

ROUND 14

TOSS-UP

1) CHEMISTRY *Multiple Choice* The triple point of a substance can be represented in what type of graphical representation:

- W) Lewis diagram
- X) phase diagram
- Y) energy diagram
- Z) time-temperature transformation diagram

ANSWER: X) PHASE DIAGRAM

BONUS

1) CHEMISTRY *Short Answer* Based on the acid dissociation constants of the following acids, order the following 4 acids from the strongest to the weakest in acid strength: HBr; HCl; HF; HI

ANSWER: HI; HBr; HCl; HF

TOSS-UP

2) PHYSICS *Multiple Choice* Color photography and the eventual development of the color television was advanced most directly by:

- W) Planck's quantum theory of light
- X) Young's and Helmholtz's three color theory of light
- Y) the three color pigment theory
- Z) Kichoff's understanding of the photoelectric effect

ANSWER: X) YOUNG'S AND HELMHOLTZ'S THREE COLOR THEORY OF LIGHT

BONUS

2) PHYSICS *Short Answer* Ignoring friction and assuming $g = 9.8 \text{ m/s}^2$, how high will a stone reach, in meters rounded to the first decimal place, if launched vertically from rest at 15 m/s ?

ANSWER: 11.5 METERS

TOSS-UP

3) BIOLOGY *Short Answer* Oligodendrocytes are responsible for producing what nerve coating that speeds nerve conduction:

ANSWER: MYELIN SHEATH (ACCEPT: MYELIN)

BONUS

3) BIOLOGY *Multiple Choice* Which of the following are mostly under the control of the hypothalamus:

- W) metabolism, heart rate, sleep
- X) metabolism, heart rate, ovulation
- Y) metabolism, heart rate, micturition
- Z) metabolism, heart rate, balance

ANSWER: W) METABOLISM, HEART RATE, SLEEP

TOSS-UP

4) ASTRONOMY *Multiple Choice* To a stargazer in Ohio, a star far enough south of the celestial equator to be circumpolar such as Miaplacidus is:

- W) only seen for about 6 hours
- X) only seen briefly for about half an hour on the horizon
- Y) only seen on the winter solstice
- Z) never seen

ANSWER: Z) NEVER SEEN

BONUS

4) ASTRONOMY *Multiple Choice* Non-circumpolar stars that lie north of the celestial equator when viewed from Michigan will:

- W) spend less than 6 hours above the horizon
- X) spend more than 6 hours but less than 12 hours above the horizon
- Y) spend more than 12 hours but less than 24 hours above the horizon
- Z) spend 24 hours above the horizon

ANSWER: Y) SPEND MORE THAN 12 HOURS BUT LESS THAN 24 HOURS ABOVE THE HORIZON

TOSS-UP

5) MATH *Multiple Choice* Which of the following trigonometric relationships is TRUE:

W) $\sin \theta \times \cotangent \theta = 1$ (read θ as theta)

X) $\tan \theta \times \cotangent \theta = 1$

Y) $\sec \theta - \cos \theta = 1$

Z) $\sin \theta + \csc \theta = 1$

ANSWER: X) $\tan \theta \times \cotangent \theta = 1$

BONUS

5) MATH *Short Answer* Given the points, (0, 0) and $(-4/5, 3/5)$, find the distance between them:

ANSWER: 1 (ACCEPT: $\sqrt{1}$)

(Solution: $r^2 = (x_1 - 0)^2 + (y_1 - 0)^2$; $= (-4/5)^2 + (3/5)^2$; $= 1$)

TOSS-UP

6) EARTH SCIENCE *Multiple Choice* Which of the following is NOT classified as an intrusive igneous rock:

W) granite

X) diorite

Y) rhyolite

Z) gabbro

ANSWER: Y) RHYOLITE

BONUS

6) EARTH SCIENCE *Short Answer* Order the following three types of magma based on their typical percentage of dissolved gas, starting with the lowest: andesitic, basaltic, rhyolitic

ANSWER: BASALTIC, ANDESITIC, RHYOLITIC

TOSS-UP

7) GENERAL SCIENCE *Multiple Choice* The neutralization of the magnetic field around a body by encircling it with a conductor through which a current is maintained is called:

- W) demodulation
- X) degaussing
- Y) debugging
- Z) dehissing

ANSWER: X) DEGAUSSING

BONUS

7) GENERAL SCIENCE *Short Answer* For his discovery of a new form of radiation in 1895, what person received the first Nobel prize in physics?

