

ROUND 7A

TOSS-UP

1) Earth and Space – *Multiple Choice* On a geology field trip, you come across a sedimentary rock containing marks. These marks might contain information about which of the following?

- W) Water depth
- X) Seasonal climate variability
- Y) Flow direction
- Z) Local vegetation

ANSWER: Y) FLOW DIRECTION

BONUS

1) Earth and Space – *Multiple Choice* Which of the following is the term for a downward shift of the Earth's surface caused by excess removal of ground water?

- W) Slippage
- X) Aseismic creep
- Y) Subsidence
- Z) Erosion

ANSWER: Y) SUBSIDENCE

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### TOSS-UP

2) Life Science – *Multiple Choice* Before a protein can be made, a gene must first be transcribed into what molecule?

- W) tRNA
- X) rRNA
- Y) mRNA
- Z) sRNA

ANSWER: Y) mRNA

### BONUS

2) Life Science – *Short Answer* In what organ does the female germ cell develop?

ANSWER: OVARY

### TOSS-UP

3) Energy – *Short Answer* New research at Lawrence Livermore National Lab captures carbon dioxide and converts it to sodium bicarbonate. What is the more common name of sodium bicarbonate?

ANSWER: BAKING SODA

### BONUS

3) Energy – *Multiple Choice* To maximize solar energy absorption in the northern hemisphere, the front of a building constructed for passive solar should face what direction?

- W) North
- X) South
- Y) East
- Z) West

ANSWER: X) SOUTH

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### TOSS-UP

4) Life Science – *Short Answer* What is the structure capable of transporting dissolved organic material throughout a plant?

ANSWER: PHLOEM

### BONUS

4) Life Science – *Short Answer* If one parent is homozygous [*homo-ZYE-gus*] dominant for a trait and the other is homozygous recessive for that trait, what is the probability that the offspring will be homozygous recessive for that trait?

ANSWER: ZERO

**TOSS-UP**

5) Math – *Short Answer* What is the additive inverse of  $-4/7$ ?

ANSWER:  $4/7$

**BONUS**

5) Math – *Short Answer* If a fully-charged cell phone is good for 8 hours, how many minutes remain after using 30% of the battery?

ANSWER: 336



**TOSS-UP**

6) Physical Science – *Multiple Choice* A photon of what wavelength carries the most energy?

- W) Red
- X) Ultraviolet
- Y) Infrared
- Z) Blue

ANSWER: X) ULTRAVIOLET

**BONUS**

6) Physical Science – *Short Answer* A 25-kilogram load is placed on a beam 1 meter from the fulcrum. How far away from the fulcrum, in meters, must a 5-kilogram mass be placed to keep the system in equilibrium?

ANSWER: 5

**TOSS-UP**

7) Math – *Multiple Choice* When a pair of parallel lines is cut by a transversal, 8 angles are formed. If one of these angles measures 145 degrees, how many of the other 7 angles also measure 145 degrees?

- W) 1
- X) 2
- Y) 3
- Z) 4

ANSWER: Y) 3

**BONUS**

7) Math – *Short Answer* If  $b$  and  $c$  satisfy the system of equations  $6b + 7 = 12c$  and  $2b - 5c = 4$ , what is  $c$ ?

ANSWER:  $-19/3$  (ACCEPT:  $-6 \frac{1}{3}$ )

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TOSS-UP

8) Life Science – *Multiple Choice* Which of the following is NOT a nucleic [*new-CLAY-ik*] acid?

- W) DNA
- X) RNA
- Y) ATP
- Z) DNR

ANSWER: Z) DNR

BONUS

8) Life Science – *Short Answer* What stage of cellular respiration involves the net conversion of glucose to two pyruvate [*pie-ROO-vate*] molecules?

ANSWER: GLYCOLYSIS

TOSS-UP

9) Physical Science – *Multiple Choice* Water ice floats because its density is less than liquid water at the same temperature. Which of the following intermolecular forces best explains this effect?

- W) Covalent [*koh-VAY-lent*] bonding
- X) Ionic bonding
- Y) Hydrogen bonding
- Z) London forces

ANSWER: Y) HYDROGEN BONDING

BONUS

9) Physical Science – *Multiple Choice* A beaker of water is placed in a vacuum chamber and the chamber evacuated. Which of the following will NOT happen?

- W) The water begins to boil
- X) The water heats up
- Y) The water cools down
- Z) The water freezes

ANSWER: X) THE WATER HEATS UP

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**TOSS-UP**

10) Earth and Space – *Short Answer* How many constellations are currently officially recognized?

ANSWER: 88

**BONUS**

10) Earth and Space – *Short Answer* Who was the first American woman to fly in space?

ANSWER: SALLY RIDE

**TOSS-UP**

11) Energy – *Multiple Choice* Which of the following areas of the United States has the most potential for geothermal energy?

- W) Northeast
- X) Southeast
- Y) Northwest
- Z) Southwest

ANSWER: Y) NORTHWEST

**BONUS**

11) Energy – *Short Answer* Mirrors are molded into what shape to capture and concentrate solar energy in trough-type solar thermal installations?

ANSWER: PARABOLA (ACCEPT: PARABOLIC)

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TOSS-UP

12) Physical Science – *Multiple Choice* Which of the following best describes quantum tunneling?

