

## ROUND 6

### TOSS-UP

1) PHYSICS *Multiple Choice* Which of the following most commonly functions to limit current to one direction:

- W) capacitor
- X) transformer
- Y) resistor
- Z) diode

ANSWER: Z) DIODE

### BONUS

1) PHYSICS *Short Answer* Debbie pushes a 10-kilogram box of books with a horizontal force of 500 newtons. What is the acceleration of the box, giving your answer in standard SI units, if friction is neglected?

ANSWER: 50 METERS PER SECOND SQUARED (ACCEPT: 50 METERS PER SECOND PER SECOND)

(Solution:  $A = F/M$ ;  $A = 500/10$ ;  $A = 50\text{m/sec}^2$ )

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### TOSS-UP

2) CHEMISTRY *Short Answer* If pure water is at its boiling point at standard pressure, how many additional calories of heat are needed to convert 1 gram of water from the liquid to the vapor state?

ANSWER: 540

### BONUS

2) CHEMISTRY *Short Answer* What is the name for the straight-chain alkane containing 5 carbons?

ANSWER: PENTANE

### TOSS-UP

3) BIOLOGY *Short Answer* In what part of photosynthesis, named after its discoverers, is NADPH used to produce 3-carbon sugar phosphate molecules?

ANSWER: CALVIN CYCLE (ACCEPT: CALVIN-BENSON CYCLE or CALVIN-BENSON-BASSHAM CYCLE)

### BONUS

3) BIOLOGY *Short Answer* For every carbon dioxide molecule fixed in the Calvin-Benson cycle, how many NADPH molecules are utilized?

ANSWER: 2

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### TOSS-UP

4) MATH *Short Answer* What is the specific name for a common tangent that intersects the segment joining the centers of 2 circles?

ANSWER: INTERNAL COMMON TANGENT (ACCEPT: INTERNAL or INTERNAL TANGENT)

### BONUS

4) MATH *Short Answer* A flagpole casts a 100-foot long shadow. If a 6-foot tall person standing at the base of the pole casts an 8-foot shadow, how many feet tall is the flagpole?

ANSWER: 75

(Solution:  $(100 \times 6)/8 = 75$  ft)

### TOSS-UP

5) EARTH SCIENCE *Multiple Choice* Which of the following happens to the shells of snails and limpets as seawater becomes increasingly acidic:

- W) they begin to dissolve
- X) they become thicker
- Y) they develop much later in the organism's life
- Z) they become darker

ANSWER: W) THEY BEGIN TO DISSOLVE

### BONUS

5) EARTH SCIENCE *Multiple Choice* Continental margins facing the edges of diverging tectonic plates are called:

- W) passive margins
- X) Pacific-type margins
- Y) transform fault margins
- Z) active margins

ANSWER: W) PASSIVE MARGINS

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### TOSS-UP

6) GENERAL SCIENCE *Short Answer* Giving your answer to the first decimal place, an increase of 1°C is equivalent to an increase of how many degrees Fahrenheit?

ANSWER: 1.8

### BONUS

6) GENERAL SCIENCE *Short Answer* Convert 140°F into degrees Celsius:

ANSWER: 60

(Solution:  $5/9(140^\circ - 32^\circ) = 60^\circ \text{ C}$ )

### TOSS-UP

7) ASTRONOMY *Multiple Choice* Which of the following best explains from where most of the dust that covers the surface of the Moon came:

- W) weathering when the Moon was young and had an atmosphere
- X) interstellar dust deposited over billions of years
- Y) from rock pulverized from many impacts
- Z) from its original makeup of a soft, silicate rock

ANSWER: Y) FROM ROCK PULVERIZED FROM MANY IMPACTS

### BONUS

7) ASTRONOMY *Short Answer* What physical property of stars is most directly responsible for how long they will continue fusion?

ANSWER: MASS

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### TOSS-UP

8) PHYSICS *Multiple Choice* Which of the following is the device in a galvanic cell that completes the electric circuit by connecting the two sides of the cell with an inert electrolyte:

- W) electrolytic reservoir
- X) cathode
- Y) conducting wire
- Z) salt bridge

ANSWER: Z) SALT BRIDGE

### BONUS

8) PHYSICS *Short Answer* How many joules are in a single watt-hour?

ANSWER: 3,600

(Solution: (1 joule per second)(60 sec)(60 minutes) = 3600 J)



### TOSS-UP

9) CHEMISTRY *Short Answer* If the electronegativity difference in the bonding atoms is intermediate in strength, what general type of bond is typically formed?

