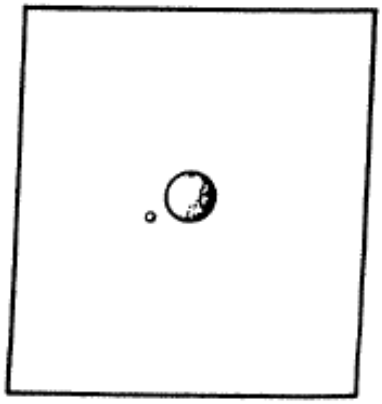
6. a. _____
   b. _____



7. a. _____
   b. _____



8. a. _____
   b. _____



9. a. _____
   b. _____

A Last Look—Part III

A. Find the statement in the second column that best describes each word in the first column. Write the letter of the statement before the word it describes.

1. _____ Mars
2. _____ umbra
3. _____ prominences
4. _____ Saturn
5. _____ moon
6. _____ Venus
7. _____ comets
8. _____ asteroids
9. _____ Earth
10. _____ core

a. center of the sun
b. piece of rock or metal material
c. the darkest part of a shadow
d. the "red" planet
e. dirty, frozen snowballs
f. bodies between Mars and Jupiter
g. a colored, glowing halo of gases
h. morning or evening star
i. surrounded by rings composed of rock and ice particles
j. three-fourths of surface covered by water
k. irregularly-shaped clouds of hot gases
l. one-sixth the gravity of Earth

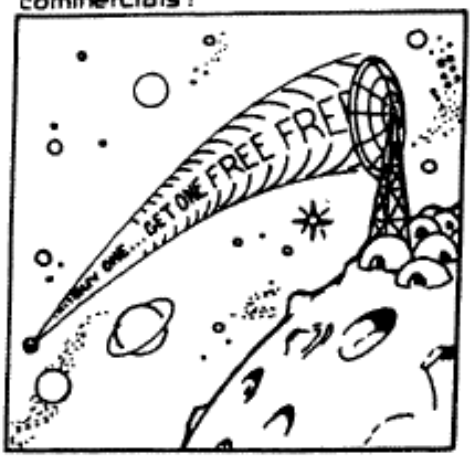
B. Circle the word that will make each sentence a true statement.

1. _____ moons orbit Saturn.
   seventeen ten four
2. _____ takes the longest time to revolve around the sun.
   Mars Pluto Jupiter
3. Jupiter's moon is called _____ .
   Leo Apollo Io
4. A star's brightness is dependent on temperature, distance from Earth, and _____ .
   size orbit constellation
5. A _____ hole has the greatest density.
   white black red
6. A _____ is the result of the explosion of a Red Giant.
   supernova planet quasar
7. Pulses of radiation are called _____ .
   neutrons penumbra pulsars
8. Another name for _____ is the North Star.
   Polaris Rigel Cygnus
9. The brightest star as seen from the Earth is _____ .
   Sun Venus Sirius
10. _____ has a greenish color and narrow rings.
    Uranus Jupiter Venus

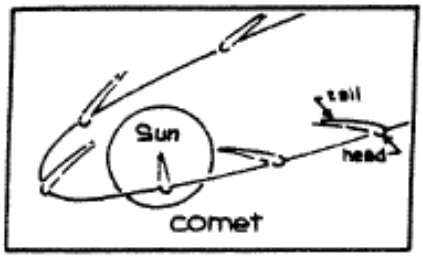
A Last Look—Part IV

A. Explain fully the meaning of this cartoon.

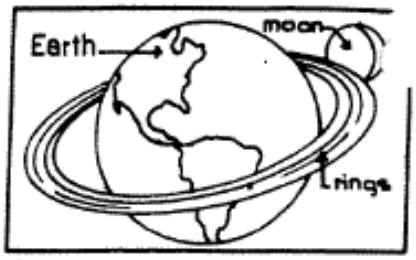
"We get a lot of radio signals from a planet Earth... but they are mostly commercials!"



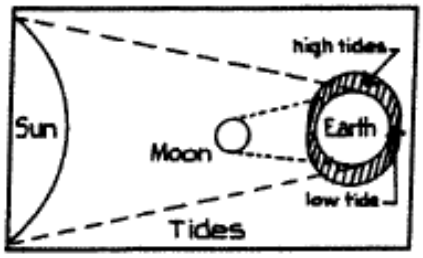
B. There is something wrong with each of these pictures. Circle the part that is incorrect and explain why you circled it.



