

ROUND 15

TOSS-UP

1) GENERAL SCIENCE *Short Answer* In a milliliter of seawater one might expect to find 10^4 members of the SAR11 clade of marine bacteria. Expressing your answer in scientific notation, how many SAR11 bacteria would one expect to find in a cubic meter of this seawater?

ANSWER: 1×10^{10}

BONUS

1) GENERAL SCIENCE *Multiple Choice* In what year was the idea that humans would contribute to climate change via emissions and the greenhouse effect first published?

- W) 1850
- X) 1896
- Y) 1958
- Z) 1969

ANSWER: X) 1896

TOSS-UP

2) ENERGY *Short Answer* What kind of dam consists of a line of large gates, set between flanking piers, that can be opened or closed to control the amount of water passing the dam?

ANSWER: BARRAGE (ACCEPT: TIDAL BARRAGE)

BONUS

2) ENERGY *Short Answer* By number, identify all of the following four statements that are true of La Rance Barrage in Brittany, France: 1) it is the world's first tidal power station; 2) its electricity production costs are higher than that of nuclear power generation; 3) it has caused some silting of the Rance ecosystem; 4) it follows tidal patterns so as to minimize negative biological impact.

ANSWER: 1, 3, 4

TOSS-UP

3) PHYSICAL SCIENCE *Short Answer* What is the name for the temperature above which a ferromagnetic material becomes a paramagnet?

ANSWER: THE CURIE TEMPERATURE (ACCEPT: CURIE POINT)

BONUS

3) PHYSICAL SCIENCE *Multiple Choice* A 10 kilogram mass hangs from a string in an elevator that is accelerating upwards at 2.0 meters per second squared. What is the tension in the string in newtons?

- W) 10
- X) 78
- Y) 98
- Z) 118

ANSWER: Z) 118

TOSS-UP

4) LIFE SCIENCE *Multiple Choice* Which of the following is a nonvascular plant?

- W) Moss
- X) Fern
- Y) Horsetail
- Z) Rhododendron

ANSWER: W) MOSS

BONUS

4) LIFE SCIENCE *Short Answer* A parent cell is $2n = 2$, and undergoes meiosis [*my-OH-sis*]. Assuming nondisjunction occurs in one cell during metaphase II, identify the number of chromosomes that can be expected in each of the two gametes.

ANSWER: TWO AND ZERO

TOSS-UP

5) MATH *Short Answer* The tens digit of a two digit number is twice the units digit. If the digits are reversed, the new number is 18 less than the original number. What is the original number?

ANSWER: 42

BONUS

5) MATH *Short Answer* If A is a point on the line with equation $y = x - 1$, and if A is located $2\sqrt{2}$ units from the point (4, -1), what are the coordinates of A?

ANSWER: (2, 1)

TOSS-UP

6) EARTH AND SPACE *Multiple Choice* Space is not a true vacuum as it contains a low density of particles. How many particles would you expect to find in a cubic meter of deep space?

- W) 0.1
- X) 100
- Y) 10,000
- Z) 1,000,000

ANSWER: Z) 1,000,000

BONUS

6) EARTH AND SPACE *Short Answer* What is the term for the path of the deepest part of a river?

ANSWER: THALWEG

TOSS-UP

7) GENERAL SCIENCE *Short Answer* What is term for the primary function of the Calvin cycle?

ANSWER: CARBON FIXATION

BONUS

7) GENERAL SCIENCE *Short Answer* Identify all of the following four plant structures that are NOT present in conifers: 1) vines, 2) bulbs, 3) rhizomes [**RY-zohms**], 4) simple leaves.

ANSWER: 1, 2, 3 (ACCEPT: VINES, BULBS, RHIZOMES)

TOSS-UP

8) PHYSICAL SCIENCE *Multiple Choice* Coulombic repulsion is about how many times as strong as Newtonian gravitational attraction?