ANSWER: POLAR COVALENT (DO NOT ACCEPT: COVALENT)

### BONUS

9) CHEMISTRY *Multiple Choice* Which of the following is a molecule having a nonpolar covalent bond:

- W) bromine gas
- X) hydrogen fluoride
- Y) water
- Z) hydrogen bromide

ANSWER: W) BROMINE GAS

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### TOSS-UP

10) BIOLOGY *Multiple Choice* In which of the following organ systems of the human body do chief cells primarily function:

- W) excretory
- X) digestive
- Y) nervous
- Z) reproductive

ANSWER: X) DIGESTIVE

### BONUS

10) BIOLOGY *Short Answer* What section of the small intestine is the first to receive gastric contents?

ANSWER: DUODENUM

**TOSS-UP**

11) MATH *Short Answer* Solve the following equation for  $x$  over the integers:  $x^2 = 3x$

ANSWER: 0; 3

**BONUS**

11) MATH *Short Answer* Giving your answer as a fraction reduced to lowest terms, solve the following equation for  $x$ :  $\frac{2}{3}x - \frac{1}{4} = \frac{10}{6}x + \frac{1}{2}$

ANSWER:  $-\frac{3}{4}$

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**TOSS-UP**

12) EARTH SCIENCE *Multiple Choice* Which of the following is best used to date the age of the Earth to about 4.5 billion years old:

- W) uranium-235
- X) uranium-238
- Y) potassium-40
- Z) carbon-14

ANSWER: X) URANIUM-238

**BONUS**

12) EARTH SCIENCE *Multiple Choice* Which of the following is a ubiquitous trace mineral found in many igneous, metamorphic and clastic sedimentary rocks, and has been used to date Earth's oldest rocks at 4-plus billion years:

- W) titanite
- X) tremolite
- Y) zircon
- Z) beryl

ANSWER: Y) ZIRCON

### TOSS-UP

13) GENERAL SCIENCE *Multiple Choice* Which of the following is NOT true:

- W) only a few harmful algal bloom species actually produce toxins that are poisonous to people
- X) algal blooms occur in marine and freshwater environments
- Y) algal blooms can occur in the open ocean far from any coastal inlets
- Z) pollution is always to blame for harmful algal blooms along coastal waters

ANSWER: Z) POLLUTION IS ALWAYS TO BLAME FOR HARMFUL ALGAL BLOOMS ALONG COASTAL WATERS

### BONUS

13) GENERAL SCIENCE *Multiple Choice* 500 metric gigatons is approximately equal to how many pounds:

- W) 1.1 trillion
- X) 11 trillion
- Y) 110 trillion
- Z) 1,100 trillion

ANSWER: Z) 1,100 TRILLION

(Solution:  $\sim 2205 \times 500 \times 1000 = 1,102,000,000$ )

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### TOSS-UP

14) ASTRONOMY *Multiple Choice* If a star is seen just above the eastern horizon at sunset, where would it most likely be found just before the following sunrise:

- W) just above the eastern horizon
- X) half-way up in the eastern sky
- Y) low in the western sky
- Z) directly overhead

ANSWER: Y) LOW IN THE WESTERN SKY

### BONUS

14) ASTRONOMY *Short Answer* What is the MOST common organic molecule in the atmosphere of the planet Uranus?

ANSWER: METHANE (ACCEPT: CH<sub>4</sub>)

### TOSS-UP

15) PHYSICS *Short Answer* Radon is primarily produced naturally on Earth most directly from the decay of what element?

ANSWER: RADIUM

### BONUS

15) PHYSICS *Short Answer* By words or numbers, name all of the following 4 choices that are TRUE for an object moving at a constant speed:

- 1) it must have a constant velocity
- 2) it must be constantly moving in the same direction
- 3) it can be accelerating
- 4) it must have a constant weight

ANSWER: 3) IT CAN BE ACCELERATING

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### TOSS-UP

16) CHEMISTRY *Multiple Choice* Which of the following are elements in the Periodic Table whose outer shell electrons are on two principal energy levels:

- W) alkali metals
- X) noble gases
- Y) alkaline Earth metals
- Z) transition elements

ANSWER: Z) TRANSITION ELEMENTS

### BONUS

16) CHEMISTRY *Short Answer* According to standard chemical nomenclature and indicating the proper charge, what is the formula for potassium perchlorate?

ANSWER:  $\text{KClO}_4$

### TOSS-UP

17) BIOLOGY *Short Answer* What specific type of microscopy passes a beam of electrons through an ultra-thin specimen that is usually stained with an electron opaque substance, producing an image which can be captured by a charged coupled device?

