

ROUND ROBIN ~ ROUND 1

TOSS UP

1. BIOLOGY *Short Answer* Stomata are pores in leaves that allow gas exchange. What is the name of the structure with this function that is present in twigs, stems, bark, and fruit?

ANSWER: LENTICEL

BONUS

1. BIOLOGY *Short Answer* Identify all of the following four choices that are typically K strategists life history characteristics: 1) Type III survivorship curve, 2) density dependent mortality, 3) large body size, 4) rapid embryonic development.

ANSWER: 2, 3 (ACCEPT: DENSITY DEPENDENT MORTALITY, LARGE BODY SIZE)

TOSS UP

2. CHEMISTRY *Multiple Choice* Which of the following species would be expected to have the most covalent character?

- W) Beryllium fluoride
- X) Magnesium chloride
- Y) Aluminum oxide
- Z) Silver bromide

ANSWER: W) BERYLLIUM FLUORIDE

BONUS

2. CHEMISTRY *Multiple Choice* Under which of the following sets of conditions would nitrogen gas deviate the MOST from the ideal gas law?

- W) 500 Kelvin and 50 atmospheres
- X) 500 Kelvin and 5 atmospheres
- Y) 150 Kelvin and 50 atmospheres
- Z) 150 Kelvin and 5 atmospheres

ANSWER: Y) 150 KELVIN AND 50 ATMOSPHERES

TOSS UP

3. MATH *Short Answer* What is the smallest possible sum of a positive number and its reciprocal?

ANSWER: 2

BONUS

3. MATH *Short Answer* Find the point of intersection of $2x + 3y = -4$ and $5x - y = 7$.

ANSWER: (1, -2)

TOSS UP

4. PHYSICS *Multiple Choice* The escape velocity for a 100 kilogram object to leave planet Earth is approximately 11,000 meters per second. Which of the following is the escape velocity in meters per second for a 200 kilogram object to leave Earth?

- W) 5,500
- X) 11,000
- Y) 16,500
- Z) 22,000

ANSWER: X) 11,000

BONUS

4. PHYSICS *Short Answer* A proton with a charge of 1.6×10^{-19} coulombs is moving with a speed of 2×10^5 meters per second when it encounters a uniform magnetic field of 2 teslas in a direction perpendicular to the proton's motion. Providing your answer in scientific notation to two significant figures, what is the magnitude of the force in newtons experienced by the proton?

ANSWER: 6.4×10^{-14}

TOSS UP

5. EARTH AND SPACE *Multiple Choice* In terms of naturally supplied nutrients, which of the following elements is typically least abundant and most limiting to biological productivity in lakes?

- W) Nitrogen
- X) Phosphorus
- Y) Calcium
- Z) Carbon

ANSWER: X) PHOSPHORUS

BONUS

5. EARTH AND SPACE *Multiple Choice* Which of the following rock types could form from the earthfall material following a mass wasting event?

- W) Limestone
- X) Tillite [**TIL-eyet**]
- Y) Breccia [**BRECH-ee-uh**]
- Z) Schist [**SHIST**]

ANSWER: Y) BRECCIA

TOSS UP

6. ENERGY *Short Answer* If it takes 900 Btus [**B-T-USE**] of fuel to produce a gallon of hot water and you take a 10 minute shower using 2 gallons of hot water per minute, how many Btus of fuel were used in the shower?

ANSWER: 18,000

BONUS

6. ENERGY *Multiple Choice* Which of the following is closest to the maximum horsepower a healthy person can briefly generate?

- W) 0.25
- X) 0.5
- Y) 1
- Z) 2

ANSWER: Y) 1

TOSS UP

7. BIOLOGY *Multiple Choice* Which of the following unusual vertebrates was known in the fossil record for over 100 years before a living specimen was discovered?

