

### ROUND 3

#### TOSS-UP

- 1) **PHYSICS** *Short Answer* When Natalie rides in a circle on her horse, she perceives a force which tends to throw her off her horse to the outside of the ring. What is the common name for this fictitious center-fleeing force?

ANSWER: CENTRIFUGAL FORCE

#### BONUS

- 1) **PHYSICS** *Short Answer* What is the angular velocity in radians per second of a wheel with a radius of 1.2 meters and a surface velocity of 15.6 meters/sec:

ANSWER: 13

(Solution:  $\omega = v/r = 15.6/1.2 = 13$ )

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#### TOSS-UP

- 2) **BIOLOGY** *Multiple Choice* Which of the following is the correct botanical term for the stem of a flower:

- W) peduncle (Pron: pea-dunkle)
- X) stolon (Pron: stow-lon)
- Y) rhizome (Pron: RI-zome)
- Z) tuber

ANSWER: W) PEDUNCLE

#### BONUS

- 2) **BIOLOGY** *Short Answer* The Gram stain delineates the differences between bacteria by differentially staining what part of the bacteria?

ANSWER: CELL WALL

### TOSS-UP

- 3) CHEMISTRY *Multiple Choice* Which of the following groups of elements would generally have the lowest ionization energies:

W) group 1A  
X) group 5A  
Y) group 7A  
Z) group 8A

ANSWER: W) GROUP 1A

### BONUS

- 3) CHEMISTRY *Short Answer* From the lowest to the highest atomic number, give the full names of 4 noble gases:

ANSWER: HELIUM; NEON; ARGON; KRYPTON; XENON; RADON (accept any 4 in order)

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### TOSS-UP

- 4) ASTRONOMY *Short Answer* In the H-R diagram, what two characteristics are plotted on the horizontal axis?

ANSWER: SURFACE TEMPERATURE AND SPECTRAL CLASS

### BONUS

- 4) ASTRONOMY *Multiple choice* According to the spectral sequence on the H-R diagram, “O” stars have a surface temperature of about:

W) 2,000,000 Kelvin  
X) 40,000 Kelvin  
Y) 8,000 Kelvin  
Z) 1600 Kelvin

ANSWER: X) 40,000 Kelvin

### TOSS-UP

- 5) MATH *Short Answer* How many different 3-letter arrangements of the word “truck” are there?

ANSWER: 60

(Solution:  $P(5,3) = 5! \div (5-3)!; = 5! \div 2!; = 60$ )

### BONUS

- 5) MATH *Short Answer* A small business had first-year sales of \$20,000. For the next several years, sales increased by \$10,000 per year over the previous year. What were its total sales over the first 6 years of operation?

ANSWER: \$270,000

(Solution:  $S_n = n/2 [2(a) + (n-1)d]; 6/2 [2(20,000) + (6-1)10,000]; = 270,000$ )

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### TOSS-UP

- 6) EARTH SCIENCE *Short Answer* What is the name for the point on the Earth's surface that is directly above the focus of an earthquake?

ANSWER: EPICENTER

### BONUS

- 6) EARTH SCIENCE *Multiple Choice* A Karst landscape generally forms on which of the following types of rock:

- W) limestone
- X) clay and silt
- Y) volcanic rocks
- Z) sandstone

ANSWER: W) LIMESTONE

### TOSS-UP

- 7) GENERAL SCIENCE Multiple Choice Which of the following is TRUE for the f-number in a typical camera lens:
- W) the larger the f-number, the more light reaches the film
  - X) the larger the f-number, the greater the depth of field
  - Y) the smaller the f-number, the lesser the light reaches the film
  - Z) the smaller the f-number, the greater the depth of field

ANSWER: X) THE LARGER THE F-NUMBER, THE GREATER THE DEPTH OF FIELD

### BONUS

- 7) GENERAL SCIENCE Multiple Choice Which of the following has been most effectively implicated in Alzheimer's disease:
- W) glutamic oxygenase (Pron: glu-tan-ik oxygen-ace)
  - X) aluminum toxicosis (Pron: aluminum tox-ee-kosis)
  - Y) amyloid-beta (Pron: am-ah-loyd beta) precursor protein
  - Z) poor diet

ANSWER: Y) AMYLOID-BETA PRECURSOR PROTEIN

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### TOSS-UP

- 8) COMPUTER SCIENCE *Multiple Choice* A rather primitive graphics file format used mostly in the Windows environment for things such as wallpaper is:
- W) BMP
  - X) PICT
  - Y) GIF
  - Z) JPEG

ANSWER: W) BMP

### BONUS

- 8) COMPUTER SCIENCE *Short Answer* What does the acronym for the GIF graphics file format stand for?

