

## ROUND 14

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### TOSS-UP

1) EARTH AND SPACE *Multiple Choice* Halley's Comet, a famous short-period comet, was last visible from Earth in 1986. In which of the following years will it be visible from Earth again?

- W) 2016
- X) 2061
- Y) 2099
- Z) 2260

ANSWER: X) 2061

### BONUS

1) EARTH AND SPACE *Short Answer* What is the name of the group of large fissure basalt flows found covering a great portion of the Pacific Northwest?

ANSWER: COLUMBIA RIVER BASALTS

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### TOSS-UP

2) LIFE SCIENCE *Multiple Choice* Which of the following is NOT an effect of the sympathetic nervous system?

- W) Stimulation of glucose release
- X) Inhibition of salivation
- Y) Relaxation of bronchi
- Z) Constriction of pupils

ANSWER: Z) CONSTRICTION OF PUPILS

### BONUS

2) LIFE SCIENCE *Multiple Choice* Which of the following properties of water allow tall trees to transport water to the canopy?

- W) Hydrolytic action
- X) Adhesion and cohesion
- Y) Ionic bonding
- Z) Salt gradient

ANSWER: X) ADHESION AND COHESION

### TOSS-UP

3) GENERAL SCIENCE *Multiple Choice* Which of the following animals is NOT extinct?

- W) Tasmanian wolf
- X) Passenger pigeon
- Y) Red wolf
- Z) Dodo

ANSWER: Y) RED WOLF

### BONUS

3) GENERAL SCIENCE *Multiple Choice* Of the following salts, which is the least soluble in water?

- W) Magnesium nitrate
- X) Sodium acetate
- Y) Lead perchlorate
- Z) Lead chromate

ANSWER: Z) LEAD CHROMATE

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### TOSS-UP

4) MATH *Multiple Choice* Which of the following best describes the graph of this system of equations:  $y = \frac{3}{4}x + 2$  and  $y = \frac{4}{3}x + 4$ ?

- W) They are parallel
- X) They are perpendicular
- Y) They are skewed
- Z) They intersect at one point

ANSWER: Z) THEY INTERSECT AT ONE POINT

### BONUS

4) MATH *Short Answer* Find the discriminant of the following equation, and then state the number of rational, irrational, and imaginary solutions, respectively:  $6n^2 + n - 3 = 7 + 2n$ .

ANSWER: DISCRIMINANT = 241; TWO IRRATIONAL SOLUTIONS (ACCEPT: 0 RATIONAL, 2 IRRATIONAL, 0 IMAGINARY or 0, 2, 0)

### TOSS-UP

5) PHYSICAL SCIENCE *Multiple Choice* Which of the following is the minimum amount of energy needed to start a chemical reaction?

- W) Production
- X) Reaction
- Y) Activation
- Z) Catalytic

ANSWER: Y) ACTIVATION

### BONUS

5) PHYSICAL SCIENCE *Short Answer* Using proper chemical nomenclature and indicating the state of each substance as solid, liquid, aqueous [**AY-kwee-uhs**], or gas, what is a balanced equation for the reaction in which silver nitrate solution is mixed with sodium chloride solution, producing insoluble silver chloride and sodium nitrate solution?

ANSWER:  $\text{AgNO}_{3(aq)} + \text{NaCl}_{(aq)} \rightarrow \text{AgCl}_{(s)} + \text{NaNO}_{3(aq)}$

[NOTE: AQ = AQUEOUS; S = SOLID]

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### TOSS-UP

6) EARTH AND SPACE *Short Answer* When a meteoroid passes through Earth's atmosphere, what is the term for the transient visible streak in the sky it leaves behind?

ANSWER: METEOR (ACCEPT: SHOOTING STAR, FALLING STAR)

### BONUS

6) EARTH AND SPACE *Short Answer* What layer separates the crust and the mantle?

