

ROUND 14

TOSS-UP

1) CHEMISTRY *Multiple Choice* Which of the following is NOT an exothermic reaction:

- W) condensation
- X) freezing
- Y) vaporization
- Z) deposition

ANSWER: Y) VAPORIZATION

BONUS

1) CHEMISTRY *Short Answer* Unlike other halogens, this element does not form higher oxides or oxyacids:

ANSWER: FLUORINE (ACCEPT: F)

TOSS-UP

2) PHYSICS *Short Answer* Order the following substances from the LEAST dense to the MOST dense: silver, water at 1°C, water at 4°C, iron

ANSWER: WATER AT 1°C; WATER AT 4°C; IRON; SILVER
(Solution: water is most dense at 3.98)

BONUS

2) PHYSICS *Multiple Choice* Which of the following is true concerning objects moving down an inclined plane:

- W) a solid cylinder will roll faster than a hollow cylinder regardless of the mass or outer diameter of either cylinder
- X) a hollow cylinder will roll faster than a solid cylinder regardless of the mass or outer diameter of either cylinder
- Y) a solid cylinder will roll at the same rate as a hollow cylinder regardless of the mass or outer diameter of either cylinder
- Z) a solid cylinder will roll slower than a hollow cylinder of twice the mass and outer diameter of the solid cylinder

ANSWER: W) A SOLID CYLINDER WILL ROLL FASTER THAN A HOLLOW CYLINDER REGARDLESS OF THE MASS OR OUTER DIAMETER OF EITHER CYLINDER

TOSS-UP

3) **BIOLOGY** *Multiple Choice* The propagation of an action potential down a myelinated nerve occurs by which of the following methods:

- W) synaptic transmission
- X) initiation and regeneration
- Y) saltatory conduction
- Z) absolute propagation

ANSWER: Y) SALTATORY CONDUCTION

BONUS

3) **BIOLOGY** *Multiple Choice* The Frank Starling Law depends most directly on which of the following:

- W) the ability of cardiac sarcoplasmic retic ula to sense sarcomere distension
- X) the ability of the action potential to be lowered as the heart is filled with more blood
- Y) optimal sarcomere length for strength of contraction
- Z) retrograde pulmonic stenosis

ANSWER: Y) OPTIMAL SARCOMERE LENGTH FOR STRENGTH OF CONTRACTION

TOSS-UP

4) **ASTRONOMY** *Multiple Choice* Determining the mass of a planet is most easily done if:

- W) the planet has a satellite
- X) the planet is large
- Y) the planet has a comet pass by it
- Z) the planet is close to the Earth

ANSWER: W) THE PLANET HAS A SATELLITE

BONUS

4) **ASTRONOMY** *Short Answer* What is the process called when planetesimals grow into protoplanets by the accumulation of material driven by gravity?

ANSWER: ACCRETION

TOSS-UP

5) MATH *Short Answer* Factor the expression: $x^2 + 3x - 10$

ANSWER: $(x + 5)(x - 2)$

BONUS

5) MATH *Short Answer* Express $\cos(\arctan x)$ (read as: cosine of arc tangent x) without trigonometric functions:

ANSWER: $\frac{1}{\sqrt{x^2 + 1}}$

(Solution: draw a right triangle with base 1, height x, hypotenuse $\sqrt{x^2 + 1}$)

TOSS-UP

6) EARTH SCIENCE *Multiple Choice* The Curie point of an iron-bearing mineral is 580°C. This value specifically indicates that at 581°C, the sample will be:

- W) radioactive
- X) a liquid
- Y) magnetic
- Z) non-magnetic

ANSWER: Z) NON-MAGNETIC

BONUS

6) EARTH SCIENCE *Multiple Choice* The terminus of a retreating glacier is covered by the landslide of a nearby mountain buttress, covering nearly one-third of the ablation area with a 20 foot thick blanket of rubble. Which of the following will most likely occur:

- W) the glacier continues to retreat, but at an even greater rate
- X) the glacier continues to retreat, but at the same rate
- Y) the glacier is impeded by the debris and neither advances nor retreats
- Z) the glacier begins to advance

ANSWER: Z) THE GLACIER BEGINS TO ADVANCE

(Solution: the debris impedes its melting)

TOSS-UP

7) GENERAL SCIENCE *Multiple choice* To which of the following groups does the popular organism for developmental biological studies called *C. elegans* belong:

- W) budding yeasts
- X) nematodes
- Y) flatworms
- Z) vascular plants

ANSWER: X) NEMATODES

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BONUS

7) GENERAL SCIENCE *Short Answer* What force of nature is responsible for the fact that heated gases in a flame take on a tear-drop shape?