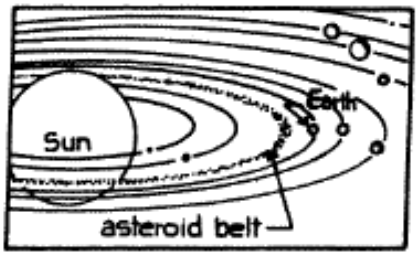
1. _____



2. _____

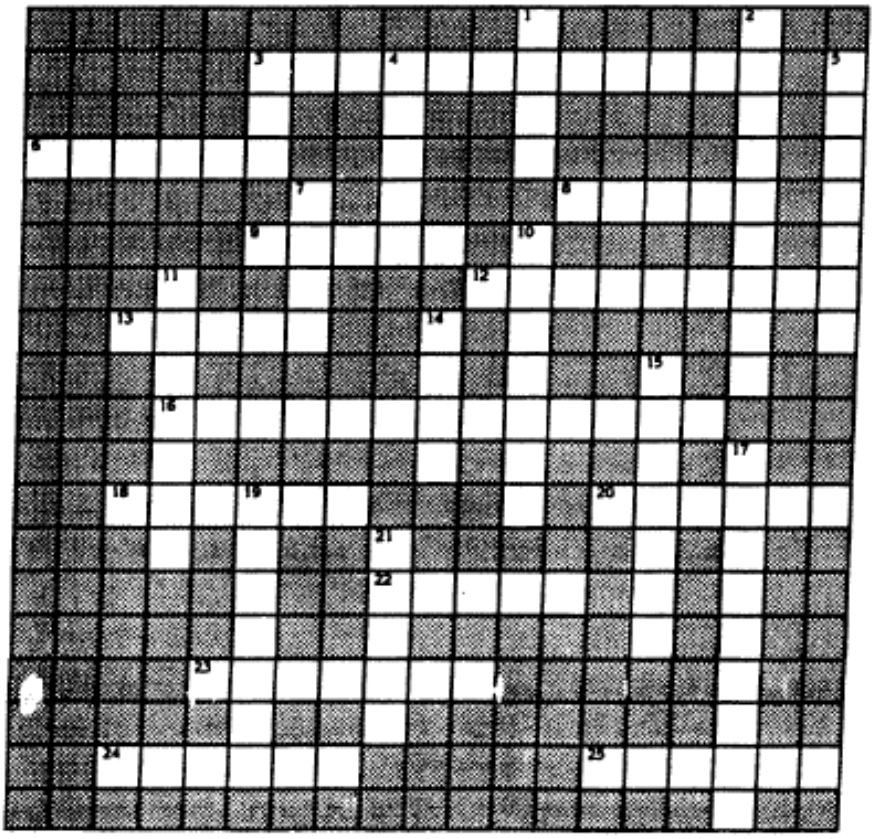


3. _____



4. _____

C. Complete the crossword puzzle.



Across

3. analyzes an object's spectrum
6. planet that has many rings
8. incandescent bodies of gases
9. planet covered mostly with water
12. explosion of a Red Giant
13. seen in phases like the moon
16. a grouping of stars
18. third largest planet
20. a cluster of stars and nebulae
22. energy released from the stars
23. the largest planet
24. "shooting stars"
25. envelope of gas around sun

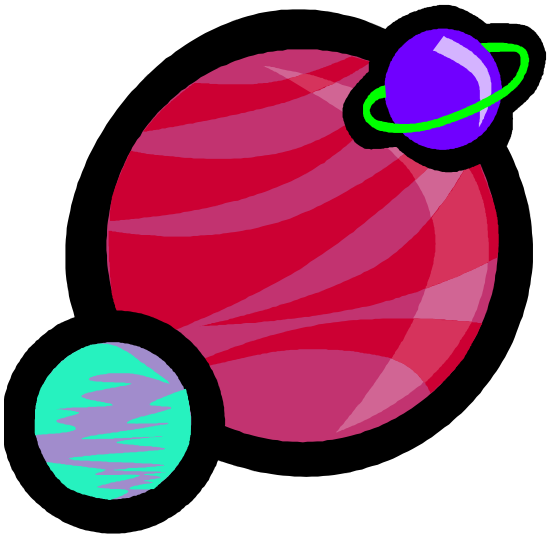
Down

1. Earth's closest neighbor
2. astronomer's tool
3. the center of the universe
4. mass of rocks, dust, and gases
5. concentrations of gas and dust
7. fourth planet from the sun
10. stars that emit radiation pulses
11. closest planet to the sun
14. a black _____
15. star in handle of Little Dipper
17. layer nearest the sun's core
19. twin of Uranus
21. the smallest planet

