

**Iolani Science Bowl Invitational
Replacements**

Tossup

Earth and Space [RR1] - *Short Answer* Order the following 3 minerals in order of increasing hardness. I. Graphite; II. Orthoclase; III. Corundum;

Answer: I, II, III [RE]

Bonus

Earth and Space [RR1] - *Multiple Choice* Order the following four moons in terms of increasing mass. I. Ganymede; II. Deimos; III. Earth's Moon; IV. Enceladus

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

Tossup

Biology [RR1] - *Short Answer* During which phase of meiosis does crossing-over occur?

Answer: PROPHASE I (DO NOT ACCEPT: PROPHASE)

Bonus

Biology [RR1] - *Short Answer* Male stickleback fish will not attack fish without red stripes, but will attack unrealistic fish models with red stripes. This is an example of what type of behavior?

Answer: FIXED ACTION PATTERN (accept FAP)

Tossup

Chemistry [RR1] - *Multiple Choice* A certain reaction has a rate constant with units 1 over molar seconds. The order of the reaction is

- W. First
- X. Second
- Y. Third
- Z. Zeroth

Answer: X. SECOND [AI]

Bonus

Chemistry [RR1] - *Short Answer* Free rotation about single bonds is characteristic of what VSEPR hybridization?

Answer: SP³ [JK]

Tossup

Math [RR1] - Brennan doesn't pay attention in his meetings. If his coworkers speak at a rate of 200 words per minute and he only pays attention 20% of the time, what fractional proportion of the words of his coworker does he hear?

Answer: 1/5 [RE]

Bonus

Math [RR1] - *Short Answer* What is the angle formed between the minute and hour hand at the time 10:30?

Answer: 135 degrees [RE]

Tossup

Physics [RR1] - *Short Answer* How many ways can 3 couples fill 6 seats at a movie theater if each couple must sit together?

Answer: 48 [RE]

Bonus

Physics [RR1] -

Tossup

Earth and Space [RR2] - *Short Answer* Identify all of the following moons that orbit a planet lying past the solar system's frost line? I. Triton; II. Phobos; III. Io

Answer: I, III [AE]

Bonus

Earth and Space [RR2] - *Multiple Choice* Which of the following best describes the Gulf Stream current that runs along the US east coast?

- W) Warm water and eastern boundary
- X) Cold water and eastern boundary
- Y) Warm water and western boundary
- Z) Cold water and western boundary

Answer: Y) WARM WATER, WESTERN BOUNDARY [RE]

Tossup

Biology [RR2] - *Short Answer* What term describes the failure of one or more pairs of homologous chromosomes or sister chromatids to separate during cell division?

Answer: NONDISJUNCTION

Bonus

Biology [RR2] - *Short Answer* Chordata and Echinodermata fall into what clade, characterized by the formation of the mouth secondary to the anus?

Answer: DEUTEROSTOME

Tossup

Chemistry [RR2] - *Multiple Choice* Which of the following reactions is a double-replacement reaction?

- W) $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$
- X) $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$
- Y) $\text{AgNO}_3 + \text{NaCl} \rightarrow \text{AgCl} + \text{NaNO}_3$
- Z) $\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$

Answer: Y) $\text{AgNO}_3 + \text{NaCl} \rightarrow \text{AgCl} + \text{NaNO}_3$ [AE]

Bonus

Chemistry [RR2] - *Short Answer* How many unpaired electrons are in a neutral fluorine atom?

Answer: 2 [AI]

Tossup

Math [RR2] - *Short Answer* In square centimeters, what is the surface area of a cylinder of radius 5 cm and height 10 cm in terms of pi?

Answer: 150π centimeters squared [RE]

Bonus

Math [RR2] - *Multiple Choice* What is the sum of the first 3 terms in a geometric sequence with 4th term 64 and 5th term 32?

- W) 1792
- X) 1536
- Y) 896
- Z) 384

Answer: Y) 896 [RE]

Tossup

Physics [RR2] -

Bonus

Physics [RR2] -

Tossup

Earth and Space [RR3] - *Short Answer* What geological feature is formed at a convergent boundary between two tectonic plates when one plate is forced beneath the other?

