

## ROUND ROBIN ~ ROUND 3

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### TOSS UP

1. MATH *Short Answer* Solve the following equation for  $x$ :  $2[x - (3x + 1)] = 4 - 2x$  **[2 open brackets x minus open parenthesis 3x plus 1 close parenthesis close brackets equals 4 minus 2x].**

ANSWER:  $x = -3$

### BONUS

1. MATH *Short Answer* How many zeroes are at the end of  $25!$  **[25 factorial]**?

ANSWER: 6

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### TOSS UP

2. EARTH AND SPACE *Short Answer* What geomorphic province is best described as an area consisting of separate broad mountain ranges separated by broad valleys?

ANSWER: BASIN AND RANGE

### BONUS

2. EARTH AND SPACE *Multiple Choice* A new study has found that white spruce trees on the edge of the tundra in Alaska's far north have thrived in the past 100 years. Which of the following methodologies was most likely used to determine the age of the trees?

- W) Sclerochronology
- X) Dendrochronology
- Y) Radiometric dating
- Z) Acanthochronology

ANSWER: X) DENDROCHRONOLOGY

### TOSS UP

3. BIOLOGY *Multiple Choice* Which of the following is NOT an effect of epinephrine [*e-puh-NE-fruhn*]?

- W) Decreased blood pressure
- X) Increased breathing rate
- Y) Decreased digestion
- Z) Glycogenolysis [*gly-KUH-juh-NOL-i-sis*]

ANSWER: W) DECREASED BLOOD PRESSURE

### BONUS

3. BIOLOGY *Multiple Choice* During a plankton tow, you catch many fish larvae. Which of the following categories best characterizes your organisms?

- W) Holoplankton
- X) Ichthyoplankton [*ik-thee-uh-PLAN(k)-tuhn*]
- Y) Larvaceans [*lahr-vuh-SEE-uhns*]
- Z) Mysids [*MY-sids*]

ANSWER: X) ICHTHYOPLANKTON

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### TOSS UP

4. PHYSICS *Short Answer* If the amplitude of a simple harmonic oscillator is decreased to 50% of its initial value, providing your answer as a decimal, compute the ratio of its final energy to its initial energy.

ANSWER: 0.25

### BONUS

4. PHYSICS *Short Answer* Three capacitors with capacitances of 2 microfarads, 2.5 microfarads, and 10 microfarads are connected in series. Find the combined capacitance in microfarads.

ANSWER: 1

### TOSS UP

5. ENERGY *Multiple Choice* Which of the following is considered a zero marginal cost generator?

- W) Nuclear
- X) Wind
- Y) Biomass
- Z) Geothermal

ANSWER: X) WIND

### BONUS

5. ENERGY *Short Answer* How much power in watts is consumed by a motor running at 440 volts and drawing 6.6 amperes?

ANSWER: 2904

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### TOSS UP

6. CHEMISTRY *Short Answer* What is the molecular geometry of sulfur tetrafluoride?

ANSWER: SEESAW

### BONUS

6. CHEMISTRY *Multiple Choice* A total of 50.0 milliliters of 0.100 molar sulfuric acid are used to titrate 10.0 milliliters of sodium hydroxide to its endpoint. Which of the following is the molarity of the sodium hydroxide?

- W) 0.025
- X) 0.100
- Y) 0.50
- Z) 1.00

ANSWER: Z) 1.00

### TOSS UP

7. MATH *Short Answer* What is the ratio of the area of a square that circumscribes a circle to the area of a square inscribed in the same circle?

ANSWER: 2 TO 1 (ACCEPT: 2)

### BONUS

7. MATH *Short Answer* Find the coordinates of the center and the radius of the circle:  
 $x^2 + y^2 - 8x + 6y - 11 = 0$

ANSWER: CENTER = (4, -3); RADIUS = 6

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### TOSS UP

8. EARTH AND SPACE *Multiple Choice* Which of the following is the term for the depositional feature created as streams deposit sediments beneath a glacier?

