

ROUND 7

TOSS-UP

1) CHEMISTRY *Multiple Choice* Which of the following is NOT considered a state function of a system in a reaction:

- W) work
- X) enthalpy
- Y) temperature
- Z) volume

ANSWER: W) WORK

BONUS

1) CHEMISTRY *Short Answer* What is the name of the law that states that the overall enthalpy change for a reaction is equal to the sum of the enthalpy changes for the individual steps in the reaction:

ANSWER: HESS'S LAW (ACCEPT: HESS)

TOSS-UP

2) PHYSICS *Multiple Choice* A beam of white light is incident on one face of a prism. Which of the following colors will emerge on the other side at the lowest angle with respect to the primary beam:

- W) violet
- X) yellow
- Y) red
- Z) blue

ANSWER: Y) RED

BONUS

2) PHYSICS *Short Answer* Consider a lever with a 4-gram mass located 12 centimeters from its fulcrum. A 6-gram mass is placed on the opposite side of the lever. How far, in centimeters, must the 6-gram mass be placed from the fulcrum to equally balance the 4-gram mass?

ANSWER: 8 CENTIMETERS

TOSS-UP

3) BIOLOGY *Short Answer* What is the substrate for which catalase has the greatest affinity?

ANSWER: HYDROGEN PEROXIDE (ACCEPT: H_2O_2)

BONUS

3) BIOLOGY *Multiple Choice* Which of the following kinds of microscopy will most commonly employ freeze fracture preparation of tissue specimens:

- W) bright field microscopy
- X) scanning electron microscopy
- Y) Normarsky microscopy
- Z) transmission electron microscopy

ANSWER: X) SCANNING ELECTRON MICROSCOPY

TOSS-UP

4) ASTRONOMY *Multiple Choice* Cepheid variables are a large and important group of:

- W) yellow giants and super giants
- X) red giants
- Y) blue giants
- Z) pulsating quasars

ANSWER: W) YELLOW GIANTS AND SUPER GIANTS

BONUS

4) ASTRONOMY *Short Answer* What is the name of the simple astronomical instrument consisting of a vertical stick placed in a sunny spot to cast a shadow?

ANSWER: GNOMON

TOSS-UP

5) MATH *Short Answer* Find the derivative of the following function: $f(x) = \sin(\ln x)$ (read as: f of x equals the sine of the natural log of x)

ANSWER: $\frac{\cos(\ln x)}{x}$

BONUS

5) MATH *Multiple Choice* Using the Cartesian coordinate system, find the distance between the points (2, 3) and (-3, 1):

W) $\sqrt{29}$

X) $\sqrt{7}$

Y) $\sqrt{5}$

Z) $\sqrt{39}$

ANSWER: W) $\sqrt{29}$

TOSS-UP

6) EARTH SCIENCE *Multiple Choice* What percentage of the earth's total volcanic activity occurs under the ocean?

W) 30%

X) 45%

Y) 65%

Z) 90%

ANSWER: Z) 90%

BONUS

6) EARTH SCIENCE *Multiple Choice* Which of the following is NOT true about the Earth's troposphere:

W) within the layer, temperature decreases with altitude

X) it is terminated by the tropopause

Y) it contains the jet stream

Z) within the layer, temperature increases with altitude

ANSWER: Z) WITHIN THE LAYER, TEMPERATURE INCREASES WITH ALTITUDE

TOSS-UP

7) GENERAL SCIENCE *Multiple Choice* Galena is a primary ore of which of the following metals:

- W) zinc
- X) lead
- Y) germanium
- Z) tungsten

ANSWER: X) LEAD

BONUS

7) GENERAL SCIENCE *Short Answer* According to Aristotle, the portion of the Cosmos lower than the moon is made of what four elements?

ANSWER: EARTH, WATER, AIR, FIRE (accept in any order)

TOSS-UP

8) COMPUTER SCIENCE *Multiple Choice* The letter "T" in 10 Base-T wiring refers to:

- W) Teflon coated
- X) telephone wire
- Y) tetrahedral packing
- Z) twisted pair

ANSWER: Z) TWISTED PAIR

BONUS

8) COMPUTER SCIENCE *Multiple Choice* In Windows 98, what screen would you access to change device resources and troubleshoot resource conflicts:

- W) