

## ROUND 16A

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### TOSS-UP

1) Energy – *Short Answer* What alkaline earth metal, commonly used in X-ray-transparent windows, is lighter than aluminum but stiffer than steel?

ANSWER: BERYLLIUM

### BONUS

1) Energy – *Short Answer* Oak Ridge National Lab operates the High Flux Isotope Reactor, which can produce rare radioisotopes. What particles have a high flux in this reactor?

ANSWER: NEUTRONS

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### TOSS-UP

2) Math – *Short Answer* What is the largest quotient that can be formed using two of the following five numbers:  $-40$ ,  $-2$ ,  $1$ ,  $8$ ,  $16$ ?

ANSWER: 20

### BONUS

2) Math – *Short Answer* What is the y-intercept of the line that contains the points  $(-2, 3)$  and  $(3, 10)$ ?

ANSWER: 5.8 (ACCEPT:  $29/5$ ,  $5\ 4/5$ )

**TOSS-UP**

3) Physical Science – *Short Answer* By definition, what is the magnitude of a unit vector?

ANSWER: ONE

**BONUS**

3) Physical Science – *Short Answer* In meters per second and to one significant figure, what will be the magnitude of the final velocity when a 1000-kilogram mass traveling at 20 meters per second collides perfectly inelastically [*in-ee-LASS-tik-lee*] with a stationary mass of 3000 kilograms?

ANSWER: 5

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**TOSS-UP**

4) Life Science – *Multiple Choice* The reactions that the cell uses to harvest energy from sugars can be classified as what?

- W) Decomposition
- X) Synthesis
- Y) Redox [*REE-dox*]
- Z) Combustion

ANSWER: Y) REDOX

**BONUS**

4) Life Science – *Short Answer* In a biology lab, what machine is used to sterilize glassware via the application of very hot steam?

ANSWER: AUTOCLAVE

**TOSS-UP**

5) Math – *Short Answer* Joe’s average score on his first four exams was 80. If his average after the fifth exam was 82, what did he score on the fifth test?

ANSWER: 90

**BONUS**

5) Math – *Short Answer* What is the coefficient of the  $ab^2$  term in the binomial expansion of open parenthesis  $5a - 6b$  close parenthesis cubed?

ANSWER: 540

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**TOSS-UP**

6) Earth and Space – *Short Answer* Wolframite is an ore for what transition metal?

ANSWER: TUNGSTEN

**BONUS**

6) Earth and Space – *Multiple Choice* Which of the following statements is true regarding ocean tides and currents?

- W) Tides are the horizontal movement of ocean water and currents are vertical movements
- X) Tides are constant while currents are variable
- Y) Both tides and currents are influenced by gravitational pull
- Z) Tides and currents vary with the moon phases

ANSWER: Y) BOTH TIDES AND CURRENTS ARE INFLUENCED BY GRAVITATIONAL PULL

**TOSS-UP**

7) Physical Science – *Short Answer* If an object is moving in uniform circular motion, there is a force vector pointing towards the center of the circle. What is the name of this force?

ANSWER: CENTRIPETAL FORCE (DO NOT ACCEPT: CENTRIFUGAL FORCE)

**BONUS**

7) Physical Science – *Short Answer* How much work, in joules to the nearest integer, is done by gravity when a 2-kilogram ball falls 12 meters to the ground?

ANSWER: 235

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**TOSS-UP**

8) Energy – *Short Answer* What is the most common type of geothermal plant?

ANSWER: FLASH STEAM

**BONUS**

8) Energy – *Multiple Choice* The capacity factor for a power plant is defined as the amount of electric energy generated over a given time period, divided by the amount of electric energy that would have been generated had that plant operated at 100% for the entire time period. Which of the following would be a typical capacity factor for a solar photovoltaic [*photo-vawl-TAY-ik*] power plant?

- W) 5%
- X) 20%
- Y) 50%
- Z) 80%

ANSWER: X) 20%

**TOSS-UP**

9) Math – *Short Answer* What are the smallest and largest integers that satisfy the following absolute value inequality: the absolute value of open parenthesis  $x - 5$  close parenthesis is less than 3?

Answer: 3 AND 7 (MUST GIVE BOTH ANSWERS)

**BONUS**

9) Math – *Short Answer* How many different (that is, non-congruent) isosceles triangles that are not equilateral have the length of each side being an integer between 3 and 6 inclusive?

ANSWER: 11



**TOSS-UP**

10) Energy – *Short Answer* In the water-gas shift reaction, what gas reacts with water?

ANSWER: CARBON MONOXIDE

**BONUS**

10) Energy – *Short Answer* The radioisotope thermoelectric generators used by NASA to power spacecraft primarily use what radioactive element as a heat source?

ANSWER: PLUTONIUM

**TOSS-UP**

11) Life Science – *Short Answer* What are the two types of vascular tissue found in plants?

ANSWER: XYLEM AND PHLOEM

**BONUS**

11) Life Science – *Short Answer* What human organ produces glucagon [*GLUE-kah-gon*]?

