

## ROUND ROBIN ~ ROUND 2

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### TOSS UP

1. CHEMISTRY *Multiple Choice* Which of the following elements is paramagnetic?

- W) Manganese
- X) Neon
- Y) Silver
- Z) Zinc

ANSWER: W) MANGANESE

### BONUS

1. CHEMISTRY *Multiple Choice* Which of the following group 6A hydrides has the highest boiling point?

- W) H<sub>2</sub>O
- X) H<sub>2</sub>S
- Y) H<sub>2</sub>Se
- Z) H<sub>2</sub>Te

ANSWER: W) H<sub>2</sub>O

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### TOSS UP

2. BIOLOGY *Multiple Choice* Which of the following pairs of baleen whales lacks a dorsal fin?

- W) Northern right whale and bowhead whale
- X) Narwhal and blue whale
- Y) Fin whale and sei **[SAY]** whale
- Z) Bryde's whale and minke whale

ANSWER: W) NORTHERN RIGHT WHALE AND BOWHEAD WHALE

### BONUS

2. BIOLOGY *Short Answer* In Sanger and cycle DNA sequencing, the absence of a hydroxyl on which position of the ribose ring in a dideoxynucleoside **[dy-dee-ok-si-ry-boh-NOO-kee-uh-syd]** triphosphate, or ddNTP, is responsible for nucleotide chain termination?

ANSWER: 3 PRIME (ACCEPT: THREE OR 3<sup>RD</sup>)

### TOSS UP

3. ENERGY *Multiple Choice* Which of the following substances contains the most Btus per pound?

- W) Peat
- X) Gasoline
- Y) Hydrogen
- Z) Charcoal

ANSWER: Y) HYDROGEN

### BONUS

3. ENERGY *Multiple Choice* Approximately how much power in watts is consumed by, respectively, five 120 volt incandescent light bulbs consuming 0.5 amperes each compared to five compact fluorescent lamp bulbs producing the equivalent lumens?

- W) 120 versus 25
- X) 300 versus 65
- Y) 330 versus 220
- Z) 600 versus 300

ANSWER: X) 300 VERSUS 65

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### TOSS UP

4. EARTH AND SPACE *Multiple Choice* Which of the following types of sand dunes form under winds that blow in one direction?

- W) Barchan [**bahr-KAHN**]
- X) Linear
- Y) Star
- Z) Parabolic

ANSWER: W) BARCHAN

### BONUS

4. EARTH AND SPACE *Multiple Choice* Which of the following is the most direct proof that the Earth is NOT stationary?

- W) The existence of ocean tides
- X) Kepler's third law
- Y) The increased accuracy of the Copernican model over the Ptolemaic model
- Z) The Coriolis force

ANSWER: Z) THE CORIOLIS FORCE

### TOSS UP

5. PHYSICS *Multiple Choice* A plane wave of red light goes from the air into a glass block. Which of the following describes how the wave changes?

- W) The frequency decreases
- X) The speed increases
- Y) The wavelength decreases
- Z) The amplitude increases

ANSWER: Y) THE WAVELENGTH DECREASES

### BONUS

5. PHYSICS *Short Answer* Imagine a uniform meter stick supported on a knife edge at the 40 centimeter mark. The right end of the meter stick with the 100 centimeter mark swings down. To balance the meter stick, at what centimeter mark should you hang an object with mass equal to that of the meter stick?

ANSWER: 30

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### TOSS UP

6. MATH *Short Answer* If one exterior angle of a regular convex polygon measures  $40^\circ$ , how many sides does the polygon have?

ANSWER: 9

### BONUS

6. MATH *Short Answer* A circle is inscribed within a square. The diagonal of the square has a length of 6 centimeters. Providing your answer in simplest form, what is the circumference of the circle in centimeters?

ANSWER:  $3\pi\sqrt{2}$

### TOSS UP

7. CHEMISTRY *Multiple Choice* Blue light has a frequency of about  $7.0 \times 10^{14}$  hertz. Which of the following is the wavelength of this light in centimeters?

