Forces Within a Star- There are a number of powerful forces acting on a star. Every object in the universe that has mass (e.g., atoms, planets, the sun, yourself!), generates gravity, a force that attracts other objects and particles towards its center. This force is very weak, but **the more mass an object has, the more gravity it generates**. Inside a star, gravity pulls inwards, trying to collapse the star in on itself (imagine your hands squeezing a ball). The heat and radiation generated by nuclear fusion in the core pushes outward, trying to blast matter into space. Stars whose size changes relatively little have achieved a state of equilibrium, which means that the forces pushing in and the forces pushing out are equal and balance each other out (Figure 1). As long as the star has enough fuel in its core to continue its nuclear fusion reaction, the star will maintain equilibrium and stay as a main sequence star. This means that **when the star shrinks or expands, it is because the force of gravity that pushes inward and the internal fusion force that pushes outward are not equal anymore**. In other words, the forces are not in equilibrium.

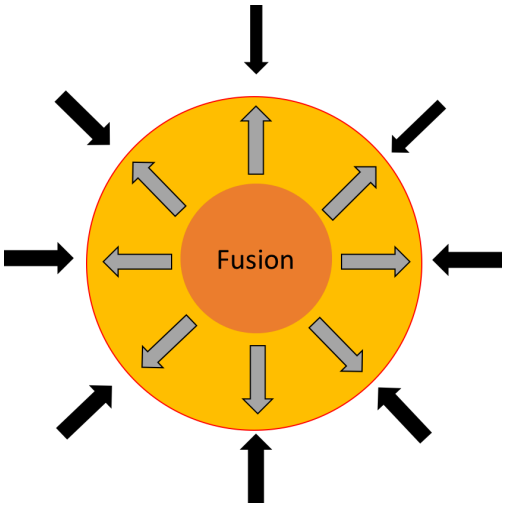


Figure 1. Forces acting on a star. The black arrows represent the force of gravity. The gray arrows represent the internal pressure generated by heat and radiation. Note that grey and black arrows have the same size, which means that both are equal.

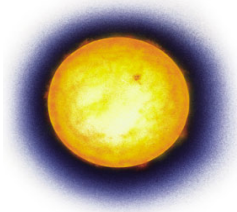
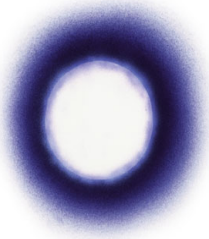
1. What are the two forces within a star?

2. What happens when the two forces are balanced?

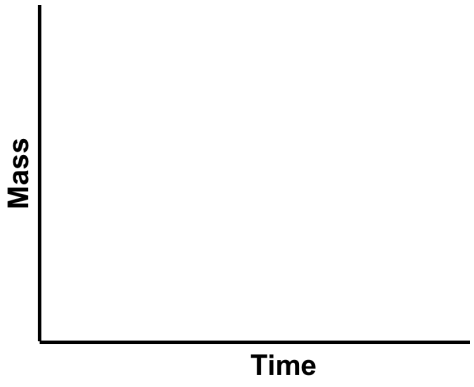
3. From **Star in a Box** give an example of a stage in the lifespan of a star where the forces are balanced.

4. From Star in a box, give an example of one stage in the life span of a star where the forces are not balanced.

Explaining the Life Cycle of a Star (1 solar mass) Use the information you just read about the forces acting on a star, and the diagrams you created when investigating how stars change throughout their lives, to draw the forces pushing outward and inward at each stage of a star's life cycle.	
Draw Arrows	**Explanation (Why are your arrows drawn as they are, don't forget to include the evidence to support your claim)**
Nebula (hydrogen and dust cloud) 	

Main Sequence star 	
Red Giant 	
White dwarf 	

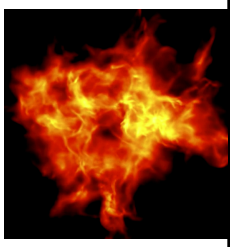
Mass of a Star vs Time since it was formed In the next graph, show the relationship between mass of a star and time in the graph below. This is a relationship you already determined from the data you collected with the *Star in a Box* simulator. Then use what you have learned about nuclear fusion to explain the relationship between mass of a star and time.

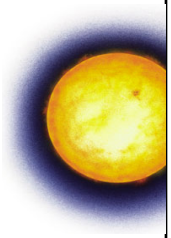
Relationship between mass of a star and time since it was formed	**Explanation (don't forget to include the evidence that supports your conclusion)**
	

Explaining the Life Cycle of a Star (1 solar mass)

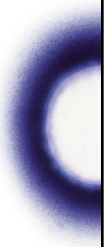
Use the information you just read about the forces acting on a star, and the diagrams you created when investigating how stars change throughout their lives, to draw the forces pushing outward and inward at each stage of a star's life cycle. Your teacher has already used the nebula as an example. Use the explanation for a main sequence star to decide on the size of gravity and fusion pressure arrows you want to draw to represent their relative force within the main sequence star. Then try completing the rest of the explanations for what is going on during the other stages of this star's life cycle.

	Explanation (Don't forget to include the evidence to support your claim) **NOTE THE EXAMPLE BELOW**

	I think the force of gravity is much stronger than fusion force in a star nebula. In the animation, the hydrogen and dust cloud is coming together and getting smaller. Since we know that the force of gravity causes star material to come together and fusion pressure causes the star material to spread further part, I can conclude that the force of gravity was the main driving factor at this stage of the star's life cycle.

	Explanation (Don't forget to include the evidence to support your claim)
	In the simulator, the radius of a star in the Main Sequence Stage did not really change or changed very slowly compared to other stages. Since we know that the forces of gravity and internal pressure affect the size of a star, we can conclude that force due to fusion pressure and the force of gravity are similar in magnitude.

	Explanation (Don't forget to include the evidence to support your claim)

	
White dwarf	**Explanation (Don't forget to include the evidence to support your claim)**
	_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____
