

ASTRONOMY 1504

First Exam – September 14, 2007

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1. What force holds golden retrievers together?
  - (a) the strong (nuclear) force
  - (b) the EM force
  - (c) gravity
  - (d) the dog force
2. The strong (nuclear) force
  - (a) applies only to electrons
  - (b) is a repulsive force which prevents electrons from falling into nuclei
  - (c) is a long-range force
  - (d) is a very short-range force
3. The difference between "normal" hydrogen and "heavy" hydrogen (deuterium) is the addition of
  - (a) a neutron
  - (b) a proton
  - (c) an electron
  - (d) a neutrino
4. An ordinary carbon atom with 6 protons and 6 neutrons captures an electron so it now has 7 electrons. This is now a(n) \_\_\_\_ of carbon
  - (a) photon
  - (b) molecule
  - (c) ion
  - (d) isotope
5. Which of the following would be typical of temperatures in Oklahoma on a nice warm day?
  - (a) 0 K
  - (b) 0 Centigrade
  - (c) 212 Fahrenheit
  - (d) 300 K

6. Consider two stars, Boomer and Sooner. If Boomer has an apparent magnitude (brightness) of 0 and Sooner has an apparent magnitude of +5, which of the following is true?
- (a) Sooner is 100 times brighter than Boomer
  - (b) Boomer and Sooner both appear brighter than the sun
  - (c) Sooner is 100 times fainter than Boomer
  - (d) Boomer and Sooner are both fainter than any stars we could possibly see
7. The apparent magnitude of Sirius (the brightest star in the sky) is -1.5. The apparent visual magnitude of the full Moon is
- (a) 0
  - (b) 1.5
  - (c) 3.5
  - (d) none of the above
8. Hydrostatic equilibrium means that a star
- (a) will never change its size and temperature
  - (b) will change its size and temperature suddenly, similar to an explosion
  - (c) will change its size and temperature gradually, similar to a balloon slowly inflating or car tires responding to temperature changes
  - (d) will never die
9. In which spectral region is it possible for astronomers (in the U.S.) to observe 24 hours per day?
- (a) visual
  - (b) radio
  - (c) ultraviolet
  - (d) x-ray
10. We must use telescopes in space to observe
- (a) gamma-rays
  - (b) EM radiation emitted in the Balmer series of spectral lines
  - (c) visible light
  - (d) EM radiation like that observed with the VLA
11. The Keck telescope and the radio telescope at Arecibo works on the principle of
- (a) reflection
  - (b) diffraction
  - (c) scattering

- (d) refraction
12. Astronomers use telescopes, like the Keck telescope, in order to
- (a) gather the most light
  - (b) eliminate all of the “twinkling” of stars
  - (c) gain increased sensitivity in detecting X-rays
  - (d) all of these
13. The blue sky is caused by the
- (a) the absorption of red light by the earth’s atmosphere
  - (b) reflection of sunlight by the earth
  - (c) the refraction of starlight by the earth’s atmosphere
  - (d) the scattering of blue light by the earth’s atmosphere
14. Which of these has the lowest frequency?
- (a) ultraviolet radiation
  - (b) gamma rays
  - (c) infrared radiation
  - (d) x-rays
15. Which of the following properties of a photon is directly proportional to its frequency?
- (a) wavelength
  - (b) velocity
  - (c) energy
  - (d) temperature
16. Red light and blue light in our classroom both have the same
- (a) frequency
  - (b) wavelength
  - (c) photon energy
  - (d) velocity
17. The source of energy in the sun and the stars is mainly:
- (a) nuclear fission
  - (b) gravitational energy
  - (c) electromagnetic energy
  - (d) nuclear fusion
18. In the proton-proton cycle, a nucleus of normal helium is formed when

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(a) four protons collide simultaneously, producing one nucleus of ordinary (normal) helium

(b) two deuterium (heavy hydrogen) nuclei combine to produce 1 nucleus of ordinary (normal) helium

(c) two nuclei of light helium combine to produce 1 nucleus of normal helium

(d) a carbon nucleus splits into 3 nuclei of normal helium

19. Two protons come together in nuclear fusion

(a) only at low temperatures and densities

(b) only at high temperatures and densities

(c) only in the outer envelopes of stars

(d) only when the mood is right

20. It takes a very long time for two individual protons to form a new particle in the proton-proton (PP) cycle in the sun, but fusion is always occurring. How is this possible?