- W)  $4.3 \times 10^{-5}$
- X)  $8.4 \times 10^{-8}$
- Y)  $3.1 \times 10^{-12}$
- Z)  $2.0 \times 10^{-24}$

ANSWER: W)  $4.3 \times 10^{-5}$

### BONUS

7. CHEMISTRY *Short Answer* Your teacher wants you to use the Clausius-Clapeyron equation to determine the vapor pressure at a particular temperature. Assuming you know the value for the gas constant, what other two values must you be given?

ANSWER: TEMPERATURE CHANGE AND ENTHALPY OF VAPORIZATION (ACCEPT: HEAT OF VAPORIZATION)

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### TOSS UP

8. BIOLOGY *Multiple Choice* Which of the following is NOT an even-toed ungulate [*UHNG-gyuh-lit*]?

- W) Hippopotamus
- X) Rhinoceros
- Y) Kudu
- Z) Klipspringer

ANSWER: X) RHINOCEROS

### BONUS

8. BIOLOGY *Short Answer* Name all of the following four trees that have an alternate branching pattern rather than an opposite pattern: 1) box elder, 2) Paulownia, 3) white oak, 4) ash.

ANSWER: 3 (ACCEPT: WHITE OAK)

### TOSS UP

9. ENERGY *Short Answer* If a water heater uses 20 cubic feet of natural gas in 30 minutes and natural gas contains 1,000 Btus **[B-T-USE]** per cubic foot, what is the hourly input rating of the water heater in Btu per hour?

ANSWER: 40,000

### BONUS

9. ENERGY *Short Answer* What physical property is used to rate building insulation?

ANSWER: THERMAL RESISTANCE (ACCEPT: R-VALUE, RESISTANCE; DO NOT ACCEPT: HEAT RESISTANCE)

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### TOSS UP

10. EARTH AND SPACE *Multiple Choice* The end of which of the following time periods marked the greatest mass extinction event in Earth's history?

- W) Precambrian
- X) Cambrian
- Y) Permian
- Z) Cretaceous **[kri-TAY-shuhs]**

ANSWER: Y) PERMIAN

### BONUS

10. EARTH AND SPACE *Multiple Choice* Which of the following does NOT accurately describe the Hawaiian islands?

- W) They were formed by undersea volcanoes
- X) They are mostly made up of basalts
- Y) They are associated with a mid-Pacific convergent plate boundary
- Z) They are the projecting tops of the tallest mountain range in the world

ANSWER: Y) THEY ARE ASSOCIATED WITH A MID-PACIFIC CONVERGENT PLATE BOUNDARY

### TOSS UP

11. PHYSICS *Multiple Choice* Two identical positively charged spheres are separated by a distance much bigger than their radii so that electric and gravitational forces are balanced. If the mass of each object is multiplied by 4, by what factor should the charge on each be multiplied so that the two forces still balance?

- W) 2
- X) 4
- Y) 8
- Z) 16

ANSWER: X) 4

### BONUS

11. PHYSICS *Short Answer* A car is travelling at a constant 30 meters per second for 10 seconds. The car then undergoes constant deceleration for 5 seconds, coming to a stop. How far in meters did the car travel during the entire 15 second time interval?

ANSWER: 375

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### TOSS UP

12. MATH *Multiple Choice* The values of  $a$ ,  $b$ ,  $c$ , and  $d$  are 0, 1, 2, and 3, although not necessarily in that order. What is the maximum value of  $c \cdot a^b - d$  [***c times a to the power of b minus d***]?

- W) 6
- X) 8
- Y) 9
- Z) 12

ANSWER: Y) 9

### BONUS

12. MATH *Short Answer* Find the coordinates of all points of intersection between the graphs of  $y = -x^2 + x$  and  $y = |3x + 3|$  [***y equals the absolute value of the quantity 3x plus 3***].

ANSWER: NONE

### TOSS UP

13. CHEMISTRY *Multiple Choice* Which of the following statements is NOT true?

- W) Liquids with weak intermolecular forces tend to have high surface tension
- X) Liquids with strong intermolecular forces tend to have high surface tension
- Y) Liquids with weak intermolecular forces tend to have high vapor pressures
- Z) Cohesion forces refer to intermolecular attractions between like molecules

ANSWER: W) LIQUIDS WITH WEAK INTERMOLECULAR FORCES TEND TO HAVE HIGH SURFACE TENSION

### BONUS

13. CHEMISTRY *Multiple Choice* Which of the following gases will exhibit the greatest deviation from ideal gas behavior?

