

## ROUND 7

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### TOSS-UP

1) EARTH AND SPACE *Short Answer* What element is produced in a fusion of hydrogen within a star?

ANSWER: HELIUM

### BONUS

1) EARTH AND SPACE *Multiple Choice* Which of the following statements best explains how conglomerates differ from breccias **[BRECH-ee-uhs]**?

- W) Conglomerates are comprised of interlocking crystals rather than sediments
- X) Breccias are comprised of less mature sediments
- Y) Conglomerates are formed at higher elevations
- Z) Breccias are formed through metamorphic processes

ANSWER: X) BRECCIAS ARE COMPRISED OF LESS MATURE SEDIMENTS

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### TOSS-UP

2) BIOLOGY *Short Answer* In eukaryotic cells, the citric acid cycle takes place in what cellular organelle?

ANSWER: MITOCHONDRIA

### BONUS

2) BIOLOGY *Multiple Choice* Which of the following is NOT characteristic of eudicots **[yoo-DY-kots]**?

- W) Flower parts in multiples of 4 or 5
- X) Taproot
- Y) Two cotyledons **[kot-I-EED-ns]**
- Z) Pollen granules with one opening

ANSWER: Z) POLLEN GRANULES WITH ONE OPENING

### TOSS-UP

3) CHEMISTRY *Multiple Choice* Which of the following elements, in its gaseous state, has the greatest electron affinity?

- W) Fluorine
- X) Bromine
- Y) Sulfur
- Z) Chlorine

ANSWER: W) FLUORINE

### BONUS

3) CHEMISTRY *Short Answer* What disaccharide [**dy-SAK-uh-ryd**] is composed of beta-D-galactose [**guh-LAK-tos**] in a beta-1,4 linkage with alpha-D-glucose?

ANSWER: LACTOSE

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### TOSS-UP

4) MATH *Multiple Choice* The equation  $-mx + 1 = 13 - 4(x + 3)$  [**negative m x plus 1 equals 13 minus 4 times the quantity x plus 3**] is an identity if  $m$  equals which of the following?

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

ANSWER: Z) 4

### BONUS

4) MATH *Multiple Choice* If  $f(x) = -2x^2 + 8x - 4$ , which of the following is true?

- W)  $f$  is not a one to one function
- X) The graph of  $f$  opens upward
- Y) The graph of  $f$  has no  $x$ -intercept
- Z) The maximum value of  $f(x)$  is -4

ANSWER: W)  $f$  IS NOT A ONE TO ONE FUNCTION

### TOSS-UP

5) PHYSICS *Multiple Choice* The acceleration of an object that is in free fall in a vacuum is which of the following?

- W) Proportional to the mass of the object
- X) Proportional to the inverse of the mass of the object
- Y) Independent of the mass of the object
- Z) Equal to the product of force and mass

ANSWER: Y) INDEPENDENT OF THE MASS OF THE OBJECT

### BONUS

5) PHYSICS *Short Answer* What is the name of the phenomenon that explains why the surface of water might look like a mirror when viewed from underwater?

ANSWER: TOTAL INTERNAL REFLECTION (ACCEPT: REFRACTION PAST THE CRITICAL ANGLE)

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### TOSS-UP

6) EARTH AND SPACE *Short Answer* What do scientists call the process by which trade winds in the Pacific weaken, allowing warmer water to move toward the west coast of South America?

ANSWER: EL NINO (ACCEPT: EL NINO SOUTHERN OSCILLATION OR ENSO)

### BONUS

6) EARTH AND SPACE *Multiple Choice* Which of the following surfaces has the highest albedo?

- W) Fresh snow cover
- X) Metallic roof on a skyscraper
- Y) Grass
- Z) Asphalt

ANSWER: W) FRESH SNOW COVER

### TOSS-UP

7) BIOLOGY *Short Answer* The fossil record of European black bears provides evidence of adaptive selection. In a population of black bears, identify the specific type of adaptive selection which would allow the average size of European black bears to increase after periods of glaciation but later decrease in size as interglacial periods warmed.

