

## ROUND 9

### TOSS-UP

16) MATH Multiple Choice If the surface area of a cube is 96 square units, which of the following is the length of a diagonal of a face of the cube?

W) 4

X)  $4\sqrt{2}$

Y)  $4\sqrt{3}$

Z)  $16\sqrt{2}$

ANSWER: X)  $4\sqrt{2}$

### BONUS

16) MATH Short Answer Determine the largest possible real domain of  $y = \sqrt{x-1}$

$\sqrt{x-1}$  [y equals

the fraction with numerator the square root of the quantity x minus 1 and denominator

the square root of the quantity x squared minus 1 ].

ANSWER:  $x > 1$

### TOSS-UP

13) EARTH AND SPACE Multiple Choice Which of the following classes of stars does NOT have radiative zones?

W) A

X) G

Y) M

Z) O

ANSWER: Y) M

### BONUS

13) EARTH AND SPACE Multiple Choice Under which of the following circumstances does ocean depth affect ocean wave motion?

W) When ocean depth falls below half the wavelength of a wave

X) When the ocean wave has a period exceeding 20 seconds

Y) When the ocean waves are impacted by tides

Z) When the ocean floor has high relief, regardless of the depth

ANSWER: W) WHEN OCEAN DEPTH FALLS BELOW HALF THE WAVELENGTH OF A WAVE

### TOSS-UP

4) EARTH AND SPACE Multiple Choice Which of the following is the rate at which atmospheric gases and particles are moved across a surface?

W) Vertical dispersion

X) Turbulence

Y) Flux

Z) Stratospheric transport

ANSWER: Y) FLUX

### BONUS

4) EARTH AND SPACE Multiple Choice Which of the following is true of sandstone formed

from a long-term paleodesert?

W) It would exhibit clearly graded bedding

X) It would have preserved ripples but not dunes

Y) It would appear black due to the dark iron-rich minerals present

Z) It would contain well rounded grains and have high quartz content

CONTENT

TOSS-UP

1) BIOLOGY Multiple Choice Which of the following processes results in a net reduction in the amount of atmospheric carbon dioxide?

W) Photosynthesis [foh-tuh-SIN-thuh-sis]

X) Fossil fuel use

Y) Respiration

Z) Decomposition

ANSWER: W) PHOTOSYNTHESIS

BONUS

1) BIOLOGY Multiple Choice Photosynthesis requires water as a reactant. Oxygen atoms from the water end up in which of the following product molecules?

W) Molecular oxygen

X) Water

Y) Glucose

Z) ATP

ANSWER: W) MOLECULAR OXYGEN

TOSS-UP

8) PHYSICS Multiple Choice Pascal's law governs the actions of forces in which of the following?

W) Gases

X) Solids

Y) Incompressible fluids

Z) A vacuum

ANSWER: Y) INCOMPRESSIBLE FLUIDS

BONUS

8) PHYSICS Short Answer What current, in amperes, is carried in a lightning stroke that lasts 0.5 seconds and transfers 100 coulombs of charge?

ANSWER: 200

TOSS-UP

15) CHEMISTRY Multiple Choice Which of the following is an aldehyde [AL-duh-hyd]?

W) C<sub>11</sub> H<sub>20</sub>

X) C<sub>5</sub> H<sub>11</sub> OH

Y) C<sub>5</sub> H<sub>11</sub> CHO

Z) C<sub>5</sub> H<sub>11</sub> NH<sub>2</sub>

ANSWER: Y) C<sub>5</sub> H<sub>11</sub> CHO

BONUS

15) CHEMISTRY Short Answer Which one of the following five metals would react the least with dilute hydrochloric acid: 1) lead, 2) chromium, 3) manganese, 4) nickel, 5) gold?

ANSWER: 5 (ACCEPT: GOLD)

TOSS-UP

20) MATH Short Answer In terms of a, b, c, and d, what is the slope of the line  $3x + 2by = cd$ ?

ANSWER:  $-\frac{3}{2b}$

BONUS

20) MATH Multiple Choice Which of the following points lies in the solution set for the system of two inequalities:  $2y - x \geq -6$  and  $2y - 3x < -6$ ?

W) (-4, -1)

X) (3, 1)

Y) (0, -3)

Z) (4, 3)

ANSWER: X) (3, 1)

TOSS-UP

6) ENERGY Multiple Choice When traveling at the same speed, which of the following fission products has the greatest kinetic energy?

