

ROUND 16

TOSS-UP

1) LIFE SCIENCE *Multiple Choice* What is the name for the basic five carbon sugar that is present in slightly different forms in both DNA and RNA nucleotides:

- W) glucose
- X) fructose
- Y) ribose
- Z) maltose

ANSWER: Y) RIBOSE

BONUS

1) LIFE SCIENCE *Short Answer* Tommy has blue eyes and his wife Jean has brown eyes. Tommy's father has brown eyes and Jean's father has blue eyes. What percentage of Tommy and Jean's children would be expected to have blue eyes, assuming blue eyes are recessive?

ANSWER: 50%

TOSS-UP

2) PHYSICAL SCIENCE *Multiple Choice* Which of the following has the greatest density at room temperature:

- W) 2 kilograms of uranium
- X) 3 kilograms of calcium
- Y) 4 kilogram of lithium
- Z) 5 kilograms of ice

ANSWER: W) 2 KILOGRAMS OF URANIUM

BONUS

2) PHYSICAL SCIENCE *Short Answer* What color of light is produced when equal intensities of green and magenta light are combined?

ANSWER: WHITE

(Solution: they are complementary colors)

TOSS-UP

3) EARTH SCIENCE *Multiple Choice* Which of the following is the primary reason for the decline in fish populations in New England lakes, rivers and streams:

- W) destruction of native species by invasive species
- X) acid rain
- Y) fertilizer runoff
- Z) over fishing

ANSWER: X) ACID RAIN

BONUS

3) EARTH SCIENCE *Short Answer* When sulfur dioxide combines with atmospheric water, what acid is ultimately produced that has greatly contributed to the formation of acid rain?

ANSWER: SULFURIC ACID (ACCEPT: AQUEOUS SULFURIC ACID OR H₂SO₄)

TOSS-UP

4) MATH *Multiple Choice* Which of the following BEST describes the graph of the following equation, $(x - 1)^2 + (y + 2)^2 = 9$

- W) straight line
- X) parabola
- Y) ellipse
- Z) circle

ANSWER: Z) CIRCLE

BONUS

4) MATH *Short Answer* Find the lateral surface area, in square meters, of a right circular cylinder with radius 4 meters and height 10 meters. Use $\pi = 3.14$ and give your answer rounded to the nearest whole number:

ANSWER: 251

(Solution: $LA = 2\pi rh; = 2(3.14)(4)(10) = 251.2 \text{ m}^2$)

TOSS-UP

5) GENERAL SCIENCE *Multiple Choice* Which of the following is the MOST accurate description of a Newtonian reflector telescope:

- W) it has one flat primary mirror and two ocular lenses
- X) it has a concave parabolic main or primary mirror, a flat secondary mirror, and an eyepiece lens
- Y) it has a primary glass lens, a secondary flat mirror, and an ocular lens
- Z) it has 2 convex glass lenses and an ocular lens

ANSWER: X) IT HAS A CONCAVE PARABOLIC MAIN OR PRIMARY MIRROR, A FLAT SECONDARY MIRROR, AND AN EYEPIECE LENS

BONUS

5) GENERAL SCIENCE *Multiple Choice* Which of the following is a MAIN advantage of a Newtonian reflector telescope over a Galilean refractor telescope:

- W) the Newtonian is much smaller and resistant to changes in temperature
- X) the Newtonian can be used in a wider variety of temperatures
- Y) the Newtonian focuses all colors of light at the same focal point
- Z) the Newtonian mirrors are usually made of metal so they cannot easily break

ANSWER: Y) THE NEWTONIAN FOCUSES ALL COLORS OF LIGHT AT THE SAME FOCAL POINT

TOSS-UP

6) LIFE SCIENCE *Multiple Choice* Which of the following types of microscopes passes negatively charged particles guided by magnetic lenses through a very thin specimen, all in a partial vacuum, to produce an image at high magnification:

- W) bright field microscopy
- X) scanning electron microscopy
- Y) dark field microscopy
- Z) transmission electron microscopy

ANSWER: Z) TRANSMISSION ELECTRON MICROSCOPY

BONUS

6) LIFE SCIENCE *Short Answer* What is the scientific name for the instrument used to separate substances of different densities in solution using a rotor to spin specimens at high RPM's?