ANSWER: MOHOROVIČIĆ DISCONTINUITY (ACCEPT: MOHO)

**TOSS-UP**

7) LIFE SCIENCE *Short Answer* What is the term for the RNA sequences between exons that are removed before translation in eukaryotic [*yoo-KAR-ee-oh-tik*] cells?

ANSWER: INTRONS

**BONUS**

7) LIFE SCIENCE *Short Answer* You have isolated a very small segment of DNA from the remains of an organism and would like to make many copies of it so that you can determine its identity. What commonly used tool in molecular biology are you most likely to use to amplify this DNA segment for further testing?

ANSWER: PCR (ACCEPT: POLYMERASE CHAIN REACTION)

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**TOSS-UP**

8) ENERGY *Multiple Choice* Which of the following types of seismic waves are S waves?

- W) Shear
- X) Surface
- Y) Compressional
- Z) Tsunami

ANSWER: W) SHEAR

**BONUS**

8) ENERGY *Multiple Choice* Burning which of the following produces the least amount of carbon dioxide per unit of energy?

- W) Coal
- X) Oil
- Y) Natural gas
- Z) Wood

ANSWER: Y) NATURAL GAS

### TOSS-UP

9) GENERAL SCIENCE *Multiple Choice* Which of the following is the name for a plant hormone produced primarily in root tips?

- W) Auxin [**AWK-sin**]
- X) Cytokinin [**sy-tuh-KY-nin**]
- Y) Ethylene [**ETH-uh-leen**]
- Z) Gibberellin [**jib-uh-REL-in**]

ANSWER: X) CYTOKININ

### BONUS

9) GENERAL SCIENCE *Multiple Choice* Bacteria are surviving in an anaerobic environment. The lack of oxygen forces the cells to generate which of the following via fermentation?

- W) NAD<sup>+</sup>
- X) NADH
- Y) FAD<sup>+</sup>
- Z) FADH<sub>2</sub>

ANSWER: W) NAD<sup>+</sup>

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### TOSS-UP

10) MATH *Short Answer* What is  $\log_5 625$  [**log base 5 of 625**]?

ANSWER: 4

### BONUS

10) MATH *Multiple Choice* A parabola, when graphed on a coordinate plane, has a vertex at (-1, 3) and opens to the right. Which of the following could possibly be the equation for this parabola?

- W)  $x = y^2 + 2y - 2$
- X)  $x = y^2 + 2y + 4$
- Y)  $x = y^2 - 6y + 8$
- Z)  $x = y^2 - 6y + 10$

ANSWER: Y)  $x = y^2 - 6y + 8$

**TOSS-UP**

11) PHYSICAL SCIENCE *Multiple Choice* For which of the following reasons is baking soda a good substance for putting out a grease fire?

- W) It cools the area
- X) It soaks up the grease
- Y) It deprives the fire of oxygen
- Z) It removes all the components of a fire

ANSWER: Y) IT DEPRIVES THE FIRE OF OXYGEN

**BONUS**

11) PHYSICAL SCIENCE *Multiple Choice* Which of the following solutions could be used to titrate an oxalic acid solution?

- W) Hydrogen bromide
- X) Calcium nitrate
- Y) Sodium hydroxide
- Z) Ammonium chloride

ANSWER: Y) SODIUM HYDROXIDE

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**TOSS-UP**

12) EARTH AND SPACE *Multiple Choice* If the Earth were to suddenly gain mass, it would need to do which of the following in order to maintain its current distance from the Sun?

- W) Accelerate
- X) Decelerate
- Y) Increase the eccentricity of its orbit
- Z) Nothing

ANSWER: Z) NOTHING

**BONUS**

12) EARTH AND SPACE *Multiple Choice* Which of the following volcanoes erupted in 1915?

- W) St. Helens
- X) Hood
- Y) Lassen
- Z) Shasta

ANSWER: Y) LASSEN

**TOSS-UP**

13) LIFE SCIENCE *Multiple Choice* Which of the following is the most practical method that could be used to isolate proteins for reinjection into mice?

