

## **ROUND 4A**

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### **TOSS-UP**

1) General Science – *Multiple Choice* Which of the following best describes a scientific law?

- W) A proposed explanation for a narrow set of phenomena
- X) Broad explanations for a wide range of phenomena
- Y) A statement that is verified by observation and describes how phenomena are related
- Z) An opinion based on observations of phenomena

ANSWER: Y) A STATEMENT THAT IS VERIFIED BY OBSERVATION AND DESCRIBES HOW PHENOMENA ARE RELATED

### **BONUS**

1) General Science – *Short Answer* What does a paleoclimatologist study?

ANSWER: ANCIENT CLIMATES (DO NOT ACCEPT: ANCIENT WEATHER)

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### **TOSS-UP**

2) Physical Science – *Short Answer* What type of energy is generally thought of as the energy of movement?

ANSWER: KINETIC

### **BONUS**

2) Physical Science – *Short Answer* A pen weighing 1 newton is thrown into the air. At the top of its flight, what is the net force, in newtons, on the pen?

ANSWER: 1

### **TOSS-UP**

3) Math – *Short Answer* How many real solutions are there to the equation  $2x^2 - 3x + 4 = 0$ ?

ANSWER: 0 (ACCEPT: NONE)

### **BONUS**

3) Math – *Short Answer* At the Hamburger Den, John sold  $m + 17$  hamburgers on Saturday. Jenny sold  $3m - 7$  hamburgers. If Jenny sold more hamburgers than John, what is the smallest possible value of  $m$ ?

ANSWER: 13

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### **TOSS-UP**

4) Earth and Space – *Short Answer* The Colorado River carved what well-known steep-sided landform in the United States?

ANSWER: THE GRAND CANYON

### **BONUS**

4) Earth and Space – *Multiple Choice* What layer of the Earth lies directly beneath the tectonic plates?

- W) Core
- X) Asthenosphere
- Y) Crust
- Z) Lithosphere

ANSWER: X) ASTHENOSPHERE

### **TOSS-UP**

5) Life Science – *Multiple Choice* In comparison to sexual reproduction, asexual reproduction produces which of the following?

- W) Less genetic variation among offspring
- X) Smaller offspring
- Y) Fewer offspring
- Z) More genetic variation among offspring

ANSWER: W) LESS GENETIC VARIATION AMONG OFFSPRING

### **BONUS**

5) Life Science – *Multiple Choice* Which of the following energy conversions takes place during photosynthesis?

- W) Light energy to mechanical energy
- X) Chemical energy to mechanical energy
- Y) Light energy to chemical energy
- Z) Light energy to mechanical energy to chemical energy

ANSWER: Y) LIGHT ENERGY TO CHEMICAL ENERGY

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### **TOSS-UP**

6) Energy – *Multiple Choice* Electricity used to power a home in the United States is sold by what unit?

- W) Kilojoule
- X) Kilojoule per hour
- Y) Kilowatt
- Z) Kilowatt hour

ANSWER: Z) KILOWATT HOUR

### **BONUS**

6) Energy – *Short Answer* Light water nuclear reactors use primarily what element isotope as a fuel for fission?

ANSWER: URANIUM-235

### **TOSS-UP**

7) Earth and Space – *Short Answer* What is the chemical formula of the mineral quartz?

ANSWER: SiO<sub>2</sub>

### **BONUS**

7) Earth and Space – *Multiple Choice* A lunar eclipse can only happen during which of the following?

- W) New moon
- X) First quarter
- Y) Full moon
- Z) Third quarter

ANSWER: Y) FULL MOON

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### **TOSS-UP**

8) General Science – *Multiple Choice* Which of the following types of scientists studies celestial bodies?

- W) Astronomer
- X) Astrologist
- Y) Astronaut
- Z) Exobiologist

ANSWER: W) ASTRONOMER

### **BONUS**

8) General Science – *Multiple Choice* Which of the following is NOT a type of sampling used by field scientists?

