

## ROUND 15

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### TOSS-UP

1) EARTH AND SPACE SCIENCE *Multiple Choice* In 1849, bones of a beluga whale were discovered in Vermont buried nearly 10 feet below the surface and over 150 miles from the nearest ocean. During which of the following time frames would the whale most likely have died?

- W) 6,000 to 7,000 years ago
- X) 11,000 to 12,000 years ago
- Y) 17,000 to 18,000 years ago
- Z) 23,000 to 24,000 years ago

ANSWER: X) 11,000 TO 12,000 YEARS AGO

### BONUS

1) EARTH AND SPACE SCIENCE *Short Answer* By name or number, list the following four fossils in chronological order from earliest to most recent according to their first occurrence in geological history: 1) bird, 2) trilobite, 3) dinosaur, 4) eurypterid (read as: yuh-RIP-the-rid).

ANSWER: TRILOBITE, EURYPTERID, DINOSAUR, BIRD (ACCEPT: 2, 4, 3, 1)

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### TOSS-UP

2) PHYSICAL SCIENCE *Multiple Choice* Which of the following processes could NOT take place in the active site of an enzyme?

- W) Phosphorylation (read as: fahs-fohr-i-LAY-shohn)
- X) Hydrolysis
- Y) Dehydration synthesis
- Z) Glycolysis

ANSWER: Z) GLYCOLYSIS

### BONUS

2) PHYSICAL SCIENCE *Short Answer* Providing your answer to the nearest integer, what is the heat of fusion, in joules per gram, of water?

ANSWER: 334

**TOSS-UP**

3) EARTH AND SPACE SCIENCE *Multiple Choice* Which of the following seas of the Arctic Ocean has observed the greatest loss of ice since 1990?

- W) Greenland
- X) Laptev
- Y) Labrador
- Z) Chukchi (read as: CHOOK-chee)

ANSWER: Z) CHUKCHI

**BONUS**

3) EARTH AND SPACE SCIENCE *Multiple Choice* Which of the following sets of two locations have the most similar latitudes?

- W) New York City, New York and London, England
- X) Tampa, Florida and Kathmandu, Nepal
- Y) Death Valley, California and Boston, Massachusetts
- Z) Sydney, Australia and Lima, Peru

ANSWER: X) TAMPA, FLORIDA AND KATHMANDU, NEPAL

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**TOSS-UP**

4) ENERGY *Multiple Choice* Which of the following is the most efficient type of solar cell?

- W) Multijunction
- X) Single-junction
- Y) Crystalline silicon
- Z) Thin-film

ANSWER: W) MULTIJUNCTION

**BONUS**

4) ENERGY *Short Answer* In which state is the world's largest onshore wind farm?

ANSWER: TEXAS

### TOSS-UP

5) LIFE SCIENCE *Multiple Choice* Indicate which of the following is most efficient for water and mineral transport in plants?

- W) Tracheids (read as: TRAY-keeds)
- X) Sclerids
- Y) Sieve tube elements
- Z) Vessel elements

ANSWER: Z) VESSEL ELEMENTS

### BONUS

5) LIFE SCIENCE *Short Answer* What term is used to describe a form of reproduction in which growth and development of embryos occurs without fertilization by the male?

ANSWER: PARTHENOGENESIS

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### TOSS-UP

6) MATH *Short Answer* What is the sum of the interior angles, in degrees, of a regular octadecagon?

ANSWER: 2880

### BONUS

6) MATH *Short Answer* How many different permutations consisting of 3 letters, each ending in the letter T, can be formed from the seven letters of the word MASTERS?

ANSWER: 21

### TOSS-UP

7) LIFE SCIENCE *Multiple Choice* Which of the following is responsible for speeding up the transmission of action potentials across axons?

