AstroSizeWhitdwrfNeutstarQSO

The LaTex code that creates this quiz is released to the Public Domain
Attribution for each question is documented in the Appendix

Saturday 3rd November, 2018

Latex markup at
https://en.wikiversity.org/wiki/special:permalink/1863362

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Contents

1 Quiz

1. At the center of the Crab nebula is [1]

   A. a) all of these is correct

   B. b) a pulsar

   C. c) none of these is correct

   D. d) a neutron star

   E. e) the remnants of a supernova

2. One way to determine the distance to a nebula or small cluster of clouds is to compare the angular expansion to the spectroscopic Doppler shift. Two clusters (A and B) have the same spectroscopically measured velocity. Cluster A is moving towards the observer and exhibits the greater angular expansion. Which cluster is closer? [2]

   A. cluster A, because it exhibits greater angular expansion

   B. cluster B, because it exhibits less angular expansion

   C. cluster A, because it exhibits a blue Doppler shift

   D. cluster B, because it exhibits a red Doppler shift

   E. either cluster might be more distant

3. What causes the "finger-like" filamentary structure in the Crab nebula?[3]

   A. cyclotron motion, causing the electrons to strike oxygen molecules

   B. a heavy (high density) fluid underneath a light (low density) fluid, like a lava lamp

   C. a light(low density) fluid underneath a heavy(high density) fluid, like a lava lamp

   D. electrons striking oxygen molecules, like a lava lamp

   E. electrons striking hydrogen molecules, like a lava lamp

4. $KE = \frac{4\pi^2}{5}\frac{MR^2}{P^2}$ is the kinetic energy of a solid rotating ball, where M is mass, R is radius, and P is period. And, $power = \frac{energy}{time}$. You are banging espressos in a little coffeehouse with your astronomy friends, talking about a new SN remnant that closely resembles the Crab. You have observed the pulsar, and wonder what the total power output of the nebula might be. You know both the period of the pulsar, as well as τ, which represents the amount of time you think the pulsar will continue pulsing if it continues slowing down at its present rate. What formula do you write on your napkin?[4]

   A. $power = \frac{4\tau\pi^2}{5}\frac{MR^2}{P^2}$

   B. $power = \frac{4\pi^2}{5\tau}\frac{MR^2}{P^2}$

   C. $power = \frac{5}{4\tau\pi^2}\frac{MR^2}{P^2}$

   D. $power = \frac{4\pi^2}{5\tau^2}\frac{MR^2}{P^2}$

   E. $power = \frac{4\pi^2}{5}\frac{MR^2}{P^2}\tau^4$

5. In one respect, the universie is arguably "young", considering how much complexity it contains. This is often illustrated by a calculation of[5]

   A. recalibration of supernovae luminosity

   B. recalibration of supernovae relative magnitude

   C. cosmic expansion

   D. chimps typing Shakespeare

   E. cosmic redshift

6. Comparing Hubble's original (1929) plot of redshift versus distance with the later one in 2007, the latter extends farther into space by a factor of[6]

   A. 10

   B. 100

   C. 1000

   D. 10,000

   E. 100,000

7. The course materials present two cosmic expansion plots. Hubble's original (1929) plot used[7]

   A. Cepheid variables

   B. red giants

   C. novae

   D. supernovae

   E. entire galaxies

8. The course materials present two cosmic expansion plots. The more recent (2007) plot used[8]

   A. Cepheid variables

   B. red giants

   C. novae

   D. supernovae

   E. entire galaxies

9. Place yourself in an expanding raisinbread model of Hubble expansion. A raisin originally situated at a distance of 4 cm expands out to 12 cm. To what distance would a raisin originally situated at a distance of 2 cm expand?[9]

   A. 2

   B. 3

   C. 4

   D. 6

   E. 8

10. You at the center raisin of an expanding raisinbread model of Hubble expansion, and from your location a raisin originally situated at a distance of 1 cm expands out to a distance of 4 cm. The nearest raisin with intelligent life is situated exactly halfway between your (central) location and the edge. How would this second "intelligent" raisin view an expansion of a raisin 1 cm away?[10]

    A. expansion from 1 cm to 8 cm (twice yours).

    B. expansion from 1 cm to 4 cm (just like yours).

    C. expansion from 1 cm to 2 cm (half of yours)

    D. expansion from 1 cm to 3 cm (since 3-1=2)

    E. expansion from 1 cm to 9 cm (since 5-1=4)

11. Place yourself in an expanding raisinbread model of Hubble expansion. A raisin originally situated at a distance of 2 cm expands out to 4 cm. To what distance would a raisin originally situated at a distance of 4 cm expand?[11]

