

## MIDDLE SCHOOL - ROUND 10A

### TOSS-UP

- 1) Energy – *Short Answer* Researchers at DOE recently used the SLAC [*slack*] Synchrotron [*SINK-row-trawn*] Radiation Light Source to solve the structure of the Lassa virus glycoprotein bound to a human neutralizing antibody. What particles did they use from this source to image the protein complex?

ANSWER: PHOTONS (ACCEPT: X-RAYS)

### BONUS

- 1) Energy – *Short Answer* The first nuclear-generated electricity in the United States was located at what DOE lab?

ANSWER: ARGONNE NATIONAL LAB (ACCEPT: ANL)

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### TOSS-UP

- 2) Earth and Space – *Multiple Choice* Which of the following is NOT commonly used to describe mineral luster?

- W) Dull
- X) Metallic
- Y) Resinous
- Z) Conchoidal [*kon-KOI-dal*]

ANSWER: Z) CONCHOIDAL

### BONUS

- 2) Earth and Space – *Short Answer* Cinnabar is an ore of what element?

ANSWER: MERCURY

### **TOSS-UP**

3) Life Science – *Short Answer* Which of the three classes of muscle tissue is responsible for vasodilation [*vay-zoh-dye-LAY-shun*] and constriction?

ANSWER: SMOOTH

### **BONUS**

3) Life Science – *Short Answer* Keratins and lamins, known for their mechanical strength, belong to what class of cytoskeletal [*SIGH-toh-skeletal*] filament?

ANSWER: INTERMEDIATE FILAMENT

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### **TOSS-UP**

4) Math – *Multiple Choice* If an angle of  $x$  degrees and an angle of  $y$  degrees are complementary, which of the following is NOT a possible value of  $y$  minus  $x$ ?

- W) 0
- X) 45
- Y) -45
- Z) 100

ANSWER: Z) 100

### **BONUS**

4) Math – *Short Answer* To the nearest whole number, how many minutes would it take for a car traveling at 30 miles per hour to go 3,500 yards?

ANSWER: 4

### **TOSS-UP**

5) Physical Science – *Short Answer* What type of thermal energy transfer is mediated by electromagnetic waves?

ANSWER: RADIATION

### **BONUS**

5) Physical Science – *Short Answer* Rank the following four electromagnetic waves in decreasing order of wavelength: 1) X-rays; 2) Visible light; 3) Radio; 4) Infrared.

ANSWER: 3, 4, 2, 1

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### **TOSS-UP**

6) Earth and Space – *Short Answer* During which of the lunar phases can a lunar eclipse occur?

ANSWER: FULL

### **BONUS**

6) Earth and Space – *Short Answer* Sunlight takes approximately 8 minutes to reach Earth. What integer power of 10 is nearest the number of meters in one astronomical unit?

ANSWER: 11 (ACCEPT:  $10^{11}$ )

### **TOSS-UP**

7) Energy – *Short Answer* Researchers at the Pacific Northwest National Laboratory are working to make longer-lasting lithium batteries by using silicon as an electrode. The electrodes of lithium-ion batteries are typically made of what material?

ANSWER: GRAPHITE (ACCEPT: CARBON)

### **BONUS**

7) Energy – *Short Answer* Bioethanol is often treated with molecular [**moh-LEK-yoo-lur**] sieves [**sivs**] or zeolites before it is mixed with gasoline to make E10. What substance is being removed from the ethanol during this treatment?

ANSWER: WATER (ACCEPT: H<sub>2</sub>O)

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### **TOSS-UP**

8) Math – *Short Answer* When flipping a coin 4 times, what is the probability that all 4 results are the same?

ANSWER: 1/8 (ACCEPT: 0.125, 12.5%, 12 1/2 %)

### **BONUS**

8) Math – *Short Answer* A school has  $5m - 13$  students in its science club, and  $2m + 41$  students in its band. If there are more students in the science club than in band, what is the smallest possible value of  $m$ ?

ANSWER: 19

### **TOSS-UP**

9) Life Science – *Short Answer* What group of organisms gives birth or lays watertight eggs and includes chickens, lizards, and humans?

ANSWER: AMNIOTES

### **BONUS**

9) Life Science – *Multiple Choice* A new vertebrate organism is discovered. It reproduces by laying an amniotic [*am-nee-AWT-ik*] egg. It also produces milk. Which of the following terms best classifies this animal?

- W) Aves [*AY-veez*]
- X) Monotrema [*mono-TREH-mah*]
- Y) Marsupialia [*mar-soop-ee-AY-lee-ah*]
- Z) Eutheria [*yoo-THEER-ee-ah*]

ANSWER: X) MONOTREMA

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### **TOSS-UP**

10) Physical Science – *Short Answer* What two-carbon carboxylic acid is the main solute in vinegar?

ANSWER: ACETIC ACID (ACCEPT: ETHANOIC ACID)

### **BONUS**

10) Physical Science – *Short Answer* How many lone pairs of electrons are present in the Lewis diagram of carbon dioxide?

ANSWER: 4

### **TOSS-UP**

11) Earth and Space – *Multiple Choice* Which of the following blows from west to east over Kansas and Tennessee?

- W) Trade winds
- X) Jet stream
- Y) Prevailing easterlies
- Z) Prevailing westerlies

ANSWER: Z) PREVAILING WESTERLIES

### **BONUS**

11) Earth and Space – *Short Answer* Valley glaciers can scoop out deep depressions called cirques [*surks*], which meet at a sharp ridge called what?

ANSWER: ARÊTE

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### **TOSS-UP**

12) Math – *Short Answer* What is the least common multiple of 5, 7, and 30?