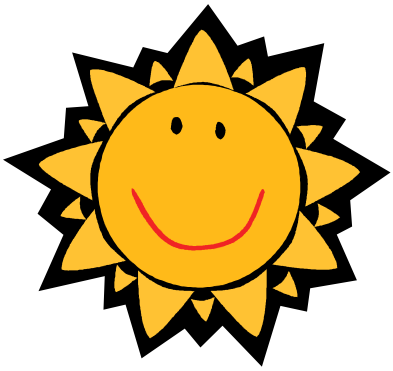
Solar System Project

In groups you will be assigned a planet. You must research the key points for your planet.

Name:
Position:
Size:
Distance from sun:
Mass compared to Earth:
Average temperature:
Composition of the planet:
Any exploration of the planet:
Number of moons:
2 significant dates:
Namesake:
How it formed:
Climate and weather:
Atmospheric composition:



Each person in the group must write a postcard from their planet to somebody on earth. The conversation must be relevant to your planet and the picture on the front should reflect something about your planet.



Name _____ Date _____

Information Collection Sheet

Use this page to help you write your postcard.

1. My planet is called _____.

2. My planet is the _____ planet in the solar system.

3. My planet is _____ miles from the sun.

4. This is what my planet looks like:
   _____
   _____
   _____

5. It takes my planet _____ to orbit the sun. This means that one year on my planet is actually _____ Earth _____ long.

6. It takes my planet _____ to make one rotation. This means that one day on my planet is actually _____ long. That is as many as _____ Earth days!

7. These are 3 interesting facts about my planet:
   i. _____
      _____
   ii. _____
      _____
   iii. _____
      _____

Name _____ Date _____

Information Collection Sheet

Use this page to help you write your postcard.

1. My planet is called _____.

2. My planet is the _____ planet in the solar system.

3. My planet is _____ miles from the sun.

4. This is what my planet looks like:
   _____
   _____
   _____

5. It takes my planet _____ to orbit the sun. This means that one year on my planet is actually _____ Earth _____ long.

6. It takes my planet _____ to make one rotation. This means that one day on my planet is actually _____ long. That is as many as _____ Earth days!

7. These are 3 interesting facts about my planet:
   i. _____
      _____
   ii. _____
      _____
   iii. _____
      _____

AIM 15 | What causes the seasons?

Are you ready for a vacation? Will you go swimming or will you go ice-skating? Of course, it all depends on the *season*.

Most people live in places that have *four* seasons—spring, summer, autumn, and winter.

The four seasons are marked by differences in temperature and in the lengths of day and night.

Summer, for example, is much warmer than winter. And summer days are longer than winter days.

What causes seasons? Seasons are caused by the earth's revolution around the sun and the unchanging tilt of the earth's axis.

You have already learned how the earth's axis causes differences in the lengths of day and night. The axis also causes differences in temperature.

Part of the year, the axis leans *towards* the sun. Part of the year, the axis leans *away* from the sun.

For example, June 21 is the first day of summer in the Northern Hemisphere. On that day, the Northern Hemisphere leans *toward* the sun the most. The sun's rays strike head-on or nearly head-on over a large part of this hemisphere.

Head-on, or *direct*, rays are strong rays. They do not spread over a large area. Direct rays heat up the earth the most.

December 21 is the first day of winter in the Northern Hemisphere. On that day, the Northern Hemisphere leans *away* from the sun the most. The sun's rays do not strike head-on. They spread over a large area. Rays that spread out are called *slanting* rays. Slanting rays are weak rays. They heat up the earth the least.

UNDERSTANDING DIRECT AND SLANTING RAYS

Figure A shows *direct* rays and *indirect* rays. Study it. Then answer the questions or fill in the blanks.

