

## ROUND ROBIN ~ ROUND 5

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### TOSS UP

1. BIOLOGY *Multiple Choice* The cell wall of a diatom is primarily composed of which of the following?

- W) Silicon dioxide
- X) Calcium carbonate
- Y) Magnesium carbonate
- Z) Cellulose

ANSWER: W) SILICON DIOXIDE

### BONUS

1. BIOLOGY *Short Answer* Arrange the following four choices from proximal to distal of the trachea [*truh-KE-uh*]: 1) bronchiole [*BRONG-kee-ohl*], 2) alveolar [*al-VEE-uh-ler*] sac, 3) primary bronchus, 4) alveolar duct.

ANSWER: 3, 1, 4, 2 (ACCEPT: PRIMARY BRONCHUS, BRONCHIOLE, ALVEOLAR DUCT, ALVEOLAR SAC)

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### TOSS UP

2. CHEMISTRY *Multiple Choice* Which of the following conjugate acid-base pairs will NOT function as a buffer?

- W)  $\text{HNO}_3$  and  $\text{NO}_3^-$
- X)  $\text{NH}_3$  and  $\text{NH}_4^+$
- Y)  $\text{CH}_3\text{COOH}$  and  $\text{CH}_3\text{COO}^-$
- Z)  $\text{HF}$  and  $\text{F}^-$

ANSWER: W)  $\text{HNO}_3$  AND  $\text{NO}_3^-$

### BONUS

2. CHEMISTRY *Short Answer* Giving your answers to the nearest integers, identify the pressure in atmospheres of a gas that starts at 1 atmosphere and 23° Celsius at each of the following three temperatures: 1) 52°, 2) 317°, 3) 2700°.

ANSWER: 1) 1, 2) 2, 3) 10

### TOSS UP

3. MATH *Multiple Choice* Which of the following is equivalent to  $25^{\log_5 8}$  [**25 to the power of the log base 5 of 8**]?

- W) 8
- X) 16
- Y) 64
- Z) 128

ANSWER: Y) 64

### BONUS

3. MATH *Short Answer* Suppose  $2\frac{1}{2}$  woodchucks can chuck  $1\frac{1}{4}$  cords of wood in  $1\frac{1}{5}$  hours; providing your answer as a fraction in simplest form, how many cords of wood can 1 woodchuck chuck in 1 hour?

ANSWER: 5/12

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### TOSS UP

4. PHYSICS *Multiple Choice* A block floats at rest with 1/3 of its total volume below the surface of the water. The block is pushed down until it is completely submerged. Which of the following is the magnitude of the net force on the block when it is released?

- W) Half of the block's weight
- X) Equal to the block's weight
- Y) Twice the block's weight
- Z) Three times the block's weight

ANSWER: Y) TWICE THE BLOCK'S WEIGHT

### BONUS

4. PHYSICS *Short Answer* A 2 kilogram box is pushed forward with a 10 newton force while it experiences a 5 newton force of kinetic friction in the opposite direction. Providing your answer to the nearest meter, after 3 seconds, how far has the box moved?

ANSWER: 11

**TOSS UP**

5. EARTH AND SPACE *Short Answer* After the Mount St. Helens volcanic eruption, what type of mudflow resulted from glacial melting and caused extensive damage?

ANSWER: LAHAR

**BONUS**

5. EARTH AND SPACE *Multiple Choice* Which of the following volcanoes erupted the most sulfuric acid into the atmosphere?

- W) Mount St. Helens
- X) Pinatubo
- Y) Tambora
- Z) Toba

ANSWER: Z) TOBA

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**TOSS UP**

6. ENERGY *Multiple Choice* In which of the following sets of three states is most U.S. oil shale located?

- W) Utah, Montana, and Idaho
- X) Colorado, Nevada, and New Mexico
- Y) Colorado, Utah, and Wyoming
- Z) Montana, Colorado, and Utah

ANSWER: Y) COLORADO, UTAH, AND WYOMING

**BONUS**

6. ENERGY *Short Answer* If a million people leave their cell phone chargers plugged in unnecessarily for 16 hours per day and each charger consumes 1 watt when not in use, providing your answer to the nearest million, how many kilowatt-hours are consumed per year while the chargers are plugged in but not charging?

