

## MIDDLE SCHOOL - ROUND 3A

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### TOSS-UP

1) Math – *Short Answer* Simplify the expression  $x$  times open parenthesis  $2xy^2$  close parenthesis squared.

ANSWER:  $4x^3y^4$

### BONUS

1) Math – *Short Answer* From a point 20 feet from the base of a tree, the angle of elevation to the top is 60 degrees. To the nearest foot, what is the height of the tree?

ANSWER: 35

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### TOSS-UP

2) Life Science – *Short Answer* Mushrooms are parts of organisms that are contained in what kingdom of life?

ANSWER: FUNGI (DO NOT ACCEPT: FUNGUS)

### BONUS

2) Life Science – *Short Answer* What group of airborne chemicals do insects use to communicate with each other?

ANSWER: PHEROMONES

### TOSS-UP

3) Physical Science – *Short Answer* When nitric acid and sodium hydroxide react, the products are a salt and what other compound?

ANSWER: WATER

### BONUS

3) Physical Science – *Short Answer* What is the oxidation state of hydrogen atoms in ammonia?

ANSWER: +1 (ACCEPT: 1)

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### TOSS-UP

4) Energy – *Short Answer* Researchers at Oak Ridge National Lab have successfully simulated an atomic nucleus using a quantum computer. From these calculations, they were able to extract the binding energy of a deuteron, the bound state of what two subatomic particles?

ANSWER: PROTON AND NEUTRON

### BONUS

4) Energy – *Short Answer* Scientists at Savannah River National Lab are researching novel methods to store hydrogen gas. One such method is a physical storage process in which gas is adsorbed onto glass microbeads. This adsorption creates a heterogenous [*hetero-JEE-nee-us*] mixture of hydrogen and glass that is NOT a solution, but does display the Tyndall effect. What is the general name for this type of mixture?

ANSWER: COLLOID

### TOSS-UP

5) Earth and Space – *Multiple Choice* Which of the following geologic structures forms from sediment deposited at the mouth of a river?

- W) Fjord
- X) Delta
- Y) Levee
- Z) Berm

ANSWER: X) DELTA

### BONUS

5) Earth and Space – *Short Answer* Rhyolitic [*rye-oh-LIT-ik*] lavas have a chemical composition identical to what intrusive igneous rock?

ANSWER: GRANITE

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### TOSS-UP

6) Physical Science – *Short Answer* The specific gravity of a solid or a liquid is defined as its density compared to that of what substance?

ANSWER: WATER

### BONUS

6) Physical Science – *Short Answer* You want to hide your gold in a bottle that you plan to let sink in a freshwater lake. If the bottle has a mass of 105 grams and a total volume of 1 liter, and the gold comes in nuggets of 10 grams each, what is the minimum number of nuggets you need to put in the bottle before it will sink?

ANSWER: 90

### TOSS-UP

7) Energy – *Short Answer* Researchers at Princeton Plasma Physics Lab are studying a nuclear reaction that involves deuterium [*doo-TEER-ee-um*] and tritium as reactants. What general type of nuclear reaction is this?

ANSWER: FUSION (ACCEPT: NUCLEAR FUSION)

### BONUS

7) Energy – *Short Answer* Scientists at Princeton Plasma Physics Lab are studying magnetic reconnection, a process that can occur in what phase of matter?

ANSWER: PLASMA

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### TOSS-UP

8) Life Science – *Short Answer* Many people suffer from anemia because they lack what metal that is a component of hemoglobin?

ANSWER: IRON

### BONUS

8) Life Science – *Multiple Choice* Microscopic zooplankton [*ZOH-oh-plank-ton*] can best be classified as which of the following trophic levels?

- W) Decomposers
- X) First-level carnivores
- Y) Herbivores
- Z) Tertiary [*TUR-shee-ary*] carnivores

ANSWER: Y) HERBIVORES

### TOSS-UP

9) Earth and Space – *Short Answer* What adjective, meaning Earth-like, is used to refer to the four inner planets?

ANSWER: TERRESTRIAL (ACCEPT: TERRESTRIAL PLANETS)

### BONUS

9) Earth and Space – *Short Answer* Identify all of the following three statements that are true regarding the Moon's formation: 1) It was a captured asteroid; 2) It formed at the same time as Earth; 3) It contains material that used to be part of Earth.

ANSWER: 3

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### TOSS-UP

10) Physical Science – *Short Answer* What is the term for the heat required to change the phase of a solid to a liquid?

ANSWER: HEAT OF FUSION (ACCEPT: ENTHALPY OF FUSION)

### BONUS

10) Physical Science – *Short Answer* Lithium has two stable isotopes and has an atomic mass of 6.941 amu. How many neutrons do most lithium nuclei possess?

ANSWER: FOUR

### TOSS-UP

11) Math – *Multiple Choice* Which of the following is a rational number?

- W)  $\sqrt{9}$
- X)  $\sqrt{10}$
- Y)  $\sqrt{11}$
- Z)  $\sqrt{12}$

ANSWER: W)  $\sqrt{9}$

### BONUS

11) Math – *Short Answer* Six dogs have an average woofiness of 7. Another 8 dogs have a woofiness of 4. To the nearest tenth, what is the average woofiness of both groups of dogs combined?

