

## ROUND 14

### TOSS-UP

- 1) CHEMISTRY *Multiple Choice* The amount of heat required for melting a substance is called its:
- W) heat of liquidation
  - X) enthalpy of evaporation
  - Y) enthalpy of vaporization
  - Z) heat of fusion

ANSWER: Z) HEAT OF FUSION

### BONUS

- 1) CHEMISTRY *Short Answer* A Beer's law standard straight-line curve is a plot of what value on the ordinate and what value on the abscissa?

ANSWER: ORDINATE = ABSORBANCE; ABSCISSA = CONCENTRATION (or molarity)

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### TOSS-UP

- 2) PHYSICS *Short Answer* According to the standard model of particle physics, how many leptons are there, including both matter and antimatter?

ANSWER: 12

### BONUS

- 2) PHYSICS *Short Answer* Order the following three substances from the one that will show the largest increase in temperature for each single calorie added to one gram of that substance, to the one that will show the least: lead, water, aluminum

ANSWER: LEAD, ALUMINUM, WATER

( Solution: specific heat of water is 1.0, aluminum is 0.21 , and lead is 0.03)

### TOSS-UP

- 3) **BIOLOGY** *Multiple Choice* Which of the following most closely represents the resting membrane potential in a typical human neuron:

- W) -70 millivolts
- X) - 60 millivolts
- Y) - 45 millivolts
- Z) 0 millivolts

ANSWER: W) -70 MILLIVOLTS

### BONUS

- 3) **BIOLOGY** *Short Answer* According to recent research, especially by Japanese scientists, there are 5 basic tastes. What are they?

ANSWER: UMAMI, SOUR, BITTER, SALTY, SWEET (accept in any order)

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### TOSS-UP

- 4) **ASTRONOMY** *Multiple Choice* Which of the following do many astronomers consider as the best candidates for dark matter:

- W) intergalactic quasars
- X) dwarf stars and baryons
- Y) undetected galaxies
- Z) cosmic background radiation

ANSWER: X) DWARF STARS AND BARYONS

### BONUS

- 4) **ASTRONOMY** *Short Answer* Which 2 of the following 5 stars are binary stars: Sirius, Arcturus, Vega, Rigel, Betelgeuse

ANSWER: SIRIUS; RIGEL

### TOSS-UP

5) MATH *Multiple Choice* In trigonometry, the ratio of  $\frac{\text{hypotenuse}}{\text{adjacent}}$  is denoted by:

- W)  $\sec \theta$  (read as: the secant of theta)
- X)  $\cot \theta$  (read as: the cotangent of theta)
- Y)  $\csc \theta$  (read as: the cosecant of theta)
- Z)  $\tan \theta$  (read as: the tangent of theta)

ANSWER: W) SEC  $\theta$

### BONUS

5) MATH *Short Answer* Use the Binomial Theorem to expand and simplify the following equation:  $(x - 2)^3$

ANSWER:  $x^3 - 6x^2 + 12x - 8$

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### TOSS-UP

6) EARTH SCIENCE *Short Answer* From the oldest to the youngest, the Mesozoic Era is subdivided into what 3 periods of the Geological Time Scale:

ANSWER: TRIASSIC, JURASSIC, CRETACEOUS

### BONUS

6) EARTH SCIENCE *Short Answer* On open seacoasts, what man-made structures are often constructed in pairs at the mouth of an inlet, estuary, or bay, and are intended to stabilize the channel, prevent shoaling, and are used as general protection from larger waves?

ANSWER: JETTIES (DO NOT ACCEPT: GROINS, BREAKWATERS, OR SEA WALLS)

**TOSS-UP**

7) GENERAL SCIENCE *Multiple Choice* During the summer, a person swimming on the surface of a lake is swimming in which layer:

- W) thermocline
- X) thermolimnion
- Y) epilimnion
- Z) hypolimnion

ANSWER: Y) EPILIMNION

**BONUS**

7) GENERAL SCIENCE *Multiple Choice* Cellophane is which of the following polymers:

- W) cellulose arylate
- X) nitrocellulose
- Y) colloidon cellulose
- Z) cellulose acetate

ANSWER: Z) CELLULOSE ACETATE

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**TOSS-UP**

8) COMPUTER SCIENCE *Multiple Choice* What type of data structure consists of a set of keys and corresponding values:

- W) vector
- X) array
- Y) hashtable
- Z) list

ANSWER: Y) HASHTABLE

**BONUS**

8) COMPUTER SCIENCE *Short Answer* What does the acronym NIC stand for?

ANSWER: NETWORK INTERFACE CARD

### TOSS-UP

- 9) CHEMISTRY *Multiple Choice* What law states that the vapor pressure of a solution containing a nonvolatile solute is equal to the vapor pressure of pure solvent times the mole fraction of the solvent?
- W) Gay-Lussac's Law
  - X) Raoult's Law
  - Y) Henry's Law
  - Z) Dalton's Law

ANSWER: X) RAOULT'S LAW

### BONUS

- 9) CHEMISTRY *Short Answer* After one hour, a radioactive substance decays to 25% of its original radioactivity. What is the half-life of the sample in minutes?

ANSWER: 30 MINUTES

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### TOSS-UP

- 10) PHYSICS *Multiple Choice* Which of the following colors of light has the greatest angle of refraction in normal glass:
- W) yellow
  - X) green
  - Y) orange
  - Z) red

ANSWER: X) GREEN

### BONUS

- 10) PHYSICS *Short Answer* Ignoring friction and assuming  $g = 9.8 \text{ m/sec}^2$ , how high will a stone reach, in meters rounded to the nearest whole number, if launched vertically at 25 m/sec:

ANSWER: 32

### TOSS-UP

- 11) **BIOLOGY** *Short Answer* What gland is located in the mediastinum (Pron: meed-i-ast-in-um) and after puberty continues to diminish in size and function until it is mostly fatty connective tissue at age 50 in humans?

ANSWER: THYMUS

### BONUS

- 11) **BIOLOGY** *Multiple Choice* Which of the following is NOT true of the Calvin-Benson Cycle:
- W) it was partially deciphered by using two-dimensional paper chromatography
  - X) it is also sometimes called the light-independent reaction of photosynthesis
  - Y) it converts energy trapped in the light reactions into sugar
  - Z) for each 12 CO<sub>2</sub> fixed, 6 PGAL are formed

ANSWER: Z) FOR EACH 12 CO<sub>2</sub> FIXED, 6 PGAL ARE FORMED

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### TOSS-UP

- 12) **ASTRONOMY** *Multiple Choice* Which of the following is another name for the Pleiades (Pron: plea-ah-dees):
- W) M25
  - X) the seven sisters
  - Y) the little dipper
  - Z) the crescent

ANSWER: X) THE SEVEN SISTERS

### BONUS

- 12) **ASTRONOMY** *Short Answer* For a telescope with a focal length of 440 centimeters and an eyepiece of 20 millimeters, what is the magnifying power of the telescope?

ANSWER: 220 TIMES (ACCEPT: 220X OR 220)

(Solution: Since 440 centimeters = 4,400 mm → 4,400 / 20 = 220)

**TOSS-UP**

13) MATH *Multiple Choice* If  $f''$  (read as: f double prime) is greater than zero, the function f is:

- W) concave up
- X) concave down
- Y) the point of inflection
- Z) the point of local maximum

ANSWER: W) CONCAVE UP

**BONUS**

13) MATH *Short Answer* A circle has a diameter of 120 and a minor arc L whose interior angle is  $120^\circ$ . In terms of  $\pi$ , what is the arc length?