ANSWER: 6,000,000

### TOSS UP

7. BIOLOGY *Multiple Choice* Which of the following methods of fish harvesting is most damaging to benthic habitats?

- W) Purse-seining [**SAYN-ing**]
- X) Long-lining
- Y) Drift-net fishing
- Z) Bottom trawling

ANSWER: Z) BOTTOM TRAWLING

### BONUS

7. BIOLOGY *Multiple Choice* Long bristles are found around the bills of insectivorous [**in-sek-TIV-er-uhs**] birds. How might these bristles help birds when they catch prey?

- W) Bristles help birds snap up insects by improving the bird's aerial balance
- X) Bristles protect the bird's nares [**NAIR-eez**] from an insect's legs
- Y) Bristles function only for attracting a mate, not for catching prey
- Z) Bristles act as nets, catching insects that the bird misses with its bill

ANSWER: Z) BRISTLES ACT AS NETS, CATCHING INSECTS THAT THE BIRD MISSES WITH ITS BILL

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### TOSS UP

8. CHEMISTRY *Multiple Choice* Which of the following elements is a metalloid?

- W) Copper
- X) Magnesium
- Y) Silicon
- Z) Sulfur

ANSWER: Y) SILICON

### BONUS

8. CHEMISTRY *Short Answer* Assuming that the transition of an electron in the hydrogen atom from the fourth to the second electron energy level is two electron volts, providing your answer to the nearest tenth, how many electronvolts is the transition between the first and third energy level?

ANSWER: 9.5 (ACCEPT: 9.6)

### TOSS UP

9. MATH *Short Answer* A room contains 2000 gnats at 12:00 noon and the number of gnats in the room doubles every 6 minutes. The room is filled with gnats at 1:00 p.m. To the nearest minute, at what time was the room one-fourth full of gnats?

ANSWER: 12:48 p.m.

### BONUS

9. MATH *Short Answer* If the position of a moving object in meters is given by  $s(t) = 4t^3 - 6\ln t$  [***s of t equals 4 t cubed minus 6 natural log of t***], what is its velocity in meters per second at  $t = 3$  seconds?

ANSWER: 106

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### TOSS UP

10. PHYSICS *Multiple Choice* A skydiver is falling at a speed slightly less than terminal velocity. Which of the following statements about the magnitude of the forces on the skydiver is true?

- W) The air resistance is less than the weight, and the net force is down
- X) The air resistance is equal to the weight, and the net force is zero
- Y) The air resistance is equal to the weight, and the net force is down
- Z) The air resistance is greater than the weight, and the net force is down

ANSWER: W) THE AIR RESISTANCE IS LESS THAN THE WEIGHT, AND THE NET FORCE IS DOWN

### BONUS

10. PHYSICS *Multiple Choice* A laser beam moves from inside a glass block with an index of refraction of 1.4 to a vacuum. Which of the following angles in degrees best represents the critical angle where total internal reflection will begin to occur?

- W) 30°
- X) 45°
- Y) 60°
- Z) 135°

ANSWER: X) 45°

### TOSS UP

11. EARTH AND SPACE *Short Answer* Which of the Galilean moons experiences the strongest tidal forces?

ANSWER: IO

### BONUS

11. EARTH AND SPACE *Multiple Choice* Which of the following mountain ranges exhibits basin and range topography?

- W) Cascade Mountains
- X) Rocky Mountains
- Y) Appalachian Mountains
- Z) Wasatch Mountains

ANSWER: Z) WASATCH MOUNTAINS

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### TOSS UP

12. BIOLOGY *Multiple Choice* Which of the following organisms would be described as demersal?

- W) Anchovy
- X) Flounder
- Y) Tuna
- Z) Sailfish

ANSWER: X) FLOUNDER

### BONUS

12. BIOLOGY *Multiple Choice* Different species of hummingbirds have bills that vary in length and shape, matching the structure of the flowers on which they feed. Which of the following evolutionary scenarios best explains this diversity of hummingbird bill morphology?

