Iolani Science Bowl Invitational
Single Elimination 2

Tossup

Earth and Space - *Short Answer* Identify all of the following 4 types of precipitation that are liquid at some point as they fall to Earth. I. Hail; II. Virga; III. Sleet; IV. Snow

Answer: II, III [RE]

Bonus

Earth and Space - *Multiple Choice* Brennan's shipping company is shipping 100 thousand rubber ducks from China to Seattle. Unfortunately, a terrible Alaskan storm wrecks their boat and the rubber ducks are spilled in the Northern Pacific gyre. Where will the most rubber ducks accumulate with respect to the gyre?

W) To the east
X) To the west
Y) To the south
Z) In the middle

Answer: Z) IN THE MIDDLE [RE]

Tossup

Biology - *Multiple Choice* Which of the following animals would you expect to have the longest alimentary canal?

W) Koala
X) Lion
Y) Human
Z) Shark

Answer: W) Koala

Bonus

Biology - Multiple Choice Which of the following hormones does NOT play a role in apical dominance?

W) Auxin
X) Cytokinin
Y) Ethylene
Z) Strigolactone

Answer: Y) ETHYLENE

Tossup

Chemistry - *Multiple Choice* The principal quantum number of an electron determines
W) The size of its orbital
X) The shape of its orbital
Y) The orientation of its orbital
Z) The value of its spin

Answer: W) THE SIZE OF ITS ORBITAL [AI]

Bonus

Chemistry - *Multiple Choice* Which of the following has the largest ionic radius?
W) S^{2-}
X) Cl^{-}
Y) Ar
Z) K^{+}

Answer: W) S^{2-} [JK]

Tossup

Math - *Multiple Choice* - How many solutions on the closed interval from 0 to 2pi does the equation cos(x) = sin(x) have?

W) 0
X) 1
Y) 2
Z) 3

Answer: Y) 2 [RE]

Bonus

Math - *Multiple Choice* What is the sum of all the coefficients in the expansion of the polynomial (x + y)^6?

W) 64
X) 81
Y) 729
Z) 2048

Answer: W) 64 [RE]

Tossup

Physics - *Short Answer* What are the 3 flavors of neutrinos?

Answer: MUON, ELECTRON, AND TAU (Accept any order) [RE]

Bonus

Physics - *Multiple Choice* 4 objects are released at the same time down a ramp. If they roll without slipping, in what order do the objects reach the bottom from first to last? I. Hoop; II. Solid Sphere; III. Cylinder; IV. Hollow Sphere

Answer: II, III, IV, I [RE]

Tossup

Earth and Space - *Short Answer* The methods used to determine distances to various objects are most effective at their ideal distance ranges. Order the following three methods in order of increasing ideal ranges. I. Hubble's Law; II. Cepheid Variables; III. Parallax

Answer: III, II, I [AE]

Bonus

Earth and Space - *Short Answer* What is the name of the nuclear fusion process occurring at the center of a red giant?

Answer: TRIPLE ALPHA PROCESS [AE]

Tossup

Biology - *Multiple Choice* Which one of the following is NOT a post-transcriptional modification of pre-mRNA?

W) 5' Cap [5 PRIME Cap]
X) 3' UTR [3 PRIME UTR]
Y) Splicing
Z) Poly A Tail

Answer: X) 3' UTR

Bonus

Biology - *Short Answer* Brennan the cellular biologist wants to visualize regions in a plant cell using a dye that is only fluorescent in acidic environments. Identify all of the four following regions where you would expect to find fluorescence: I - Mitochondrial Matrix, II - Mitochondrial Intermembrane Space, III - Thylakoid Lumen, IV - Chloroplast Stroma

Answer: II, III

Tossup

Chemistry - *Short Answer* A weak acid has a Ka value of 2.0 times 10 to the -5. What is the Kb value of its conjugate base?

Answer: 5.0x10^-10 [AI]

Bonus

Chemistry - *Short Answer* With six sigma-bonds, three pi-bonds, and six carbon atoms, what is the bond order of benzene?

Answer: 1.5 [JK]

Tossup

Math - *Short Answer* What is the value of 5i^5 - 3i^4 in the form of a + bi?

Answer: -3 + 5i (Accept: 5i - 3) [RE]

Bonus

Math - *Short Answer* - Brennan the magician modifies a standard deck of 52 cards so that there are no cards with faces or prime numbers. What is the expected value of a card he randomly selects from this new deck?

Answer: 19/3 (Accept: 6 and 1/3) [RE]

Tossup

Physics - *Short Answer* The conductivity of a material is given by the resistivity raised to what power?

Answer: -1 [RE]

Bonus

Physics - *Multiple Choice* Which of the following best describes the distribution of charge on a charged copper sphere?

W) Concentrated at the center
X) Concentrated more at the center than at the outside
Y) Evenly distributed throughout its volume
Z) Evenly distributed along the outer surface

Answer: Z) EVENLY DISTRIBUTED ALONG THE OUTER SURFACE [RE]

Tossup

Earth and Space - *Short Answer* Olivine forms a solid solution in which magnesium is replaced by iron. The magnesium-rich end member is called forsterite. What is the name of the iron-rich end member?

Answer: Fayalite [RE]

Bonus

Earth and Space - *Multiple Choice* Which of the following types of soil would you be likely to find in an area underlain with significant amounts of permafrost?

