

Middle School
Set 3

TOSS-UP

1) Energy – *Short Answer* Researchers at Brookhaven National Lab are working with Cu-H mordenite catalysts to oxidize what molecule that is present in natural gas into methyl alcohol?

ANSWER: METHANE

BONUS

1) Energy – *Short Answer* Scientists at Pacific Northwest National Lab are developing sodium-ion batteries. What element is the anode in this battery made of?

ANSWER: CARBON



TOSS-UP

2) Life Science – *Short Answer* What is the general term for hypersensitivity reactions of the immune system towards harmless environmental stimuli?

ANSWER: ALLERGY

BONUS

2) Life Science – *Multiple Choice* Which of the following types of plants is considered non-vascular?

- W) Fern
- X) Moss
- Y) Oak
- Z) Conifer

ANSWER: X) MOSS

TOSS-UP

3) Math – *Short Answer* What fraction is halfway between $\frac{1}{8}$ and $\frac{1}{12}$?

ANSWER: $\frac{5}{48}$

BONUS

3) Math – *Short Answer* A triangle has two exterior angles that have degree measures of 156 and 129, respectively. What is the degree measure of their common remote interior angle?

ANSWER: 105

TOSS-UP

4) Physical Science – *Multiple Choice* Which of the following elements is the most electronegative?

- W) Sodium
- X) Boron
- Y) Carbon
- Z) Rubidium [*roo-BID-ee-um*]

ANSWER: Y) CARBON

BONUS

4) Physical Science – *Short Answer* Identify all of the following three compounds that would burn green in a flame test: 1) Barium chloride; 2) Potassium chloride; 3) Lithium chloride.

ANSWER: 1

TOSS-UP

5) Earth and Space – *Multiple Choice* Radiometric dating of the oldest meteoroids of the solar system would produce ages closest to which of the following?

- W) 13 billion years
- X) 9 billion years
- Y) 5 billion years
- Z) 2 billion years

ANSWER: Y) 5 BILLION YEARS

BONUS

5) Earth and Space – *Multiple Choice* When geologists are studying a geologic unit that contains folds and faults, they typically assume that geologic units didn't start with folds and faults. This is an application of which of the following?

- W) Principle of superposition
- X) Principle of original horizontality
- Y) Principle of faunal succession
- Z) Principle of lateral continuity

ANSWER: X) PRINCIPLE OF ORIGINAL HORIZONTALITY

TOSS-UP

6) Energy – *Short Answer* Ames Lab researchers are studying crystals on a spherical surface and quantum mechanical behavior of electrons in their lowest-energy state. What is the term for this state?

ANSWER: GROUND STATE

BONUS

6) Energy – *Multiple Choice* Oak Ridge National Lab researchers are using neutron scattering to study the mechanics of alpha-catenin [*KAT-ah-nin*] and its ability to bind to actin. Which of the following roles do these proteins play in the cell?

- W) Metabolic
- X) Structural
- Y) Transcriptional
- Z) Translational

ANSWER: X) STRUCTURAL

TOSS-UP

7) Life Science – *Multiple Choice* Pepper the cat that likes to hunt. He brings home the skull of an unidentified animal with very sharp and robust canines. What did this unknown animal most likely eat?

- W) Meat
- X) Detritus [*deh-TRY-tus*]
- Y) Grasses
- Z) Berries

ANSWER: W) MEAT

BONUS

7) Life Science – *Short Answer* What part of the eye contains photoreceptors and is responsible for detecting light?

ANSWER: RETINA

TOSS-UP

8) Math – *Short Answer* What is the surface area of a cube with edges of length $\frac{3}{4}$?

ANSWER: $\frac{27}{8}$ (ACCEPT: $3\frac{3}{8}$, 3.375)

BONUS

8) Math – *Short Answer* The mean number of weekly work hours for 16 part-time employees at a store is 17. The mean number of hours for 9 of these employees is 14. To the nearest whole number, what is the mean number of hours for the rest of the 16 employees?

ANSWER: 21

TOSS-UP

9) Physical Science – *Multiple Choice* Which of the following changes would be most likely to increase the terminal velocity of a falling object?

- W) Increasing the size of the object without changing its mass
- X) Decreasing the acceleration of gravity
- Y) Adding mass to the object without changing its size
- Z) Increasing the viscosity of the atmosphere

ANSWER: Y) ADDING MASS TO THE OBJECT WITHOUT CHANGING ITS SIZE

BONUS

9) Physical Science – *Short Answer* Magnesium hydroxide can be taken to neutralize the acidity in your stomach. What is the chemical formula of the primary salt this reaction will produce in your stomach?

ANSWER: MgCl_2

TOSS-UP

10) Earth and Space – *Short Answer* When Earth passes through the orbit of a comet, large amounts of debris may fall into Earth's atmosphere. With what observational event is this associated?

ANSWER: METEOR SHOWER (do not accept: SHOOTING STAR)

BONUS

10) Earth and Space – *Short Answer* Identify all of the following three changes that would improve the angular resolution of a telescope: 1) Increasing the diameter of its aperture; 2) Increasing the thickness of its lens; 3) Increasing the wavelength of light that it images.

ANSWER: 1

TOSS-UP

11) Energy – *Short Answer* Researchers at Oak Ridge National Lab are engineering soil microbes to turn plant biomass into biodegradable plastics. What structural polymer that characterizes sclerenchymal [*sklair-EN-kim-mul*] tissue are they attempting to process?

ANSWER: LIGNIN

BONUS

11) Energy – *Short Answer* Scientists at Argonne National Lab are studying the charge-separation mechanisms in photosynthetic reaction centers. Identify all of the following three kingdoms of life that contain organisms that utilize these reaction centers: 1) Bacteria; 2) Plantae; 3) Protista.

ANSWER: ALL

TOSS-UP

12) Life Science – *Short Answer* What is the most abundant molecule found in the cytosol of cells?

ANSWER: WATER (ACCEPT: H₂O)

BONUS

12) Life Science – *Short Answer* What biopolymer is the primary constituent of the cell wall of fungi?

ANSWER: CHITIN

TOSS-UP

13) Math – *Short Answer* What is the area of a right triangle with legs of lengths 13 and 14?

ANSWER: 91

BONUS

13) Math – *Short Answer* A cell phone plan costs a fixed rate per month plus a charge per text message. One month, Sally had 300 texts and her total bill was \$58. The next month, she had 700 texts and her total bill was \$90. In dollars, what is the fixed rate per month?

ANSWER: 34

TOSS-UP

14) Physical Science – *Short Answer* What force provides the centripetal acceleration needed to keep a satellite in circular orbit about a planet?

ANSWER: GRAVITY (ACCEPT: GRAVITATIONAL)

BONUS

14) Physical Science – *Short Answer* What is the term for a substance that speeds up a chemical reaction without being consumed?

ANSWER: CATALYST

TOSS-UP

15) Earth and Space – *Short Answer* Sulfuric acid clouds are a prominent component of what planet?

ANSWER: VENUS

BONUS

15) Earth and Space – *Short Answer* When a supergiant star undergoes a supernova, what is the predominant element present in its core?

ANSWER: IRON