

ROUND 4

TOSS-UP

1) MATH *Short Answer* What is the mode of the following list of nine numbers: 4, 4, 5, 6, 6, 7, 7, 7, 8?

ANSWER: 7

BONUS

1) MATH *Short Answer* Fred has an average of 90% on 5 calculus tests. What percent score does he need on the next test to have an average of 91%?

ANSWER: 96

TOSS-UP

2) EARTH AND SPACE *Multiple Choice* Name the notable scientist who first devised the mathematical laws governing the motion of planetary orbits.

- W) Galileo
- X) Copernicus
- Y) Kepler
- Z) Newton

ANSWER: Y) KEPLER

BONUS

2) EARTH AND SPACE *Short Answer* Name the first human ever to travel in space.

ANSWER: YURI GAGARIN

TOSS-UP

3) PHYSICS *Multiple Choice* In projectile motion, assuming no air resistance, all of the following are constant except:

- W) Horizontal speed
- X) Horizontal acceleration
- Y) Vertical acceleration
- Z) Vertical speed

ANSWER: Z) VERTICAL SPEED

BONUS

3) PHYSICS *Multiple Choice* A diver jumps out of a plane into free fall without air resistance. Which of the following quantities is the greatest?

- W) Instantaneous velocity after 1 second
- X) Instantaneous velocity after 2 seconds
- Y) Average velocity after 1 second
- Z) Average velocity after 2 seconds

ANSWER: X) INSTANTANEOUS VELOCITY AFTER 2 SECONDS

TOSS-UP

4) BIOLOGY *Multiple Choice* In natural systems, when a population uses the available resources at the rate equal to the resources' renewal rate, the population is said to have reached:

- W) Extinction
- X) Constant growth
- Y) Holding capacity
- Z) Carrying capacity

ANSWER: Z) CARRYING CAPACITY

BONUS

4) BIOLOGY *Multiple Choice* Why are secondary and tertiary consumers typically more susceptible to pollutants, such as DDT, than organisms lower in the food web?

- W) They are larger
- X) Susceptibility is positively correlated with biomagnification
- Y) Consumers come in more direct contact with pollutants
- Z) Pollutant toxicity increases with each cycle of necrosis

ANSWER: X) SUSCEPTIBILITY IS POSITIVELY CORRELATED WITH BIOMAGNIFICATION

TOSS-UP

5) CHEMISTRY *Multiple Choice* The standard heat of formation of hydrogen gas in the form H_2 is:

- W) Always greater than 1
- X) Twice that of atomic hydrogen
- Y) Equal to 0
- Z) Determined by checking a table of the Standard Heats of Formation

ANSWER: Y) EQUAL TO 0

BONUS

5) CHEMISTRY *Multiple Choice* If the ΔH (read as: delta H) for a reaction is negative, which of the following statements is true?

- W) The enthalpy of the products is less than the enthalpy of the reactants
- X) Heat is released by the surroundings during the course of this reaction
- Y) The enthalpy term will be added to the reactant side of the chemical equation
- Z) Heat is absorbed by the system during the course of this reaction

ANSWER: W) THE ENTHALPY OF THE PRODUCTS IS LESS THAN THE ENTHALPY OF THE REACTANTS

TOSS-UP

6) PHYSICS *Short Answer* In 1905, Albert Einstein published his paper about the photoelectric effect, for which he later won a Nobel Prize. His studies showed that light exhibits a duality, behaving in which two ways?

ANSWER: PARTICLE AND WAVE

BONUS

6) PHYSICS *Short Answer* What component of the electromagnetic spectrum has the highest frequency?

ANSWER: GAMMA RAY (DO NOT ACCEPT: COSMIC RAY)

TOSS-UP

7) CHEMISTRY *Multiple Choice* In what unit is the atomic radius often measured?

- W) Picometers
- X) Millimeters
- Y) Nanometers
- Z) Centimeters

ANSWER: W) PICOMETERS

BONUS

7) CHEMISTRY *Multiple Choice* Which of the following neutral elements has the largest atomic radius?

- W) Silicon
- X) Phosphorus
- Y) Sulfur
- Z) Chlorine

ANSWER: W) SILICON

TOSS-UP

8) MATH *Short Answer* Simplify the following completely: $(3xy^2)(4x^2y^3)$ (read as: 3xy squared times 4x squared y squared)

ANSWER: $12x^3y^5$

BONUS

8) MATH *Short Answer* Solve for x: $3x^2 + 6x - 9 = 0$

ANSWER: $x = -3$, AND $x = 1$

TOSS-UP

9) ENERGY *Short Answer* What U.S. endeavor designed and constructed the first atomic bomb?

