

## ROUND 16

### TOSS-UP

1) LIFE SCIENCE *Multiple Choice* Which of the following is the most common term biologists use to indicate that an enzyme has lost its normal 3-dimensional shape:

- W) virulent
- X) catalyzed
- Y) denatured
- Z) degenerated

ANSWER: Y) DENATURED

### BONUS

1) LIFE SCIENCE *Short Answer* By words or numbers, name all of the following 3 physical or chemical changes that will typically denature a protein:

1) large changes in pH; 2) rapid cooling to 4°C; 3) heating to over 45°C

ANSWER: 1 AND 3

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### TOSS-UP

2) PHYSICAL SCIENCE *Multiple Choice* Which of the following is the BEST description of the thermodynamic term entropy:

- W) a measure of the disorder of a system
- X) the amount of heat in a system
- Y) all energy is conserved
- Z) heat moving from a warm system and generating work

ANSWER: W) A MEASURE OF THE DISORDER OF A SYSTEM

### BONUS

2) PHYSICAL SCIENCE *Multiple Choice* Which of the following is an example of the Doppler effect:

- W) the higher a sound pitch the slower it travels through a dense medium
- X) light emitted from a galaxy that is moving away from Earth is shifted to the red wavelengths
- Y) sound is louder the closer it is to an observer
- Z) light intensity falls off with the cube of the distance from an observer

ANSWER: X) LIGHT EMITTED FROM A GALAXY THAT IS MOVING AWAY FROM EARTH IS SHIFTED TO THE RED WAVELENGTHS

### TOSS-UP

3) EARTH SCIENCE *Multiple Choice* Which of the following did Alfred Wegener study to come up with the theory of continental drift:

- W) remnant magnetism in rock
- X) the shape of landmasses and the distribution of fossils
- Y) altimetry data
- Z) sea floor topography

ANSWER: X) THE SHAPE OF LANDMASSES AND THE DISTRIBUTION OF FOSSILS

### BONUS

3) EARTH SCIENCE *Multiple Choice* The interpretation of which of the following gave strong and convincing support to the concept of sea-floor spreading:

- W) subsurface crystallography studies
- X) color comparisons of basaltic rock
- Y) fossil studies of benthic organisms
- Z) magnetic surveys of the seafloor

ANSWER: Z) MAGNETIC SURVEYS OF THE SEAFLOOR

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### TOSS-UP

4) MATH *Short Answer* In how many different ways can 4 people line up for a photograph?

ANSWER: 24

(Solution:  $4 \times 3 \times 2 \times 1 = 24$ )

### BONUS

4) MATH *Short Answer* If the price of carpeting is \$20.00 per square yard, how much will it cost to cover a 30-foot by 30-foot square area?

ANSWER: \$2,000.00

(Solution:  $A = 900 \text{ ft}^2$ ;  $(900 \text{ ft}^2)(1 \text{ yd}^2/9 \text{ ft}^2)(\$20/\text{yd}^2) = \$2000$ )

**TOSS-UP**

5) GENERAL SCIENCE *Multiple Choice* For people viewing the night sky from mid-northern latitudes, which of the following constellations would never set below the horizon during the night:

- W) Centaurus
- X) Orion
- Y) Pegasus
- Z) Ursa Major

ANSWER: Z) URSA MAJOR

**BONUS**

5) GENERAL SCIENCE *Short Answer* Name all of the following 4 choices that are characteristic of coke used in blast furnaces: porous; shiny; grey; soft

ANSWER: POROUS; GREY

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**TOSS-UP**

6) LIFE SCIENCE *Short Answer* Into what organelle does the nuclear membrane get absorbed at the start of prophase?

