

ROUND 6

TOSS-UP

19) CHEMISTRY Short Answer How many modes of vibration would a non-linear molecule with 9 atoms exhibit?

ANSWER: 21

BONUS

19) CHEMISTRY Short Answer When an acid is added to any metal carbonate, such as barium carbonate, what gas is always formed?

ANSWER: CARBON DIOXIDE (ACCEPT: CO₂)

TOSS-UP

13) BIOLOGY Multiple Choice Which of the following organ systems is responsible for the secretion of hormones?

W) Endocrine

X) Reproductive

Y) Circulatory

Z) Immune

ANSWER: W) ENDOCRINE

BONUS

13) BIOLOGY Short Answer In an area originally devoid of life, what is the name for the first community to become established?

ANSWER: PIONEER (DO NOT ACCEPT: FOUNDER)

TOSS-UP

7) BIOLOGY Multiple Choice Which of the following is true of enzymes?

W) They increase the activation energy of metabolic reactions

X) They have active sites that bind to specific substrate molecules

Y) They are made of chitin [KY-tin] protein

Z) They generally act on a variety of substrate molecules

ANSWER: X) THEY HAVE ACTIVE SITES THAT BIND TO SPECIFIC SUBSTRATE MOLECULES

BONUS

7) BIOLOGY Multiple Choice Which of the following branches of science deals with study of the life and phenomena of inland standing waters, especially lakes and ponds?

W) Limnology [lim-NOL-uh-jee]

X) Hydrology

Y) Ichthyology [ik-thee-OL-uh-jee]

Z) Ecology

ANSWER: W) LIMNOLOGY

TOSS-UP

8) ENERGY Multiple Choice Which of the following terms would be used as a synonym for a building described with the term LEED?

W) Lead contaminated

X) Green

Y) Renewed

Z) Sanitized

ANSWER: X) GREEN

BONUS

8) ENERGY Short Answer What is the term for the liquid or gas discharged after processing activities, such as in sewage treatment plants?

ANSWER: EFFLUENT

TOSS-UP

6) EARTH AND SPACE Short Answer What do scientists call the process by which trade winds in the Pacific weaken, allowing warmer water to move toward the west coast of South America?

ANSWER: EL NINO (ACCEPT: EL NINO SOUTHERN OSCILLATION OR ENSO)

BONUS

6) EARTH AND SPACE Multiple Choice Which of the following surfaces has the highest albedo?

W) Fresh snow cover

X) Metallic roof on a skyscraper

Y) Grass

Z) Asphalt

ANSWER: W) FRESH SNOW COVER

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 $f(x) = \sin\left(\frac{\pi}{6}x + \frac{\pi}{4}\right)$ [if $\sin x$ equals the sine of the quantity π over 6 times x plus π over 4]?

ANSWER: 12

TOSS-UP

20) ENERGY Short Answer What is the term for power that is consumed by electronics when they are not in use?

ANSWER: STANDBY POWER (ACCEPT: VAMPIRE POWER, VAMPIRE DRAW, PHANTOM LOAD, PHANTOM POWER, or LEAKING ELECTRICITY)

BONUS

20) ENERGY Multiple Choice Which of the following statements is NOT true about electronic tattoos?

W) They are flexible electronic circuits, thinner than a human hair

X) They stay on the skin through the adhesion forces between the atoms of the tattoo and the

atoms of the skin

Y) They are powered by the individualâ€™s movements

Z) The circuitâ€™s filamentary serpentine shape allows them to bend, twist, scrunch and stretch while maintaining functionality

ANSWER: Y) THEY ARE POWERED BY THE INDIVIDUALâ€™S MOVEMENTS

TOSS-UP

4) ENERGY Multiple Choice In 1859, drilling first began in the U.S. for which of the following energy resources?

W) Coal

X) Oil

Y) Natural gas

Z) Geothermal energy

ANSWER: X) OIL

BONUS

4) ENERGY Short Answer In what kind of electrochemical cell would copper and zinc plates be lowered into a sulfuric acid solution in order to generate an electric current?