- W) Tarn
- X) Esker
- Y) Kame
- Z) Arete [***ahr-i-TAY***]

ANSWER: X) ESKER

### BONUS

8. EARTH AND SPACE *Short Answer* Based on Bowen's reaction series, which feldspar forms last as a magma cools?

ANSWER: ORTHOCLASE (ACCEPT: POTASSIUM FELDSPAR, K-SPAR)

### TOSS UP

9. BIOLOGY *Multiple Choice* Which of the following recent fossil discoveries helped evolutionary biologists understand how tetrapods could have evolved from fishes?

- W) *Tiktaalik roseae* [tik-TAH-lik roh-ZEE-uh]
- X) *Australopithecus sediba* [aw-stray-loh-PITH-i-kuhs se-DEE-buh]
- Y) *Titanoboa* [ti-tan-uh-BOH-uh]
- Z) *Acherontisuchus guajiraensis* [AK-uh-ron-tee-SU-choos gwah-HEE-rah-EHN-soos]

ANSWER: W) TIKTAALIK ROSEAE

### BONUS

9. BIOLOGY *Multiple Choice* Which of the following mechanisms would best explain how bisphenol A causes above average production of yellow agouti [uh-GOO-tee] mice?

- W) Decreased methylation [meth-uh-LAY-shuhn] of the agouti [uh-GOO-tee] gene
- X) Increased methylation of the agouti gene
- Y) Decreased phosphorylation [FOS-fer-uh-lay-shuhn] of the agouti gene
- Z) Increased phosphorylation of the agouti gene

ANSWER: W) DECREASED METHYLATION OF THE AGOUTI GENE

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### TOSS UP

10. PHYSICS *Multiple Choice* When a piano tuner uses a tuning fork to tune the piano, she knows a string is in tune when the beat frequency has which of the following values in hertz?

- W) 0
- X) 2
- Y) 10
- Z) 33

ANSWER: W) 0

### BONUS

10. PHYSICS *Multiple Choice* An electron is accelerated through a potential difference of 5.0 kilovolts. Which of the following is the kinetic energy in joules gained in the process?

- W)  $8.0 \times 10^{22}$
- X)  $8.0 \times 10^{-16}$
- Y)  $1.6 \times 10^{-16}$
- Z)  $1.6 \times 10^{-22}$

ANSWER: X)  $8.0 \times 10^{-16}$

### TOSS UP

11. CHEMISTRY *Multiple Choice* Which of the following solid compounds would NOT be soluble to a large extent in water, but would be soluble in hydrochloric acid?

- W) Ba(NO<sub>3</sub>)<sub>2</sub>
- X) CuSO<sub>4</sub>
- Y) MgCO<sub>3</sub>
- Z) KClO<sub>4</sub>

ANSWER: Y) MgCO<sub>3</sub>

### BONUS

11. CHEMISTRY *Multiple Choice* Assuming complete dissociation and the absence of ion pairing, which of the following 1.00 molar aqueous solutions would have the lowest freezing point?

- W) Sucrose
- X) Sodium chloride
- Y) Calcium hydroxide
- Z) Potassium phosphate

ANSWER: Z) POTASSIUM PHOSPHATE

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### TOSS UP

12. BIOLOGY *Multiple Choice* Which of the following species can be considered partially endothermic?

- W) Salmon
- X) Trout
- Y) Tuna
- Z) Flounder

ANSWER: Y) TUNA

### BONUS

12. BIOLOGY *Short Answer* During DNA replication, what would be the complement of the template strand: 5' **[5 prime]**-TAT CAG CCC-3' **[3 prime]**, including strand polarity in your answer.

ANSWER: 3'- ATA GTC GGG-5' (ACCEPT: 5'-GGG CTG ATA-3')

**TOSS UP**

13. MATH *Short Answer* State the quadrant in which  $\theta$  [*theta*] lies if  $\cot \theta < 0$  and  $\sec \theta > 0$  [*cotangent of theta is less than 0 and secant of theta is greater than 0*].

