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: \( \omega = \frac{v}{r} = \frac{15.6}{1.2} = 13 \))

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
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)  

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)  

**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! ÷ (5-3)!, = 5! ÷ 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)

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

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: $0.6 \times 10 + 331$)

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)

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

TOSS-UP

14) EARTH SCIENCE Short Answer What term is given to the line of latitude 23\(1/2\)° south of the equator that marks the most southerly place where the Sun is overhead on December 21st?

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

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: period = 1 / f )

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) Cl$_2$
X) LiBr
Y) CaCl$_2$
Z) Na$_2$O

ANSWER: W) 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

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

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

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) panpiniform 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)