

## ROUND 16A

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### TOSS-UP

1) GENERAL SCIENCE *Short Answer* In an RNA molecule, a codon is AUG. What is the 5' to 3' **[5-prime to 3-prime]** sequence of the anticodon for the tRNA?

ANSWER: CAU

### BONUS

1) GENERAL SCIENCE *Multiple Choice* Which of the following could be viewed with an electron microscope but not with a light microscope?

- W) Ribosomes **[RY-buh-sohms]**
- X) Plant cells
- Y) Animal cells
- Z) Mitochondria **[my-tuh-KON-dree-uh]**

ANSWER: W) RIBOSOMES

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### TOSS-UP

2) MATH *Short Answer* In base-3, what is the product of 100 and 110?

ANSWER: 11000

### BONUS

2) MATH *Short Answer* In a right triangle with legs of length 8 and 15, expressing your answer in simplest form, what is the length of the altitude to the hypotenuse?

ANSWER: 120/17 (ACCEPT: 7 1/17)

### TOSS-UP

3) PHYSICAL SCIENCE *Multiple Choice* A chisel would represent what type of simple machine?

- W) Pulley
- X) Wedge
- Y) Lever
- Z) Screw

ANSWER: X) WEDGE

### BONUS

3) PHYSICAL SCIENCE *Multiple Choice* Which of the following best demonstrates the mass continuity of fluid flow?

- W) Water flows fastest through the narrowest piece of a long pipe
- X) Water flows slower after having moved further from Earth's center
- Y) Pressure is lower in water moving at high speed
- Z) A small force can be used on a small tube to lift a large object sitting on a large tube

ANSWER: W) WATER FLOWS FASTEST THROUGH THE NARROWEST PIECE OF A LONG PIPE

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### TOSS-UP

4) LIFE SCIENCE *Multiple Choice* Which of the following characteristics will a lake that has undergone eutrophication exhibit [*yoo-tro-fi-KAY-shun*]?

- W) The lake will be clear and cold
- X) The lake will be high in nutrients
- Y) The lake will support large numbers of fish
- Z) The lake will have low primary productivity

ANSWER: X) THE LAKE WILL BE HIGH IN NUTRIENTS

### BONUS

4) LIFE SCIENCE *Multiple Choice* Which of the following animal products has NOT been correctly paired with the animal that produces it?

- W) Ambergris, sperm whale [*AM-ber-grees*]
- X) Lanolin, goat
- Y) Carticin, sharks
- Z) Leaf lard, pig

ANSWER: X) LANOLIN, GOAT

### TOSS-UP

5) EARTH AND SPACE *Multiple Choice* What type of galaxy usually occupies the central regions of a galaxy cluster?

- W) Peculiar
- X) Elliptical
- Y) Lenticular
- Z) Spiral

ANSWER: X) ELLIPTICAL

### BONUS

5) EARTH AND SPACE *Short Answer* Which atmospheric element is converted into a bioavailable form through the Haber-Bosch process [*HA-buhr BOSH*]?

ANSWER: NITROGEN

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### TOSS-UP

6) GENERAL SCIENCE *Multiple Choice* Which of the following distinguishes different isotopes of an element?

- W) Chemical reactivity
- X) Number of electrons
- Y) Number of protons
- Z) Their mass

ANSWER: Z) THEIR MASS

### BONUS

6) GENERAL SCIENCE *Short Answer* List the following four geologic time scale divisions in order from largest to smallest: 1) periods, 2) eras, 3) epochs, 4) eons.

ANSWER: 4, 2, 1, 3 (ACCEPT: EONS, ERAS, PERIODS, EPOCHS)

### TOSS-UP

7) MATH *Multiple Choice* Which of the following theorems does NOT allow one to conclude directly that two triangles are congruent?

- W) Side-side-angle
- X) Side-angle-side
- Y) Hypotenuse-leg [**hy-POT-n-oos**]
- Z) Side-side-side

ANSWER: W) SIDE-SIDE-ANGLE

### BONUS

7) MATH *Short Answer* The diameter of a circle is increased by 50%. By what percentage is the area of the circle increased?

ANSWER: 125 (ACCEPT: 125%)

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### TOSS-UP

8) ENERGY *Multiple Choice* What fuel is used in a nuclear reactor?

- W) Polonium-275
- X) Radium-226
- Y) Uranium -235
- Z) Curium-258 [**KYOOOR-ee-uhm**]

ANSWER: Y) URANIUM -235

### BONUS

8) ENERGY *Multiple Choice* The U.S. Department of Energy is currently developing methods aimed at carbon capture, utilization, and storage (CCUS). How can the CO<sub>2</sub> captured in this way also be used to increase energy output in the U.S.?

- W) Increased output at oil fields
- X) Increased output at geothermal sources
- Y) Increased output at hydroelectric dams
- Z) Increased output at wind farms

ANSWER: W) INCREASED OUTPUT AT OIL FIELDS

### TOSS-UP

9) PHYSICAL SCIENCE *Multiple Choice* Which of the following metals is the most reactive with water?

