

Down:

1. Edwin _____ discovered that galaxies are spreading apart.
2. This theory explains how the Universe was “flattened”.
3. All objects on Earth are made of _____.

Across:

4. This theory explains the beginning of the Universe.
5. All of the _____ in the Universe was compacted into one small point before the Big Bang.
6. The Universe was created about 15 _____ years ago.
7. The Universe is constantly _____.

Beginning of the Universe Homework

Name: _____

5th Grade PSI Science

1. Why can you say that the Big Bang and spreading of the Universe is similar to a stone hitting the surface of the water?
2. Explain how inflation “flattens” the universe.
3. Explain the effect of dark matter on the Universe.
4. Explain the effect of dark energy on the Universe.
5. What percentage of the mass of the universe is composed of dark matter and dark energy?

Light-Years Classwork

Name _____

6th Grade PSI Science

The distance between objects in outer space are measured in light-years. A light-year is the distance that light can travel in one year. In one year, light can travel about 10 trillion (10^{12}) km. In other words:

$$1 \text{ light-year} = 10 \text{ trillion km}$$

Another way to write this is:

$$\frac{1 \text{ light year}}{10 \text{ trillion km}}$$

Using this ratio, we can convert km to light-years, and vice versa.

Questions

1. The Milky Way galaxy is 150,000 light years across. How many km is this?

2. Alpha Centauri is the next nearest star to us, other than the sun. It is 42 trillion km away from us. How many light-years is this?

Galaxies Homework

Name: _____

5th Grade PSI Science

1. What is a galaxy and what force holds it together?
2. Define gravity.
3. What is mass?
4. Mass is measured in what unit?
5. The force of gravity between two objects depends on what two factors?

Stars Classwork

Name _____

6th Grade PSI Science

The Milky Way galaxy is filled with billions of stars. The table below shows the distances, in light-years, of various stars from Earth. It also shows the apparent magnitude of each star. The apparent magnitude of a star is its brightness as observed from Earth. The brighter the star, the lower the apparent magnitude.

Star	Distance (light-years)	Apparent Magnitude
Barnard's Star	5.96	9.53
Proxima Centauri	4.29	11.09
Procyon	11.40	0.38
Sirius	8.58	-1.46
Wolf 359	7.78	13.44

Use the guidelines below to create a graph using this information.

- Determine the values of the x-axis (apparent magnitude). Write them in with appropriate spacing.
- Determine the values of the y-axis (light-years). Write them in with appropriate spacing.
- For each star, find the location on the graph where its distance (along the y-axis) intersects with its apparent magnitude (along the x-axis). Mark each intersection with a dot.
- Label each dot with the name of the star.
- Write an appropriate title for the graph.

Distance (light-years)

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Apparent Magnitude

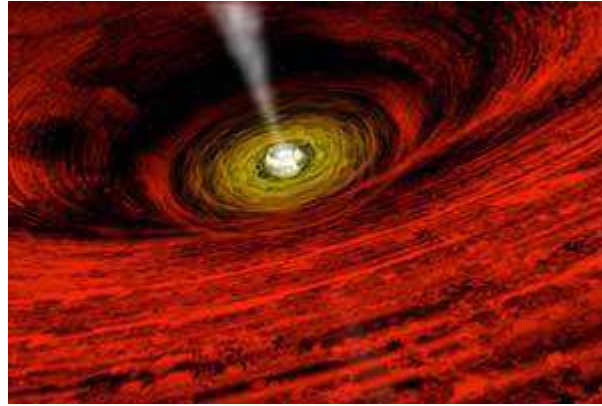
Stars Homework

Name: _____

5th Grade PSI Science

1. What force holds stars together?
2. Why are Copernicus and Galileo important in our scientific studies?
3. Why does a time lapse video of the night sky show the stars moving in a circular direction?
4. Rewrite the following sentences, filling in the blanks with either **revolves** or **rotates**:
 - a. The Earth _____ about its axis.
 - b. The Earth _____ around the Sun.
5. In the summer months, does the Sun appear to be higher or lower in the sky than average?

What are Black Holes Anyway?