ANSWER: DIRECTIONAL (DO NOT ACCEPT: DIVERSIFYING)

### BONUS

7) BIOLOGY *Short Answer* What is the common name of the large species of lizard found in Indonesia whose unusual size is attributed to island gigantism?

ANSWER: KOMODO DRAGON

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### TOSS-UP

8) ENERGY *Multiple Choice* Which of the following terms would be used as a synonym for a building described with the term LEED?

- W) Lead contaminated
- X) Green
- Y) Renewed
- Z) Sanitized

ANSWER: X) GREEN

### BONUS

8) ENERGY *Short Answer* What is the term for the liquid or gas discharged after processing activities, such as in sewage treatment plants?

ANSWER: EFFLUENT

### TOSS-UP

9) CHEMISTRY *Multiple Choice* Which of the following represents the enthalpy **[EN-thal-pee]** change that occurs to melt a solid at its melting point?

- W) Heat of fusion
- X) Heat of hydration
- Y) Heat of liquidation
- Z) Heat of vaporization

ANSWER: W) HEAT OF FUSION

### BONUS

9) CHEMISTRY *Short Answer* A gaseous mixture of nitrogen, oxygen, and argon have molar fractions of 0.25, 0.65, and .010, respectively. What is the pressure in atmospheres of nitrogen if the total pressure of the mixture is 4.0 atmospheres?

ANSWER: 1.0

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### TOSS-UP

10) MATH *Short Answer* What is the solution set of the inequality  $(x - 1)^2 \leq 0$  **[the quantity x minus one squared is less than or equal to zero]**?

ANSWER: 1

### BONUS

10) MATH *Multiple Choice* If function  $f$  is defined by  $f(x) = (4x^2 - 12x)/(x^2 - 9)$  **[f of x equals a fraction with numerator 4 x squared minus 12 x and denominator x squared minus 9]**, then at  $x = 3$ , which of the following is true?

- W) The graph of  $f$  has a vertical asymptote
- X) The graph of  $f$  has a hole on the  $x$  axis
- Y) The graph of  $f$  has a hole at  $(3, 2)$
- Z)  $f(x) = 0$

ANSWER: Y) THE GRAPH OF  $F$  HAS A HOLE AT  $(3, 2)$

### TOSS-UP

11) PHYSICS *Multiple Choice* An object is suspended from a spring balance in an elevator. The reading of the balance is 200 newtons when the elevator is at rest. If the balance reading later is 190 newtons, which of the following best describes how the elevator could be moving at that time?

- W) Downward at constant speed
- X) Downward and increasing in speed
- Y) Upward at constant speed
- Z) Upward and increasing in speed

ANSWER: X) DOWNWARD AND INCREASING IN SPEED

### BONUS

11) PHYSICS *Multiple Choice* A small object is 10 centimeters in front of a plane mirror. Standing 20 centimeters behind the object, 30 centimeters from the mirror, at what distance in centimeters must you focus your eyes to see the object's mirror image clearly?

- W) 20
- X) 30
- Y) 40
- Z) 50

ANSWER: Y) 40

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### TOSS-UP

12) EARTH AND SPACE *Short Answer* What is the boundary between the troposphere and the stratosphere called?

ANSWER: TROPOPAUSE

### BONUS

12) EARTH AND SPACE *Multiple Choice* Which of the following stellar reactions releases the most energy?

- W) Hydrogen to helium
- X) Helium to oxygen
- Y) Oxygen to silicon
- Z) Silicon to iron

ANSWER: W) HYDROGEN TO HELIUM

**TOSS-UP**

13) BIOLOGY *Multiple Choice* Which of the following organ systems is responsible for the secretion of hormones?

- W) Endocrine
- X) Reproductive
- Y) Circulatory
- Z) Immune

ANSWER: W) ENDOCRINE

**BONUS**

13) BIOLOGY *Short Answer* In an area originally devoid of life, what is the name for the first community to become established?

ANSWER: PIONEER (DO NOT ACCEPT: FOUNDER)

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**TOSS-UP**

14) ENERGY *Multiple Choice* Which of the following sectors in the U.S. uses the most petroleum?

