

## ROUND 10

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### TOSS-UP

1) EARTH AND SPACE SCIENCE *Multiple Choice* Which of the following is NOT a present-day lithospheric plate?

- W) Philippine
- X) Scotia
- Y) Arabian
- Z) Arctic

ANSWER: Z) ARCTIC

### BONUS

1) EARTH AND SPACE SCIENCE *Multiple Choice* During the month of January, the Earth moves along its orbit at a rate that is which of the following?

- W) Faster than during July
- X) The same rate as any other month of the year
- Y) Slower than during March or September
- Z) The same rate as it is in June

ANSWER: W) FASTER THAN DURING JULY

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### TOSS-UP

2) PHYSICAL SCIENCE *Multiple Choice* In which of the following pairs are both properties colligative?

- W) Freezing point depression and lowering of vapor pressure
- X) Freezing point depression and density
- Y) Boiling point elevation and color
- Z) Boiling point elevation and ionic strength

ANSWER: W) FREEZING POINT DEPRESSION AND LOWERING OF VAPOR PRESSURE

### BONUS

2) PHYSICAL SCIENCE *Short Answer* What is the noble gas electron configuration for gold?

ANSWER: [Xe] 6s<sup>1</sup>5d<sup>10</sup>4f<sup>14</sup>

**TOSS-UP**

3) EARTH AND SPACE SCIENCE *Multiple Choice* Which of the following is associated with Karst topography?

- W) Fossiliferous sandstones
- X) Hydrothermal activity
- Y) Large granitic boulders
- Z) Sinkholes

ANSWER: Z) SINKHOLES

**BONUS**

3) EARTH AND SPACE SCIENCE *Short Answer* What is the gradient, in feet per mile, of a stream slope whose highest elevation is 1600 feet to a point with an elevation of 400 feet over a distance of 5 miles?

ANSWER: 240

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**TOSS-UP**

4) ENERGY *Multiple Choice* Identify which of the following forces has the weakest relative strength.

- W) Electromagnetic
- X) Gravity
- Y) Weak nuclear
- Z) Strong nuclear

ANSWER: X) GRAVITY

**BONUS**

4) ENERGY *Short Answer* By name or number, rank the following four states from least to greatest in terms of average daily solar radiation intensity: 1) Indiana, 2) South Dakota, 3) Arizona, 4) California.

ANSWER: INDIANA, SOUTH DAKOTA, CALIFORNIA, ARIZONA (ACCEPT: 1, 2, 4, 3)

**TOSS-UP**

5) LIFE SCIENCE *Multiple Choice* Which of the following will NOT alter a somatic cell's genome during an organism's lifetime?

- W) Gene amplification
- X) Selective gene loss
- Y) Transposons
- Z) Meiosis (read as: my-ŌE-sis)

ANSWER: Z) MEIOSIS

**BONUS**

5) LIFE SCIENCE *Multiple Choice* Which of the following reptiles is known as a living fossil?

- W) Komodo dragon
- X) Sea turtle
- Y) Anaconda
- Z) Tuatara (read as: tuh-ah-TAHR-ah)

ANSWER: Z) TUATARA

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**TOSS-UP**

6) MATH *Short Answer* How many subsets does the set consisting of the numbers 1, 2, and 3 have?

ANSWER: 8

**BONUS**

6) MATH *Short Answer* Sarah is 10 years older than Tom. Tom is 4 years younger than Jim. Sarah is twice as old as Jim. Give the ages, in years, of Sarah, Jim, and Tom, respectively.

ANSWER: SARAH = 12; JIM = 6; TOM = 2

**TOSS-UP**

7) EARTH AND SPACE SCIENCE *Short Answer* What is the term for fractures that result in smooth curved surfaces, such as broken glass?

ANSWER: CONCHOIDAL

**BONUS**

7) EARTH AND SPACE SCIENCE *Short Answer* Give the name of the soft, porous, calcium carbonate spires found in places like Mono Lake in eastern California that formed long ago when calcium-bearing fresh water bubbled up into the alkaline lake rich in carbonates.

