

ROUND 2

TOSS-UP

1) EARTH AND SPACE *Short Answer* What is the name of the sedimentary rock formed by compaction and cementation of rounded, pebble-size particles?

ANSWER: CONGLOMERATE

BONUS

1) EARTH AND SPACE *Multiple Choice* Which of the following is NOT a characteristic of a good index fossil?

- W) Easy to identify
- X) Geographically widespread
- Y) Slow evolution
- Z) Easy to preserve

ANSWER: Y) SLOW EVOLUTION

TOSS-UP

2) BIOLOGY *Multiple Choice* Which of the following is NOT an evolutionary adaptation of plants to arid climates?

- W) Leaves have a waxy coating
- X) Carbon incorporation and the Calvin cycle are separated
- Y) Stomata are closed at night
- Z) Leaves are absent

ANSWER: Y) STOMATA ARE CLOSED AT NIGHT

BONUS

2) BIOLOGY *Multiple Choice* Which of the following mammal species is usually considered diurnal [**dy-UR-nl**]?

- W) Eastern fox squirrel
- X) Black-footed ferret
- Y) Virginia opossum
- Z) Raccoon

ANSWER: W) EASTERN FOX SQUIRREL

TOSS-UP

3) CHEMISTRY *Short Answer* What is the specific chemical term for the minimum pressure required to produce liquefaction of a substance at the critical temperature?

ANSWER: CRITICAL PRESSURE

BONUS

3) CHEMISTRY *Short Answer* Name the molecule with the formula $\text{CH}_3\text{COOCH}_2\text{CH}_2\text{CH}_3$.

ANSWER: PROPYL ETHANOATE (ACCEPT: PROPYL ACETATE)

TOSS-UP

4) MATH *Multiple Choice* The variables x and y vary directly. Which of the following equations could represent the relationship between x and y ?

W) $(1/5)x = 1/y$ [**one fifth x equals 1 over y**]

X) $x/y = 1/5$ [**x over y equals one fifth**]

Y) $xy = 1/5$ [**x y equals one fifth**]

Z) $xy = 5$

ANSWER: X) $x/y = 1/5$

BONUS

4) MATH *Short Answer* An open box is to be made from a rectangular piece of material 8 inches by 6 inches by cutting equal squares of side x from the four corners and turning up the sides. In terms of x , give an expression for the volume of the box in cubic inches.

ANSWER: $x(8 - 2x)(6 - 2x)$ (ACCEPT: $4x^3 - 28x^2 + 48x$)

TOSS-UP

5) PHYSICS *Multiple Choice* A rock is thrown vertically upwards with speed v from the edge of a cliff. At the same moment, a second rock is thrown vertically downwards with the same initial speed v . Neglecting air resistance, which of the following statements is true?

- W) The rock that was thrown upwards reaches the bottom of the cliff with a higher velocity
- X) The rock that was thrown downwards reaches the bottom of the cliff with a higher velocity
- Y) Both rocks reach the bottom of the cliff with the same velocity at the same time
- Z) Both rocks reach the bottom of the cliff with the same velocity but at different times

ANSWER: Z) BOTH ROCKS REACH THE BOTTOM OF THE CLIFF WITH THE SAME VELOCITY BUT AT DIFFERENT TIMES

BONUS

5) PHYSICS *Short Answer* A mass is spun horizontally at the end of a string. If its speed is changed so that the centripetal force is doubled, in simplest decimal form to the nearest tenth, what is the ratio of final speed to initial speed?

ANSWER: 1.4

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

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 is NOT a potential source of biogas?

- W) Landfills
- X) Sewage treatment plants
- Y) Automobile engine
- Z) Animal waste

ANSWER: Y) AUTOMOBILE ENGINE

BONUS

8) ENERGY *Multiple Choice* The presence of which of the following traits is required for the creation of all oil traps?