ANSWER: WILHELM RÖNTGEN (ACCEPT: RÖNTGEN)

TOSS-UP

8) COMPUTER SCIENCE *Multiple Choice* In most microprocessors, cache memory built into the microprocessor is what kind of cache:

- W) L1
- X) L2
- Y) L3
- Z) L4

ANSWER: W) L1

BONUS

8) COMPUTER SCIENCE *Short Answer* A component of the CPU, what does the acronym ALU stand for?

ANSWER: ARITHIMETIC LOGIC UNIT

TOSS-UP

9) CHEMISTRY *Multiple Choice* Of the following, which is the most powerful tool available for the quantitative elemental analysis of metals in solutions:

- W) potentiometry
- X) nuclear magnetic resonance spectrometry
- Y) atomic absorption spectrometry
- Z) liquid chromatography

ANSWER: Y) ATOMIC ABSORPTION SPECTROMETRY

BONUS

9) CHEMISTRY *Short Answer* A sodium chloride solution in water has a weight percent of 6%. What mass of solution, in grams, contains 1.5 grams of sodium chloride?

ANSWER: 25

(Solution: $\text{mass} = 1.5\text{gNaCl} \times 100\text{g soln} / 6\text{gNaCl} = 25\text{g solution}$)

TOSS-UP

10) PHYSICS *Multiple Choice* Which of the following forms of ionizing radiation expends most of its energy over the shortest distance when passing through human tissue:

- W) alpha particles
- X) beta particles
- Y) x-rays
- Z) gamma particles

ANSWER: W) ALPHA PARTICLES

BONUS

10) PHYSICS *Short Answer* Consider a sailor off the coast of Cape Cod, Massachusetts. How far from a fog horn, in meters, is the sailor if it takes 5 seconds to hear the horn at 10° C?

ANSWER: 1685 (ACCEPT: 1680 TO 1690)

(Solution: $0.6 \times 10 = 6 \rightarrow 6 + 331 = 337 \rightarrow 337 \times 5 = 1685 \text{ meters}$)

TOSS-UP

11) BIOLOGY *Short Answer* Okazaki (read as: OH-kah-zak-ee) fragments are joined by what specific enzyme?

ANSWER: DNA LIGASE (ACCEPT: DNA POLYMERASE I)

BONUS

11) BIOLOGY *Multiple Choice* Assuming a man has Daltonism and marries a homozygous, normal woman, their children would most likely have which of the following genetic distributions:

- W) 100% of the females would be carriers and 50% of the males would be carriers
- X) 100% of the females would be carriers and 100% of the males would be normal
- Y) 50% of the females would be carriers and all of the males would have Daltonism
- Z) both the females and the males would all have Daltonism

ANSWER: X) 100% OF THE FEMALES WOULD BE CARRIERS AND 100% OF THE MALES WOULD BE NORMAL

TOSS-UP

12) ASTRONOMY *Multiple Choice* What shape do interstellar dust particles have since the light emitted by stars is dimmed and partially polarized:

- W) sphere
- X) cube
- Y) disk
- Z) rodlike

ANSWER: Z) RODLIKE

BONUS

12) ASTRONOMY *Short Answer* What astronomical instrument, used to determine the position of celestial bodies, uses light in parallel rays falling on a mercury surface, which then pass through a prism and into a telescope?

