

## ROUND 7

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### TOSS-UP

1) EARTH AND SPACE SCIENCE *Multiple Choice* Which of the following is NOT a reasonable line of evidence for a global cooling event?

- W) Glacial tills at low latitudes
- X) Heightened sea levels
- Y) Reduced photosynthesis
- Z) Reduced hydrologic cycle

ANSWER: X) HEIGHTENED SEA LEVELS

### BONUS

1) EARTH AND SPACE SCIENCE *Multiple Choice* At which of the following internal Earth boundaries do mantle plumes occur?

- W) Inner core/outer core boundary
- X) Atmosphere/lithosphere boundary
- Y) Mantle/outer core boundary
- Z) Mantle/crust boundary

ANSWER: Y) MANTLE/OUTER CORE BOUNDARY

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### TOSS-UP

2) PHYSICAL SCIENCE *Short Answer* What is the name of the  $\text{ClO}_4^-$  (read as: C-L-O-4 minus) ion?

ANSWER: PERCHLORATE

### BONUS

2) PHYSICAL SCIENCE *Short Answer* What is the ideal mechanical advantage of an 18-centimeter lever if the fulcrum is located 3 centimeters from the resistance?

ANSWER: 5

**TOSS-UP**

3) EARTH AND SPACE SCIENCE *Multiple Choice* Which of the following sets of states are included as a part of "tornado alley"?

- W) Texas, Kansas, and Missouri
- X) Oklahoma, Texas, and Virginia
- Y) Texas, New Mexico, and Arizona
- Z) Mississippi, Georgia, and Kansas

ANSWER: W) TEXAS, KANSAS, AND MISSOURI

**BONUS**

3) EARTH AND SPACE SCIENCE *Short Answer* Hadley and Ferrel atmospheric cells are the result of what kind of heat transport?

ANSWER: CONVECTION

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**TOSS-UP**

4) ENERGY *Short Answer* What is the general name of the process through which light is generated from a chemical reaction without the release of significant heat energy?

ANSWER: CHEMILUMINESCENCE

**BONUS**

4) ENERGY *Multiple Choice* Which of the following statements is NOT true about the solar tower, Solar Two?

- W) It generated steam directly from water in its receiver
- X) It could supply electric power on demand to the local utility company
- Y) Nearly 2000 heliostats reflected sunlight onto a receiver located at the top of the tower
- Z) Concentrated sunlight heated molten salt to temperatures as high as 1000° Fahrenheit

ANSWER: W) IT GENERATED STEAM DIRECTLY FROM WATER IN ITS RECEIVER

**TOSS-UP**

5) LIFE SCIENCE *Short Answer* Which type of cell becomes cancerous in people who develop leukemia?

ANSWER: WHITE BLOOD CELL

**BONUS**

5) LIFE SCIENCE *Short Answer* What are the five most common chemical elements of living biological matter?

ANSWER: OXYGEN, CARBON, HYDROGEN, NITROGEN, AND PHOSPHORUS

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**TOSS-UP**

6) MATH *Multiple Choice* Which of the following adjectives describes the function:  $y = \frac{1}{3 - x^2}$   
(read as: y equals 1 over open parenthesis 3 minus x squared close parenthesis)?

- W) Even
- X) Odd
- Y) One-to-one
- Z) Polynomial

ANSWER: W) EVEN

**BONUS**

6) MATH *Short Answer* Frodo drove 250 miles at an average speed of 50 miles per hour, and the remaining 360 miles at an average speed of 60 miles per hour. To the nearest integer, what was his average speed in miles per hour for the entire trip?

ANSWER: 55

### TOSS-UP

7) LIFE SCIENCE *Short Answer* What term is used to describe sphere-shaped bacteria?

ANSWER: COCCI

### BONUS

7) LIFE SCIENCE *Short Answer* Why are there no human vaccines against bacteriophages (read as: bahk-TIR-ee-oh-fay-jehs)?

ANSWER: BACTERIOPHAGES DO NOT INFECT HUMANS (ACCEPT: BACTERIOPHAGES ONLY INFECT PROKARYOTES)

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### TOSS-UP

8) ENERGY *Multiple Choice* Which of the following best describes the composition of polycrystalline silicon solar panels?

- W) A piece of semi-conducting material with a thin silicon film over the top
- X) One continuous sheet of silicon with a backing of metal-conducting material
- Y) Lots of individual PV cells that have a backing of metal-conducting material
- Z) Strips of silicon form the PV cells that have a backing of metal-conducting material

ANSWER: Y) LOTS OF INDIVIDUAL PV CELLS THAT HAVE A BACKING OF METAL-CONDUCTING MATERIAL

### BONUS

8) ENERGY *Short Answer* Aside from the residual heat generated from the formation of Earth, what three principle radioactive elements are thought to be the main sources of heat within Earth's interior?

ANSWER: POTASSIUM, URANIUM, AND THORIUM

**TOSS-UP**

9) PHYSICAL SCIENCE *Short Answer* What is the maximum number of bonds a carbon atom can form?

ANSWER: 4

**BONUS**

9) PHYSICAL SCIENCE *Multiple Choice* Which of the following situations requires the most power?

- W) Lifting a 60 newton weight 50 meters in 3 minutes
- X) Lifting a 60 newton weight 70 meters in 5 minutes
- Y) Lifting a 70 newton weight 50 meters in 3 minutes
- Z) Lifting a 70 newton weight 70 meters in 5 minutes

ANSWER: Y) LIFTING A 70 NEWTON WEIGHT 50 METERS IN 3 MINUTES

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**TOSS-UP**

10) LIFE SCIENCE *Multiple Choice* Which of the following contributes to the hydrophobicity of lipids?

- W) Water is polar and lipids are non-polar
- X) Water and lipids are both polar
- Y) Water and lipids are both non-polar
- Z) Water is non-polar and lipids are polar

ANSWER: W) WATER IS POLAR AND LIPIDS ARE NON-POLAR

**BONUS**

10) LIFE SCIENCE *Short Answer* What is the name of the network responsible for echinoderm (read as: ee-KY-neh-dehrm) movement?

ANSWER: WATER VASCULAR SYSTEM

### TOSS-UP

11) MATH *Short Answer* Give the name of the Greek mathematician, often referred to as the father of geometry, who deduced geometrical principles based upon postulates such as, "it is possible to draw a straight line from any point to any other point."

ANSWER: EUCLID

### BONUS

11) MATH *Short Answer* A committee of 3 is to be formed from a group of 6 people. How many different committees are possible?

ANSWER: 20

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### TOSS-UP

12) GENERAL SCIENCE *Multiple Choice* Which of the following is a TRUE statement about fructose and glucose?

- W) They have different molecular formulas
- X) They have different molecular structures
- Y) They have the same molecular structure
- Z) They are both disaccharides (read as: dy-SAH-keh-ryds)

ANSWER: X) THEY HAVE DIFFERENT MOLECULAR STRUCTURES

### BONUS

12) GENERAL SCIENCE *Short Answer* Name all of the layers of Earth's atmosphere that have an increasing temperature as altitude increases.

ANSWER: THERMOSPHERE AND STRATOSPHERE

**TOSS-UP**

13) EARTH AND SPACE SCIENCE *Short Answer* What is the term for breakage along planes of weak bonding that produces distinctive, smooth, flat surfaces?

ANSWER: CLEAVAGE

**BONUS**

13) EARTH AND SPACE SCIENCE *Short Answer* What are the three gases that primarily compose Uranus's atmosphere?

ANSWER: HYDROGEN, HELIUM, AND METHANE

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**TOSS-UP**

14) GENERAL SCIENCE *Short Answer* A see-saw is an example of what class of lever?

ANSWER: FIRST

**BONUS**

14) GENERAL SCIENCE *Multiple Choice* Which of the following animal structures does NOT make use of countercurrent exchange?

- W) Mammalian lungs
- X) Fish gills
- Y) Vertebrate kidneys
- Z) Muscles of a great white shark

ANSWER: W) MAMMALIAN LUNGS

**TOSS-UP**

15) LIFE SCIENCE *Short Answer* What is always the RNA start codon, where translation begins?

ANSWER: AUG (DO NOT ACCEPT: ATG)

**BONUS**

15) LIFE SCIENCE *Short Answer* When exposed to unfavorable environmental conditions, coral loses its symbiont zooxanthella (read as: zoo-zahn-THEH-lah), a condition known as "bleaching." Name the process, beneficial to the coral as a whole, for which zooxanthella (read as: zoo-zahn-THEH-lah) are responsible.

ANSWER: PHOTOSYNTHESIS

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**TOSS-UP**

16) GENERAL SCIENCE *Multiple Choice* Which kind of mouth would belong to a fish that feeds on crustaceans and other shellfish?

- W) Inferior
- X) Superior
- Y) Terminal
- Z) Protrusible

ANSWER: W) INFERIOR

**BONUS**

16) GENERAL SCIENCE *Short Answer* In a reaction that runs to completion, 3 moles of substance A react with 5 moles of substance B to create 2 moles of substance C. To create 18 moles of substance C, what is the total number of moles of reactants required?

ANSWER: 72



**TOSS-UP**

17) MATH *Short Answer* What is the largest two-digit prime number?

ANSWER: 97

**BONUS**

17) MATH *Short Answer* What are the coordinates of the vertex of the parabola with equation  $y = x^2 + 6x + 4$ ?

ANSWER: (-3, -5)

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**TOSS-UP**

18) PHYSICAL SCIENCE *Short Answer* What is the term for an insoluble product that is formed in a chemical reaction as a result of combining two liquids?

ANSWER: PRECIPITATE

**BONUS**

18) PHYSICAL SCIENCE *Short Answer* Name three properties of non-metals that correspond, respectively, to the following properties of metals: malleable, shiny, and conducting.

ANSWER: BRITTLE, DULL, AND INSULATING

### TOSS-UP

19) LIFE SCIENCE *Short Answer* Lobsters and centipedes have jointed appendages and are both classified as arthropods. What defining characteristic, shared by all arthropods, provides a protective function but limits growth and flexibility?

ANSWER: EXOSKELETON

### BONUS

19) LIFE SCIENCE *Multiple Choice* In terms of available energy, why would low biomass be expected for any tundra biome?

- W) Plants are not able to grow in the cold temperatures
- X) High wind speeds remove the nutrients needed by plants
- Y) There is little sunlight to provide the initial energy
- Z) There are few top predators, so little energy is needed

ANSWER: Y) THERE IS LITTLE SUNLIGHT TO PROVIDE THE INITIAL ENERGY

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### TOSS-UP

20) GENERAL SCIENCE *Multiple Choice* Which of the following is the dominant direction of surface currents at low latitudes along the coast of South America in the Pacific Ocean?

- W) Southwest
- X) Northwest
- Y) Southeast
- Z) Northeast

ANSWER: X) NORTHWEST

### BONUS

20) GENERAL SCIENCE *Short Answer* Object 1 has a mass of 3 kilograms and moves across a frictionless surface at a velocity of 4 meters per second. Object 1 then strikes object 2, which has a mass of 2 kilograms and was motionless prior to the collision. The collision is completely inelastic. Providing your answer as a decimal to the nearest tenth, what is the speed of object 2 after the collision, in meters per second?

ANSWER: 2.4

**TOSS-UP**

21) PHYSICAL SCIENCE *Short Answer* What scientist received the Nobel Prize for perfecting a technique for refining uranium?

ANSWER: MARIE CURIE (DO NOT ACCEPT: CURIE)

**BONUS**

21) PHYSICAL SCIENCE *Multiple Choice* In a parallel circuit with constant voltage, if a branch was added, which of the following would happen to the total equivalent resistance and the total supplied current?

- W) Both would both increase
- X) Both would both decrease
- Y) The resistance would increase and the current would decrease
- Z) The resistance would decrease and the current would increase

ANSWER: Z) THE RESISTANCE WOULD DECREASE AND THE CURRENT WOULD INCREASE

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**TOSS-UP**

22) EARTH AND SPACE SCIENCE *Multiple Choice* The Solar System is believed to have formed following the collapse of which of the following?

- W) A galactic core
- X) A globular cluster
- Y) A neutron star
- Z) A molecular cloud

ANSWER: Z) A MOLECULAR CLOUD

**BONUS**

22) EARTH AND SPACE SCIENCE *Short Answer* Name the three types of tectonic plate boundaries.

ANSWER: DIVERGENT, CONVERGENT, AND TRANSFORM

### TOSS-UP

23) PHYSICAL SCIENCE *Multiple Choice* Which of the following describes most of the elements on the periodic table?

- W) Synthetic
- X) Nonmetals
- Y) Noble gases
- Z) Conductors

ANSWER: Z) CONDUCTORS

### BONUS

23) PHYSICAL SCIENCE *Short Answer* When subjected to a potential difference of 100 volts, a certain capacitor builds up a charge on one plate of 0.2 coulombs. Providing your answer as a decimal to the nearest thousandth, what is this capacitor's capacitance in farads?

ANSWER: 0.002

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### TOSS-UP

24) ENERGY *Multiple Choice* Which of the following is NOT an example of a direct-use application of geothermal energy?

- W) Bathing
- X) Production of electricity
- Y) Heating homes
- Z) Heating water at fish farms

ANSWER: X) PRODUCTION OF ELECTRICITY

### BONUS

24) ENERGY *Short Answer* The 1947 Texas City disaster, the deadliest industrial accident in the United States, was caused by the detonation of what chemical compound, often used as an oxidizing agent in explosives?

ANSWER: AMMONIUM NITRATE

### TOSS-UP

25) MATH *Short Answer* Solve the equation  $|x - 2| = 3$  (read as: the absolute value of the quantity  $x$  minus 2 equals 3).

ANSWER:  $x = -1$  or  $x = 5$

[NOTE: STUDENTS MUST GIVE BOTH ANSWERS]

### BONUS

25) MATH *Short Answer* Solve the inequality:  $-3x - 4 \geq 6x - 3$ .

ANSWER:  $x \leq -1/9$  (ACCEPT:  $-1/9 \geq x$ )