

RR2

TOSSUP

1) Biology - *Short Answer* Translation is terminated by the addition of what small molecule instead of an amino acid by release factors?

ANSWER: Water (ACCEPT: H_2O) [HL]

BONUS

1) Biology - *Short Answer* What principle governing the creation of phylogenetic trees states that the simplest solution involving the least number of evolutionary changes is the most likely relationship between a group of species?

ANSWER: Maximum Parsimony (DO NOT ACCEPT: Parsimony) [HL]

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TOSSUP

2) Chemistry - *Multiple Choice* The value of which of the following concentration units for a solution varies with temperature?

W) Molality
X) Molarity
Y) Mass percent
Z) Mole fraction

ANSWER: X) Molarity [SO]

BONUS

2) Chemistry - *Short Answer* Order the following three gases in DECREASING value of root mean square velocity:

1) Argon
2) Carbon Dioxide
3) Oxygen

ANSWER: 3, 1, 2 [SO]

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TOSSUP

#) Earth and Space - *Multiple Choice* Which of the following soil horizons is characterized by the presence of partially decayed organic matter near the surface?

W) B
X) A
Y) E
Z) O

ANSWER: Z) O [JY]

BONUS

#) Earth and Space - *Short Answer* What is the name for the soil process in which rainwater percolates downwards and removes dissolved materials like iron and oxide compounds from upper soil horizons?

ANSWER: Leaching [JY]

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TOSSUP

4) Math - *Multiple Choice* Monish is flipping an unfair coin that lands heads with probability ⅘ and tails with probability ⅕ . What is the expected amount of the flips monish sees before he encounters his first tail?

W) 5
X) 4
Y) 3
Z) 2

ANSWER: X) 4

BONUS

4) Math - *Short Answer* In a certain Science Bowl tournament, round-robin occurs in 6 groups of 6 teams, where each team plays every other team in their group. How many total games are played?

ANSWER: 90
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TOSSUP

5) Physics - *Short Answer* What particle transmits the electromagnetic force between particles?

ANSWER: Photon

BONUS

5) Physics - *Short Answer* 2 particles each with charge Q and separated by distance D feel a force F. If the charge on one charge is doubled, and the charge on the other charge is tripled, and the distance is increased by a factor of 2, what is the new force in terms of F?

ANSWER: 1.5F

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TOSSUP

6) Biology - *Short Answer* What structure secretes progesterone responsible for pregnancy and is formed from the ruptured remnants of ovarian follicles?

ANSWER: Corpus Luteum [HL]

BONUS

6) Biology - *Short Answer* What term refers to a cell-signalling pathway in bacteria in which each individual releases autoinducers in order to help each other gauge density, regulating the formation of biofilms or other symbiotic activities?

ANSWER: Quorum Sensing [HL]

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TOSSUP

7) Chemistry - *Short Answer* Identify all of the following three thermodynamic quantities which are considered path functions:

1) Work
2) Heat
3) Entropy

ANSWER: 1 and 2 [SO]

BONUS

7) Chemistry - *Multiple Choice* Addition of 5M (molar) HCl to which of the following substances will NOT result in the evolution of a gas?

W) Al
X) Zn
Y) $CaCO_3$
Z) $NaNO_3$

ANSWER: Z) NaNO3 [SO]

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TOSSUP

8) Earth and Space - *Short Answer* What is the general term for a ridge-shaped glacial deposit of unconsolidated sediment deposited directly by a glacier?

ANSWER: Moraine (ACCEPT: End moraine, recessional moraine, lateral moraine, medial moraine, terminal moraine, ground moraine)

BONUS

8) Earth and Space - *Short Answer* Order the following four minerals from first to last to crystallize according to Bowen's Reaction Series:

1) Olivine
2) Orthoclase
3) Quartz
4) Amphibole

ANSWER: 1, 4, 2, 3 [JY]

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TOSSUP

9) Math - *Short Answer* A standard six-sided dice is rolled 6 times. What is the probability that the sum of the six numbers is a multiple of 6?

ANSWER: ⅙

BONUS

9) Math - *Short Answer* For real numbers x and y, let x~y = (x+y)(x-y), (read: x tilda y is equal to open parenthesis x plus y close parenthesis times open parenthesis x minus y close parenthesis). What is 3~(4~5) (read: 3 tilda open parenthesis 4 tilda 5 close parenthesis)

ANSWER: -72

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TOSSUP

10) Physics - *Short Answer* Assuming no air resistance and that g = 10 m/s^2, what is the maximum height reached by an object thrown with a velocity of 10 m/s straight up?

ANSWER: 5 meters

BONUS

10) Physics - *Multiple Choice* Which of the following describes the kinetic and potential energy of a satellite in orbit around the Earth respectively?

W) Positive, positive
X) Positive, negative
Y) Negative, positive
Z) Negative, negative

ANSWER: X) Positive, negative

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TOSSUP

11) Biology - *Short Answer* What term refers to stem-cell like tissue found in plants' root and shoot tips that are responsible for facilitating primary growth.

ANSWER: Apical Meristem (DO NOT ACCEPT: Meristem, Primary Meristem) [HL]

BONUS

11) Biology - *Multiple Choice* A student is performing an experiment in which they need to isolate albumen from blood plasma. Which of the following techniques would be best for this application?

