Earth/Space Science Bowl Questions – 10/23/12

**TOSS-UP**

1) EARTH/SPACE *Multiple Choice* Which of the following statements concerning white dwarfs is false?

W) its degenerate gas resists compression

X) the pressure of its degenerate gas does not depend on temperature

Y) no white dwarf has become a black dwarf yet  
Z) a white dwarf can generate energy by nuclear fusion  
ANSWER: Z) A WHITE DWARF CAN GENERATE ENERGY BY NUCLEAR FUSION

**BONUS**

1) EARTH/SPACE *Short Answer* The gravitational fields of binary stars, combined with the rotation of the binary system, define a dumbbell-shaped volume around each star called what?

ANSWER: ROCHE LOBE

**TOSS-UP**

2) EARTH/SPACE *Short Answer* Identify all of the following four astronomical objects that have emission spectra containing hydrogen lines.

1: H II regions

2: planetary nebulae

3: Type I supernovae

4: Type II supernovae

ANSWER: 1, 2, AND 4 (H II REGIONS, PLANETARY NEBULAE, TYPE II SUPERNOVAE)

**BONUS**

2) EARTH/SPACE *Short Answer* What astronomical object is the cause of synchrotron radiation emitted by gas in the Crab Nebula?

ANSWER: “PULSAR” OR “NEUTRON STAR”

**TOSS-UP**

3) EARTH/SPACE *Multiple Choice* A type Ia supernova occurs when a white dwarf gaining mass in a binary star system exceeds the Chandrasekhar limit and collapses. The lack of a pressure-temperature thermostat leads to

W) helium flash

X) pulsation in brightness

Y) carbon deflagration

Z) nuclear fission

ANSWER: Y) CARBON DEFLAGRATION

**BONUS**

3) EARTH/SPACE *Short Answer* What is the maximum mass of a star in solar masses, such that if a star is under this limit, it can lose enough mass during its life to shrink under the Chandrasekhar limit and die as a white dwarf?

ANSWER: 8 SOLAR MASSES

**TOSS-UP**

4) EARTH/SPACE *Short Answer* Identify all of the following 4 events which are caused by the collapse of a massive star.

1: Type Ia supernova

2: Type Ib supernova

3: Type II supernova

4: carbon deflagration

ANSWER: 2 AND 3 (TYPE IB SUPERNOVA, TYPE II SUPERNOVA)

**BONUS**

4) EARTH/SPACE *Short Answer* Calculate the Schwarzschild radius, in terms of the gravitational constant G, for a star with a mass of , given that the speed of light is .

ANSWER: 2G METERS

**TOSS-UP**

5) EARTH/SPACE *Multiple Choice* If the collapsing core of a star is more massive than 1.4 solar masses, then it may become a mass of neutrons through a process known as

W) neutron capture

X) electron capture

Y) CNO cycle

Z) proton-proton chain

ANSWER: X) ELECTRON CAPTURE

**BONUS**

5) EARTH/SPACE *Short Answer* The principle that an object cannot change its brightness appreciably in an interval shorter than the time light takes to cross its diameter puts a limit on what characteristic of a pulsar?

ANSWER: “SIZE” OR “DIAMETER”

**TOSS-UP**

6) EARTH/SPACE *Multiple Choice* Which of the following phenomena, upon detection, indicates the formation of a neutron star?

W) burst of neutrinos

X) burst of neutrons

Y) gravitational radiation

Z) burst of gamma rays

ANSWER: W) BURST OF NEUTRINOS

**BONUS**

6) EARTH/SPACE *Short Answer* What is the term given to binary systems involving mass transfer to a neutron star, in which bursts of high energy photons occur when a large enough layer of degenerate fuel accumulates?

ANSWER: X-RAY BURSTERS

**TOSS-UP**

7) EARTH/SPACE *Short Answer* Identify all of the following 5 particles which are products of the CNO cycle.

1: proton

2: helium-4

3: neutrino

4: electron

5: carbon-12

ANSWER: 2, 3, AND 5 (HELIUM-4, NEUTRINO, CARBON-12)

**BONUS**

7) EARTH/SPACE *Multiple Choice* Low mass stars, including the sun, have

W) convective cores and convective envelopes

X) convective cores and radiative envelopes

Y) radiative cores and radiative envelopes

Z) radiative cores and convective envelopes

ANSWER: Z) RADIATIVE CORES AND CONVECTIVE ENVELOPES

**TOSS-UP**

8) EARTH/SPACE *Multiple Choice* Which of the following correctly describes the Algol paradox of binary systems?