ANSWER: VOLTAIC (ACCEPT: GALVANIC; DO NOT ACCEPT BATTERY)

TOSS-UP

4) ENERGY Multiple Choice In 1859, drilling first began in the U.S. for which of the following energy resources?

W) Coal

X) Oil

Y) Natural gas

Z) Geothermal energy

ANSWER: X) OIL

BONUS

4) ENERGY Short Answer In what kind of electrochemical cell would copper and zinc plates be lowered into a sulfuric acid solution in order to generate an electric current?

ANSWER: VOLTAIC (ACCEPT: GALVANIC; DO NOT ACCEPT BATTERY)

TOSS-UP

19) BIOLOGY Short Answer Damage to which human brain region results in anomalous circadian [uh-NOM-uh-luhs sur-kay-dee-uhn] rhythms?

ANSWER: HYPOTHALAMUS

BONUS

19) BIOLOGY Multiple Choice Which of the following is true regarding osmoregulation in a freshwater fish?

W) Osmotic water loss occurs over body surface and via gills

X) Nitrogenous wastes are excreted primarily in the form of uric acid

Y) Copious amount of urine hypotonic to the blood is excreted

Z) Excess salt is excreted from gills

ANSWER: Y) COPIOUS AMOUNT OF URINE HYPOTONIC TO THE BLOOD IS EXCRETED

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

6) EARTH AND SPACE Multiple Choice Which of the following mineral properties is most reliable for identification?

W) Color

X) Density

Y) Cleavage

Z) Luster

ANSWER: Y) CLEAVAGE

BONUS

6) EARTH AND SPACE Short Answer In what wavelengths of electromagnetic radiation do greenhouse gases absorb and reradiate energy back to Earth's surface?

ANSWER: INFRARED (ACCEPT: IR)

TOSS-UP

13) BIOLOGY Multiple Choice Which of the following organ systems is responsible for the secretion of hormones?

W) Endocrine

X) Reproductive

Y) Circulatory

Z) Immune

ANSWER: W) ENDOCRINE

BONUS

13) BIOLOGY Short Answer In an area originally devoid of life, what is the name for the first community to become established?

ANSWER: PIONEER (DO NOT ACCEPT: FOUNDER)

TOSS-UP

7) BIOLOGY Multiple Choice Which of the following is true of enzymes?

W) They increase the activation energy of metabolic reactions

X) They have active sites that bind to specific substrate molecules

Y) They are made of chitin [KY-tin] protein

Z) They generally act on a variety of substrate molecules

ANSWER: X) THEY HAVE ACTIVE SITES THAT BIND TO SPECIFIC SUBSTRATE MOLECULES

BONUS

7) BIOLOGY Multiple Choice Which of the following branches of science deals with study of the life and phenomena of inland standing waters, especially lakes and ponds?

W) Limnology [lim-NOL-uh-jee]

X) Hydrology

Y) Ichthyology [ik-thee-OL-uh-jee]

Z) Ecology

ANSWER: W) LIMNOLOGY

TOSS-UP

10) MATH Short Answer If the exterior angle of a base angle of an isosceles [eye-SOS-uh-lees] triangle measures 141° , what is the measure of the vertex angle?

ANSWER: 102°

BONUS

10) MATH Short Answer If $f(x) = -2x - e^x$ [f of x equals negative 2x minus e to the x], what is the range of $f'(x)$ [the derivative of f]?

ANSWER: $(-\infty, -2)$ (ACCEPT: $x < -2$ or THE OPEN INTERVAL FROM NEGATIVE INFINITY TO -2)

TOSS-UP

19) BIOLOGY Short Answer Damage to which human brain region results in anomalous circadian [uh-NOM-uh-luhs sur-kay-dee-uhn] rhythms?

ANSWER: HYPOTHALAMUS

BONUS

19) BIOLOGY Multiple Choice Which of the following is true regarding osmoregulation in a freshwater fish?