W) Alfisols
X) Histosols
Y) Oxisols
Z) Gelisols

Answer: Z) GELISOLS [RE]

Commented [1]: this pair feels REALLY HARD compared to the rest of the round

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Tossup

Biology - *Short Answer* Porgs have either white, grey, or black fur. Wookies hunt Porgs on black and white chessboards. As a result, grey Porgs have difficulty hiding compared to their white and black counterparts. What type of selection do you expect to see in Porgs?

Answer: DISRUPTIVE SELECTION

Bonus

Biology - *Short Answer* Brennan has been diagnosed with Hashimoto's Disease, a form of hypothyroidism. Identify all of the following four symptoms Brennan would be expected to have: I - Rapid Heartbeat, II - Weight Loss, III - Thyroid Swelling, IV - Increased Sensitivity to Cold

Answer: III, IV

Tossup

Chemistry - *Multiple Choice* Which of the following best describes the relationship between 1,4-heptadiene and 4,7-heptadiene?

W) Same compound
X) Structural isomers
Y) Diastereomers
Z) Enantiomers

Answer: W) SAME COMPOUND [RE]

Commented [2]: connor says this is bad (i do not know)

Commented [3]: should be 3,6-heptadiene i think

Bonus

Chemistry - *Multiple Choice* The beta minus decay of potassium 42 creates which of the following isotopes?

W) Calcium 41
X) Calcium 42
Y) Calcium 43
Z) Scandium 43

Answer: X) CALCIUM 42 [RE]

Tossup

Math - *Multiple Choice* The range of some function f(x) is the closed interval from -5 to 10. If g(x) is f inverse of x divided by the quantity (x - 7), what is the domain of g(x)?
W) All real numbers between 5 and 10
X) All real numbers between 5 and 10, excluding 7
Y) All real numbers between -5 and 10
Z) All real numbers between -5 and 10, excluding 7

Answer: Z) ALL REAL NUMBERS BETWEEN -5 AND 10, EXCLUDING 7 [RE]

Bonus

Math - *Short Answer* What value of x satisfies the equation log base 4 of quantity x + 7 equals log base 16 of quantity x + 13?

Answer: -4 [RE]

Tossup

Physics - *Short Answer* The energy of a photon is proportional to its wavelength raised to what power?

Answer: -1 [RE]

Bonus

Physics - *Multiple Choice* Which of the following is not an equivalent unit to the watt?

W) Joule per second
X) Volt amp
Y) Newton meter per second
Z) Volt per ohm

Answer: Z) VOLT PER OHM [RE]

Tossup

Earth and Space - *Short Answer* Identify all of the following statements that are true of open clusters compared with globular clusters. I. Open clusters are older; II. Open clusters have fewer stars; III. Open clusters are more metallic; IV. Open clusters are more uniformly shaped.

Answer: II, III [AE]

Bonus

Earth and Space - *Short Answer* A planet orbits a star of 3 solar masses with a semi-major axis of 12 AU. In years, what is the period of this planet?

Answer: 24 [AE]

Tossup

Biology - *Multiple Choice* Removing which of the following plant structures will lead to a lack of phototropism in a plant?

W) Apical Meristem
X) Vascular Cylinder
Y) Root Hairs
Z) Root Cap

Answer: W) APICAL MERISTEM

Bonus

Biology - *Short Answer* Brennan is studying hemophilia in a human population at Hardy-Weinberg equilibrium. He notices that 5% of males are affected by the disease. Given that hemophilia is a sex-linked trait, what is the frequency of hemophilia allele?

Answer: 0.05 (Accept: 5%)

Tossup

Chemistry - *Multiple Choice* The dipole moment of a neutral diatomic molecule depends on all of the following except?

W) distance between atomic nuclei
X) magnitude of charge
Y) percent ionic character
Z) sign of charge on the larger atom

Answer: Z) SIGN OF CHARGE ON THE LARGER ATOM [JK]

Bonus

Chemistry - *Multiple Choice* Permanganate is often used as an oxidizing agent due its high reduction potential. How many electrons are involved in the half-reaction where permanganate is reduced to manganese (II)?

W) 1
X) 3
Y) 5
Z) 7

Answer: Y) 5 [AI]

Tossup

Math - *Short Answer* What is the derivative of the function xsin(x) [x times sin of x] with respect to x?

Answer: xcos(x) + sin(x) (Accept: sin(x) + xcos(x)) [RE]

Bonus

Math - *Short Answer* The set of integers 1, 3, 9, 11, and x has the same mean and median. What is the sum of the two largest possible values of x?

Answer: 27 [RE]

Tossup

Physics - *Multiple Choice* Which of the following best explains why birds are able to stand on exposed high voltage electric wires without being shocked?

W) Their feet are strong enough insulators to prevent current from flowing through them
X) The wires quickly oxidize upon contact forming an insulating layer
Y) The alternating current creates such a quickly oscillating voltage that they do not get shocked
Z) They are not connected to a surface of lower voltage so there is no voltage difference driving current through their bodies

Answer: Z) THEY ARE NOT CONNECTED TO A SURFACE OF LOWER VOLTAGE SO THERE IS NO VOLTAGE DIFFERENCE DRIVING CURRENT THROUGH THEIR BODIES [RE]

Bonus

Physics - *Multiple Choice* A large number of physics equations take the form of ½ ax^2 where a and x are relevant quantities. This is mathematically due to the integration of which of the following functions of x?

W) a/x
X) ax
Y) ax^2
Z) ax^3

Answer: X) ax [RE]