- W) Glia
- X) Synapse
- Y) Dendrites
- Z) Myelin (read as: MY-eh-lin)

ANSWER: Z) MYELIN

### BONUS

7) LIFE SCIENCE *Short Answer* A gardener is trying to graft two fruit trees together. Which type of hormone should she use to form callus tissue to connect the plants?

ANSWER: AUXIN

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### TOSS-UP

8) ENERGY *Short Answer* What is the term for a compound that is often used as an odorant to assist in the detection of natural gas?

ANSWER: THIOL (ACCEPT: MERCAPTAN, THIOPHANE)

### BONUS

8) ENERGY *Short Answer* By name or number, identify all of the following four organisms that can live near a cold seep: 1) bacteria, 2) *Bathymodiolus* (read as: bah-TI-moh-dioh-luhs), 3) tubeworms, 4) corals.

ANSWER: BACTERIA, *BATHYMODIOLUS*, TUBEWORMS, CORALS (ACCEPT: 1, 2, 3, AND 4 OR ALL)

### TOSS-UP

9) PHYSICAL SCIENCE *Multiple Choice* Which of the following is NOT an acid-base conjugate pair?

- W)  $\text{H}_3\text{O}^+$  and  $\text{H}_2\text{O}$
- X)  $\text{NH}_4^+$  and  $\text{NH}_3$
- Y)  $\text{H}_2\text{SO}_4$  and  $\text{OH}^-$
- Z)  $\text{H}_2\text{CO}_3$  and  $\text{HCO}_3^-$

ANSWER: Y)  $\text{H}_2\text{SO}_4$  AND  $\text{OH}^-$

### BONUS

9) PHYSICAL SCIENCE *Short Answer* Using proper chemical nomenclature, indicating the charge of each ion, what is the balanced net ionic equation for the reaction between barium chloride and potassium phosphate?

ANSWER:  $3\text{Ba}^{2+} + 2(\text{PO}_4)^{3-} \rightarrow \text{Ba}_3(\text{PO}_4)_2$

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### TOSS-UP

10) LIFE SCIENCE *Multiple Choice* Hormones released by the posterior pituitary control numerous emotions, drives, and autonomic functions. In which of the following locations are those hormones actually produced?

- W) Thalamus
- X) Hypothalamus
- Y) Anterior pituitary
- Z) Amygdaloid (read as: AH-mig-lohid) body

ANSWER: X) HYPOTHALAMUS

### BONUS

10) LIFE SCIENCE *Short Answer* What is the genus name of the leatherback sea turtle?

ANSWER: *DERMOCHELYS*

**TOSS-UP**

11) MATH *Short Answer* What are the coordinates of the x-intercept of the line:  $5y = 4x - 20$ ?

ANSWER: (5, 0)

**BONUS**

11) MATH *Short Answer* Find the minimum possible value of  $y$  in the equation  $y = |x - 3| - |x - 5|$  (read as:  $y$  equals the absolute value of the quantity  $x$  minus three minus the absolute value of the quantity  $x$  minus 5), where  $x$  is a real number.

ANSWER: -2

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**TOSS-UP**

12) GENERAL SCIENCE *Multiple Choice* Which of the following elements is NOT in group 8 of the periodic table?

- W) Iron
- X) Osmium
- Y) Meitnerium (read as: myt-NIR-ee-uhm)
- Z) Hassium

ANSWER: Y) MEITNERIUM

**BONUS**

12) GENERAL SCIENCE *Short Answer* John scores 1.75 standard deviations below the mean on an exam. If the average score is 50, and 42 is exactly one standard deviation below the mean on a normal distribution, then what was John's score on this exam?

ANSWER: 36

### TOSS-UP

13) EARTH AND SPACE SCIENCE *Short Answer* What product of airplane travel cools Earth's climate by reflecting incoming solar radiation?

ANSWER: CONTRAILS

### BONUS

13) EARTH AND SPACE SCIENCE *Short Answer* By name or number, identify all of the following three clay minerals that are important in brick making: 1) kaolinite (read as: kah-OH-li-nyt), 2) illite, 3) montmorillonite (read as: mohnt-moh-RI-loh-nyt).