ANSWER: MANHATTAN PROJECT

BONUS

9) ENERGY *Short Answer* Nuclear power plants are built with multiple safety components in order to help prevent meltdown or the escape of radiation in the event of an accident. Name two of these safety components.

ANSWER: (ACCEPT TWO) CONTROL RODS, COOLING WATER, CONCRETE LINER, STEEL CONTAINMENT VESSEL, OUTER CONCRETE BUILDING, HUMAN SUPERVISION

TOSS-UP

10) EARTH AND SPACE *Multiple Choice* Which of the following is NOT a mineral?

- W) Diamond
- X) Coal
- Y) Quartz
- Z) Zinc

ANSWER: X) COAL

BONUS

10) EARTH AND SPACE *Multiple Choice* Which of the following minerals does not have cubic cleavage?

- W) Fluorite
- X) Halite
- Y) Calcite
- Z) Galena (read as: gah-LEE-nah)

ANSWER: Y) CALCITE

TOSS-UP

11) PHYSICS *Short Answer* What theory predicts that for every known particle, there exists a superpartner particle of the same mass?

ANSWER: SUPERSYMMETRY

BONUS

11) PHYSICS *Short Answer* Supersymmetry seeks to unify which three fundamental interactions?

ANSWER: STRONG, WEAK AND ELECTROMAGNETIC

TOSS-UP

12) ENERGY *Short Answer* Name all of the following reasons that influence why gasoline prices are higher in some U.S. regions than in others: 1) distance from supply, 2) retail competition, 3) environmental programs, and/or 4) supply disruptions?

ANSWER: DISTANCE FROM SUPPLY, RETAIL COMPETITION, ENVIRONMENTAL PROGRAMS, AND SUPPLY DISRUPTIONS (ACCEPT: 1, 2, 3, 4, OR ALL)

BONUS

12) ENERGY *Multiple Choice* Which of the following statements is NOT true about gasoline?

W) The octane rating of gasoline tells you how much the fuel can be compressed before it spontaneously ignites

X) Gasoline is a hydrocarbon

Y) When gasoline is burned under ideal conditions, its products are carbon dioxide, water, and heat

Z) The overall efficiency of an automotive gasoline engine is about 80%

ANSWER: Z) THE OVERALL EFFICIENCY OF AN AUTOMOTIVE GAS ENGINE IS ABOUT 80%

TOSS-UP

13) MATH *Short Answer* You paid \$300 for a new Seagull guitar. Your guitar cost \$50 more than twice the cost of your friend's guitar. How much was her guitar?

ANSWER: \$125

BONUS

13) MATH *Short Answer* In order to include caloric information, a pancake restaurant printed new menus for \$1.51 each. With a budget of \$2500.00, how many menus could the pancake restaurant print?

ANSWER: 1655

TOSS-UP

14) ENERGY *Multiple Choice* Which of the following would least likely be used for biomass energy production?

- W) Soybeans and sunflowers
- X) Urban wood waste and biodegradable garbage
- Y) Corn and sorghum
- Z) Car parts from a salvage yard

ANSWER: Z) CAR PARTS FROM A SALVAGE YARD

BONUS

14) ENERGY *Short Answer* In the United States, corn is the major feedstock for which biofuel?

ANSWER: ETHANOL (ACCEPT: ETHYL ALCOHOL, GRAIN ALCOHOL)

TOSS-UP

15) EARTH AND SPACE *Multiple Choice* The Earth's atmosphere contains roughly what percentage of oxygen by volume?

- W) 0.2%
- X) 2%
- Y) 20%
- Z) 80%

ANSWER: Y) 20%

BONUS

15) EARTH AND SPACE *Short Answer* The average atmospheric pressure at sea level is about 1 atmosphere, which is equivalent to how many kilopascals? Provide your answer as a decimal to the nearest tenth.

ANSWER: 101.3

TOSS-UP

16) BIOLOGY *Short Answer* Name two major types of electron microscopes.

ANSWER: TRANSMISSION AND SCANNING (ACCEPT: TEM, LVEM FOR TRANSMISSION, AND STM (OR SEM) FOR SCANNING)

BONUS

16) BIOLOGY *Short Answer* One parent is homozygous for type A blood and the other is homozygous for type B blood. Their offspring has the phenotype AB blood. What mode of inheritance occurs when an allele from each homozygous parent combines in the offspring, and the offspring simultaneously demonstrates both phenotypes?

