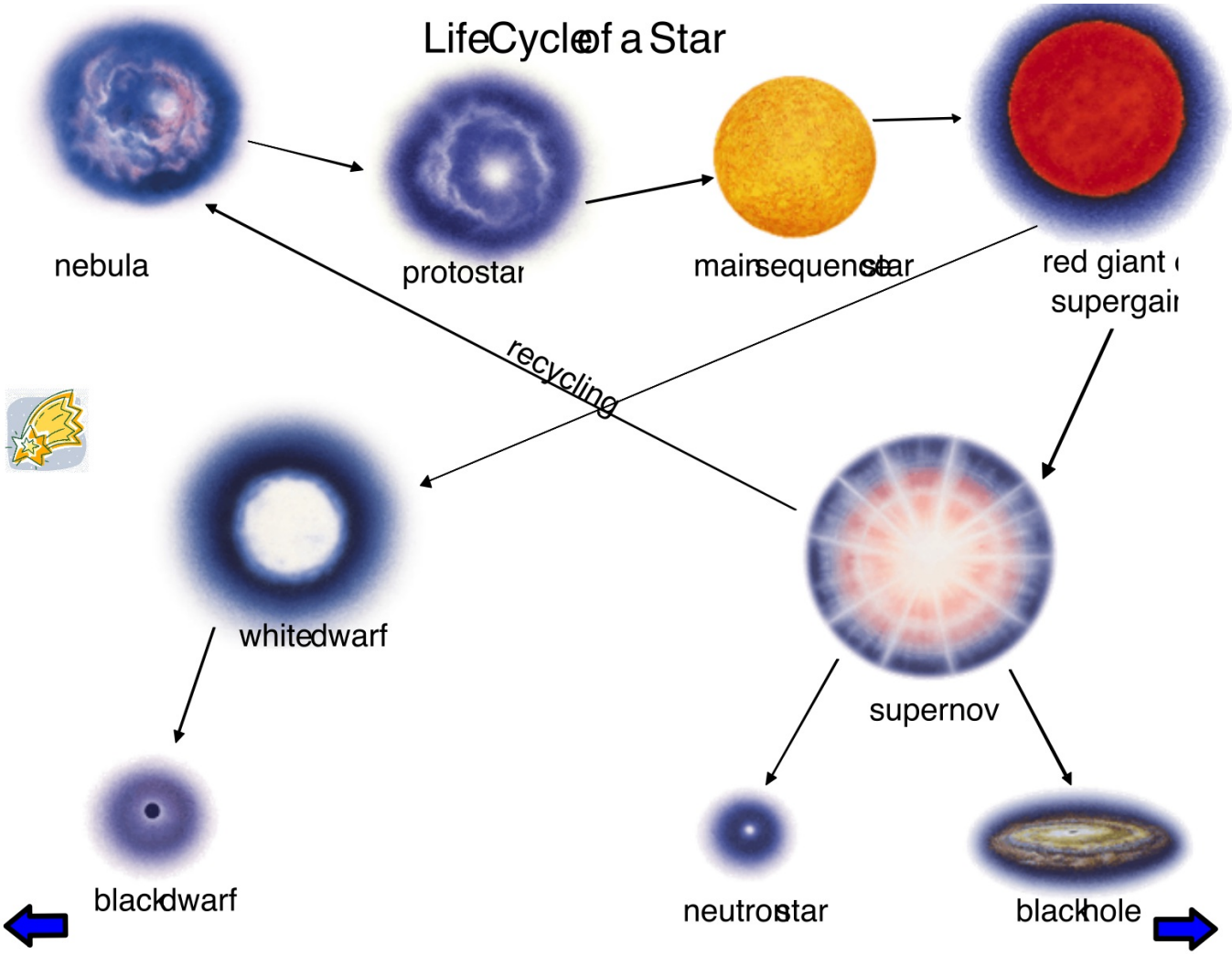
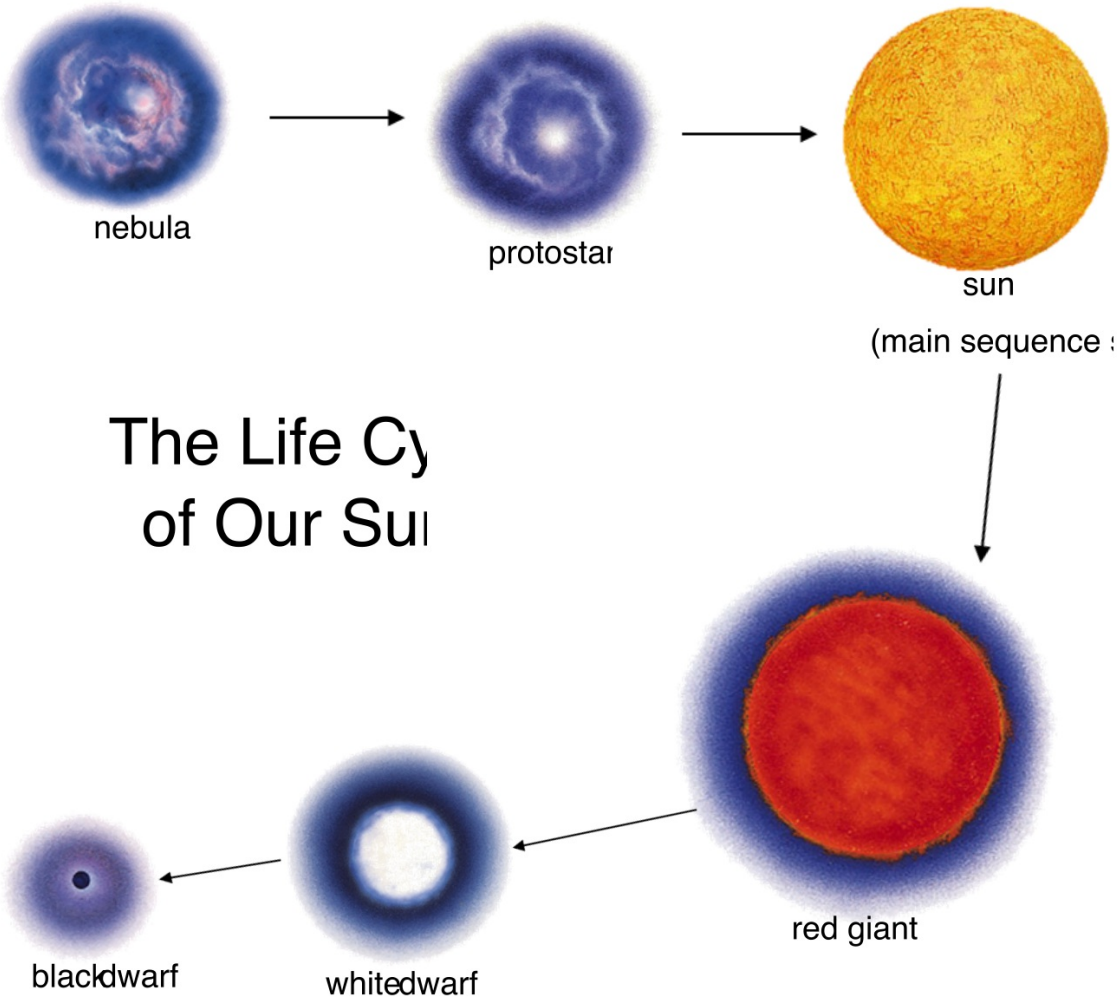