ANSWER: GRAPHICS INTERCHANGE FORMAT

### TOSS-UP

- 9) PHYSICS *Multiple Choice* If light is passed through two pin holes and the patterns allowed to overlap on a wall, the pattern produced by the intersection of waves is called:
- W) an intersection pattern
  - X) an interference pattern
  - Y) an arcing pattern
  - Z) a construction pattern

ANSWER: X) AN INTERFERENCE PATTERN

### BONUS

- 9) PHYSICS *Short Answer* In meters per second, what is the approximate speed of sound in air if the temperature of the air is 10 °C?

ANSWER: 337 METERS PER SECOND (ACCEPT: 336 TO 338)

(Solution:  $0.6 \times 10 + 331$  )

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### TOSS-UP

- 10) BIOLOGY *Short Answer* Of the following 4 organisms, which is LEAST related to the others taxonomically: spider; tick; lobster; horse-shoe crab

ANSWER: LOBSTER

### BONUS

- 10) BIOLOGY *Short Answer* Saltatory (Pron: salt-a-tor-ee) conduction is a propagation used by what specific type of nerves?

ANSWER: MYELINATED (Pron: my-lee-in-ate-ed)

### TOSS-UP

- 11) CHEMISTRY *Multiple Choice* If an atom X, which has an electronegativity of 3.0, bonds with atom Y, which has an electronegativity of 2.5, what type of bond is most likely prevalent:

W) ionic  
X) polar covalent  
Y) non-polar covalent  
Z) neutral

ANSWER: X) POLAR COVALENT

### BONUS

- 11) CHEMISTRY *Short Answer* Finish balancing the following equation, which represents the etching of glass:  $\text{SiO}_2 + 4\text{HF} \rightarrow (\text{what?})$  (READ AS: S-I-O-2 plus 4-H-F yields what)?

ANSWER:  $\text{SiF}_4 + 2\text{H}_2\text{O}$  (READ AS: S-I-F-4 PLUS 2-H-2-O)

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### TOSS-UP

- 12) ASTRONOMY *Short Answer* What is the most common name for the dipper-shaped open cluster of stars found in the constellation Taurus, 6 of which are visible to the naked eye?

ANSWER: PLEIADES

### BONUS

- 12) ASTRONOMY *Short Answer* Named after the father of Saturn, what planet rotates on its side with its pole tilted 90 degrees to the plane of the solar system?

ANSWER: URANUS

**TOSS-UP**

- 13) MATH *Short Answer* Convert  $\frac{2\pi}{3}$  radians into degrees:

ANSWER: 120°

**BONUS**

- 13) MATH *Short Answer* Multiply and simplify the following polynomial expression:  
 $(-2a^2b^3 + 5c)(2a^2b^3 + 5c)$

ANSWER:  $25c^2 - 4a^4b^6$

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**TOSS-UP**

- 14) EARTH SCIENCE *Short Answer* What term is given to the line of latitude 23½° south of the equator that marks the most southerly place where the Sun is overhead on December 21<sup>st</sup>?

ANSWER: THE TROPIC OF CAPRICORN

**BONUS**

- 14) EARTH SCIENCE *Short Answer* What term is used to describe a particularly lethal form of volcanic eruption, occurring when red-hot tephra and searing gases are too dense to rise upward and can rush down the flanks of volcanoes at speeds approaching 450 miles/hr?

ANSWER: PYROCLASTIC FLOW (ACCEPT: NUEE ARDENTE OR GLOWING CLOUD)

**TOSS-UP**

15) GENERAL SCIENCE *Short Answer* How many feet are in 1000 meters?

ANSWER: 3281 (ACCEPT: 3280-3281)

**BONUS**

15) GENERAL SCIENCE *Short Answer* What is the enzyme used by cyanobacteria in the nitrogen-fixation process?

ANSWER: NITROGENASE

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**TOSS-UP**

16) COMPUTER SCIENCE *Multiple Choice* Copyrighted software that is distributed free of charge by the author for people to use but not sell is called:

- W) freeware
- X) openware
- Y) open source
- Z) public-domain

ANSWER: W) FREEWARE

**BONUS**

16) COMPUTER SCIENCE *Multiple Choice* What is the octal equivalent of the binary number 1000 (read as: one, zero, zero, zero)?

