

ROUND 10

TOSS-UP

16) MATH Multiple Choice Which of the following numbers is NOT prime?

W) 107

X) 109

Y) 111

Z) 113

ANSWER: Y) 111

BONUS

16) MATH Short Answer Todd the Tortoise is 268 years old, while Sammy the Snail is 32 years old. How many years will it take for Todd's age to be exactly 5 times Sammy's age?

ANSWER: 27

TOSS-UP

8) PHYSICS Multiple Choice Pascal's law governs the actions of forces in which of the following?

W) Gases

X) Solids

Y) Incompressible fluids

Z) A vacuum

ANSWER: Y) INCOMPRESSIBLE FLUIDS

BONUS

8) PHYSICS Short Answer What current, in amperes, is carried in a lightning stroke that lasts 0.5 seconds and transfers 100 coulombs of charge?

ANSWER: 200

TOSS-UP

6) MATH Short Answer What is the limit of $\frac{1}{x}$ as x approaches 0?

ANSWER: 1

BONUS

6) MATH Short Answer Given the equation $9x^2 + 4y^2 + 54x - 8y + 49 = 0$, what kind of shape is its graph, and what are the coordinates of its center?

ANSWER: ELLIPSE, (-3, 1)

TOSS-UP

4) ENERGY Short Answer A commercial scale gas atomizer will soon be developed in order to produce fine powder of what element, known for its strength, light weight, biocompatibility, and resistance to corrosion?

ANSWER: TITANIUM

BONUS

4) ENERGY Short Answer Biodiesel is made through a chemical process called transesterification [trans-uh-ster-uh-fi-KAY-shuhn]. Vegetable oil and methanol react to form biodiesel and what other byproduct?

ANSWER: GLYCERIN (ACCEPT: GLYCEROL)

TOSS-UP

3) CHEMISTRY Multiple Choice Which of the following elements, in its gaseous state, has the greatest electron affinity?

W) Fluorine

X) Bromine

Y) Sulfur

Z) Chlorine

ANSWER: W) FLUORINE

BONUS

3) CHEMISTRY Short Answer What disaccharide [dy-SAK-uh-ryd] is composed of beta-D-galactose [guh-LAK-tos] in a beta-1,4 linkage with alpha-D-glucose?

ANSWER: LACTOSE

TOSS-UP

16) MATH Short Answer If the graph of the function f lies in quadrant IV, then in which quadrant does the graph of the inverse of f lie?

ANSWER: II (ACCEPT: 2 OR SECOND)

BONUS

16) MATH Short Answer What is the period of the function $f(x) = \sin\left(\frac{\pi}{6}x + \frac{\pi}{4}\right)$ [f of x equals the sine of the quantity pi over 6 times x plus pi over 4]?

ANSWER: 12

TOSS-UP

19) BIOLOGY Multiple Choice Which of the following bird species feeds their young crop milk for the first few days after hatching?

W) Pigeons

X) Gulls

Y) Ostriches

Z) Hawks

ANSWER: W) PIGEONS

BONUS

19) BIOLOGY Short Answer What is the common name of one mammal species that is not viviparous [vy-VIP-ayr-uhs]?

ANSWER: DUCK BILLED PLATYPUS OR SPINY ANTEATERS (ACCEPT: ECHIDNAS)

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3) PHYSICS Short Answer A bicycle wheel undergoes constant angular acceleration for time t . Identify all of the following three choices at which the average acceleration equals the instantaneous acceleration: 1) $0.5t$, 2) $0.67t$, 3) $0.707t$.

ANSWER: ALL (ACCEPT 1, 2, 3)

BONUS

3) PHYSICS Short Answer What is the average force in newtons exerted on a 25 gram egg by a bed sheet if the egg hits the sheet at 4 meters per second and takes 0.2 seconds to stop, given acceleration due to gravity as 10 meters per second squared?

ANSWER: 0.5

TOSS-UP

10) ENERGY Multiple Choice Which of the following statements about the mass of atoms in a nuclear fission reaction is true?

W) The mass of the products is less than the original mass

X) The mass of the products is equal to the original mass

Y) There is no change in the original mass

Z) The mass of the products is more than the original mass

ANSWER: W) THE MASS OF THE PRODUCTS IS LESS THAN THE ORIGINAL MASS

BONUS

10) ENERGY Multiple Choice Diesel fuel does not need a spark to ignite like gasoline does.