- W) Industry
- X) Residential
- Y) Transportation
- Z) Construction

ANSWER: Y) TRANSPORTATION

**BONUS**

14) ENERGY *Multiple Choice* Which of the following statements is true about the relationship between a BTU and a kilocalorie?

- W) A BTU has about one tenth the energy of a kilocalorie
- X) A BTU has about one fourth the energy of a kilocalorie
- Y) A BTU has about the same amount of energy as a kilocalorie
- Z) A BTU has about 251 times the energy of a kilocalorie

ANSWER: X) A BTU HAS ABOUT ONE FOURTH THE ENERGY OF A KILOCALORIE

### TOSS-UP

15) CHEMISTRY *Multiple Choice* Ethylene [**ETH-uh-leen**] has which of the following?

- W) 2 pi bonds
- X) 2 sigma bonds and 1 pi bond
- Y) 3 sigma bonds
- Z) 5 sigma bonds and 1 pi bond

ANSWER: Z) 5 SIGMA BONDS AND 1 PI BOND

### BONUS

15) CHEMISTRY *Short Answer* What is the electron-pair geometry for  $\text{ICl}_4^-$  [**eye C L 4 minus**]?

ANSWER: OCTAHEDRAL

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### TOSS-UP

16) MATH *Multiple Choice* The lines defined by  $y = 2x$  and  $2y = -x$  are which of the following?

- W) Parallel
- X) Perpendicular
- Y) Horizontal
- Z) Vertical

ANSWER: X) PERPENDICULAR

### BONUS

16) MATH *Short Answer* Providing your answers as fractions in lowest terms, what are the x-intercepts of the graph of  $y = 12x^2 - 5x - 2$ ?

ANSWER: 2/3 AND -1/4



### TOSS-UP

17) PHYSICS *Multiple Choice* Which of the following products has the same units as power?

- W) Work and time
- X) Force and distance
- Y) Force and velocity
- Z) Force and acceleration

ANSWER: Y) FORCE AND VELOCITY

### BONUS

17) PHYSICS *Short Answer* When turned on, a ceiling fan reaches 100 revolutions per minute in 30 seconds. When turned off, it coasts to a stop in 60 seconds. What is the ratio of the average angular acceleration in the first 30 seconds after it was turned on to that observed after it was turned off?

ANSWER: -2 (ACCEPT: -2 TO 1)

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### TOSS-UP

18) EARTH AND SPACE *Short Answer* Which form of electromagnetic radiation does NASA primarily use to transfer information from spacecraft back to Earth?

ANSWER: RADIO

### BONUS

18) EARTH AND SPACE *Multiple Choice* Which of the following prevents limestone from forming below 5000 meters in the open ocean?

- W) The conditions of the overlying water at that depth cause a net dissolution of calcite
- X) The organisms that form limestone are not found in pelagic environments
- Y) The complex deep ocean ecosystem results in the consumption of limestone-forming organisms
- Z) Ocean temperature along abyssal plains is cold enough to prevent compaction and cementation of sediments

ANSWER: W) THE CONDITIONS OF THE OVERLYING WATER AT THAT DEPTH CAUSE A NET DISSOLUTION OF CALCITE

### TOSS-UP

19) BIOLOGY *Multiple Choice* Which of the following statements is NOT true about lichen [*LY-kuhn*]?

- W) It is a composite organism
- X) It is composed of algae and moss
- Y) It is hardy and slow-growing
- Z) It usually reproduces asexually

ANSWER: X) IT IS COMPOSED OF ALGAE AND MOSS

### BONUS

19) BIOLOGY *Short Answer* Many angiosperms flower at the same time every year, even though they may have started growing at different times. Their flowering is a response to the changing length of day and night. What is the name of this phenomenon?

ANSWER: PHOTOPERIODISM (ACCEPT: PHOTOPERIODICITY)

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### TOSS-UP

20) ENERGY *Short Answer* What is the term for power that is consumed by electronics when they are not in use?

ANSWER: STANDBY POWER (ACCEPT: VAMPIRE POWER, VAMPIRE DRAW, PHANTOM LOAD, PHANTOM POWER, or LEAKING ELECTRICITY)

### BONUS

20) ENERGY *Multiple Choice* Which of the following statements is NOT true about electronic tattoos?