ANSWER:  $40\pi$

(Solution: arc length =  $(120^\circ/360^\circ)(2\pi r)$ ; =  $1/3 (2)(60)\pi$ ; =  $40\pi$ )

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**TOSS-UP**

14) EARTH SCIENCE *Multiple Choice* The depth at which an ocean wave is disturbed is a function of which of the following:

- W) wavelength
- X) wave energy
- Y) wave period
- Z) wave frequency

ANSWER: W) WAVELENGTH

**BONUS**

14) EARTH SCIENCE *Multiple Choice* An ocean wave begins to change in appearance and behavior when it reaches water depth that is approximately:

- W) 1/8 of its wavelength
- X) 1/4 of its wavelength
- Y) 1/2 of its wavelength
- Z) 3/4 of its wavelength

ANSWER: Y) 1/2 OF ITS WAVELENGTH

### TOSS-UP

15) GENERAL SCIENCE *Multiple Choice* Which of the following is the term for the process whereby steel is softened through slow cooling after enough heat has been added to make the steel lose its brittleness:

- W) drawing
- X) quenching
- Y) tempering
- Z) annealing

ANSWER: Z) ANNEALING

### BONUS

15) GENERAL SCIENCE *Multiple Choice* A new 2002 USA penny weighs about how many grams:

- W) 0.5
- X) 1.0
- Y) 1.5
- Z) 2.5

ANSWER: Z) 2.5

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### TOSS-UP

16) COMPUTER SCIENCE *Multiple Choice* With ray tracing, the appearance of an object is governed by how the object surface reflects light. Which of the following is best used to give an object an inhomogeneous appearance:

- W) texture
- X) pixelation
- Y) specularity
- Z) amorphous shape

ANSWER: W) TEXTURE

### BONUS

16) COMPUTER SCIENCE *Short Answer* What does the acronym FORTRAN stand for?

ANSWER: FORMULA TRANSLATOR



### TOSS-UP

- 17) CHEMISTRY *Multiple Choice* Which of the following is an aromatic hydrocarbon?
- W) benzene
  - X) dimethyl ketone
  - Y) ethyl methyl ether
  - Z) formamide

ANSWER: W) BENZENE

### BONUS

- 17) CHEMISTRY *Multiple Choice*  $C_2H_4Br_2$  is the only product of a reaction between ethane and bromine. The reaction is:
- W) an addition reaction
  - X) a substitution reaction
  - Y) an esterification reaction
  - Z) a hydrogenation reaction

ANSWER: W) AN ADDITION REACTION

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### TOSS-UP

- 18) PHYSICS *Multiple Choice* Light that is a green color is composed of which of the following wavelengths:
- W) 300-400 nanometers
  - X) 400-500 nanometers
  - Y) 500-600 nanometers
  - Z) 600-700 nanometers

ANSWER: Y) 500-600 NANOMETERS

### BONUS

- 18) PHYSICS *Short Answer* What is the energy used, in joules, if a current of 2 amps flows through a 10 ohm resistance circuit for 1 minute?

ANSWER: 2,400

(Solution:  $W = I^2 R \times T = (2A)^2 \times 10 \text{ ohms} \times 60 \text{ s} = 2400 \text{ joules}$ )

### TOSS-UP

- 19) **BIOLOGY** *Short Answer* The absence of what accessory organ demands that Elasmobranchs constantly swim or else they will sink?

ANSWER: SWIMBLADDER

### BONUS

- 19) **BIOLOGY** *Short Answer* Which 2 of the following 5 organisms are NOT nematodes?  
*Necator mercantes* (Pron: nee-kate-or mer-kant-ees), *Ancylostoma duodenale* (Pron: ank-ee-low-stow-mah dew-odd-en-ale-ee), *Ascaris lumbricoides* (Pron: as-kar-iss lum-bri-koid-ees), *Taenia saginata* (Pron: teen-i-ah saj-inn-a-tah), *Fasciola hepatica* (Pron: fas-i-oh-lah hep-at-i-ka)