ANSWER: IV (ACCEPT: 4 OR FOURTH)

**BONUS**

13. MATH *Short Answer* Express the following quotient of complex numbers in simplest  $a + bi$  form:  $\frac{4+3i}{5-2i}$  [*the numerator is 4 plus 3i and the denominator is 5 minus 2i*].

ANSWER:  $\frac{14}{29} + \frac{23}{29}i$  (DO NOT ACCEPT:  $\frac{14+23i}{29}$ )

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**TOSS UP**

14. EARTH AND SPACE *Multiple Choice* Which of the following types of sand is commonly associated with beach areas close to tropical reef environments?

- W) White
- X) Quartz
- Y) Black
- Z) Green

ANSWER: W) WHITE

**BONUS**

14. EARTH AND SPACE *Multiple Choice* Which of the following minerals shows two directions of cleavage?

- W) Hornblende
- X) Calcite
- Y) Olivine
- Z) Quartz

ANSWER: W) HORNBLLENDE

### TOSS UP

15. BIOLOGY *Multiple Choice* In many organisms, sex-determination is genetic. However, in turtles and crocodiles, this is not the case. Which of the following plays a role in sex-determination for turtles and crocodiles?

- W) Humidity
- X) Atmospheric pressure
- Y) Temperature
- Z) UV index

ANSWER: Y) TEMPERATURE

### BONUS

15. BIOLOGY *Multiple Choice* Which of the following organisms is triploid?

- W) Aphid
- X) *Escherichia coli* [*esh-uh-RIK-ee-uh*]
- Y) Seedless watermelon
- Z) Wheat

ANSWER: Y) SEEDLESS WATERMELON

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### TOSS UP

16. PHYSICS *Short Answer* What is the current in amperes for a simple circuit with a potential difference of 100 volts and two 10 ohm resistors in parallel?

ANSWER: 20

### BONUS

16. PHYSICS *Multiple Choice* Some scientists have predicted the melting of polar ice caps due to climate change. Which of the following changes would be caused by the melting?

- W) The moment of inertia of the Earth would increase
- X) The moment of inertia of the Earth would decrease
- Y) The angular momentum associated with the Earth's rotation would increase
- Z) The angular momentum associated with the Earth's rotation would decrease

ANSWER: W) THE MOMENT OF INERTIA OF THE EARTH WOULD INCREASE

### TOSS UP

17. ENERGY *Short Answer* How many kilowatt-hours do you use annually if you have a 14 watt light bulb operating for 2,000 hours per year?

ANSWER: 28

### BONUS

17. ENERGY *Multiple Choice* Modern smart grid technology predominantly improves which of the following components of the electricity system?

- W) Transmission and distribution
- X) Fuel extraction
- Y) Renewable energy generation
- Z) Fossil fuel energy generation

ANSWER: W) TRANSMISSION AND DISTRIBUTION

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### TOSS UP

18. CHEMISTRY *Multiple Choice* The specific heat of an unknown metal is 0.230 joules per gram degree Celsius. A 45.0 gram sample of the metal is heated from 25.0° Celsius to 35.0° Celsius. How much heat in joules is required to heat the metal?

- W) 10.4
- X) 104
- Y) 342
- Z) 600

ANSWER: X) 104

### BONUS

18. CHEMISTRY *Short Answer* Providing your answers to the nearest integer, convert the following four pressures to atmospheres: 1) 203 kilopascals, 2) 2660 Torr, 3) 2.2 bar, and 4) 3700 millimeters of mercury.

ANSWER: 1) 2, 2) 3, 3) 2, 4) 5

### TOSS UP

19. MATH *Short Answer* If  $\frac{x-y}{x+y} = \frac{9}{13}$  [***the fraction with numerator x minus y and denominator x plus y equals 9 over 13***], providing your answer as a fraction in simplest form, compute the value of  $\frac{x}{y}$ .