- W) Coevolution of flowers and hummingbirds, leading to specialization of hummingbirds on particular flowers
- X) Random mutation of plants to develop varying flower shapes, and subsequent evolution of hummingbird bills to match these shapes
- Y) Evolutionary race between flowers and hummingbirds, in which flowers become more extreme in shape to prevent nectar feeding
- Z) Evolution of various bill shapes, since all hummingbirds opportunistically feed on many different species of flower, regardless of shape

ANSWER: W) COEVOLUTION OF FLOWERS AND HUMMINGBIRDS, LEADING TO SPECIALIZATION OF HUMMINGBIRDS ON PARTICULAR FLOWERS

### TOSS UP

13. CHEMISTRY *Short Answer* According to the VSEPR model, what is the molecular geometry of carbon dioxide?

ANSWER: LINEAR

### BONUS

13. CHEMISTRY *Short Answer* Identify, respectively, the VSEPR theory shapes of the following four molecules: 1) sulfur dioxide, 2) phosphorous pentachloride, 3) ammonia, and 4) boron trichloride.

ANSWER: 1) BENT (ACCEPT: BENT 109 OR V-SHAPED), 2) TRIGONAL BIPYRAMIDAL, 3) TRIGONAL PYRAMIDAL, 4) TRIGONAL PLANAR

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### TOSS UP

14. MATH *Short Answer* If  $f(x)$  is an odd function and  $\int_0^4 f(x)dx = 6$  [***the integral from 0 to 4 of f of x dx equals 6***] then what is the value of  $\int_{-4}^4 f(x)dx$  [***the integral from negative 4 to 4 of f of x dx***]?

ANSWER: 0

### BONUS

14. MATH *Short Answer* Find the length, to the nearest tenth of a centimeter, of the arc of a circle with a radius of 6 centimeters that is intercepted by a central angle that measures 15 degrees.

ANSWER: 1.6

### TOSS UP

15. PHYSICS *Short Answer* A student is in a rollercoaster that is going through a loop on the inside of the track. At the top of the loop, the normal force on the student has a magnitude of 100 newtons. If the student's weight and mass are 500 newtons and 50 kilograms, respectively, then what is the magnitude of the student's acceleration at the top of the loop in meters per second squared?

ANSWER: 12

### BONUS

15. PHYSICS *Short Answer* A pendulum that has a period of 2 seconds on the Earth is moved to another planet where the period is now 4 seconds. Given the acceleration due to gravity on Earth as 10 meters per second squared and providing your answer to two significant figures, what is the acceleration due to gravity on this new planet in meters per second squared?

ANSWER: 2.5

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### TOSS UP

16. EARTH AND SPACE *Multiple Choice* Which of the following statements about groundwater is NOT true?

- W) Precipitation becomes groundwater after falling to the ground and seeping into aquifers
- X) Groundwater occurs almost everywhere beneath the land surface
- Y) Groundwater flows mainly in underground rivers
- Z) Groundwater is naturally pure and usually remains undisturbed for years before it is used

ANSWER: Y) GROUNDWATER FLOWS MAINLY IN UNDERGROUND RIVERS

### BONUS

16. EARTH AND SPACE *Short Answer* What mineral commonly comprises green sand beaches forming in volcanic areas?

ANSWER: OLIVINE

### TOSS UP

17. ENERGY *Multiple Choice* Who is generally credited with defining the term horsepower?

- W) Thomas Edison
- X) James Watt
- Y) Michael Faraday
- Z) Samuel Clinton

ANSWER: X) JAMES WATT

### BONUS

17. ENERGY *Short Answer* The half life of radium is 1600 years. What fraction of the original quantity of radium has decayed after 9600 years?

ANSWER: 63/64

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### TOSS UP

18. BIOLOGY *Multiple Choice* Which of the following invertebrate groups has the most complex nervous system?

- W) Crustaceans [**kruh-STAY-shuhns**]
- X) Cephalopods [**SEF-uh-luh-pods**]
- Y) Scyphozoans [**sy-fuh-ZOH-uhns**]
- Z) Segmented worms

ANSWER: X) CEPHALOPODS

### BONUS

18. BIOLOGY *Multiple Choice* Compared to the Antarctic region, the Arctic region has which of the following?

- W) Fewer endemic species
- X) Fewer terrestrial mammal species
- Y) Less seasonality in pack ice
- Z) More flightless birds

ANSWER: Y) LESS SEASONALITY IN PACK ICE

### TOSS UP

19. CHEMISTRY *Multiple Choice* Which of the following is NOT a colligative property?

- W) Solubility
- X) Freezing point depression
- Y) Boiling point elevation
- Z) Osmotic pressure

ANSWER: W) SOLUBILITY

### BONUS

19. CHEMISTRY *Short Answer* In the following three ions, what are the highest energy sublevels, respectively, that contain electrons: 1)  $\text{Fe}^{2+}$ , 2)  $\text{Sn}^{4+}$ , 3)  $\text{P}^{3-}$ ?

