

MIDDLE SCHOOL - ROUND 14A

TOSS-UP

1) Earth and Space – *Multiple Choice* Olivine [*AW-liv-eeen*] belongs to what major mineral class?

W) Silicates [*SILL-ih-kates*]

X) Carbonates

Y) Oxides

Z) Sulfates

ANSWER: W) SILICATES

BONUS

1) Earth and Space – *Multiple Choice* Which of the following is believed to have led to the oxygenation of Earth's atmosphere approximately 2.4 billion years ago?

W) Increase in the photolysis [*foh-TAWL-ih-sis*] of water by UV radiation

X) Evolution of oxygenic photosynthesis

Y) Increase in volcanic outgassing

Z) Collision with a comet

ANSWER: X) EVOLUTION OF OXYGENIC PHOTOSYNTHESIS

TOSS-UP

2) Physical Science – *Short Answer* By what process does dry ice turn directly into gaseous carbon dioxide?

ANSWER: SUBLIMATION

BONUS

2) Physical Science – *Short Answer* Identify all of the following three reactions that are redox reactions: 1) Acid-base neutralization; 2) Combustion; 3) Ionic precipitation.

ANSWER: 2

TOSS-UP

3) Math – *Short Answer* What is the smallest positive integer that is 1 more than a multiple of 3, and 1 less than a multiple of 7?

ANSWER: 13

BONUS

3) Math – *Short Answer* One angle of an isosceles triangle measures 68 degrees. In degrees, what are the possible measures of the smallest angle of the triangle?

ANSWER: 44 AND 56

TOSS-UP

4) Life Science – *Short Answer* The reptile egg can develop on land and does not need the constant presence of water. What is the term for this type of egg?

ANSWER: AMNIOTIC EGG

BONUS

4) Life Science – *Short Answer* In humans, what germ layer gives rise to the muscles and the circulatory system?

ANSWER: MESODERM

TOSS-UP

5) Energy – *Multiple Choice* Researchers at Thomas Jefferson National Accelerator Facility recently completed the 12 giga-electron-volt upgrade of the Continuous Electron Beam Accelerator Facility. To which of the following does the 12 giga-electron-volts best correspond?

- W) Number of electrons in the beam
- X) Charge of the electrons
- Y) Potential energy of the electrons
- Z) Kinetic energy of the electrons

ANSWER: Z) KINETIC ENERGY OF THE ELECTRONS

BONUS

5) Energy – *Multiple Choice* Ames National Lab scientists have developed a method for cheaply synthesizing materials, such as sodium hydride and potassium hydride. These can be classified as which of the following?

- W) Strong acids
- X) Strong ligands
- Y) Alkali metal hydrides
- Z) Rare earth hydrides

ANSWER: Y) ALKALI METAL HYDRIDES

TOSS-UP

6) Earth and Space – *Short Answer* How many planets in our solar system have polar ice caps?

ANSWER: TWO

BONUS

6) Earth and Space – *Multiple Choice* Which of the following is NOT a component of the solar wind?

- W) Electrons
- X) Alpha particles
- Y) Protons
- Z) Photons

ANSWER: Z) PHOTONS

TOSS-UP

7) Physical Science – *Multiple Choice* For a projectile that is accelerating only due to gravity, where is its speed the lowest?

- W) Just as it is fired
- X) Just before it hits the ground
- Y) At the top of its arc
- Z) At the bottom of its arc

ANSWER: Y) AT THE TOP OF ITS ARC

BONUS

7) Physical Science – *Short Answer* To the nearest kilojoule, how much energy is required to heat 75 milliliters of water from 25 degrees Celsius to 40 degrees Celsius?

ANSWER: 5

TOSS-UP

8) Energy – *Short Answer* Scientists at the National Renewable Energy Lab investigated a biomolecule that catalyzes the degradation of the plastic PET. What is the general name for this type of biological catalyst?