Artist's idea of a black hole, with gas and dust swirling rapidly around it before being pulled in by its powerful gravitational field. You can't really see the black hole itself.

Black holes are not really holes at all. They are the opposite of empty! Black holes have the most matter stuffed into the least space of any objects in the universe. Because they are so compact, they have very strong gravity.

Here on Earth, gravity is what makes things fall down, rather than just float away, when you let go of them. Gravity is what you are measuring when you step on a scale to weigh yourself. Your weight is the amount of force that Earth's gravity exerts on you. The more matter your body contains, the more you weigh. Likewise, the more matter an object has, the stronger its gravity.

The gravity of a black hole is so strong that not even light can escape. Even if a bright star is shining right next to a black hole, you cannot see the black hole. Instead of reflecting the light as other objects do, the black hole just swallows the starlight forever. Any matter that gets too close to a black hole gets swallowed up as well.

There are at least two kinds of black holes

One kind is called a stellar-mass black hole. You can think of it as a "one-big-star" black hole. This type of black hole forms when a big star burns up all its fuel and explodes (called a supernova). Then what's left collapses into a super-compact object—a black hole. Stars must contain quite a bit more matter than our Sun for this to happen. So our Sun, and most stars, will never become black holes.

Stellar-mass black holes are only a few tens of kilometers across—maybe about 40 miles. Just imagine. Our Sun is so huge that about one million Earths would fit inside it. A star with enough matter to become a black hole contains maybe 10 times as much matter as the Sun. Now imagine a star with that much matter, shrinking into a space no farther across than the distance you can drive a car in less than one hour!

A black hole with all the mass of Earth would be about the size of a fingernail!

Another kind of black hole is called a supermassive black hole. You can think of this type as a "million-big-star" black hole, because it contains as much matter as one million to 100 million Suns! Astronomers

think that supermassive black holes are lurking at the centers of galaxies, including our own Milky Way galaxy. They don't know yet how these humongous black holes are formed.

Learning More About Black Holes

Scientists really want to learn more about black holes and other strange and massive objects in the Universe.



Artist's idea of XMM Newton Space Telescope. Image courtesy of D. Ducros and the European Space Agency (ESA).

One space mission that is helping them do just that is a space telescope called **XMM-Newton**. It was launched into Earth orbit in 1999 by NASA and the European Space Agency. It observes the universe in high-energy x-rays, a type of light that we can't see with our eyes. Matter, such as gas and dust particles, near black holes puts out x-rays as it swirls around at light speed just before the black hole swallows it up. By observing these x-rays, XMM can help scientists understand the black hole.

Questions

1. When you weigh something, what are you actually measuring?
2. Why will the sun never become a black hole?
3. What is the difference between a stellar mass black hole and a supermassive black hole?
4. What is the purpose of the XMM-Newton space telescope?

Black Holes and Supernovas Homework Name: _____

5th Grade PSI Science

1. Where are black holes located?
2. What gives a black hole its black color?
3. Fill in the blank: Nothing can escape a black hole because of its incredibly high _____.
4. What is a supernova?
5. What will happen to our Sun when it reaches the end of its life?

Beginning of the Universe

Classwork Answer Key

Down

1. Hubble
2. Inflation
3. Matter

Across

4. Big Bang
5. Mass
6. Billion
7. Expanding

Homework Answer Key

- 1) The Big Bang Theory states that all of the mass in the universe was compacted into one point which then exploded and began expanding.
- 2) Inflation flattens the surface of the universe by filling in all the gaps to make the surface smooth.
- 3) Dark matter slows the spreading of the universe.
- 4) Dark energy speeds up the spreading of the universe.
- 5) 95%