Life Cycle of a Star
nebula
protostar
main sequence star
red giant
supergiant
recycling
white dwarf
supernova
black dwarf
neutron star
black hole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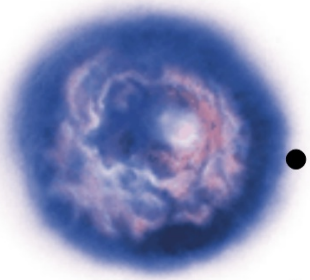
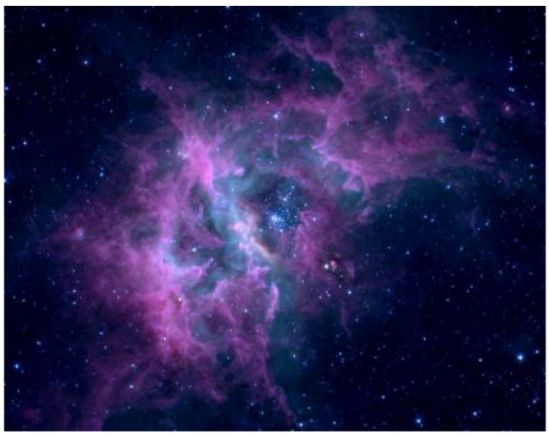
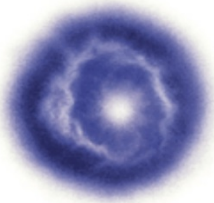


