

ROUND 6

TOSS-UP

1) GENERAL SCIENCE *Multiple Choice* Numerous individuals contributed to the development of the scientific method, and thus modern science. Which of the following scientists placed an emphasis on mathematics, drew upon the writings of Muslim scientists, and described a repeating cycle of observations, hypothesis generation, experiments, and independent verification?

- W) Aristotle
- X) John Dalton
- Y) Roger Bacon
- Z) Robert Boyle

ANSWER: Z) ROBERT BOYLE

BONUS

1) GENERAL SCIENCE *Short Answer* What are the two types of optical phenomena that must occur for light to form a rainbow through the water droplets in the air?

ANSWER: DISPERSION AND REFLECTION (ACCEPT: DISPERSE AND REFLECT)

TOSS-UP

2) ENERGY *Short Answer* Using his arms, a boy holds a box weighing 1 kilogram 1 meter above the ground for 1 minute. How much work, in joules, does the boy do on the box?

ANSWER: 0

BONUS

2) ENERGY *Multiple Choice* How many Btus are needed to raise the temperature of 5 pounds of water from 45° Fahrenheit to 65° Fahrenheit?

- W) 20
- X) 40
- Y) 75
- Z) 100

ANSWER: Z) 100

TOSS-UP

3) GENERAL SCIENCE *Multiple Choice* The “great ocean conveyor belt” refers to what?

- W) The series of strong currents that shipping companies follow
- X) The path of water as it circulates throughout the world’s ocean
- Y) The influx of migrants from Europe and Asia across the sea to the New World
- Z) A collection of prominent currents, such as the Gulf Stream and the East Australian Current

ANSWER: X) THE PATH OF WATER AS IT CIRCULATES THROUGHOUT THE WORLD’S OCEAN

BONUS

3) GENERAL SCIENCE *Short Answer* Within our solar system, what are the four Jovian planets?

ANSWER: JUPITER, SATURN, URANUS, NEPTUNE

TOSS-UP

4) LIFE SCIENCE *Multiple Choice* Which of the following animals possesses a lateral line?

- W) Fish
- X) Salamander
- Y) Snake
- Z) Turtle

ANSWER: W) FISH

BONUS

4) LIFE SCIENCE *Short Answer* Following is a list of organisms in a food chain: grass, grasshoppers, mice, snakes, and hawks. A toxin exhibits biomagnification and can be found in all members of this food chain. Which organism will have the highest concentration of this toxin?

ANSWER: HAWKS

TOSS-UP

5) MATH *Short Answer* What is the probability that a randomly chosen person has his or her next birthday on a weekend?

ANSWER: 2/7

BONUS

5) MATH *Short Answer* If $\frac{a+b}{b} = 3.5$, what is $\frac{a}{b}$?

ANSWER: 2.5 (ACCEPT: 5/2)

TOSS-UP

6) EARTH AND SPACE *Multiple Choice* What term describes the height of an object in the sky?

- W) Zenith
- X) Altitude
- Y) Nadir
- Z) Meridian

ANSWER: X) ALTITUDE

BONUS

6) EARTH AND SPACE *Multiple Choice* What is responsible for producing ozone in the stratosphere?

- W) The interaction of oxygen and ultraviolet light
- X) Biogenic emissions
- Y) Volcanic emissions
- Z) The interaction of methane and ultraviolet light

ANSWER: W) THE INTERACTION OF OXYGEN AND ULTRAVIOLET LIGHT

TOSS-UP

7) GENERAL SCIENCE *Multiple Choice* What is the difference between magma and lava?

W) Lava cools more slowly than magma

X) Lava interacts with oxygen on the Earth's surface, while magma remains beneath the surface

Y) Magma erupts from volcanoes and hot spots, while lava flows below or on the surface

Z) Magma is the liquid form of lava, while lava is the hardened rock from magma

ANSWER: X) LAVA INTERACTS WITH OXYGEN ON THE EARTH'S SURFACE, WHILE MAGMA REMAINS BENEATH THE SURFACE

BONUS

7) GENERAL SCIENCE *Short Answer* Put the following three Earth layers in order from the outermost layer to the innermost layer: 1) asthenosphere [*as-THEN-uh-sfeer*], 2) inner core, 3) lithosphere.