ANSWER: PRISMATIC ASTROLABE (ACCEPT: ASTROLABE OR IMPERSONAL ASTROLABE)

TOSS-UP

13) MATH *Multiple Choice* For a population of 100 individuals with a normal distribution, how many individuals will be found to fall greater than 1 standard deviation above the mean:

- W) 12
- X) 16
- Y) 32
- Z) 68

ANSWER: X) 16

BONUS

13) MATH *Short Answer* Solving for x , find the roots of the following equation: $x^2 - 2x - 2 = 0$

ANSWER: $x = 1 \pm \sqrt{3}$ (ACCEPT: $x = 1 + \sqrt{3}$ AND $x = 1 - \sqrt{3}$)

TOSS-UP

14) EARTH SCIENCE *Multiple Choice* Which of the following minerals has a hardness of 7, often has good crystal shape with 6 sides, varies from colorless to white, pink, purple and several other colors, and exhibits conchoidal fracture:

- W) quartz
- X) diamond
- Y) pyroxene
- Z) olivine

ANSWER: W) QUARTZ

BONUS

14) EARTH SCIENCE *Short Answer* Calculate the percent relative humidity for air at 70°F containing 10 millibars of water vapor if the saturation vapor pressure is 25.0 millibars at that temperature:

ANSWER: 40%

(Solution: $RH = 10/25 \times 100\% = 40$)

TOSS-UP

15) GENERAL SCIENCE *Multiple Choice* In population ecology, which of the following best defines the number of individuals of a species per unit of area:

- W) population size
- X) population density
- Y) biomass
- Z) cohort

ANSWER: X) POPULATION DENSITY

BONUS

15) GENERAL SCIENCE *Short Answer* Recent studies of Troglodytes indicate they are some of the most sensitive endangered life forms. In what specific environment do Troglodytes typically live?

ANSWER: CAVES

TOSS-UP

16) COMPUTER SCIENCE *Multiple Choice* In Java, a vector is different from an array in that:

- W) it is unordered
- X) it has no API to support it
- Y) it can store only integers
- Z) its size does not need to be explicitly declared

ANSWER: Z) ITS SIZE DOES NOT NEED TO BE EXPLICITLY DECLARED

BONUS

16) COMPUTER SCIENCE *Multiple Choice* Which of the following operating systems came first:

- W) UNIX
- X) Linux
- Y) Windows 3.1
- Z) OS/2

ANSWER: W) UNIX

TOSS-UP

17) CHEMISTRY *Multiple Choice* Which of the following is the common name for the following compound: benzene with a methyl group on carbon #1 and a chlorine atom on carbon #2

- W) chlorotoluene (Pronounced: KLOR-o-tol-you-eeen)
- X) o-chlorotoluene
- Y) p-chlorotoluene
- Z) m-chlorotoluene

ANSWER: X) o-CHLOROTOLUENE

BONUS

17) CHEMISTRY *Short Answer* What is the oxidation number of the sulfur atom in H_2SO_4 ?

ANSWER: +6 (ACCEPT: 6)

(Solution: $2(+1) + \text{S} + 4(-2) = 0$; $\text{S} = +6$)

TOSS-UP

18) PHYSICS *Multiple Choice* If e is energy, f is frequency, and h is Planck's constant, which of the following is NOT possible according to Planck's quantum hypothesis:

- W) $e = hf$
- X) $e = 0.5 hf$
- Y) $e = 1 hf$
- Z) $e = 2 hf$

ANSWER: X) $E = 0.5 HF$

BONUS

18) PHYSICS *Multiple Choice* Einstein proposed that the photoelectric effect was a test for which of the following:

- W) the wave nature of light
- X) that light traveled a constant speed in a vacuum
- Y) the photon theory of light
- Z) the wave particle duality of light

ANSWER: Y) THE PHOTON THEORY OF LIGHT

TOSS-UP

19) BIOLOGY *Short Answer* Give the common chemical name for where new bases are added to a DNA strand:

ANSWER: 3 PRIME HYDROXYL (ACCEPT: 3 PRIME END)

