Round 5

TOSSUP

1) CHEMISTRY *Short Answer* Which quantum number determines the orientation of the electrons?

ANSWER: SPIN QUANTUM NUMBER (ACCEPT: S)

BONUS

1) CHEMISTRY *Short Answer* If 44 grams of C3H8 are combusted in excess oxygen, what mass, in grams, of carbon dioxide is produced?

ANSWER: 132

TOSSUP

2) EARTH AND SPACE *Multiple Choice* What is the name of the great circle that represents the sun's apparent path through the sky?

W) Ecliptic
X) Solar Circle
Y) Eclipse Path
Z) Circumstellar

ANSWER: W) ECLIPTIC

BONUS

2) EARTH AND SPACE *Short Answer* Which of Jupiter's moons is the smoothest celestial body in the Solar System, and its smoothness is evidence that it may harbor life?

ANSWER: EUROPA

TOSSUP

3) PHYSICS *Multiple Choice* What law predicts the ultraviolet catastrophe, the prediction that as the wavelength a black body emitted grew shorter, the blackbody would produce infinite energy?

W) Wien's distribution law
X) Rayleigh-Jeans Law
Y) Planck's Law
Z) Stefan-Boltzmann Law

ANSWER: X) RAYLEIGH-JEANS LAW

BONUS

3) PHYSICS *Short Answer* A car is moving in a straight line from point A to Point B. The car's velocity at point A is 10m/s. It will start to accelerate at Point A with 5 m/s^2, How far it will travel after 10 seconds?

ANSWER: 350 M

TOSSUP

4) BIOLOGY *Multiple Choice* Which of the following sets of reactions occurs in the stroma of the chloroplast in plant cells?

W) Calvin cycle
X) Krebs cycle
Y) Fermentation
Z) Decarboxylation

ANSWER: W) CALVIN CYCLE

BONUS

4) BIOLOGY *Multiple Choice* What lineage of Cnidarians exist only as polyps as adults. Many build calcium carbonate exoskeletons and have a mutualistic relationship with photosynthetic protists.

W) Hydrozoa
X) Scyphozoa
Y) Cubozoa
Z) Anthozoa

ANSWER: Z) ANTHOZOA

TOSSUP

5) EARTH AND SPACE *Short Answer* This is a process that occurs in multiple macronutrient cycles: In this step, producers absorb elements from the soil, and they incorporate the nutrients into their tissues.

ANSWER: ASSIMILATION

BONUS

5) EARTH AND SPACE *Short Answer* By name or number, identify which of the following 3 statements are true regarding the nitrogen cycle. 1) Nitrification oxidizes ammonia into nitrite and then nitrate. 2) Nitrogen fixation converts ammonia to atmospheric nitrogen, 3) Organic waste is converted into inorganic substances through ammonification.

ANSWER: 1 AND 3 (NITRIFICATION OXIDIZES AMMONIA INTO NITRITE AND THEN NITRATE AND ORGANIC WASTE IS CONVERTED INTO INORGANIC SUBSTANCES THROUGH AMMONIFICATION)

TOSSUP

6) PHYSICS *Short Answer* The first confirmed Bose-Einstein Condensate was created using what cooling technique that uses a namesake phenomenon to change the momentum of the particles?

ANSWER: LASER COOLING (ACCEPT: DOPPLER COOLING)

BONUS

6) PHYSICS *Short Answer* What is the name of the four-dimensional manifold that is commonly associated with special relativity, and is named after one of Einstein's professors?

ANSWER: MINKOWSKI SPACE (ACCEPT MINKOWSKI SPACETIME)

TOSSUP

7) CHEMISTRY *Short Answer* Name this hydrocarbon: C_2H_4

ANSWER: ETHYLENE (ACCEPT: ETHENE)

BONUS

7) CHEMISTRY *Short Answer* What is the name of this thermochemical cycle that calculates the lattice energy for a compound by using Hess's law on a series of well-defined processes that show the formation of an ionic compound?

ANSWER: BORN-HABER CYCLE

TOSSUP

8) BIOLOGY *Short Answer* What is the name of fluid found in the brain and spinal cord that helps protect the brain and is produced in the choroid plexus?