- W) Carbon dioxide
- X) Methane
- Y) Sulfur dioxide
- Z) Molecular oxygen

ANSWER: Y) SULFUR DIOXIDE

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### TOSS UP

14. BIOLOGY *Multiple Choice* The Ampullae [**am-PUHL-ee**] of Lorenzini are used to sense which of the following stimuli?

- W) Mechanical vibrations
- X) Chemicals
- Y) Electrical currents
- Z) Light

ANSWER: Y) ELECTRICAL CURRENTS

### BONUS

14. BIOLOGY *Short Answer* Name all of the following four organisms that are members of the phylum Platyhelminthes [**FY-luhm plat-ee-hel-MIN-theez**]: 1) tapeworms, 2) nematodes, 3) blood flukes, 4) sea slugs.

ANSWER: 1, 3 (ACCEPT: TAPEWORMS, BLOOD FLUKES)

### TOSS UP

15. EARTH AND SPACE *Multiple Choice* Which of the following types of lava is the sole lava erupted on the island of Hawaii?

- W) Komatiite [**koh-MAHD-ee-YT**]
- X) Basalt
- Y) Andesite [**AN-duh-syt**]
- Z) Rhyolite [**RAY-uh-lyt**]

ANSWER: X) BASALT

### BONUS

15. EARTH AND SPACE *Multiple Choice* Which of the following planets has the longest day?

- W) Mercury
- X) Venus
- Y) Mars
- Z) Jupiter

ANSWER: X) VENUS

### TOSS UP

16. PHYSICS *Multiple Choice* Which of the following is the effect on the resistance of a wire if it is replaced with an equally thick wire of a material of higher resistivity and longer length?

- W) The effect cannot be predicted without knowing the actual value of the resistivities of the materials
- X) Resistance increases
- Y) Resistance decreases
- Z) Resistance is unchanged

ANSWER: X) RESISTANCE INCREASES

### BONUS

16. PHYSICS *Short Answer* A 2 henry inductance coil is connected in series to a 100 ohm resistor to create an LR circuit. If this circuit is connected to a 12 volt power supply, what are, respectively, the initial current in the circuit and the final current in the circuit after it has been connected for a long time, both measured in amperes?

ANSWER: INITIAL CURRENT = 0, FINAL CURRENT = 0.12

### TOSS UP

17. MATH *Short Answer* What are the coordinates of the vertex of the parabola with equation  $y = 8 + (x + 5)(x - 3)$  [**y equals 8 plus open parenthesis x plus 5 close parenthesis times the quantity x minus 3**]?

ANSWER: (-1, -8)

### BONUS

17. MATH *Short Answer* Determine the coordinates of each inflection point for the graph of  $f(x) = \frac{1}{3}x^3 - x^2 - 35x$

ANSWER:  $(1, \frac{-107}{3})$  [ACCEPT:  $(1, -35\frac{2}{3})$ ]

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### TOSS UP

18. CHEMISTRY *Multiple Choice* Assuming each of the following is in an aqueous solution with a 1 molar concentration, which of the following solutions would have the highest conductivity at room temperature?

- W) Potassium hydroxide
- X) Aluminum nitrate
- Y) Magnesium chloride
- Z) Iron (II) sulfate

ANSWER: X) ALUMINUM NITRATE

### BONUS

18. CHEMISTRY *Multiple Choice* The pH of aqueous hydrogen cyanide most accurately represents which of the following?

- W) The negative base-10 logarithm of the initial molar hydronium ion concentration
- X) The negative base-10 logarithm of the equilibrium molar hydronium ion concentration
- Y) The negative base-10 logarithm of the initial molar hydrogen cyanide concentration
- Z) The negative base-10 logarithm of the equilibrium molar hydrogen cyanide concentration

ANSWER: X) THE NEGATIVE BASE-10 LOGARITHM OF THE EQUILIBRIUM MOLAR HYDRONIUM ION CONCENTRATION

### TOSS UP

19. BIOLOGY *Multiple Choice* Hatchetfish control their luminescence using which of the following specialized organs?

- W) Photophores
- X) Chromophores
- Y) Siphonophores [*SY-fuh-nuh-fohrs*]
- Z) Sipunculids [*sy-PUHNG-kyuh-lids*]

ANSWER: W) PHOTOPHORES

### BONUS

19. BIOLOGY *Multiple Choice* Which of the following is the genus for the primary insect vector for African sleeping sickness?