W) Osmotic water loss occurs over body surface and via gills

X) Nitrogenous wastes are excreted primarily in the form of uric acid

Y) Copious amount of urine hypotonic to the blood is excreted

Z) Excess salt is excreted from gills

ANSWER: Y) COPIOUS AMOUNT OF URINE HYPOTONIC TO THE BLOOD IS EXCRETED

TOSS-UP

7) MATH Short Answer Given that $g(x) \leq f(x) \leq h(x)$ for all x , the $\lim_{x \rightarrow a} f(x) = M$ [limit as x

approaches a of g of x is M], and the $\lim_{x \rightarrow a} f(x) = M$ [limit as x approaches a of f of x is M], what is the $\lim_{x \rightarrow a} f(g(x))$ [limit as x approaches a of f of g 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

4) ENERGY Multiple Choice In 1859, drilling first began in the U.S. for which of the following energy resources?

W) Coal

X) Oil

Y) Natural gas

Z) Geothermal energy

ANSWER: X) OIL

BONUS

4) ENERGY Short Answer In what kind of electrochemical cell would copper and zinc plates be lowered into a sulfuric acid solution in order to generate an electric current?

ANSWER: VOLTAIC (ACCEPT: GALVANIC; DO NOT ACCEPT BATTERY)

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

20) MATH Short Answer Convert 420 degrees to radians as an improper fraction in terms of pi.

ANSWER: $7/3$

BONUS

20) MATH Short Answer The midpoint of segment AB is (1.5, -3). The coordinates of point A are (7, -5); what are the coordinates of point B?

ANSWER: (-4, -1)

TOSS-UP

4) ENERGY Multiple Choice In 1859, drilling first began in the U.S. for which of the following energy resources?

W) Coal

X) Oil

Y) Natural gas

Z) Geothermal energy

ANSWER: X) OIL

BONUS

4) ENERGY Short Answer In what kind of electrochemical cell would copper and zinc plates be lowered into a sulfuric acid solution in order to generate an electric current?

ANSWER: VOLTAIC (ACCEPT: GALVANIC; DO NOT ACCEPT BATTERY)

TOSS-UP

4) EARTH AND SPACE Multiple Choice Which of the following is the rate at which atmospheric gases and particles are moved across a surface?

W) Vertical dispersion

X) Turbulence

Y) Flux

Z) Stratospheric transport

ANSWER: Y) FLUX

BONUS

4) EARTH AND SPACE Multiple Choice Which of the following is true of sandstone formed from a long-term paleodesert?

W) It would exhibit clearly graded bedding

X) It would have preserved ripples but not dunes

Y) It would appear black due to the dark iron-rich minerals present

Z) It would contain well rounded grains and have high quartz content

CONTENT

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

TOSS-UP

4) EARTH AND SPACE Multiple Choice Which of the following is the rate at which atmospheric gases and particles are moved across a surface?

W) Vertical dispersion

X) Turbulence

Y) Flux

Z) Stratospheric transport

ANSWER: Y) FLUX

BONUS

4) EARTH AND SPACE Multiple Choice Which of the following is true of sandstone formed from a long-term paleodesert?

W) It would exhibit clearly graded bedding

X) It would have preserved ripples but not dunes

Y) It would appear black due to the dark iron-rich minerals present

Z) It would contain well rounded grains and have high quartz content

CONTENT

TOSS-UP

5) PHYSICS Multiple Choice The acceleration of an object that is in free fall in a vacuum is which of the following?

W) Proportional to the mass of the object

X) Proportional to the inverse of the mass of the object

Y) Independent of the mass of the object

Z) Equal to the product of force and mass

ANSWER: Y) INDEPENDENT OF THE MASS OF THE OBJECT

BONUS

5) PHYSICS Short Answer What is the name of the phenomenon that explains why the surface of water might look like a mirror when viewed from underwater?

ANSWER: TOTAL INTERNAL REFLECTION (ACCEPT: REFRACTION PAST THE CRITICAL ANGLE)