HW9

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1. The end
(8 point(s))

Which is the correct sequence for the following end-points of stellar evolution, in order of increasing maximum mass?

- 1. neutron star, black hole, white dwarf
- 2. white dwarf, neutron star, black hole
- 3. black hole, neutron star, white dwarf
- 4. white dwarf, black hole, neutron star

Save Answer

2. Time after time.
(8 point(s))

How does a gravitational field affect the passage of time?

- 1. Gravity has no effect on the passage of time.
- 2. Clocks in a gravitational field run faster than clocks outside the field.
- 3. Gravity makes time stop.
- 4. Clocks in a gravitational field run slower than clocks outside the field.

Save Answer

3. Planet watching
(8 point(s))

Suppose that, from a stationary spaceship, you identify a source of hydrogen (H-alpha) light on the surface of a planet that has a very strong gravitational field. When you observe an equivalent H-alpha light source on your spaceship, the wavelength is 656.3 nm. How long is the wavelength you measure when you look at the light source on the planet?

- 1. shorter than 656.3 nm

2. the same wavelength of 656.3 nm, but the frequency of the light appears lower

3. 656.3 nm, the same as your light source, but the source appears very faint because the radiation has been weakened by the gravity field

4. longer than 656.3 nm

Save Answer

4. Sun stroke

(8 point(s))

According to general relativity, why does the Earth orbit the Sun?

1. Space around the Sun is curved and the Earth follows this curved space.

2. The Sun exerts a gravitational force on the Earth across empty space.

3. Matter contains quarks, and the Earth and Sun attract each other with the "color force" between their quarks.

4. The Earth and the Sun are continually exchanging photons of light in a way that holds the Earth in orbit.

5. It just does.

Save Answer

5. Naming convention

(8 point(s))

Black holes are so named because

1. they emit a perfect blackbody spectrum.

2. no light can escape from inside them.

3. all their electromagnetic radiation is gravitationally redshifted to the infrared, leaving no light in the optical region.

4. they emit no visible light, their only spectral lines being in the radio and infrared.

Save Answer

6. Black holes for fun

(8 point(s))

A black hole can be thought of as

1. strongly curved space.

2. a star with a temperature of 0 K, emitting no light.

3. the point at the center of every star, providing the star's energy by gravitational collapse.

4. densely packed matter inside a small but finite volume.

Save Answer

7. Replace this

(8 point(s))

If the Sun were replaced by a 1-solar-mass black hole, then the Earth would

1. move into an elliptical orbit passing close to the black hole, with its farthest distance from the black hole equal to 1 AU.

2. spiral quickly into the black hole.

3. head off into interstellar space along a straight line at a tangent to its original orbit around the Sun.

4. continue to orbit the black hole in precisely its present orbit.

Save Answer

8. Where art thou?

(8 point(s))

Where would you look for a supermassive black hole?

1. in an orbit around a normal star in our galaxy

2. at the center of the universe

3. at the center of a supernova remnant

4. in the center of a galaxy

Save Answer

9. Escape from NYC

(8 point(s))

The escape velocity of matter from the center of a black hole whose mass is 3 solar masses is

- 1. quite small.
- 2. much greater than the speed of light.
- 3. exactly equal to the speed of light.
- 4. about half the speed of light.

Save Answer

10. Radius

(8 point(s))

The radius of the event horizon of a black hole, the Schwarzchild radius,

- 1. is constant, because the general theory of relativity states that the size of a black hole is independent of its mass.
- 2. is smaller, the more massive the black hole, because the matter will be more condensed.
- 3. will not depend on its mass but will depend on the material from which it was formed, a "hydrogen" black hole being smaller than an "iron" black hole.
- 4. is larger, the more massive the black hole.

Save Answer

11. Gettin' close

(10 point(s))

What is the closest you could get to a 2-solar-mass black hole and still come home to tell us about it? Give the result in km.

Save Answer

12. ET

(10 point(s))

Give two reasons why it it feasible that extraterrestrial life may exist in the Galaxy. Give two reasons why life may only exisit on Earth.

Save Answer

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