

ROUND 2

TOSS-UP

5) CHEMISTRY Multiple Choice Which of the following is false regarding the reaction $A(g) + B(s) \rightarrow C(s)$? (READ IS: A gaseous plus B solid yields C solid)

- W) As pressure decreases, reaction rate decreases
- X) As temperature increases, reaction rate increases
- Y) As surface area increases, reaction rate decreases
- Z) When a catalyst is added, reaction rate increases

ANSWER: Y) AS SURFACE AREA INCREASES, REACTION RATE DECREASES

[NOTE: \rightarrow = YIELDS; (G) = GASEOUS; (S) = SOLID]

BONUS

5) CHEMISTRY Short Answer Calculate the change in energy from a hydrogen atom's ground state to its first excited state in Rydbergs.

ANSWER: $+3/4$

TOSS-UP

6) MATH Short Answer In the three by three matrix, [such that row one

contains negative 2, 2, and 0; row two contains 4, 1, and negative 5; row three contains 8, 3, and 7], which is the

ANSWER:

[x sub 2, 3] element?
5

BONUS

6) MATH Short Answer If the squared length of the diagonal of one face of a cube is 162, what is the surface area in square units of the cube?

ANSWER: 486

TOSS-UP

22) PHYSICS Short Answer What force does a charged particle moving through a magnetic field experience that is perpendicular to the direction the particle is traveling?

ANSWER: LORENTZ (ACCEPT: MAGNETIC FORCE)

BONUS

22) PHYSICS Short Answer What is the mass, in kilograms, of a 2 kilogram rock on a planet with a gravitational acceleration of 8.2 meters per second squared?

ANSWER: 2

TOSS-UP

13) EARTH AND SPACE Multiple Choice Which of the following is true about the sediments found at the farthest edges of an alluvial fan?

- W) They are metal rich
- X) They are relatively fine-grained
- Y) They are the most angular
- Z) They are chemically altered by their unique environment

ANSWER: X) THEY ARE RELATIVELY FINE-GRAINED

BONUS

13) EARTH AND SPACE Short Answer What is observed to reconstruct paleoclimate [pay-lee-oh-kly-mit] information, specifically based on historical concentrations of carbon dioxide gas?

ANSWER: ICE CORES

TOSS-UP

5) MATH Short Answer How many distinct diagonals does a pentagon have?

ANSWER: 5

BONUS

5) MATH Short Answer The polynomial $p(x) = x^4 + 5x^3 - 2x^2 - 24x$ has a zero at $x = 2$. Factor p completely.

ANSWER: $x(x - 2)(x + 3)(x + 4)$

[NOTE: EXPRESSIONS IN ANSWER CAN BE IN ANY ORDER]

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TOSS-UP

8) EARTH AND SPACE Short Answer What type of event marks the end of major geologic eras such as the Paleozoic and Mesozoic?

ANSWER: MASS EXTINCTION (ACCEPT: MAJOR EXTINCTION)

BONUS

8) EARTH AND SPACE Short Answer What seismologic feature led scientists to identify the Earth's liquid outer core?

ANSWER: S-WAVE SHADOW ZONE

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TOSS-UP

12) BIOLOGY Multiple Choice For ions or polar molecules to pass across a plasma membrane in passive transport, the molecules must move in which of the following ways?

W) Down an electrochemical gradient

X) Up an electrochemical gradient

Y) Through a pump

Z) With a chaperone molecule

ANSWER: W) DOWN AN ELECTROCHEMICAL GRADIENT

BONUS

12) BIOLOGY Multiple Choice Symmetry in animal taxonomy describes which of the following?

W) How the animals are related

X) Similarities in anatomy of different species

Y) Patterns of animal behavior

Z) How the parts of an animal are arranged around a point or an axis

ANSWER: X) SIMILARITIES IN ANATOMY OF DIFFERENT SPECIES

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19) MATH Short Answer For what values of x is the function $f(x) = \frac{x^2}{x^2 - 4x + 4}$ [if x equals the fraction with numerator x squared and denominator x squared minus $4x$ plus 4] NOT defined?

