

## **ROUND 17A**

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### **TOSS-UP**

1) Energy – *Short Answer* What hydrocarbon is the primary constituent of natural gas?

ANSWER: METHANE

### **BONUS**

1) Energy – *Short Answer* What would be the cost, in cents, if you use a 2000-watt heater for two hours and electricity costs 10 cents per kilowatt-hour?

ANSWER: 40

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### **TOSS-UP**

2) Life Science – *Multiple Choice* DNA ligase [**LYE-gase**] is an enzyme that catalyzes which of the following reactions?

- W) Cutting phosphodiester [**faws-fo-dye-ES-tur**] bonds
- X) Cutting hydrogen bonds
- Y) Forming phosphodiester [**faws-fo-dye-ES-tur**] bonds
- Z) Forming hydrogen bonds

ANSWER: Y) FORMING PHOSPHODIESTER BONDS

### **BONUS**

2) Life Science – *Short Answer* Neurons have very stereotyped electro-physiological activity that behaves in an "all-or-none" pattern. What is the name of this activity?

ANSWER: ACTION POTENTIAL

## **TOSS-UP**

3) Math – *Multiple Choice* What is the sum, in degrees, of the interior angles of a regular heptagon?

- W) 540
- X) 720
- Y) 900
- Z) 1080

ANSWER: Y) 900

## **BONUS**

3) Math – *Short Answer* The numerals for the counting numbers are written in order, beginning with 1. What is the 125th digit written?

ANSWER: 7

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## **TOSS-UP**

4) Physical Science – *Short Answer* A 500-gram object is moving at 4 meters per second. What is its kinetic energy in joules [*jools*]?

ANSWER: 4

## **BONUS**

4) Physical Science – *Multiple Choice* Which of the following elements has the highest first ionization [*eye-on-ih-ZAY-shun*] energy?

- W) Calcium
- X) Phosphorus
- Y) Oxygen
- Z) Aluminum

ANSWER: Y) OXYGEN

### **TOSS-UP**

5) Math – *Multiple Choice* Given that the function  $f$  of  $x$  has a zero at  $x = 6$ . At what  $x$ -value must  $f$  of open parenthesis  $x + 2$  close parenthesis have a zero?

- W) 3
- X) 4
- Y) 8
- Z) 12

ANSWER: X) 4

### **BONUS**

5) Math – *Short Answer* Len takes 12 hours to clean a 40 by 50 room. Ben can clean the same room in 10 hours. To the nearest tenth of an hour, how long would it take them if they worked together?

ANSWER: 5.5

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### **TOSS-UP**

6) Earth and Space – *Short Answer* Pyrite is primarily composed of what two elements?

ANSWER: IRON AND SULFUR

### **BONUS**

6) Earth and Space – *Multiple Choice* The ocean conveyor belt is driven by which of the following?

- W) Wind and tectonic activities
- X) Thermohaline gradients and wind currents
- Y) Waves and tides
- Z) Tidal phases and the Earth's rotation

ANSWER: X) THERMOHALINE GRADIENTS AND WIND CURRENTS

**TOSS-UP**

7) Energy – *Short Answer* By definition, what is the octane number of heptane?

ANSWER: ZERO

**BONUS**

7) Energy – *Multiple Choice* If a wind turbine produces 400 kilowatts of electrical power at one wind speed, how much power, in kilowatts, will be produced if the wind speed decreases to one-half the original value?

- W) 20
- X) 50
- Y) 100
- Z) 200

ANSWER: X) 50

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**TOSS-UP**

8) Math – *Short Answer* How many faces does a quadrilateral prism have?

ANSWER: 6

**BONUS**

8) Math – *Short Answer* A sequence has the property that every term starting with the third is the sum of the previous two terms. If the tenth term is 157 and the eighth term is 60, what is the sixth term?

ANSWER: 23

**TOSS-UP**

9) Earth and Space – *Short Answer* What scientist used Cepheid [*SEE-fee-id*] variables in order to propose that recession velocity is related to distance?

ANSWER: EDWIN HUBBLE

**BONUS**

9) Earth and Space – *Short Answer* Order the following four gasses from most to least abundant in Earth's atmosphere:  
1) Argon; 2) Nitrogen; 3) Helium; 4) Oxygen.

ANSWER: 2, 4, 1, 3

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**TOSS-UP**

10) Physical Science – *Short Answer* What is the velocity, in meters per second to the nearest tenth, of a wave with wavelength 15 meters and frequency 0.3 hertz?

ANSWER: 4.5

**BONUS**

10) Physical Science – *Short Answer* A 300-gram mass is experiencing a constant force of 6 newtons. In meters per second squared, what is its acceleration?

ANSWER: 20

### **TOSS-UP**

11) Life Science – *Short Answer* During what phase of the cell cycle do cells synthesize new DNA?

ANSWER: S PHASE (ACCEPT: S or SYNTHESIS PHASE)

### **BONUS**

11) Life Science – *Short Answer* Schwann cells are responsible for making what insulatory material in the peripheral nervous system?

ANSWER: MYELIN

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### **TOSS-UP**

12) Energy – *Multiple Choice* Which of the following is closest to the percentage of the total power radiated by the Sun incident on the Earth's atmosphere that is reflected or scattered before reaching the surface of the planet?

