Star formation happens _____.

*a. in GMCs
b. in H I regions
c. in the coronal gas in the ISM
d. just after a planetary nebula forms
e. just before the Helium Flash

The dimming of the visible light from distant stars is caused primarily by _____.

a. hydrogen atoms
*b. dust particles
c. molecules such as carbon monoxide
d. ice crystals (clouds)
e. the blocking of the distant stars by foreground stars

The bright red emission nebulas known as H II regions form _____.

a. around stars like the Sun
b. in regions where you typically find planets
c. around binary star systems
*d. around massive, hot stars
e. around every protostar we have seen

Which of the following statements about the initial chemical composition of Main Sequence stars is correct?

a. Most are composed primarily of hydrogen and oxygen
*b. Most are composed of hydrogen and helium
c. Most are composed of nitrogen and oxygen
d. Massive stars are composed primarily of hydrogen and carbon
e. Low mass stars are pure hydrogen gas spheres

A Reflection Nebula requires the presence of which of the following?

a. carbon and water
b. a brown dwarf and hydrogen gas
*c. dust and a massive star (an O or B star)
d. dust and a planetary nebula
e. hydrogen and helium gas

The _____ is used to determine the age of the cluster.

a. number of stars in a stellar cluster
b. main sequence turn-off of a stellar cluster
c. number of white dwarfs in a stellar cluster
d. shape of a stellar cluster
e. position in the Milky Way galaxy of a stellar cluster

Which relationship concerning the mass of protostars is false?

a. The more massive protostars reach the main sequence first.
b. The most massive protostars will be the hottest and most luminous stars.
*c. The more massive protostars will be made of the heaviest elements.
d. The more massive protostars will become hot enough to produce H II regions.

Photons with energies slightly lower than the energies of visible light photons are

- **a) infrared photons.**
- b) radio photons.
- c) ultraviolet photons.
- d) x-ray photons.
- e) photon torpedoes.

Rigel has an apparent magnitude of 0.1 and Polaris has an apparent magnitude of 2.1. What is the ratio of the fluxes from these two stars?

- a) 2.0
- b) 2.512
- c) 5.024
- **d) 6.31**
- e) 100

Which of the following spectral types corresponds to the hottest Main Sequence stars?

- **a) O**
- b) M
- c) K
- d) G
- e) F

Which of the following spectral types corresponds to the Main Sequence stars of the lowest mass?

- a) O
- **b) M**
- c) K
- d) G
- e) F

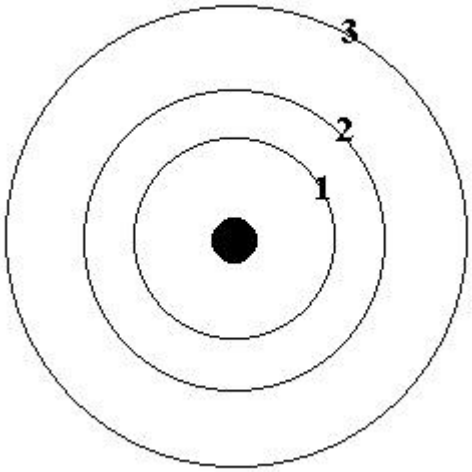
The temperature of an object is a measure of

- a) its total energy content.
- b) the average amount of energy per gram.
- **c) the average amount of energy per particle.**
- d) the total energy contained in the motions of all of the particles.

A star with a surface temperature of 6000 K will emit a blackbody spectrum which peaks at what wavelength?

- a) 6000 m
- b) 5×10^{-7} nm
- c) 18 nm

- **d) 5 x 10^{-7} m**
- e) 1.8 x 10^{-7} nm



In the above sketch, the Bohr model of an atom is represented with a black nucleus and three acceptable electron orbits. If an electron in this atom were initially in state 2 and moved to state 1, this would result in

- a) the emission of a light photon whose energy is equal to the energy of state 1.
- b) the absorption of a light photon whose energy is equal to the difference in energy between states 1 and 2.
- **c) the emission of a light photon whose energy is equal to the difference in energy between states 1 and 2.**
- d) the emission of a light photon whose energy is equal to the energy of state 2.
- e) the absorption of a light photon whose energy is equal to the energy of state 2.