ANSWER: GRAVITY

TOSS-UP

8) GENERAL SCIENCE *Multiple Choice* A WAN would be absolutely required for a network:

- W) between two computers
- X) between two buildings on a college campus
- Y) between neighboring towns
- Z) between two continents

ANSWER: Z) BETWEEN TWO CONTINENTS

BONUS

8) GENERAL SCIENCE *Multiple choice* If we wanted to use a string as an index into an array in Pascal or Java, what data structure would we use:

- W) hash table
- X) layer
- Y) objects list
- Z) column

ANSWER: W) HASH TABLE

TOSS-UP

9) CHEMISTRY *Multiple Choice* Which of the following is a value that determines whether or not a reaction is spontaneous:

- W) entropy change
- X) exothermic reaction
- Y) heat of formation
- Z) Gibbs free energy

ANSWER: Z) GIBBS FREE ENERGY

BONUS

9) CHEMISTRY *Short Answer* This strong reducing agent is an acid which occurs naturally in ants and nettles:

ANSWER: FORMIC ACID (ACCEPT: METHANOIC ACID)

TOSS-UP

10) PHYSICS *Short Answer* This future Nobel laureate and champion of science education would co-discover more than a dozen new elements while working at Berkeley California along with Edwin McMillan:

ANSWER: GLENN SEABORG

BONUS

10) PHYSICS *Multiple Choice* Which of the following is the conventional description of radioactive isomers:

- W) atoms with the same number of nucleons but different radioactive decay schemes
- X) atoms with different numbers of nucleons but the same radioactive decay schemes
- Y) atoms with the same numbers of nucleons and the same radioactive decay schemes
- Z) molecules with the same radioactive atoms but different structures

ANSWER: W) ATOMS WITH THE SAME NUMBER OF NUCLEONS BUT DIFFERENT RADIOACTIVE DECAY SCHEMES

TOSS-UP

11) **BIOLOGY** *Multiple Choice* Which of the following is NOT associated with PKU, which is also known as phenylketonuria (read as: phenyl-KEE-tone-uria):

- W) brain damage
- X) an inborn error of metabolism
- Y) Kappa proteins in the urine
- Z) inability to metabolize phenylalanine

ANSWER: Y) KAPPA PROTEINS IN THE URINE

BONUS

11) **BIOLOGY** *Multiple Choice* In a nucleosome, the DNA is wrapped around:

- W) a cluster of histones 1, 2A, 2B, 3 and 4
- X) ribosomes
- Y) the nucleolus (pronounced: NEW-lee-oh-luss)
- Z) a single histone monomer

ANSWER: W) A CLUSTER OF HISTONES 1, 2A, 2B, 3 AND 4

TOSS-UP

12) **ASTRONOMY** *Multiple Choice* In the early 1700's, James Bradley calculated the speed of light at 185 thousand miles per second based partially on which of the following:

- W) the amount he angled his telescope to observe stars because of the motion of the Earth
- X) the reflection of light using three mirrors about 20 meters apart
- Y) the bending of light around planets
- Z) the reflection of light from an 8-sided rotating mirror

ANSWER: W) THE AMOUNT HE ANGLED HIS TELESCOPE TO OBSERVE STARS BECAUSE OF THE MOTION OF THE EARTH

BONUS

12) **ASTRONOMY** *Short Answer* In Henrietta's Law, the period of variation in a Cepheid star is directly related to its:

ANSWER: LUMINOSITY (ACCEPT: ABSOLUTE BRIGHTNESS)

TOSS-UP

13) MATH *Multiple Choice* For which of the following mathematical systems does the commutative law of multiplication NOT hold:

- W) ordinary algebra
- X) algebra of groups
- Y) algebra of fields
- Z) algebra of matrices

ANSWER: Z) ALGEBRA OF MATRICES

BONUS

13) MATH *Short Answer* The crossing point between two lines, $x + 2y - 4 = 0$ and $-2x + y + 3 = 0$, is how far away from the origin?

