

MIDDLE SCHOOL - ROUND 2A

TOSS-UP

1) Earth and Space – *Multiple Choice* As you are swimming in a river, you find two cobbles made of the same rock, but one is angular and one is rounded. Which of the following best explains this observation?

- W) The angular cobble was transported further
- X) The rounded cobble was transported further
- Y) The rounded cobble was formed in shallower water than the angular cobble
- Z) The angular cobble was formed in shallower water than the rounded cobble

ANSWER: X) THE ROUNDED COBBLE WAS TRANSPORTED FURTHER

BONUS

1) Earth and Space – *Short Answer* How many well-defined planes of cleavage does the mineral quartz have?

ANSWER: 0

TOSS-UP

2) Life Science – *Multiple Choice* In what cellular component does a plant cell store water?

- W) Lysosome [*LYE-soh-sohm*]
- X) Central vacuole [*VAK-yu-ole*]
- Y) Golgi [*GOAL-jee*] complex
- Z) Chloroplast

ANSWER: X) CENTRAL VACUOLE

BONUS

2) Life Science – *Multiple Choice* Which of the following organs is responsible for maintaining blood sugar 4 hours after a meal?

- W) Skeletal muscle
- X) Kidney
- Y) Fat
- Z) Liver

ANSWER: Z) LIVER

TOSS-UP

3) Math – *Multiple Choice* Which of the following numbers is largest?

- W) $10^4 + 10^5$
- X) $10^3 + 10^6$
- Y) $10^2 + 10^7$
- Z) $10^1 + 10^8$

ANSWER: Z) $10^1 + 10^8$

BONUS

3) Math – *Short Answer* What is the area of the triangle formed by the x -axis, the y -axis, and the line passing through the point $(0, 8)$ with slope -2 ?

ANSWER: 16

TOSS-UP

4) Energy – *Multiple Choice* Concentrated solar power stores the sun's radiation in what form of energy?

- W) Thermal
- X) Chemical
- Y) Kinetic
- Z) Acoustic

ANSWER: W) THERMAL

BONUS

4) Energy – *Multiple Choice* Researchers at Lawrence Berkeley National Lab are examining organic carbon in soil as a potential source of greenhouse gases. Which of the following best describes their finding?

- W) Soil carbon cannot be converted to carbon dioxide
- X) Organisms release more carbon dioxide in cold soil than in warm soil
- Y) Organisms release more carbon dioxide in warm soil than in cold soil
- Z) Soil is a relatively static carbon sink

ANSWER: Y) ORGANISMS RELEASE MORE CARBON DIOXIDE IN WARM SOIL THAN IN COLD SOIL

TOSS-UP

5) Life Science – *Short Answer* Photosynthesis produces sugar and what gaseous [*gah-shus*] byproduct?

ANSWER: OXYGEN (ACCEPT: O₂)

BONUS

5) Life Science – *Short Answer* Catalase [*CAT-ah-lace*] is an enzyme that catalyzes the transformation of hydrogen peroxide to water and oxygen gas. Identify all of the following three terms that apply to hydrogen peroxide in this reaction: 1) Substrate; 2) Inhibitor; 3) Reactant.

ANSWER: 1 AND 3

TOSS-UP

6) Physical Science – *Short Answer* What group of elements have a shiny luster and are good conductors of heat and electricity?

ANSWER: METALS

BONUS

6) Physical Science – *Multiple Choice* Middle C on a piano is 256 hertz. Given that the speed of sound in air is 330 meters per second, which of the following is closest to the wavelength of middle C in meters?

- W) 0.75
- X) 1.3
- Y) 4.3
- Z) 8.7

ANSWER: X) 1.3

TOSS-UP

7) Energy – *Short Answer* What two fossil fuels are produced via hydraulic fracturing of sedimentary rock?

ANSWER: OIL AND NATURAL GAS (ACCEPT: PETROLEUM (for oil), METHANE (for natural gas))

BONUS

7) Energy – *Multiple Choice* Scientists in the Biosciences Division at Argonne National Lab are studying lignin, a structural polymer. Where can one find lignin?