ANSWER: 3, 1, 2 (ACCEPT: LITHOSPHERE, ASTHENOSPHERE, INNER CORE)

TOSS-UP

8) PHYSICAL SCIENCE *Short Answer* Under atmospheric pressure, carbon dioxide in the solid state transitions directly into the gaseous state. What is this phase change called?

ANSWER: SUBLIMATION

BONUS

8) PHYSICAL SCIENCE *Short Answer* To a chemist, the term "organic" means that a compound is based on what element?

ANSWER: CARBON

TOSS-UP

9) LIFE SCIENCE *Short Answer* Appearing approximately 2.7 billion years ago, the first oxygen-producing organisms most likely belonged to what group of bacteria?

ANSWER: CYANOBACTERIA (ACCEPT: BLUE-GREEN ALGAE or BLUE-GREEN BACTERIA)

BONUS

9) LIFE SCIENCE *Multiple Choice* Agar is derived from what organism?

- W) Brown algae
- X) Red algae
- Y) Green algae
- Z) Fungi

ANSWER: X) RED ALGAE

TOSS-UP

10) MATH *Multiple Choice* On the graph of the function $y = (x + 2)^2$, what is the x -value of the point with the least y -value?

- W) -2
- X) 0
- Y) 2
- Z) 4

ANSWER: W) -2

BONUS

10) MATH *Short Answer* In terms of n , what is the number of diagonals that can be drawn from any one vertex of a convex polygon with n sides?

ANSWER: $n - 3$

TOSS-UP

11) EARTH AND SPACE *Multiple Choice* Which of the following scales is used to rate hurricanes?

- W) Saffir-Simpson
- X) Modified Mercalli
- Y) Enhanced Fujita
- Z) Richter Magnitude

ANSWER: W) SAFFIR-SIMPSON

BONUS

11) EARTH AND SPACE *Short Answer* Snowflakes can take on a variety of shapes depending on the physical environment in which they form. In addition to temperature, what is the major physical factor that determines snowflake shape?

ANSWER: HUMIDITY (ACCEPT: WATER AVAILABILITY, SUPERSATURATION LEVEL)

TOSS-UP

12) GENERAL SCIENCE *Short Answer* A scientist wants to use a figure to show the change in ATP production over time by a cell infected by the flu virus. In what type of graph should a scientist most likely present the results of this experiment?

ANSWER: LINE GRAPH (ACCEPT: LINE CHART)

BONUS

12) GENERAL SCIENCE *Short Answer* Divergent boundaries have a unique structure in their centers. For example, one such structure contains the Red Sea and was formed from the separation of the African and Arabian Plate. What is the name for this structure?

ANSWER: RIFT VALLEY

TOSS-UP

13) ENERGY *Short Answer* A battery generates what type of current?

ANSWER: DIRECT CURRENT (ACCEPT: DC)

BONUS

13) ENERGY *Short Answer* Rank the following three materials from best thermal insulator to worst: 1) brick, 2) fiberglass batting, 3) steel.

ANSWER: 2, 1, 3 (ACCEPT: FIBERGLASS BATTING, BRICK, STEEL)

TOSS-UP

14) PHYSICAL SCIENCE *Multiple Choice* For the balanced combustion reaction of methane to produce carbon dioxide and water, which of the following would NOT be expected?

- W) The reaction is exothermic
- X) The reactants are gases
- Y) A catalyst is necessary
- Z) The reaction produces heat

ANSWER: Y) A CATALYST IS NECESSARY

BONUS

14) PHYSICAL SCIENCE *Multiple Choice* Which of the following sound wave frequencies in hertz would a human be most likely to hear?