Still referring to the above sketch, which electronic transition would produce the shortest wavelength photon?

- a) the transition from state 2 to state 1
- **b) the transition from state 3 to state 1**
- c) the transition from state 3 to state 2
- d) the transition from state 1 to state 3
- e) the ionization of the electron from state 1

One of the primary differences between elliptical and spiral galaxies is that

- a) elliptical galaxies do not have black holes at their centers.
- b) spiral galaxies do not have globular clusters.
- **c) elliptical galaxies don't have as much dust as spirals.**
- d) spiral galaxies are smaller than ellipticals.
- e) elliptical galaxies are older than spirals.

Why can we see the center of our galaxy in infrared light, but not in visible light?

- a) The center of our galaxy doesn't emit visible light.
- b) Because infrared photons have a lower energy than visible photons, stars emit more infrared light than visible light.
- **c) Because infrared photons have a longer wavelength than visible light, infrared light can travel through the obscuring dust between here and the galactic center.**
- d) Because infrared photons have a higher frequency that optical photons, they travel faster through the interstellar medium.
- e) The black hole at the center of our galaxy absorbs all of the light emitted in the galactic center region.

When photons are emitted from a region of strong gravity such as the surface of a neutron star, their wavelengths change as they move outward because of

- a) the doppler effect.
- b) the Hubble law.
- c) neutron degeneracy.
- **d) the gravitational redshift.**
- e) electron degeneracy.

High mass stars evolve off the Main Sequence faster than low mass stars because

- a)they have a lower fraction of hydrogen in their cores.
- b) their cores are hotter and fuse hydrogen more quickly.
- c) they fuse helium instead of hydrogen.
- d) trick question: all stars spend the same amount of time on the Main Sequence .

You measure the flux from two stars, star #1 in cluster Gak-6, and star #2 in cluster Bip-4. Based on their colors, you conclude that both stars have the same surface temperature. You also notice that star #1 has a higher flux than star #2. Based on this information, what can you conclude?

- a) The two clusters are at the same distance.
- b) Cluster Gak-6 is closer to us than cluster Bip-4.
- c) Cluster Gak-6 is farther from us than cluster Bip-4.
- d) You don't have enough information to determine which cluster is closer.

The surface temperature of a star can be determined from its

- a) absolute magnitude.
- b) apparent magnitude.
- c) bolometric magnitude.
- d) color index.
- e) total luminosity.

Main Sequence stars are supported against gravitational collapse by

- a) thermal pressure from fusion in their cores.
- b) atomic pressure.
- c) electron degeneracy pressure.
- d) neutron degeneracy pressure.
- e) gravitational pressure.

White dwarfs are supported against gravitational collapse by

- a) thermal pressure from fusion in their cores.

- b) atomic pressure.
- c) electron degeneracy pressure.
- d) neutron degeneracy pressure.
- e) gravitational pressure.

Which of the following is evidence for the presence of dark matter in the outer reaches of our galaxy?

- a) Absorption of light from distant galaxies.
- b) Hydrogen spin-flip emission from the outer reaches of the galaxy.
- c) The high rotation velocity of material in the outer reaches of the galaxy.
- d) The small number of stars seen in the outer reaches of our galaxy.

The reason stars less than one-fortieth as massive as the sun are not found is that

A) the internal fission reactions use up all the fuel very quickly.

B) they are so small that they fall into black holes.

C) the gravitational forces in such a small star would not hold it together against the pressure produced by the nuclear reactions in its interior.

D) gravity cannot squeeze the matter sufficiently to produce the temperatures necessary for nuclear fusion reactions.

From knowledge of only a star's temperature and luminosity, we can determine its

a. mass.
b. **radius.**
c. distance.
d. period of rotation.
e. rotational velocity.

The resolution to the question of the nature of the "nebulae'' came from the discovery of _____ within the "Andromeda nebulae''.

a. solar-type stars
b. T-Tauri stars
c. RR Lyrae stars
d. Cepheid variables
e. planetary nebulae

A galaxy whose overall color is reddish would probably be

a. spiral.
b. elliptical.
c. irregular.
d. indeterminate; color has nothing to do with galaxy type.