- W) 10^2
- X) 10^{20}
- Y) 10^{40}
- Z) 10^{100}

ANSWER: Y) 10^{40}

BONUS

8) PHYSICAL SCIENCE *Short Answer* A long circular wire of some resistivity ρ in ohms per meter has a resistance of 10 ohms. If the radius of the wire were multiplied by a factor of $\sqrt{2}$, what would be the new resistance in ohms?

ANSWER: 5

TOSS-UP

9) LIFE SCIENCE *Short Answer* When a black chicken is crossed with a white chicken; all of the offspring are checkered (partially white and partially black). This is an example of what type of inheritance pattern?

ANSWER: CO-DOMINANCE

BONUS

9) LIFE SCIENCE *Multiple Choice* In the human skull, which of the following sinuses sits most posteriorly?

- W) Sphenoid [**SFEE-noid**]
- X) Ethmoid [**ETH-moid**]
- Y) Maxillary
- Z) Frontal

ANSWER: W) SPHENOID

TOSS-UP

10) MATH *Multiple Choice* A triangle with sides of length 3, 5, and 6 is classified as which of the following?

- W) Acute
- X) Right
- Y) Obtuse
- Z) The classification can't be determined from the information given

ANSWER: Y) OBTUSE

BONUS

10) MATH *Short Answer* If $f(x) = x^2 + 2x$ for $x > 0$, and $g(x) = 2x - 5$, determine the value of $g^{-1}(f^{-1}(15))$ [**g inverse of f inverse of 15**].

ANSWER: 4

TOSS-UP

11) EARTH AND SPACE *Multiple Choice* Which of the following earthquakes is recognized as having the highest magnitude?

- W) 1989 Loma Prieta, California
- X) 1964 Prince William Sound, Alaska
- Y) 1959 Hebgen Lake, Montana
- Z) 1812 New Madrid, Missouri

ANSWER: X) 1964 PRINCE WILLIAM SOUND, ALASKA

BONUS

11) EARTH AND SPACE *Short Answer* What was the magnitude of the Prince William Sound earthquake that occurred in Alaska in 1964?

ANSWER: 9.2

TOSS-UP

12) GENERAL SCIENCE *Multiple Choice* What is the most common element found in the Earth's crust and magma?

- W) Oxygen
- X) Aluminum
- Y) Iron
- Z) Silicon

ANSWER: W) OXYGEN

BONUS

12) GENERAL SCIENCE *Short Answer* Radiocarbon dating is accomplished by measuring the ratio of two carbon isotopes, one of which is radioactive. What isotopes are these?

ANSWER: CARBON-12 AND CARBON-14

TOSS-UP

13) ENERGY *Multiple Choice* Solar dryers do which of the following?

W) Harness the power of the Sun to dry clothes by means of a special solar alternator to reduce electricity consumption

X) Harness the power of the Sun to provide a way of storing food for underdeveloped communities

Y) Use the Sun's heat to convert water into steam through a solar collector and a turbine

Z) Use the Sun's heat and wind to evaporate water and then condense it to be able to dry fruits through steam

ANSWER: X) HARNESS THE POWER OF THE SUN TO PROVIDE A WAY OF STORING FOOD FOR UNDERDEVELOPED COMMUNITIES

BONUS

13) ENERGY *Short Answer* Suppose your parents would like to install a solar water heater system in their dream house in Houston, Texas. During the winter, your family likes to use hot water more often than during other seasons. Given that the latitude of Texas is 29.5° and assuming the collectors do not track the Sun's position, should the solar collectors be tilted at an angle greater than, less than, or equal to 29.5° in order to have more hot water in the winter?

ANSWER: GREATER THAN

TOSS-UP

14) PHYSICAL SCIENCE *Short Answer* Name an object commonly used by the Large Hadron Collider in its high-energy particle collisions.

ANSWER: PROTON (ACCEPT: LEAD ION OR LEAD NUCLEUS; DO NOT ACCEPT: HADRON)

BONUS

14) PHYSICAL SCIENCE *Short Answer* What is the molecular geometry of methane?

