

## MIDDLE SCHOOL - ROUND 2

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### TOSS-UP

1) Earth and Space – *Short Answer* What is the second-most-abundant element in the universe?

ANSWER: HELIUM

### BONUS

1) Earth and Space – *Short Answer* What unit of astronomical distance is approximately 206,000 astronomical units?

ANSWER: PARSEC

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### TOSS-UP

2) Life Science – *Short Answer* Mammals are named after glands that produce what substance?

ANSWER: MILK

### BONUS

2) Life Science – *Multiple Choice* To what group of plants do sequoias belong?

- W) Conifers
- X) Cycads [*SIGH-cads*]
- Y) Angiosperms
- Z) Ginkgos

ANSWER: W) CONIFERS

### TOSS-UP

3) Math – *Multiple Choice* The equation 3 times 4 = 4 times 3 illustrates which of the following properties of multiplication?

- W) Associative
- X) Commutative
- Y) Distributive
- Z) Identity

ANSWER: X) COMMUTATIVE

### BONUS

3) Math – *Short Answer* A rectangle's long sides are three times the length of its shorter sides. If its perimeter is 48, what is its area?

ANSWER: 108

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### TOSS-UP

4) Energy – *Short Answer* Scientists at the National Energy Technology Lab are studying the use of anhydrous, nonvolatile solvents for carbon capture. What specific compound is being captured?

ANSWER: CARBON DIOXIDE (ACCEPT: CO<sub>2</sub>)

### BONUS

4) Energy – *Short Answer* Scientists at Oak Ridge National Lab have used electron energy gain spectroscopy using a monochromated beam to directly observe the atomic vibration energies. What kind of device did they create?

ANSWER: THERMOMETER

**TOSS-UP**

5) Life Science – *Short Answer* What is the largest and most prominent region of the human brain, which is thought to be responsible for voluntary activities?

ANSWER: CEREBRUM

**BONUS**

5) Life Science – *Short Answer* What is the term for the granular material inside the nucleus that consists of DNA bound to protein?

ANSWER: CHROMATIN

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**TOSS-UP**

6) Physical Science – *Short Answer* What is the general term for a device used to measure atmospheric pressure?

ANSWER: BAROMETER

**BONUS**

6) Physical Science – *Short Answer* The isotope carbon-14 has six protons and eight neutrons. If it undergoes beta-minus decay, how many neutrons will the decay product have?

ANSWER: 7

### TOSS-UP

7) Energy – *Short Answer* Researchers at Oak Ridge National Lab are studying how groundwater moves through fractured rock using neutron scattering experiments. What is the term for an underground water-permeable layer composed of porous or fractured rock?

ANSWER: AQUIFER

### BONUS

7) Energy – *Short Answer* Jefferson Lab researchers are imaging alpha particles to better understand the nucleus of what element?

ANSWER: HELIUM (ACCEPT: He)

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### TOSS-UP

8) Life Science – *Short Answer* Humans are part of what phylum [*FYE- lum*]?

ANSWER: CHORDATA (DO NOT ACCEPT: CHORDATES)

### BONUS

8) Life Science – *Short Answer* What part of cellular respiration oxidizes the original carbon atoms from glucose and releases them as carbon dioxide?

ANSWER: KREBS CYCLE (ACCEPT: CITRIC ACID CYCLE, TRICARBOXYLIC ACID CYCLE)

### TOSS-UP

9) Earth and Space – *Multiple Choice* Which of these would lead to the formation of a deep ocean trench?

- W) Compressional tectonic forces
- X) Extensional tectonic forces
- Y) Volcanic activity
- Z) Hydrothermal activity

ANSWER: W) COMPRESSIONAL TECTONIC FORCES

### BONUS

9) Earth and Space – *Short Answer* Rank the following three reservoirs of Earth's water supply from largest to smallest: 1) Ground water; 2) Lakes; 3) Glaciers

ANSWER: 3, 1, 2

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### TOSS-UP

10) Earth and Space – *Short Answer* In the rock cycle, what is the adjective for the type of rock that forms as magma cools and solidifies?

ANSWER: IGNEOUS (ACCEPT: INTRUSIVE IGNEOUS, DO NOT ACCEPT: EXTRUSIVE IGNEOUS)

### BONUS

10) Earth and Space – *Multiple Choice* Which of the following is closest to the ratio of the thickness of the mantle to that of the outer core?

- W) 1 to 1
- X) 2 to 1
- Y) 5 to 1
- Z) 10 to 1

ANSWER: W) 1 TO 1

### TOSS-UP

11) Physical Science – *Multiple Choice* Which of the following substances is most likely to be able to combust?

- W) Octane
- X) Silicon dioxide
- Y) Sodium chloride
- Z) Iron three oxide

ANSWER: W) OCTANE

### BONUS

11) Physical Science – *Multiple Choice* A chemist might use filter paper and a funnel when she wants to do which of the following separations?

- W) Liquid-liquid
- X) Solid-liquid
- Y) Solid-solid
- Z) Liquid-gas

ANSWER: X) SOLID-LIQUID

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### TOSS-UP

12) Math – *Short Answer* What is the greatest common factor of the 3 numbers 2, 8, and 13?

