

Middle School  
Set 4

TOSS-UP

1) Life Science – *Multiple Choice* Which of the following nitrogenous bases is the most structurally similar to guanine?

- W) Thymine [*THIGH-meen*]
- X) Uracil [*YUR-ah-sil*]
- Y) Adenine [*AD-eh-neen*]
- Z) Cytosine [*sigh-toh-seen*]

ANSWER: Y) ADENINE

BONUS

1) Life Science – *Multiple Choice* Which of the following is an example of a protist?

- W) Cyanobacterium
- X) Mosquito
- Y) Mushroom
- Z) Kelp

ANSWER: Z) KELP

## TOSS-UP

2) Math – *Short Answer* If the intercepts of a line are (8, 0) and (0, -8), what is the slope-intercept equation of the line?

ANSWER:  $y = x - 8$

## BONUS

2) Math – *Short Answer* Solve the following equation for  $x$ :  
 $x^2 + 17x - 480 = 0$ .

ANSWER: -32, 15 (must give both answers)

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## TOSS-UP

3) Physical Science – *Short Answer* A substance is sampled multiple times for some measurements. The mass is recorded on the  $y$ -axis and volume on the  $x$ -axis. What physical property of that substance will equal to the slope?

ANSWER: DENSITY

## BONUS

3) Physical Science – *Multiple Choice* Which of the following diatomic bonds is most polar?

- W) Br – Br
- X) C – H
- Y) C – N
- Z) Cl – H

ANSWER: Z) Cl – H

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## TOSS-UP

4) Earth and Space – *Short Answer* What is the term for the 3-kelvin radiation field that fills all of space?

ANSWER: CMB (ACCEPT: COSMIC MICROWAVE BACKGROUND, CMBR, COSMIC MICROWAVE BACKGROUND RADIATION)

## BONUS

4) Earth and Space – *Short Answer* RR Lyrae [*LYE-ree*] and Cepheid [*SEF-ee-id*] stars are examples of what general type of stars?

ANSWER: VARIABLES (ACCEPT: VARIABLE STARS)

## TOSS-UP

5) Energy – *Short Answer* Researchers at Pacific Northwest National Lab are studying the genomes of fungi that are found living in a mutualistic relationship with algae. What is the term for this composite organism?

ANSWER: LICHEN

## BONUS

5) Energy – *Short Answer* Argonne National Lab researchers are studying how to biosynthesize gold nanoparticles within hypoxic tissues. The main organ they are studying accounts for 25% of the body's oxygen demand but only 2% of the body's mass. What organ is this?

ANSWER: BRAIN

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## TOSS-UP

6) Life Science – *Short Answer* Mammals are named for their mammary glands, which produce what substance?

ANSWER: MILK

## BONUS

6) Life Science – *Short Answer* Identify all of the following three statements that are true of single-celled organisms: 1) They are all prokaryotic [**PRO-care-ee-AW-tic**]; 2) They can sexually reproduce; 3) They include both autotrophs and heterotrophs [**HEH-turoh-trofes**].

ANSWER: 2, 3

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TOSS-UP

7) Math – *Short Answer* Giving your answer as a decimal, decreasing a number by 54% is equivalent to multiplying it by what?

ANSWER: 0.46 (ACCEPT: .46)

BONUS

7) Math – *Short Answer* What is the volume of a rectangular pyramid with base dimensions 13 and 9 and height 15?

ANSWER: 585

## TOSS-UP

8) Physical Science – *Multiple Choice* David has two ramps with the same height but at different angles to the horizontal. He places identical marbles at the tops of the ramps and allows them to roll down. Which of the following quantities will be the same for the two marbles?

- W) Time taken to roll down the ramp
- X) Velocity at the bottom of the ramp
- Y) Acceleration along the ramp
- Z) Position along the ramp after one second

ANSWER: X) VELOCITY AT THE BOTTOM OF THE RAMP

## BONUS

8) Physical Science – *Short Answer* Identify all of the following three ionic compounds that are readily soluble in water: 1) Lithium phosphate; 2) Silver nitrate; 3) Calcium hydroxide.