ANSWER: TETRAHEDRAL

TOSS-UP

15) LIFE SCIENCE *Multiple Choice* Which of the following is NOT an autoimmune disease?

- W) Multiple sclerosis
- X) Shingles
- Y) Lupus
- Z) Rheumatoid arthritis

ANSWER: X) SHINGLES

BONUS

15) LIFE SCIENCE *Short Answer* The Lyon law suggests that females are a mosaic because one of the X chromosomes present in a female cell is randomly inactivated during development. What is the name given to the deactivated X chromosome when visualized through a microscope?

ANSWER: BARR BODY

TOSS-UP

16) MATH *Multiple Choice* The product of two polynomials is $x^5 - 1$. One of the polynomials is $x - 1$. What is the other polynomial?

- W) $x^4 - x^3 + x^2 - x + 1$
- X) $x^4 - x^2 + 1$
- Y) $x^4 + x^3 + x^2 + x + 1$
- Z) $x^4 + x^2 + 1$

ANSWER: Y) $x^4 + x^3 + x^2 + x + 1$

BONUS

16) MATH *Short Answer* The circumference of the base of a right circular cylinder is 7π units. The volume of the cylinder is 98π units squared. What is the height of the cylinder, in units?

ANSWER: 8

TOSS-UP

17) EARTH AND SPACE *Short Answer* What geologic term describes a landscape where dissolution of limestone or dolostone has formed many caves and a hummocky land surface?

ANSWER: KARST

BONUS

17) EARTH AND SPACE *Multiple Choice* What geologic dating technique measures radioactive decay caused during the shattering of a nucleus by cosmic rays on the surface of an exposed rock?

- W) Cosmogenic
- X) Fission-track
- Y) Magnetic
- Z) Optically-stimulated luminescent

ANSWER: W) COSMOGENIC

TOSS-UP

18) LIFE SCIENCE *Multiple Choice* You are playing outside when the neighbor's child comes running up to you screaming that he's been bitten by a snake. You look at the small wound, and immediately notice a very foul smell on his hands. Which of the following snakes most likely bit him?

- W) Gopher snake
- X) Rosy boa
- Y) Garter snake
- Z) Rattle snake

ANSWER: Y) GARTER SNAKE

BONUS

18) LIFE SCIENCE *Multiple Choice* Which of the following muscles is NOT considered a principal muscle for facial expression?

- W) Orbicularis oris [**or-bee-kyoo-LUH-ris**]
- X) Buccinator [**BUHK-suh-nay-ter**]
- Y) Hyoglossus [**hy-oh-GLOS-uhs**]
- Z) Platysma [**pluh-TIZ-muh**]

ANSWER: Y) HYOGLOSSUS

TOSS-UP

19) GENERAL SCIENCE *Multiple Choice* Insects comprise closest to which of the following fractions of all known species on Earth?

- W) 1/6
- X) 1/3
- Y) 2/3
- Z) 3/4

ANSWER: Y) 2/3

BONUS

19) GENERAL SCIENCE *Multiple Choice* What is the most abundant element dissolved in ocean water?

- W) Chlorine
- X) Sodium
- Y) Magnesium
- Z) Sulfur

ANSWER: W) CHLORINE

TOSS-UP

20) ENERGY *Multiple Choice* Solar panels commonly possess a blocking diode. What is its function?

- W) To prevent the panel from draining the energy storage system
- X) To protect the panel from excessive voltage levels
- Y) To protect the panel from excessive current levels
- Z) To store energy to be used for the circuit later

ANSWER: W) TO PREVENT THE PANEL FROM DRAINING THE ENERGY STORAGE SYSTEM

BONUS

20) ENERGY *Multiple Choice* Which of the following is a typical quality factor for a tuning fork?

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

ANSWER: Y) 1000

TOSS-UP

21) GENERAL SCIENCE *Multiple Choice* Vernal pools are which of the following?