ANSWER: ENDOPLASMIC RETICULUM (ACCEPT: ER)

**BONUS**

6) LIFE SCIENCE *Multiple Choice* Which of the following is the best explanation as to why germs that infect a certain family of animals will often NOT be able to infect a different family of animals:

- W) different metabolic pathways exist in different animals
- X) germs gain entry into cells by binding to receptors which are often specific to certain groups of organisms
- Y) the immune systems of different animals prevents infection of unusual diseases
- Z) germs reproduce only when genes in a cell allow them

ANSWER: X) GERMS GAIN ENTRY INTO CELLS BY BINDING TO RECEPTORS WHICH ARE OFTEN SPECIFIC TO CERTAIN GROUPS OF ORGANISMS

### TOSS-UP

7) PHYSICAL SCIENCE *Multiple Choice* Which of the following BEST describes what atomic particle was the last to be discovered and why:

- W) the electron because it has very small mass
- X) the proton because it resides in the nucleus
- Y) the proton because it does not have any angular momentum
- Z) the neutron because it has no charge

ANSWER: Z) THE NEUTRON BECAUSE IT HAS NO CHARGE

### BONUS

7) PHYSICAL SCIENCE *Short Answer* Assuming that sodium and chlorine have atomic masses of 23 and 35, respectively, what is the molarity of a 5-liter aqueous solution containing 292 grams of sodium chloride?

ANSWER: 1

(Solution:  $292\text{g}/5\text{L} = 58\text{g}/\text{L} = 1\text{M}$ )

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### TOSS-UP

8) EARTH SCIENCE *Multiple Choice* Which of the following is NOT a key step in the nitrogen cycle:

- W) nitrification
- X) assimilation
- Y) ammonification
- Z) evaporation

ANSWER: Z) EVAPORATION

### BONUS

8) EARTH SCIENCE *Multiple Choice* When lengthy and lasting jet contrails predominate in the sky, which of the following is the most likely forecast:

- W) showers within 24 hours
- X) fair weather with increasing cirrus or cirrostratus clouds
- Y) violent thunderstorms within 24 hours
- Z) overcast with slow clearing

ANSWER: X) FAIR WEATHER WITH INCREASING CIRRUS OR CIRROSTRATUS CLOUDS

### TOSS-UP

9) MATH *Multiple Choice* Which of the following expressions is NOT a monomial:

W)  $3x^2y$

X)  $\frac{1}{2}x$

Y)  $\sqrt{x}$

Z)  $x$

ANSWER: Y)  $\sqrt{x}$

### BONUS

9) MATH *Short Answer* Find the following product, giving your answer in simplified form:  
 $(9xy^2 + 4)(5xy^2 - 3)$

ANSWER:  $45x^2y^4 - 7xy^2 - 12$

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### TOSS-UP

10) GENERAL SCIENCE *Multiple Choice* Which of the following is the best basic guide for recognizing a theory as scientific:

W) it must have a hypothesis that will be proven true

X) it must be subject to some sort of testing or experimentation

Y) it must be new and able to be proved true in all instances

Z) the subject with which it deals must be able to be directly observed

ANSWER: X) IT MUST BE SUBJECT TO SOME SORT OF TESTING OR EXPERIMENTATION

### BONUS

10) GENERAL SCIENCE *Multiple Choice* Which of the following is NOT true regarding B-vitamins:

W) they are fat soluble

X) there are more than 5 different B-vitamins

Y) niacin is a B-vitamin

Z) vitamin B-12 is found in meat, milk and eggs

ANSWER: W) THEY ARE FAT SOLUBLE

**TOSS-UP**

11) LIFE SCIENCE *Short Answer* What human blood type has antibodies to only group A antigens?

ANSWER: TYPE B (ACCEPT: B)

**BONUS**

11) LIFE SCIENCE *Multiple Choice* Which of the following is NOT true of genes:

- W) they are passed from generation to generation through chromosomes
- X) they can come in dominant or recessive forms
- Y) genes often lead to the production of a protein
- Z) most of the DNA sequences in chromosomes are genes

ANSWER: Z) MOST OF THE DNA SEQUENCES IN CHROMOSOMES ARE GENES

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**TOSS-UP**

12) PHYSICAL SCIENCE *Multiple Choice* A botanist observes pollen grains suspended in water jittering about in a random fashion. Another scientist observes similar random motion of coal dust on the surface of another liquid. These are commonly considered examples of:

- W) speculative motion
- X) Bose condensation
- Y) Brownian motion
- Z) osmosis

ANSWER: Y) BROWNIAN MOTION

**BONUS**

12) PHYSICAL SCIENCE *Multiple Choice* With which of the following is Brownian motion most directly related:

- W) thermal energy
- X) conservation of mass
- Y) Dalton's law
- Z) chemical ionic bonds

ANSWER: W) THERMAL ENERGY

**TOSS-UP**

13) EARTH SCIENCE *Multiple Choice* The darker portion of the Moon that faces the Earth in a crescent phase often appears somewhat lighted with a faint grayish glow. Which of the following BEST describes why this happens:

- W) sunlight reflected off the Earth's surface onto the Moon
- X) afterglow of the Moon's lighted surface
- Y) an optical illusion
- Z) sunlight reflected off interplanetary dust

ANSWER: W) SUNLIGHT REFLECTED OFF THE EARTH'S SURFACE ONTO THE MOON

**BONUS**

13) EARTH SCIENCE *Multiple Choice* Which of the following best describes what occurs to the solar wind as it approaches close to the planet Earth:

- W) it is absorbed by the troposphere and significantly heats the upper atmosphere
- X) it forms cosmic rays that create the Van Allen belts
- Y) it is largely deflected by the Earth's magnetosphere
- Z) it causes a shock wave to form, creating what is called a termination shock in the Earth's ionosphere

ANSWER: Y) IT IS LARGELY DEFLECTED BY THE EARTH'S MAGNETOSPHERE

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**TOSS-UP**

14) MATH *Short Answer* A bag contains 100 crayons of which 20 are red, 55 are purple, and 25 are yellow. Expressed as a percent, what is the probability of randomly getting one crayon from the bag and having it be yellow?

ANSWER: 25

**BONUS**

14) MATH *Short Answer* Assuming  $\log 2 = 0.3$  and  $\log 3 = 0.5$ , find  $\log 6$ :

ANSWER: 0.8

(Solution:  $\log 2 + \log 3 = 0.8$ )

### TOSS-UP

15) GENERAL SCIENCE *Multiple Choice* Which of the following is the earliest stage in the birth of a star:

- W) globular cluster
- X) planetary nebula
- Y) Blue Giant
- Z) nebula

ANSWER: Z) NEBULA

### BONUS

15) GENERAL SCIENCE *Short Answer* Name all of the following 3 energy resources that are typically considered renewable: tidal power; geothermal energy; coal

ANSWER: TIDAL POWER; GEOTHERMAL ENERGY

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### TOSS-UP

16) LIFE SCIENCE *Multiple Choice* Which of the following is a set of reactions that do NOT require light and where carbon dioxide is used to make 3 carbon sugar phosphate molecules that are later used to make 6 carbon sugars:

- W) photosystem-two
- X) Calvin cycle
- Y) citric acid cycle
- Z) electron transport

ANSWER: X) CALVIN CYCLE

### BONUS

16) LIFE SCIENCE *Multiple Choice* Which of the following instruments did Louis Pasteur use in dispelling the theory of spontaneous generation:

- W) swan necked flasks with boiled and unboiled broth
- X) open and closed jars with rotting meat
- Y) flasks of amino acids and other organic molecules exposed to electric charges
- Z) bacterial cultures inside sterile tubes

ANSWER: W) SWAN NECKED FLASKS WITH BOILED AND UNBOILED BROTH

### TOSS-UP

17) PHYSICAL SCIENCE *Multiple Choice* Which of the following is TRUE of a gas contained in a tall, sealed cylindrical container at 1 atmosphere of pressure and 25°C:

- W) the gas exerts the same pressure on all the walls of the container
- X) the gas exerts a higher pressure on the top of the container
- Y) the gas exerts a higher pressure on the bottom of the container
- Z) the gas exerts a higher pressure on the sides of the container

ANSWER: W) THE GAS EXERTS THE SAME PRESSURE ON ALL THE WALLS OF THE CONTAINER

### BONUS

17) PHYSICAL SCIENCE *Short Answer* Which 2 of the following 4 choices represent standard conditions when working with gases: 1 atmosphere; 273 kelvin; 25°C; 760 atmospheres

ANSWER: 1 ATMOSPHERE; 25°C

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### TOSS-UP

18) EARTH SCIENCE *Multiple Choice* The prevailing westerlies converge and are caused to rise at which of the following latitudes:

- W) 0°
- X) 30°
- Y) 60°
- Z) 90°

ANSWER: Y) 60°

### BONUS

18) EARTH SCIENCE *Multiple Choice* The horse latitudes are zones primarily characterized by:

- W) fierce polar winds
- X) very light winds
- Y) rising air masses
- Z) strong tropical downbursts

ANSWER: X) VERY LIGHT WINDS

**TOSS-UP**

19) MATH *Short Answer* What is the most common name for the branch of mathematics developed by Mandelbrot that generates geometrically self-similar patterns?