ANSWER: PANCREAS



**TOSS-UP**

12) Earth and Space – *Short Answer* What type of stellar event created the Crab Nebula?

ANSWER: SUPERNOVA

**BONUS**

12) Earth and Space – *Multiple Choice* Geologically, detritus [*de-TRY-tus*] consists of chunks and smaller grains of rock broken off other rocks by physical weathering and erosion. What is the term for a fragment of detritus?

- W) Sediment
- X) Clast
- Y) Particle
- Z) Breccia [*BRETCH-ee-ah*]

ANSWER: X) CLAST

**TOSS-UP**

13) Physical Science – *Short Answer* How many lone pairs does a single molecule of water have?

ANSWER: TWO

**BONUS**

13) Physical Science – *Short Answer* What is the oxidation number of sulfur in the sulfate ion,  $\text{SO}_4^{2-}$ ?

ANSWER: +6 (must say the +)

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**TOSS-UP**

14) Earth and Space – *Multiple Choice* Which of the following is closest to the percentage of mass in our Solar System belonging to the Sun?

- W) 80
- X) 90
- Y) 95
- Z) 99

ANSWER: Z) 99

**BONUS**

14) Earth and Space – *Multiple Choice* The Chandrasekhar [*chun-dra-SHAY-kar*] limit sets a theoretical maximum on which of the following properties of a white dwarf star?

- W) Luminosity
- X) Mass
- Y) Age
- Z) Temperature

ANSWER: X) MASS

**TOSS-UP**

15) Life Science – *Short Answer* What organ system in the human body is responsible for coordinating activities of the body via hormones?

ANSWER: ENDOCRINE

**BONUS**

15) Life Science – *Short Answer* What type of tissue covers the surface of the vertebrate body and is derived from all three germ layers?

ANSWER: EPITHELIUM



**TOSS-UP**

16) Earth and Space – *Multiple Choice* Just before the totality of a solar eclipse, the Moon's rough surface allows small patches of sunlight to break through. What is this effect known as?

- W) Diamond ring effect
- X) Bailey's beads
- Y) Clavius spots
- Z) Humboldt dots

ANSWER: X) BAILEY'S BEADS

**BONUS**

16) Earth and Space – *Short Answer* Which of the planets of the Solar System has the longest orbital period?

ANSWER: NEPTUNE



**TOSS-UP**

17) Physical Science – *Short Answer* What allotrope of carbon is similar to graphite, but consists of only a single layer of atoms?

ANSWER: GRAPHENE

**BONUS**

17) Physical Science – *Short Answer* In order for nuclear fusion to occur, the repulsion from what fundamental force must be overcome?

ANSWER: ELECTROMAGNETIC



**TOSS-UP**

18) Math – *Short Answer* What is the perimeter of a right triangle with legs of length 1 and 3?

ANSWER:  $4 + \sqrt{10}$

**BONUS**

18) Math – *Short Answer* A 5-digit palindrome has 3 different digits and is divisible by 3. What is the largest such number?

ANSWER: 98,589

**TOSS-UP**

19) Physical Science – *Short Answer* What is the name of the thermodynamic law that describes why the isothermal mixing of two ideal gases is spontaneous?

ANSWER: SECOND LAW OF THERMODYNAMICS (ACCEPT: THE LAW OF ENTROPY or SECOND)

**BONUS**

19) Physical Science – *Short Answer* The strongest known hydrogen bond occurs between the fluoride ion and what molecule?

ANSWER: HF (ACCEPT: HYDROGEN FLUORIDE)



**TOSS-UP**

20) Math – *Short Answer* What is the slope of the line with equation  $3x + 7y = -21$ ?

ANSWER:  $-3/7$

**BONUS**

20) Math – *Short Answer* In a particular year, if April 17 is on a Friday, on what day of the week is October 29?

ANSWER: THURSDAY

**TOSS-UP**

21) Life Science – *Short Answer* What is the term for the small, fingerlike projections in the small intestine that increase the overall surface area?

ANSWER: VILLI (ACCEPT: MICROVILLI)

**BONUS**

21) Life Science – *Short Answer* What is the adjective for the type of muscle contraction that involves the muscle remaining the same length throughout the contraction?

ANSWER: ISOMETRIC



**TOSS-UP**

22) Earth and Space – *Short Answer* Lakes and rain on Titan are primarily composed of what compound?

ANSWER: METHANE

**BONUS**

22) Earth and Space – *Short Answer* In oceanography, what does the abbreviation PSU stand for?

ANSWER: PRACTICAL SALINITY UNIT

### **TOSS-UP**

23) Life Science – *Short Answer* What is the term for RNA-based viruses that produce DNA once they infect their host?

ANSWER: RETROVIRUS

### **BONUS**

23) Life Science – *Short Answer* What kind of tropism in plants occurs as a result of touch?

ANSWER: THIGMOTROPISM