ANSWER: TUFA

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**TOSS-UP**

8) ENERGY *Multiple Choice* The mass of a brick is measured on Earth, then transported to the Moon and measured again. Compared to its mass on Earth, the brick's mass on the Moon will be which of the following?

- W) Smaller
- X) The same
- Y) Larger
- Z) Impossible to determine without further information

ANSWER: X) THE SAME

**BONUS**

8) ENERGY *Short Answer* By name or number, rank the following four choices from least to greatest annual methane emissions: 1) wastewater treatment, 2) landfills, 3) ruminant digestion, 4) manure management.

ANSWER: WASTEWATER TREATMENT, MANURE MANAGEMENT, LANDFILLS, RUMINANT DIGESTION (ACCEPT: 1, 4, 2, 3)

**TOSS-UP**

9) PHYSICAL SCIENCE *Multiple Choice* Atoms of the most active nonmetals have which of the following characteristics?

- W) Small atomic radii and high ionization energies
- X) Small atomic radii and low ionization energies
- Y) Large atomic radii and high ionization energies
- Z) Large atomic radii and low ionization energies

ANSWER: W) SMALL ATOMIC RADII AND HIGH IONIZATION ENERGIES

**BONUS**

9) PHYSICAL SCIENCE *Short Answer* Suppose you tie a rock to the end of a 1 meter long string and spin it in a vertical circle. Given 10 meters per second squared as  $g$ , what is the minimum integer speed needed to “just” get around the top?

ANSWER: 4

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**TOSS-UP**

10) LIFE SCIENCE *Short Answer* By mass, what element is the most abundant in the human body?

ANSWER: OXYGEN

**BONUS**

10) LIFE SCIENCE *Multiple Choice* Which of the following are NOT bryophytes (read as: BRY-oh-fyts):?

- W) Liverworts
- X) Ferns
- Y) Hornworts
- Z) Mosses

ANSWER: X) FERNS

### TOSS-UP

11) MATH *Multiple Choice* Which of the following inequalities has a finite solution set over the integers?

W)  $x^2 + 5x + 6 > 0$

X)  $|x + 2| > 4$  (read as: the absolute value of the quantity  $x$  plus 2 is greater than 4)

Y)  $9x - 7 < 3x + 14$

Z)  $x^2 - 4x + 3 < 0$

ANSWER: Z)  $x^2 - 4x + 3 < 0$

### BONUS

11) MATH *Short Answer* Alice stands 30 feet away from a building and looks up to the top of it. The angle of elevation is 45 degrees. If she is 5 feet tall, how tall is the building in feet?

ANSWER: 35

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### TOSS-UP

12) GENERAL SCIENCE *Multiple Choice* Monotremes (read as: MOH-noh-treems) are often considered ancestral mammals. Which of the following characteristics are present for every species of mammal except monotremes (read as: MOH-noh-treems)?

W) Mammary glands

X) Live birth

Y) Fur or hair

Z) Warm-blooded

ANSWER: X) LIVE BIRTH

### BONUS

12) GENERAL SCIENCE *Multiple Choice* Which of the following temperatures is the warmest?

W) 31° Celsius

X) 74° Fahrenheit

Y) 84° Fahrenheit

Z) 303 Kelvin

ANSWER: W) 31° CELSIUS

**TOSS-UP**

13) EARTH AND SPACE SCIENCE *Multiple Choice* Which of the following represents the rate at which atmospheric gases and particles are moved across a surface?

- W) Vertical dispersion
- X) Turbulence
- Y) Flux
- Z) Stratospheric transport

ANSWER: Y) FLUX

**BONUS**

13) EARTH AND SPACE SCIENCE *Short Answer* By name or number, what is the order, from thinnest to thickest, of the Earth's: 1) crust, 2) mantle, 3) outer core, and 4) inner core?

ANSWER: CRUST, INNER CORE, OUTER CORE, MANTLE (ACCEPT: 1, 4, 3, 2)

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**TOSS-UP**

14) MATH *Short Answer* What is the largest subset of the real numbers that can be the domain of the function  $f(x) = 1/x$ ?