ANSWER: 1) 3d, 2) 4d, 3) 3p

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### TOSS UP

20. MATH *Short Answer* How many unique 5-letter arrangements are possible from the letters in the word PAPER?

ANSWER: 60

### BONUS

20. MATH *Short Answer* Providing your answer as a fraction in simplest form, what is the slope of the tangent line to the curve  $y = \sqrt{x^2 - 3x}$  [***y equals the square root of the quantity x squared minus 3 x***] at the point (4, 2)?

ANSWER: 5/4

### TOSS UP

21. PHYSICS *Short Answer* You stand 2 meters from a point source of sound. Ignoring any effects due to reflection and providing your answer as a fraction in simplest form, by what factor would the intensity of sound be multiplied if you were to move to a position 3 meters from the source?

ANSWER: 4/9

### BONUS

21. PHYSICS *Short Answer* A wave pulse travels along a string with a speed of 20 meters per second. If the tension in the string is 100 newtons, providing your answer as a decimal, what is the linear density of the string in kilograms per meter?

ANSWER: 0.25

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### TOSS UP

22. EARTH AND SPACE *Short Answer* As corals grow and expand, reefs take on one of three major characteristic structures. Name all three.

ANSWER: FRINGING, BARRIER, AND ATOLL

### BONUS

22. EARTH AND SPACE *Short Answer* Imagine that you've just spent a long, hot summer day at the beach. The water was cool and refreshing after being out in the hot sun. As the Sun sets and night falls, you start to get chilled by the drop in air temperature. You decide to get back into the water, and you notice that its temperature doesn't seem to have changed much. In fact, it is warmer than the air. Which property of water best explains your observation?

ANSWER: SPECIFIC HEAT

### TOSS UP

23. ENERGY *Multiple Choice* Which of the following is the typical electrical efficiency of a large energy-efficient electric motor?

- W) 74%
- X) 89%
- Y) 94%
- Z) 99%

ANSWER: Y) 94%

### BONUS

23. ENERGY *Multiple Choice* Which of the following has the most kinetic energy?

- W) A 1 kilogram mass moving at 10 meters per second
- X) A 2 kilogram mass moving at 7 meters per second
- Y) A 0.5 kilogram mass moving at 14 meters per second
- Z) A 0.25 kilogram mass moving at 18 meters per second

ANSWER: W) A 1 KILOGRAM MASS MOVING AT 10 METERS PER SECOND

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### TOSS UP

24. BIOLOGY *Multiple Choice* If the two alleles for color sensitivity are  $X^b$  [**X-little-B**] = color-blind, and  $X^B$  [**X-big-B**] = color-sensitive, which of the following genotypes corresponds to a color-blind individual?

- W)  $X^B X^b$  [**X-big-B-X-little-B**]
- X)  $X^B X^B$  [**X-big-B-X-big-B**]
- Y)  $X^b Y$  [**X-little-B-Y**]
- Z)  $X^B Y$  [**X-big-B-Y**]

ANSWER: Y)  $X^b Y$

### BONUS

24. BIOLOGY *Multiple Choice* Which of the following groups consists only of organisms incapable of photosynthesizing without the aid of symbiotic organisms?

- W) Dinoflagellates [**din-uh-FLAJ-uh-layts**]
- X) Radiolarians [**ray-dee-oh-LAIR-ee-uhns**]
- Y) Diatoms
- Z) Bacteria

ANSWER: X) RADIOLARIANS

### TOSS UP

25. CHEMISTRY *Multiple Choice* The energy of a photon is directly proportional to which of the following properties?

- W) Intensity
- X) Frequency
- Y) Polarity
- Z) Wavelength

ANSWER: X) FREQUENCY

### BONUS

25. CHEMISTRY *Multiple Choice* At extremely high temperatures and pressures, nitrogen gas and oxygen gas react to produce nitrogen dioxide gas. If the cylinder volume in which this reaction takes place is doubled and the temperature is held constant, which of the following effects will this have on the reaction?

- W) No effect
- X) The reaction will shift to the left
- Y) The reaction will shift to the right
- Z) The equilibrium **[ee-kwuh-LIB-ree-uhm]** constant will double

ANSWER: X) THE REACTION WILL SHIFT TO THE LEFT