- W) Ca
- X) Fe
- Y) K
- Z) Mg

ANSWER: Y) K

### BONUS

9) PHYSICAL SCIENCE *Short Answer* Providing your answer to the nearest hundred, what is the half-life in years of carbon-14?

ANSWER: 5,700

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### TOSS-UP

10) LIFE SCIENCE *Multiple Choice* Which of the following statements does NOT support the cell theory?

- W) All organisms are composed of cells
- X) Cells are alive
- Y) Cells arise *de novo* (from nothing)
- Z) Cells are the fundamental units of living organisms

ANSWER: Y) CELLS ARISE *DE NOVO* (FROM NOTHING)

### BONUS

10) LIFE SCIENCE *Multiple Choice* Which of the following are the result of the 5' to 3' [**5-prime to 3-prime**] directionality of DNA polymerase [**POL-uh-muh-rays**]?

- W) Semi conservative DNA replication
- X) Okazaki fragments [**AW-kah-ZAH-kee**]
- Y) Thymine dimers [**THY-meen**]
- Z) Degradation of the 3' to 5' strand of parental DNA

ANSWER: X) OKAZAKI FRAGMENTS

### TOSS-UP

11) EARTH AND SPACE *Short Answer* To the nearest Kelvin, what is the temperature of the Cosmic Microwave Background?

ANSWER: 3

### BONUS

11) EARTH AND SPACE *Multiple Choice* Which of the following would be affected the least by the Coriolis effect?

- W) Direction for a wind blowing from the north
- X) A hurricane
- Y) A tornado
- Z) A high pressure system

ANSWER: Y) A TORNADO

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### TOSS-UP

12) GENERAL SCIENCE *Short Answer* What structure of the brain, referred to as “little brain,” is responsible for maintaining balance and posture as well as coordination of voluntary movements?

ANSWER: CEREBELLUM

### BONUS

12) GENERAL SCIENCE *Multiple Choice* Which of the following organelles is found in motile cells of higher order animals, but NOT in flowering plant cells?

- W) Cytoplasm
- X) Cell wall
- Y) Centrioles [**SEN-tree-ohls**]
- Z) Centrosome

ANSWER: Y) CENTRIOLES

### TOSS-UP

13) MATH *Multiple Choice* The secant of 70 is equivalent to which of the following expressions?

- W)  $1 / \cos(70)$  [**1 over the cosine of 70**]
- X)  $1 / \sin(70)$  [**1 over the sine of 70**]
- Y)  $\sin(70) / \cos(70)$  [**sine of 70 over the cosine of 70**]
- Z)  $\cos(70) / \sin(70)$  [**cosine of 70 over the sine of 70**]

ANSWER: W)  $1/\cos(70)$

### BONUS

13) MATH *Multiple Choice*  $2^{30}$  is nearest which of the following powers of 10?

- W)  $10^8$
- X)  $10^9$
- Y)  $10^{11}$
- Z)  $10^{12}$

ANSWER: X)  $10^9$

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### TOSS-UP

14) PHYSICAL SCIENCE *Multiple Choice* The source of the tremendous energy and rapid rotations of stars detected at the center of the Milky Way is attributed to which of the following?

- W) Supernova explosions
- X) Dark matter
- Y) Neutron star
- Z) Supermassive black hole

ANSWER: Z) SUPERMASSIVE BLACK HOLE

### BONUS

14) PHYSICAL SCIENCE *Short Answer* One common way to express the distance from the Earth to the Sun is in light-minutes, which is a similar concept to light-years. The distance to the Sun in these units is about 8.5 light-minutes. If the Sun were to go out in an instant, how long, in seconds, would it take people on Earth to notice?

ANSWER: 510

**TOSS-UP**

15) LIFE SCIENCE *Short Answer* What is the first amino acid encoded by all eukaryotic mRNAs [**yoo-KAR-ee-oh-tik**]?

ANSWER: METHIONINE

**BONUS**

15) LIFE SCIENCE *Multiple Choice* Which of the following is the role of DNA ligase [**LY-gayz**] in DNA replication?

- W) Joining the 3' [**3-prime**] end of the DNA that replaces the primer to the rest of the sequence
- X) Unwinding the parental DNA strand
- Y) Relieving strain caused by over-winding the DNA strand
- Z) Synthesis of an RNA primer

ANSWER: W) JOINING THE 3' END OF THE DNA THAT REPLACES THE PRIMER TO THE REST OF THE SEQUENCE

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**TOSS-UP**

16) EARTH AND SPACE *Short Answer* What is the term that refers to waves at high tide during a spring tide?

ANSWER: TIDAL SURGES (ACCEPT: TIDAL SURGE)

**BONUS**

16) EARTH AND SPACE *Short Answer* What is the term for the surface where the water pressure head is equal to the atmospheric pressure?

