Iolani Science Bowl Invitational
Round Robin 3

Tossup

Earth and Space - *Short Answer* Identify all of the following types of fronts that require at least 2 cold air masses to be present? I. Cold; II. Warm; III. Occluded

Answer: III only [RE]

Bonus

Earth and Space - *Short Answer* What name is given to the steeply sloping section of a subducting plate where a large number of earthquakes originate from?

Answer: WADATI-BENIOFF ZONE [RE]

Tossup

Biology - *Multiple Choice* Brennan is tracking the fate of the carbons in a glucose molecule in both eukaryotes and prokaryotes. To distinguish these carbons, he adds radioactive Carbon-13 glucose to cultures of the cells of interest. Which of the following molecules would Brennan NOT expect to be radioactive?

W) Pyruvate
X) Acetyl CoA
Y) Ethanol
Z) NADH

Answer: Z) NADH

Bonus

Biology - *Short Answer* If the embryo of an angiosperm has 32 chromosomes, how many chromosomes does the endosperm have?

Answer: 48

Tossup

Chemistry - *Short Answer* What is the oxidation number of the chlorine atom in a perchlorate ion?

Answer: +7 (Accept: 7) [AI]

Bonus

Chemistry - *Short Answer* According to Molecular Orbital Theory, oxygen gas has how many anti-bonding electrons?

Answer: 6 [JK]

Tossup

Math - *Short Answer* What is the value of sin(30º)^2 + cos(30º)^2 [sin squared 30 degrees plus cosin squared 30 degrees] in simplest radical form?

Answer: 1 [RE]

Bonus

Math - *Multiple Choice* Brennan the metal worker creates an aluminum sphere of radius 5 meters. If he then proceeds to melt the sphere and cast it into cubes of side length 5 meter, how many cubes can he make?

W) 1
X) 2
Y) 3
Z) 4

Answer: Z) 4 [RE]

Tossup

Physics - *Short Answer* What name is given to the phase transition between solid and gas?

Answer: SUBLIMATION [RE]

Bonus

Physics - *Short Answer* What principle states that a change in pressure is transmitted to the rest of the fluid undiminished?

Answer: PASCAL'S PRINCIPLE [RE]

Tossup

Earth and Space - *Short Answer* What is the name for the region on the HR diagram where Cepheid (*se-fee-id*) and RR Lyrae (*lee-ray*) variable stars lie?

Answer: INSTABILITY STRIP [AE]

Bonus

Earth and Space - *Short Answer* What is the name for the radius of a black hole's event horizon?

Answer: SCHWARZSCHILD RADIUS [AE]

Tossup

Biology - *Multiple Choice* Which of the following macromolecule groups contains both nitrogen and phosphorus?

W) Carbohydrates
X) Proteins
Y) Lipids
Z) Nucleic Acids

Answer: Z) NUCLEIC ACIDS

Bonus

Biology - *Multiple Choice* As a competitor listens to a science bowl question, their sympathetic nervous system activates. Which of the following is not a result of sympathetic nervous system activation?

W) Increased Heart Rate
X) Widened Bronchial Passages
Y) Pupil Constriction
Z) Blood Vessel Constriction

Answer: Y) PUPIL CONSTRICTION

Tossup

Chemistry - *Multiple Choice* Which of the following atoms would require the most energy to remove an electron from?
W) N
X) N^+
Y) F
Z) F^+

Answer: Z) F^+ [AI]

Bonus

Chemistry - *Multiple Choice* Which of the following acids is not polyprotic?

W) Carbonic Acid
X) Oxalic Acid
Y) Phosphoric Acid
Z) Nitric Acid
Answer: Z) NITRIC ACID [AE]

Tossup

Math - *Multiple Choice* The magnitude of the cross product between two vectors is maximized when the angle between the two vectors is what?

W) 0 degrees
X) 45 degrees
Y) 90 degrees
Z) 180 degrees

Answer: Y) 90 DEGREES [RE]

Bonus

Math - *Multiple Choice* The sum of an infinitely decreasing geometric series is 1. If its first term is x, what is the common ratio in terms of x?

W) x + 1
X) x
Y) 1 - x
Z) x^2

Answer: Y) 1 - x [RE]

Tossup

Physics - *Short Answer* The Stefan-Boltzmann law states that the radiative intensity of a blackbody is proportional to the temperature raised to what power?

Answer: 4 [RE]

Bonus

Physics - *Short Answer* Brennan's car is moving at 25 m/s and suddenly stops over a distance of 1 meter. How many g's does Brennan experience rounded to the nearest g?

Answer: 32 [RE]

Tossup

Earth and Space - *Multiple Choice* The Enhanced Fujita Scale was developed to describe the intensity of which of the following phenomena?

W) Tornadoes
X) Earthquakes
Y) Volcanic Eruptions
Z) Hurricanes

Answer: W) TORNADOES [RE]

Bonus

Earth and Space - *Multiple Choice* Which of the following best explains why building a well on a confined aquifer is advantageous to building onto an unconfined aquifer?