W) Northern Blot
X) Eastern Blot
Y) Southern Blot
Z) Western Blot

ANSWER: Z) Western Blot [HL]

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TOSSUP

12) Chemistry - *Multiple Choice* Catalysts function by altering which of the following quantities of a reaction?

W) Temperature
X) Gibbs Free Energy
Y) Equilibrium Constant
Z) Activation Energy

ANSWER: Z) Activation Energy [SO]

BONUS

12) Chemistry - *Short Answer* An orbital in a ground state Argon atom has quantum numbers n=3 and l=1. How many electrons are in the subshell of this orbital?

ANSWER: 6 [SO]

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TOSSUP

13) Earth and Space - *Short Answer* Rank the following 3 galaxies by increasing mass:

1) Large Magellanic Cloud
2) Andromeda Galaxy
3) Milky Way

ANSWER: 132

BONUS

13) Earth and Space - *Multiple Choice* Which of the following best describes the direction that low mass stars go on the HR diagram after the helium flash?

W) Up and to the right
X) Down and to the right
Y) Up and to the left
Z) Down and to the left

ANSWER: Z) Down and to the left

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TOSSUP

14) Math - *Short Answer* Simplify the expression (-5-5i)(-5+5i) (READ AS: open parenthesis negative five minus five i close parentheses open parenthesis negative five plus five i close parentheses)

ANSWER: 50

BONUS

14) Math - *Multiple Choice* A magic square is a grid of size n by n filled with a unique number from 1 to n^2 such that each row and column of this grid have the same sum. What is the sum of any particular row or column of a magic square with side length 9?

W) 360
X) 369
Y) 720
Z) 738

ANSWER: X) 369
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TOSSUP

15) Physics - *Short Answer* What principle states that within an ideal fluid, the pressure remains constant throughout?

ANSWER: Pascal's Principle

BONUS

15) Physics - *Short Answer* A pipe with a radius of 2 cm has water flowing through it at a speed of 2 m/s. The water then flows into another pipe with a radius of 0.5 cm. What is the new speed of the water assuming that water is an ideal fluid?

ANSWER: 32 m/s

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TOSSUP

16) Biology - *Multiple Choice* A scientist is studying a particular cell as it undergoes cellular respiration. They notice that the cell is capable of producing ATP, water, and NADH, but does not produce any FADH2. Which of the following stages of cellular respiration is most likely damaged in this cell?

W) Glycolysis
X) Pyruvate Oxidation
Y) Kreb's Cycle
Z) Fermentation

ANSWER: X) Krebs Cycle [HL]

BONUS

16) Biology - *Short Answer* Originally, angiosperms were divided into two groups: monocots and dicots. However, the group of dicots was divided into eudicots, basal angiosperms, and magnoliids. This was because the taxonomic group of dicots was found to be what term referring to when a group is lacking some of a common ancestor's descendents?

ANSWER: Paraphyletic [HL]

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TOSSUP

17) Chemistry - *Short Answer* Reaction 2A + 4B yields 2C has an equilibrium constant of 400. For the reaction C yields A + 2B, what is the value of the new equilibrium constant?

ANSWER: 1/20 [SO]

BONUS

#17) Chemistry - *Short Answer* Order the following three isotopes in terms of increasing amount of neutrons

1) Cobalt-60
2) Nickel-60
3) Copper-60

ANSWER: 3, 2, 1 [SO]

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TOSSUP

18) Earth and Space - *Short Answer* Rank the following 3 objects by increasing atmospheric pressure at their surfaces:

1) Mars
2) Europa
3) Titan

ANSWER: 2, 1, 3

BONUS

18) Earth and Space - *Short Answer* The convective core in certain main sequence stars is mainly caused by the high temperature dependance of what process?

ANSWER: CNO Cycle
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TOSSUP

19) Math - *Short Answer* What is the x coordinate of the vertex of the parabola with equation y = 2x^2 + 6x -10?

ANSWER: -3/2

BONUS

Math Multiple Choice What is the difference between the second smallest 3 digit palindrome and the second largest 3 digit palindrome?

W) 898
X) 878
Y) 868
Z) 858

ANSWER: X) 878

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TOSSUP

20) Physics - *Multiple Choice* Which of the following is a true statement about elastic collisions?

W) The velocity of the center of mass increases during an elastic collision.
X) The velocity of the center of mass remains constant during an elastic collision.
Y) Momentum is conserved but kinetic energy is not.
Z) Momentum is not conserved but kinetic energy is.

ANSWER: X

BONUS

20) Physics - *Multiple Choice* Which of the following accurately contrasts Rayleigh Jeans Law and Plank's Law?

W) Rayleigh-Jeans Law predicts blackbody radiation correctly at all wavelengths, while Planck's Law only works at long wavelengths.
X) Rayleigh-Jeans Law assumes energy is continuous, while Planck's Law introduces discrete energy quanta.
Y) Rayleigh-Jeans Law is based on quantized oscillators, while Planck's Law assumes continuous energy distributions.
Z) Rayleigh-Jeans Law applies only to solids, while Planck's Law applies only to gases.

ANSWER: X) Rayleigh-Jeans Law assumes energy is continuous, while Planck's law introduces discrete energy quanta