Nebula

- large amounts of gas and dust spread out in an immense volume
- considered to be the "nursery" as stars begin here



nebula RCW49 in the constellation Sagittarius

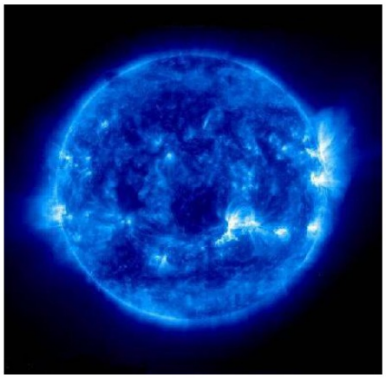


Protostar

- a star is "born" when the contracting gas and dust become so hot that nuclear fusion starts
- the protostar forms in the nebula
- enormous amounts of energy are released

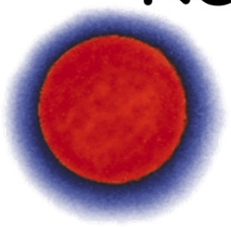
Protostar Herbig-Haro 46 47

Main Sequence Star

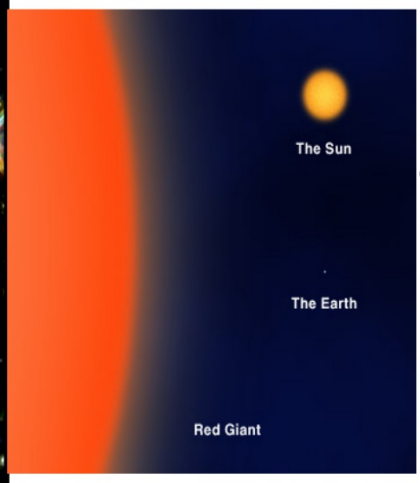


- lifespan can last anywhere between 10 billion-80 billion years
- 90% of a star's life will be in this stage
- vary in mass
- usually medium sized stars
- nuclear fusion---turns Hydrogen into Helium
- radiate (shine) energy into space
- example: Sun, Sirius, Alpha Centauri A and B

Red Giant/Super Giants



- formed when the star's hydrogen fuel begins to run out
- made up mostly of helium, shrinks, and then releases energy as it collapses

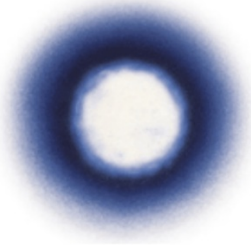


- all of its energy and the remaining nuclear reactions causes the outer layers of the star to expand far out into space (swelling the star to many times its original size)
- as the outer layers cool, the light becomes red

The life cycle of the star can go in one of two ways after the Red Giant/Supergiant stage. Click on the words to see what happens after this stage.

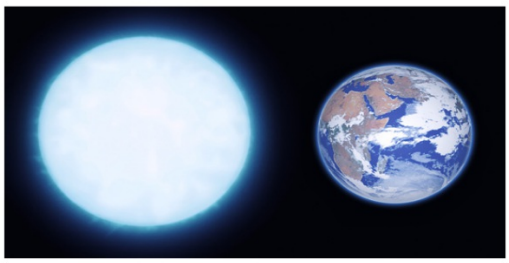
Red Giant Red Super Giants

White Dwarf

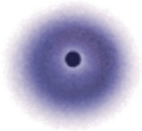


- the outer layer of a red giant floats out into space leaving the blue-white core behind

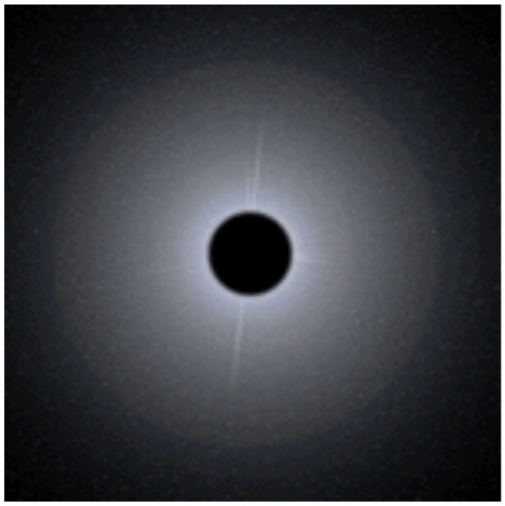
- about the size of Earth, but has the mass of the sun (much denser than Earth)
- has no fuel, but glows faintly from left over energy