ANSWER: CENTRIFUGE

TOSS-UP

7) PHYSICAL SCIENCE *Multiple Choice* Which of the following functional groups replaces a hydrogen in an alcohol:

- W) hydroxyl
- X) carboxyl
- Y) ester
- Z) amide

ANSWER: W) HYDROXYL

BONUS

7) PHYSICAL SCIENCE *Short Answer* Which one of the following 4 colors of light has the greatest angle of refraction in normal glass: orange; violet; red; yellow

ANSWER: VIOLET

TOSS-UP

8) EARTH SCIENCE *Multiple Choice* Which of the following is the global wind system that most influences weather in Denver Colorado:

- W) tropical easterlies
- X) trade winds
- Y) prevailing westerlies
- Z) polar easterlies

ANSWER: Y) PREVAILING WESTERLIES

BONUS

8) EARTH SCIENCE *Multiple Choice* Which of the following ocean waters typically has the LEAST pronounced thermocline layer:

- W) polar
- X) temperate
- Y) sub-tropical
- Z) tropical

ANSWER: W) POLAR

TOSS-UP

9) MATH *Short Answer* In how many ways can 5 different people be standing around a circular table?

ANSWER: 24

(Solution: circular permutation, $(n-1)! = (5-1)! = 4! = 24$)

BONUS

9) MATH *Short Answer* Express the following in its simplest radical form:

$$(5 + \sqrt{2})(7 - \sqrt{2})$$

ANSWER: $33 + 2\sqrt{2}$ (ACCEPT: $2\sqrt{2} + 33$)

TOSS-UP

10) GENERAL SCIENCE *Multiple Choice* Which of the following is a group of organic compounds that is often added to foods to enhance flavors such as strawberry or banana and are also found in sweet-smelling flowers:

- W) amines
- X) esters
- Y) alcohols
- Z) halogenated hydrocarbons

ANSWER: X) ESTERS

BONUS

10) GENERAL SCIENCE *Multiple Choice* Honey is considered hygroscopic because it:

- W) is very dense for a sugar
- X) loses water to its environment
- Y) attracts water from the air
- Z) expands rapidly on heating

ANSWER: Y) ATTRACTS WATER FROM THE AIR

TOSS-UP

11) LIFE SCIENCE *Multiple Choice* As a tree ages, which of the following BEST describes what happens to the secondary phloem:

- W) it stops being produced
- X) it accumulates in large quantities into the xylem
- Y) it is crushed between each year's xylem
- Z) it is lost as part of the bark and does not accumulate in great quantities

ANSWER: Z) IT IS LOST AS PART OF THE BARK AND DOES NOT ACCUMULATE IN GREAT QUANTITIES

BONUS

11) LIFE SCIENCE *Multiple Choice* If an order of plant has floral parts usually arranged in multiples of 4 or 5, it would most likely have:

- W) net venation and one cotyledon
- X) vascular bundles arranged in a ring and a taproot
- Y) diffuse or fibrous root system and 2 cotyledons
- Z) parallel venation and 2 cotyledons

ANSWER: X) VASCULAR BUNDLES ARRANGED IN A RING AND A TAPROOT

TOSS-UP

12) PHYSICAL SCIENCE *Multiple Choice* Which of the following can transfer heat through a vacuum:

- W) convection
- X) conduction
- Y) radiation
- Z) sublimation

ANSWER: Y) RADIATION

BONUS

12) PHYSICAL SCIENCE *Short Answer* Consider a 2.0 kilogram rock that falls vertically from a ledge and strikes the ground with a velocity of 50 meters per second. If friction is ignored, what was the gravitational potential energy, in joules, of the rock when it was on the ledge in relation to the place where it struck the ground?