ANSWER: CODOMINANCE

TOSS-UP

17) MATH *Short Answer* Change 120 degrees to radians in terms of π .

ANSWER: $\frac{2\pi}{3}$

BONUS

17) MATH *Short Answer* If the sine of an angle is negative, which other trigonometric function or functions will definitely have negative values?

ANSWER: COSECANT

TOSS-UP

18) EARTH AND SPACE *Short Answer* What weather pressure systems are characteristic of subtropical latitudes?

ANSWER: HIGH PRESSURE

BONUS

18) EARTH AND SPACE *Short Answer* If you lived near the equator, which kind of surface wind circulation would you likely most often experience?

W) Colliding air masses

X) Highly variable and unsteady; but mostly blowing from west to east

Y) Sunny weather with little clouds and rain

Z) Steady wind blowing from east to west

ANSWER: W) COLLIDING AIR MASSES

TOSS-UP

19) MATH *Short Answer* What kind of polygon can never be concave?

ANSWER: TRIANGLE

BONUS

19) MATH *Multiple Choice* Which of the following is NOT true about a convex polygon?

- W) Every line segment connecting two interior points lies in the interior
- X) Every line segment connecting two vertices remains inside or on the boundary of the polygon
- Y) At least one interior angle is greater than 180 degrees
- Z) The number of edges is finite

ANSWER: Y) AT LEAST ONE INTERIOR ANGLE IS GREATER THAN 180 DEGREES

TOSS-UP

20) PHYSICS *Multiple Choice* One wavelength of light is measured:

- W) From node to node
- X) From crest to crest
- Y) From crest to trough
- Z) From axis to amplitude

ANSWER: X) FROM CREST TO CREST

BONUS

20) PHYSICS *Multiple Choice* Which of the following types of electromagnetic radiation has the lowest frequency?

- W) Yellow light
- X) Gamma rays
- Y) Ultraviolet radiation
- Z) Green light

ANSWER: W) YELLOW LIGHT

TOSS-UP

21) PHYSICS *Multiple Choice* Which of the following changes with the local acceleration due to gravity?

- W) Mass
- X) Density
- Y) Inertia
- Z) Weight

ANSWER: Z) WEIGHT

BONUS

21) PHYSICS *Short Answer* Baby Petey drops a spoonful of mashed potatoes from his high chair and it hits the floor. This results in what kind of collision?

ANSWER: INELASTIC

TOSS-UP

22) EARTH AND SPACE *Multiple Choice* Felsic rocks are rich in silicate, while mafic rocks are rich in iron. Which of the following rock types would be felsic?

- W) Basalt
- X) Granite
- Y) Gabbro
- Z) Dolomite

ANSWER: X) GRANITE

BONUS

22) EARTH AND SPACE *Multiple Choice* Which of the following rock types would be from the depositional environment with the lowest energy?

- W) Conglomerate
- X) Sandstone
- Y) Siltstone
- Z) Greywacke

ANSWER: Y) SILTSTONE

TOSS-UP

23) BIOLOGY *Short Answer* What is the name of the organized structure within a cell which, in eukaryotic cells, bears genetic material as a threadlike linear strand of DNA bonded to various proteins?

ANSWER: CHROMOSOME (DO NOT ACCEPT: CHROMATIN)

BONUS

23) BIOLOGY *Short Answer* What specific term describes the specific location of a gene on its chromosome?

ANSWER: LOCUS (ACCEPT: GENE LOCUS, LOCI)

TOSS-UP

24) CHEMISTRY *Short Answer* The quantity of which subatomic particle differs between isotopes of a single element?

ANSWER: NEUTRONS

BONUS

24) CHEMISTRY *Short Answer* Given that the atomic number of silver is 47, how many neutrons are in the Ag-108 isotope?

ANSWER: 61

TOSS-UP

25) BIOLOGY *Multiple Choice* Which of the following scientists first discovered a cell?

- W) Anton van Leeuwenhoek
- X) Henri Dutrochet
- Y) Stephen Inwood
- Z) Robert Hooke

ANSWER: Z) ROBERT HOOKE

BONUS

25) BIOLOGY *Short Answer* What specimen did Hooke describe as a multitude of tiny cells that looked like the compartments of honeycomb?

ANSWER: CORK