    A. 2

    B. 3

C. 4

D. 6

E. 8

12. Aside from its location on the HR diagram, evidence that the white dwarf has a small radius can be found from[12]

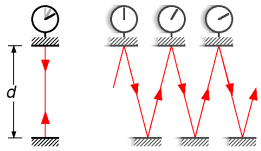
A. the expansion of the universe

B. the mass as measured by Kepler's third law (modified by Newton)

C. the doppler shift

D. the temperature

E. the gravitational redshift

13. 

This light clock is associated with [13]

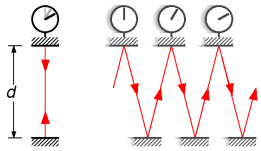
A. all of these are true

B. gravitational shift

C. doppler shift

D. special relativity

E. general relativity

14. 

Suppose the light clock involved a ball being tossed back and forth on a train going just under the speed of sound. In contrast to the situation for light reflecting back and forth on a train going just under the speed of light, there is virtually no time dilation. Why?[14]

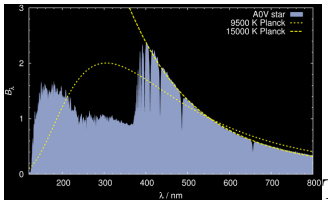
A. The observer on the ground would perceive the width the train to be greater.

B. The observer on the ground would perceive the ball to be travelling faster.

C. The observer on the ground would perceive the ball to be travelling more slowly.

D. The observer on the ground would perceive the width the train to be smaller.

E. Special relativity is valid only for objects travelling in a vacuum.

15. 

This spectrum of the star Vega suggests that[15]

A. it is an approximate black body

B. if is not really a black body

C. all of these are true

D. it's surface can be associated with a range of temperatures

E. it can be associated with an "effective" temperature

16. Which of the following is NOT an essential piece of a a strong argument that a white dwarf is not only the size of the earth, but typically has the same mass as the Sun. [16]

A. the wobble of Sirius A

B. the distance to Sirius A

C. all of these are true

D. the "color" (spectral class) of Sirius B

E. the relative magnitude of Sirius B

17. The course materials presented three arguments suggesting that a white dwarf is roughly the size of the earth. Which best summarizes them?[17]

A. doppler-shift...period-of-pulsation...temperature-luminosity

B. temperature-luminosity...redshift...quantum-theory-of-solids

C. x-ray-emmission...doppler-shift...rotation-rate

D. HR-diagram-location...X-ray-emmision...spectral-lines

E. all of these are true

18. As of 2008, the percent uncertainty in the distance to the Crab nebula is approximately, [18]

A. 0.1

B. 1

C. 10

D. 25

E. 100

19. What was Messier doing when he independently rediscovered the Crab in 1758? [19]

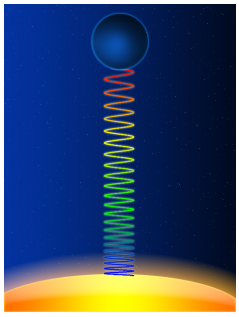
A. Trying to measure the orbital radius of a planet

B. Looking for a comet that he knew would be appearing in that part of the sky.

C. Looking for lobsters

D. Attempting one of the first star charts

E. Attempting to count asteroids

20.  What best explains this figure?[20]

A. The photon loses energy, not speed. By $c=f\lambda$, it loses frequency, and by $E=hf$ it increases wavelength and turns red.

B. The photon slows down, by the Doppler shift, $E=hf$, and therefore by $c=f\lambda$ it turns red.

C. The photon slows down, by the Doppler shift, $c=f\lambda$, and therefore by $E=hf$ it turns red.

D. The photon slows down as it goes uphill, and by $c=f\lambda$ it increases wavelength therefore by $E=hf$, it turns red.

E. The photon loses energy, not speed. By $E=hf$, it loses frequency, and by $c=f\lambda$ it increases wavelength and turns red.

21. What causes the blue glow of the Crab nebula?[21]

A. the curving motion of electrons in a magnetic field; such motion resembles a radio antenna

B. the same emission found in a Lava lamp (ultra-violet)

C. the curving motion of electrons in a magnetic field; such motion traps ultra-violet and blue light

D. the Doppler blue shift

E. the Gravitational blue shift

2 Attribution

Notes

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