- W) Animal liver cells
- X) Chloroplasts
- Y) Wood
- Z) Skin

ANSWER: Y) WOOD

TOSS-UP

8) Life Science – *Short Answer* Bacterial cells outnumber host cells within the human gastrointestinal tract. What is the collective name commonly used for the collection of bacteria present in the human digestive system?

ANSWER: GUT MICROBIOME (ACCEPT: MICROBIOME, GUT MICROBIOTA, MICROBIOTA, GUT FLORA, GASTROINTESTINAL MICROBIOTA)

BONUS

8) Life Science – *Short Answer* In humans, what structure enables the equalization of air between the inner ear and the atmosphere by way of the mouth?

ANSWER: EUSTACHIAN TUBE (ACCEPT: EUSTACHIAN CANAL)

TOSS-UP

9) Math – *Short Answer* A 60-foot rope is stretched across 60 feet. How many cuts would be required to cut it into 5-foot sections?

ANSWER: 11

BONUS

9) Math – *Short Answer* Katy the Cat spots Squeaky the Mouse. Squeaky quickly runs 16 feet due east, then 6 feet due south. He then runs due west to a hole in the ground 4 feet away. How many feet is Squeaky from where he was originally spotted by Katy?

ANSWER: $6\sqrt{5}$

TOSS-UP

10) Earth and Space – *Short Answer* What is the term for the mound-shaped deposits of dripstone on the ground?

ANSWER: STALAGMITES

BONUS

10) Earth and Space – *Short Answer* Place the following three oceans in order of decreasing water volume: 1) Indian; 2) Pacific; 3) Atlantic.

ANSWER: 2, 3, 1

TOSS-UP

11) Physical Science – *Short Answer* In an atom, what is the maximum number of electrons the first energy level can hold?

ANSWER: 2

BONUS

11) Physical Science – *Short Answer* Identify all of the following three statements that are true of matter:

- 1) Atoms contain mostly empty space; 2) All atoms must contain at least one neutron; 3) Two atoms of the same element may contain different numbers of neutrons.

ANSWER: 1 AND 3

TOSS-UP

12) Math – *Multiple Choice* A rectangle is drawn on a coordinate grid. One side lies on the line $y = 2x + 1$. An adjacent side of the rectangle could lie on which of the following lines?

- W) $y = 0.5x + 2$
- X) $y = -0.5x - 2$
- Y) $y = 2x - 1$
- Z) $y = -2x + 1$

ANSWER: X) $y = -0.5x - 2$

BONUS

12) Math – *Short Answer* The Sullivan house has a pile of building blocks. Susan used $\frac{1}{3}$ of the blocks to build a fire station, and Chris used $\frac{2}{5}$ of the blocks to build a boat. If 120 unused blocks remained, how many blocks were there to begin with?

ANSWER: 450

TOSS-UP

13) Physical Science – *Short Answer* For a machine, what is the term for the percentage of the input energy that can be used for output work?

ANSWER: EFFICIENCY

BONUS

13) Physical Science – *Short Answer* Identify all of the following three objects that are undergoing acceleration: 1) A car braking; 2) The Moon orbiting the Earth; 3) An ice skater moving at constant velocity.

ANSWER: 1 AND 2

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### **TOSS-UP**

14) Life Science – *Short Answer* During what phase of the cell cycle does a eukaryotic [*YOU-care-ee-AW-tic*] cell divide into two genetically identical daughter cells?

ANSWER: MITOSIS (ACCEPT: MITOTIC, M; DO NOT ACCEPT: TELOPHASE)

### **BONUS**

14) Life Science – *Short Answer* Jellyfish possess specialized harpoon-like cells on their tentacles that enable them to sting. What are these cells called?

ANSWER: CNIDOCYTES [*NYE-doh-sites*] (ACCEPT: NEMATOCYTES)

### **TOSS-UP**

15) Earth and Space – *Short Answer* What two planets in the solar system have no natural satellites?

ANSWER: MERCURY AND VENUS

### **BONUS**

15) Earth and Space – *Short Answer* Identify all of the following three statements that are true of our Sun: 1) It is more dense than water; 2) It is a variable star; 3) It rotates about its axis.

