

RR1

TOSSUP

1) Biology - *Multiple Choice* The selective pressure on birth weight in humans acts against extreme phenotypes (low and high birthweights) because intermediate birth weights have a higher reproductive fitness. Which of the following types of selection does human birth weight exemplify?

W) Disruptive
X) Stabilizing
Y) Balancing
Z) Directional

ANSWER: X [AD]

BONUS

1) Biology - *Short Answer* Identify all of the following three conditions are assumptions made for Hardy-Weinberg Equilibrium:

1) Negligible genetic drift
2) Random mating
3) Equal sex ratio

ANSWER: 1, 2 [AD]

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TOSSUP

2) Chemistry - *Multiple Choice* A characteristic purple color for a flame test indicates which of the following elements?

W) Barium
X) Potassium
Y) Strontium
Z) Sodium

ANSWER: X) Potassium [SO]

BONUS

2) Chemistry - *Short Answer* For the lewis structure of the carbonate ion, CO_3^{2-} how many lone pairs of electrons are present on the central atom?

ANSWER: 0 [SO]
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TOSSUP

3) Earth and Space - *Multiple Choice* Which of the following best describes gabbro?

W) Extrusive, felsic
X) Extrusive, mafic
Y) Intrusive, felsic
Z) Intrusive, mafic

ANSWER: Z) Intrusive, mafic [JY]

BONUS

3) Earth and Space - *Short Answer* What is the term for the subsurface boundary between the unsaturated zone and saturated zone where the water pressure in the pore spaces equals atmospheric pressure?

ANSWER: Water table [JY]

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TOSSUP

4) Math - *Multiple Choice* Which of the following integers are prime?

W) 81
X) 91
Y) 101
Z) 111

ANSWER: Y) 101 [MS]

BONUS

4) Math - *Short Answer* Polynomial f(x) has a degree of 2 and polynomial g(x) has a degree of 3. What is the degree of polynomial f(g(x))?

ANSWER: 6 [MS]

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TOSSUP

5) Physics - *Short Answer* Identify all of the following three quantities that are not vectors:

1) Velocity
2) Speed
3) Distance

ANSWER: 2 AND 3 [PA]

BONUS

5) Physics - *Short Answer* The potential energy of a 2 kg object is 40J and has 0 initial velocity. At a later instant, the object is moving at 4 m/s. What is the object's potential energy?

ANSWER: 24 J [PA]

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TOSSUP

6) Biology - *Short Answer* Humans experience a life history where mortality rate starts low in offspring and increases rapidly in the elderly. What type of survivorship curve characterizes this type of behavior?

ANSWER: Type I [AD]

BONUS

6) Biology - *Short Answer* Pharyngeal gill slits, a post anal tail and notochord are all examples of traits possessed by which phylum, to which humans belong?

ANSWER: Chordata (ACCEPT: Chordates, Phylum Chordata) [AD]

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TOSSUP

7) Chemistry - *Short Answer* Naphthol Violet, Bromocresol Green, and Methyl Red are all examples of what type of compound, which marks the color change at the endpoint of a titration?

ANSWER: Indicator [SO]

BONUS

7) Chemistry - *Short Answer* Identify all of the following three phase transitions which are exothermic:

1) Deposition
2) Sublimation
3) Condensation

ANSWER: 1, 3 [SO]

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TOSSUP

8) Earth and Space - *Short Answer* What term refers to the layer of the ocean in which temperature rapidly decreases with increasing depth?

ANSWER: Thermocline [JY]

BONUS

8) Earth and Space - *Multiple Choice* Which of the following atmospheric circulation cells is primarily responsible for driving the low-latitude, easterly trade winds?

W) Polar
X) Ferrel
Y) Hadley
Z) Supercell

ANSWER: Y) Hadley [JY]

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TOSSUP

9) Math - *Multiple Choice* If the least common multiple of two integers a and b is 72, which of the following cannot be a value of the greatest common factor of a and b?

W) 1
X) 3
Y) 9
Z) 27

ANSWER: Z) 27 [MS]

BONUS

9) Math - *Short Answer* In a certain triangle SCB, angle S is equal to 101 degrees and angle C is equal to 21 degrees. What is the measure of angle B?

ANSWER: 58 [MS]

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TOSSUP

10) Physics - *Short Answer* What principle states that the weight of a displaced fluid equals the buoyant force?

ANSWER: Archimedes Principle [PA]

BONUS

10) Physics - *Short Answer* An object moves at a speed of 2 m/s and collides with a 4 kg object initially at rest. If the final velocity of the object is 3 m/s, what is the original velocity of the 2 kg object?