- W) Anticline
- X) Syncline
- Y) Impermeable layer
- Z) Fault

ANSWER: Y) IMPERMEABLE LAYER

TOSS-UP

9) CHEMISTRY *Multiple Choice* Which of the following catabolic pathways liberates carbon dioxide?

- W) Electron transport
- X) Glycolysis [**gly-KOL-uh-sis**]
- Y) Citric acid cycle
- Z) Cori cycle

ANSWER: Y) CITRIC ACID CYCLE

BONUS

9) CHEMISTRY *Short Answer* If one mole of a substance with a molar mass of 20 is burned at constant pressure and 800 kilojoules of energy is released as heat, what is the standard enthalpy change, in kilojoules, when a 5-gram sample of this substance is burned at constant pressure?

ANSWER: -200 (MUST INCLUDE NEGATIVE SIGN IN ANSWER)

TOSS-UP

10) MATH *Short Answer* Providing your answer to one decimal place, find the value of the following fraction: $\frac{63!}{62!3!}$ [**the numerator is 63 factorial; the denominator is 62 factorial times 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

11) PHYSICS *Multiple Choice* A string 40 centimeters long produces a fundamental frequency of 384 hertz. To produce a note one octave higher, the tension in the string must be increased by which of the following factors?

- W) 0.7
- X) 1.4
- Y) 2
- Z) 4

ANSWER: Z) 4

BONUS

11) PHYSICS *Short Answer* A meter stick is held by a low-friction support on a stand. A single weight and an air-filled balloon hang from the left side of the meter stick; a weight hangs from the right side of the meter stick. The fulcrum is adjusted so that the system is balanced and level. If the string holding the balloon is burned so as to exert no torque when the string breaks, identify by number what will happen when the string breaks: 1) the right side of the meter stick will go down; 2) the left side of the meter stick will go down; or 3) the meter stick will remain balanced.

ANSWER: 1

TOSS-UP

12) EARTH AND SPACE *Multiple Choice* Which of the following is produced by gas-to-particle conversion in the atmosphere?

- W) Primary particulate matter
- X) Secondary particulate matter
- Y) Tertiary aerosols
- Z) Primary aerosols

ANSWER: X) SECONDARY PARTICULATE MATTER

BONUS

12) EARTH AND SPACE *Short Answer* What are the two most abundant minerals in the continental crust?

ANSWER: QUARTZ AND FELDSPAR (ACCEPT: FELDSPAR FAMILY)

TOSS-UP

13) BIOLOGY *Short Answer* What is the highest level of protein structure present in collagen, a fibrous protein with three discrete helical polypeptides [**HEL-i-kuhl pol-ee-PEP-tyds**] supercoiled into a triple helix?

ANSWER: QUATERNARY

BONUS

13) BIOLOGY *Short Answer* Estrogen and progesterone [**proh-JES-tuh-rohn**] are most directly regulated by which two hormones?

ANSWER: FSH AND LH (ACCEPT: FOLLICLE-STIMULATING AND LUTEINIZING)

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

15) CHEMISTRY *Multiple Choice* Which of the following is an aldehyde [**AL-duh-hyd**]?

- W) $C_{11}H_{20}$
- X) $C_5H_{11}OH$
- Y) $C_5H_{11}CHO$
- Z) $C_5H_{11}NH_2$

ANSWER: Y) $C_5H_{11}CHO$

BONUS

15) CHEMISTRY *Short Answer* Which one of the following five metals would react the least with dilute hydrochloric acid: 1) lead, 2) chromium, 3) manganese, 4) nickel, 5) gold?

ANSWER: 5 (ACCEPT: GOLD)

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) $4\sqrt{2}$
- Y) $4\sqrt{3}$
- Z) $16\sqrt{2}$

ANSWER: X) $4\sqrt{2}$

BONUS

16) MATH *Short Answer* Determine the largest possible real domain of $y = \frac{\sqrt{x-1}}{\sqrt{x^2-1}}$ [**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* If two inductance coils of inductance L are connected in parallel, but are well separated, the equivalent inductance of the system is which of the following?

