ROUND 4

TOSS-UP

1) PHYSICS Short Answer    What is the angular velocity of a wheel with a radius of 15 meters and a surface velocity of 120 meters/sec:

ANSWER: 8 RAD/SEC

(Solution: $T = \frac{v}{r} = \frac{120}{15} = 8$)

BONUS

1) PHYSICS Short Answer    Assuming friction is negligible, how long will it take an object to stop if it has an initial velocity of 5 meters per second, if the average braking force is 20 Newtons, and if the object’s mass is 20 kilograms?

ANSWER: 5 SECONDS

(Solution: $v = at$, $f = ma$ => $t = \frac{v}{a} = \frac{v}{m} \times \frac{m}{f} = \frac{20 \times 5}{20} = 5$ seconds)

TOSS-UP

2) CHEMISTRY Multiple Choice    For individuals who are “Lactose Intolerant,” the reason for their gastric distress is the production of:

W) methane
X) acetic acid and nitrogen
Y) lactic acid and carbon dioxide
Z) acetic acid and methane

ANSWER: Y) LACTIC ACID AND CARBON DIOXIDE

BONUS

2) CHEMISTRY Multiple Choice    Which acid connects the 2-deoxyribose units within every DNA strand:

W) acetic acid
X) phosphoric acid
Y) citric acid
Z) glycolic acid

ANSWER: X) PHOSPHORIC ACID
TOSS-UP

3) BIOLOGY  *Multiple Choice*  Which of the following organisms does NOT belong to the Class Arachnida:

W) scorpions  
X) lobsters  
Y) mites  
Z) ticks  

ANSWER:  X) LOBSTERS  

BONUS

3) BIOLOGY  *Short Answer*  What anatomical structure is responsible for the various colors of eyes in humans?

ANSWER:  IRIS  

TOSS-UP

4) ASTRONOMY  *Multiple Choice*  Which of the following planets is NOT known to have any orbiting satellites:

W) Venus  
X) Mars  
Y) Uranus  
Z) Saturn  

ANSWER:  W) VENUS  

BONUS

4) ASTRONOMY  *Short Answer*  Cassini’s division is associated with what planet?

ANSWER:  SATURN
TOSS-UP

5) MATH  Short Answer  Convert 135° into radians:

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

BONUS

5) MATH  Short Answer  Solve the following inequality:  $3 - 6x > 15$

ANSWER: $x < -2$

TOSS-UP

6) EARTH SCIENCE  Multiple Choice  Hawaiian volcanoes such as Kilauea and Mauna Loa are examples of which of the following types of volcanoes:

W) basaltic
X) rhyolitic
Y) andesitic
Z) andesitic and rhyolitic

ANSWER: W) BASALTIC

BONUS

6) EARTH SCIENCE  Short Answer  In reference to glacial ice, the process by which ice below the snow line is lost by evaporation and melting is called what?

ANSWER: ABLATION
TOSS-UP

7) GENERAL SCIENCE  Short Answer  What is a quantity that has only a magnitude most commonly called?

ANSWER: SCALAR

BONUS

7) GENERAL SCIENCE  Multiple Choice  What pioneer bacteriologist in 1873 located a particular bacterium that caused anthrax in the spleen of infected cattle and, after transferring it serially to mice, recovered the same bacterium in the end:

W) Louis Pasteur
X) Robert Koch (pronounced: Coke)
Y) Rudolf Virchow
Z) Peter Vogt

ANSWER: X) ROBERT KOCH

TOSS-UP

8) COMPUTER SCIENCE  Short Answer  In most computer systems, a byte is a unit of data that is how many binary digits long?

ANSWER: 8

BONUS

8) COMPUTER SCIENCE  Short Answer  What is the term for half a byte, or four bits?

ANSWER: NIBBLE (ACCEPT: NYBBLE)
9) PHYSICS  *Short Answer*  In a standing wave of a vibrating wire cord, what are the points of constructive interference most commonly called where the cord oscillates with maximum amplitude?

**ANSWER:** ANTINODES

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**BONUS**

9) PHYSICS  *Short Answer*  For a radioactive element with a half-life of 5000 years, if a sample of the radioactive element is left to decay for 15,000 years, what fraction of the original radioactive atoms in the sample will be left?