- W) *Cimex*
- X) *Musca*
- Y) *Glossina*
- Z) *Culex*

ANSWER: Y) GLOSSINA

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### TOSS UP

20. ENERGY *Multiple Choice* Which of the following states has the highest potential for wind energy generation?

- W) Illinois
- X) Arkansas
- Y) Michigan
- Z) North Dakota

ANSWER: Z) NORTH DAKOTA

### BONUS

20. ENERGY *Short Answer* To heat a cup of water in a microwave takes about 0.01 kilowatt-hours. Providing your answer to the nearest tenth, about how many minutes should you need to heat it if it is exposed to 1,000 watts of microwave energy?

ANSWER: 0.6

### TOSS UP

21. EARTH AND SPACE *Multiple Choice* Which of the following gases is the most prevalent in volcanic eruptions?

- W) Water vapor
- X) Methane
- Y) Carbon dioxide
- Z) Carbon monoxide

ANSWER: W) WATER VAPOR

### BONUS

21. EARTH AND SPACE *Short Answer* Which major ocean has the highest salinity?

ANSWER: ATLANTIC

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### TOSS UP

22. PHYSICS *Multiple Choice* A top that is spinning on a table begins to precess. Which of the following would decrease the rate of precession of the top?

- W) An increase in the torque that the top experiences due to gravity
- X) A decrease in its moment of inertia
- Y) A decrease in its angular velocity
- Z) An increase in its angular velocity

ANSWER: Z) AN INCREASE IN ITS ANGULAR VELOCITY

### BONUS

22. PHYSICS *Short Answer* Two parallel plates of equal area are separated by a distance of 20 millimeters. If the plates are connected to a 12 volt battery, providing your answer in scientific notation with one significant figure, what is the magnitude of the electrostatic force in newtons that a microcoulomb charge between the plates would feel?

ANSWER:  $6 \times 10^{-4}$

### TOSS UP

23. MATH *Short Answer* State an equation for the graph that results when the graph of  $y = \cos(x)$  [**y equals cosine of x**] is stretched vertically by a factor of 5 and is shifted  $\pi/2$  units to the right.

ANSWER:  $y = 5\cos(x - \pi/2)$  (ACCEPT:  $5 \sin(x)$ )

### BONUS

23. MATH *Short Answer* Providing your answer in simplest form, what is the distance from the origin to the line  $y = x + 1$ ?

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

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### TOSS UP

24. CHEMISTRY *Short Answer* If the molar mass of chlorine is 35 grams per mole, of oxygen is 16 grams per mole, and of hydrogen is 1 gram per mole, what is the molar mass in grams per mole of hypochlorous acid?

ANSWER: 52

### BONUS

24. CHEMISTRY *Multiple Choice* Which of the following can behave as a Lewis acid, but NOT as a Brønsted-Lowry acid?

- W)  $\text{NH}_3$
- X)  $\text{H}_2\text{CO}_3$
- Y)  $\text{BF}_3$
- Z)  $\text{HSO}_3^-$

ANSWER: Y)  $\text{BF}_3$

### TOSS UP

25. BIOLOGY *Multiple Choice* *Pyrolobus fumarii* [**py-ROH-loh-boos foo-MA-ree**], an extreme thermophile, would be found in which of the following marine habitats?

- W) Photic zone
- X) Neritic zone
- Y) Benthic zone
- Z) Littoral zone

ANSWER: Y) BENTHIC ZONE

### BONUS

25. BIOLOGY *Short Answer* There are three cupboards labeled “Rodentia”, “Lagomorpha,” and “Chiroptera” [**kee-ROHP-tuh-ruh**]. You have 4 taxidermy specimens: a pika, a fruit bat, a guinea pig, and a skunk to be correctly stored in the cupboards. One of these specimens does not fit into the 3 available cupboards and thus you will need to label a fourth cupboard. What should be the label on the fourth cupboard, and which animal would you place in that cupboard?

ANSWER: CARNIVORA; SKUNK