- W) Okapi [**oh-KAH-pee**]
- X) Coelacanth [**SEE-luh-kanth**]
- Y) Pangolin [**PANG-guh-lin**] or [**pang-GOH-lin**]
- Z) Seven gilled shark

ANSWER: X) COELACANTH

BONUS

7. BIOLOGY *Short Answer* While chilling with your favorite tunes, the parasympathetic division of your autonomic nervous system is driving many of your physiological systems. Indicate all of the following four physiological responses that would be unlikely to occur: 1) widely dilated bronchi [**BRONG-kee**], 2) stimulated digestive processes, 3) dry mouth, 4) dilated pupils.

ANSWER: 1, 3, 4 (ACCEPT: WIDELY DILATED BRONCHI, DRY MOUTH, DILATED PUPILS)

TOSS UP

8. CHEMISTRY *Multiple Choice* Infrared spectroscopy typically analyzes which of the following?

- W) Electronic excitement
- X) Nuclear spins
- Y) Molecular vibrations
- Z) Atomic rotation

ANSWER: Y) MOLECULAR VIBRATIONS

BONUS

8. CHEMISTRY *Short Answer* What is the oxidation number of the central cobalt atom in $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$ [**C-O-N-H-3-4-C-L-2-plus**]?

ANSWER: +3 (ACCEPT: THREE PLUS)

TOSS UP

9. MATH *Short Answer* If $f(t) = 3t + 1$, what is the limit of $f(t)$ as t approaches 2?

ANSWER: 7

BONUS

9. MATH *Short Answer* Find the ratio of x to y if: $\frac{(x-y)}{(x+y)} = \frac{2}{3}$ **[the fraction with numerator x minus y and denominator x plus y equals two thirds].**

ANSWER: 5 TO 1 (ACCEPT: 5)

TOSS UP

10. PHYSICS *Short Answer* A planet is found with a mass that is 50 times the mass of Earth and a radius that is 5 times that of the Earth. Providing your answer to the nearest integer, what is the acceleration due to gravity in meters per second squared on this planet, given that the acceleration due to gravity on the Earth is 9.8 meters per second squared?

ANSWER: 20

BONUS

10. PHYSICS *Short Answer* In the de Broglie **[duh broh-GLEE]** equation, Planck's constant relates which two properties of a particle?

ANSWER: WAVELENGTH AND MOMENTUM (ACCEPT: FREQUENCY AND ENERGY)

TOSS UP

11. EARTH AND SPACE *Short Answer* In the early part of the 20th century, the German geologist and meteorologist Alfred Wegener introduced what theory?

ANSWER: CONTINENTAL DRIFT

BONUS

11. EARTH AND SPACE *Multiple Choice* Which of the following materials is most commonly associated with schistosity [*shis-TOHS-i-tee*]?

- W) Amphibolite [*am-FIB-uh-lyt*]
- X) Gneiss [*NYS*]
- Y) Schist [*SHIST*]
- Z) Slate

ANSWER: W) AMPHIBOLITE

TOSS UP

12. BIOLOGY *Multiple Choice* A realized ecological niche [*NICH*] includes all but which of the following?

- W) Resource requirements
- X) Range of tolerance
- Y) Geographical location
- Z) Competitors

ANSWER: Y) GEOGRAPHICAL LOCATION

BONUS

12. BIOLOGY *Multiple Choice* Which of the following organisms starts out as a free-swimming larva and then undergoes a metamorphosis during which its tail, notochord, and most of its nervous system are reabsorbed?

- W) Sea squirt
- X) Arrow worm
- Y) Eel
- Z) Hellgrammite [*HEL-gruh-myt*]

ANSWER: W) SEA SQUIRT

TOSS UP

13. CHEMISTRY *Multiple Choice* Which of the following does NOT have to contain an oxygen atom single-bonded to at least one carbon atom?

- W) Ether
- X) Ester
- Y) Mercaptan
- Z) Carboxylic acid

ANSWER: Y) MERCAPTAN

BONUS

13. CHEMISTRY *Multiple Choice* Which of the following elements is most reactive to water?

- W) Potassium
- X) Zinc
- Y) Palladium [*puh-LAY-dee-uhm*]
- Z) Nickel

ANSWER: W) POTASSIUM

TOSS UP

14. MATH *Short Answer* If it takes 12 minutes to cut a log into 4 pieces, how many minutes will it take to cut a log into 3 pieces?