- W) Ponds that are found throughout the Mediterranean region
- X) Wetlands that come and go with the seasons
- Y) Water bodies that are dry in the summer
- Z) Lakes that shift slightly every year

ANSWER: X) WETLANDS THAT COME AND GO WITH THE SEASONS

BONUS

21) GENERAL SCIENCE *Short Answer* What form of nitrogen results from the reactions catalyzed by denitrifying bacteria?

ANSWER: MOLECULAR (ACCEPT: N₂)

TOSS-UP

22) LIFE SCIENCE *Short Answer* What endocrine gland is located on the posterior surface of the thyroid gland?

ANSWER: PARATHYROID

BONUS

22) LIFE SCIENCE *Multiple Choice* Pellagra [*puh-LAG-ruh*] results from a deficiency of what?

- W) Vitamin B12
- X) Vitamin B5
- Y) Vitamin B3
- Z) Magnesium

ANSWER: Y) VITAMIN B3

TOSS-UP

23) MATH *Short Answer* If angle ABC is inscribed in a circle and measures 70 degrees, what is the degree measure of arc ABC?

ANSWER: 220°

BONUS

23) MATH *Short Answer* Determine the area in square units for a triangle whose sides have lengths 7, 8, and 9 units, respectively.

ANSWER: $12\sqrt{5}$

TOSS-UP

24) EARTH AND SPACE *Multiple Choice* With over 10,000 different species, grasses are the most widespread plant on the planet. Which of the following makes them different from, and more successful than, flowering plants?

- W) Continuous growth from the bottom
- X) Continuous growth from the apex
- Y) Lack of flowers
- Z) Flowers taking the form of leaves

ANSWER: W) CONTINUOUS GROWTH FROM THE BOTTOM

BONUS

24) EARTH AND SPACE *Multiple Choice* Piedmont glaciers, such as the Wilson-Piedmont glacier in Murdo Sound, Antarctica, are defined by which of the following characteristics?

- W) They contain unusually salty ice
- X) They are older than other glacier types
- Y) They spread broadly into flat valleys
- Z) They occur only in Antarctica

ANSWER: Y) THEY SPREAD BROADLY INTO FLAT VALLEYS

TOSS-UP

25) PHYSICAL SCIENCE *Multiple Choice* You graph a series of equipotentials between two point charges of equal but opposite charge. Which of the following would NOT be true?

- W) The equipotentials cross all lines of force at right angles
- X) If you graphed all possible equipotentials, there would be no straight lines
- Y) If you graphed all possible equipotentials, the potentials would be mirrored across an axis perpendicular to the line that runs through the two charges
- Z) The voltage is the same at any point along one of the equipotential lines

ANSWER: X) IF YOU GRAPHED ALL POSSIBLE EQUIPOTENTIALS, THERE WOULD BE NO STRAIGHT LINES

BONUS

25) PHYSICAL SCIENCE *Multiple Choice* You want to design an experiment to measure the moment of inertia of a hollow spherical ball, or at least to theoretically calculate the ball's moment of inertia. Which of the following would NOT be sufficient to do so?

- W) Observe that the ball is actually an extremely thin shell, and measure its mass in grams and its outer radius in meters
- X) Measure the ball's mass in grams, its inner radius in meters, and its outer radius in meters
- Y) Suspend the ball from a wire oscillating in simple harmonic motion with a known torsional restoring constant K , and measure the velocity of the ball at the lowest point of its oscillation
- Z) Suspend the ball from a wire oscillating in simple harmonic motion with a known torsional restoring constant K , and measure the period of the ball

ANSWER: Y) SUSPEND THE BALL FROM A WIRE OSCILLATING IN SIMPLE HARMONIC MOTION WITH A KNOWN TORSIONAL RESTORING CONSTANT K , AND MEASURE THE VELOCITY OF THE BALL AT THE LOWEST POINT OF ITS OSCILLATION