ANSWER: KAOLINITE, ILLITE, AND MONTMORILLONITE (ACCEPT: 1, 2, AND 3 OR ALL)

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### TOSS-UP

14) GENERAL SCIENCE *Multiple Choice* Which of the following elements is NOT a lanthanide?

- W) Europium
- X) Terbium
- Y) Thulium
- Z) Curium

ANSWER: Z) CURIUM

### BONUS

14) GENERAL SCIENCE *Multiple Choice* Which of the following organisms has the highest salinity tolerance?

- W) Water stargrass
- X) Horned podweed
- Y) Hydrilla
- Z) Wild celery

ANSWER: X) HORNED PODWEED

**TOSS-UP**

15) LIFE SCIENCE *Multiple Choice* Which of the following is the longest snake alive today?

- W) Burmese python
- X) Reticulated python
- Y) Yellow anaconda
- Z) Green anaconda

ANSWER: X) RETICULATED PYTHON

**BONUS**

15) LIFE SCIENCE *Short Answer* Nitrate, carbonate, or sulfate may be used as exogenous electron acceptors in which energy-creating process?

ANSWER: ANAEROBIC RESPIRATION

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**TOSS-UP**

16) GENERAL SCIENCE *Multiple Choice* Which of the following ocean layers receives the least amount of natural light?

- W) Epipelagic (read as: eh-pi-peh-LAH-jik)
- X) Bathypelagic (read as: bah-thi-peh-LAH-jik)
- Y) Hadal Zone
- Z) Mesopelagic

ANSWER: Y) HADAL ZONE

**BONUS**

16) GENERAL SCIENCE *Short Answer* What is the common name of the only mammal to have large keratin scales covering its skin?

ANSWER: PANGOLIN (DO NOT ACCEPT: ARMADILLO)



**TOSS-UP**

17) MATH *Short Answer* What is the largest possible radius, in units, of a circle contained in the interior of the ellipse  $4x^2 + 9y^2 = 36$ ?

ANSWER: 2

**BONUS**

17) MATH *Short Answer* For what positive integers  $a$  is it true that  $a - 7$  divides  $a$ ?

ANSWER: 6, 8, AND 14

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**TOSS-UP**

18) PHYSICAL SCIENCE *Multiple Choice* A bob of mass  $m$  is attached to a string, forming a pendulum. If the bob is replaced with one of mass  $4m$ , what effect does it have on the period of the pendulum?

- W) It quarters the period
- X) It halves the period
- Y) There is no effect on the period
- Z) It doubles the period

ANSWER: Y) THERE IS NO EFFECT ON THE PERIOD

**BONUS**

18) PHYSICAL SCIENCE *Short Answer* How much energy, in joules, is used by a football player if he pushes a blocking sled for two minutes while generating 40 watts of power?

ANSWER: 4800

### TOSS-UP

19) LIFE SCIENCE *Multiple Choice* Photosynthesis has both light and dark reactions. Which of the following occurs without the presence of light?

- W) Water is split to produce oxygen
- X) Carbon dioxide is transformed to sugar
- Y)  $\text{NADP}^+$  is converted to NADPH
- Z) ADP is converted to ATP

ANSWER: X) CARBON DIOXIDE IS TRANSFORMED TO SUGAR

### BONUS

19) LIFE SCIENCE *Multiple Choice* Cholesterol is responsible for altering membrane fluidity. In which of the following conditions would the presence of cholesterol have the greatest effect on the fluidity of the cell membrane?

