

ROUND 7

TOSS-UP

14) EARTH AND SPACE Multiple Choice Which of the following is a term specifically given to water that replenishes an aquifer?

- W) Recharge
- X) Discharge
- Y) Hydraulic
- Z) Permeable

ANSWER: W) RECHARGE

BONUS

14) EARTH AND SPACE Multiple Choice Which of the following is the most commonly accepted theory for the creation of Earth's moon?

- W) The Earth collided with a large proto-planet
- X) The Earth captured a proto-planet due to gravity
- Y) The Earth rotated too fast and spun off a large piece
- Z) The Earth and the Moon condensed together

ANSWER: W) THE EARTH COLLIDED WITH A LARGE PROTO-PLANET

TOSS-UP

6) MATH Multiple Choice A certain radioactive element decays over time according to the equation $y = R \cdot \left(\frac{1}{2}\right)^{\frac{x}{300}}$, where R equals the number of grams that were present initially and x equals time in years. If 1000 grams were present initially, how many grams will remain after 900 years?

- W) 62.5
- X) 125
- Y) 250
- Z) 500

ANSWER: X) 125

BONUS

6) MATH Short Answer If $-4x - 9y - 3z = -10$ and $-5a - 9b = -6$, then what is $-9b - 15z - 45y - 20x - 5a$?

ANSWER: -56

TOSS-UP

22) EARTH AND SPACE Multiple Choice Which of the following is NOT evidence that liquid water was once present on Mars?

- W) Large flood channels
- X) Sedimentary layering
- Y) Sand dunes
- Z) Eroded craters

ANSWER: Y) SAND DUNES

BONUS

22) EARTH AND SPACE Short Answer What is the typical adjective used to describe a volcano that is not currently erupting but is considered likely to do so in the future?

ANSWER: DORMANT

TOSS-UP

9) CHEMISTRY Multiple Choice Which of the following represents the enthalpy [EN-thal-pee] change that occurs to melt a solid at its melting point?

W) Heat of fusion

X) Heat of hydration

Y) Heat of liquidation

Z) Heat of vaporization

ANSWER: W) HEAT OF FUSION

BONUS

9) CHEMISTRY Short Answer A gaseous mixture of nitrogen, oxygen, and argon have molar fractions of 0.25, 0.65, and .010, respectively. What is the pressure in atmospheres of nitrogen if the total pressure of the mixture is 4.0 atmospheres?

ANSWER: 1.0

TOSS-UP

13) BIOLOGY Multiple Choice Which of the following best describes blood?

W) It is a specialized type of cell found in blood vessels

X) It is a type of cell formed in the bone marrow

Y) It is a kind of connective tissue in which red and white blood cells are suspended in plasma

Z) It is a kind of epithelial tissue [ep-uh-THÉE-lee-al]

ANSWER: Y) IT IS A KIND OF CONNECTIVE TISSUE IN WHICH RED AND WHITE BLOOD CELLS ARE SUSPENDED IN PLASMA

BONUS

13) BIOLOGY Short Answer Valproic acid and trapoxin are inhibitors of what class of enzymes that regulate gene expression by altering chromatin accessibility?

ANSWER: HDAC (ACCEPT: HISTONE DEACETYLASES; DO NOT ACCEPT: HAT)

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TOSS-UP

1) MATH Short Answer What is the degree of the polynomial: $(x - 3)^3(x - 7)^4$ [open parenthesis x minus 3 close parenthesis cubed times open parenthesis x minus 7 close parenthesis to the power of 4]?

ANSWER: 7

BONUS

1) MATH Multiple Choice If x is an angle such that $\tan(x) = 5/12$ and $0 < x < \pi/2$, then $\sec(x)$ [secant of x] is equal to which of the following?

W) $-13/12$

X) $-13/5$

Y) $13/5$

Z) $13/12$

ANSWER: W) $-13/12$

TOSS-UP

24) CHEMISTRY Short Answer In the balanced equation $2\text{Ag}^+ + \text{Cu}$ [yields]

$2\text{Ag} + \text{Cu}^{2+}$,

what is the reducing agent?