- W) Western blot
- X) Affinity chromatography
- Y) X-ray crystal diffraction
- Z) NMR

ANSWER: X) AFFINITY CHROMATOGRAPHY

**BONUS**

13) LIFE SCIENCE *Short Answer* How many origins of replication are there in a bacterial chromosome?

ANSWER: ONE

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**TOSS-UP**

14) ENERGY *Multiple Choice* Which of the following is used to focus sunlight to a specific point in solar panels?

- W) Heliostats
- X) Concave mirrors
- Y) Convex mirrors
- Z) Diffuse mirrors

ANSWER: W) HELIOSTATS

**BONUS**

14) ENERGY *Multiple Choice* Which of the following is the type of moderator used in the reactor in Chernobyl, Ukraine?

- W) Fast neutron
- X) Composite
- Y) Light water
- Z) Graphite

ANSWER: Z) GRAPHITE

### TOSS-UP

15) GENERAL SCIENCE *Short Answer* According to the Richter scale, a magnitude 7 earthquake has a wave with an amplitude how many times as large as that of a magnitude 5 earthquake?

ANSWER: 100

### BONUS

15) GENERAL SCIENCE *Short Answer* A single-subunit protein folds into a single, giant alpha helix. If there are 3.6 amino acids per turn of the alpha helix and there are 3791 water molecules formed during the synthesis of this protein, then how many full alpha helical turns are there in the protein?

ANSWER: 1053

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### TOSS-UP

16) MATH *Multiple Choice* Which of the following is equal to the imaginary number  $i^3$ ?

W) -1

X) 1

Y)  $i$

Z)  $-i$

ANSWER: Z)  $-i$

### BONUS

16) MATH *Short Answer* What are the largest possible real domain and range, respectively, of the following function:  $f(x) = \frac{4}{x+1}$  [***f of x equals 4 over the quantity x plus 1***]?

ANSWER: DOMAIN = ALL REALS EXCEPT -1; RANGE = ALL REALS EXCEPT 0

### TOSS-UP

17) PHYSICAL SCIENCE *Multiple Choice* A student observes her weight on a scale as she rides an elevator down 3 stories. What happens to her observed weight during the ride?

- W) Her weight stays the same, but it is less than her weight on the ground
- X) Her weight stays the same, and it equals her weight on the ground
- Y) First she weighs less, then the same, then more than her weight on the ground
- Z) First she weighs more, then the same, then less than her weight on the ground

ANSWER: Y) FIRST SHE WEIGHS LESS, THEN THE SAME, THEN MORE THAN HER WEIGHT ON THE GROUND

### BONUS

17) PHYSICAL SCIENCE *Multiple Choice* Two objects, each with a mass of 1 kilogram, are moving directly towards each other at 20 meters per second before they collide perfectly inelastically. What will be the impulse in kilogram meters per second on the first object?

- W) 0
- X) 20
- Y) 40
- Z) 80

ANSWER: X) 20

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### TOSS-UP

18) EARTH AND SPACE *Short Answer* What are the two most abundant ions found in seawater?

ANSWER: SODIUM (ACCEPT: Na<sup>+</sup>) AND CHLORIDE (ACCEPT: Cl<sup>-</sup>; DO NOT ACCEPT: CHLORINE)

### BONUS

18) EARTH AND SPACE *Multiple Choice* Which of the following environments is most likely to host a community of methane producing organisms?

- W) Hydrothermal vents
- X) The upper ocean
- Y) Leaf litter in the forest
- Z) A fast moving stream

ANSWER: W) HYDROTHERMAL VENTS

### TOSS-UP

19) LIFE SCIENCE *Multiple Choice* Which of the following structures do bacteria use to transfer DNA during conjugation?

- W) Nucleoids [**NOO-klee-oids**]
- X) Pili [**pee-LEE**]
- Y) Transcriptase [**tran-SKRIP-tays**]
- Z) Capsid

ANSWER: X) PILI

### BONUS

19) LIFE SCIENCE *Short Answer* What end product of glycolysis [**gly-KOL-uh-sis**] serves as an electron acceptor for oxidizing NADH back to NAD<sup>+</sup>?