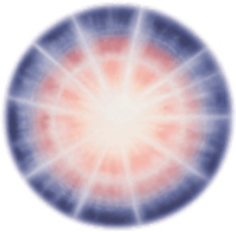
Black Dwarf



- when a white dwarf stops glowing it becomes a black dwarf
- last stage of a star's life
- the star is dead



Supernova



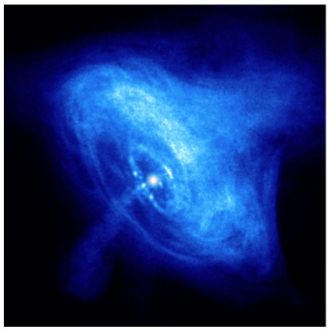
- a super redgiant suddenly explodes and forms a supernova
- dust and particles are blown out into space and this can lead back to forming a nebula
- a supernova can then go in one of two ways; click on the next stage below

Cygnus Loop supernova, which occurred about 15,000 years ago.

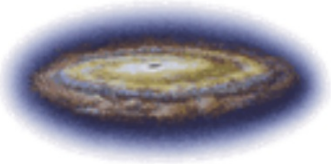
Neutron Star Black Holes

Neutron Star

- material left behind after the supernova explosion forms a neutron star
- smaller and more dense than white dwarfs
- about the size of a large asteroid or a town on Earth



Black Hole



- most massive stars become black holes
- gravity is so strong that gas is pulled inward
- nothing can escape, not even light

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Click on Moby to watch a video on black holes

collapsed red giant;
becomes hotter and white
in color

A. white dwarf
B. black dwarf
C. nebula
D. neutron star

cloud of dust and gas in space; the birth of a star begins here

A. neutron star
B. nebula
C. white dwarf
D. supernova

a very large star that explodes violently

A. supernova
B. black hole
C. neutron star
D. nebula

Lets discuss:

What is day, and what causes it?

Lets use the lamp to represent the sun.

Your head can be the Earth

One of your eyes is an observer on Earth

Move yourself to demonstrate how your observer (eye) can experience day and night on your Earth (head).

So that everyone has enough room, stay about 3 feet away from the sun and out of your neighbor's shadow.

Now that you have day and night down, model so that your observer (eye) is seeing ***noon***, and then ***midnight***.

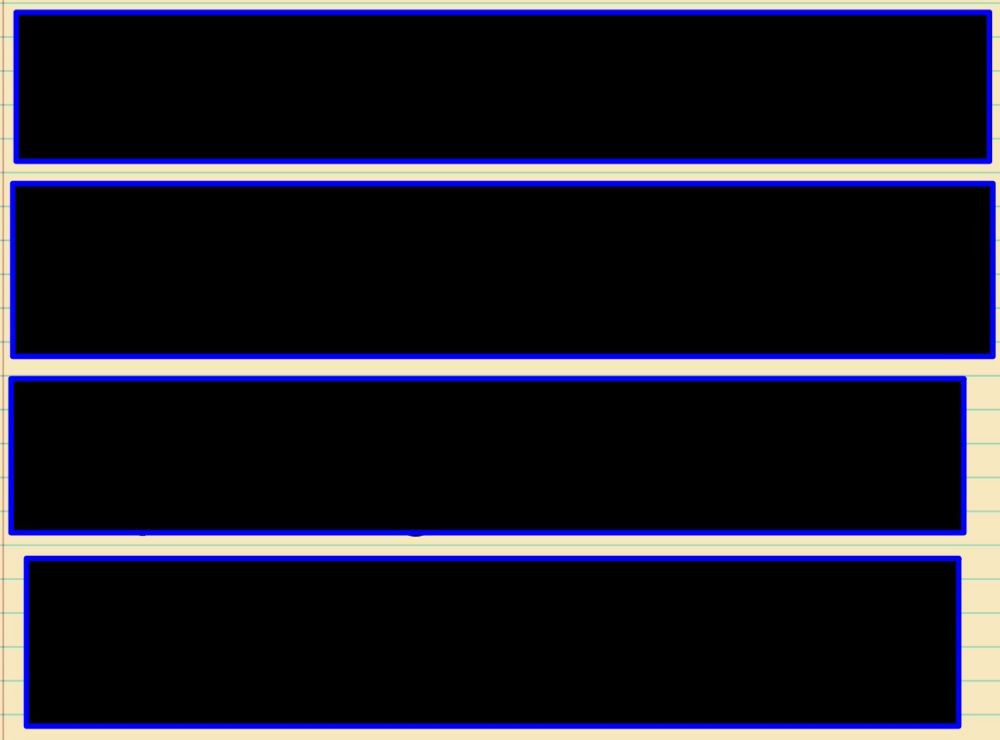
Lets look back to our discussion.