Galaxies

Light-Years Answer Key

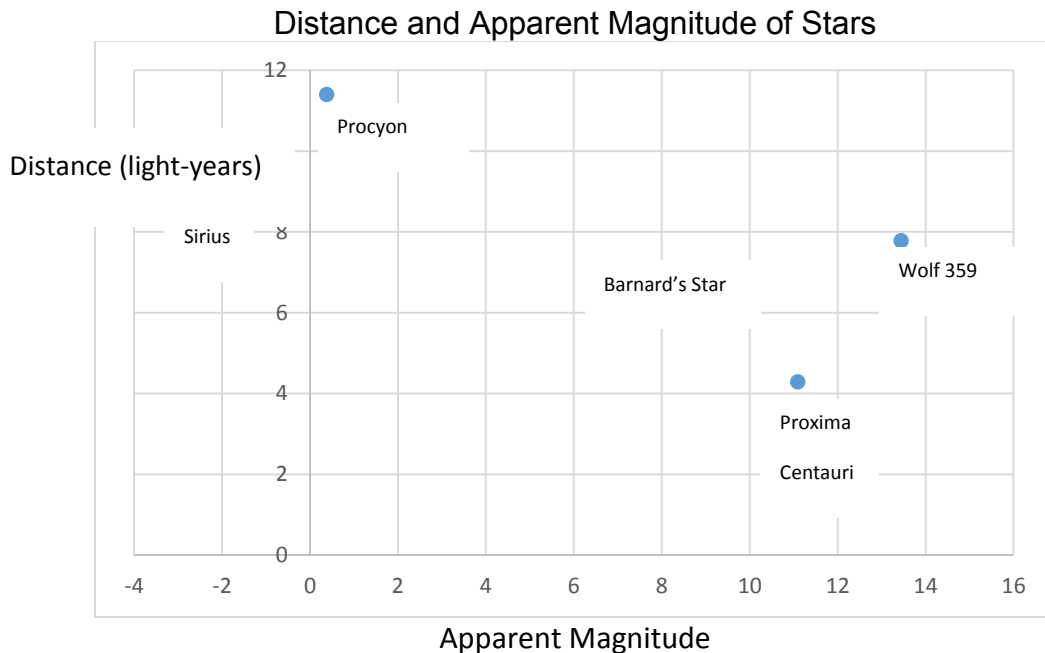
1. $150,000 \times 10 \text{ trillion} = 1,500,000 \text{ km}$
2. $42 \text{ trillion} / 10 \text{ trillion} = 4.2 \text{ light-years}$
3.
 - a. $10 \text{ trillion} \times 1000 = 10^{15} \text{ meters}$
 - b. $1 \text{ year} \times 365 \text{ days} \times 24 \text{ hours} \times 3600 \text{ seconds} = 31,536,000 \text{ seconds}$
 - c. $10^{15} \text{ meters} / 31,536,000 \text{ seconds} = 3.17 \times 10^7 \text{ m/s}$

Homework Answer Key

- 1) A galaxy is a system of stars, gas and dust held together by gravity.
- 2) Gravity is the force of attraction between any two bodies, based on their mass and the distance between them.
- 3) Mass is the amount of matter in an object.
- 4) Grams (g)
- 5) The size of the objects and the distance between those objects.

Stars

Classwork Answer Key



Analysis

1. Sirius
2. The three factors that determine a star's brightness is temperature, size and distance from Earth. The hotter a star, the brighter it is. The larger a star, the brighter it is. The closer a star is to Earth, the brighter it is.
3. Although Sirius is more luminous than the sun, the sun is located much closer to Earth. This makes the sun appear brighter.

Homework Answer Key

- 1) Gravity
- 2) They challenged the belief that the sun revolves around the Earth.
- 3) They seem to move in a circular motion because the Earth is round and the Earth rotates on its axis.
- 4) a) rotates b) revolves
- 5) In the summer, the sun is higher in the sky.

Black Holes and Supernovas

Classwork Answer Key

1. When you weigh something, you are measuring the force of Earth's gravity on it.
2. The sun does not have enough matter to become a black hole.
3. A stellar mass black hole is made from one star and is relatively small. A supermassive black hole is an incredibly large black hole.
4. The XMM-Newton space telescope is trying to capture high energy x-rays that will help scientists gather information about black holes.

Homework Answer Key

- 1) A black hole is located in the center of a galaxy.
- 2) It is black because no light can escape it. Therefore, no light can shine back to our eyes.
- 3) Gravity
- 4) A supernova is an exploding star that has reached the end of its life cycle.
- 5) When the Sun reaches the end of its life, it will explode and become a supernova.