

## ROUND 2A

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### TOSS-UP

1) CHEMISTRY *Multiple Choice* In proteins, a beta sheet is an example of what type of structure?

- W) Primary
- X) Secondary
- Y) Tertiary
- Z) Quaternary

ANSWER: X) SECONDARY

### BONUS

1) CHEMISTRY *Short Answer* On a phase diagram, what is the name for the one point in phase space where gas, liquid, and solid phases all coexist in equilibrium [*ee-kwuh-LIB-ree-uhm*]?

ANSWER: TRIPLE POINT

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### TOSS-UP

2) BIOLOGY *Short Answer* A group of butterflies occurs in many color patterns. The butterflies can interbreed and the offspring are fertile. What is the most appropriate taxonomical rank for this group of butterflies?

ANSWER: SPECIES

### BONUS

2) BIOLOGY *Multiple Choice* Which of the following animals is most likely to be responsible for girdling a tree?

- W) Skunk
- X) Porcupine
- Y) Raccoon
- Z) Yellow bellied marmot

ANSWER: X) PORCUPINE

### TOSS-UP

3) ENERGY *Short Answer* Named after its inventor, what battery powered the earliest telegraphs?

ANSWER: DANIELL CELL (ACCEPT: GROVE CELL)

### BONUS

3) ENERGY *Short Answer* What valuable co-product of the water-gas-shift reaction is left when the resultant CO<sub>2</sub> [**C -O- two**] is removed?

ANSWER: HYDROGEN

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### TOSS-UP

4) EARTH AND SPACE *Short Answer* What gas can naturally form in a crystalline solid in ocean floor sediments?

ANSWER: METHANE

### BONUS

4) EARTH AND SPACE *Multiple Choice* NOAA's 2008-2017 Tsunami Programs Strategic Plan aims to minimize loss of life and disruption to economically vital coastal communities from future tsunamis. Which of the following is NOT an anticipated outcome of the national tsunami effort?"

- W) Timely and accurate tsunami forecast and warning products
- X) Tsunami products that are understandable and usable
- Y) Resilient communities inhabited by a public educated to take appropriate actions
- Z) Improved predictive modeling capabilities to treat tsunamis as a single giant wave

ANSWER: Z) IMPROVED PREDICTIVE MODELING CAPABILITIES TO TREAT TSUNAMIS AS A SINGLE GIANT WAVE

### TOSS-UP

5) MATH *Short Answer* Solve for  $x$  in  $(2x - 9)^2 = 81$  [**two x minus 9 quantity squared equals 81**]

ANSWER:  $x = 0$  or  $x = 9$  (must give both answers)

### BONUS

5) MATH *Multiple Choice* Which of the following pizzas has the greatest area on its top?

W) A rectangular pizza, 18" by 12" [**eighteen inches by twelve inches**]

X) A square pizza, 15" by 15" [**fifteen inches by fifteen inches**]

Y) A circular pizza with a 14" diameter [**fourteen inch diameter**]

Z) A circular pizza with an 8" radius [**eight inch radius**]

ANSWER: X) A SQUARE PIZZA, 15" BY 15"

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### TOSS-UP

6) BIOLOGY *Multiple Choice* Mistletoe is a vascular plant that imbeds root-like structures into the limbs of a tree, robbing it of moisture and nutrients. The mistletoe provides no resources to the tree on which it depends. The ecological relationship between the mistletoe and the tree is an example of which of the following?

W) Commensalism

X) Herbivory [**hur-buh-VOH-re**]

Y) Mimicry

Z) Parasitism

ANSWER: Z) PARASITISM

### BONUS

6) BIOLOGY *Multiple Choice* Which of the following glands contributes to thermoregulation by adjusting the resting metabolic rate?

W) Pancreas

X) Thyroid

Y) Anterior pituitary [**pi-TOO-i-ter-ee**]

Z) Adrenal

ANSWER: X) THYROID

### TOSS-UP

7) CHEMISTRY *Multiple Choice* Which of the following is not one of the characteristics of indirect coulometry [*koo-LOM-i-tree*]?

- W) Utilizes a constant current source and both indicating and generating electrodes
- X) Can detect microgram amounts
- Y) Requires the use of standards even if the current efficiency is known
- Z) Can use unstable reagents

ANSWER: Y) REQUIRES THE USE OF STANDARDS EVEN IF THE CURRENT EFFICIENCY IS KNOWN

### BONUS

7) CHEMISTRY *Short Answer* Bronze and brass are both alloys that are made by combining copper and another substance. What other substances are most typically used to make bronze and brass, respectively?

ANSWER: TIN: BRONZE; ZINC: BRASS

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### TOSS-UP

8) PHYSICS *Short Answer* What type of electrical circuit component can be used to store energy electrostatically?

ANSWER: CAPACITOR

### BONUS

8) PHYSICS *Short Answer* Indicate, by number, all of the following three forces that would act on a rock as it slides along the ground after being kicked: 1) gravity; 2) friction; 3) air resistance.