**ANSWER:** 1/8 (ACCEPT: 12.5%)

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10) CHEMISTRY  *Multiple Choice*  Which of the following elements is found in Period 3 and main Group 5A:

W) phosphorous  
X) silicon  
Y) nitrogen  
Z) arsenic

**ANSWER:** W) PHOSPHOROUS

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**BONUS**

10) CHEMISTRY  *Short Answer*  From the lowest to the highest atomic number, give the full names of any 4 alkaline earth metals:

**ANSWER:** BERYLLIUM; MAGNESIUM; CALCIUM; STRONTIUM; BARIUM; RADIUM
TOSS-UP

11) BIOLOGY  Short Answer  Which is the more common specific name for the polymorphonuclear (read as: poly-morph-oh-nuclear) leukocyte?

ANSWER: NEUTROPHIL (ACCEPT: PMN)

BONUS

11) BIOLOGY  Short Answer  Tobacco, jimsonweed, belladonna, and tomatoes all belong to what family of plants?

ANSWER: NIGHTSHADE  (ACCEPT: SOLANACEAE)

TOSS-UP

12) ASTRONOMY  Short Answer  How many degrees above the horizon will the north celestial pole be for someone standing at latitude 53° North?

ANSWER: 53

BONUS

12) ASTRONOMY  Short Answer  What kind of celestial bodies have cores that consist primarily of neutral particles in a superfluid state and are thought to have evolved from stars with masses more than about 1.4 times the Chandrasekhar limit?

ANSWER: NEUTRON STARS (DO NOT ACCEPT: PULSAR)
TOSS-UP

13) MATH  Short Answer  What is the formula for the volume of a sphere?

ANSWER: $\frac{4}{3}\pi r^3$ (read as: four third pi radius cubed)

BONUS

13) MATH  Short Answer  Subtract the following 2 polynomials:

$(-4x^3y + 2x^3y^2 + 2x^2y^3 + 2y) - (4x^3y - 7x^3y^2 + x^2y^3 - y)$

ANSWER: $-8x^3y + 9x^3y^2 + x^2y^3 + 3y$

TOSS-UP

14) EARTH SCIENCE  Multiple Choice  A measure of how easily water flows through rock is called its:

W) porosity
X) aquifer system
Y) permeability
Z) zone of aeration

ANSWER: Y) PERMEABILITY

BONUS

14) EARTH SCIENCE  Short Answer  In coastal engineering terms, the area from the shoreline to just beyond the breaker zone is called what?

ANSWER: LITTORAL ZONE (ACCEPT: INTERTIDAL ZONE)
TOSS-UP

15) GENERAL SCIENCE  
*Short Answer*  What ardent behaviorist and author of “Walden Two” believed that human behavior is strongly influenced by what he referred to as operant reinforcement?

ANSWER: B.F. SKINNER (ACCEPT: SKINNER)

BONUS

15) GENERAL SCIENCE  
*Multiple choice*  The total amount of sediment a stream can carry past a point in a given amount of time, is known as its:

W) competence  
X) capacity  
Y) abrasion  
Z) dissolved load

ANSWER: X) CAPACITY

TOSS-UP

16) COMPUTER SCIENCE  
*Short Answer*  In word processing, a collection of letters and associated characters in the same typeface, style and point size is called:

ANSWER: FONT

BONUS

16) COMPUTER SCIENCE  
*Multiple choice*  A logic chip that is just 20 nanometers wide would be about how many times wider than a single silicon atom?

W) 5  
X) 50  
Y) 200  
Z) 500

ANSWER: Y) 200
TOSS-UP

17) PHYSICS  *Multiple Choice*  Which physical phenomenon explains the flotation of boats and air balloons:

W) Bernoulli’s principle  
X) Archimedes principle  
Y) Newton’s second law of motion  
Z) Galileo’s law of displacement

**ANSWER: X) ARCHIMEDES PRINCIPLE**

**BONUS**

17) PHYSICS  *Short Answer*  A runner, with her feet braced against her starting blocks, accelerates with a horizontal magnitude of 5 meters per second squared. How much horizontal force, in Newtons, must she exert on the blocks to produce this acceleration if the she has a mass of 70 kilograms?

**ANSWER: 350 NEWTONS (ACCEPT: 350)**

(Solution:  \( F=MA; F=70\times5; F=350 \))

TOSS-UP

18) CHEMISTRY  *Short Answer*  How many electrons would fill the 4d energy subshell?