ANSWER: WATER TABLE

### TOSS-UP

17) ENERGY *Multiple Choice* What will raising water temperature (under pressure) from 100°C to 110°C do to the cooking time of a potato?

- W) Decrease it by 10%
- X) Decrease it by 50%
- Y) Increase it by 50%
- Z) No change

ANSWER: X) DECREASE IT BY 50%

### BONUS

17) ENERGY *Multiple Choice* At what specific angle of incidence should the irradiance hit a solar panel in order to produce maximum power?

- W) 0 degrees
- X) 15 degrees
- Y) 45 degrees
- Z) 90 degrees

ANSWER: W) 0 DEGREES

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### TOSS-UP

18) GENERAL SCIENCE *Multiple Choice* Which of the following is NOT a way in which bacteria can obtain foreign DNA?

- W) Transduction
- X) Conjugation
- Y) Transformation
- Z) Transcription

ANSWER: Z) TRANSCRIPTION

### BONUS

18) GENERAL SCIENCE *Short Answer* What is the term for a volcano that has NOT erupted for tens of thousands of years and is not expected to erupt again?

ANSWER: EXTINCT

### TOSS-UP

19) MATH *Short Answer* Given that a particular right triangle contains one  $45^\circ$  angle and one side of length 6, what are all possible lengths of one of the other two sides?

ANSWER:  $3\sqrt{2}$ ; 6;  $6\sqrt{2}$

### BONUS

19) MATH *Short Answer* On the domain  $5 \leq x \leq 12$  [**5 is less than or equal to x is less than or equal to 12**], what is the maximum y-value of the parabola with equation  $y = 17 - (x + 7)^2$  [**y equals 17 minus the square of the quantity x plus 7**]?]

ANSWER: -127

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### TOSS-UP

20) PHYSICAL SCIENCE *Short Answer* While on the side of the road, a student is approached and passed by an emergency vehicle with its siren blaring. While the vehicle is approaching the student, the pitch that the student hears is higher than when the vehicle is receding away after passing him. What is the name of the effect which is responsible for this difference in pitch?

ANSWER: DOPPLER EFFECT

### BONUS

20) PHYSICAL SCIENCE *Multiple Choice* Which of the following best explains why diamond is much harder than graphite even though both are made of arranged carbon atoms?

W) Graphite is arranged in sheets, whereas diamond's layers are intertwined in a crystalline structure, making it stronger

X) Graphite is opaque and grey while diamond has a greater clarity and sheen to it

Y) Diamond is arranged in sheets, whereas graphite's layers are intertwined in a crystalline structure, making them weaker

Z) The density of graphite is greater than that of diamond, meaning the carbon atoms are more likely to leave the structure

ANSWER: W) GRAPHITE IS ARRANGED IN SHEETS WHEREAS DIAMOND'S LAYERS ARE INTERTWINED IN A CRYSTALLINE STRUCTURE, MAKING IT STRONGER

### TOSS-UP

21) ENERGY *Short Answer* In ecology, GPP is the amount of light energy that is converted to chemical energy via photosynthesis per unit of time. In this case, for what is GPP an abbreviation?

ANSWER: GROSS PRIMARY PRODUCTION (DO NOT ACCEPT: GROSS PRIMARY PRODUCTIVITY)

### BONUS

21) ENERGY *Multiple Choice* Which of the following is one of the main disadvantages of molten carbonate fuel cells, when compared to solid oxide fuel cells?

- W) Sensitivity to carbon dioxide
- X) Risk of corrosion at high temperatures
- Y) They require an external reformer to convert more energy-dense fuels to hydrogen
- Z) Sensitivity to fuel impurities

ANSWER: X) RISK OF CORROSION AT HIGH TEMPERATURES

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### TOSS-UP

22) LIFE SCIENCE *Multiple Choice* The ocean's distinct smell comes from dimethyl [**dy-METH-uhl**] sulfide (DMS), which is released upon the death of what ocean organism?

- W) Worms
- X) Nudibranchs [**NOO-duh-brangks**]
- Y) Phytoplankton [**fy-tuh-PLANGK-tuhn**]
- Z) Shrimp

ANSWER: Y) PHYTOPLANKTON

### BONUS

22) LIFE SCIENCE *Short Answer* Which organ in the human body is sometimes referred to as the "graveyard" for red blood cells?

ANSWER: SPLEEN

### TOSS-UP

23) EARTH AND SPACE *Short Answer* What is the term used to describe the period when Jupiter is directly opposite the Sun as viewed from Earth?

ANSWER: OPPOSITION

### BONUS

23) EARTH AND SPACE *Multiple Choice* The presence of oxygen in our atmosphere makes it which of the following?

- W) A low pressure gradient atmosphere
- X) An oxidizing atmosphere
- Y) A high pressure gradient atmosphere
- Z) A reducing atmosphere

ANSWER: X) AN OXIDIZING ATMOSPHERE