W) Confined aquifers are more protected from polluted rainwater
X) The recharge time of confined aquifers is much quicker
Y) Confined aquifers are pressurized so water doesn't need to be pumped to the surface
Z) Confined aquifers are typically much larger

Answer: Y) CONFINED AQUIFERS ARE PRESSURIZED SO WATER DOESN'T NEED TO BE PUMPED TO THE SURFACE [RE]

Tossup

Biology - *Short Answer* What is the maximum observable recombination frequency between two genes on the same chromosome?

Answer: 50% (Accept: 0.5)

Bonus

Biology - *Short Answer* Order the following three chambers of the heart based on the order blood will flow through them after it has exited the left atrium: I - Left Ventricle, II - Right Atrium, III - Right Ventricle

Answer: I, II, III

Tossup

Chemistry - *Short Answer* Given a reaction with constant concentrations of the reactants, the reaction rate of aqueous barium chloride with silver nitrate to form barium nitrate and silver chloride is proportional to the concentration of silver chloride raised to what power?

Answer: 0 [RE]

Bonus

Chemistry - *Multiple Choice* Which of the following best describes the trend in melting point as you move across the group on the periodic table?

W) Always increases
X) Always decreases
Y) Increases towards the middle
Z) Decreases towards the middle

Answer: Y) INCREASES TOWARDS THE MIDDLE [RE]

Tossup

Math - *Short Answer* The ratio of consecutive terms in the Fibonacci sequence approaches which of the following mathematical constants?

W) e
X) Pi
Y) i
Z) The Golden Ratio

Answer: Z) THE GOLDEN RATIO [RE]

Bonus

Math - *Short Answer* Suppose that an equilateral triangle simultaneously has a circle inscribed and circumscribed about it. What is the ratio of the area of the circumscribed circle to that of the inscribed circle?

Answer: 4 (Accept: 4 to 1) [RE]

Tossup

Physics - *Short Answer* What color does a red shirt primarily reflect?

Answer: RED [RE]

Bonus

Physics - *Short Answer* 5, 1 farad capacitors are wired in series. How much charge, in coulombs, is stored across all the capacitors if they are then connected to a 10V battery?

Answer: 50 COULOMBS [RE]

Tossup

Earth and Space - *Multiple Choice* Which of the following is not a requirement for a celestial body to be classified as a planet?

W) It's in hydrostatic equilibrium
X) It has cleared its orbit of debris
Y) Its mass is at least 10% of Earth's
Z) It directly orbits its central star

Answer: Y) ITS MASS IS AT LEAST 10% OF EARTH'S [AE]

Bonus

Earth and Space - *Short Answer* Order the following four planets by mass in increasing order. I. Earth; II. Mars; III. Jupiter; IV. Saturn

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

Tossup

Biology - *Short Answer* Brennan wants to track the growth of a tree. He sticks a pole in the trunk of the tree 5 feet above the ground. If the tree grows at a rate of 1 foot/2 years, how far above the ground will Brennan's pole be in 10 years?

Answer: 5 FEET

Bonus

Biology - *Multiple Choice* Steroid hormones such as testosterone and estrogen are hydrophobic. Which of the following would be the least likely place for a steroid hormone receptor to be found?

W) Cell Membrane
X) Nucleus
Y) Cytoplasm
Z) Mitochondria

Answer: W) CELL MEMBRANE

Tossup

Chemistry - *Multiple Choice* Which of the following elements react most violently in water?

W) Sodium
X) Aluminum
Y) Zinc
Z) Silver

Answer: W) SODIUM [AE]

Bonus

Chemistry - *Multiple Choice* Which of the following techniques can be used to separate two liquids of different densities?
W) Chromatography
X) Distillation
Y) Decanting
Z) Filtration

Answer: Y) DECANTING [AI]

Tossup

Math - *Short Answer* Brennan notices that on his 30 minute drive into work everyday, the traffic is 30 minutes worse on days when it rains. If there is a 1/3rd chance of rain on a given day, what is the expected time it takes for Brennan to get to work?

Answer: 40 minutes [RE]

Bonus

Math - *Short Answer* A circle is tangent to the lines y = 7 and y = -9. If its center lies on the line y = 3x + 4, what is the equation of the circle in standard (x - a)^2 + (y - b)^2 = c form [x minus a squared plus y minus b squared equals c]?

Answer: (x + 5/3)^2 + (y + 1)^2 = 64 [RE]

Tossup

Physics - *Multiple Choice* Brennan drops a book out of his airplane. Which of the following properties of the book will approach zero as it travels towards the ground?

W) Mass
X) Velocity
Y) Acceleration
Z) Momentum

Answer: Y) ACCELERATION [RE]

Bonus

Physics - *Short Answer* Identify all of the following 3 forces which are not considered pseudo forces? I. Gravity; II. Coriolis Force; III. Centrifugal Force

Answer: I [RE]