BONUS

19) BIOLOGY *Short Answer* Which one of the following 5 intermediates of the citric acid cycle is considered a 6 carbon intermediate: citric acid, oxaloacetic acid, succinic acid, alpha ketoglutaric acid, fumaric acid

ANSWER: CITRIC ACID

TOSS-UP

20) ASTRONOMY *Multiple Choice* Which of the following is not a characteristic of the terrestrial planets:

- W) low average density
- X) closely spaced orbits
- Y) craters in old surfaces
- Z) very few moons

ANSWER: W) LOW AVERAGE DENSITY

BONUS

20) ASTRONOMY *Multiple Choice* Which of the following is NOT true of Kepler's works in astronomy:

- W) Kepler gathered most of his data from his monitoring of the planets with a quadrant
- X) Kepler very seldom observed the planets and looked through a telescope only a few times in his life
- Y) many of Kepler's computations were based on data gathered by Tycho Brahe
- Z) Kepler assumed planetary motion was not circular

ANSWER: W) KEPLER GATHERED MOST OF HIS DATA FROM HIS MONITORING OF THE PLANETS WITH A QUADRANT

TOSS-UP

21) MATH *Short Answer* Find $\sin 2\theta$ (read as: sine 2 theta) given that $\tan \theta$ (read as: tangent theta) equals minus three-fourths and θ is in the second quadrant:

ANSWER: $-\frac{24}{25}$

(Solution: $\sin \theta = 3/5$; $\cos \theta = -4/5$; $\sin 2\theta = 2 \sin \theta \cos \theta$; $= 2(3/5)(-4/5) = -24/25$)

BONUS

21) MATH *Short Answer* Find the solution set of the following equation: $x^2 + 6x + 6 = 0$

ANSWER: $-3 \pm \sqrt{3}$

TOSS-UP

22) GENERAL SCIENCE *Multiple Choice* In keeping with developments in the science of physics, Freud incorporated which of the following into his personality theory:

- W) relativity
- X) quantum theory
- Y) conservation of energy
- Z) entropy constantly increases

ANSWER: Y) CONSERVATION OF ENERGY

BONUS

22) GENERAL SCIENCE *Short Answer* Which of the following 5 metals has the lowest thermal conductivity: iron; lead; tin; magnesium; zinc

ANSWER: LEAD

(Solution: iron – 80.2; lead - 35.3; tin – 66.6; magnesium - 156; zinc – 116)

TOSS-UP

23) CHEMISTRY *Multiple Choice* Which of the following is a naturally occurring amino acid that is NOT found in proteins?

- W) threonine (read as: three-oh-neen)
- X) histidine
- Y) ornithine (read as: oar-nih-thine)
- Z) isoleucine

ANSWER: Y) ORNITHINE

BONUS

23) CHEMISTRY *Short Answer* Which two of the following 5 amino acids contain nonpolar R groups? valine, lysine, arginine, alanine, histidine

ANSWER: VALINE, ALANINE

TOSS-UP

24) PHYSICS *Short Answer* If the Earth was the same mass but half its present diameter, by what multiple, to the first decimal place, would escape velocity increase?

ANSWER: 1.4

BONUS

24) PHYSICS *Short Answer* What is the energy used in Kilowatt-hours if a current of 2 amps flows through a circuit whose resistance is 5 ohms for one hour?

ANSWER: 0.020 (ACCEPT: 0.020 KILOWATT – HOURS)

(Solution: $W = (2A)^2 \times 5 \text{ ohms} \times 1 \text{ hr} = .020 \text{ Kilowatt-hours}$)

TOSS-UP

25) BIOLOGY *Short Answer* What common organic molecule has a hydrocarbon phytol tail and a multi-ring structure with a magnesium metal ion in the center?

ANSWER: CHLOROPHYLL (ACCEPT: ANY CHLOROPHYLL)

BONUS

25) BIOLOGY *Short Answer* Order the following 3 monosaccharides from the smallest to the largest: xylose, threose, glyceraldehyde

ANSWER: GLYCERALDEHYDE, THREOSE, XYLOSE