

# **ROUND REPLACEMENTS 2**

## **TOSSUP**

**1 BIOLOGY *Short Answer*** What type of speciation would occur when a population of lizards becomes separated by a mountain?

ANSWER: ALLOPATRIC [W: OW, E: EB; EDE Bio-Other]

## **BONUS**

**1 BIOLOGY *Short Answer*** Identify all of the following three cell types that could be found in the xylem of an oak tree:

- 1) Tracheids
- 2) Vessel elements
- 3) Sieve tubules

ANSWER: 1 AND 2 [W: SG, E: EB; EDE Bio-P]

## **TOSSUP**

**2 BIOLOGY *Short Answer*** What is the term for the failure of homologous pairs to separate during meiosis one?

ANSWER: NONDISJUNCTION [W: OW, E: EB; EDE Bio-G]

### **BONUS**

2 BIOLOGY *Multiple Choice* Which of the following statements best describes a difference between meiosis 1 and meiosis 2?

- W) During prophase 1 crossing over occurs between sister chromatids and during prophase 2 crossing over occurs between homologous pairs
- X) During metaphase 1 sister chromatids line up on opposite sides of the metaphase line and during metaphase 2 homologous pairs line up on opposite sides of the metaphase line
- Y) During anaphase 1 homologous pairs separate and during anaphase 2 sister chromatids separate
- Z) After telophase 1 daughter cells will have double the number of chromosomes as daughter cells after telophase 2

ANSWER: Y) DURING ANAPHASE 1 HOMOLOGOUS PAIRS SEPARATE AND DURING ANAPHASE 2 SISTER CHROMATIDS SEPARATE [W: OW, E: EB; EDE Bio-CB]

### TOSSUP

3 CHEMISTRY *Short Answer* What quantity has the same expression as the equilibrium constant, but can refer to any stage of a reaction?

ANSWER: REACTION QUOTIENT (ACCEPT: Q) [W: HJ, E: AS; EDE Chem-EK]

### BONUS

3 CHEMISTRY *Short Answer* In the reaction  $2 A + 3 B \rightarrow 2 C$ , the rate of consumption of B is  $1.8 \times 10^{-3}$  moles per liter per second. In moles per liter per second, what is the rate of formation of C?

ANSWER:  $1.2 \times 10^{-3}$  [W: HJ, E: AS; EDE Chem-EK]

### TOSSUP

4 CHEMISTRY *Short Answer* How many major resonance structures does a molecule of benzene have?

ANSWER: 2 [W: OW, E: HJ; EDE Chem-Other]

### BONUS

4 CHEMISTRY *Multiple Choice* Which of the following solutions would have the highest freezing point?

W) 0.4 molal sulfuric acid

X) 0.5 molal sodium phosphate

Y) 0.6 molal calcium nitrate

Z) 0.7 molal magnesium chloride

ANSWER: X) 0.5 MOLAL SODIUM PHOSPHATE [W: EB, E: HJ; EDE Chem-Other]

### TOSSUP

5 EARTH AND SPACE *Multiple Choice* Which of the following types of air masses would most likely form above central Russia?

- W) Maritime tropical
- X) Maritime polar
- Y) Continental tropical
- Z) Continental polar

ANSWER: Z) CONTINENTAL POLAR [W: EB, E: SC; EDE ESS-AO]

### BONUS

5 EARTH AND SPACE *Short Answer* By name or number, identify all of the following three techniques that are used to detect exoplanets:

- 1) Direct imaging
- 2) Doppler spectroscopy
- 3) Turnoff point

ANSWER: 1 AND 2 [W: EB, E: SC; EDE ESS-OA]

### TOSSUP

6 EARTH AND SPACE *Multiple Choice* Which of the following moons of Saturn is theorized to have a subsurface ocean?

- W) Titan
- X) Enceladus
- Y) Mimas
- Z) Prometheus

ANSWER: ENCELADUS [W: EB, E: SC; EDE ESS-SS]