- W) 12
- X) 23
- Y) 34
- Z) 45

ANSWER: Y) 34

### **BONUS**

12) Energy – *Short Answer* Rank the following types of vehicles in terms of increasing reliance on a battery to drive the vehicle: 1) Plug-in hybrid; 2) Clean diesel; 3) All-electric; 4) Hybrid

ANSWER: 2, 4, 1, 3 (ACCEPT: CLEAN DIESEL, HYBRID, PLUG-IN HYBRID, ALL-ELECTRIC)

**TOSS-UP**

13) Math – *Short Answer* The product of 7 consecutive integers is 0. What is the smallest possible value of one of them?

ANSWER: -6

**BONUS**

13) Math – *Short Answer* What is the area of a regular hexagon with sides of length 4?

ANSWER:  $24\sqrt{3}$

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**TOSS-UP**

14) Physical Science – *Short Answer* What scientist first measured the charge of the electron in his famous oil drop experiment?

ANSWER: ROBERT MILLIKAN

**BONUS**

14) Physical Science – *Short Answer* The tire on your unicycle is inflated to a pressure of  $1.0 \times 10^6$  pascals. The total weight of you and your unicycle is 1000 newtons. What is the area of the tire, in square meters, that is in contact with the road when you are riding?

ANSWER: 0.001

### **TOSS-UP**

15) Earth and Space – *Multiple Choice* Clementine, Lunar Prospector, and LCROSS were all space probes sent to verify the presence of what feature on the Moon?

- W) Water ice
- X) Helium-3
- Y) Atmosphere
- Z) Magnetic field

ANSWER: W) WATER ICE

### **BONUS**

15) Earth and Space – *Multiple Choice* Ring galaxies and tidal tails are both thought to result from what galactic phenomena?

- W) Formation of a supermassive black hole
- X) Collapse of spiral arms
- Y) Collision of multiple galaxies
- Z) Rotational dissolution

ANSWER: Y) COLLISION OF MULTIPLE GALAXIES

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### **TOSS-UP**

16) Life Science – *Short Answer* What is the name for the outermost germ layer?

ANSWER: ECTODERM

### **BONUS**

16) Life Science – *Short Answer* What phylum [*FYE-lum*] contains sponges?

ANSWER: PORIFERA

### **TOSS-UP**

17) Physical Science – *Short Answer* What specific theory, proposed by Einstein, describes how masses warp space-time?

ANSWER: GENERAL RELATIVITY (DO NOT ACCEPT: SPECIAL RELATIVITY, RELATIVITY)

### **BONUS**

17) Physical Science – *Short Answer* A 10-liter flask containing an ideal gas at 4 atmospheres of pressure is connected with a 6-liter evacuated flask. What will be the final pressure, in atmospheres, in the 10-liter flask at equilibrium?

ANSWER: 2.5

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### **TOSS-UP**

18) Earth and Space – *Multiple Choice* A star's spectral type is most related to which of its following properties?

- W) Mass
- X) Temperature
- Y) Luminosity
- Z) Distance

ANSWER: X) TEMPERATURE

### **BONUS**

18) Earth and Space – *Multiple Choice* Which of the following best explains why most discovered meteorites are composed of iron?

- W) They are more common in the solar system
- X) They are more likely to cross Earth's orbit
- Y) They survive weathering longer
- Z) They are brighter when falling to Earth

ANSWER: Y) THEY SURVIVE WEATHERING LONGER

**TOSS-UP**

19) Math – *Short Answer* Which of the quadrants is NOT intersected by the line with equation  $y = -2x + 3$ ?

ANSWER: 3 (ACCEPT: THIRD)

**BONUS**

19) Math – *Short Answer* To the nearest unit, what is the volume of a sphere with radius 3?

ANSWER: 113

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**TOSS-UP**

20) Life Science – *Short Answer* AIDS is a human syndrome caused by what virus?

ANSWER: HIV (ACCEPT: HUMAN IMMUNODEFICIENCY VIRUS)

**BONUS**

20) Life Science – *Short Answer* What is the name of the extinct animal from which modern birds are thought to have evolved?

ANSWER: ARCHAEOPTERYX

**TOSS-UP**

21) Physical Science – *Short Answer* What is the mole percent of magnesium ions in 10 grams of magnesium oxide?

ANSWER: 50

**BONUS**

21) Physical Science – *Short Answer* During the complete combustion of methane, the oxidation number of the carbon changes from -4 to what?

ANSWER: 4

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**TOSS-UP**

22) Life Science – *Short Answer* What human organ is composed of the duodenum [*dew-AW-den-um*], jejunum [*jeh-JOO-num*], and ileum [*ILL-ee-um*]?

ANSWER: SMALL INTESTINE

**BONUS**

22) Life Science – *Short Answer* In humans, what connects the pharynx to the stomach?

ANSWER: ESOPHAGUS

## **TOSS-UP**

23) Earth and Space – *Short Answer* Hale-Bopp was discovered in 1995. Its solid, icy-conglomerate nucleus, long, dusty tail, and high orbital eccentricity and inclination, distinguishes it as what type of celestial object?

ANSWER: COMET

## **BONUS**

23) Earth and Space – *Short Answer* Name all of the following four tectonic features that result from seafloor spreading; 1) Left lateral fault; 2) Right lateral fault; 3) Divergent plate boundary; 4) Normal fault.

ANSWER: ALL (ACCEPT: 1, 2, 3, AND 4)