

ROUND 8

TOSS-UP

1) CHEMISTRY *Multiple Choice* A molecule having a chemical formula of CH_3CCCH_3 would be classified by which of the following?

- W) Alkyne
- X) Alkene
- Y) Alkane
- Z) Aldehyde (read as: AHL-deh-hyd)

ANSWER: W) ALKYNE

BONUS

1) CHEMISTRY *Multiple Choice* The rare earth elements are primarily composed of elements from which groups of the periodic table?

- W) Transition metals and main group
- X) Alkali and alkaline
- Y) Lanthanides (read as: LAHN-thah-nyds) and actinides
- Z) Alkaline and transition metals

ANSWER: Y) LANTHANIDES AND ACTINIDES

TOSS-UP

2) EARTH AND SPACE *Short Answer* What substance primarily determines the viscosity of magma?

ANSWER: SILICA

BONUS

2) EARTH AND SPACE *Multiple Choice* Which of the following is NOT a property of pyroclastic (read as: py-rōe-KLAHS-tik) flows?

- W) They can flow uphill
- X) They move slowly
- Y) Hot rock and ash flow like a turbulent blanket over the ground
- Z) They glow red at night but appear grey in the daytime

ANSWER: X) THEY MOVE SLOWLY

TOSS-UP

3) BIOLOGY *Multiple Choice* During meiosis, haploid cells are created from diploid parent cells. In animals, this process only takes place in:

- W) Gametes
- X) Reproductive organs
- Y) Somatic cells
- Z) Plasma cells

ANSWER: X) REPRODUCTIVE ORGANS

BONUS

3) BIOLOGY *Short Answer* Certain species of fungi are self-fertile, in which a sexual spore can result from the fusion of nuclei that are genetically distinct but derived from the same body. What do we call these kinds of organisms?

ANSWER: HOMOTHALLIC

TOSS-UP

4) PHYSICS *Short Answer* What is the ideal mechanical advantage of a 24 inch lever if the fulcrum is located 6 inches from the resistance, which is at one end of the lever?

ANSWER: 3

BONUS

4) PHYSICS *Short Answer* What is the mechanical advantage of a screw with a radius of 1 centimeter and a thread of 0.25 centimeters? Provide your answer to the nearest integer.

ANSWER: 25

TOSS-UP

5) BIOLOGY *Multiple Choice* Which of the following organisms is NOT an autotroph?

- W) Pigmented sulfur bacteria
- X) Palm tree
- Y) Nitrifying bacteria
- Z) Mosquito

ANSWER: Z) MOSQUITO

BONUS

5) BIOLOGY *Short Answer* Besides water, what is the second most common reducing agent that most autotrophs use?

ANSWER: HYDROGEN SULFIDE

TOSS-UP

6) PHYSICS *Multiple Choice* Which one of the following statements concerning permanent bar magnets is NOT true?

- W) The north pole of a permanent magnet is attracted to a south pole of another magnet
- X) The direction of a magnetic field is indicated by the north pole of a compass
- Y) All permanent magnets are surrounded by a magnetic field
- Z) When a permanent magnet is cut in half, one piece will be a north pole and one a south pole

ANSWER: Z) WHEN A PERMANENT MAGNET IS CUT IN HALF, ONE PIECE WILL BE A NORTH POLE AND ONE PIECE WILL BE A SOUTH POLE

BONUS

6) PHYSICS *Multiple Choice* The force exerted by a coiled spring is directly proportional to which of the following?

- W) Uncoiled length of the spring
- X) Diameter of the string
- Y) Thickness of the string
- Z) Extension of the string

ANSWER: Z) EXTENSION OF THE STRING

TOSS-UP

7) EARTH AND SPACE *Short Answer* The surface of Titan is so cold that water is only stable in ice form. However, Titan still has clouds, rain, and lakes composed of which category of substances that includes oil and gasoline.

ANSWER: HYDROCARBONS

BONUS

7) EARTH AND SPACE *Multiple Choice* A mineral with the chemical formula $\text{Ca}_2\text{Mg}_5\text{Si}_8\text{O}_{22}(\text{OH})_2$ belongs to which of the following mineral groups?

- W) Serpentine
- X) Amphiboles
- Y) Olivines (read as: OH-li-veens)
- Z) Pyroxenes (read as: py-ROHK-seens)

ANSWER: X) AMPHIBOLES

TOSS-UP

8) CHEMISTRY *Multiple Choice* How would you classify a reaction in which solid potassium and chlorine gas react to form the ionic compound potassium chloride?

- W) Decomposition
- X) Combustion
- Y) Synthesis
- Z) Disproportionation

ANSWER: Y) SYNTHESIS

BONUS

8) CHEMISTRY *Short Answer* Generally, what type of reaction is an acid base reaction?