W) the more massive star has become a giant, while the less massive star is still on the main sequence

X) the less massive star has become a white dwarf, while the more massive star is still on the main sequence

Y) the less massive star has become a giant, while the more massive star is still on the main sequence

Z) the more massive star has become a white dwarf, while the less massive star is still on the main sequence

ANSWER: Y) THE LESS MASSIVE STAR HAS BECOME A GIANT, WHILE THE MORE MASSIVE STAR IS STILL ON THE MAIN SEQUENCE

**BONUS**

8) EARTH/SPACE *Short Answer* In a binary star system, the two Roche lobes meet at which Lagrangian point?

ANSWER: L1 (ACCEPT “INNER LAGRANGIAN POINT”)

**TOSS-UP**

9) EARTH/SPACE *Short Answer* In a binary star system, mass transferred through the inner Lagrangian point toward one of the stars must conserve its angular momentum. If the star is small enough, what will the transferred mass form around the star?  
ANSWER: ACCRETION DISK

**BONUS**

9) EARTH/SPACE *Short Answer* What is the term given for the time between Earth’s closest approaches to the sun?

ANSWER: ANOMALISTIC YEAR

**TOSS-UP**

10) EARTH/SPACE *Short Answer* What is the name of the closest extrasolar planet to Earth?

ANSWER: ALPHA CENTAURI Bb

**BONUS**

10) EARTH/SPACE *Multiple Choice* Which of the following is the celestial equivalent of terrestrial longitude?

W) right ascension

X) hour angle  
Y) declination

Z) nutation

ANSWER: W) RIGHT ASCENSION

**TOSS-UP**

11) EARTH/SPACE *Short Answer* What is the type of reflecting telescope in which the light focused by the primary mirror is intercepted short of focal point and refocused by a secondary mirror through a hole in the center of the primary mirror?

ANSWER: CASSEGRAIN

**BONUS**

11) EARTH/SPACE *Multiple Choice* How far away from Earth is the Andromeda galaxy?

W) 200,000 light years

X) 2,000,000 light years

Y) 20,000,000 light years

Z) 200,000,000 light years

ANSWER: X) 2,000,000 LIGHT YEARS

**TOSS-UP**

12) EARTH/SPACE *Multiple Choice* The angular position of an object measured from a fixed point along the horizon is its

W) apoapsis

X) zenith

Y) azimuth

Z) declination

ANSWER: Y) AZIMUTH

**BONUS**

12) EARTH/SPACE *Short Answer* What is the rocking, swaying, or nodding motion in the axis of rotation of a largely axially symmetric object?

ANSWER: NUTATION

**TOSS-UP**

13) EARTH/SPACE *Short Answer* What is a pivoted support that allows the rotation of an object about a single axis?

ANSWER: GIMBAL

**BONUS**

13) EARTH/SPACE *Short Answer* What 3 degrees of freedom does a set of 3 gimbals mounted together provide?

ANSWER: ROLL, PITCH, AND YAW

**TOSS-UP**

14) EARTH/SPACE *Multiple Choice* Which of the following is not a primary physical property that is commonly used to identify a mineral?

W) hardness

X) cleavage

Y) habit

Z) double refraction

ANSWER: Z) DOUBLE REFRACTION

**BONUS**

14) EARTH/SPACE *Short Answer* What property does a mineral with chemical bonds that are equally strong in all directions exhibit?

ANSWER: FRACTURE

**TOSS-UP**

15) EARTH/SPACE *Multiple Choice* What shape does a mineral with 3 directions of cleavage that meet at 90 degrees cleave to?

W) flat sheet

X) rhombohedron

Y) cube

Z) octahedron

ANSWER: Y) CUBE

**BONUS**

15) EARTH/SPACE *Short Answer* If Fluorite is a mineral that cleaves to form octahedrons, how many directions of cleavage does it have?

ANSWER: 4

**TOSS-UP**

16) EARTH/SPACE *Short Answer* The crystals of some minerals undergoing stress will recrystallize with a preferred orientation, perpendicular to the compressional force. What appearance does the resulting mineral alignment give?  
ANSWER: FOLIATED TEXTURE

**BONUS**

16) EARTH/SPACE *Short Answer* Identify all of the following 5 rocks which are nonfoliated metamorphic rocks.

