

# Key

## Astronomy Stars Study Guide

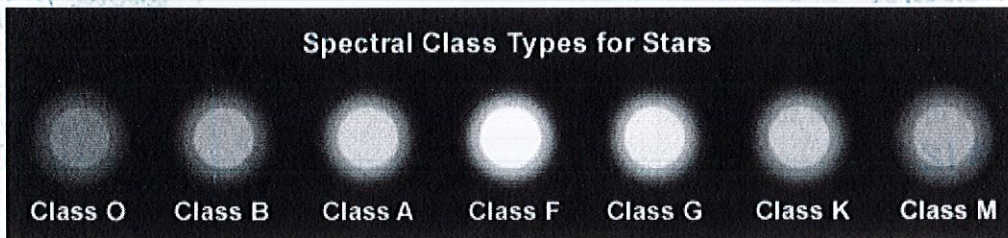
Directions: Complete the following questions. The problems are in the text book.

1. Describe some ways in which a cool star can be more luminous than a hot star.

A cool star can be more luminous than a hot star if it is a lot bigger than the hot star or a lot closer to Earth.

2. How do astronomers know that white dwarfs are really small?

White dwarfs are really small because they are very dim and their density & gravity are really high.



3. Which stars are the hottest and which are the coolest? What class is the Sun?

Class O are the hottest and they're blue.

Class M are the coolest and they're red.

4. What is the H-R diagram and why is it useful.

An H-R diagram is a graph of a star's temperature or class (x-axis) vs its luminosity. It is useful to predict the life cycle of a particular star.

5. Describe the process by which protostars convert gravity into thermal energy.

As more and more hydrogen is collected by the protostar, its gravity increases which squishes the atoms together & heats it up (thermal energy).

6. Describe the four different ways a giant molecular cloud can be triggered to contract.

4 ways a stellar nebula can be triggered are:

1) thermal energy (pressure)

2) magnetic fields

3) rotation (angular momentum)

4) turbulence

7. What is the principle of hydrostatic equilibrium as it relates to the internal structure of a star.

Hydrostatic equilibrium means that the force of gravity trying to squish the star is equal to the force from the pressure of energy caused by nuclear fusion in the core.

8. Explain why a star's life expectancy depends on mass?

The larger a star is (more mass it has) the hotter it is in the core. The hotter the core is, the faster elements undergo fusion and the faster the star uses up its fuel & "dies".

9. Why does an expanding star become cooler and more luminous?

The farther the material gets away from the core, the more energy it uses so it cools off. It also gets more luminous because it has more surface area, allowing more light to be given off.



10. Why can't massive stars generate energy from Fe fusion?

Even massive stars are not hot enough to fuse Fe (iron)

11. What are white dwarfs?

A white dwarf is the cooling core of a low-mass star that has blown off its outer layers

12. How do white dwarfs form?

When a low-mass star runs out of hydrogen to fuse into helium, gravity is greater than its internal pressure pushing out. The star contracts. This causes the core to heat up enough to start fusing Helium. The star's internal pressure skyrockets, making a red giant star. Hydrogen also starts fusing in the layer above the core. This leads to the star running out of fuel again. The outer layers get blown off leaving a small core - white dwarf

13. How are planetary nebulae different from stellar nebulae?

Stellar nebulae create stars

Planetary nebulae are what happens to the star's outer layers after they are blown off

14. Describe the way the sun will die.

See #12

15. Describe everything that happens during a supernova.

Once a high-mass star creates iron (Fe) in its core, it starts contracting & heating up. It cannot get hot enough to fuse the iron but is hot enough to fuse other elements in outer layers which causes a huge explosion (hot enough to make new elements). Depending on the mass of the star, it creates a neutron star or black hole

16. What are neutron stars and what force keeps them from collapsing?

Neutron stars are the former cores of high-mass stars between 1.5 to 3 solar masses ( $M_{\odot}$ ). The fact that the neutrons cannot get any closer together keeps it from collapsing.

17. Describe a neutron star and how it forms.

See #15 → comes from a star between 1.5 to 3  $M_{\odot}$

18. What are black holes and how do they form?

See #15 → comes from a star w/ a mass greater than 3  $M_{\odot}$

19. If you were near the event horizon for a black hole, what is the scientific term for gravity's effect on your body, stretching you out into a very long noodle?

spaghettification

20. Which stellar remnant has the lowest gravity: white dwarf, neutron star, or black hole? Which has the highest gravity?

↑  
lowest  
gravity

↑  
highest  
gravity



21. What are pulsars? Pulsars are rapidly spinning neutron stars that eject hot gas from their poles. We see them as "pulsing" when the poles momentarily face the Earth.

22. Diagram the cores and energy transfers of a high mass star vs a low mass star.

23. Why are massive stars described as element factories? In other words, how do they produce so many different elements?

The fuse Hydrogen  $\rightarrow$  Helium  $\rightarrow$  Carbon  $\rightarrow$  Neon  $\rightarrow$  Oxygen  
 $\downarrow$   
 Silicon  
 $\downarrow$   
 Iron

Then they fuse heavier elements when they go super nova

Low-mass star

near death

High-mass star