ANSWER: 210

### **BONUS**

12) Math – *Short Answer* What is the degree measure of each interior angle of a regular 45-sided polygon?

ANSWER: 172

### **TOSS-UP**

13) Life Science – *Short Answer* What is the term for the process of programmed cell death?

ANSWER: APOPTOSIS [*AY-pah-TOW-sis*]

### **BONUS**

13) Life Science – *Multiple Choice* The haploidy [*HAP-loy-dee*] of gametes [*GAM-eets*] supports which of Gregor Mendel's laws?

- W) Law of independent assortment
- X) Law of dominance
- Y) Law of segregation of alleles [*ah-LEELZ*]
- Z) Law of meiosis [*my-OH-sis*]

ANSWER: Y) LAW OF SEGREGATION OF ALLELES

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### **TOSS-UP**

14) Physical Science – *Short Answer* For water, rank the following three phases of matter in terms of increasing distance between individual particles: 1) Gas; 2) Liquid; 3) Solid.

ANSWER: 2, 3, 1

### **BONUS**

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

ANSWER: 18

### **TOSS-UP**

15) Earth and Space – *Multiple Choice* Which of the following is closest to the ratio of the energy released by a magnitude 5 earthquake to that of a magnitude 4 earthquake?

- W) 10
- X) 16
- Y) 32
- Z) 64

ANSWER: Y) 32

### **BONUS**

15) Earth and Space – *Multiple Choice* Which of the following does NOT affect weathering rates for a rock?

- W) Parent material
- X) Climate
- Y) Fracture density
- Z) Soil texture

ANSWER: Z) SOIL TEXTURE

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### **TOSS-UP**

16) Life Science – *Short Answer* In what part of the cell does glycolysis [*glye-KAWL-eh-sis*] occur?

ANSWER: CYTOPLASM (ACCEPT: CYTOSOL)

### **BONUS**

16) Life Science – *Multiple Choice* What structures are responsible for delivering amino acids to the ribosome [*RYE-beh-sohm*]?

- W) mRNA
- X) dsRNA
- Y) tRNA
- Z) polymerase [*paw-LIM-er-ace*]

ANSWER: Y) tRNA

### **TOSS-UP**

17) Math – *Short Answer* What is the slope-intercept equation of the line through the origin that contains the point  $(6, -24)$  ?

ANSWER:  $y = -4x$  (ACCEPT:  $y = -4x + 0$ )

### **BONUS**

17) Math – *Short Answer* A pyramid with 18 edges has how many faces?

ANSWER: 10

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### **TOSS-UP**

18) Energy – *Multiple Choice* At the Environmental Molecular Sciences Laboratory, part of the Pacific Northwest National Laboratory, scientists are examining the formation of soot using jet fuel. How is soot formed?

- W) Complete combustion of hydrocarbon fuels
- X) Partial combustion of hydrocarbon fuels
- Y) Wildfires
- Z) Release of methane by livestock

ANSWER: X) PARTIAL COMBUSTION OF HYDROCARBON FUELS

### **BONUS**

18) Energy – *Short Answer* When uranium is inside a nuclear fuel rod, it is a compound in the form of black pellets. What is its chemical formula?

ANSWER:  $\text{UO}_2$

### **TOSS-UP**

19) Physical Science – *Short Answer* What physical principle is used to determine the buoyant force acting on a body?

ANSWER: ARCHIMEDES' PRINCIPLE

### **BONUS**

19) Physical Science – *Short Answer* Identify all of the following three statements that are true of waves:  
1) Light cannot travel through a vacuum; 2) Sound cannot travel through a vacuum; 3) Sound waves travel faster than light waves.

ANSWER: 2

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### **TOSS-UP**

20) Earth and Space – *Short Answer* The 21-centimeter hydrogen radiation line is detectable in what part of the electromagnetic spectrum?

ANSWER: RADIO

### **BONUS**

20) Earth and Space – *Short Answer* Arrange the following three features of the solar system in order of increasing distance from the Sun: 1) Ceres [*SEER-ez*]; 2) Heliopause; 3) The farthest extent of the Oort [*ort*] cloud.

ANSWER: 1, 2, 3

### **TOSS-UP**

21) Math – *Short Answer* If the product of two binomials is  $h^2 + 10h - 144$  and one factor is  $h - 8$ , what is the other factor?

ANSWER:  $h + 18$

### **BONUS**

21) Math – *Short Answer* Giving your answer in base 8, what is ONE-SEVEN base 8 times FIVE-SIX base 8?

ANSWER: ONE-TWO-SIX-TWO (ACCEPT: 1262)

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### **TOSS-UP**

22) Life Science – *Short Answer* Identify all of the following four vitamins that are fat soluble:  
1) Vitamin A; 2) Vitamin C; 3) Vitamin D; 4) Vitamin B6.

ANSWER: 1 AND 3

### **BONUS**

22) Life Science – *Short Answer* What cells in the pancreas are the primary producers of the hormone insulin and are attacked by the immune system in type I diabetes?

ANSWER: BETA ISLET CELLS (ACCEPT: ISLET CELLS, BETA CELLS)

### **TOSS-UP**

23) Physical Science – *Short Answer* The rate of a chemical reaction is related to the minimum energy required to get the reaction going. What is the term for this energy?

ANSWER: ACTIVATION ENERGY

### **BONUS**

23) Physical Science – *Short Answer* Identify all of the following three acids that are considered weak acids: 1) Hydrochloric acid; 2) Acetic acid; 3) Ascorbic acid.

ANSWER: 2 AND 3