ANSWER: CEREBROSPINAL FLUID (CSF)

BONUS

8) BIOLOGY *Short Answer* What level of protein structure includes alpha helices and beta sheets?

ANSWER: SECONDARY STRUCTURE

TOSSUP

9) ENERGY *Short Answer* What is this type of energy, researched at the Lawrence Berkeley National Laboratory, that is theorized to be the cause of the accelerating expansion of the universe?

ANSWER: DARK ENERGY

BONUS

9) ENERGY *Short Answer* One explanation for dark energy is that space itself has energy, and as more space comes into existence, there is more energy for the space to expand. What term in Einstein's field equations accounts for this energy?

ANSWER: COSMOLOGICAL CONSTANT

TOSSUP

10) CHEMISTRY *Short Answer* What substance is an alloy of copper and zinc and has a golden tinge?

ANSWER: BRASS

BONUS

10) CHEMISTRY *Multiple Choice* Which of the following acids has the strongest conjugate base?

W) Hydrochloric Acid
X) Perchloric acid
Y) Hydrofluoric acid
Z) Nitric acid

ANSWER: Y) HYDROFLUORIC ACID

TOSSUP

11) BIOLOGY *Multiple Choice* Which of the following tissues in an actively photosynthesizing plant would have the highest rate of oxygen production?

W) cortex
X) palisade mesophyll
Y) epidermis
Z) vascular cambium

ANSWER: X) PALISADE MESOPHYLL

BONUS

11) BIOLOGY *Short Answer* During DNA replication, the helix unwinds and one new DNA strand is copied continuously in the direction of unwinding. DNA polymerase copies the other strand in short lengths, in the opposite direction to DNA unwinding. What is the name for the short lengths of DNA synthesized on this lagging strand?

ANSWER: OKAZAKI FRAGMENTS

TOSSUP

12) MATH *Multiple Choice* Which of the following is not a Pythagorean triple?

W) 20, 21, 28
X) 12, 35, 37
Y) 9, 40, 41
Z) 28, 45, 53

ANSWER: W) 20, 21, 28

BONUS

12) MATH *Short Answer* Jack and Jill are painting a wall. If Jack was working alone, he could get the job done in 20 minutes, while Jill could have finished the task in 30 minutes. If the two work together, how long would it take, in minutes, for the wall to be painted, assuming they both work at their maximum rates?

ANSWER: 12

TOSSUP

13) PHYSICS *Multiple Choice* Which of the following statements regarding entropy is not true?

W) The total entropy change during any reversible cycle is zero
X) Entropy remains constant in Carnot Cycle
Y) In some special cases the total entropy changes could be smaller than zero
Z) Entropy provides a quantitative measure of disorder

ANSWER: Y) IN SOME SPECIAL CASES THE TOTAL ENTROPY CHANGES COULD BE SMALLER THAN ZERO

Commented [1]: this is also an incorrect statemetn

BONUS

13) PHYSICS *Short Answer* What is the name of the line that minimizes the distance between two points, and is the path that an object takes when under the influence of gravity?

ANSWER: GEODESIC

TOSSUP

14) ENERGY *Short Answer* What thermodynamic quantity is equal to the enthalpy (of a system or process) minus the product of the entropy and the absolute temperature.

ANSWER: GIBBS FREE ENERGY

BONUS

14) ENERGY *Short Answer* Gibbs Free Energy determines the spontaneity of a reaction. Identify which of the following four reactions is spontaneous. 1) Electrolysis of water, 2) Combustion of methane, 3) Rusting of iron, 4) Redox reaction with zinc at anode and copper at cathode.

ANSWER: 2,3,4 (COMBUSTION OF METHANE, RUSTING OF IRON, REDOX REACTION WITH ZINC AT ANODE AND COPPER AT CATHODE)

TOSSUP

15) MATH *Short Answer* What is the derivative of (2x-3)^4 (open parenthesis 2x minus 3 close parenthesis to the fourth)

ANSWER: 8(2X-3)^3

BONUS

15) MATH *short answer* What is the sum of the first 12 terms of the geometric sequence whose first three terms are 1, 2, and 4?

ANSWER: 4095

TOSSUP

16) CHEMISTRY *Multiple Choice* Which of the following elements has 3 valence electrons?