ANSWER: 2500

(Solution: $\frac{1}{2}mv^2 = \frac{1}{2}(2)(50)^2 = \frac{1}{2} \times 2 \times 2500 = 2500 \text{ J}$)

TOSS-UP

13) EARTH SCIENCE *Multiple Choice* Which of the following is when ocean tidal currents typically reach their maximum velocity:

- W) at high tide extremes
- X) at low tide extremes
- Y) midway between high and low tides
- Z) during flood tide

ANSWER: Y) MIDWAY BETWEEN HIGH AND LOW TIDES

BONUS

13) EARTH SCIENCE *Multiple Choice* Which of the following is the name for the last of 4 glacial episodes recognized in North America:

- W) the Wisconsinan
- X) the Ordovician
- Y) the Alaskan
- Z) the Nebraskan

ANSWER: W) THE WISCONSINAN

TOSS-UP

14) MATH *Short Answer* What is the degree of the following polynomial: $7x^4y - 5x^3y^3 + 3xy^3 - 4$

ANSWER: 6

(Solution: the degree of the term with the largest degree, 3 + 3)

BONUS

14) MATH *Short Answer* Giving your answer in terms of pi, what is the volume of a cone with a height of 8 meters and a base whose diameter is 6 meters?

ANSWER: 24π

(Solution: $V = \frac{1}{3}\pi r^2 h = \frac{1}{3}(\pi)(3^2)(8) = 24\pi$)

TOSS-UP

15) GENERAL SCIENCE *Short Answer* What element is MOST commonly added to steel to make it stainless steel?

ANSWER: CHROMIUM

BONUS

15) GENERAL SCIENCE *Short Answer* What metal is silvery-white when pure, is used as a catalyst in fuel cells and in antipollution devices in automobiles, does not oxidize in air at any temperature, and is used extensively in the making of jewelry and wires?

ANSWER: PLATINUM

TOSS-UP

16) LIFE SCIENCE *Multiple Choice* What type of virus has the Food and Drug Administration recently approved to be sprayed on certain foods as a preservative against bacterial contamination:

- W) bacteriophage
- X) H5N1
- Y) Marburg
- Z) Ebola

ANSWER: W) BACTERIOPHAGE

BONUS

16) LIFE SCIENCE *Multiple Choice* Which of the following is the BEST reason why high salt environments are difficult environments for organisms to survive in:

- W) salt is an ionic molecule and causes a charge differential
- X) salt causes an osmotic imbalance leading to excessive loss of water from cells
- Y) salt usually is contaminated with toxic heavy metals
- Z) salt causes heavy metal poisons to be readily absorbed through skin

ANSWER: X) SALT CAUSES AN OSMOTIC IMBALANCE LEADING TO EXCESSIVE LOSS OF WATER FROM CELLS

TOSS-UP

17) PHYSICAL SCIENCE *Multiple Choice* Which of the following follows from the Doppler effect for a sound wave source where a loud motorcycle is moving towards you:

- W) the wavelength will shorten and frequency increases
- X) the wavelength will shorten and frequency decreases
- Y) the wavelength will increase and frequency increases
- Z) the wavelength will increase and frequency decreases

ANSWER: W) THE WAVELENGTH WILL SHORTEN AND FREQUENCY INCREASES

BONUS

17) PHYSICAL SCIENCE *Short Answer* Name all of the following 3 forms of radioactive decay that change the atomic number of the decaying element: alpha decay; beta decay; gamma decay

ANSWER: ALPHA DECAY; BETA DECAY

TOSS-UP

18) EARTH SCIENCE *Multiple Choice* Eutrophic lakes are most commonly noted for which of the following sets of characteristics:

- W) high temperature differences from top to bottom and extremely deep
- X) unhealthy containing no living organisms and a very low pH
- Y) healthy with abundant life and neutral pH
- Z) shallow, warm, and containing abundant nutrients

ANSWER: Z) SHALLOW, WARM, AND CONTAINING ABUNDANT NUTRIENTS

BONUS

18) EARTH SCIENCE *Short Answer* Choosing from dawn, noon, sunset, and midnight, when will the Moon rise and set, respectively, for a star gazer in mid-northern latitudes, if the Moon's phase is a waxing crescent?