1: Quartzite

2: Gneiss

3: Marble

4: Schist

5: Anthracite

ANSWER: 1, 3, AND 5 (QUARTZITE, MARBLE, ANTHRACITE)

**TOSS-UP**

17) EARTH/SPACE *Multiple Choice* What is the texture of an igneous rock that has large crystals embedded in a matrix of smaller crystals?

W) fine-grained

X) glassy

Y) coarse-grained

Z) porphyritic

ANSWER: Z) PORPHYRITIC

**BONUS**

17) EARTH/SPACE *Short Answer* What texture arises when ions in molten rock do not have enough time to unite into an orderly crystalline structure?

ANSWER: GLASSY

**TOSS-UP**

18) EARTH/SPACE *Multiple Choice* Which of the following igneous rocks is an intrusive andesitic rock?

W) Andesite

X) Diorite

Y) Rhyolite

Z) Gabbro

ANSWER: X) DIORITE

**BONUS**

18) EARTH/SPACE *Short Answer* Bowen’s reaction series begins and ends with what minerals?

ANSWER: BEGINS WITH OLIVINE, ENDS WITH QUARTZ

**TOSS-UP**

19) EARTH/SPACE *Multiple Choice* An example of a rock whose minerals have been crushed into thin sheets or bands is

W) shale

X) conglomerate

Y) schist

Z) granite

ANSWER: Y) SCHIST

**BONUS**

19) EARTH/SPACE *Short Answer* What is the term given for the formation of one or more secondary magmas from a single parent magma?

ANSWER: MAGMATIC DIFFERENTIATION

**TOSS-UP**

20) EARTH/SPACE *Multiple Choice* Which of the following is not a type of crystal shape or habit?

W) conchoidal

X) botryoidal

Y) banded

Z) prismatic

ANSWER: W) CONCHOIDAL

**BONUS**

20) EARTH/SPACE *Short Answer* What cleavage does feldspar exhibit?  
ANSWER: 2 PLANES AT 90 DEGREES

**TOSS-UP**

21) EARTH/SPACE *Multiple Choice* Which of the following 4 materials is the hardest?   
W) gypsum  
X) quartz  
Y) diamond  
Z) carbon nitride  
ANSWER: Z) CARBON NITRIDE

**BONUS**

21) EARTH/SPACE *Short Answer* What is the name of the phenomenon that causes an accumulation of heat in the lower atmosphere because of the absorption of longwave radiation from the Earth's surface?

ANSWER: GREENHOUSE EFFECT

**TOSS-UP**

22) EARTH/SPACE *Short Answer* What is the name given to a region where one plate of the earth's crust is sliding under another?

ANSWER: SUBDUCTION ZONE

**BONUS**

22) EARTH/SPACE *Multiple Choice* The tectonic plates on which India and the adjacent portion of Asia ride are colliding at a rate of

W) 1-10 millimeters per year

X) 1-10 centimeters per year

Y) 1-10 meters per year

Z) 1-10 decimeters per year

ANSWER: 1-10 CENTIMETERS PER YEAR

**TOSS-UP**

23) EARTH/SPACE *Multiple Choice* Which physical phenomenon or principle is most often applied in the search for petroleum reservoirs?

W) gravitational attraction

X) magnetic field distortions

Y) natural radioactive decay of minerals

Z) acoustic wave transmission and reflection

ANSWER: Z) ACOUSTIC WAVE TRANSMISSION AND REFLECTION

**BONUS**

23) EARTH/SPACE *Short Answer* On a topographic map, what are the lines that indicate water depth termed?

ANSWER: BATHYMETRIC LINES

**TOSS-UP**

24) EARTH/SPACE *Short Answer* During which period, in the earth's history, did MOST dinosaurs become extinct?

ANSWER: CRETACEOUS

**BONUS**

24) EARTH/SPACE *Multiple Choice* The disappearance of the dinosaurs also marks the end of which geological era?

W) Precambrian   
X) Mesozoic  
Y) Cenozoic  
Z) Cambrian  
ANSWER: X) MESOZOIC

**TOSS-UP**

25) EARTH/SPACE *Short Answer* What is the circle of latitude on Earth that marks the most northerly position at which the Sun may appear directly overhead at its zenith?

ANSWER: TROPIC OF CANCER

**BONUS**

25) EARTH/SPACE *Short Answer* Which hypothesis states that small changes in Earth’s orbit, precession, and inclination affect Earth’s climate and can cause ice ages?

ANSWER: MILANKOVITCH HYPOTHESIS