ANSWER: 8

BONUS

14. MATH *Short Answer* In simplest form, find the radius of a semi-circle in which is inscribed a square of side 4 units.

ANSWER: $2\sqrt{5}$

TOSS UP

15. PHYSICS *Short Answer* A 10 kilogram object falls to the surface of a planet where the acceleration due to gravity is 6.5 meters per second squared. If the object is falling at terminal velocity, what is the drag force on the object in newtons?

ANSWER: 65

BONUS

15. PHYSICS *Short Answer* A 2000 kilogram car moves with a steady speed of 10 meters per second up a hill that is inclined 10 degrees above the horizontal. Describe the magnitude and direction of the net force on the car after 10 seconds.

ANSWER: THERE IS NO NET FORCE

TOSS UP

16. EARTH AND SPACE *Short Answer* Give the name of the depressions that are the result of a violent volcanic eruption and within which lakes often form.

ANSWER: CALDERAS

BONUS

16. EARTH AND SPACE *Multiple Choice* Where in the interstellar medium are stars believed to form?

- W) Giant molecular clouds
- X) Warm-hot interstellar medium
- Y) H I regions
- Z) H II regions

ANSWER: W) GIANT MOLECULAR CLOUDS

TOSS UP

17. ENERGY *Multiple Choice* Chlorophyll undergoes which of the following types of reaction when it is activated by light?

- W) Reduction
- X) Oxidation
- Y) Hydrolysis [*hy-DROL-uh-sis*]
- Z) Phosphorylation [*FOS-fer-uh-lay-shuhn*]

ANSWER: X) OXIDATION

BONUS

17. ENERGY *Multiple Choice* Approximately how many pounds of coal are required to light a 100 watt light bulb for one year?

- W) 325
- X) 450
- Y) 575
- Z) 700

ANSWER: Z) 700

TOSS UP

18. BIOLOGY *Multiple Choice* The development of a streamlined body in a variety of fast swimming animals, including penguins, sharks, and dolphins, is a good example of which of the following evolutionary concepts?

- W) Coevolution
- X) Divergent evolution
- Y) Convergent evolution
- Z) Founder's effect

ANSWER: Y) CONVERGENT EVOLUTION

BONUS

18. BIOLOGY *Multiple Choice* Access to desert aquifers has provided a positive feedback stimulus to all but which of the following?

- W) Human population
- X) Cattle population
- Y) Kangaroo rat population
- Z) Commercial agriculture

ANSWER: Y) KANGAROO RAT POPULATION

TOSS UP

19. CHEMISTRY *Multiple Choice* A student is titrating an unknown acid with 0.100 molar sodium hydroxide. At the end of the experiment, the student calculates the concentration of the acid to be 1.1% higher than the actual value. Which of the following sources of possible experimental error most likely contributed to this final error?

- W) Not zeroing the balance
- X) Adding 2 drops of indicator instead of the procedure-stated 3 drops
- Y) Not reading from the bottom of the meniscus when reading the burette
- Z) Leaving some water in the receiving Erlenmeyer flask before adding the acid

ANSWER: Z) LEAVING SOME WATER IN THE RECEIVING ERLENMEYER FLASK BEFORE ADDING THE ACID

BONUS

19. CHEMISTRY *Short Answer* Place the following four molecules in order from strongest to weakest ionic bonding: 1) calcium oxide, 2) cesium iodide, 3) potassium chloride, 4) lithium fluoride.

ANSWER: 1, 4, 3, 2 (ACCEPT: CALCIUM OXIDE, LITHIUM FLUORIDE, POTASSIUM CHLORIDE, CESIUM IODIDE)

TOSS UP

20. MATH *Multiple Choice* Which of the following represents the degree measure of the angle between the circle and the chord for an arc of measure 90° ?