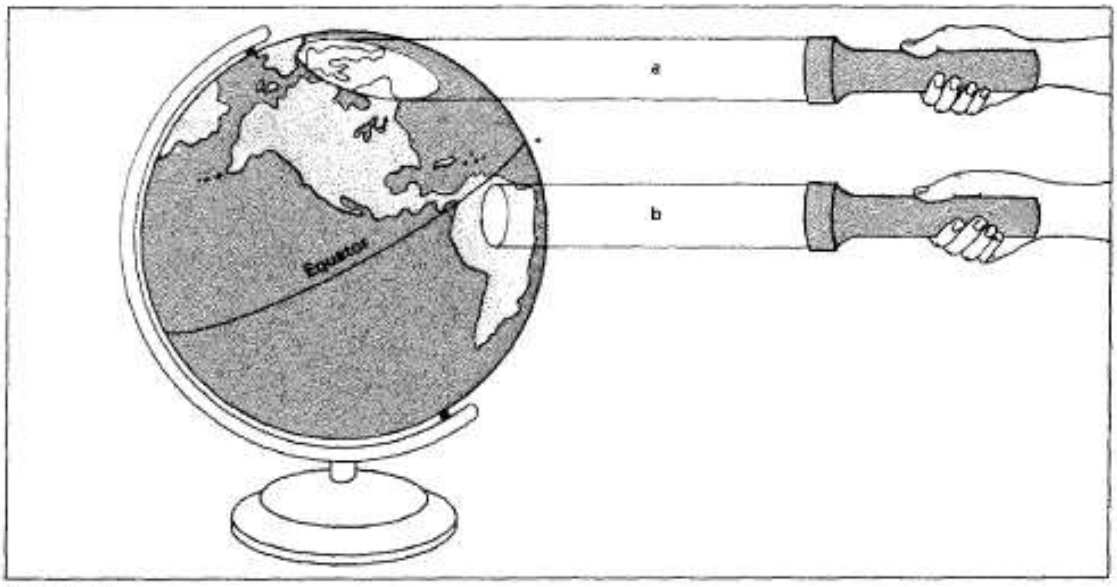


Figure A

1. Which rays are direct? _____ (a, b)

2. Which rays are slanting? _____ (a, b)

Answer *direct* or *slanting*:

3. Which rays spread out? _____

4. Which rays do not spread out? _____

5. Which rays are stronger? _____

6. Which rays are weaker? _____

7. Which rays heat a place more? _____

8. Which rays heat a place less? _____

9. Winter rays are _____ rays.

10. Summer rays are _____ rays.

11. Which of the rays of Figure A can stand for winter rays? _____ (a, b)

12. Which of the rays on Figure A can stand for summer rays? _____ (a, b)

UNDERSTANDING THE CHANGING SEASONS

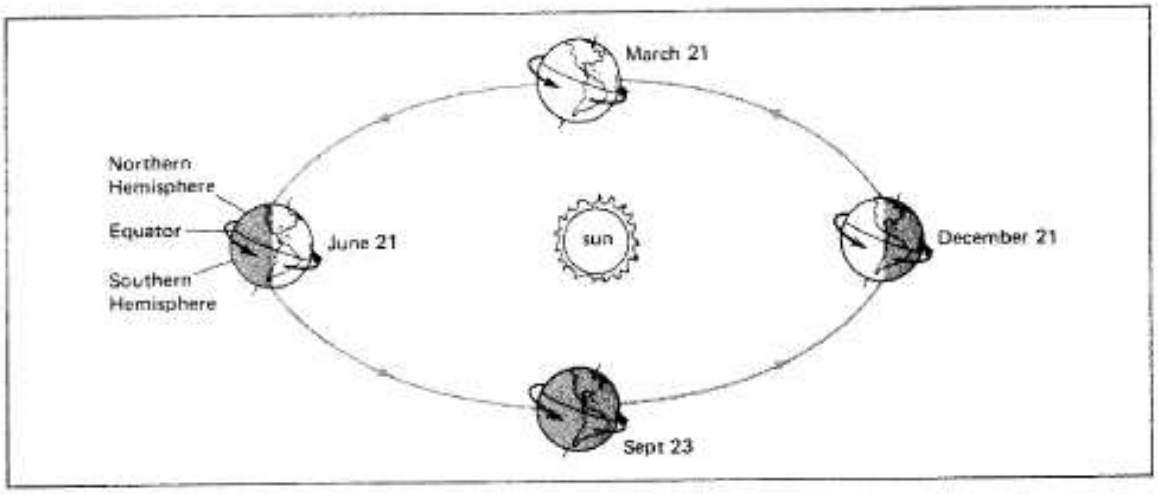


Figure B

TAKE A TRIP. Follow the earth for one revolution around the sun. Study Figure B. Then fill in the blanks.