ANSWER: THE REAL NUMBERS EXCEPT FOR 0

**BONUS**

14) MATH *Short Answer* Find the area in square centimeters of an irregular dodecagon that looks like a plus sign formed from 12 equal segments with lengths of 7 centimeters each.

ANSWER: 245

### TOSS-UP

15) LIFE SCIENCE *Multiple Choice* Which of the following do chloroplasts have in common with mitochondria (read as: my-toh-KOHN-dree-ah)?

- W) They do not contain ribosomes (read as: RY-boh-sōems)
- X) They have a single membrane
- Y) They replicate themselves and their own DNA
- Z) They contain thylakoids (read as: THY-lah-kohids)

ANSWER: Y) THEY REPLICATE THEMSELVES AND THEIR OWN DNA

### BONUS

15) LIFE SCIENCE *Short Answer* What is the phrase for the maximum number of individuals of a given species that an area's resources can sustain indefinitely without significantly depleting or degrading those resources?

ANSWER: CARRYING CAPACITY

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### TOSS-UP

16) GENERAL SCIENCE *Multiple Choice* Which of the following animals does NOT belong to the scientific suborder Ruminata?

- W) Cow
- X) Llama
- Y) Moose
- Z) Wildebeest

ANSWER: X) LLAMA

### BONUS

16) GENERAL SCIENCE *Multiple Choice* In a given reaction, three moles of Substance A react completely with two moles of Substance B to create Substances C and D. The reaction continues to completion and feels cold to the touch, but neither Substance A nor B was cold to the touch prior to the reaction. Which of the following is TRUE regarding the reaction?

- W) There was a total of 5 moles of products created
- X) The overall reaction was exothermic
- Y) Substance B is the limiting reagent
- Z) The activation energy of the reaction is less than the activation energy of the reverse reaction

ANSWER: Y) SUBSTANCE B IS THE LIMITING REAGENT



**TOSS-UP**

17) MATH *Short Answer* In simplest radical form, what is the magnitude of the complex number  $2 + 3i$  ?

ANSWER:  $\sqrt{13}$

**BONUS**

17) MATH *Multiple Choice* Which of the following features would indicate that a dataset is not from a normal distribution?

- W) The range is equal to 6 standard deviations
- X) There are outliers
- Y) The range is much larger than the interquartile range
- Z) The mean is much larger than the median

ANSWER: Z) THE MEAN IS MUCH LARGER THAN THE MEDIAN

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**TOSS-UP**

18) PHYSICAL SCIENCE *Short Answer* What is the charge of the ammonium ion?

ANSWER: +1

**BONUS**

18) PHYSICAL SCIENCE *Short Answer* Providing your answer as a decimal to the nearest tenth and given that the speed of sound in air is 350 meters per second, what is the length, in meters, of a closed organ pipe that can produce a tone of 440 hertz?

ANSWER: 0.2

### TOSS-UP

19) LIFE SCIENCE *Short Answer* What is the general term for an enzyme that unwinds the DNA double-helix during DNA replication?

ANSWER: HELICASE

### BONUS

19) LIFE SCIENCE *Multiple Choice* A farmer has planted corn in a field for the last 5 years, and has been disappointed with his crop yield for the last 2 years. Which of the following crops should he plant next year to maximize the corn yield for the following year?

- W) Nothing, it will let the soil recover completely from being planted
- X) Potatoes, because they have the deepest roots and will aerate the soil
- Y) Peas, because they will maximize the nitrogen in the soil for the corn
- Z) Wheat, because they use different nutrients than the corn

ANSWER: Y) PEAS, BECAUSE THEY WILL MAXIMIZE THE NITROGEN IN THE SOIL FOR THE CORN

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### TOSS-UP

20) GENERAL SCIENCE *Short Answer* What is the name of the process in which nitrogen from dead and decomposing animals is converted to inorganic forms such as ammonium salts?

