ROUND 9

TOSS-UP

20) EARTH AND SPACE Multiple Choice Given the current climatic conditions on Earth, at which of the following locations would a glacier most likely form?

W) 0Â° latitude at an elevation of 6,000 meters

X) 15Â° N latitude at an elevation of 4,000 meters

Y) 30Â° N latitude at an elevation of 3,000 meters

Z) 45Â° N latitude at an elevation of 1,000 meters

ANSWER: W) 0Â° LATITUDE AT AN ELEVATION OF 6,000 METERS

BONUS

20) EARTH AND SPACE Multiple Choice The analysis of which of the following fossil types from ancient vertebrates provides important information about the diet and biota of ancient environments?

W) Tracks

X) Coprolite

Y) Burrows

Z) Fulgurite [FUHL-gyuh-ryt]

ANSWER: X) COPROLITE

TOSS-UP

12) EARTH AND SPACE Multiple Choice Which of the following processes leads directly to the formation of topsoil and subsoil in the A and B horizons?

W) Erosion and deposition

X) Erosion and leaching

Y) Weathering and leaching

Z) Weathering and deposition

ANSWER: Y) WEATHERING AND LEACHING

BONUS

12) EARTH AND SPACE Short Answer Taking the value of the Hubble constant to be 75 kilometers per second per megaparsec, if a galaxy is observed with a recessional velocity of 50 kilometers per second, what is its distance, in kiloparsecs, to two significant figures?

ANSWER: 670

TOSS-UP

17) PHYSICS Multiple Choice When a tennis racket hits a tennis ball, how do the forces on each object compare?

W) The force on the tennis ball has a greater magnitude than the force on the racket

X) The force on the racket has a greater magnitude than the force on the ball

Y) The magnitude of the force on each object is the same

Z) The forces depend on the level of impact

ANSWER: Y) THE MAGNITUDE OF THE FORCE ON EACH OBJECT IS THE SAME

BONUS

17) PHYSICS Short Answer A wave with a frequency of 40 hertz has a wavelength of 2.5

meters. What is the phase velocity in meters per second?
ANSWER: 100

TOSS-UP
14) ENERGY Multiple Choice Which of the following is typically increased in order for electricity to travel long distances through transmission lines?
W) Voltage
X) Amperage
Y) Wattage
Z) Current
ANSWER: W) VOLTAGE
BONUS
14) ENERGY Short Answer What type of semi-conducting junction is essential to the functioning of a solar cell?
ANSWER: P-N JUNCTION (ACCEPT: P-N)

TOSS-UP
23) PHYSICS Short Answer What is the efficiency of an ideal Carnot engine operating between temperature reservoirs of 27Âº Celsius and 227Âº Celsius?
ANSWER: 40%
BONUS
23) PHYSICS Short Answer A parachutist lands on the ground at a speed of 6 meters per second. Providing your answer to the nearest tenth and given acceleration due to gravity as 10 meters per second squared, what is the height in meters from which a free-falling object would have to fall to reach the same speed?
ANSWER: 1.8

TOSS-UP
12) EARTH AND SPACE Multiple Choice Which of the following processes leads directly to the formation of topsoil and subsoil in the A and B horizons?
W) Erosion and deposition
X) Erosion and leaching
Y) Weathering and leaching
Z) Weathering and deposition
ANSWER: Y) WEATHERING AND LEACHING
BONUS
12) EARTH AND SPACE Short Answer Taking the value of the Hubble constant to be 75 kilometers per second per megaparsec, if a galaxy is observed with a recessional velocity of 50 kilometers per second, what is its distance, in kiloparsecs, to two significant figures?
ANSWER: 670

TOSS-UP
1) EARTH AND SPACE Short Answer What element is produced in a fusion of hydrogen

within a star?
ANSWER: HELIUM
BONUS
1) EARTH AND SPACE Multiple Choice Which of the following statements best explains how conglomerates differ from breccias [BRECH-ee-uhs]?
W) Conglomerates are comprised of interlocking crystals rather than sediments
X) Breccias are comprised of less mature sediments
Y) Conglomerates are formed at higher elevations
Z) Breccias are formed through metamorphic processes
ANSWER: X) BRECCIAS ARE COMPRISED OF LESS MATURE SEDIMENTS

TOSS-UP
24) MATH Multiple Choice The lines y = (a - 5)x + 5 [y equals open parentheses a minus 5 close parentheses x plus 5] and y = -2x + 7 are perpendicular if a equals which of the following?
W) -2/9
X) 9/2
Y) 5
Z) 11/2
ANSWER: Z) 11/2
BONUS
24) MATH Short Answer For a function f(x), suppose that you know that f(-1) = -2 and that f(3) = 2. What would you need to know about f in order to invoke the Intermediate Value Theorem to conclude that there is at least one zero of f on [-1, 3] [the closed interval from negative 1 to 3]?
ANSWER: f IS CONTINUOUS ON [-1, 3] (ACCEPT: F IS CONTINOUS ON THE INTERVAL)

