

## ROUND 1

### TOSS-UP

24) BIOLOGY Short Answer What class of hormone, often produced in a plant's roots, induces cell division in plant roots and shoots?

ANSWER: CYTOKININ

### BONUS

24) BIOLOGY Multiple Choice Which of the following is NOT true regarding human myoglobin [my-uh-GLOH-bin]?

W) It is a monomer

X) It exhibits higher affinity for oxygen than hemoglobin

Y) It exhibits a sigmoidal [SIG-moid-uhl] saturation curve

Z) It is primarily an oxygen storage protein

ANSWER: Y) IT EXHIBITS A SIGMOIDAL SATURATION CURVE

### TOSS-UP

21) CHEMISTRY Multiple Choice Which of the following is true for the isotopes of an element?

W) They cannot be separated at all

X) They have equal masses

Y) They have similar chemical behavior

Z) They cannot be separated by physical methods

ANSWER: Y) THEY HAVE SIMILAR CHEMICAL BEHAVIOR

### BONUS

21) CHEMISTRY Short Answer The equilibrium constant K for the following reaction is  $6 \times 10^{-4}$ :

$(\text{CH}_3)_2\text{NH} + \text{H}_2\text{O} \rightleftharpoons (\text{CH}_3)_2\text{NH}_2^+ + \text{OH}^-$  [CH<sub>3</sub><sub>2</sub>NH plus H<sub>2</sub>O yields star C H<sub>3</sub><sub>2</sub>N H<sub>2</sub> plus plus O H minus].

Providing your answer in scientific notation, find K for the reaction  $(\text{CH}_3)_2\text{NH}_2^+ + \text{H}^+ \rightleftharpoons (\text{CH}_3)_2\text{NH} + \text{H}^+$  [C H<sub>3</sub><sub>2</sub>N H<sub>2</sub> plus yields star C H<sub>3</sub><sub>2</sub>N H plus H plus].

ANSWER:  $1.7 \times 10^{-11}$

### TOSS-UP

8) ENERGY Multiple Choice Which of the following effects does lowering the temperature have on the decay rate of a sample of radioactive material?

W) The decay will speed up

X) The decay will slow down

Y) There is no change

Z) There is an inverse relationship between temperature and fission

ANSWER: Y) THERE IS NO CHANGE

### BONUS

8) ENERGY Multiple Choice FutureGen 2.0 power plants will reduce carbon dioxide production by burning coal in which of the following ways?

W) With a mixture of oxygen and carbon dioxide instead of air to produce concentrated carbon dioxide

X) With an enhanced concentration of oxygen instead of air to produce less carbon dioxide per

ton of coal burned

Y) In a catalytic chamber that scrubs the carbon dioxide out of the emissions

Z) Using carbon dioxide reduced coal in an 80% nitrogen and 18% oxygen mixture

ANSWER: W) WITH A MIXTURE OF OXYGEN AND CARBON DIOXIDE INSTEAD OF AIR TO PRODUCE CONCENTRATED CARBON DIOXIDE

TOSS-UP

15) PHYSICS Multiple Choice Which of the following particles has an electric charge of zero?

W) Electron

X) Quark

Y) Gluon

Z) Muon

ANSWER: Y) GLUON

BONUS

15) PHYSICS Short Answer A swimming pool water pump draws about 4.2 amperes when connected to 240 volts. If energy costs 10 cents per kilowatt hour, what is the bill to the nearest cent for running the pump continuously for 1 day?

ANSWER: \$2.42 (ACCEPT: 242 CENTS)

TOSS-UP

6) MATH Short Answer In the three by three matrix,

[such that row one

contains negative 2, 2, and 0; row two contains 4, 1, and negative 5; row three contains 8,

3, and 7], which is the

[x sub 2, 3] element?

ANSWER:

5

BONUS

6) MATH Short Answer If the squared length of the diagonal of one face of a cube is 162, what is the surface area in square units of the cube?

ANSWER: 486

TOSS-UP

14) BIOLOGY Multiple Choice Which of the following pairs are the most likely hydrogen-bonding partners?

W) Water and ammonia

X) Water and estrogen

Y) Water and carbonate

Z) Water and methane

ANSWER: W) WATER AND AMMONIA

BONUS

14) BIOLOGY Short Answer Name the structure to which the following terms refer: stylate [STY-layt], lamellate [luh-MEL-ayt], filiform [FIL-uh-fohrm], clavate [KLAY-vayt] and plumose [PLOO-mohs].

ANSWER: ANTENNA

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ANSWER: ANTENNA

TOSS-UP

4) ENERGY Multiple Choice In 1859, drilling first began in the U.S. for which of the following energy resources?

W) Coal

X) Oil

Y) Natural gas

Z) Geothermal energy

ANSWER: X) OIL

BONUS

4) ENERGY Short Answer In what kind of electrochemical cell would copper and zinc plates be lowered into a sulfuric acid solution in order to generate an electric current?

ANSWER: VOLTAIC (ACCEPT: GALVANIC; DO NOT ACCEPT BATTERY)

TOSS-UP

23) PHYSICS Short Answer Three masses are arranged at the vertices of an equilateral triangle and are connected by springs along the edges of the equilateral triangle. How many normal modes for vibration does this mass-spring system have?

ANSWER: THREE

BONUS

23) PHYSICS Short Answer When a charged particle moves in a dielectric medium at a speed greater than the speed of light in that medium, what kind of radiation do the atoms in the medium emit?

ANSWER: CHERENKOV

TOSS-UP

10) EARTH AND SPACE Multiple Choice Which of the following is the term for the hygroscopic [hy-gruh-SKOP-ik] atmospheric particles that are precursors to clouds?