Answer: SUBDUCTION ZONE (Accept: SUBDUCTION) [RE]

Bonus

Earth and Space [RR3] - *Short Answer* A binary star system has one star with mass 4 solar masses and semi-major axis 3 AU. The other star has a mass of 6 solar masses. What is its semi-major axis?

Answer: 2 AU [AE]

Tossup

Biology [RR3] - *Short Answer* What term describes a body cavity formed from the mesoderm?

Answer: COELOM

Bonus

Biology [RR3] - *Short Answer* Identify all of the following three phyla that contain true tissues:
I - Porifera, II - Cnidaria [NI-DARIA], III - Platyhelminthes [PLA-D-HEL-MIN-THEZ]

Answer: II, III

Tossup

Chemistry [RR3] - *Short Answer* Thorium-228 atoms naturally undergo alpha decay to produce radium-224. Given that the atomic number of radium is 88, how many neutrons are in a radium-224 nucleus?

Answer: 136 [AI]

Bonus

Chemistry [RR3] - *Short Answer* Brennan dissolves 3 moles of sodium chloride into 1 liter of water. If water's freezing point depression constant is approximately 2, by how many degrees Celsius does the water's freezing point decrease?

Answer: 12 [AI]

Tossup

Math [RR3] - *Short Answer* If theta is an angle in the 2nd quadrant and cos of theta is $-3/5$, what is the value of sin of theta?

Answer: $4/5$ [RE]

Bonus

Math [RR3] - *Multiple Choice* An unfair coin is 5 times more likely to land on heads than it is on tails. What is the probability that Brennan flips said coin 4 times and gets tails every time?

- W) 1/625
- X) 256/625
- Y) 1/1296
- Z) 625/1296

Answer: Y) 1/1296 [RE]

Tossup

Physics [RR3] -

Bonus

Physics [RR3] -

Tossup

Earth and Space [SE1] - *Short Answer* Compared to the Sun, a star has half the radius and twice the surface temperature. How many times greater is its luminosity?

Answer: 4 [AE]

Bonus

Earth and Space [SE1] - *Multiple Choice* Which of the following gasses is considered the strongest greenhouse gas?

- W) Water vapor
- X) Carbon dioxide
- Y) Sulfur dioxide
- Z) Methane

Answer: Z) METHANE [RE]

Tossup

Biology [SE1] - *Short Answer* Which of the following phyla has the most species?

- W) Arthropoda
- X) Annelida
- Y) Cnidaria
- Z) Chordata

Answer: W) ARTHROPODA

Bonus

Biology [SE1] - *Multiple Choice* After which of the following scenarios would you expect primary succession to occur?

- W) A flood in a grassland area
- X) A volcanic eruption
- Y) A fire burns through a forest
- Z) A hurricane blows through a marshland area

Answer: X) A VOLCANIC ERUPTION

Tossup

Chemistry [SE1] - *Multiple Choice* Brennan has 7 foil balls for his cats, stuck under one of his three bookshelves. By how many microstates can this macrostate be realized?

- W. 0
- X. 1
- Y. 3
- Z. 7

Answer: X. 1 [JK]

Bonus

Chemistry [SE1] - *Short Answer* After Brennan tries and fails to retrieve his foil balls, all 7 are still stuck under the same bookshelf. What is the entropy of this macrostate?

Answer: 0 [JK]

Tossup

Math [SE1] - *Short Answer* Which two of the following three equations never intersect? I. $2y = 4x + 7$; II. $4y - 14 = 16x$; III. $y = 4x + 14$

Answer: II and III [RE]

Bonus

Math [SE1] - *Short Answer* What is the square root of the expression $11 - 4\sqrt{7}$ [eleven minus four root seven] in the form a plus b root seven?

Answer: $-2 + \sqrt{7}$ [RE]

Tossup

Physics [SE1] -

Bonus

Physics [SE1] -

Tossup

Earth and Space [SE2] - *Short Answer* What name is given to obducted chunks of oceanic crust, which are often found near current or former subduction zones?

Answer: OPHIOLITES (Do not accept TERRANE) [RE]

Bonus

Earth and Space [SE2] - *Short Answer* What is the name describing bodies who cross planetary orbits between Jupiter and Neptune?

Answer: CENTAURS [AE]

Tossup

Biology [SE2] - *Short Answer* The cortical reaction is triggered by the release of what positively charged, divalent ion into the cytosol?