- W) 45°
- X) 90°
- Y) 135°
- Z) 180°

ANSWER: W) 45°

BONUS

20. MATH *Short Answer* Savannah travels 5 miles in a direction north 30° east and then 7 miles in a direction south 60° east. In simplest form, how many miles is she from her starting point?

ANSWER: $\sqrt{74}$

TOSS UP

21. PHYSICS *Short Answer* A 5 kilogram ball is thrown at a wall with a speed of 10 meters per second. If the ball rebounds with a speed of 7 meters per second, what was the magnitude of the impulse that the ball experienced in kilogram meters per second?

ANSWER: 85

BONUS

21. PHYSICS *Multiple Choice* An airplane is scheduled to travel to a city that is 100 miles due north of the departure city. If there is a wind that blows from east to west at a steady rate of 100 miles per hour, and the plane travels at a speed of 200 miles per hour in still air, then which of the following directions should the plane be directed?

- W) 30 degrees north of east
- X) 60 degrees north of east
- Y) 30 degrees north of west
- Z) 60 degrees north of west

ANSWER: X) 60 DEGREES NORTH OF EAST

TOSS UP

22. EARTH AND SPACE *Multiple Choice* Which of the following map projections has true latitude and longitude lines and angles, yet distortion increases near the map's polar regions?

- W) Globe
- X) Mercator
- Y) Equidistant
- Z) Robinson

ANSWER: X) MERCATOR

BONUS

22. EARTH AND SPACE *Short Answer* Which spectral class of stars has the strongest hydrogen lines?

ANSWER: A

TOSS UP

23. ENERGY *Multiple Choice* Methane's influence on global warming is approximately how many times that of carbon dioxide?

- W) 1/2
- X) 10
- Y) 20
- Z) 40

ANSWER: Y) 20

BONUS

23. ENERGY *Multiple Choice* About how many pounds of carbon dioxide are generated by burning 6 pounds of pure carbon?

- W) 22
- X) 32
- Y) 42
- Z) 52

ANSWER: W) 22

TOSS UP

24. BIOLOGY *Multiple Choice* Which of the following molluscan **[mol-UHS-kuhn]** structures is NOT correctly paired with its function?

- W) Adductor muscle and closing valves
- X) Siphon and feeding while buried
- Y) Radula and reproduction
- Z) Foot and locomotion

ANSWER: Y) RADULA AND REPRODUCTION

BONUS

24. BIOLOGY *Multiple Choice* Which of the following statements is true?

- W) Prostaglandins **[pros-tuh-GLAN-dins]** are paracrine **[PAR-uh-kruhn]** regulators that act locally
- X) Insulin is a paracrine regulator that acts over long distances
- Y) Melatonin is an endocrine hormone that acts locally **[EN-duh-krin]**
- Z) Prostaglandins are endocrine hormones that act over long distances

ANSWER: W) PROSTAGLANDINS ARE PARACRINE REGULATORS THAT ACT LOCALLY

TOSS UP

25. CHEMISTRY *Multiple Choice* Jacques Charles is well-known as the inventor of the hot air balloon, and there is also a law that carries his name. Which of the following is a correct postulation, based on Charles's Law?

- W) As the gas in a balloon is heated, its mass increases
- X) As the gas in a balloon is heated, the pressure of the gas outside the balloon decreases
- Y) As the gas in a balloon is heated, the pressure of the gas outside the balloon increases
- Z) As the gas in a balloon is cooled, its density increases

ANSWER: Z) AS THE GAS IN A BALLOON IS COOLED, ITS DENSITY INCREASES

BONUS

25. CHEMISTRY *Short Answer* A 10.0 gram sample of gold with a specific heat capacity of 0.1 joules per gram degree Celsius is heated using 100.0 joules of energy. If the original temperature of the gold is 25.0° Celsius, what is its final temperature in degrees Celsius?

ANSWER: 125