ANSWER: DOUBLE DISPLACEMENT (ACCEPT: DOUBLE REPLACEMENT)

TOSS-UP

9) BIOLOGY *Multiple Choice* The Spotted Owl is considered an endangered species in the western United States, largely due to competition from the introduced Barred Owl. These two species are genetically similar and are believed to have speciated from a common ancestor after separation of the two populations on opposite coasts of the United States. This is an example of:

- W) Allopatric speciation
- X) Sympathetic speciation
- Y) Sympatric speciation
- Z) Genetic drift

ANSWER: W) ALLOPATRIC SPECIATION

BONUS

9) BIOLOGY *Short Answer* Spotted Owls and Barred Owls are examples of ecotypes that can interbreed to produce Sparred Owls – a hybrid species. Which of the following is NOT true about the sparred owls?

- W) They are protected under the Endangered Species Act since they are offspring of spotted owls
- X) They may interbreed with spotted owls, reducing future numbers of pure spotted owls
- Y) They may interbreed among themselves, creating a new subspecies
- Z) They could trigger the extinction of the Spotted Owl

ANSWER: W) THEY ARE PROTECTED UNDER THE ENDANGERED SPECIES ACT SINCE THEY ARE OFFSPRING OF SPOTTED OWLS

TOSS-UP

10) CHEMISTRY *Short Answer* Most atoms combine to form molecules in such a way that they have how many electrons in a valence shell?

ANSWER: 8

BONUS

10) CHEMISTRY *Multiple Choice* In which of the following groups does the elemental form have a completed valence shell?

- W) Group 8
- X) Group 10
- Y) Group 18
- Z) Group 28

ANSWER: Y) GROUP 18

TOSS-UP

11) PHYSICS *Short Answer* A truck starts from rest. After 4 seconds of constant acceleration, its instantaneous speed is 8 meters per second. What is the average speed in meters per second over the first four seconds?

ANSWER: 4

BONUS

11) PHYSICS *Multiple Choice* The Leidenfrost effect is what causes water to "skitter" across a hot surface such as a pan and can permit a droplet to persist for longer on the hot surface at higher temperatures. On what is the water floating?

- W) A cushion of superheated air
- X) An insulating layer of steam
- Y) An insulating piece of the surface it sublimed
- Z) A transitory cold zone

ANSWER: X) AN INSULATING LAYER OF STEAM

TOSS-UP

12) MATH *Multiple Choice* If $x = 4$ and $y = 2$, which of the following expressions is undefined?

- W) $3x + \frac{7}{4-2y}$
- X) $2y + 4x$
- Y) $xy - x^2$
- Z) $x + \frac{y-4}{2}$

ANSWER: W) $3x + \frac{7}{4-2y}$

BONUS

12) MATH *Multiple Choice* Which of the following functions is continuous at $x = -1$?

- W) $\frac{x+1}{x^3+1}$
- X) $\frac{x+1}{15}$
- Y) $\frac{x^2+3x+5}{x^2+3x-4}$
- Z) $\frac{35x}{x^2-2x-3}$

ANSWER: Y) $\frac{x^2+3x+5}{x^2+3x-4}$

TOSS-UP

13) ENERGY *Multiple Choice* The typical efficiency of an automobile engine is approximately which of the following percentages?

- W) 95
- X) 65
- Y) 25
- Z) 5

ANSWER: Y) 25

BONUS

13) ENERGY *Short Answer* Mechanical power produced by wind turbines needs to be converted into electrical energy before it can be used. What is necessary to accomplish this conversion?

ANSWER: GENERATOR

TOSS-UP

14) MATH *Short Answer* The area of a square is 36 square centimeters. What is the length of its diagonal in centimeters in simplest radical form?

ANSWER: $6\sqrt{2}$

BONUS

14) MATH *Short Answer* The diagonals of a rhombus are 12 centimeters and 16 centimeters long. What is the perimeter of the rhombus in centimeters?

ANSWER: 40

TOSS-UP

15) EARTH AND SPACE *Multiple Choice* Eccentricity of an orbit describes:

- W) Its deviation from a circular orbit
- X) Its deviation from the ecliptic
- Y) Its time difference from a standard day
- Z) Its tumble ratio

ANSWER: W) ITS DEVIATION FROM A CIRCULAR ORBIT

BONUS

15) EARTH AND SPACE *Short Answer* The eccentricities of closed orbits range between which two numbers?

ANSWER: 0 AND 1

TOSS-UP

16) PHYSICS *Multiple Choice* If a soldier wants to shoot a projectile as far into enemy territory as possible over level ground, at what angle from the ground should the projectile be shot?

- W) 0°
- X) 30°
- Y) 45°
- Z) 60°

ANSWER: Y) 45°

BONUS

16) PHYSICS *Multiple Choice* A dart is shot from ground level over level ground with a speed of 30 meters per second at an angle of 30° above the ground. Assuming no air resistance, what is the vertical speed in meters per second of the dart when it hits the ground?

- W) 0
- X) 9.8
- Y) 15
- Z) 30

ANSWER: Y) 15

TOSS-UP

17) ENERGY *Multiple Choice* Which of the following types of coal is of high quality and has the highest energy content?