ANSWER: $\sqrt{5}$ or 2.236

(Solution: $x = 4 - 2y$, $-2(4 - 2y) + y + 3 = 0$, $5y = 5$, $y = 1$, $x = 2$, $r = \text{sqrt}(1 + 4)$)

TOSS-UP

14) EARTH SCIENCE *Multiple Choice* Underwater volcanoes that have a flat top are called:

- W) seamounts
- X) island arcs
- Y) abyssal mountains
- Z) guyots

ANSWER: Z) GUYOTS

BONUS

14) EARTH SCIENCE *Multiple Choice* At an ambient temperature of 20°C , which of the following dew point temperatures would indicate the highest water vapor content in the air:

- W) 15°C
- X) 10°C
- Y) 0°C
- Z) -10°C

ANSWER: W) 15°C

TOSS-UP

15) GENERAL SCIENCE *Short Answer* One hallmark of Alzheimer's disease is the presence of what protein in the brain?

ANSWER: BETA AMYLOID

BONUS

15) GENERAL SCIENCE *Multiple Choice* Assuming standard quality, which of the following wood species is the strongest when used as a supporting beam:

- W) white oak
- X) hemlock
- Y) white birch
- Z) yellow pine

ANSWER: W) WHITE OAK

TOSS-UP

16) GENERAL SCIENCE *Multiple Choice* The main function of the power supply on a computer is to:

- W) convert AC voltage to DC voltages required by the computer
- X) provide a constant 110-volt AC to the motherboard
- Y) boost power to acceptable AC voltages
- Z) protect the computer from power surges

ANSWER: W) CONVERT AC VOLTAGE TO DC VOLTAGES REQUIRED BY THE COMPUTER

BONUS

16) GENERAL SCIENCE *Short Answer* The technical name given to the hard drive by the IBM PC Institute is DASD. What does DASD stand for?

ANSWER: DIRECT ACCESS STORAGE DEVICE

TOSS-UP

17) CHEMISTRY *Multiple Choice* Sodium is a highly malleable substance whereas sodium chloride is not. Which of the following is the LEAST likely explanation:

- W) sodium is metallic
- X) in sodium chloride, the ionic forces are strong
- Y) in sodium, atoms can move without any specific bonds being broken
- Z) in sodium chloride, the ions are arranged in very irregular arrays

ANSWER: Z) IN SODIUM CHLORIDE, THE ION ARE ARRANGED IN VERY IRREGULAR ARRAYS

(Solution: ...regular arrays)

BONUS

17) CHEMISTRY *Multiple choice* Which of the following is the strongest form of magnetism:

- W) ferromagnetism
- X) paramagnetism
- Y) diamagnetism
- Z) trimagnetism

ANSWER: W) FERROMAGNETISM

TOSS-UP

18) PHYSICS *Multiple Choice* Which of the following agrees most with current theories concerning quark-gluon plasma:

- W) it exists in the core of stars like our sun
- X) it exists in deep space and is probably the source of cosmic rays
- Y) it exists at the edge of our expanding universe
- Z) it existed in the early universe

ANSWER: Z) IT EXISTED IN THE EARLY UNIVERSE

BONUS

18) PHYSICS *Short Answer* For a radioactive element with a half-life of 30 years, if a sample of the radioactive element is left to decay for 120 years, what fraction of the original radioactive atom in the sample will be left?

ANSWER: 1/16

TOSS-UP

19) **BIOLOGY** *Multiple Choice* Incomplete division of a yolk-rich egg is known as:

- W) holoblastic cleavage
- X) meroblastic cleavage
- Y) binary fission
- Z) determinate cleavage

ANSWER: W) HOLOBLASTIC CLEAVAGE

BONUS

19) **BIOLOGY** *Multiple Choice* In certain tissues, where nuclear division is NOT followed by cytokinesis, which of the following will occur:

- W) meiotic disjunction
- X) a syncytium (pronounced: SIN-sish-e-um) results
- Y) chiasmata can form in abnormal numbers
- Z) a diploid zygote is always formed