ANSWER: 1, 2, AND 3 (ACCEPT: ALL OF THEM)

**TOSS-UP**

9) EARTH AND SPACE *Short Answer* The geologic eras are separated by what sort of major biological event?

ANSWER: MASS EXTINCTION (ACCEPT: MASS EXTINCTION EVENTS)

**BONUS**

9) EARTH AND SPACE *Multiple Choice* Which of the following is nearest the percentage of the South American continent drained by the Amazon River?

- W) 15%
- X) 40%
- Y) 60%
- Z) 75%

ANSWER: X) 40%

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**TOSS-UP**

10) BIOLOGY *Multiple Choice* Which of the following visual disorders results in large pressure increases within the eye?

- W) Glaucoma
- X) Astigmatism
- Y) Macular degeneration
- Z) Cataracts

ANSWER: W) GLAUCOMA

**BONUS**

10) BIOLOGY *Multiple Choice* Konrad Lorenz, a noted behavioral psychologist, was famous for conditioning a gaggle of geese at a particular age in their development to adopt his rubber boots as their mother. This kind of animal behavior results from which of the following?

- W) Habituation
- X) Imprinting
- Y) Instinct
- Z) Nurturing

ANSWER: X) IMPRINTING

### TOSS-UP

11) MATH *Multiple Choice* A man buys candies for  $x$  cents per dozen and sells them for  $x$  over 9 cents per candy. If he buys the candies for \$1.08 per dozen, what is his profit per candy, in cents?

- W) 1 cent
- X) 3 cents
- Y) 8 cents
- Z) 12 cents

ANSWER: X) 3 CENTS

### BONUS

11) MATH *Short Answer* Simplify the following fraction for values of  $x$  for which it is defined:

$\frac{6x^2+4x-2}{4x-12x^2}$  [**the fraction with numerator six  $x$  squared plus four  $x$  minus two and denominator four  $x$  minus twelve  $x$  squared**].

ANSWER:  $-\frac{x+1}{2x}$

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### TOSS-UP

12) ENERGY *Multiple Choice* Which of the following countries has the highest percentage of its electricity production from geothermal energy?

- W) United States
- X) Philippines
- Y) Greenland
- Z) Iceland

ANSWER: Z) ICELAND

### BONUS

12) ENERGY *Short Answer* Order the following four sources of energy from least to greatest in terms of the percentage share of total electricity generation in the United States: 1) coal; 2) nuclear; 3) petroleum; 4) hydropower.

ANSWER: 3, 4, 2, 1 (ACCEPT: PETROLEUM, HYDROPOWER, NUCLEAR, COAL)

### TOSS-UP

13) CHEMISTRY *Multiple Choice* Which of the following elements would be most likely to violate the octet rule?

- W) Boron
- X) Carbon
- Y) Nitrogen
- Z) Oxygen

ANSWER: W) BORON

### BONUS

13) CHEMISTRY *Short Answer* Identify all of the following three statements that characterize pi bonds: 1) They have maximum electron density on the internuclear axis; 2) They are generally less stable than sigma bonds; 3) A triple bond consists of one pi bond and two sigma bonds.

ANSWER: 2 ONLY (ACCEPT: THEY ARE GENERALLY LESS STABLE THAN SIGMA BONDS)

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### TOSS-UP

14) BIOLOGY *Multiple Choice* Which of the following is the most similar to the ecosystem type that would be found at 4000m elevation in the Andes?

- W) Tundra
- X) Broadleaf forest
- Y) Chaparral [**shap-uh-RAL**]
- Z) Temperate grassland

ANSWER: W) TUNDRA

### BONUS

14) BIOLOGY *Multiple Choice* What is the name of the genus of the early hominid Lucy?

- W) *Ardipithecus* [**ahr-de-PITH-i-cuhs**]
- X) *Homo*
- Y) *Australopithecus* [**aw-stray-loh-PITH-i-kuhs**]
- Z) *Paranthropus* [**par-RUN-throh-puhs**]

ANSWER: Y) AUSTRALOPITHECUS

### TOSS-UP

15) EARTH AND SPACE *Multiple Choice* Frost wedging or freeze-thaw weather is most prominent in which of the following locations?

- W) Anchorage, Alaska
- X) Chicago, Illinois
- Y) Phoenix, Arizona
- Z) San Diego, California

ANSWER: X) CHICAGO, ILLINOIS

### BONUS

15) EARTH AND SPACE *Multiple Choice* Which of the following types of volcanic vents creates wide-spread basalt deposits called flood basalts?

- W) Fissures
- X) Cinder cones
- Y) Composite cone
- Z) Stratovolcanoes

ANSWER: W) FISSURES

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### TOSS-UP

16) ENERGY *Multiple Choice* Which of the following values refers to the maximum amount of non-expansion work that can be extracted from a closed system?