ANSWER: 1

### BONUS

12) Math – *Short Answer* Consider the function  $f$  of  $x = x^2 - 3x$ . What is the polynomial that is equal to the composite function  $f$  of  $f$  of  $x$ ?

ANSWER:  $x^4 - 6x^3 + 6x^2 + 9x$

### TOSS-UP

13) Physical Science – *Short Answer* What type of energy is associated with an object's motion?

ANSWER: KINETIC ENERGY

### BONUS

13) Physical Science – *Short Answer* A ball starts rolling down a hill at a velocity of 4 centimeters per second. After 15 seconds, the ball is now rolling at 49 centimeters per second. In centimeters per second squared, what is the average acceleration of the ball over this interval?

ANSWER: 3

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### TOSS-UP

14) Life Science – *Short Answer* What is the adjective for the type of external symmetry that a dragonfly demonstrates?

ANSWER: BILATERAL

### BONUS

14) Life Science – *Short Answer* Mammals, like dogs and humans, fall into a group that possess a unique organ formed from tissues from both the mother and the embryo during pregnancy. What is the term for this organ?

ANSWER: PLACENTA

### TOSS-UP

15) Earth and Space – *Short Answer* The asteroid belt lies just within the orbit of what planet?

ANSWER: JUPITER

### BONUS

15) Earth and Space – *Multiple Choice* Approximately where on a Hertzsprung-Russell diagram could you find a star like our Sun?

- W) Near the center
- X) Top right
- Y) Top left
- Z) Bottom left

ANSWER: W) NEAR THE CENTER

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### TOSS-UP

16) Energy – *Short Answer* Researchers at Princeton Plasma Physics Lab are using lithium oxide as a coating inside a tokamak to reduce plasma instabilities. What is the chemical formula of lithium oxide?

ANSWER:  $\text{Li}_2\text{O}$

### BONUS

16) Energy – *Short Answer* Researchers at Oak Ridge National Lab are using the MAJORANA [*my-or-AH-na*] DEMONSTRATOR to study the symmetry between subatomic particles and their antiparticles. What is the commonly used term for the collision and destruction of a particle and its antiparticle?

ANSWER: ANNIHILATION



### TOSS-UP

17) Math – *Short Answer* What is the area of a circle with diameter 16?

ANSWER:  $64\pi$

### BONUS

17) Math – *Short Answer* What is the smallest positive integer that has a remainder of 1 when divided by 5 and a remainder of 3 when divided by 7?

ANSWER: 31

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### TOSS-UP

18) Physical Science – *Multiple Choice* Isotopes of the same element differ in the number of which of the following particles?

- W) Protons
- X) Neutrons
- Y) Electrons
- Z) Positrons

ANSWER: X) NEUTRONS

### BONUS

18) Physical Science – *Short Answer* When filling up a bicycle tire, Zoe presses down on her pump, compressing it from 4 liters to 3.5 liters by applying a constant external pressure of 1.2 atmospheres. In liter-atmospheres, what is the magnitude of the work Zoe did on the gas inside the pump?

ANSWER: 0.6 (ACCEPT: 3/5)

**TOSS-UP**

19) Earth and Space – *Short Answer* What is the term for a chunk of interplanetary debris that lands on the surface of the Earth?

ANSWER: METEORITE (DO NOT ACCEPT: METEOR, METEOROID)

**BONUS**

19) Earth and Space – *Short Answer* The greenhouse effect on Venus is so strong because its atmosphere is primarily composed of what gas?

ANSWER: CARBON DIOXIDE (ACCEPT: CO<sub>2</sub>)

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**TOSS-UP**

20) Math – *Short Answer* What is the sum of  $\frac{2}{3}$  and  $\frac{3}{4}$ ?

ANSWER:  $\frac{17}{12}$  (ACCEPT:  $1 \frac{5}{12}$ )

**BONUS**

20) Math – *Short Answer* What is the volume of a sphere inscribed in a cube with edge length 12?

ANSWER:  $288\pi$

**TOSS-UP**

21) Life Science – *Multiple Choice* A diatom is an example of what?

- W) Bacterium
- X) Fungus
- Y) Protist
- Z) Archaean

ANSWER: Y) PROTIST

**BONUS**

21) Life Science – *Short Answer* What is the location at which one neuron transmits an impulse to another neuron via chemical signaling?

ANSWER: SYNAPSE

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**TOSS-UP**

22) Physical Science – *Short Answer* Water has a high specific heat capacity due in part to its strong intermolecular interactions known as what?

ANSWER: HYDROGEN BONDS (ACCEPT: H BONDS)

**BONUS**

22) Physical Science – *Short Answer* A meter stick has a mass of 1-kilogram that is uniformly distributed through the stick. Margaret ties a 1-kilogram rock to one end of the stick. In centimeters, at what distance from the rock is the center of mass of the system?

ANSWER: 25

**TOSS-UP**

23) Math – *Short Answer* What is the degree measure of the supplement of 43 degrees?

ANSWER: 137

**BONUS**

23) Math – *Short Answer* Mary left home at 8:00 a.m. and drove until 2:45 p.m. If the distance she traveled is 351 miles, what was her average speed, in miles per hour, during the trip?

ANSWER: 52