ANSWER: X) A SYNCYTIUM RESULTS

TOSS-UP

20) **ASTRONOMY** *Multiple Choice* According to most accepted theories, the Oort Cloud cannot account for the origin of what types of comets in our solar system:

- W) comets that have origins outside of the Kuiper (pronounced: KY-per) belt.
- X) comets that have short orbits and travel along the ecliptic
- Y) comets that are classified as cold comets
- Z) comets that have origins at a distance farther from the sun than the Oort Cloud

ANSWER: X) COMETS THAT HAVE SHORT ORBITS AND TRAVEL ALONG THE ECLIPTIC

BONUS

20) **ASTRONOMY** *Short Answer* To use this ancient astronomical instrument, the user hangs it from a metal ring attached to the top of a round star map and looks toward a specific star through a sighting device called an adilade:

ANSWER: AN ASTROLABE

TOSS-UP

21) MATH *Multiple Choice* Which of the following most closely approximates the golden ratio:

- W) an 8 inch by 10 inch photograph
- X) an 8.5 inch by 11 inch sheet of paper
- Y) a 3 inch by 5 inch index card
- Z) a square greeting card

ANSWER: Y) A 3 INCH BY 5 INCH INDEX CARD

(Solution: $x = \frac{1 + \sqrt{5}}{2} = 1.618$; $\frac{3}{5} = 1.6$)

BONUS

21) MATH *Short Answer* In a class of 20 students, each student speaks German, Chinese, or both. Thirteen students speak German and 17 students speak Chinese. How many speak both German and Chinese?

ANSWER: 10

TOSS-UP

22) GENERAL SCIENCE *Short Answer* This nurse/statistician was the first person in the English speaking world to apply statistics to the study of public health and invented the pie chart:

ANSWER: FLORENCE NIGHTINGALE

BONUS

22) GENERAL SCIENCE *Multiple choice* Over a time period of thousands of years, which of the following is true for the Carbon Cycle:

- W) the oceans determine atmospheric CO₂ concentration
- X) the atmosphere determines the oceanic CO₂ concentration
- Y) the oceans have only a minor affect on atmospheric CO₂ concentration
- Z) the terrestrial CO₂ reservoir directly determines the oceanic CO₂ concentration

ANSWER: W) THE OCEANS DETERMINE ATMOSPHERIC CO₂ CONCENTRATION

TOSS-UP

23) CHEMISTRY *Multiple Choice* Which of the following is NOT an example of a chelating (pronounced: KEE-lay-ting) agent:

- W) EDTA
- X) hemoglobin
- Y) chlorophyll
- Z) lead

ANSWER: Z) LEAD

BONUS

23) CHEMISTRY *Short Answer* What is the name of the tarnish resistant alloy of tin and lead which can be hardened by antimony and copper?

ANSWER: PEWTER

TOSS-UP

24) PHYSICS *Multiple Choice* If mechanical work is done by a gas as its volume increases and its temperature falls, it would be considered:

- W) a violation of thermodynamic laws
- X) an adiabatic expansion
- Y) a violation of the Carnot Cycle
- Z) having a negative delta G

ANSWER: X) AN ADIABATIC EXPANSION

BONUS

24) PHYSICS *Short Answer* In a tug of war over a cow, one woman pulls on the tail of the 200 Kg cow to the left of an observer with a force of 30 Newtons and another woman pulls on the head of the cow to the right of an observer with a force of 40 Newtons. What is the net force on the cow?

ANSWER: 10 NEWTONS

TOSS-UP

25) BIOLOGY *Multiple Choice* Aposematic coloration does which of the following:

- W) tricks predators into believing the prey is bigger than it appears
- X) alerts predators to stay away
- Y) entices prey into a trap
- Z) camouflages its prey

ANSWER: X) ALERTS PREDATORS TO STAY AWAY

BONUS

25) BIOLOGY *Multiple Choice* The chemiosmotic theory of ATP production in electron transport is based on:

- W) the pH of the cytosol
- X) sodium channels in both mitochondria and chloroplasts
- Y) H⁺ gradient across the mitochondrial membrane
- Z) the second law of thermodynamics

ANSWER: Y) H⁺ GRADIENT ACROSS THE MITOCHONDRIAL MEMBRANE