(a) the sun is fusing other particles as well as hydrogen

(b) the other steps in the PP cycle happen so fast that they can compensate for the slowness of the first step

(c) the sun has many protons available for fusion

(d) the sun is not fusing particles in the PP cycle, but instead works by the fusion of carbon with nitrogen and oxygen

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21. The fact that we detected fewer neutrinos from the Sun (in our neutrino experiments) that we had originally expected, only finding about 1/3 of the originally predicted number, tells us that

(a) our neutrino experiment was not working correctly

(b) the temperature of the center of the Sun is really only about 6,000 K so you would not expect as many neutrinos emitted

(c) neutrinos have a small mass which allow them to change into one of three different neutrino types, and we detected only one type

(d) the neutrinos are being absorbed by material in the center of the Sun so that only about 1/3 of the neutrinos are actually getting out of the Sun

22. If an atom emits a blue line when one of its electrons goes from the second to the first energy state, what wavelength radiation will be needed for the same electron in that atom to go from the first to the third energy state?

(a) 6,563 angstroms

- (b) 100 MHz (million cycles per second)
  - (c) x-rays
  - (d) infrared rays
23. A photon is absorbed by an atom to move an electron from one orbit to the next highest one. The electron returns to the original orbit, emitting a photon. This new photon
- (a) has a shorter wavelength than the one which was absorbed
  - (b) has the same wavelength as the one which was absorbed
  - (c) has a longer wavelength than the one which was absorbed
  - (d) in fact, the electron could not return to the original orbit
24. Light produced by a hot solid object (like an incandescent lamp) shines through a hot gas (like sodium) and is observed by a spectrograph.
- (a) the observed spectrum is continuous (no dark or bright lines)
  - (b) absorption (dark) lines are seen in the continuous spectrum
  - (c) emission (bright) lines are seen in the spectrum
  - (d) only the red light remains, the blue is all absorbed
25. Which of the following emits a continuous spectrum in the visible?
- (a) the earth
  - (b) a glowing piece of solid metal
  - (c) a thin, hot glowing gas
  - (d) the Moon
26. A low pressure (i.e., thin) hot glowing gas has
- (a) a continuous spectrum
  - (b) an absorption line spectrum
  - (c) an emission line spectrum
  - (d) all of the above
27. In order for an electron in an atom to make a transition from one orbit to a larger one
- (a) the atom must be supplied with a certain amount of energy
  - (b) the atom must get rid of a certain amount of energy
  - (c) the atom must be entirely isolated from its surroundings
  - (d) the nucleus of the atom must contain at least one neutron
28. A person emits mainly
- (a) radio waves
  - (b) infrared radiation

- (c) ultraviolet radiation  
(d) protons
29. The density of the center of the sun is most like
- (a) the earth's atmosphere  
(b) water  
(c) rocks  
(d) none of the above
30. The *average* density of the sun is
- (a) near that of water ( $1.0 \text{ gm/cm}^3$ )  
(b) near that of earth ( $5.5 \text{ gm/cm}^3$ )  
(c) near that of lead ( $11.4 \text{ gm/cm}^3$ )  
(d) much denser than lead
31. Granulation on the surface of the Sun is directly caused by
- (a) convection  
(b) hydrostatic equilibrium  
(c) sunspots  
(d) nuclear fusion
32. Which of the following terms refer to the same objects, viewed in different ways?
- (a) sunspots & filaments  
(b) filaments & prominences  
(c) prominences & sunspots  
(d) prominences & flares
33. Arrange the following features of the sun in order (lowest to highest) of temperature
- (a) sunspots, photosphere, center of sun, corona  
(b) photosphere, sunspots, corona, center of sun  
(c) sunspots, photosphere, corona, center of sun  
(d) photosphere, sunspots, center of sun, corona
34. Sunspots appear dark because
- (a) they lack magnetic fields  
(b) they are cooler than the surrounding photosphere  
(c) they are holes in the photosphere  
(d) of optical illusion

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35. X-rays from the sun only come from the corona. The reason that they don't come from the photosphere is that

- (a) the photosphere is too dense
- (b) the photosphere is too cool
- (c) the photosphere is too thin
- (d) the photosphere is too high in the atmosphere