ANSWER: COPPER (DO NOT ACCEPT: COPPER 2+)

BONUS

24) CHEMISTRY Multiple Choice Converting carbon dioxide to carbon monoxide through reduction would be effective method for reducing harmful levels of atmospheric carbon dioxide. However, this conversion is very difficult for which of the following reasons?

W) There is a limited supply of rhenium in the world

X) Not all steps of the reduction have been completely determined

Y) The final step takes an extremely long time

Z) The carbon dioxide is too difficult to harness

ANSWER: W) THERE IS A LIMITED SUPPLY OF RHENIUM IN THE WORLD

TOSS-UP

10) MATH Short Answer Providing your answer to one decimal place, find the value of the $63!$

following fraction:

[the numerator is 63 factorial; the

denominator is 62 factorial times 3

$62!3!$

factorial].

ANSWER: 10.5

BONUS

10) MATH Short Answer Name all of the quadrants that contain solutions of the inequality $2x - y > 4$.

ANSWER: I, III, IV (ACCEPT: 1, 3, 4 or FIRST, THIRD, FOURTH)

TOSS-UP

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ANSWER: 7

BONUS

1) MATH Multiple Choice If x is an angle such that $\tan(x) = 5/12$ and $0^\circ < x < 90^\circ/2$, then $\sec(x)$ [secant of x] is equal to which of the following?

W) $-13/12$

X) $-13/5$

Y) $13/5$

Z) $13/12$

ANSWER: W) $-13/12$

TOSS-UP

5) BIOLOGY Short Answer What is the term for the hypothesized process by which eukaryotes [yoo-KAR-ee-ohts] evolved a photosynthetic [foh-tuh-SIN-thuh-tik] organelle?

ANSWER: ENDOSYMBIOSIS

BONUS

5) BIOLOGY Multiple Choice Which of the following is NOT an example of energy coupling?

W) An ion releases energy as it travels through an ion channel down its concentration gradient

X) A kinase hydrolyzes ATP for energy to catalyze a reaction

Y) A transport molecule uses energy from one molecule going down its concentration gradient to power transport of another molecule up its gradient

Z) As protons move down their concentration gradient, ATP synthase gathers energy to catalyze the synthesis of ATP

ANSWER: W) AN ION RELEASES ENERGY AS IT TRAVELS THROUGH AN ION CHANNEL DOWN ITS CONCENTRATION GRADIENT

TOSS-UP

17) PHYSICS Multiple Choice As a photon travels from water to air, which of the following quantities changes?

- W) Frequency
- X) Wavelength
- Y) Energy
- Z) Phase

ANSWER: X) WAVELENGTH

BONUS

17) PHYSICS Multiple Choice A starship is heading towards Earth at $0.7c$. To begin slowing down, it enables a forward thruster that emits fuel at $0.8c$ in the direction of Earth. Relative to Earth, which of the following is the approximate speed of the fuel?

- W) $0.8c$
- X) $0.96c$
- Y) $0.99c$
- Z) $1.5c$

ANSWER: X) $0.96c$

TOSS-UP

17) PHYSICS Short Answer A person standing on a scaffold lowers an object with a weight of 250 newtons by means of a rope, at constant speed. If the weight of the rope is negligible, what is the force in newtons that the person exerts on the rope?

ANSWER: 250

BONUS

17) PHYSICS Short Answer Relative to the ground, how many joules of potential energy does a 1000 newton boulder have at the top of a 5 meter ledge, relative to the bottom of the ledge and given g as 10 meters per second squared?

ANSWER: 5000

TOSS-UP

2) EARTH AND SPACE Multiple Choice Which of the following minerals is NOT typically found in the rock granite?