- W) They are flexible electronic circuits, thinner than a human hair
- X) They stay on the skin through the adhesion forces between the atoms of the tattoo and the atoms of the skin
- Y) They are powered by the individual's movements
- Z) The circuits' filamentary serpentine shape allows them to bend, twist, scrunch and stretch while maintaining functionality

ANSWER: Y) THEY ARE POWERED BY THE INDIVIDUAL'S MOVEMENTS

### TOSS-UP

21) CHEMISTRY *Short Answer* Give the name of the periodic table group that contains elements that are silver in color, soft, and react explosively with water.

ANSWER: ALKALI METALS (ACCEPT: GROUP 1 OR GROUP 1A)

### BONUS

21) CHEMISTRY *Short Answer* A particle has a de Broglie [*duh broh-GLEE*] wavelength of  $3 \times 10^{-10}$  meters when it is traveling at  $1.1 \times 10^7$  meters per second. Expressing your answer in kilograms and in scientific notation to one significant figure, what is its approximate mass?

ANSWER:  $2 \times 10^{-31}$

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### TOSS-UP

22) MATH *Short Answer* What is the value of  $i^4$ ?

ANSWER: 1

### BONUS

22) MATH *Multiple Choice* The hyperbola with equation  $\frac{y^2}{25} - \frac{x^2}{36} = 1$  possesses which of the following characteristics?

W) It opens left and right and has asymptotes  $y = \frac{5}{4}x$  and  $y = -\frac{5}{4}x$

X) It opens up and down and has asymptotes  $y = \frac{5}{4}x$  and  $y = -\frac{5}{4}x$

Y) It opens left and right and has asymptotes  $y = \frac{4}{5}x$  and  $y = -\frac{4}{5}x$

Z) It opens up and down and has asymptotes  $y = \frac{4}{5}x$  and  $y = -\frac{4}{5}x$

ANSWER: X) IT OPENS UP AND DOWN AND HAS ASYMPTOTES  $y = \frac{5}{4}x$  AND  $y = -\frac{5}{4}x$

### TOSS-UP

23) PHYSICS *Multiple Choice* A girl runs up one flight of steps. Which of the following factors does NOT affect the work done by the girl against gravity?

- W) Her mass
- X) Height of the flight of steps
- Y) Her speed
- Z) Acceleration due to gravity

ANSWER: Y) HER SPEED

### BONUS

23) PHYSICS *Short Answer* What is the efficiency of the body when a cyclist expends 1000 watts of power to deliver mechanical energy to the bicycle at a rate of 100 watts?

ANSWER: 10%

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### TOSS-UP

24) EARTH AND SPACE *Short Answer* Japan consists of a volcanic island arc and trench system. This is indicative of which type of tectonic plate boundary?

ANSWER: CONVERGENT

### BONUS

24) EARTH AND SPACE *Multiple Choice* Which of the following describes solifluction, the slow mass movement of soil resulting from freeze-thaw action?

- W) It occurs in soils found above permafrost, which prevents drainage
- X) It results in the rotational slip of sediments along a slope
- Y) It requires coarse, shallow soils developed over bedrock along steep slopes
- Z) It involves the gradual up and down motion of soil particles and net creep of soils downslope

ANSWER: W) IT OCCURS IN SOILS FOUND ABOVE PERMAFROST, WHICH PREVENTS DRAINAGE

### TOSS-UP

25) BIOLOGY *Multiple Choice* Which of the following statements about the lone star tick is true?

- W) It only lives in Texas
- X) It transmits Lyme disease
- Y) It feeds on humans, dogs, and cats
- Z) It is relatively passive

ANSWER: Y) IT FEEDS ON HUMANS, DOGS, AND CATS

### BONUS

25) BIOLOGY *Short Answer* What is the common name of the woody shrub or small tree with the following three characteristics: 1) 7 to 13 leaflets per pinnate leaf, 2) grows in very wet or flooded soils, and 3) contains a resin that causes skin and mucus membrane irritation to humans?

ANSWER: POISON SUMAC