- W) Subbituminous (read as: suhb-bi-tuh-MI-nehs)
- X) Bituminous (read as: bi-TUH-mi-nehs)
- Y) Lignite (read as: LIG-nyt)
- Z) Peat

ANSWER: X) BITUMINOUS

BONUS

17) ENERGY *Multiple Choice* Burning wood leads to the release of chemical energy via the process of oxidation. Which of the following describes this more accurately?

- W) Wood → (read as: yields) Fire
- X) Wood + Oxygen → (read as: yields) Carbon Dioxide + Water + Energy
- Y) Wood + Oxygen → (read as: yields) Coal + Carbon Dioxide + Energy
- Z) Wood + Oxygen → (read as: yields) Carbon Dioxide + Water + Sulfur Dioxide + Energy

ANSWER: X) WOOD + OXYGEN → CARBON DIOXIDE + WATER + ENERGY

TOSS-UP

18) MATH *Multiple Choice* The radius of a bicycle tire is 10 inches. How far does the wheel travel in inches in 6 revolutions?

- W) 45π
- X) 60π
- Y) 90π
- Z) 120π

ANSWER: Z) 120π

BONUS

18) MATH *Multiple Choice* If a train's wheels have a diameter of 4 feet and turn at rate of π radians per second, how fast is the train moving in feet per second?

- W) 2
- X) 4
- Y) 2π
- Z) 4π

ANSWER: Y) 2π

TOSS-UP

19) ENERGY *Short Answer* When a ball rolls on a pool table, it eventually stops moving because of friction between the ball and the table. In this case, the kinetic energy of the ball has been converted to what other form of energy?

ANSWER: HEAT

BONUS

19) ENERGY *Multiple Choice* Plug-in hybrid electric vehicles are:

- W) Completely powered by electricity
- X) Powered by electricity until batteries are discharged and then powered by gasoline
- Y) Completely powered by solar energy
- Z) Powered completely by biofuels

ANSWER: X) POWERED BY ELECTRICITY UNTIL BATTERIES ARE DISCHARGED AND THEN POWERED BY GASOLINE

TOSS-UP

20) EARTH AND SPACE *Short Answer* What type of water condition is created by differing water densities resulting from melting ice caps and glaciers?

ANSWER: STRATIFIED

BONUS

20) EARTH AND SPACE *Short Answer* Thermohaline circulation is an important moderator of Earth's climate. Approximately how long in years does it take for a parcel of water to transit this circulation pathway?

- W) 1
- X) 10
- Y) 100
- Z) 1000

ANSWER: Z) 1000

TOSS-UP

21) BIOLOGY *Multiple Choice* According to the Hardy-Weinberg Law, from generation to generation, gene frequencies and genotype frequency in a randomly-breeding population are:

- W) Constant
- X) Increasing
- Y) Decreasing
- Z) Variable, depending upon habitat limitations

ANSWER: W) CONSTANT

BONUS

21) BIOLOGY *Multiple Choice* Some transposons in bacteria carry genes for proteins as well as the gene for transposase. These proteins often benefit the bacteria by imparting:

- W) Antibiotic resistance
- X) Growth factors
- Y) Gamete formation
- Z) New organelles

ANSWER: W) ANTIBIOTIC RESISTANCE

TOSS-UP

22) MATH *Multiple Choice* Given two parallel lines in a plane, the set of points that lie in that plane and are equidistant from the given lines forms a:

- W) Point
- X) Segment perpendicular to the lines
- Y) Circle
- Z) Line

ANSWER: Z) LINE

BONUS

22) MATH *Multiple Choice* In a plane, the set of points equidistant from a point and a line form a:

- W) Ellipse
- X) Parabola
- Y) Triangle
- Z) Tip of a cone

ANSWER: X) PARABOLA

TOSS-UP

23) EARTH AND SPACE *Short Answer* Found on Mars, what is the name of the largest volcano in the Solar System?

ANSWER: OLYMPUS MONS

BONUS

23) EARTH AND SPACE *Short Answer* Mars has the largest and deepest canyon system in the Solar System. What is its name?

ANSWER: VALLES MARINERIS

TOSS-UP

24) MATH *Short Answer* A fair 6-sided die is rolled 2 times. As a fraction in lowest terms, what is probability of rolling a 5 both times?

ANSWER: $\frac{1}{36}$

BONUS

24) MATH *Short Answer* The first row in a theatre contains 8 seats. Every other row contains 2 seats more than the one in front of it. How many people can sit in the first 6 rows?

ANSWER: 78

TOSS-UP

25) CHEMISTRY *Short Answer* Determine the oxidation state of each of the elements in the polyatomic ion $\text{C}_2\text{O}_4^{2-}$.

ANSWER: CARBON = 3+; OXYGEN = 2-

BONUS

25) CHEMISTRY *Multiple Choice* Which of the following 1.0 molar solutions will have the largest change in boiling point from that of pure water?

- W) Sodium bromide
- X) Magnesium iodide
- Y) Sucrose
- Z) Potassium phosphate

ANSWER: Z) POTASSIUM PHOSPHATE