- W) Enthalpy
- X) Entropy
- Y) Helmholtz free energy
- Z) Gibbs free energy

ANSWER: Z) GIBBS FREE ENERGY

### BONUS

16) ENERGY *Short Answer* The addition of 2.0 moles of sulfur dioxide to 1.0 mole of diatomic oxygen forms 2.0 moles of sulfur trioxide at a constant pressure and releases 198 kilojoules of energy as heat. In kilojoules, what is the change in enthalpy for this reaction?

ANSWER: -198 (DO NOT ACCEPT: 198)

### TOSS-UP

17) MATH *Short Answer* Consider two sets, A and B, that show a correlation coefficient  $R$  equal to 0.6. If all the members of set A are multiplied by 3 and all members of set B are reduced by 2, what is the new value of  $R$ ?

ANSWER: 0.6 (ACCEPT: IT STAYS THE SAME)

### BONUS

17) MATH *Multiple Choice* How many roots satisfy the equation  $\sqrt{6-x} = x\sqrt{6-x}$  [**square root of quantity six minus x equals x times the square root of quantity six minus x**]?

- W) 0
- X) 1
- Y) 2
- Z) 3

ANSWER: Y) 2

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### TOSS-UP

18) PHYSICS *Short Answer* Identify all of the following three quantities that are constant for a body in uniform circular motion: 1) kinetic energy; 2) speed; 3) angular velocity.

ANSWER: 1, 2, AND 3 (ACCEPT: KINETIC ENERGY, SPEED, AND ANGULAR VELOCITY OR ALL OF THEM)

### BONUS

18) PHYSICS *Short Answer* Indicate, by number, all of the following three optical properties that are involved in the production of rainbows: 1) dispersion; 2) absorption; 3) total internal reflection.

ANSWER: 1 AND 3

### TOSS-UP

19) BIOLOGY *Multiple Choice* Which of the following neurotransmitters typically has a fast excitation response?

- W) Aminobutyric acid [*uh-MEE-noh-byoo-TIR-ik*]
- X) Acetylcholine [*uh-seet-I-KOH-leen*]
- Y) Glycine [*GLY-seen*]
- Z) Histamine

ANSWER: X) ACETYLCHOLINE

### BONUS

19) BIOLOGY *Short Answer* What is the primary force that holds the antiparallel stands of a DNA helix together?

ANSWER: HYDROGEN BOND

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### TOSS-UP

20) CHEMISTRY *Short Answer* What law gives the solubility of a gaseous species as a linear function of its partial pressure about a liquid solvent?

ANSWER: HENRY'S LAW

### BONUS

20) CHEMISTRY *Short Answer* Match the four acids with their proper IUPAC [*I-U- pak*] names:

1) HClO [*H-C-L-O*]; 2) HClO<sub>2</sub> [*H-C-L-O two*]; 3) HClO<sub>3</sub> [*H-C-L-O three*]; 4) HClO<sub>4</sub> [*H-C-L-O four*]; A) chloric acid; B) perchloric acid; C) hypochlorous acid; and D) chlorous acid

ANSWER: 1-C, 2-D, 3-A, 4-B (HClO – HYPOCHLOROUS ACID; HClO<sub>2</sub> – CHLOROUS ACID; HClO<sub>3</sub> – CHLORIC ACID; HClO<sub>4</sub> – PERCHLORIC ACID)

### TOSS-UP

21) MATH *Multiple Choice* The bob on a pendulum swings through an arc 3 feet long when the string swings through an angle of 0.5 radians. What is the length of the pendulum in feet?

- W) 4
- X) 5
- Y) 6
- Z) 7

ANSWER: Y) 6

### BONUS

21) MATH *Short Answer* You have a sample of 30 values that correspond to the amounts of money you spent on gas in each of 30 months. You notice that the highest value was mistakenly recorded with an extra zero, but after correcting it, it remains the highest value. Identify all of the following four values that change after the correction: 1. Mean, 2. Median, 3. Interquartile Range, 4. Range.

ANSWER: 1, 4 (ACCEPT: MEAN AND RANGE)

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### TOSS-UP

22) PHYSICS *Short Answer* The idea that energy is quantized in order to explain the observed black-body radiation was first postulated by what German scientist?

ANSWER: MAX PLANCK

### BONUS

22) PHYSICS *Short Answer* What scientist first described the wave mechanics of quantum particles with his namesake wave function?

ANSWER: ERWIN SCHRODINGER

### TOSS-UP

23) EARTH AND SPACE *Multiple Choice* In which of the following climates is chemical weathering generally most effective?

- W) Temperate
- X) Hot and arid
- Y) Tropical
- Z) Arctic

ANSWER: Y) TROPICAL

### BONUS

23) EARTH AND SPACE *Multiple Choice* The reasons why the earth's core is believed to be largely molten iron do NOT include which of following?

- W) Density of iron
- X) Conductivity of iron
- Y) Magnetic properties of iron
- Z) Abundance of iron in the universe

ANSWER: Y) MAGNETIC PROPERTIES OF IRON