ANSWER: 9 m/s [PA]

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TOSSUP

11) Biology - *Short Answer* Bacteria often need to turn multiple sets of genes on and off at a time. To this end, their genome is organized into groups of genes organized under a single promoter. What are these genomic structures known as?

ANSWER: Operons [HL]

BONUS

11) Biology - *Short Answer* The chloroplast contains stacks of thylakoids that perform the light dependent reactions. What is the term for the stacks of these within the chloroplast?

ANSWER: Granum [HL]

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TOSSUP

12) Chemistry - *Multiple Choice* An isotope of lead is obtained after Uranium-238 undergoes eight alpha decays and six beta decays. What is the mass number of this isotope?

W) 204
X) 206
Y) 208
Z) 210

ANSWER: X) 206 [SO]

BONUS

12) Chemistry - *Multiple Choice* Which of the following compounds has the highest Lattice Energy?

W) AlF_3
X) SF_4
Y) Na_2O
Z) BeO

ANSWER: Z) BeO [SO]

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TOSSUP

13) Earth and Space - *Multiple Choice* Which of the following stars will last the longest?

W) Red Dwarf
X) Yellow Dwarf
Y) Blue Giant
Z) Red Supergiant

ANSWER: W) Red Dwarf

BONUS

13) Earth and Space - *Short Answer* What two planets in the solar system rotate clockwise?

Answer: Uranus and Venus

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TOSSUP

14) Math - *Short Answer* In how many ways can Alex, Bob, Connor, Dylan, and Erick sit it in a line of 5 chairs such that Alex and Erick must sit together?

ANSWER: 48

BONUS

14) Math - *Short Answer* At what points do the functions y = x^2 and y = 2x intersect?

ANSWER: (0, 0) and (2, 4) (DO NOT ACCEPT: 0 and 2)

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TOSSUP

15) Physics - *Multiple Choice* Which of the following is true of work?

W) When an object is lifted in a gravitational field, gravity does positive work
X) Work is always path independent
Y) The work done by friction is path dependent
Z) According to the work energy theorem, work is a vector

ANSWER: Y) The work done by friction is path dependent

BONUS

15) Physics - *Short Answer* A particle with charge 1 C and mass 10 kg moves in with a speed of 5 m/s in a magnetic field of 0.5 T, what is the radius of the orbit?

ANSWER: 100 meters

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TOSSUP

16) Biology - *Multiple Choice* The globular form of what protein forms polymer filaments to create microfilaments in the cytoskeleton?

W) Actin
X) Keratin
Y) Myosin
Z) Tubulin

ANSWER: W) Actin [HL]

BONUS

16) Biology - *Short Answer* What amino acid's cyclic structure containing its R-group and amino group gives it a high degree of rigidity, making it known as the "helix-breaker"?

ANSWER: Proline [HL]

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TOSSUP

17) Chemistry - *Short Answer* A given reaction has a rate constant with units of hertz. What is the overall reaction order for this reaction?

ANSWER: First [SO]

BONUS

17) Chemistry - *Short Answer* Identify all of the following 3 compounds that are soluble in water:

1) Barium Hydroxide
2) Silver Chloride
3) Magnesium Hydroxide

ANSWER: 1 ONLY [SO]

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TOSSUP

18) Earth and Space - *Short Answer* During nuclear fusion in stars, the atoms have to overcome what electromagnetic barrier in order to collide?

ANSWER: Coulomb Barrier

BONUS

18) Earth and Space - *Short Answer* During what era in the early universe did electrons combine with atomic nuclei to form atoms?

ANSWER: Recombination Era

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TOSSUP

19) Math - *Short Answer* What is the area of a triangle with side lengths 5, 6, and 7?

ANSWER: 6sqrt(6)

BONUS

19) Math - *Multiple Choice* Sanjay has a bag of marbles. He gives 20% of the marbles to his friend Monish. He then gives 10% of the remaining to his classmate, Arjun. Finally he gives 25% of the remaining marbles to his brother. What percentage of the original marbles does he still have?

W) 27
X) 36
Y) 45
Z) 54

ANSWER: Z) 54

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TOSSUP

20) Physics - *Multiple Choice* Which of the following correctly describes a capacitor?

W) A capacitor generates a magnetic field perpendicular to the current
X) A capacitor generates a magnetic field parallel to the current
Y) A capacitor generates an electric field perpendicular to the current
Z) A capacitor generates an electric field parallel to the current

ANSWER: Z

BONUS

20) Physics - *Short Answer* A circuit consists of a 2 ohm and 3 ohm resistor in parallel, with a voltage supply of 9 volts. What is the power dissipated by the 3 ohm resistor?

ANSWER: 27 W