ANSWER: FRACTALS

**BONUS**

19) MATH *Multiple Choice* Which of the following is the most economical purchase for a given brand of olive oil:

- W) 3 liters at \$30.00
- X) 4 quarts at \$30.00
- Y) 6,000 milliliters at \$30.00
- Z) 1 gallon at \$30.00

ANSWER: Y) 6,000 MILLILITERS AT \$30.00

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**TOSS-UP**

20) GENERAL SCIENCE *Multiple Choice* Which of the following is a crystalline material found in arctic regions and within relatively shallow marine sediments that is sometimes called “burning ice” and may one day be used as a vast energy source:

- W) methane gas hydrate
- X) liquid hydrogen
- Y) sublimated helium
- Z) coal gas

ANSWER: W) METHANE GAS HYDRATE

**BONUS**

20) GENERAL SCIENCE *Short Answer* Name all of the following 4 choices that are common resources for biodiesel fuel: palm oil; switch grass; sunflower seeds; soybeans

ANSWER: PALM OIL; SUNFLOWER; SOYBEANS (ACCEPT: ALL BUT SWITCH GRASS)

**TOSS-UP**

21) LIFE SCIENCE *Short Answer* What substance is most directly formed when oxygen accepts electrons at the end of the electron transport system of oxidative phosphorylation?

ANSWER: WATER

**BONUS**

21) LIFE SCIENCE *Short Answer* Name all of the following 3 metabolic processes in vertebrate cells that release carbon dioxide as a byproduct:  
glycolysis; citric acid cycle; oxidative phosphorylation

ANSWER: CITRIC ACID CYCLE

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**TOSS-UP**

22) PHYSICAL SCIENCE *Short Answer* What basic force of the universe most directly functions to keep the nucleus of an atom together?

ANSWER: STRONG FORCE

**BONUS**

22) PHYSICAL SCIENCE *Short Answer* Maryjane sees a fireworks display and 3 seconds later hears its explosion. Rounded to the nearest 100 meters, how far away from Maryjane were the fireworks?

ANSWER: 1,000

(Solution:  $330/\text{second} \times 3 = 990$  or 1,000 m)

**TOSS-UP**

23) EARTH SCIENCE *Short Answer* On the geological time scale, the Pleistocene Epoch is followed by what epoch?

ANSWER: HOLOCENE (ACCEPT: RECENT)

**BONUS**

23) EARTH SCIENCE *Short Answer* Which of Kepler's laws most directly leads us to have terms such as apogee, aphelion, and perigee?

ANSWER: 1<sup>ST</sup> LAW

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**TOSS-UP**

24) MATH *Short Answer* What is the degree of the following monomial:  $12x^2y^3z^4$

ANSWER: 9

(Solution:  $2 + 3 + 4 = 9$ )

**BONUS**

24) MATH *Short Answer* If the sum of the INTERIOR angles of a regular polygon is  $540^\circ$ , how many sides does it have?

ANSWER: 5

(Solution:  $180^\circ(n - 2) = 540^\circ$ ,  $n = 5$  sides)

### **TOSS-UP**

25) GENERAL SCIENCE *Short Answer* What is the most common term for the principal, rule or effect, that explains what is referred to by astronomers as blue shift?

ANSWER: DOPPLER EFFECT

### **BONUS**

25) GENERAL SCIENCE *Short Answer* From the EARLIEST to the LATEST, what are the 4 strokes or stages in a typical 4-stroke internal combustion engine?

ANSWER: INTAKE; COMPRESSION; POWER; EXHAUST