ANSWER: 2

BONUS

19) MATH Multiple Choice Which of the following inequalities has NO solutions?

W) $7x + 4 > 3$

X) $|x - 1| > -10$ [the absolute value of the quantity x minus 1 is greater than negative 10]

Y) $|x + 3| < -2$ [the absolute value of the quantity x plus 3 is less than negative 2]

Z) $-100x + 5 \geq 8$

ANSWER: Y) $|x + 3| < -2$

TOSS-UP

20) MATH Short Answer If the height of a cone is equal to the diameter of its base, express the volume of the cone in terms of its radius r and as a fraction in terms of π .

ANSWER: $(2/3)\pi r^3$ (ALSO ACCEPT:: $2\pi r^3/3$)

BONUS

20) MATH Multiple Choice Which of the following is the volume of the solid created by revolving the area bounded by semicircle $y = \sqrt{16 - x^2}$ [y equals the square root of open bracket 16 minus open parenthesis x minus 4 close parenthesis squared close brackets] and the x -axis around the x -axis?

W) 16π

X) $64\pi/3$

Y) 64π

Z) $256\pi/3$

ANSWER: Z) $256\pi/3$

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11) BIOLOGY Multiple Choice Which of the following is necessary for the evolution of pesticide resistance?

W) A population that is highly susceptible to the pesticide

X) An extremely lethal pesticide

Y) Genetic variation in susceptibility to the pesticide

Z) Heterogeneous [het-er-uh-JEE-nee-uhs] application of pesticide

ANSWER: Y) GENETIC VARIATION IN SUSCEPTIBILITY TO THE PESTICIDE

BONUS

11) BIOLOGY Short Answer Order the following three human oxygen-binding proteins from highest to lowest affinity for oxygen: 1) fetal hemoglobin, 2) myoglobin [my-uh-GLOH-bin], 3) maternal hemoglobin.

ANSWER: 2, 1, 3 (ACCEPT: MYOGLOBIN, FETAL HEMOGLOBIN, MATERNAL HEMOGLOBIN)

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4) EARTH AND SPACE Short Answer Mechanical weathering is one type of weathering, what is the other?

ANSWER: CHEMICAL (ALSO ACCEPT BIOLOGICAL)

BONUS

4) EARTH AND SPACE Multiple Choice For the June solstice, which of the following statements is NOT true?

W) The northern hemisphere experiences the day with the longest period of sunlight

X) There are 24 hours of sunlight in the Arctic Circle

Y) Earth is further from the Sun than it is at the winter solstice

Z) The Sun is directly overhead at noon in the Arctic Circle

ANSWER: Z) THE SUN IS DIRECTLY OVERHEAD AT NOON IN THE ARCTIC CIRCLE

TOSS-UP

17) CHEMISTRY Multiple Choice Which of the following is the molarity of a 3.0 liter solution that contains 21 grams of methane?

W) 0.15

X) 0.32

Y) 0.44

Z) 0.56

ANSWER: Y) 0.44

BONUS

17) CHEMISTRY Short Answer Given that the K_a of benzoic acid is 6.4×10^{-5} and its pK_a is 4.2, providing your answer to one decimal place, what is the pH of a solution of 0.1 molar benzoic acid and 0.10 molar sodium benzoate?

ANSWER: 3.2

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AXIS

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ANSWER: 3.2

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23) PHYSICS Multiple Choice A girl runs up one flight of steps. Which of the following factors does NOT affect the work done by the girl against gravity?

W) Her mass

X) Height of the flight of steps

Y) Her speed

Z) Acceleration due to gravity

ANSWER: Y) HER SPEED

BONUS

23) PHYSICS Short Answer What is the efficiency of the body when a cyclist expends 1000 watts of power to deliver mechanical energy to the bicycle at a rate of 100 watts?

ANSWER: 10%

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