ANSWER: ENZYME

BONUS

8) Energy – *Short Answer* Researchers at Idaho National Laboratory have developed a more efficient, lower-temperature method to crack hydrocarbons that uses 65 percent less energy and reduces the carbon footprint by 98 percent. In this process, natural gas is a source for ethane, which is cracked to produce ethylene. To what general hydrocarbon classes do ethane and ethylene, respectively, belong?

ANSWER: ALKANE (ETHANE) AND ALKENE (ETHYLENE)

TOSS-UP

9) Math – *Multiple Choice* Which of the following statements is equivalent to the negation of the statement " P and Q "?

- W) not P and not Q
- X) not P or not Q
- Y) P or not Q
- Z) P or Q

ANSWER: X) NOT P OR NOT Q

BONUS

9) Math – *Short Answer* At what value of y does the line that contains the points $(-3, 5)$ and $(5, 16)$ cross the y -axis?

ANSWER: $73/8$ (ACCEPT: $9\ 1/8$, 9.125)

TOSS-UP

10) Earth and Space – *Multiple Choice* In which of the following environments would you typically find a skarn?

- W) Divergent boundary
- X) Magmatic intrusion
- Y) Volcanic eruption
- Z) Convergent boundary

ANSWER: X) Magmatic intrusion

BONUS

10) Earth and Space – *Short Answer* Identify all of the following three characteristics of a flowing river that can be inferred from the shape of sedimentary layers it deposits:

1) Flow direction; 2) Relative flow speed; 3) Water depth.

ANSWER: 1, 2

TOSS-UP

11) Life Science – *Short Answer* What is the most specific taxonomic rank for which individuals belonging to different categories of that rank cannot interbreed to produce fertile offspring?

ANSWER: SPECIES

BONUS

11) Life Science – *Short Answer* What is the main nitrogenous waste product secreted by humans?

ANSWER: UREA

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**TOSS-UP**

12) Math – *Short Answer* An isosceles trapezoid has an interior angle measuring 136 degrees. What is the degree measure of its smallest interior angle?

ANSWER: 44

**BONUS**

12) Math – *Short Answer* If  $\log A = 1.2$ ,  $\log B = 2.1$ , and  $\log C = 3.7$ , what is the log of the fraction with numerator  $AB^2$  and denominator  $C$ ?

ANSWER: 1.7 (ACCEPT:  $1 \frac{7}{10}$ ,  $17/10$ )

### TOSS-UP

13) Energy – *Short Answer* Fermi National Lab scientists demonstrated the accuracy of a theory called quantum chromodynamics, which is primarily relevant to the interactions of what fundamental force?

ANSWER: STRONG (ACCEPT: STRONG NUCLEAR)

### BONUS

13) Energy – *Short Answer* Scientists at Lawrence Berkeley National Lab are modeling the development of tropical cyclones and hurricanes. These types of storms are classified according to what severity scale?

ANSWER: SAFFIR-SIMPSON (ACCEPT: SSHWS, SAFFIR-SIMPSON HURRICANE WIND SCALE)

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### TOSS-UP

14) Life Science – *Short Answer* What bacterially-derived enzymes are often used in DNA-engineering applications due to their ability to cut DNA at very specific nucleotide sequences?

ANSWER: RESTRICTION ENZYMES (ACCEPT: RESTRICTION ENDONUCLEASE)

### BONUS

14) Life Science – *Short Answer* Humans are part of what taxonomic family?

ANSWER: HOMINIDAE

**TOSS-UP**

15) Math – *Short Answer* A sphere has a surface area of 60. If its radius is tripled, what is the new surface area?

ANSWER: 540

**BONUS**

15) Math – *Short Answer* A Fibonacci-type sequence has the property that every term starting with the third is the sum of the previous two terms. If the seventh term is 45 and the tenth term is 191, what is the fifth term?

