

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: $T = v/r = 120/15 = 8$)

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: $v = at$, $f = ma \Rightarrow t = v/a = v m / f = 20 \times 5 / 20 = 5$ 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)

TOSS-UP

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

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%)

TOSS-UP

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

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: $F=MA$; $F=70 \times 5$; $F=350$)

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: $v = 35/5 = 7$ 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 FeCO_3 ?

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)