- W) Systematic sampling
- X) Stratified random sampling
- Y) Nested sampling
- Z) Null sampling

ANSWER: Z) NULL SAMPLING

### **TOSS-UP**

9) Life Science – *Multiple Choice* What is the name for the large green complex organelles that perform photosynthesis and are typically found in plant cells and algae?

- W) Lysosomes
- X) Cytosol
- Y) Chlorophyll
- Z) Chloroplasts

ANSWER: Z) CHLOROPLASTS

### **BONUS**

9) Life Science – *Multiple Choice* Which of the following is NOT a characteristic of bacteria?

- W) Single-celled
- X) Prokaryotic
- Y) Contain nuclei
- Z) Lack membrane bound organelles

ANSWER: Y) CONTAIN NUCLEI

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### **TOSS-UP**

10) Math – *Short Answer* What is  $2^3 - 3^2$ ?

ANSWER: -1

### **BONUS**

10) Math – *Short Answer* What is the area of an equilateral triangle with sides of length 8?

ANSWER:  $16\sqrt{3}$

**TOSS-UP**

11) Energy – *Short Answer* What specific fuel is predominantly used in modern blast furnaces?

ANSWER: COKE (DO NOT ACCEPT: COAL)

**BONUS**

11) Energy – *Short Answer* In 1997, the United Nations negotiated a treaty to reduce greenhouse gas emissions from industrialized countries. What is the name of this treaty?

ANSWER: KYOTO PROTOCOL

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**TOSS-UP**

12) Physical Science – *Short Answer* A lightbulb can be modeled as a heat-dependent version of what type of electrical circuit component?

ANSWER: RESISTOR

**BONUS**

12) Physical Science – *Short Answer* If the diameter of a doorknob is 10 centimeters and the radius of the axle is 1.25 centimeters, what is the mechanical advantage?

ANSWER: 4

### **TOSS-UP**

13) Energy – *Multiple Choice* What is the category of vehicles that can run on a mixture of up to 85% ethanol in gasoline?

- W) Plug-in
- X) Hybrid
- Y) Flexible fuel
- Z) Mixed fuel

ANSWER: Y) FLEXIBLE FUEL

### **BONUS**

13) Energy – *Multiple Choice* You have decided to build a biomass plant that will use waste from the corn harvest. Which of the following would be the best place to build your plant?

- W) California-Nevada border
- X) Pennsylvania-New York border
- Y) Iowa-Illinois border
- Z) Ohio-Kentucky border

ANSWER: Y) IOWA-ILLINOIS BORDER

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### **TOSS-UP**

14) Life Science – *Multiple Choice* Which of the following is the best reason that snakes do not reproduce with worms?

- W) Temporal isolation
- X) Habitat isolation
- Y) Behavioral isolation
- Z) Mechanical isolation

ANSWER: Z) MECHANICAL ISOLATION

### **BONUS**

14) Life Science – *Short Answer* What term is used to describe the developmental course of an organism from fertilization to maturity?

ANSWER: ONTOGENY

### **TOSS-UP**

15) Physical Science – *Multiple Choice* The cesium atom is used to define which of the following SI units?

- W) Meter
- X) Gram
- Y) Second
- Z) Lumen

ANSWER: Y) SECOND

### **BONUS**

15) Physical Science – *Short Answer* In physics, what does the acronym "laser" stand for?

ANSWER: LIGHT AMPLIFICATION BY STIMULATED EMISSION OF RADIATION

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### **TOSS-UP**

16) Earth and Space – *Multiple Choice* Which of the following are the two types of glaciers?

- W) Terrestrial and marine
- X) Drumlin and moraine
- Y) Alpine and continental
- Z) Divergent and convergent

ANSWER: Y) ALPINE AND CONTINENTAL

### **BONUS**

16) Earth and Space – *Short Answer* What planet in the inner solar system has exactly 2 natural satellites that are thought to be captured asteroids?