W) A neutron

X) An alpha particle

Y) A beta particle

Z) A positron

ANSWER: X) AN ALPHA PARTICLE

BONUS

6) ENERGY Short Answer Name all of the following four choices that are types of coal: 1) lignite, 2) bituminous [by-TOO-muh-nuhs], 3) dolomite, 4) anthracite [AN-thruh-syt].

ANSWER: 1, 2, 4 (ACCEPT: LIGNITE, BITUMINOUS, ANTHRACITE)

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TOSS-UP

2) BIOLOGY Multiple Choice Which of the following is NOT an evolutionary adaptation of plants to arid climates?

- W) Leaves have a waxy coating
- X) Carbon incorporation and the Calvin cycle are separated
- Y) Stomata are closed at night
- Z) Leaves are absent

ANSWER: Y) STOMATA ARE CLOSED AT NIGHT

BONUS

2) BIOLOGY Multiple Choice Which of the following mammal species is usually considered diurnal [dy-UR-nl]?

- W) Eastern fox squirrel
- X) Black-footed ferret
- Y) Virginia opossum
- Z) Raccoon

ANSWER: W) EASTERN FOX SQUIRREL

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18) EARTH AND SPACE Multiple Choice Which of the following types of smog in the boundary layer of the atmosphere contains sulfur dioxide?

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18) EARTH AND SPACE Multiple Choice Glacial striations indicate which of the following?

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ANSWER: X) THE DIRECTION OF GLACIAL ADVANCEMENT

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TOSS-UP

23) CHEMISTRY Multiple Choice What stress applied to an equilibrium [ee-kwuh-LIB-ree-uhm] causes the equilibrium to shift to the side with fewer moles of gas?

W) Increase in pressure

X) Increase in volume

Y) Increase in temperature

Z) Addition of a catalyst

ANSWER: W) INCREASE IN PRESSURE

BONUS

23) CHEMISTRY Multiple Choice Which of the following would be most likely to undergo an SN 1, reaction?

W) Methyl bromide

X) 2-propyl bromide

Y) Isopropyl chloride

Z) Tert-butyl chloride

ANSWER: Z) TERT-BUTYL CHLORIDE

TOSS-UP

18) ENERGY Multiple Choice Which of the following nuclides is both fissile and fissionable only with high energy bombardment?

W) U-233

X) U-235

Y) U-238

Z) Pu-239

ANSWER: Y) U-238

BONUS

18) ENERGY Short Answer Name the process, suggested as a possible avenue for cold fusion to occur, in which a sound wave is passed through a bubble in a jar, causing the bubble to expand and collapse.

ANSWER: SONOLUMINESCENCE

TOSS-UP

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

ANSWER: 1

BONUS

22) MATH Multiple Choice The hyperbola with equation  $\frac{y^2}{16} - \frac{x^2}{9} = 1$  possesses which of the following characteristics?

W) It opens left and right and has asymptotes  $y = \frac{4}{3}x$  and  $y = -\frac{4}{3}x$

X) It opens up and down and has asymptotes  $y = \frac{4}{3}x$  and  $y = -\frac{4}{3}x$

Y) It opens left and right and has asymptotes  $y = \frac{3}{4}x$  and  $y = -\frac{3}{4}x$

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TOSS-UP

9) CHEMISTRY Multiple Choice Which of the following catabolic pathways liberates carbon dioxide?

W) Electron transport

X) Glycolysis [gly-KOL-uh-sis]

Y) Citric acid cycle

Z) Cori cycle

ANSWER: Y) CITRIC ACID CYCLE

BONUS

9) CHEMISTRY Short Answer If one mole of a substance with a molar mass of 20 is burned at constant pressure and 800 kilojoules of energy is released as heat, what is the standard enthalpy change, in kilojoules, when a 5-gram sample of this substance is burned at constant pressure?

ANSWER: -200 (MUST INCLUDE NEGATIVE SIGN IN ANSWER)

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9) PHYSICS Multiple Choice Which of the following wave types does not exhibit polarization?

W) Gravitational

X) X-ray

Y) Acoustic

Z) Visible light

ANSWER: Y) ACOUSTIC

BONUS

9) PHYSICS Short Answer Identify all of the following three choices that may define the phase velocity of a wave: 1) frequency, 2) period, 3) wavelength.

ANSWER: ALL (ACCEPT: 1, 2, 3)

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