1. The earth revolves around the sun in a _____ direction.
   (clockwise, counterclockwise)

2. As the earth revolves around the sun, the earth's axis _____ change.
   (does, does not)

3. **On June 21,** the Northern Hemisphere . . .

   a) faces _____ the sun.
   (toward, away from)

   b) has mainly _____ weather.
   (cold, warm)

   c) has _____ hours of daylight than the Southern Hemisphere.
   (more, fewer)

   d) receives _____ rays. These are _____ rays.
   (direct, slanting) (strong, weak)

   e) has the first day of _____.
   (name season)

4. **Between June 21 and September 22,** the Northern Hemisphere still leans toward the sun. But every day . . .

   a) the lean becomes _____.
   (greater, less)

b) the rays become _____ (more, less) direct and spread out _____ (more, less).

c) the days become _____ (longer, shorter) and the nights become _____ (longer, shorter).

5. **On September 23 . . .**

a) the earth's axis is tilted _____ (toward, away from, neither toward nor away from) the sun.

b) the sun's rays are _____ (direct, slanting, neither direct or indirect).

c) _____ (name season) starts in the Northern Hemisphere.

d) every place on earth has _____ hours of day and _____ hours of night.

6. **Between September 23 and December 20 . . .**

a) the Northern Hemisphere starts to lean _____ (toward, away from) the sun.

b) the sun's rays become more _____ (direct, slanting). These rays are _____ (stronger, weaker).

c) days become _____ (longer, shorter) and nights become _____ (longer, shorter).

7. The Northern Hemisphere leans away from the sun the most on _____ (give date) which is the first day of _____ (name the season).

8. **Between December 21 and March 20 . . .**

a) the Northern Hemisphere leans away from the sun. But every day the lean becomes _____ (greater, less).

b) the rays become _____ (more, less) slanting.

c) the days become _____ (longer, shorter) and the nights become _____ (longer, shorter).

9. **On March 21 . . .**

a) the earth's axis is tilted _____ the sun.
(toward, away from, neither toward nor away from)

b) the sun's rays are _____.
(direct, slanting neither direct nor indirect)

c) _____ starts in the Northern Hemisphere.
(name the season)

10. **After March 21 . . .**

a) the Northern Hemisphere starts to lean _____ the sun.
(toward, away from)

b) the rays become more and more _____.
(direct, slanting)

c) the rays become _____.
(stronger, weaker)

d) the days become _____ and the nights become _____.
(longer, shorter) (longer, shorter)

11. In the Northern Hemisphere, the number of daylight hours is greatest on _____; this is the first day of _____.
(give date)

CONGRATULATIONS! YOUR TRIP AROUND THE SUN IS NOW COMPLETE!

12. How long did your trip take? _____

REACHING OUT

Record-breaking temperatures rarely happen on the first day of summer. It is usually the later months of summer that have the hottest weather. Why? _____

_____

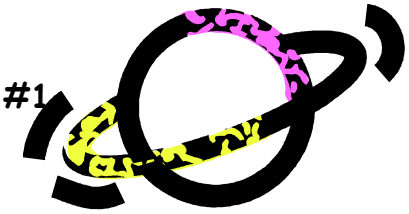
_____

_____

SCIENCE 10F

ASTRONOMY PROJECT OPTION #1

POSTER



The Assignment:

Working in groups, you will be asked to create a poster that explains one of the many types of objects that exists in the Universe. After you choose a topic, make sure your poster answers the questions below.

The Topics:

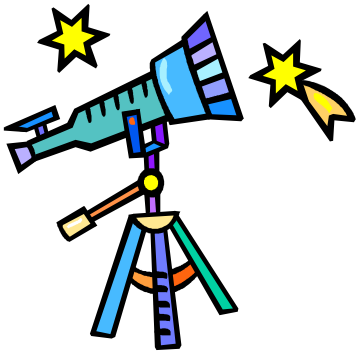
Comets	Asteroids	Nebulae
Galaxies	The Milky Way	The Rocky Planets
The Gas Giants	Stars	The Sun
The Moon	Black Holes	Space Station
Mars Rovers	Satellites	Our Solar System
Astronauts	Rockets/Shuttles	Telescopes

The Questions:

1) What are the general characteristics of the object (how would you define the word)?
2) Where in the Universe would you find them?
3) Two interesting or unique facts about your object.