Diesel can rely on compression to heat the fuel for which of the following reasons?

W) It has a lower molecular weight than gasoline

X) It has a lower flash point than gasoline

Y) It has a lower auto ignition temperature than gasoline

Z) It has a lower spark point than gasoline

ANSWER: Y) IT HAS A LOWER AUTO IGNITION TEMPERATURE THAN GASOLINE

TOSS-UP

19) BIOLOGY Short Answer What is the term for the process in which a reptile sheds its outer layer of skin, or an arthropod [AHR-thruh-pod] or crustacean [kruh-STAY-shuhn] sheds its outer shell?

ANSWER: ECDYSIS (ACCEPT: MOLTING)

BONUS

19) BIOLOGY Short Answer The acronym NAD stands for what phrase?

ANSWER: NICOTINAMIDE ADENINE DINUCLEOTIDE

TOSS-UP

13) BIOLOGY Short Answer Which gas was in short supply in the Earth's atmosphere prior to the evolution of the citric acid cycle?

ANSWER: OXYGEN

BONUS

13) BIOLOGY Multiple Choice Neurons can communicate with each another at synapses via synaptic vesicles. Which of the following does NOT participate in communication at these sites?

W) Neurotransmitter

X) Gated channels

Y) ATP dependent channels

Z) Acetylcholine [uh-seet-l-KOH-leen]

ANSWER: Y) ATP DEPENDENT CHANNELS

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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: if = 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

18) EARTH AND SPACE Multiple Choice Which of the following is true of galaxies that are more distant from us?

- W) They are moving away faster
- X) They are expanding more
- Y) They are generally larger
- Z) They possess more heavy elements

ANSWER: W) THEY ARE MOVING AWAY FASTER

BONUS

18) EARTH AND SPACE Multiple Choice The Sun has already completed nearly one half of its main sequence stage. Which of the following will occur next?

- W) White dwarf
- X) Red giant
- Y) Pulsar
- Z) Neutron star

ANSWER: X) RED GIANT

TOSS-UP

22) MATH Short Answer Give the coordinates of the point where the line $3x + 2y = 18$ intersects the x axis.

ANSWER: (6, 0)

BONUS

22) MATH Multiple Choice A jar contains 50 marbles. Exactly 10% are green, 20% are blue, 30% are yellow, and the rest are orange. Which of the following is the probability of randomly picking first a blue marble, replacing it, and then picking an orange marble?

- W) $\frac{1}{25}$
- X) $\frac{2}{25}$
- Y) $\frac{3}{25}$
- Z) $\frac{4}{25}$

25

ANSWER: X) 2

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24) EARTH AND SPACE Multiple Choice Which of the following clockwise currents brings

warm Caribbean waters into the Gulf of Mexico before joining the Gulf Stream?

W) Caribbean system

X) Loop

Y) North Equatorial

Z) Florida

ANSWER: X) LOOP

BONUS

24) EARTH AND SPACE Multiple Choice Which of the following does NOT describe the asthenosphere?

W) Region of the lower mantle

X) Viscous [VIS-kuhs]

Y) Mechanically weak and ductile

Z) Involved in plate tectonic movements

ANSWER: W) REGION OF THE LOWER MANTLE

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6) ENERGY Short Answer When processing mined uranium ore, it is first crushed to a fine powder and then processed with concentrated acid, alkaline, or peroxide solutions to leach out the uranium. What is the common term for the remaining coarse powder?

ANSWER: YELLOWCAKE (ALSO ACCEPT: URANIA)

BONUS

6) ENERGY Multiple Choice Which of the following metabolites has the most negative standard Gibbs free energy of hydrolysis [hy-DROL-uh-sis]?

W) Phosphocreatine [fohs-foh-KREE-uh-teen]

X) Pyrophosphate [py-roh-FOS-fayt]

Y) Glucose 1-phosphate

Z) Phosphoenolpyruvate [fohs-foh-uh-nol-py-ROO-vayt]

ANSWER: Z) PHOSPHOENOLPYRUVATE

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