W) Nitrogen
X) Boron
Y) Carbon
Z) Phosphorous

ANSWER: X) BORON

BONUS

16) CHEMISTRY *Multiple Choice* Which of the following compounds would be expected to have the greatest lattice binding energy?

W) LiNO3
X) LiF
Y) KI
Z) NH4Br

ANSWER: X) LIF

TOSSUP

17) BIOLOGY *Multiple Choice* All of the following characteristics are typical of r-selected species except

W) high reproductive rate
X) small body size
Y) high competitive ability
Z) minimal parental care

ANSWER: Y) HIGH COMPETITIVE ABILITY

BONUS

17) BIOLOGY *Short answer* What class and superclass do turtles belong to?

ANSWER: REPTILIA AND TETRAPODA RESPECTIVELY

TOSSUP

18) MATH *Short Answer* What is the area bounded by f(x) = 3x^2 and the x-axis from x = 3 to x = 6?

ANSWER: 189

BONUS

18) MATH *Short Answer* Find the value of the (5th derivative of x to the power of 5) plus (the 4th derivative of the natural logarithm of x) when x = 1.

ANSWER: 114

TOSSUP

19) EARTH AND SPACE *Multiple Choice* What soil horizon is generally located at the top and contains humus and organic material?

W) O Horizon
X) C Horizon
Y) B Horizon
Z) E Horizon

ANSWER: W) O Horizon

BONUS

19) EARTH AND SPACE *Multiple Choice* An unprecedented fire has swept through a watershed and has destroyed all of the vegetation in the area. What is most likely to happen to the river that the watershed feeds into after the fire?

W) The stream's dissolved oxygen content will increase for a while.
X) The average water level will rise for a while.
Y) The erosion around the stream will decrease for a while.
Z) The water's pH will immediately decrease after the fire.

ANSWER: X) THE AVERAGE WATER LEVEL WILL RISE FOR A WHILE.

TOSSUP

20) ENERGY *Multiple Choice* Which of the following has the highest boiling point?

W) Methane
X) Ethane
Y) Propane
Z) Butane

ANSWER: Z) BUTANE

BONUS

20) ENERGY *Short Answer* Identify which of the following 4 alkanes is a liquid at STP.
1) Butane, 2) Ethane, 3) Decane, 4) Hexadecane

ANSWER: 3 AND 4 (DECANE AND HEXADECANE)

TOSSUP

21) MATH *Multiple Choice* Which of the following is the range for the function f(x) = (3x^2+1)/(2x^3-x^2+2)?

W) All real numbers
X) All real numbers but -3
Y) All real numbers but 0
Z) All real numbers but 3/2

ANSWER: Y) ALL REAL NUMBERS BUT 0

BONUS

21) MATH *Short Answer* Given that a and b are the roots of the quadratic function x^2 - 10x + 18, find the value of a^3 + b^3.

ANSWER: 460

TOSSUP

22) PHYSICS *Multiple Choice* Which of the following quantities is not unitless?

W) Coefficient of friction
X) Spring constant
Y) Index of refraction
Z) Specific gravity

ANSWER: X) SPRING CONSTANT

BONUS

22) PHYSICS *Short Answer* What is the linear momentum of a 1000 kilogram car, in kg.m/s, that is going around in a circle with radius 4 meters with a centripetal acceleration of 16 meters per second squared.

ANSWER: 8000 (KG.M/S)

TOSSUP

23) EARTH AND SPACE *Multiple Choice* Which of the following is not true about white dwarfs?

W) Black dwarfs are theoretical constructs that form when white dwarfs essentially stop emitting light and heat.
X) If a white dwarf's mass exceeds the Chandrasekhar limit, it ends its life in a supernova.
Y) The nearest known white dwarf is Sirius B
Z) Arthur Eddington coined the term "white dwarf"

ANSWER: Z) Arthur EDDINGTON COINED THE TERM "WHITE DWARF"

BONUS

23) EARTH AND SPACE *Short Answer* The Sun will become a red giant in the future. An expanding, glowing shell of ionized gas is ejected from red giant stars late in their lives, which creates what type of nebula?

ANSWER: PLANETARY (NEBULA)