ANSWER:  $\frac{11}{2}$

### BONUS

19. MATH *Short Answer* The slope of a line is  $-2/3$ . The two points with coordinates (4, 7) and (-2, y) are on the line. Determine the value of y.

ANSWER: 11

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### TOSS UP

20. EARTH AND SPACE *Multiple Choice* Normal faults suggest which of the following sorts of forces on the crust?

- W) Tension
- X) Shear
- Y) Compression
- Z) Listral

ANSWER: W) TENSION

### BONUS

20. EARTH AND SPACE *Multiple Choice* Which of the following is the metallicity of Population III stars as compared to that of the Sun?

- W) Much greater
- X) About the same
- Y) About one tenth as much
- Z) Much less than one tenth as much

ANSWER: Z) MUCH LESS THAN ONE TENTH AS MUCH

### TOSS UP

21. BIOLOGY *Multiple Choice* Which of the following is the name of the muscle in humans that extends the forearm?

- W) Triceps brachii [**BRAY-kee-ee**]
- X) Biceps brachii
- Y) Pronator teres
- Z) Brachialis [**bray-kee-AL-uhs**]

ANSWER: W) TRICEPS BRACHII

### BONUS

21. BIOLOGY *Multiple Choice* Which of the following foramina of the human skull houses the spinal cord?

- W) Foramen ovale [**for-A-men oh-VAL-ay**]
- X) Foramen incisivum
- Y) Foramen magnum
- Z) Foramen spinosum

ANSWER: Y) FORAMEN MAGNUM

### TOSS UP

22. PHYSICS *Multiple Choice* For a small ball at the end of a string, calculate the angular momentum in joule seconds if the ball weighs 3 kilograms, has a tangential velocity of 10 meters per second, and has an orbit with a 10 meter radius?

- W) 33.3
- X) 100
- Y) 300
- Z) 900

ANSWER: Y) 300

### BONUS

22. PHYSICS *Multiple Choice* In a photoelectric experiment, if the intensity of the incident light beam is unchanged while the frequency of the light beam is increased, which of the following is true?

- W) The number of photoelectrons emitted per second increases
- X) The maximum kinetic energy of the photoelectrons emitted increases
- Y) The maximum kinetic energy of the photoelectrons emitted decreases
- Z) The maximum kinetic energy of the photoelectrons emitted remains unchanged

ANSWER: X) THE MAXIMUM KINETIC ENERGY OF THE PHOTOELECTRONS EMITTED INCREASES

**TOSS UP**

23. ENERGY *Short Answer* Kirchhoff's second law states that the directed sum of the voltage around any closed circuit is equal to what?

ANSWER: ZERO

**BONUS**

23. ENERGY *Short Answer* If a 20 watt computer monitor is left on 5,000 hours per year, how much does it cost to operate per year if a kilowatt-hour costs \$0.15?

ANSWER: \$15

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**TOSS UP**

24. BIOLOGY *Short Answer* What type of white blood cell differentiates to form antibody secreting cells and memory cells?

ANSWER: B LYMPHOCYTE (ACCEPT: B CELL)

**BONUS**

24. BIOLOGY *Short Answer* Name all the following four components of the human kidney that extend into the kidney medulla: 1) proximal convoluted tubule, 2) distal convoluted tubule, 3) Bowman's capsule, 4) ascending limb of the Loop of Henle.

ANSWER: 4 (ACCEPT: ASCENDING LIMB OF THE LOOP OF HENLE)

### TOSS UP

25. CHEMISTRY *Multiple Choice* Which of the following is the maximum number of orbitals allowed when  $l = 5$  [**L equals 5**]?

- W) 2
- X) 5
- Y) 11
- Z) 13

ANSWER: Y) 11

### BONUS

25. CHEMISTRY *Short Answer* Rank the following four substances according to increasing boiling point: 1) helium, 2) water, 3) ammonia, 4) carbon monoxide.

ANSWER: 1, 4, 3, 2 (ACCEPT: HELIUM, CARBON MONOXIDE, AMMONIA, WATER)