ANSWER: MINERALIZATION

### BONUS

20) GENERAL SCIENCE *Short Answer* Of the 5 nitrogenous bases commonly found in either DNA or RNA, name all of the pyrimidines found in RNA.

ANSWER: CYTOSINE AND URACIL

### TOSS-UP

21) PHYSICAL SCIENCE *Short Answer* The generator of a utility company produces 100 amperes of current at 10,000 volts. The voltage is then stepped up by a transformer to 100,000 volts for transmission. What will be the current, in amperes, in the transmission lines?

ANSWER: 10

### BONUS

21) PHYSICAL SCIENCE *Short Answer* What is the term for the process by which a gas under pressure escapes through an opening that is much smaller than the distance between gas molecules?

ANSWER: EFFUSION

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### TOSS-UP

22) LIFE SCIENCE *Multiple Choice* Which of the following parts of a fish can be used to estimate its age?

- W) Scale
- X) Fin
- Y) Gill
- Z) Mouth

ANSWER: W) SCALE\*

\*[See <http://www.fw.delaware.gov/Fisheries/Documents/agegrowth.pdf> to learn how this is done.]

### BONUS

22) LIFE SCIENCE *Multiple Choice* Which of the following is the principle difference between the two types of active transport?

- W) Primary active transport involves an electrochemical gradient, while secondary active transport involves chemical energy
- X) Primary active transport involves chemical energy, while secondary active transport involves an electrochemical gradient
- Y) Primary active transport involves moving ions into a cell, while secondary active transport involves moving ions out of a cell
- Z) Primary active transport involves moving ions out of a cell, while secondary active transport involves moving ions into a cell

ANSWER: X) PRIMARY ACTIVE TRANSPORT INVOLVES CHEMICAL ENERGY, WHILE SECONDARY ACTIVE TRANSPORT INVOLVES AN ELECTROCHEMICAL GRADIENT



### TOSS-UP

23) PHYSICAL SCIENCE *Multiple Choice* Atoms with one or more unpaired electrons are which of the following?

- W) Diamagnetic
- X) Paramagnetic
- Y) Polar
- Z) Radioactive

ANSWER: X) PARAMAGNETIC

### BONUS

23) PHYSICAL SCIENCE *Short Answer* What is the current, in amperes, produced by a lightning strike that lasts 0.5 seconds and transfers 100 coulombs?

ANSWER: 200

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### TOSS-UP

24) ENERGY *Multiple Choice* In the mid-nineteenth century, the English physicist James Joule created a device in which falling weights rotated paddles immersed in a barrel of water. Which of the following results did he observe?

- W) The potential energy of the weights transferred entirely into kinetic energy to drive the paddles
- X) The potential energy of the weights transferred entirely into elastic energy to drive the paddles
- Y) The water in the barrel warmed slightly
- Z) The water in the barrel cooled slightly

ANSWER: Y) THE WATER IN THE BARREL WARMED SLIGHTLY

### BONUS

24) ENERGY *Short Answer* What is the term for the accumulated partially decayed vegetation or histosol that forms in wetland bogs, moors, and pocosins?

ANSWER: PEAT (ACCEPT: TURF)

### TOSS-UP

25) GENERAL SCIENCE *Multiple Choice* Which of the following minerals might you use in insulation?

- W) Talc
- X) Albite
- Y) Pyrope (read as: PY-rōep)
- Z) Quartz

ANSWER: X) ALBITE

### BONUS

25) GENERAL SCIENCE *Multiple Choice* An ice cube dyed with red food coloring is placed into a cup of fresh water at room temperature. An identical cube is placed into salt water. Where will the color go as the ice cubes melt?

- W) Bottom of the cup in fresh water and top of the cup in salt water
- X) Top of the cup in fresh water and bottom of the cup in salt water
- Y) Mixed into the water in both cups
- Z) Bottom of the cup in both cups

ANSWER: W) BOTTOM OF THE CUP IN FRESH WATER AND TOP OF THE CUP IN SALT WATER