Answer: Ca^{2+} (Accept: Calcium, Do NOT accept: Ca)

Bonus

Biology [SE2] - *Short Answer* Identify all of the following three statements which are true of C4 plants: I - PEP Carboxylase reduces photorespiration, II - There is temporal separation of carbon fixation and the Calvin cycle, III - Calvin cycle occurs in bundle-sheath cells

Answer: I, III

Tossup

Chemistry [SE2] - *Multiple Choice* At 1 atmosphere, what must the temperature be for the enthalpy of formation of molecular oxygen (O_2) to be zero Joules?

W. 37 °C

X. 25 °C

Y. 0 °C

Z. 0 K

Answer: X. 25 °C [JK]

Bonus

Chemistry [SE2] - *Short Answer* Heat is transferred to a system containing 1 mol of an ideal gas such that its temperature rises by 20 K and the volume increases by 2 L. In Joules, what is the net change in energy to the system, ΔU ? Assume the constant of molar heat capacity under constant volume, C_v , to be 12.5 (J/mol K).

Answer: 250 J [JK]

Tossup

Math [SE2] - *Multiple Choice* Variance is proportional to the population standard deviation raised to what power?

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

Answer: Z) 2 [RE]

Bonus

Math [SE2] - *Short Answer* If the point (5, 2) is reflected across the line $x = -12$, then across the line $y = x$, what are the final coordinates of the point?

Answer: (2, -29) [RE]

Tossup

Physics [SE2] -

Bonus

Physics [SE2] -

Tossup

Earth and Space [SE3] - *Short Answer* Using luminosity decline rate, the Phillips Relation allows astronomers to use what type of supernovae as a standard candle?

Answer: TYPE IA (DO NOT ACCEPT TYPE I) [AE]

Bonus

Earth and Space [SE3] - *Short Answer* What name is given to intrusive igneous rocks that form close to the surface and appear more like extrusive rocks than plutonic rocks?

Answer: HYPABYSSAL [RE]

Tossup

Biology [SE3] - *Multiple Choice* A pineapple is an example of what type of fruit?

- W) Simple
- X) Aggregate
- Y) Multiple
- Z) Accessory

Answer: Y) MULTIPLE

Bonus

Biology [SE3] - *Multiple Choice* Which of the following parts of the adult brain originates from the embryonic forebrain in humans?

- W) Medulla Oblongata
- X) Pons
- Y) Hypothalamus
- Z) Cerebellum

Answer: Y) Hypothalamus

Tossup

Chemistry [SE3] - *Short Answer* The acid- or base-catalyzed tautomerization of an enol results in a molecule with what functional group?

Answer: KETONE [JK]

Bonus

Chemistry [SE3] - *Multiple Choice* A molecule of toluene (C_7H_8) contains how many chemically distinct carbon molecules?

- W. 1
- X. 3
- Y. 5
- Z. 7

Answer: Y. 5 [JK]

Tossup

Math [SE3] - *Short Answer* In terms of pi and in centimeters squared, what is the lateral surface area of a cone with radius 5 cm and height 12 cm?

Answer: $65\pi \text{ cm}^2$ [RE]

Bonus

Math [SE3] - *Short Answer* Brennan the penguin sits at the origin of a coordinate grid. Every minute, Brennan waddles one unit north, south, east, or west, choosing between them at random. What is the probability that Brennan is back at the origin 4 waddles later?

Answer: 9/64 [RE]

Tossup

Physics [SE3] -

Bonus

Physics [SE3] -

Tossup

Biology [Extra] *Multiple Choice* According to the island equilibrium model, which of the following islands would have the greatest amount of species diversity?

- W) Small island, close to the mainland
- X) Small island, far from the mainland
- Y) Large island, close to the mainland
- Z) Large island, far from the mainland

Answer: Y) LARGE ISLAND, CLOSE TO THE MAINLAND

Bonus

Biology [Extra] - *Short Answer* Brennan has a rare disorder in which his pancreas is no longer able to produce enzymes. Identify all of the four following macromolecules which would have impaired digestion: I - Carbohydrates, II - Proteins, III - Nucleic Acids, IV - Fats

Answer: All