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
20) EARTH AND SPACE Multiple Choice Given the current climatic conditions on Earth, at

which of the following locations would a glacier most likely form?
W) 0Â° latitude at an elevation of 6,000 meters
X) 15Â° N latitude at an elevation of 4,000 meters
Y) 30Â° N latitude at an elevation of 3,000 meters
Z) 45Â° N latitude at an elevation of 1,000 meters
ANSWER: W) 0Â° LATITUDE AT AN ELEVATION OF 6,000 METERS
BONUS
20) EARTH AND SPACE Multiple Choice The analysis of which of the following fossil types from ancient vertebrates provides important information about the diet and biota of ancient environments?
W) Tracks
X) Coprolite
Y) Burrows
Z) Fulgurite [FUHL-gyuh-ryt]
ANSWER: X) COPROLITE

TOSS-UP
11) BIOLOGY Multiple Choice The proboscis [proh-BOS-kis] is used primarily by invertebrates to perform which of the following functions?
W) Egg fertilization
X) Excavation
Y) Feeding
Z) Defense
ANSWER: Y) FEEDING
BONUS
11) BIOLOGY Multiple Choice Which of the following pollinators is a member of the order Lepidoptera [lep-i-DOP-ter-uh]?
W) Lesser long-nosed bats
X) Fritillary butterflies [FRIT-l-er-ee]
Y) Green bottle flies
Z) Blue orchard bees
ANSWER: X) FRITILLARY BUTTERFLIES

TOSS-UP
12) EARTH AND SPACE Multiple Choice Which of the following processes leads directly to the formation of topsoil and subsoil in the A and B horizons?
W) Erosion and deposition
X) Erosion and leaching
Y) Weathering and leaching
Z) Weathering and deposition
ANSWER: Y) WEATHERING AND LEACHING
BONUS
12) EARTH AND SPACE Short Answer Taking the value of the Hubble constant to be 75

kilometers per second per megaparsec, if a galaxy is observed with a recessional velocity of 50 kilometers per second, what is its distance, in kiloparsecs, to two significant figures?
ANSWER: 670

TOSS-UP
24) MATH Multiple Choice The lines y = (a - 5)x + 5 [y equals open parentheses a minus 5 close parentheses x plus 5] and y = -2x + 7 are perpendicular if a equals which of the following?
W) -2/9
X) 9/2
Y) 5
Z) 11/2
ANSWER: Z) 11/2
BONUS
24) MATH Short Answer For a function f(x), suppose that you know that f(-1) = -2 and that f(3) = 2. What would you need to know about f in order to invoke the Intermediate Value Theorem to conclude that there is at least one zero of f on [-1, 3] [the closed interval from negative 1 to 3]?
ANSWER: f IS CONTINUOUS ON [-1, 3] (ACCEPT: F IS CONTINOUS ON THE INTERVAL)

TOSS-UP
18) EARTH AND SPACE Multiple Choice Which of the following types of smog in the boundary layer of the atmosphere contains sulfur dioxide?
W) Oxidizing
X) Photochemical
Y) Reducing
Z) Boundary layer
ANSWER: Y) REDUCING
BONUS
18) EARTH AND SPACE Multiple Choice Glacial striations indicate which of the following?
W) The absolute age of a glacial event
X) The direction of glacial advancement
Y) The direction of glacial retreat
Z) The thickness of the glacier
ANSWER: X) THE DIRECTION OF GLACIAL ADVANCEMENT

TOSS-UP
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W) Erosion and deposition
X) Erosion and leaching
Y) Weathering and leaching
Z) Weathering and deposition

ANSWER: Y) WEATHERING AND LEACHING
BONUS
12) EARTH AND SPACE Short Answer Taking the value of the Hubble constant to be 75 kilometers per second per megaparsec, if a galaxy is observed with a recessional velocity of 50 kilometers per second, what is its distance, in kiloparsecs, to two significant figures?
ANSWER: 670

TOSS-UP
7) MATH Short Answer Given that g(Ý") â‰¤ f (Ý") â‰¤ h(Ý") for all x, the limà¯«â†'a Ýƒ(Ý") = M [limit as x approaches a of g of x is M], and the limà¯«â†'a â„Ž(Ý") = M [limit as x approaches a of h of x is M], what is the limà¯«â†'a Ý‚(Ý") [limit as x approaches a of f of x]?
ANSWER: M
BONUS
7) MATH Short Answer What is the largest possible real domain of f(x) = ln(3x - 1) [f of x equals the natural log of the quantity 3x minus 1]?
ANSWER: x > 1/3 (ACCEPT: THE OPEN INTERVAL FROM 1/3 TO (POSITIVE) INFINITY)