W) Stratospheric aerosols

X) Cloud condensation nuclei

Y) Aqueous particles [AY-kwee-uhs]

Z) Stratospheric condensation nuclei

ANSWER: X) CLOUD CONDENSATION NUCLEI

BONUS

10) EARTH AND SPACE Multiple Choice Which of the following does the far side of the Moon possess in greater quantity when compared to the near side of the Moon?

W) Maria

X) Regolith [REG-uh-lith]

Y) Impact craters

Z) Aurora

ANSWER: Y) IMPACT CRATERS

TOSS-UP

8) EARTH AND SPACE Multiple Choice Which of the following layers of the atmosphere allows AM radio stations to transmit over great distances at night?

W) Ionosphere [eye-ON-uh-sfeer]

X) Stratosphere

Y) Thermosphere

Z) Troposphere

ANSWER: W) IONOSPHERE

BONUS

8) EARTH AND SPACE Multiple Choice Which of the following steps in atoll formation is the most mature?

W) Erupting volcanic island

X) Lagoon

Y) Volcanic island with barrier reef

Z) Volcanic island with fringing reef

ANSWER: X) LAGOON

TOSS-UP

5) CHEMISTRY Multiple Choice Which of the following gases is NOT one of the major causes of the greenhouse effect?

W) Carbon dioxide

X) Nitrous oxide

Y) Methane

Z) Carbon monoxide

ANSWER: Z) CARBON MONOXIDE

BONUS

5) CHEMISTRY Short Answer In a titration experiment, 6.0 milliliters of a 0.05 molar monoprotic weak acid are titrated with 0.10 molar sodium hydroxide. How much base in milliliters will it take to reach the half-equivalence point?

ANSWER: 1.5

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Providing your answer in scientific notation, find K for the reaction  $(\text{CH}_3)_2\text{NH}_2^+ + \text{H}^+ \rightleftharpoons (\text{CH}_3)_2\text{NH} + \text{H}_2$  [C H 3 2 N H<sub>2</sub> plus yields star C H 3 2 N H plus H plus].

ANSWER:  $1.7 \times 10^{-11}$

TOSS-UP

22) EARTH AND SPACE Multiple Choice Which of the following minerals is white or colorless, has a hardness of 2.5, and splits with cubic cleavage?

W) Calcite

X) Pyrite

Y) Halite

Z) Mica [MY-kuh]

ANSWER: Y) HALITE

BONUS

22) EARTH AND SPACE Short Answer What is the largest sediment particle type a wind of 10 meters per second could transport?

ANSWER: SAND

TOSS-UP

23) PHYSICS Multiple Choice An unpowered open truck is coasting horizontally with a constant velocity along a frictionless track underneath a grain bin when grain falls vertically into the truck, partly filling it as it moves along. Which of the following will happen to the horizontal momentum of the truck with the accumulating grain?

W) It will decrease

X) It will increase

Y) It will stay the same

Z) It will first increase and then decrease

ANSWER: Y) IT WILL STAY THE SAME

BONUS

23) PHYSICS Short Answer A mass is suspended by two springs of equal length connected in parallel. The mass stretches the springs by a distance A beyond their equilibrium length. The springs are rearranged to be connected in series, so that now the mass stretches the springs by

a distance B beyond their equilibrium length. By number, identify which of the following is true:

1) A is greater than B, 2) A is less than B, 3) A and B are the same distance.

ANSWER: 2

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)

TOSS-UP

12) MATH Short Answer The perimeters of two similar figures have a ratio of 5:7. What is the ratio of their areas?

ANSWER: 25:49 (ACCEPT: 25/49)

BONUS

12) MATH Short Answer After 40 times at bat, BJ has 9 hits. What is the least number of hits he would need in his next 30 times at bat so that he has hits in at least 31% of his total at-bats?

ANSWER: 13

TOSS-UP

24) BIOLOGY Short Answer What class of hormone, often produced in a plant's roots, induces cell division in plant roots and shoots?

ANSWER: CYTOKININ

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24) BIOLOGY Multiple Choice Which of the following is NOT true regarding human myoglobin [my-uh-GLOH-bin]?

W) It is a monomer

X) It exhibits higher affinity for oxygen than hemoglobin

Y) It exhibits a sigmoidal [SIG-moid-uhl] saturation curve

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ANSWER: Y) IT EXHIBITS A SIGMOIDAL SATURATION CURVE

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

14) EARTH AND SPACE Multiple Choice The curve that the position of the Sun at noon traces on the sky over the course of a year most closely resembles which of the following?

W) Line

X) Figure 8

Y) Ellipse

Z) Circle

ANSWER: X) FIGURE 8

BONUS

14) EARTH AND SPACE Multiple Choice Which of the following should NEVER occur?

W) Mercury at inferior conjunction

X) Venus at opposition

Y) Mars at eastern quadrature

Z) Jupiter at conjunction

ANSWER: X) VENUS AT OPPOSITION

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21) BIOLOGY Multiple Choice Which of the following bases wobbles on a transfer RNA anticodon?

W) First base

X) Second base

Y) Third base

Z) First base and third base

ANSWER: W) FIRST BASE

BONUS

21) BIOLOGY Multiple Choice The mRNA codon for methionine [meh-THY-uh-neen] is 5'-AUG-3'. From 5 prime to 3 prime, which of the following would be the anticodon present in the cognate tRNA?

W) 5'-UAC-3'

X) 5'-GUA-3'



Y) 5â€™-CAU-3â€™

Z) 5â€™-AUG-3â€™

ANSWER: Y) 5â€™-CAU-3â€™

[NOTE: 3â€™ = THREE PRIME and 5â€™ = FIVE PRIME]

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