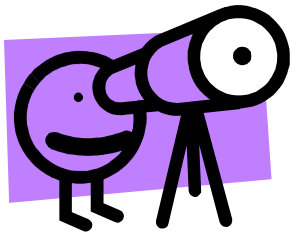
The Marks:

The poster will be marked /20 according to the attached rubric.



SCIENCE 10F

ASTRONOMY POSTER RUBRIC



STUDENT NAME: _____

CATEGORY	4	3	2	1
Use of Class Time	Used time well during each class period. Focused on getting the project done. Never distracted others.	Used time well during each class period. Usually focused on getting the project done and never distracted others.	Used some of the time well during each class period. There was some focus on getting the project done but occasionally distracted others.	Did not use class time to focus on the project OR often distracted others.
Graphics	All graphics are related to the topic and make it easier to understand. All borrowed graphics have a source citation.	All graphics are related to the topic and most make it easier to understand. All borrowed graphics have a source citation.	All graphics relate to the topic. Most borrowed graphics have a source citation.	Graphics do not relate to the topic OR several borrowed graphics do not have a source citation.
Required Elements	The poster includes all required elements as well as additional information.	All required elements are included on the poster.	All but 1 of the required elements are included on the poster.	Several required elements were missing.
Attractiveness	The poster is exceptionally attractive in terms of design, layout, and neatness.	The poster is attractive in terms of design, layout and neatness.	The poster is acceptably attractive though it may be a bit messy.	The poster is distractingly messy or very poorly designed. It is not attractive.
Grammar and Mechanics	There are no grammatical mistakes, capitalization and punctuation are correct throughout the poster.	There are 1-2 errors in grammar, capitalization or punctuation on the poster.	There are 3-4 errors in grammar, capitalization or punctuation on the poster.	There are many errors in grammar, capitalization or punctuation on the poster.

SCIENCE 10F

ASTRONOMY PROJECT OPTION #2

CREATE AN ALIEN

Design an alien that could live on your assigned planet. Consider the following:

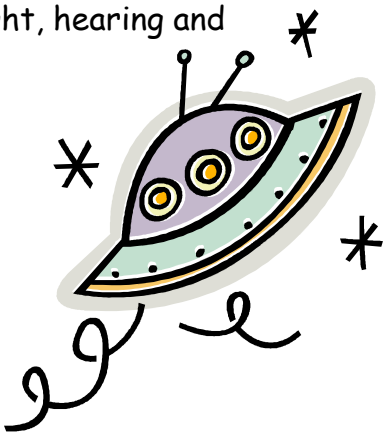
- A low gravity planet might cause aliens to be long and thin. Wings would be useful for mobility.

- A high gravity planet might cause an alien to be short and stocky, they might have stronger muscles and bones, or travel through water to make it easier.

- How will the alien cope with the temperature?

- How will your alien breath? Consider the atmosphere.

- What senses will your alien have? Consider touch, taste, sight, hearing and smell.



- How does your alien communicate?

- Will it be intelligent?

- What does it eat or drink?

- What kind of protection does it have? Fur? Skin?

- Is it like a plant or an animal? Is it more like a mammal, a bird, a reptile, an amphibian, or a fish?

- Does your alien have natural defenses like horns or teeth?

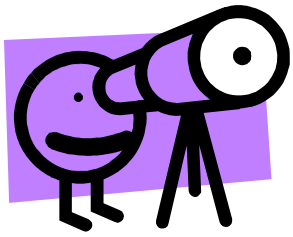
- Does your alien use technology to help it survive (fire, tools, or machines?)

Write a head to toe description of your alien explaining all of its features and why they are necessary.

Draw or build your alien.

SCIENCE 10F

CREATE AN ALIEN RUBRIC



STUDENT NAME: _____

CATEGORY	4	3	2	1
Use of Class Time	Used time well during each class period. Focused on getting the project done. Never distracted others.	Used time well during each class period. Usually focused on getting the project done and never distracted others.	Used some of the time well during each class period. There was some focus on getting the project done but occasionally distracted others.	Did not use class time to focus on the project OR often distracted others.
Alien Drawing/Model	Alien has at least 8 identified features. All features are clearly labeled.	Alien has 6-7 identified features. All features are clearly labeled.	Alien has 4-5 identified features. All features are clearly labeled.	Alien has at least 3 identified features. All features are clearly labeled.
Explanations (Value x2)	Clear explanations are present for at least 8 features of the alien. All features and explanations relate directly to the environment.	Clear explanations are present for at least 6-7 features of the alien. OR only 6-7 explanations relate directly to the environment.	Clear explanations are present for at least 4-5 features of the alien. OR only 4-5 explanations relate directly to the environment.	Clear explanations are present for at least 3 or fewer features of the alien OR 3 or fewer explanations relate directly to the environment.
Creativity, Neatness, Grammar, Mechanics	All four criteria are present.	Three criteria are present, one is missing.	Two criteria are present, two are missing.	One criteria is present, three are missing.