- W) Olivine
- X) Plagioclase [PLAY-jee-uh-kays]
- Y) Quartz
- Z) Hornblende

ANSWER: W) OLIVINE

BONUS

2) EARTH AND SPACE Multiple Choice If two black holes orbit one another at a distance of a few Schwarzschild radii [RAY-dee-eye], their orbits will slowly shrink until they merge. By which of the following processes does this occur?

- W) Dynamic friction
- X) Gravitational radiation
- Y) Third-body interactions

Z) Drag from the accretion disks

ANSWER: X) GRAVITATIONAL RADIATION

TOSS-UP

20) MATH Short Answer In terms of a, b, c, and d, what is the slope of the line $3x + 2by = cd$?

ANSWER: $-\frac{3}{2b}$

BONUS

20) MATH Multiple Choice Which of the following points lies in the solution set for the system of two inequalities: $2y - x \geq -6$ and $2y - 3x < -6$?

W) (-4, -1)

X) (3, 1)

Y) (0, -3)

Z) (4, 3)

ANSWER: X) (3, 1)

TOSS-UP

21) BIOLOGY Short Answer What biome is characterized by dense evergreen shrubs and small trees, usually in the Mediterranean region of the world?

ANSWER: CHAPARRAL (ACCEPT SHRUBLANDS, SCRUB, BRUSH)

BONUS

21) BIOLOGY Multiple Choice Which of the following processes is MOST under the influence of prolactin?

W) Growth and maturation of the uterine lining [YOO-ter-in]

X) Lactation

Y) Follicular maturation in the ovaries

Z) Stimulation of uterine contractions

ANSWER: X) LACTATION

TOSS-UP

1) BIOLOGY Short Answer What is the common name of the group of marine spiny-finned fish of the order Heterosomata, all of which, when adult, swim along the sea floor on one side of the body, which is highly compressed and has both eyes on the uppermost side?

ANSWER: FLATFISH

BONUS

1) BIOLOGY Multiple Choice Which of the following statements is NOT true about otters?

W) Newborn otters are taken care of by their fathers only

X) Their dens are called holts or couches

Y) They feed on fish, shellfish, amphibians and birds

Z) A male otter is called a dog

ANSWER: W) NEWBORN OTTERS ARE TAKEN CARE OF BY THEIR FATHERS ONLY

TOSS-UP

17) PHYSICS Multiple Choice Which of the following products has the same units as power?

W) Work and time

X) Force and distance

Y) Force and velocity

Z) Force and acceleration

ANSWER: Y) FORCE AND VELOCITY

BONUS

17) PHYSICS Short Answer When turned on, a ceiling fan reaches 100 revolutions per minute in 30 seconds. When turned off, it coasts to a stop in 60 seconds. What is the ratio of the average angular acceleration in the first 30 seconds after it was turned on to that observed after it was turned off?

ANSWER: -2 (ACCEPT: -2 TO 1)

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20) ENERGY Short Answer What energy barrier must a chemical reaction pass in order to proceed?

ANSWER: ACTIVATION ENERGY

BONUS

20) ENERGY Short Answer One proposed geoengineering mechanism that could be used to mitigate increased atmospheric carbon dioxide levels is called iron seeding and involves spreading large quantities of iron over the surface of the ocean. What is the name of the organism that would grow as a result, leading to carbon sequestration [see-kwes-TRAY-shuhn]?

ANSWER: PLANKTON (ACCEPT: PHYTOPLANKTON)

TOSS-UP

12) EARTH AND SPACE Short Answer What is the boundary between the troposphere and the stratosphere called?

ANSWER: TROPOPAUSE

BONUS

12) EARTH AND SPACE Multiple Choice Which of the following stellar reactions releases the most energy?

W) Hydrogen to helium

X) Helium to oxygen

Y) Oxygen to silicon

Z) Silicon to iron

ANSWER: W) HYDROGEN TO HELIUM

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10) MATH Short Answer Name all of the quadrants that contain solutions of the inequality

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ANSWER: I, III, IV (ACCEPT: 1, 3, 4 or FIRST, THIRD, FOURTH)

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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: \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: $+3/4$