ANSWER: *TAENIA SAGINATA*, *FASCIOLA HEPATICA*

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### TOSS-UP

- 20) **ASTRONOMY** *Multiple Choice* Considering that the Sun is expected to live for a total of ten billion years, how long would a star of ten times the mass of the sun live:
- W) 100 billion years
  - X) 100 million years
  - Y) 10 million years
  - Z) 1 million years

ANSWER: Y) 10 MILLION YEARS

### BONUS

- 20) **ASTRONOMY** *Multiple Choice* Because of recent magnetometer analysis of Europa, it is believed that this moon has:
- W) a subsurface salty ocean
  - X) a molten iron core
  - Y) polar caps of solid hydrogen
  - Z) an atmosphere of methane and ice crystals

ANSWER: W) A SUBSURFACE SALTY OCEAN

### TOSS-UP

- 21) MATH *Short Answer* What is the general term for a polyhedron with 2 congruent and parallel faces called bases, and whose remaining faces are called parallelograms?

ANSWER: PRISM

### BONUS

- 21) MATH *Multiple Choice* If the circumference of a cylindrical tube is 6 and its height is 12, what is the area in terms of  $\pi$  of the base of the cylindrical tube?

- W)  $9\pi$
- X)  $3\pi$
- Y)  $9/\pi$
- Z)  $3/\pi$

ANSWER: Y)  $9/\pi$

(Solution:  $C = 2\pi r$ ;  $6 = 2\pi r$ ;  $r = 3/\pi$ ; Area =  $\pi r^2$ ; =  $\pi(3/\pi)^2$ ; =  $9/\pi$ )

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### TOSS-UP

- 22) GENERAL SCIENCE *Multiple Choice* Another name for vitamin B<sub>3</sub> is:

- W) thiamin
- X) riboflavin
- Y) niacin
- Z) folic acid

ANSWER: Y) NIACIN

### BONUS

- 22) GENERAL SCIENCE *Multiple Choice* Which of the following best describes an interaction between two organisms when one participant is harmed but the other is unaffected:

- W) competition
- X) commensalism (Pron: ko-mens-a-lis-um)
- Y) mutualism
- Z) amensalism (ay-mens-a-lis-um)

ANSWER: Z) AMENSALISM

**TOSS-UP**

23) CHEMISTRY *Multiple Choice* Monounsaturated fatty acids contain:

- W) single bonds only
- X) one single bond
- Y) one double bond
- Z) two double bonds

ANSWER: Y) ONE DOUBLE BOND

**BONUS**

23) CHEMISTRY *Short Answer* What two monosaccharides make up the disaccharide lactose?

ANSWER: GALACTOSE AND GLUCOSE (accept in any order)

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**TOSS-UP**

24) PHYSICS *Multiple Choice* Which of the following cases would be most directly solved by applying Wien's law:

- W) half-life of an isotope given its nucleon make up
- X) angle of refraction
- Y) charge of an electron
- Z) color of a star given its temperature

ANSWER: Z) COLOR OF A STAR GIVEN ITS TEMPERATURE

**BONUS**

24) PHYSICS *Multiple Choice* In one second, how many electrons will move past a point in a wire carrying a direct current of two amps?

- W)  $2.5 \times 10^{18}$
- X)  $1.25 \times 10^{16}$
- Y)  $1.25 \times 10^{19}$
- Z)  $2.5 \times 10^{19}$

ANSWER: Y)  $1.25 \times 10^{19}$

**TOSS-UP**

25) **BIOLOGY** *Short Answer* What organ of the human body is primarily responsible for culling abnormal erythrocytes?

ANSWER: SPLEEN

**BONUS**

25) **BIOLOGY** *Short Answer* Order the following 3 monosaccharides from the smallest to the largest: erythrose, mannose, ribose

ANSWER: ERYTHROSE, RIBOSE, MANNOSE