Properties of Stars

- 2 factors that determine how luminous a star is:
  - _____ - high temperature means more _____ _____ is given off
  - _____ - greater star _____ _____ means greater luminosity

- 2 factors that determine how bright a star looks (from Earth, for example)
  - _____ from observer
  - Amount of _____ or _____ is between you and the star (this will absorb the light)

- Colour of a star is based on its temperature
  - _____ 3000º
  - _____ 6000º
  - _____ 20 000 – 35 000º

- When looking up at the sky, the stars sometimes seem to form patterns or pictures. These can be classified in two ways:
  - _____ - a distinct star pattern
    Example:

  - _____ - an officially recognized grouping of stars
    Example:

- The sky is divided into ____ regions, each associated with a different constellation.
- Different constellations are visible at different times of the year. Why?

AZIMUTH AND ALTITUDE ACTIVITY

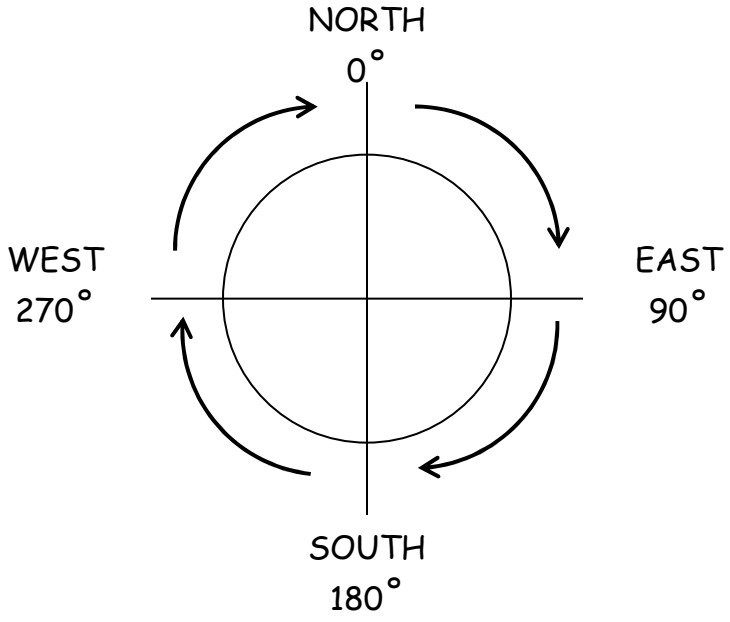
PART A: AZIMUTH

"Create your own Treasure Map"

Background Information:

A compass is a handy instrument to have with you if you get lost on Earth. It can also be used, however, to help locate and describe the position of stars, planets, the sun, and other space objects in the sky **relative to a certain point on Earth.**

Azimuth is a fancy name for compass direction. It is measured relative to true north. When measuring azimuth, North is 0° and measurement goes clockwise.



To use your compass:

1 – Point yourself and your compass toward the object you are finding the azimuth of.

2 – Turn the dial on the outside of the compass until the N lines up with where the (red) arrow is pointing North.

3 – Whatever number points at your object (lines up with "READ BEARING HERE") is the azimuth of that object.

Do some examples with your class to help you figure out how to use the compass properly.

Example)

Begin by walking out the door of the library. Take two paces. What are you looking at? _____

Turn toward 0°. Take approximately 18 paces. What is on your right? _____

Continue in the same direction about 10 paces.

Turn toward 270°. Go 15 paces. What room is on your right hand side? _____

Continue in the same direction 22 paces.

Turn toward 180°. Take 7 paces.

Turn toward 180°. Where are you? _____

Now comes the fun part. Find a spot in the school to start from. It might be the library, the office, the front door, etc. Now use compass directions and paces (roughly equal to 1 meter) to create a map that leads somewhere else in the school. For now, just put in the instructions if someone should walk up or downstairs (maybe ascend or descend sounds cool?).

Print your instructions on a piece of paper. On another piece, give the answers to any questions you ask, as well as your starting and finishing point. Tomorrow, someone will try to follow your directions!