- W) 10
- X) 1,000
- Y) 50,000
- Z) 100,000

ANSWER: X) 1,000

TOSS-UP

15) LIFE SCIENCE *Multiple Choice* Epiphytes [**EP-uh-fyts**] primarily obtain water and nutrients through what?

- W) Roots
- X) Leaves
- Y) Other plants
- Z) Haustoria [**haw-STOHR-ee-uh**]

ANSWER: X) LEAVES

BONUS

15) LIFE SCIENCE *Short Answer* The Q10 effect is the degree by which metabolic activity is reduced with a 10° Celsius drop in temperature. A typical Q10 value is 2, meaning that metabolic activity is halved for every 10° decrease in temperature. If a collection of cells with a Q10 value of 2 produces 10 nanograms of carbon dioxide per hour at 40° Celsius, how much would you expect them to produce in nanograms in one hour at 10° Celsius?

ANSWER: 1.25 (ACCEPT: 5/4, 1 ¼)

TOSS-UP

16) MATH *Short Answer* What is the least integer between -44.5 and -15.7?

ANSWER: -44

BONUS

16) MATH *Short Answer* For the equation $y = x^2 + 6x - 3$, what is the axis of symmetry of its graph?

ANSWER: $x = -3$

TOSS-UP

17) EARTH AND SPACE *Multiple Choice* In which of the following rock types are you most likely to find a fossil?

- W) Sandstone
- X) Slate
- Y) Conglomerate
- Z) Granite

ANSWER: W) SANDSTONE

BONUS

17) EARTH AND SPACE *Short Answer* What will be limited by the presence of a thick snowpack on the surface of sea ice, which will reduce primary production among sea ice algae?

ANSWER: LIGHT (ACCEPT: SUNLIGHT, PHOTOSYNTHETICALLY ACTIVE RADIATION)

TOSS-UP

18) LIFE SCIENCE *Multiple Choice* Which of the following is NOT a characteristic of a tundra?

- W) Presence of large carnivores
- X) Absence of migrant animals
- Y) Herbaceous vegetation [*hur-BAY-shuhs*]
- Z) Permafrost

ANSWER: X) ABSENCE OF MIGRANT ANIMALS

BONUS

18) LIFE SCIENCE *Short Answer* The African baobab [*bay-oh-bab*] has evolved large, white, pungent flowers to attract what pollinator?

ANSWER: BATS

TOSS-UP

19) GENERAL SCIENCE *Multiple Choice* Which of the following best describes Bernoulli's principle?

- W) As the speed of a moving fluid increases, the pressure of the moving fluid decreases
- X) The individual actions of an organism during its lifetime are the driving force of adaption
- Y) The buoyant force on an object is equal to the weight of the fluid displaced
- Z) All atoms of a given element are exactly alike and atoms of different elements could join to form compounds

ANSWER: W) AS THE SPEED OF A MOVING FLUID INCREASES, THE PRESSURE OF THE MOVING FLUID DECREASES

BONUS

19) GENERAL SCIENCE *Multiple Choice* Aquifers are areas of underground bodies of rock through which large amounts of water can flow and be stored. Which of the following rock arrangements will make for the least productive aquifer?

- W) Well-sorted, small-grained rocks that are loosely packed
- X) Well-sorted, small-grained rocks that are tightly packed
- Y) Poorly sorted rock with grains of many different sizes that are loosely packed
- Z) Poorly sorted rock with grains of many different sizes that are tightly packed

ANSWER: Z) POORLY SORTED ROCK WITH GRAINS OF MANY DIFFERENT SIZES THAT ARE TIGHTLY PACKED

TOSS-UP

20) ENERGY *Short Answer* What term is used to describe the amount of energy needed to raise one pound of water one degree Fahrenheit?

ANSWER: BRITISH THERMAL UNIT (ACCEPT: BTU)

BONUS

20) ENERGY *Multiple Choice* What are the percentages of ethanol used in the fuel of a regular vehicle and a flexible fuel vehicle (FFV), respectively?