ANSWER: TRANSMISSION ELECTRON MICROSCOPY (ACCEPT: TEM)  
(DO NOT ACCEPT: SCANNING ELECTRON MICROSCOPY OR SEM)

### BONUS

17) BIOLOGY *Short Answer* Order the following 4 objects found in the human body from the SMALLEST to the LARGEST: mitochondrion; ribosome; erythrocyte; average monocyte

ANSWER: RIBOSOME; MITOCHONDRION; ERYTHROCYTE; AVERAGE MONOCYTE

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### TOSS-UP

18) GENERAL SCIENCE *Multiple Choice* Pyrex glass contains many of the same components as soda lime glass but in addition contains at least 5%:

- W) boric acid
- X) pure silica
- Y) clay
- Z) dyes

ANSWER: W) BORIC ACID

### BONUS

18) GENERAL SCIENCE *Multiple Choice* Which of the following BEST describes the function of boric acid in the manufacture of Pyrex or borosilicate glass:

- W) makes the glass more scratch-resistant
- X) makes the glass more brittle
- Y) reduces the linear coefficient of expansion of the glass
- Z) reduces the effect of detrimental ultraviolet light exposure

ANSWER: Y) REDUCES THE LINEAR COEFFICIENT OF EXPANSION OF THE GLASS



### TOSS-UP

19) EARTH SCIENCE *Multiple Choice* Which of the following are intrusive masses of igneous rock that extend downward to unknown depths and do not show signs of a definite floor:

- W) laccolith
- X) batholith
- Y) sill
- Z) volcanic neck

ANSWER: X) BATHOLITH

### BONUS

19) EARTH SCIENCE *Multiple Choice* Which of the following is NOT a common mineral in igneous rock but rather an accessory that typically occurs in small amounts:

- W) quartz
- X) muscovite
- Y) plagioclase
- Z) orthoclase

ANSWER: X) MUSCOVITE

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### TOSS-UP

20) MATH *Short Answer* Simplify the following rational expression:  $\frac{5y - 3x^2}{9y^2 + 5x}$

ANSWER: CANNOT BE FURTHER SIMPLIFIED (ACCEPT:  $\frac{5y - 3x^2}{9y^2 + 5x}$  or THE SAME)

### BONUS

20) MATH *Short Answer* Factor the following expression completely:  $12x^2 + 24x - 36$

ANSWER:  $12(x + 3)(x - 1)$  (ACCEPT:  $12(x - 1)(x + 3)$ )

**TOSS-UP**

21) ASTRONOMY *Short Answer* To the first decimal place, how many astronomical units is the average radius of the Earth's orbit around the Sun?

ANSWER: 1.0

**BONUS**

21) ASTRONOMY *Short Answer* How many degrees above the celestial equator is the north celestial pole?

ANSWER: 90

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**TOSS-UP**

22) PHYSICS *Short Answer* What is the electric charge and mass of the carrier particle for the electromagnetic force?

ANSWER: BOTH ARE ZERO

**BONUS**

22) PHYSICS *Short Answer* If the intensity of a sound is 10,000 times as loud as another sound, by how many decibels do the two sounds differ?

ANSWER: 40

### TOSS-UP

23) CHEMISTRY *Multiple Choice* Which of the following is NOT true:

- W) hydrogen gas found in nature exists as a monatomic molecule
- X) when 2 oxygen atoms combine to form O<sub>2</sub>, energy is released
- Y) when chlorine gains 1 electron, it becomes larger
- Z) noble gases tend not to bond because of their stable valence configurations

ANSWER: W) HYDROGEN GAS FOUND IN NATURE EXISTS AS A MONATOMIC MOLECULE

### BONUS

23) CHEMISTRY *Short Answer* Knowing that the chemical name for gypsum is calcium sulfate dihydrate, gypsum is what percent water by weight? Assume the atomic masses of calcium = 40; sulfur = 32 and oxygen = 16.

ANSWER: 21

(Solution: CaSO<sub>4</sub>•2H<sub>2</sub>O)

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### TOSS-UP

24) BIOLOGY *Multiple Choice* Which of the following is the term for the transfer of genes by viruses from one prokaryote to another:

- W) transduction
- X) conjugation
- Y) transformation
- Z) relaxation

ANSWER: W) TRANSDUCTION

### BONUS

24) BIOLOGY *Short Answer* Name all of the following 3 transport systems that directly require energy to operate: active transport; facilitated diffusion; sodium potassium pump

ANSWER: ACTIVE TRANSPORT; SODIUM POTASSIUM PUMP  
(ACCEPT: ALL BUT FACILITATED DIFFUSION)

### TOSS-UP

25) CHEMISTRY *Short Answer* What is the general name for a hypothetical gas that obeys Boyle's law at all temperatures and pressures?

ANSWER: IDEAL GAS (ACCEPT: IDEAL)

### BONUS

25) CHEMISTRY *Multiple Choice* Which of the following is NOT true of ideal gases:

- W) 2 or more gases form homogeneous mixtures in all proportions
- X) collisions between gas particles are both elastic and inelastic
- Y) they diffuse rapidly
- Z) they assume the shapes of their containers

ANSWER: X) COLLISIONS BETWEEN GAS PARTICLES ARE BOTH ELASTIC AND INELASTIC