TOSS-UP
24) MATH Multiple Choice The lines y = (a - 5)x + 5 [y equals open parentheses a minus 5 close parentheses x plus 5] and y = -2x + 7 are perpendicular if a equals which of the following?
W) -2/9
X) 9/2
Y) 5
Z) 11/2
ANSWER: Z) 11/2
BONUS
24) MATH Short Answer For a function f(x), suppose that you know that f(-1) = -2 and that f(3) = 2. What would you need to know about f in order to invoke the Intermediate Value Theorem to conclude that there is at least one zero of f on [-1, 3] [the closed interval from negative 1 to 3]?
ANSWER: f IS CONTINUOUS ON [-1, 3] (ACCEPT: F IS CONTINOUS ON THE INTERVAL)

TOSS-UP
6) ENERGY Short Answer What is the term for a device used to determine or measure the presence of electrostatic charges?
ANSWER: ELECTROSCOPE
BONUS
6) ENERGY Short Answer What is the efficiency of an appliance whose useful energy output is 5 joules and wasted energy is 20 joules?
ANSWER: 20%

TOSS-UP
12) EARTH AND SPACE Multiple Choice Which of the following processes leads directly to the formation of topsoil and subsoil in the A and B horizons?
W) Erosion and deposition
X) Erosion and leaching
Y) Weathering and leaching
Z) Weathering and deposition
ANSWER: Y) WEATHERING AND LEACHING
BONUS
12) EARTH AND SPACE Short Answer Taking the value of the Hubble constant to be 75 kilometers per second per megaparsec, if a galaxy is observed with a recessional velocity of 50 kilometers per second, what is its distance, in kiloparsecs, to two significant figures?
ANSWER: 670

TOSS-UP
14) BIOLOGY Multiple Choice Which of the following pairs are the most likely hydrogen-bonding partners?
W) Water and ammonia
X) Water and estrogen
Y) Water and carbonate
Z) Water and methane
ANSWER: W) WATER AND AMMONIA
BONUS
14) BIOLOGY Short Answer Name the structure to which the following terms refer: stylate [STY-layt], lamellate [luh-MEL-ayt], filiform [FIL-uh-fohrm], clavate [KLAY-vayt] and plumose [PLOO-mohs].
ANSWER: ANTENNA

TOSS-UP
15) CHEMISTRY Multiple Choice Which of the following carbohydrates will most easily dissolve in water?
W) Glycogen [GLY-kuh-juhn]
X) Starch
Y) Maltose [MOHL-tohs]
Z) Cellulose
ANSWER: Y) MALTOSE
BONUS
15) CHEMISTRY Short Answer What adjective describes a mixture that has equal amounts of left- and right-handed enantiomers [i-NAN-tee-uh-mers] of a chiral [KY-ruhl] molecule?
ANSWER: RACEMIC (ACCEPT: RACEMATES)

TOSS-UP
16) MATH Multiple Choice If the surface area of a cube is 96 square units, which of the

following is the length of a diagonal of a face of the cube?
W) 4
X) 4âˆš2
Y) 4âˆš3
Z) 16âˆš2
ANSWER: X) 4âˆš2
BONUS
16) MATH Short Answer Determine the largest possible real domain of y = âˆšà¯«âˆ’1 âˆšà¯«2âˆ’ 1 [y equals
the fraction with numerator the square root of the quantity x minus 1 and denominator
the square root of the quantity x squared minus 1].
ANSWER: x > 1

TOSS-UP
17) PHYSICS Multiple Choice Tripling the power output from a speaker emitting a single tone will result in an increase in sound intensity in decibels that is closest to which of the following?
W) 0.3
X) 2
Y) 4
Z) 5
ANSWER: Z) 5
BONUS
17) PHYSICS Short Answer When subjected to a potential difference of 100 volts, a parallel-plate capacitor builds up a charge on one plate of 0.2 coulombs. Providing your answer to the nearest thousandth, what is this capacitor's capacitance in farads?
ANSWER: 0.002

TOSS-UP
12) ENERGY Multiple Choice Which of the following power types demonstrates large scale temporary storage of energy?
W) Coal
X) Chemical
Y) Hydroelectric
Z) Wind
ANSWER: Y) HYDROELECTRIC
BONUS
12) ENERGY Short Answer The insides of vacuum chambers are frequently mirrored; what form of heat transfer does this prevent?
ANSWER: RADIATIVE (ALSO ACCEPT RADIATION OR THERMAL RADIATION)

TOSS-UP
2) PHYSICS Multiple Choice Which of the following best describes why arches and domes are more stable than flat roofed structures?

W) They transmit compressive forces along their length to the ground, uniformly bearing the load of gravity upon the structure
X) Each section is under great tension, using the stronger dimension of the components
Y) Torsional resistance to sideways swaying ensures that such structures are stable, even in high winds
Z) The surface tension of the arched shape allows the building components to be hollowed out, saving weight
ANSWER: W) THEY TRANSMIT COMPRESSIVE FORCES ALONG THEIR LENGTH TO THE BONUS
2) PHYSICS Short Answer Given a piece of glass with an index refraction of 2, what is the optimal index of refraction, to one decimal place, for an antireflection coating?
ANSWER: 1.4