- W) 1
- X) 3
- Y) 5
- Z) 10

ANSWER: Z) 10



### TOSS-UP

17) PHYSICS *Multiple Choice* When referring to nuclear atomic structure, the upper case letter Z by convention refers to:

- W) neutron number
- X) electron number
- Y) isotope number
- Z) proton number

ANSWER: Z) PROTON NUMBER

### BONUS

17) PHYSICS *Short Answer* If a wave has a frequency of 200 hertz, what is its period?

ANSWER: 0.005 SECONDS (ACCEPT: 1/200 seconds)

(Solution:  $\text{period} = 1 / f$ )

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### TOSS-UP

18) BIOLOGY *Short Answer* T cells are to cytokines (Pron: sight-o-kins) as plasma cells are to:

ANSWER: ANTIBODIES

### BONUS

18) BIOLOGY *Short Answer* Order the four main blood types from the most common to the least common in the US population:

ANSWER: O, A, B AND AB

(Solution: O =45%, A = 41%, B = 10% and AB = 4%)

### TOSS-UP

19) CHEMISTRY *Multiple Choice* Which of the following compounds is covalently bonded:

- W)  $\text{Cl}_2$
- X)  $\text{LiBr}$
- Y)  $\text{CaCl}_2$
- Z)  $\text{Na}_2\text{O}$

ANSWER: W)  $\text{Cl}_2$

### BONUS

19) CHEMISTRY *Short Answer* Using electrophoresis at a pH of 6.0, which two of the following 5 amino acids would move fastest to the cathode: arginine, glutamic acid, glycine, alanine, lysine

ANSWER: LYSINE, ARGININE

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### TOSS-UP

20) ASTRONOMY *Short Answer* What two planets have recently been trading off as the planet with the most discovered moons?

ANSWER: SATURN AND JUPITER

### BONUS

20) ASTRONOMY *Short Answer* What is the common scientific name for the region of magnetized plasma that surrounds the sun, includes the orbits of all our planets, and is created by the solar wind?

ANSWER: HELIOSPHERE

**TOSS-UP**

21) EARTH SCIENCE *Short Answer* The core of the Earth is largely composed of what element?

ANSWER: IRON (ACCEPT: METALLIC IRON)

**BONUS**

21) EARTH SCIENCE *Multiple Choice* An agate is a form of which of the following minerals:

- W) quartz
- X) feldspar
- Y) magnetite
- Z) copper

ANSWER: W) QUARTZ

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**TOSS-UP**

22) GENERAL SCIENCE *Multiple Choice* In what type of centrifuge is a fluid, consisting of 2 or more components, sprayed into a cylindrical or conical chamber at a high rate of speed, thereby separating it into its components:

- W) stationary centrifuge
- X) ultracentrifuge
- Y) rotating centrifuge
- Z) filtration centrifuge

ANSWER: W) STATIONARY CENTRIFUGE

**BONUS**

22) GENERAL SCIENCE *Short Answer* Most helium is separated by fractional distillation from what natural resource?

ANSWER: NATURAL GAS (DO NOT ACCEPT: METHANE)

### TOSS-UP

- 23) PHYSICS *Short Answer* Where is the gravitational force the greatest for a uniform spherical planet:

ANSWER: AT ITS SURFACE

### BONUS

- 23) PHYSICS *Short Answer* What is the wavelength, in meters, of a wave moving at 200 meters per second if its frequency is 25 Hertz?

ANSWER: 8

(Solution:  $\lambda = \text{wave speed}/f$ ;  $200/25=8$ )

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### TOSS-UP

- 24) BIOLOGY *Short Answer* To prepare a tincture (Pron: tink-sure) of merthiolate (Pron: mer-thyo-late), the merthiolate is mixed in what general type of solvent?

ANSWER: ALCOHOL

### BONUS

- 24) BIOLOGY *Multiple Choice* Which of the following structures is directly attached to the transverse colon:

- W) greater omentum
- X) pancreaticiform plexus
- Y) cystic duct
- Z) uvula

ANSWER: W) GREATER OMENTUM

### TOSS-UP

- 25) CHEMISTRY *Short Answer* What general chemical term best describes a metal or alloy that can be substantially pressed or hammered into shapes without fracture?

ANSWER: MALLEABLE

### BONUS

- 25) CHEMISTRY *Short Answer* One-hundred milliliters of a 2 molar NaOH solution contains how many moles of NaOH?

ANSWER: 0.2

(Solution: moles = (2 moles/L)(0.1L) = 0.2 moles)