ANSWER: MARS

### **TOSS-UP**

17) Math – *Short Answer* If the perimeter of a triangle is 48 centimeters, and the lengths of two of its sides are 14 and 13 centimeters, find the length of the third side, in centimeters.

ANSWER: 21

### **BONUS**

17) Math – *Short Answer* Six marbles marked one through six are placed into a bag, and you draw two of them at random. What is the probability that the two marbles you draw are marked 5 and 3?

ANSWER: 1/15

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### **TOSS-UP**

18) General Science – *Short Answer* The frequency of alternating current from an electric power plant is measured in cycles per second. What is the name of the unit for this measurement?

ANSWER: HERTZ

### **BONUS**

18) General Science – *Short Answer* What two common safety devices are used to cut off the electrical supply if the current becomes too great for the device being powered?

ANSWER: CIRCUIT BREAKER (ALSO ACCEPT: BREAKER) AND FUSE

### **TOSS-UP**

19) Physical Science – *Short Answer* Identify all of the following three objects that can be affected by gravity: 1) A human; 2) A planet; 3) A ray of light.

ANSWER: ALL OF THEM

### **BONUS**

19) Physical Science – *Short Answer* What is the term for a solution containing more dissolved material than would be possible at normal conditions?

ANSWER: SUPERSATURATED (DO NOT ACCEPT: SATURATED)

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### **TOSS-UP**

20) Life Science – *Short Answer* What acid is produced from pyruvic acid in muscles during strenuous exercise?

ANSWER: LACTIC ACID

### **BONUS**

20) Life Science – *Multiple Choice* Estuaries, like wetlands, are extremely productive in terms of biotic factors. What is the main source of the nutrients that facilitate the metabolic processes necessary for this productivity?

- W) The river
- X) The sea
- Y) The soil in the estuary
- Z) The living organisms

ANSWER: W) THE RIVER

### **TOSS-UP**

21) Earth and Space – *Multiple Choice* Which of the following features is most likely to occur in deserts after heavy rainfall?

- W) Ephemeral [*eh-FEM-ur-ul*] streams
- X) Riparian [*rye-PAIR-ee-an*] corridors
- Y) Desert pavement
- Z) Alluvial fan

ANSWER: W) EPHEMERAL STREAMS

### **BONUS**

21) Earth and Space – *Multiple Choice* Which of the following prevailing wind belts is most affected by El Niño?

- W) North polar easterlies
- X) South polar easterlies
- Y) Midlatitude westerlies
- Z) Trade winds

ANSWER: Z) TRADE WINDS

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### **TOSS-UP**

22) Math – *Short Answer* Evaluate the following expression when  $b$  equals 9:  $2b$  plus  $b$  minus 6

ANSWER: 21

### **BONUS**

22) Math – *Short Answer* What is the volume in liters of a circular cylindrical container with a radius of 40 centimeters and a height of 1 meter?

ANSWER: 160 pi

### **TOSS-UP**

23) Physical Science – *Multiple Choice* Which of the following best explains why the Northern and Southern Hemispheres of the earth have different seasons?

- W) The same face of the moon is always pointed towards the Earth
- X) The orbit of the moon is tilted 5° with respect to the Earth's solar orbit
- Y) The Earth's rotational axis is tilted 23° with respect to its solar orbit
- Z) The moon orbits the Earth in a direction opposite to the Earth's rotation

ANSWER: Y) THE EARTH'S ROTATIONAL AXIS IS TILTED 23° WITH RESPECT TO ITS SOLAR ORBIT

### **BONUS**

23) Physical Science – *Multiple Choice* Where are the atoms with largest atomic radii found on the periodic table?

- W) Upper left corner
- X) Upper right corner
- Y) Lower left corner
- Z) Lower right corner

ANSWER: Y) LOWER LEFT CORNER