

ROUND REPLACEMENTS 1

TOSSUP

1 BIOLOGY *Multiple Choice* A frog with blue skin mates with a frog that has yellow skin, producing a frog with blue and yellow spots. What type of inheritance pattern does this trait appear to follow?

- W) Codominance
- X) Multiple Alleles
- Y) Incomplete Dominance
- Z) Epistasis

ANSWER: W) CODOMINANCE [W: OW, E: EB; RR Bio-G]

BONUS

1 BIOLOGY *Short Answer* What is the name given to the symbiotic association between algae and fungi?

ANSWER: LICHEN [W: EB, E: OW; RR Bio-P]

TOSSUP

2 BIOLOGY *Multiple Choice* Which of the following functional groups is not found in any amino acid?

- W) Phosphate group
- X) Amino group
- Y) Methyl group
- Z) Carboxyl group

ANSWER: W) PHOSPHATE GROUP [W: OW, E: EB; RR Bio-Other]

BONUS

2 BIOLOGY *Short Answer* Order the following three biomes by increasing

- biodiversity:
- 1) Tropical rainforest
 - 2) Tundra
 - 3) Savannah

ANSWER: 2, 3, 1 [W: OW, E: EB; RR Bio-EEB]

TOSSUP

3 CHEMISTRY *Short Answer* Milikan's oil drop experiment was used to deduce the negative charge of what subatomic particles?

ANSWER: ELECTRONS [W: AS, E: EB; RR Chem-AM]

BONUS

3 CHEMISTRY *Short Answer* What are the products in the net ionic equation of the neutralization reaction between HCl and NaOH?

ANSWER: H₂O (ACCEPT: WATER) [W: HJ, E: AS, RR Chem-Other]

TOSSUP

4 CHEMISTRY *Short Answer* How many sigma bonds are there in cyclohexane, which has chemical formula C₆H₁₂?

ANSWER: 18 [W: EB, E: HJ, RR Chem-Other]

BONUS

4 CHEMISTRY *Multiple Choice* What is the molecular geometry of a chemical compound whose central atom has two bonding domains and two lone pairs?

W) Linear

X) Bent

Y) Trigonal planar

Z) See-saw

ANSWER: X) BENT [W: EB, E: HJ; RR Chem-AM]

TOSSUP

5 EARTH AND SPACE *Multiple Choice* Which of the following types of precipitation is composed of layered ice pellets produced in cumulonimbus clouds?

- W) Sleet
- X) Snow
- Y) Hail
- Z) Freezing rain

ANSWER: Y) HAIL [W: EB, E: SC; RR ESS-AO]

BONUS

5 EARTH AND SPACE *Multiple Choice* What term is given to the values for orbital semimajor axis which are uncommon in the asteroid belt due to the gravitational influence of Jupiter?

- W) Cassini divisions
- X) Kirkwood gaps
- Y) Forbidden resonances
- Z) Horseshoe orbits

ANSWER: X) KIRKWOOD GAPS [W: JW, E: SC; RR ESS-SS]

TOSSUP

6 EARTH AND SPACE *Short Answer* Most long period comets originate from what hypothetical region surrounding the solar system?

ANSWER: OORT CLOUD [W: RF, E: SC; RR ESS-SS]

BONUS

6 EARTH AND SPACE *Short Answer* Identify all of the following three processes that bind together sedimentary rocks:

- 1) Recrystallization
- 2) Compaction
- 3) Cementation

ANSWER: 2 AND 3 [W: HJ, E: EB; RR ESS-RM]

TOSSUP

7 MATH *Short Answer* Harry walks in a straight line from his home to the gym at constant speed V . When he gets halfway there, he realizes he forgot something, and walks back home before going to the gym again, all at the same speed. What is his average velocity over this whole trip in terms of V ?

ANSWER: $V/2$ [W: JW, E: EB; RR Math-A]

BONUS

7 MATH *Short Answer* David takes out a loan of \$400 from a bank offering 5% monthly interest, compounded continuously. In terms of e , how much money will he owe 10 months later?

ANSWER: $400 \sqrt{e}$ [W: JW, E: SC; RR Math-A]

TOSSUP

8 MATH *Multiple Choice* How many diagonals does a nonagon have?

- W) 18
- X) 24
- Y) 27
- Z) 3

Answer: Y) 27 [W: KR, E: SC, RR Math-C]

BONUS

8 MATH *Short Answer* Jimmy has 10 blue balls, 12 red balls, 3 yellow balls, and 8 orange balls. What is the minimum number of balls he must draw to ensure he has four balls with different colors?

ANSWER: 31 [W: SC, E: EB; RR Math-C]

TOSSUP

9 PHYSICS *Short Answer* What is the power, in watts, dissipated by a 100 volt circuit with two 50 ohm lightbulbs connected in parallel?

ANSWER: 400 [W: EB, E: SC; RR Phys-ET]

BONUS

9 PHYSICS *Short Answer* Identify all of the following statements which are true of a simple pendulum:

- 1) It exhibits simple harmonic oscillation for all amplitudes
- 2) Period increases with increasing amplitude
- 3) Period increases with increasing mass

ANSWER: 2 ONLY [W: RF; E: SC; RR Phys-ME]

TOSSUP

10 PHYSICS *Short Answer* Identify all of the following three changes that would cause an increase in internal energy?

- 1) Expansion
- 2) Decrease in temperature
- 3) Compression under constant pressure

ANSWER: 3 ONLY [W: EB, E: SC; RR Phys-ET]

BONUS

10 PHYSICS *Short Answer* Ray hits a 120 gram baseball and sends it flying away with velocity 20 meters per second. If his bat is in contact with the ball for 0.2 milliseconds, then how much force, in Newtons, does his swing apply?

ANSWER: 12000 [W: EB, E: SC; RR Phys-ME]

TOSSUP

11 ENERGY *Short Answer* Researchers at DOE's National Energy Technology Laboratory are exploring ways to extract rare earth elements from coal based resources. Identify all of the following three groups of elements that include rare earth elements:

- 1) Group 3
- 2) Lanthanides
- 3) Actinides

ANSWER: 2 ONLY [W: HJ, E: EB; RR]

BONUS

11 ENERGY *Multiple Choice* Researchers at UW-Madison are studying how the abnormally shaped blood cells characteristic of sickle-cell anemia move through blood vessels. Which of the following statements about the disease is not true?

- W) People possessing one sickle cell allele are less likely to die from malaria
- X) The sickle-cell mutation causes hemoglobin proteins to aggregate and form long chains
- Y) Sickle-cell anemia is inherited in a x-linked recessive pattern
- Z) Sickle cell disease is caused by a point mutation in the beta globin subunit of hemoglobin

ANSWER: Y) SICKLE-CELL ANEMIA IS INHERITED IN A X-LINKED RECESSIVE PATTERN [W: OW, E: EB; RR]

TOSSUP

12 ENERGY *Short Answer* Researchers at UW Madison are studying insecticides and their effect on the food chain. What phenomenon occurs when the concentration of a pollutant increases in the tissues of animals at successively high levels of the food chain?

ANSWER: BIOMAGNIFICATION (ACCEPT: BIOLOGICAL MAGNIFICATION or BIOAMPLIFICATION) [W: OW, E: EB; RR]

BONUS

12 ENERGY *Short Answer* National Energy Technology Lab Scientists are partnering with Rice University researchers to develop new ways of manufacturing specific carbon allotropes. Identify all of the following three carbon allotropes that are sp^2 hybridized:

- 1) Graphite
- 2) Graphene
- 3) Diamond

ANSWER: 1 AND 2 [W: HJ, E: EB; RR]