ANSWER: 5.3

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### TOSS-UP

12) Life Science – *Short Answer* What plant vascular system transports nutrients and carbohydrates throughout the plant?

ANSWER: PHLOEM

### BONUS

12) Life Science – *Multiple Choice* You press down on your arm and feel a pulse beating. From which of the following types of blood vessels is the pulse originating?

- W) Vein
- X) Artery
- Y) Capillary
- Z) Lymphatics

ANSWER: X) ARTERY

**TOSS-UP**

13) Physical Science – *Short Answer* The recoil that follows from the firing of a gun is a direct result of the conservation of what quantity?

ANSWER: MOMENTUM (ACCEPT: LINEAR MOMENTUM)

**BONUS**

13) Physical Science – *Short Answer* To two significant figures, how many grams are in 4 pounds of gold?

ANSWER: 1800

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**TOSS-UP**

14) Math – *Short Answer* What is the surface area of a cube with edges of length 3?

ANSWER: 54

**BONUS**

14) Math – *Short Answer* Solve the following equation for  $x$ : open parenthesis  $3x - 7$  close parenthesis squared = 64.

ANSWER:  $-1/3$  OR 5 (must give both answers)

**TOSS-UP**

15) Earth and Space – *Multiple Choice* Which of the following is a term for a high area of land that separates one drainage basin from another?

- W) Divide
- X) Apex
- Y) Peak
- Z) Block mountain

ANSWER: W) DIVIDE

**BONUS**

15) Earth and Space – *Short Answer* What type of earthquake body waves are longitudinal waves and can therefore pass through liquids and solids?

ANSWER: P WAVES (ACCEPT: P, PRIMARY)

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**TOSS-UP**

16) Math – *Short Answer* What is the sum of the two expressions  $2a + 9b$  and  $3a - 8b$ ?

ANSWER:  $5a + b$  (ACCEPT:  $b + 5a$ )

**BONUS**

16) Math – *Short Answer* What is 9525% of 24?

ANSWER: 2286



### TOSS-UP

17) Life Science – *Short Answer* What type of cells in mammals serves as the main carriers of oxygen within the circulatory system?

ANSWER: ERYTHROCYTES (ACCEPT: RED BLOOD CELLS, RBC)

### BONUS

17) Life Science – *Multiple Choice* The malleus, incus, and stapes [*STAY-pee-z*] are small bones that play a role in which of the following functions?

- W) Hearing
- X) Balance
- Y) Locomotion
- Z) Respiration

ANSWER: W) HEARING

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### TOSS-UP

18) Energy – *Multiple Choice* Lawrence Berkeley National Lab scientists have developed ReACT, a new amino acid labeling technique. This technique can be used to study which of the following biomolecules?

- W) Proteins
- X) Phospholipids
- Y) DNA
- Z) RNA

ANSWER: W) PROTEINS

### BONUS

18) Energy – *Short Answer* Researchers at Lawrence Berkeley National Lab are studying how defects in the mixtures of multiple metals can change the properties of the mixture. Generally, these researchers are studying solutions defined by metallic bonding character, which are given what name in chemistry?

ANSWER: ALLOYS

**TOSS-UP**

19) Math – *Short Answer* Simplify the following expression:  $a^8$  times  $a^3$

ANSWER:  $a^{11}$

**BONUS**

19) Math – *Short Answer* What is the smallest positive integer that has a remainder of 3 when divided by 5, a remainder of 0 when divided by 2, and a remainder of 1 when divided by 3?

ANSWER: 28

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**TOSS-UP**

20) Earth and Space – *Short Answer* What cataclysmic event is necessary for the creation of a neutron star?

ANSWER: SUPERNOVA

**BONUS**

20) Earth and Space – *Multiple Choice* Which of the following is a correct pairing of a layer of the Sun's atmosphere and its effective temperature?

- W) Photosphere and 6,000 kelvins
- X) Photosphere and 10,000 kelvins
- Y) Corona and 6,000 kelvins
- Z) Corona and 10,000 kelvins

ANSWER: W) PHOTOSPHERE AND 6,000 KELVINS

### TOSS-UP

21) Physical Science – *Short Answer* Astronomers and physicists believe that the universe's expansion is accelerating due to the action of what undiscovered form of energy that composes 73% of the universe's mass-energy?

ANSWER: DARK ENERGY

### BONUS

21) Physical Science – *Short Answer* Consider a ball that is thrown at 20 meters per second at an angle of 30 degrees to the horizontal. In meters per second, what is the horizontal velocity of this ball during its flight?

ANSWER:  $10\sqrt{3}$

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### TOSS-UP

22) Life Science – *Short Answer* What is the term for unicellular organisms that lack a nucleus?

ANSWER: PROKARYOTES

### BONUS

22) Life Science – *Short Answer* What is the principal pigment that plants use to absorb light for photosynthesis?

ANSWER: CHLOROPHYLL

### TOSS-UP

23) Earth and Space – *Short Answer* By definition, mafic [*MAF-ik*] rocks are rich in what two elements?

ANSWER: IRON AND MAGNESIUM

### BONUS

23) Earth and Space – *Short Answer* If you see lightning and hear the thunder 15 seconds later, then, to the nearest whole kilometer, how far away was the lightning strike?

ANSWER: 5