ANSWER: RISE = DAWN; SET = SUNSET

TOSS-UP

19) MATH *Short Answer* Order the following 4 polygons from the one with the FEWEST faces to the one with the MOST faces: dodecagon; hexadecagon; octagon; hexagon

ANSWER: HEXAGON; OCTAGON; DODECAGON; HEXADECAGON

BONUS

19) MATH *Short Answer* Find the number of sides in a regular polygon if each interior angle measures 135 degrees:

ANSWER: 8

(Solution: $(n - 2)180^\circ = 135n$; $n = 8$)

TOSS-UP

20) GENERAL SCIENCE *Short Answer* Consider the following ecosystem and name the secondary consumer: A plant that derives energy from the Sun is eaten by a rabbit; the rabbit is eaten by a wolf; the scraps of rabbit are eaten by a hawk; and the remaining carcass is left to decompose

ANSWER: WOLF

BONUS

20) GENERAL SCIENCE *Multiple Choice* Which of the following BEST approximates the circumference of a U.S. nickel:

W) 1.41 centimeters

X) 3.14 centimeters

Y) 6.28 centimeters

Z) 9.42 centimeters

ANSWER: Y) 6.28 CENTIMETERS

(Solution: $C = \pi(2\text{cm}) = 6.28\text{cm}$)

TOSS-UP

21) LIFE SCIENCE *Short Answer* What symbiotic relationship is characterized by one organism benefiting while the other is being harmed?

ANSWER: PARASITISM

BONUS

21) LIFE SCIENCE *Short Answer* Over-hunting of sea otters on the northwest coast led to an overabundance of sea urchins which in turn overgrazed on sea kelp almost wiping out the kelp forests. What is the scientific ecological term for what the sea otter is considered in this case as a central organism to this community?

ANSWER: A KEYSTONE SPECIES

TOSS-UP

22) PHYSICAL SCIENCE *Short Answer* What three elements are found in ethanoic acid?

ANSWER: HYDROGEN; CARBON; OXYGEN (in any order)

BONUS

22) PHYSICAL SCIENCE *Short Answer* How many grams of potassium chloride, with a molecular weight of 104, must be dissolved in 250 milliliters of water to make a 20% potassium chloride solution?

ANSWER: 50

(Solution: $(250\text{ml}) \times (20\text{g}/100\text{ml}) = 50\text{g}$)

TOSS-UP

23) EARTH SCIENCE *Short Answer* What three gases make up over 99% of all dissolved gases in surface sea water?

ANSWER: NITROGEN, CARBON DIOXIDE AND OXYGEN (in any order)

BONUS

23) EARTH SCIENCE *Short Answer* Order the following 4 elements from the MOST common in the universe to the LEAST common: carbon; helium; hydrogen; iron

ANSWER: HYDROGEN; HELIUM; CARBON; IRON

TOSS-UP

24) MATH *Short Answer* If the fourth term in the binomial expansion of $(x + y)^7$ is $35x^4y^3$, what is the 5th term?

ANSWER: $35x^3y^4$ (ACCEPT: $35y^4x^3$)

BONUS

24) MATH *Short Answer* In simplest terms, give the 6th term of the geometric sequence whose second term is -3 and whose third term is $\frac{3}{2}$:

ANSWER: $-\frac{3}{16}$

(Solution: $a_x = a(r)^{x-1}$; $a_6 = 6(-\frac{1}{2})^5$; $a = -\frac{3}{16}$)

TOSS-UP

25) GENERAL SCIENCE *Short Answer* The lifetime of a star is mostly determined by what physical property?

ANSWER: MASS

BONUS

25) GENERAL SCIENCE *Short Answer* Order the following 4 celestial objects from the LEAST massive to the MOST massive: neutron star; brown dwarf; the Sun; a galaxy

ANSWER: BROWN DWARF; SUN; NEUTRON STAR; GALAXY