ANSWER: ALL

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### **TOSS-UP**

16) Energy – *Short Answer* Scientists at Argonne National Laboratory are working to enhance the performance and durability of polymer-electrolyte-membrane fuel cells, while simultaneously reducing their cost. These fuel cells produce electricity through the reaction of hydrogen and oxygen. What is the only chemical that these fuel cells emit?

ANSWER: WATER

### **BONUS**

16) Energy – *Short Answer* Ames Lab scientists used high-energy x-rays produced at Argonne National Lab to characterize a novel group of rare-earth solids. What user facility at Argonne National Lab was used to produce these bright x-rays?

ANSWER: ADVANCED PHOTON SOURCE (ACCEPT: APS)

### **TOSS-UP**

17) Math – *Short Answer* What is the product of the two fractions  $3\frac{1}{3}$  and  $1\frac{1}{2}$ ?

ANSWER: 5

### **BONUS**

17) Math – *Short Answer* Three apples and two bananas cost 190 cents. Four apples and one banana cost 170 cents. How many cents will two apples and three bananas cost?

ANSWER: 210

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### **TOSS-UP**

18) Physical Science – *Multiple Choice* Which of the following explains the size of a chloride ion compared to that of a chlorine atom?

- W) Chloride is smaller because it has fewer electrons
- X) Chloride is smaller because it has more electrons
- Y) Chloride is larger because it has fewer electrons
- Z) Chloride is larger because it has more electrons

ANSWER: Z) CHLORIDE IS LARGER BECAUSE IT HAS MORE ELECTRONS

### **BONUS**

18) Physical Science – *Multiple Choice* Which of the following metals appears on flame tests as bright green and is responsible for blue colors in fireworks?

- W) Calcium
- X) Barium
- Y) Copper
- Z) Sodium

ANSWER: Y) COPPER

### **TOSS-UP**

19) Earth and Space – *Multiple Choice* Which of the following situations could produce an artesian spring?

- W) A confined aquifer
- X) An unconfined aquifer
- Y) An aquifer underlain by an impermeable layer and overlain by a permeable one
- Z) An aquifer surrounded by permeable layers

ANSWER: W) A CONFINED AQUIFER

### **BONUS**

19) Earth and Space – *Short Answer* It is 18 degrees Celsius outside and the water vapor pressure is 21 millibar. If the saturation vapor pressure is 60 millibars, what is the relative humidity in percent?

ANSWER: 35

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### **TOSS-UP**

20) Math – *Short Answer* What is the coefficient of  $x^2$  in the expansion of open parenthesis  $2x$  divided by 3 close parenthesis squared?

ANSWER: 4/9

### **BONUS**

20) Math – *Short Answer* A bacteria population is estimated to be modeled by  $2$  to the  $t$  power, where  $t$  represents time measured in days. What is the smallest integer value of  $t$  for which the bacteria population is over 10,000?

ANSWER: 14

### **TOSS-UP**

21) Life Science – *Short Answer* In what phylum [**FYE-lum**] are ostriches classified?

ANSWER: CHORDATA [**kor-DAH-tah**]

### **BONUS**

21) Life Science – *Short Answer* Arrange the following four sections of the gastrointestinal tract in the order traveled by ingesta: 1) Stomach; 2) Colon; 3) Esophagus; 4) Duodenum [**dew-AW-den-um**].

ANSWER: 3, 1, 4, 2

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### **TOSS-UP**

22) Physical Science – *Short Answer* Vince lifts an 80-newton box 2 meters vertically. How much work, in joules, was done on the box?

ANSWER: 160

### **BONUS**

22) Physical Science – *Short Answer* A ballerina weighs 500 newtons and is wearing shoes whose soles have a total combined area of 300 centimeters squared. To two significant figures and in newtons per centimeter squared, what is the pressure she is exerting on the floor?

ANSWER: 1.7

### **TOSS-UP**

23) Earth and Space – *Short Answer* Pulsars are thought to be a subset of what general type of star?

ANSWER: NEUTRON STARS

### **BONUS**

23) Earth and Space – *Short Answer* Rank the following three spectral types of stars in terms of increasing temperature: 1) K; 2) F; 3) O.

ANSWER: 1, 2, 3