**ANSWER: 10**

**BONUS**

18) CHEMISTRY  *Multiple Choice*  In which element is the first crossing in the orbital-filling order encountered, whereby the next 2 electrons go into the 4s subshell rather than filling the 3d orbitals?

W) argon  
X) scandium  
Y) rubidium  
Z) potassium

**ANSWER: Z) POTASSIUM**
TOSS-UP

19) BIOLOGY  *Short Answer*  What section of the brain is sometimes referred to as the body’s thermostat?

ANSWER: HYPOTHALAMUS

BONUS

19) BIOLOGY  *Multiple Choice*  Removal of a predatory starfish results in an overabundance of mollusks dramatically altering the community population. The starfish would be considered:

W) a keystone species
X) primary competitor
Y) secondary producer
Z) an endangered species

ANSWER: W) A KEYSTONE SPECIES

TOSS-UP

20) MATH  *Short Answer*  In statistics, what is the square root of the variance most commonly known as?

ANSWER: STANDARD DEVIATION

BONUS

20) MATH  *Short Answer*  To the nearest cubic inch, find the volume of a sphere whose diameter is 4 inches:

ANSWER: 33 (ACCEPT: 32 – 34)

(Solution:  \( V = \frac{4}{3} \pi r^3; \)  \( = \frac{4}{3} (3.14)(8); \)  = 33.49)
TOSS-UP

21) EARTH SCIENCE  Multiple Choice  On a topographical map, what are the lines drawn that connect points of the same elevation above or below mean sea level called:

W) isobars  
X) ridges  
Y) isohyets  
Z) contours

ANSWER: Z) CONTOURS

BONUS

21) EARTH SCIENCE  Multiple Choice  The abyssal plain of the Atlantic ocean lies directly adjacent to the:

W) continental slope  
X) continental rise  
Y) continental shelf  
Z) continental crust

ANSWER: X) CONTINENTAL RISE

TOSS-UP

22) GENERAL SCIENCE  Multiple Choice  In 1905, on the basis of apparent irregularities in the orbital motion of Neptune that later proved to be incorrect, who predicted the existence of a ninth planet with an orbit beyond Neptune:

W) Percival Lowell  
X) Charles Dillon Perrine  
Y) George Ellery Hale  
Z) Johannes Franz Hartman

ANSWER: W) PERCIVAL LOWELL

BONUS

22) GENERAL SCIENCE  Short Answer  What native tree, prized for its wood, which looked like oak, and valued also for its fruit, is now almost extinct in the wild in the US?

ANSWER: AMERICAN CHESTNUT  (DO NOT ACCEPT CHESTNUT)
TOSS-UP

23) PHYSICS  Short Answer  The speed of light in a vacuum divided by the speed of light in a specific material is a way to compute what common optical value:

ANSWER: INDEX OF REFRACTION

BONUS

23) PHYSICS  Short Answer  What is the potential difference, in volts, if 35 joules of work is needed to move 5 coulombs of charge in a uniform electric field?

ANSWER: 7

(Solution: \( v = \frac{35}{5} = 7 \) volts)

TOSS-UP

24) CHEMISTRY  Multiple Choice  All elements in a given period of the periodic table have similar:

W) valence-shell electron configuration
X) maximum principal quantum number
Y) atomic radii
Z) atomic number

ANSWER: X) MAXIMUM PRINCIPAL QUANTUM NUMBER

BONUS

24) CHEMISTRY  Short Answer  What is the systematic name for the compound FeCO₃?

ANSWER: IRON(II) CARBONATE  (read as: iron 2 carbonate)
(DO NOT ACCEPT: FERROUS CARBONATE OR IRON CARBONATE)
TOSS-UP

25) BIOLOGY  *Multiple Choice*  Which of the following is a feeding structure in arachnids:

W) dentipalps  
X) radula  
Y) proboscis  
Z) chelicerae (read as: chill-iss-err-aye)

ANSWER: Z) CHELICERAE

BONUS

25) BIOLOGY  *Multiple Choice*  Which of the following is NOT a cranial bone:

W) parietal  
X) occipital  
Y) sphenoid  
Z) lacrimal

ANSWER: Z) LACRIMAL

(Solution: Lacrimal is a facial bone)