Which of the statements seems to explain explain night and day most effectively?

Do you have any new ideas to add to the list?

When and object turns in a circle or spins like a top, we refer to that motion as **rotation**. The imaginary shaft on which the object turns is called an **axis**. Earth rotates on an axis that runs through its center from the North Pole to the South Pole.

- Rotate so that your observer is experiencing day, and then night.



I noticed that some of you were facing left to demonstrate sunrise, and some of you were facing right. Both can't be accurate! Lets see if we can figure out which way Earth rotates so we can demonstrate sunrise accurately.

Lets operate on one agreed assumption: The top of your head is your Earth's North Pole.

You might need a partner...

Hint: think of your right ear as the West Coast, where we live, and your left ear as the East Coast (Like NYC)

What direction does Earth rotate in, in terms of clockwise or counterclockwise *as viewed from the North Pole?*

Explain!

- Stand so it is just sunrise in New York. When it is sunrise in New York, is it day or night in California?

Imagine that there is someone standing on your globe right on top of Richmond, CA. Position your globe so that the observer is experiencing the following:

- ○ Daytime
- ○ Nighttime
- ○ Noon
- ○ Midnight
- ○ Sunrise
- ○ Sunset

Yesterday we found out that the Earth appears to rotate counterclockwise if seen from above, and that in your model, you were turning to the LEFT to represent this.

Draw a diagram in your notebook showing Earth's rotation, labeling the rotation and axis, and write a short explanation.

Lets look at the first question:

Day/Night Think Questions

1. Why is it dark at night?

2. At any given time, how much of Earth is in daylight and how much is in darkness?

Discuss in your group for 1 minute

Then write in your notebook for 1 minute to answer.

Take the next 10 minutes to work on questions 2-4

2. At any given time, how much of Earth is in daylight and how much is in darkness?

3. What makes the Sun "come up" and "go down"?

4. Does the Sun come up in the morning all over the world? Explain.

- The Sun is a luminous objext that gives off light.
- When light falls on an objext, the portion in the path of the light is illuminated. The area behind the object is in the shadow, in the dark.
- When light falls on a spherical object, like a planet, exactly half is in the light, and half is in the dark.
- The dark side of the sphere is in its own shadow, not the shadow of another object.

- Day and night are the names given to the light and dark halves of a planet.
- From our position on Earth, it looks like the Sun circles Earth once every day. In reality, the Sun is stationary (essentially) and Earth rotates on its axis once every day, giving the illusion of a Sun that rises and sets.
- If a planet did not rotate, it would have a day side and a night side just the same as a planet that does rotate. The difference is that, when a planet rotates,the part of the planet experiencing day and the part experiencing night changes continually; if a planet were not moving (rotating, revolving around its star) one half would experience day all the time, and the other half would experience night all of the time.
- One complete rotation of our planet accounts for one complete day. For Earth, that means 24 hours.

The revolution of the Earth around the Sun is counterclockwise, just like the rotation.

How long does it take for Earth for make one revolution around the Sun?

Explain: How is the **revolution** of Earth different from the **rotation** of Earth?

Note: as we discussed the other day, Earth is tilted at 23.5 degrees relative to the plane of its orbit.

As we saw at the planetarium,

There is a star in the night sky called Polaris, or the **North Star.** It is positioned almost directly over Earth's North pole. Earth's North Pole points toward the north star - during all seasons, day, and night. That's why the North Star has been a navigation aid to seafarers and explorers in the Northern Hemisphere for centuries.

In our Earth/Sun system, we need a North Star. You will have to visualize the North Star through this wall and way, way off in the distance. The North Pole of our model Earth will always point its axis at the North Star as it revolves around our model sun.

We can use this small model star to remind us of approximately where the North Star is in the sky.

In your notebook, define the following terms we have been talking about (in your own words):

- North Star
- Orbit
- Revolution
- Rotation
- Axis