- W) 40% and 90%
- X) 25% and 95%
- Y) 10% and 85%
- Z) 50% and 60%

ANSWER: Y) 10% AND 85%

TOSS-UP

21) PHYSICAL SCIENCE *Multiple Choice* A vector of magnitude 14 is added to a vector of magnitude 2. The magnitude of the resulting vector is which of the following?

- W) 12
- X) 16
- Y) Between 2 and 14, inclusive
- Z) Between 12 and 16, inclusive

ANSWER: Z) BETWEEN 12 AND 16, INCLUSIVE

BONUS

21) PHYSICAL SCIENCE *Short Answer* Identify all of the following four substances that are examples of compounds: 1) alcohol, 2) soil, 3) milk, and 4) water.

ANSWER: 1, 4 (ACCEPT: ALCOHOL, WATER)

TOSS-UP

22) LIFE SCIENCE *Multiple Choice* Assuming that the following structures are unlabeled and unstained, which would be least likely to be visualized using a light microscope with the standard resolution of 0.2 microns?

- W) Nucleus
- X) Cell wall
- Y) Ribosome [**RY-buh-sohm**]
- Z) Mitochondria [**my-tuh-KON-dree-uh**]

ANSWER: Y) RIBOSOME

BONUS

22) LIFE SCIENCE *Short Answer* Animals have two sources of DNA in their cells and plants have three sources. Name the three organelles in which plant DNA can be found.

ANSWER: CHLOROPLASTS, MITOCHONDRIA, AND THE NUCLEUS

TOSS-UP

23) MATH *Short Answer* Providing your answer in slope intercept form, what is the equation of the line passing through the points (6, -5) and (2, 7)?

ANSWER: $y = -3x + 13$

BONUS

23) MATH *Short Answer* What are the coordinates for the point of intersection in the first quadrant of the graphs with equations $xy = 4$ and $y = x + 3$?

ANSWER: (1, 4)

TOSS-UP

24) EARTH AND SPACE *Multiple Choice* Which of the following contains the largest amount of the earth's freshwater?

- W) Rivers and lakes
- X) Groundwater
- Y) Ice caps and glaciers
- Z) Soil moisture

ANSWER: Y) ICE CAPS AND GLACIERS

BONUS

24) EARTH AND SPACE *Multiple Choice* Which of the following greenhouse gases is the longest-lived in the atmosphere?

- W) Methane
- X) Water vapor
- Y) Nitrous oxide
- Z) CFC-11

ANSWER: Y) NITROUS OXIDE

TOSS-UP

25) PHYSICAL SCIENCE *Multiple Choice* Which of the following most accurately describes the difference between graphite and diamond?

- W) The carbon atoms are arranged in hexagonal planes in graphite, while they are arranged in a crystal structure in a diamond
- X) The carbon atoms in graphite are held together by weak hydrogen bonds, while they are held together by strong covalent bonds in a diamond
- Y) The carbon atoms in graphite are mixed in with impurities, while diamond contains no impurities
- Z) The carbon atoms in graphite are bonded to more other atoms than the carbon atoms in diamond

ANSWER: W) THE CARBON ATOMS ARE ARRANGED IN HEXAGONAL PLANES IN GRAPHITE, WHILE THEY ARE ARRANGED IN A CRYSTAL STRUCTURE IN A DIAMOND

BONUS

25) PHYSICAL SCIENCE *Multiple Choice* Which of the following is NOT true of the Earth's magnetic field?

- W) It is created by the molten iron in the Earth's outer core
- X) It changes over time
- Y) The intensity of the field is the same at the poles and at the equator
- Z) It is possible that in a few hundred thousand years, the Earth's magnetic north pole will be reversed

ANSWER: Y) THE INTENSITY OF THE FIELD IS THE SAME AT THE POLES AND AT THE EQUATOR