

HW7

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Started: March 24, 2006 3:09 PM | 9 Questions

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1. Extrasolar Planets

(10 point(s))

Many extrasolar planets appear to have very surprising characteristics (Jupiter-like masses but very small orbital radii). Does this mean that our concept of planet formation (i.e. terrestrial planets near the star and gas giants farther out) is wrong?

- ☐ 1. Not necessarily, we don't yet have the sensitivity to solar systems like our own.
- ☐ 2. No, the astrometric method can only give an upper limit for a planet's mass, so they could be terrestrial planets.
- ☐ 3. No, the astrometric method can only give a lower limit to the orbital radius, so they could be orbiting at the proper distance expected for a Jovian planet.
- ☐ 4. Yes, all Jupiter-like planets must be formed near their star.

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2. Dumm's Energy Crisis

(20 point(s))

You and your friend Dumm ponder the life of the Sun. He says that the Sun will explode when it runs out of gas. Explain to your friend the stages the Sun will go through as it dies and why.

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3. Main Stars

(10 point(s))

What particular feature of stellar behavior is associated with the fact that a star is on the main sequence in the Hertzsprung-Russell diagram?

- ☐ 1. The star is generating internal energy by hydrogen fusion in its core.
- ☐ 2. The star is slowly shrinking, thereby releasing gravitational potential energy.
- ☐ 3. The star is generating energy by helium fusion in its core, having stopped hydrogen "burning."

- ☐ 4. The star has ceased nuclear "burning" and is simply cooling down by emitting radiation.

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4. Long Life

(10 point(s))

Why are the majority of stars in the sky in the main-sequence phase of their lives?

- ☐ 1. This is the longest-lasting phase in each star's life.
- ☐ 2. Most stars die at the end of the main-sequence phase.
- ☐ 3. This is the only phase that is common to all stars.
- ☐ 4. Most stars in the sky were created at about the same time, so they are all in the same phase of their lives.

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5. Evolve

(10 point(s))

The evolution of a star is controlled mostly by its

- ☐ 1. chemical composition.
- ☐ 2. surface temperature.
- ☐ 3. location in the galaxy.
- ☐ 4. initial mass.

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6. Next Stage

(10 point(s))

What is the next stage in a star's life after the main-sequence phase?

- ☐ 1. horizontal branch
- ☐ 2. red giant
- ☐ 3. death (i.e. either a supernova or a white dwarf)

- ☐ 4. protostar

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7. So Large

(10 point(s))

What makes a red giant star so large?

- ☐ 1. The helium-rich core has expanded, pushing the outer layers of the star outward.
- ☐ 2. The star has many times more mass than the Sun.
- ☐ 3. All red giants are rapid rotators, and centrifugal force pushes the surface of the star outward.
- ☐ 4. The hydrogen-burning shell is heating the envelope and making it expand.

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8. Heavy Elements

(10 point(s))

The majority of the elements heavier than hydrogen and helium in the universe are believed to have originated in

- ☐ 1. the original Big Bang.
- ☐ 2. the central cores of stars.
- ☐ 3. HII regions.
- ☐ 4. giant molecular clouds.

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9. Electron Degen

(10 point(s))

If electrons are collectively compressed into a very small volume (e.g., within the core of a dying white dwarf star) one electron is prevented from occupying space near to a second electron (Pauli exclusion principle), what is the result?

- ☐ 1. The electrons fall into orbit around one another in mutual pairs, reducing the restricted quantum space, thereby allowing further shrinkage of the star.

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- ☐ 2. The electrons generate a very large pressure to oppose further compression.
- ☐ 3. Nuclear fusion occurs between electrons to produce energy, thereby heating the star's core.
- ☐ 4. Half of the electrons are transformed into antimatter (positrons) that annihilates electrons, producing a burst of energy and the explosion of the star.

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