- W) $0.5L$
- X) L
- Y) $2L$
- Z) L^2

ANSWER: W) $0.5L$

BONUS

17) PHYSICS *Multiple Choice* Two balls are dropped one second apart from a tall building. Given g as 10 meters per second squared and neglecting air resistance, what is the approximate distance in meters between the two balls three seconds after the first ball is dropped?

- W) 20
- X) 25
- Y) 45
- Z) Depends on the masses

ANSWER: X) 25

TOSS-UP

18) EARTH AND SPACE *Multiple Choice* Which of the following theories describes the random movement of small particles in the atmosphere?

- W) Diffusion
- X) Reynolds number
- Y) Brownian motion
- Z) Kinetic

ANSWER: Y) BROWNIAN MOTION

BONUS

18) EARTH AND SPACE *Short Answer* Igneous **[IG-nee-uhs]** rocks and magmas are classified into four main compositional groups: ultramafic, mafic, intermediate, and felsic, based on the content of what chemical compound?

ANSWER: SILICA

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

20) ENERGY *Short Answer* Cadmium and boron are used in a nuclear reactor to absorb which subatomic particle?

ANSWER: NEUTRON

BONUS

20) ENERGY *Multiple Choice* Which of the elements, used as a nuclear fuel, is most abundant in the Earth's crust?

- W) Uranium
- X) Plutonium
- Y) Thorium
- Z) Americium

ANSWER: Y) THORIUM

TOSS-UP

21) CHEMISTRY *Multiple Choice* When hydrogen reacts with 2-butanone, which of the following is the primary product?

- W) A primary aldehyde [**AL-duh-hyd**]
- X) A secondary aldehyde
- Y) A primary alcohol
- Z) A secondary alcohol

ANSWER: Z) A SECONDARY ALCOHOL

BONUS

21) CHEMISTRY *Short Answer* Arrange the following three choices in order of increasing number of oxygen atoms: 1) one mole of carbon monoxide; 2) one mole of carbon dioxide; 3) one-half mole of calcium carbonate.

ANSWER: 1, 3, 2 (ACCEPT: ONE MOLE OF CARBON MONOXIDE; ONE-HALF MOLE OF CALCIUM CARBONATE; ONE MOLE OF CARBON DIOXIDE)

TOSS-UP

22) MATH *Short Answer* If two 6-sided fair dice are rolled, providing your answer as a fraction in lowest terms, what is the probability that both numbers will be even?

ANSWER: $\frac{1}{4}$

BONUS

22) MATH *Short Answer* Mary travels for 110 miles averaging 55 miles per hour and for 150 miles averaging 50 miles per hour. What is Mary's average speed in miles per hour for the trip?

ANSWER: 52

TOSS-UP

23) PHYSICS *Multiple Choice* White light is incident on a diffraction grating. Which of the following colors will be diffracted through the largest angle?

- W) Red
- X) Yellow
- Y) Blue
- Z) Green

ANSWER: W) RED

BONUS

23) PHYSICS *Multiple Choice* A square conducting loop of length L on a side carries a current i . Which of the following best characterizes the magnetic field at the center of the loop?

- W) Independent of L
- X) Inversely proportional to L
- Y) Proportional to L
- Z) Proportional to L^2

ANSWER: X) INVERSELY PROPORTIONAL TO L

TOSS-UP

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

TOSS-UP

25) BIOLOGY *Short Answer* Who discovered the antibiotic nature of penicillin in 1928?

ANSWER: SIR ALEXANDER FLEMING (ACCEPT: ALEXANDER FLEMING, FLEMING)

BONUS

25) BIOLOGY *Short Answer* Of the following four choices, identify all that are involved in plant primary growth: 1) axillary bud meristem, 2) cork cambium, 3) apical meristem, 4) vascular cambium.

ANSWER: 1, 3 (ACCEPT: AXILLARY BUD MERISTEM, APICAL MERISTEM)