- W) A particle crosses a potential barrier without surmounting it
- X) A particle rests at equilibrium in a potential well
- Y) A particle switches quantum numbers spontaneously
- Z) A particle disobeys the exclusion principle

ANSWER: W) A PARTICLE CROSSES A POTENTIAL BARRIER WITHOUT SURMOUNTING IT

BONUS

12) Physical Science – *Short Answer* What antimatter particle will annihilate with an electron?

ANSWER: POSITRON (ACCEPT: ANTI-ELECTRON)

TOSS-UP

13) Physical Science – *Short Answer* An atom of what isotope has a nucleus that contains eight protons and ten neutrons?

ANSWER: OXYGEN-18

BONUS

13) Physical Science – *Short Answer* How many neutrons are in an atom of carbon 14?

ANSWER: 8

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**TOSS-UP**

14) Math – *Short Answer* How many centimeters is 35 millimeters?

ANSWER: 3.5 (ACCEPT: 3 ½)

**BONUS**

14) Math – *Short Answer* What is the area of a right triangle with hypotenuse of length 7 and one leg of length 5?

ANSWER:  $5\sqrt{6}$

**TOSS-UP**

15) Earth and Space – *Short Answer* Identify all of the following three mountains that are volcanoes:

1) Mt. Fuji; 2) Pike’s Peak; 3) Mt Mazama.

ANSWER: 1 AND 3

**BONUS**

15) Earth and Space – *Short Answer* Order the following Jovian satellites, from largest to smallest:

1) Io; 2) Callisto; 3) Europa; 4) Ganymede.

ANSWER: 4, 2, 1, 3



**TOSS-UP**

16) Energy – *Short Answer* Today's nuclear power reactors convert about 4 percent of the potential energy in their fuel to make electricity. A new class of fuel being developed at DOE National Labs may increase this amount to 20 percent. In doing so, by what factor would the efficiency of the process be multiplied?

ANSWER: 5

**BONUS**

16) Energy – *Short Answer Short Answer* What were the two metal components of the first battery designed by Alesandro Volta?

ANSWER: ZINC AND SILVER (DO NOT ACCEPT: ZINC AND COPPER)

**TOSS-UP**

17) Math – *Short Answer* What is  $5^2 - 2^5$ ?

ANSWER: -7

**BONUS**

17) Math – *Short Answer* What is the distance between the points (2, -5) and (-7, 8)?

ANSWER:  $5\sqrt{10}$

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TOSS-UP

18) Life Science – *Multiple Choice* In humans, chemical digestion of protein does NOT occur in which of the following areas?

- W) Stomach
- X) Small intestine
- Y) Brush border
- Z) Mouth

ANSWER: Z) MOUTH

BONUS

18) Life Science – *Multiple Choice* Which of the following best describes the role of NADPH in the process of photosynthesis?

- W) Source of high energy phosphate
- X) Oxidizing agent
- Y) Reducing agent
- Z) Acceptor of high energy phosphate

ANSWER: Y) REDUCING AGENT

TOSS-UP

19) Math – *Short Answer* In degrees, what is the supplement of a 27-degree angle?

ANSWER: 153

BONUS

19) Math – *Short Answer* What is the prime factorization of 294?

ANSWER: $2 \cdot 3 \cdot 7^2$

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**TOSS-UP**

20) Physical Science – *Short Answer* A brick sliding on a frictionless surface collides with a second stationary object. After the collision both objects move off with the same velocity. This is known as what type of collision?

ANSWER: INELASTIC

**BONUS**

20) Physical Science – *Multiple Choice* For the redox reaction of tin(II) and iron(III) to produce tin(IV) and iron(II), the sum of the coefficients of the balanced reaction is:

- W) 0
- X) 4
- Y) 6
- Z) 10

ANSWER: Y) 6

### TOSS-UP

21) Earth and Space – *Multiple Choice* What is thought to drive plate tectonics?

- W) Earth's magnetic field
- X) Mantle convection
- Y) Gravitational influence of the Sun
- Z) Tides

ANSWER: X) MANTLE CONVECTION

### BONUS

21) Earth and Space – *Multiple Choice* Which of the following materials could potentially be found directly underneath a perched water table?

- W) Sand
- X) Clay
- Y) Gravel
- Z) Silt

ANSWER: X) CLAY

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TOSS-UP

22) Life Science – *Short Answer* What process do eukaryotic [*YOU-care-ee-AW-tic*] cells use to divide into two identical daughter cells?

ANSWER: MITOSIS

BONUS

22) Life Science – *Short Answer* What eukaryotic [*YOU-care-ee-AW-tic*] cellular organelle [*organ-ELL*] is the location of the Krebs cycle?

ANSWER: MITOCHONDRION

TOSS-UP

23) Earth and Space – *Short Answer* What is the term for rocks or layers of sediment that are permeable to water, and are located below the water table?

ANSWER: AQUIFER

BONUS

23) Earth and Space – *Short Answer* Meltwater streams leaving glaciers tend to be very cloudy. What is present in the water causing the cloudy appearance?

ANSWER: ROCK FLOUR (ACCEPT: GLACIAL FLOUR, DO NOT ACCEPT: SEDIMENT)