ANSWER: 17

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**TOSS-UP**

16) Earth and Space – *Multiple Choice* What latitude receives the most direct sunlight during the December solstice?

- W) The Equator
- X) 23.5 degrees North
- Y) 23.5 degrees South
- Z) Tropic of Cancer

ANSWER: Y) 23.5 DEGREES SOUTH

**BONUS**

16) Earth and Space – *Short Answer* Rank the following three planets in increasing order of day length: 1) Mercury; 2) Venus; 3) Earth.

ANSWER: 3,1,2



### TOSS-UP

17) Physical Science – *Multiple Choice* The plum pudding model of the atom was based on which of the following observations?

- W) When alpha particles are fired at the nucleus, some bounce back
- X) Light given off by elements in a flame test has discrete wavelengths
- Y) Alpha particles can knock positive particles from nuclei
- Z) The atom contains negative particles

ANSWER: Z) THE ATOM CONTAINS NEGATIVE PARTICLES

### BONUS

17) Physical Science – *Short Answer* Rank the following three bonds in order of increasing bond strength: 1) Carbon-carbon single bond; 2) Oxygen-hydrogen single bond; 3) Carbon-hydrogen single bond.

ANSWER: 1, 3, 2

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### TOSS-UP

18) Life Science – *Short Answer* Opiates are drugs that mimic what natural chemicals in the brain?

ANSWER: ENDORPHINS (ACCEPT: ENKEPHALINS)

### BONUS

18) Life Science – *Short Answer* Identify all of the following three statements that are true of eukaryotes: 1) Fungi are heterotrophs [*HEH-turoh-trohfs*]; 2) Protists can be either heterotrophs or autotrophs; 3) Plants are autotrophs.

ANSWER: ALL OF THEM

### TOSS-UP

19) Earth and Space – *Short Answer* What is the adjective for the type of front that is created when a cold front catches up to and overtakes a warm front?

ANSWER: OCCLUDED

### BONUS

19) Earth and Space – *Short Answer* Rank the following three detrital rocks in terms of increasing particle size: 1) Sandstone; 2) Shale; 3) Conglomerate.

ANSWER: 2, 1, 3

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### TOSS-UP

20) Physical Science – *Multiple Choice* Which of the following is true about a mixture of gasses?

W) The sum of the partial pressures of each gas is equal to the total pressure

X) The sum of the temperatures of each gas is equal to the total temperature

Y) The total volume is equal to the largest partial volume

Z) The total number of moles is equal to the total volume multiplied by the sum of the moles of each gas

ANSWER: W) THE SUM OF THE PARTIAL PRESSURES OF EACH GAS IS EQUAL TO THE TOTAL PRESSURE

### BONUS

20) Physical Science – *Short Answer* Identify all of the following three types of radioactive decay that involve the emission of charged particles: 1) Alpha; 2) Beta; 3) Gamma.

ANSWER: 1, 2

**TOSS-UP**

21) Life Science – *Short Answer* Of what group of seed plants are flowering plants a part?

ANSWER: ANGIOSPERMS

**BONUS**

21) Life Science – *Short Answer* Of what are the cell walls of diatoms composed?

ANSWER: SILICA (ACCEPT: SiO<sub>2</sub>)

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**TOSS-UP**

22) Math – *Short Answer* If the product of two binomials is  $a^2 - 3a - 180$  and one factor is  $a + 12$ , what is the other factor?

ANSWER:  $a - 15$

**BONUS**

22) Math – *Short Answer* To the nearest integer, what is the geometric mean of 9 and 33?

ANSWER: 17

### TOSS-UP

23) Physical Science – *Short Answer* What is the name for the temperature and pressure for a substance at which all three phases of matter can coexist?

ANSWER: TRIPLE POINT

### BONUS

23) Physical Science – *Short Answer* What are the total numbers of sigma and pi [*pie*] bonds, respectively, in one molecule of carbon dioxide?

ANSWER: 2 SIGMA AND 2 PI