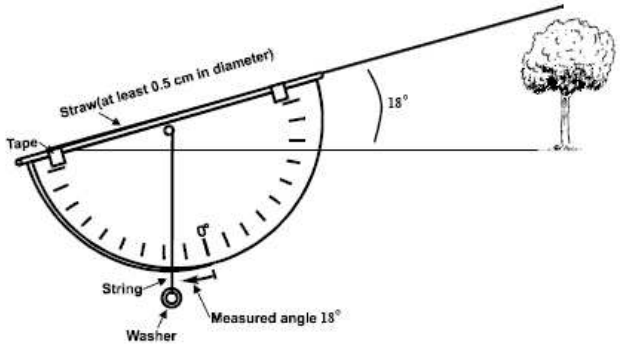
PART B: ALTITUDE
"Create an Astrolabe"

Obviously, when stating the position of an object in the sky we cannot just give a compass direction. We need some measure of how high up to look. This is called the **altitude** of an object. We can measure altitude using a specialized object called an astrolabe. Measurement starts at the horizon (0°) and goes up to a 90° angle, called the **zenith**.

INSTRUCTIONS TO CREATE YOUR ASTROLABE

1 – Carefully cut out one of the astrolabe templates.
2 – Carefully pierce a hole at the 'o' at the center of the template.
3 – Put a piece of string (approximately 30 cm or 1 foot long) through the hole and tie a knot then tape it in place on the back of the template. The string should now hang freely in the front.
4 – Tie the weight to the end of the string so it hangs at least 10 cm below the edge of the astrolabe.
5 – Tape or glue the straw securely along the flat side of the astrolabe, and test to make sure you can see through the straw.

Your astrolabe should now look like the one pictured below.



To measure altitude using your astrolabe, hold it 1 meter above the ground letting the string dangle straight down. Look up at the object you are measuring, until you can see the top through the straw. Pinch the string against the astrolabe. That is the measure of the altitude.

DO SOME EXAMPLES WITH YOUR CLASS TO MAKE SURE YOU CAN MEASURE ALTITUDE.

Astronomical Distances

We use distance measurements everyday. Different units of measurement are appropriate for different distances. For example, a millimeter works fine to measure rainfall in an average day, but you wouldn't use a millimeter to measure the depth of the ocean. We need to figure out some units that are appropriate for space.

Astronomical Unit – _____
_____

Light Year – _____
_____

Place or Thing to Measure	Unit of Measurement	Conversion Factors	Example
You	Centimeter	----	You are likely about 150 cm
Room	Meters	1 m = _____ cm	A room might be 10 m by 12 m
City	_____	1 km = _____ m	Winnipeg is about 40 km in diameter
Canada	Kilometers (but lots of them!)	----	Canada is about 5000 km from coast to coast
Earth	Kilometers	----	Earth's _____ is about _____ km
Solar System	_____ _____	1 AU ≈ _____ km	Neptune is 30 AU from the sun
Milky Way Galaxy	_____	1 Light Year ≈ 63 000 AU	The Milky Way is about _____ Light Years across
Universe	Lots of Light Years!	----	The visible universe is _____ light years

Problems

1) Given that light travels at 300 000 000 m/s, calculate how far light could travel in one year.

2) Neptune is about 30 AU away from the sun. How many kilometers would that be?

3) Your science classroom is about 18 m long. Calculate this length in a) millimeters, b) centimeters, c) kilometers. Explain why we would usually use meters to measure a science classroom instead of one of the other units.

4) The Milky Way Galaxy is about 100 000 light years across. Calculate this distance in a) AU's, and b) kilometers. You'll have to use scientific notation.

5) Polaris, the North Star, is 431 light years away from Earth. Calculate this distance in both AU's and kilometers.

Triangulation

Triangulation can be used to measure how far away something is, without going to all the work of actually measuring a huge distance. We use a baseline of known length, two measured angles, and some math to determine the distance instead.

Directions:

1) Measure the distance between two goalposts. This is your baseline.

2) Measure the angle from the edge of the baseline (goalposts) to an object in the field far away.

3) Draw a scale diagram with the baseline and two angle to form a triangle.

4) Measure the height, and use your scale to find the real distance.

5) Go and check outside by measuring.

Questions:

1) How close was your calculated distance to the actual distance. What are some possible sources of error?

2) Why would a process like triangulation be useful to astronomers?

Hand in your scale diagram, along with the answers to the questions above.