### **BONUS**

6 Earth and Space *Multiple Choice* Sediments in which of the following depositional environments are least well sorted?

W) Continental Shelf

X) Sand Dune

Y) Lake

Z) Glacial Till

ANSWER: Z) GLACIAL TILL [W: HJ, E: SC; EDE ESS-G]

### TOSSUP

7 Math *Multiple Choice* Which of the following points is found at the intersection of the three medians of a triangle?

- W) Orthocenter
- X) Incenter
- Y) Circumcenter
- Z) Centroid

ANSWER: Z) CENTROID [W: KR, SC; EDE Math-G]

### BONUS

7 MATH *Short Answer* A logistic curve  $f(x)$  is bounded by horizontal asymptotes  $y = -1$  and  $y = 1$ . For how many values of  $x$  does the absolute value of  $f(x)$  equal  $1/2$ ?

ANSWER: 2 [W: JW, E: EB; EDE Math-A]

### TOSSUP

8 MATH *Short Answer* Kartik rolls 100 fair six-sided dice. What is the expected sum of all of his rolls?

Answer: 350 [W: KR, E: EB; EDE Math-C]

### BONUS

8 MATH *Multiple Choice* Which of the following is not a zero of the equation  $y = x^3 - 7x^2 - x + 7$ ?

- W) 1
- X) 7
- Y) -1
- Z) -7

ANSWER: Z) -7 [W: OW, E: SC; EDE Math-A]

### TOSSUP

9 PHYSICS *Short Answer* Which circuit element creates a magnetic flux proportional to current, and is commonly said to oppose changes in current?

ANSWER: INDUCTOR [W: JW; E: RF, EDE Phys-ET]

### BONUS

9 PHYSICS *Multiple Choice* The electric field strength at a distance  $r$  from an infinite sheet of uniform charge density is proportional to what power of  $r$ ?

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

ANSWER: W) 0 [W: RF, E: SC; EDE Phys-ET]

### TOSSUP

10 PHYSICS *Short Answer* Identify all of the following which are true of the magnetostatic

- 1) It does no work force:
- 2) Currents that generate it are not necessarily steady
- 3) It arises due to the movement of electrons

ANSWER: 1 AND 3 [W: RF; E: SC; EDE Phys-ET]

### BONUS

10 PHYSICS *Short Answer* What spectral line, commonly observed in radio astronomy, is caused by the transition between parallel and antiparallel spin states of a hydrogen atom's proton and electron?

ANSWER: 21 CM LINE (ACCEPT: H I LINE) [W: JW, E: EB; EDE Phys-MO]

### TOSSUP

**11 ENERGY *Short Answer*** Researchers at UW Madison are trying to describe gravitational fields using quantum theory. What hypothetical elementary particle has a spin of 2 and is responsible for carrying the force of gravity?

ANSWER: GRAVITON [W: OW, E: EB; EDE]

### BONUS

**11 ENERGY *Short Answer*** Researchers at UW Madison are studying the regeneration of connective tissue following surgery. Identify all of the following four tissues that would be considered connective tissue:

- 1) Bone
- 2) Neurons
- 3) Blood
- 4) Adipose tissue

ANSWER: 1, 3, 4 [W: OW, E: EB; EDE]

### TOSSUP

**12 ENERGY *Short Answer*** Researchers at UW Madison are studying the multistep reactions needed to form complex crystals and the enthalpy change of each reaction. What law states that the enthalpy change over a complete sequence of reactions is independent of the path taken?

ANSWER: HESS'S LAW [W: OW, E: EB; EDE]

### BONUS

**12 ENERGY *Short Answer*** Researchers at UW Madison are studying the formation of new stars in the Andromeda Galaxy. What type of pre-main sequence variable star does not yet have the ability to fuse hydrogen but is instead powered by gravitational energy?

ANSWER: T-TAURI [W: OW, E: EB; EDE]