ANSWER: 2



## TOSS-UP

9) Earth and Space – *Short Answer* What term is used to describe ground that is frozen for a period of at least two years?

ANSWER: PERMAFROST

## BONUS

9) Earth and Space – *Short Answer* Identify all of the following three statements that are true of felsic magma: 1) It is more viscous than mafic [*MAY-fik*] magma; 2) It has a higher melting temperature than mafic magma; 3) It has a higher gas content than mafic magma.

ANSWER: 1, 3

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## TOSS-UP

10) Energy – *Short Answer* Scientists at Argonne National Lab are using copper-based photocatalysts to reduce carbon dioxide into useful compounds. To trace the movement of carbon atoms, they used carbon dioxide composed of a stable yet uncommon isotope of carbon. What isotope was this?

ANSWER: CARBON-13 (ACCEPT: C-13)

## BONUS

10) Energy – *Short Answer* Ames Lab has been developing a device called the SelectShred, which can recover rare earth elements from discarded disk drives. Identify all of the following three statements that are true of rare earth elements: 1) They are all metals; 2) They are all actinides; 3) Their total abundance in Earth's crust is lower than gold.

ANSWER: 1

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## TOSS-UP

11) Life Science – *Multiple Choice* Halophytes [*HAIL-oh-fites*] are plants that have adapted to which of the following environmental challenges?

- W) Aridity [*ah-RID-ih-tee*]
- X) Salinity
- Y) Long winters
- Z) Flooded soil

ANSWER: X) SALINITY

## BONUS

11) Life Science – *Short Answer* The medulla [*meh-DULL-ah*], pons, and midbrain collectively form what structure of the brain?

ANSWER: BRAINSTEM



TOSS-UP

12) Math – *Short Answer* Simplify the following expression:  
 $21 - 5 \text{ times } 3$

ANSWER: 6

BONUS

12) Math – *Short Answer* What is the largest prime factor of 2385?

ANSWER: 53



## TOSS-UP

13) Physical Science – *Short Answer* A wave is generated by moving one end of a rope up and down, so that the displacement of the rope is perpendicular to the direction of travel of the wave. What is the term for this type of wave?

ANSWER: TRANSVERSE (do not accept: SINUSOIDAL)

## BONUS

13) Physical Science – *Multiple Choice* According to VSEPR [*VESS-pur*] theory, what is the molecular geometry of water?

- W) Bent
- X) Linear
- Y) Tetrahedral
- Z) Trigonal [*TRIH-gunul*] planar

ANSWER: W) BENT

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## TOSS-UP

14) Earth and Space – *Multiple Choice* Which of the following is primarily responsible for the presence of carbon-14 used in radiometric dating?

- W) Volcanic gasses
- X) Biomass burning
- Y) Cosmic rays
- Z) Lightning

ANSWER: Y) COSMIC RAYS

## BONUS

14) Earth and Space – *Multiple Choice* Which of the following minerals, when examined at a molecular level, would appear to be a stack of loosely interacting sheets?

- W) Muscovite [*MUSK-ah-vite*]
- X) Augite [*AW-jite*]
- Y) Olivine [*AW-liv-een*]
- Z) Quartz

ANSWER: W) MUSCOVITE

## TOSS-UP

15) Energy – *Short Answer* Brookhaven National Lab researchers are working on a reactor that can reduce a notable greenhouse gas into compounds such as formic acid, ethanol, and acetic acid. Which greenhouse gas are they attempting to reduce?

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

## BONUS

15) Energy – *Short Answer* Lawrence Berkeley National Lab researchers are working to develop new uses for graphene, an atomically thin 2D material. Identify all of the following four statements that are true of graphene: 1) It is an excellent electrical conductor; 2) It is an excellent heat conductor; 3) It contains silicon atoms; 4) It contains carbon atoms.

ANSWER: 1, 2, 4