- W) When cholesterol levels increase and the membrane is at a low temperature
- X) When cholesterol levels increase and the membrane is at a moderate temperature
- Y) When cholesterol levels decrease and the membrane is at a low temperature
- Z) Cholesterol has the same effect, regardless of the temperature

ANSWER: W) WHEN CHOLESTEROL LEVELS INCREASE AND THE MEMBRANE IS AT A LOW TEMPERATURE

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### TOSS-UP

20) GENERAL SCIENCE *Multiple Choice* A reaction is currently at equilibrium. Which of the following will NOT happen when a catalyst is added to the reaction?

- W) The forward reaction will proceed at a faster rate
- X) The reverse reaction will proceed at a faster rate
- Y) The rate constant will change
- Z) The equilibrium constant will change

ANSWER: Z) THE EQUILIBRIUM CONSTANT WILL CHANGE

### BONUS

20) GENERAL SCIENCE *Short Answer* Based on a typical soil profile, what soil horizon is primarily composed of organic matter?

ANSWER: O

### TOSS-UP

21) PHYSICAL SCIENCE *Multiple Choice* Lighter gases diffuse more quickly than heavier gases. Mathematically, this is expressed by which of the following laws?

- W) Avogadro's
- X) Boyle's
- Y) Graham's
- Z) Charles's

ANSWER: Y) GRAHAM'S

### BONUS

21) PHYSICAL SCIENCE *Short Answer* What is the name of a high-frequency air core transformer that can take the output of a 120-volt AC to several kilovolt transformer and driver circuit, and step it up to hundreds of kilovolts?

ANSWER: TESLA COIL (ACCEPT: RESONANT TRANSFORMER, RESONANCE TRANSFORMER)

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### TOSS-UP

22) EARTH AND SPACE SCIENCE *Multiple Choice* The salinity of ocean water is often determined from its conductivity, measured against the conductivity of which of the following substances dissolved in water?

- W) Potassium chloride
- X) Sodium chloride
- Y) Sodium sulfate
- Z) Magnesium sulfate

ANSWER: W) POTASSIUM CHLORIDE

### BONUS

22) EARTH AND SPACE SCIENCE *Short Answer* What are the three primary ions that contribute to seawater's salinity?

ANSWER: CHLORIDE, SODIUM, AND SULFATE

### TOSS-UP

23) MATH *Multiple Choice* A one-story building has floor dimensions of 400 feet by 100 feet. If a square patio with sides of 28 feet occupies the center of the building, which of the following is the area in square feet that remains for offices?

- W) 36,216
- X) 37,216
- Y) 38,216
- Z) 39,216

ANSWER: Z) 39,216

### BONUS

23) MATH *Short Answer* What are the coordinates of the foci of the hyperbola

$$\frac{(x-3)^2}{64} - \frac{(y+2)^2}{36} = 1?$$

ANSWER: (-7, -2) AND (13, -2)

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### TOSS-UP

24) ENERGY *Multiple Choice* Which of the following processes could be used to control fission reactions in a nuclear power plant?

- W) Cooling the fuel rods with water
- X) Placing gallium control rods between the fuel rods to absorb neutrons
- Y) Placing cadmium control rods between the fuel rods to absorb neutrons
- Z) Placing uranium-235 control rods between the fuel rods to absorb neutrons

ANSWER: Y) PLACING CADMIUM CONTROL RODS BETWEEN THE FUEL RODS TO ABSORB NEUTRONS

### BONUS

24) ENERGY *Short Answer* In the formation of lightning, what is the term for a channel of positively charged air, originating from ground-connected objects, which responds to a strong electric field by reaching out to the clouds?

ANSWER: STREAMER (ACCEPT: POSITIVE STREAMER)

### TOSS-UP

25) MATH *Short Answer* What quadrant is not passed through by the line  $5x + 3y = 15$ ?

ANSWER: III

### BONUS

25) MATH *Short Answer* The linear function  $f(x)$  contains the points  $(-1, 7)$  and  $(4, 3)$ . What is  $f(10)$  in simplest form?

ANSWER:  $-9/5$  (ACCEPT:  $-1.8$ ;  $-1 \frac{4}{5}$ )