ANSWER: PYRUVATE

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### TOSS-UP

20) ENERGY *Multiple Choice* The Energy Star program was created by which of the following agencies?

- W) Environmental Protection Agency
- X) Green Building Council
- Y) Federal Energy Regulatory Commission
- Z) Department of Energy

ANSWER: W) ENVIRONMENTAL PROTECTION AGENCY

### BONUS

20) ENERGY *Multiple Choice* Kirchhoff's voltage law states that which of the following is true?

- W) The sum of voltages in a closed path is equal to zero
- X) The power produced by sources must be equal to the power used by appliances
- Y) The sum of currents in a node is equal to zero
- Z) The voltage in a resistor is equal to the current times the value of the circuit's resistance

ANSWER: W) THE SUM OF VOLTAGES IN A CLOSED PATH IS EQUAL TO ZERO

### TOSS-UP

21) GENERAL SCIENCE *Multiple Choice* During nitrogen fixation, lightning converts nitrogen gas into which of the following forms that can be used by living organisms?

- W)  $\text{NO}_3$
- X)  $\text{NH}_4$
- Y)  $\text{N}_3$
- Z)  $\text{CN}_3$

ANSWER: W)  $\text{NO}_3$

### BONUS

21) GENERAL SCIENCE *Multiple Choice* A person is brought into a hospital following a terrible accident. This person has no difficulty speaking, but his words are out of sequence and do not make sense. Additionally, he is very agitated and will try to attack the doctors if given the chance. He also seems to have severe memory impairments. Based on this information, which region of his brain does NOT appear to be damaged?

- W) Wernicke's area
- X) Broca's area
- Y) Hippocampus [*hip-uh-KAM-puhs*]
- Z) Amygdala [*uh-MIG-duh-luh*]

ANSWER: X) BROCA'S AREA

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### TOSS-UP

22) MATH *Short Answer* What is  $\sqrt{1,600}$  divided by  $\sqrt{0.04}$ ?

ANSWER: 200

### BONUS

22) MATH *Short Answer* Classify the following conic section and provide its equation in vertex form:  $-x^2 + 10x + y - 21 = 0$ .

ANSWER: PARABOLA;  $y = (x - 5)^2 - 4$

**TOSS-UP**

23) PHYSICAL SCIENCE *Short Answer* What do scientists call the group of liquids that, close to absolute zero, have zero viscosity or infinite fluidity?

ANSWER: SUPERFLUIDS

**BONUS**

23) PHYSICAL SCIENCE *Short Answer* What are the four fundamental forces?

ANSWER: GRAVITY, ELECTROMAGNETISM, STRONG, AND WEAK

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**TOSS-UP**

24) EARTH AND SPACE *Multiple Choice* Which of the following is the thickest layer of Earth's interior?

- W) Crust
- X) Mantle
- Y) Outer core
- Z) Inner core

ANSWER: X) MANTLE

**BONUS**

24) EARTH AND SPACE *Multiple Choice* Radioactive isotopes from which of the following elements would be most useful for dating very old rocks?

- W) Lead
- X) Uranium
- Y) Carbon
- Z) Hydrogen

ANSWER: X) URANIUM

### TOSS-UP

25) LIFE SCIENCE *Multiple Choice* On the Galapagos Islands, Darwin discovered 13 species of finches that possess specialized beaks for unique environments. Which of the following evolutionary principles is exemplified by this phenomenon?

- W) Convergent evolution
- X) Parallel evolution
- Y) Adaptive radiation
- Z) Coevolution

ANSWER: Y) ADAPTIVE RADIATION

### BONUS

25) LIFE SCIENCE *Multiple Choice* Which of the following sets of two light colors do chloroplast pigments absorb most effectively during photosynthesis?

- W) Red and blue
- X) Green and yellow
- Y) Green and blue
- Z) Red and purple

ANSWER: W) RED AND BLUE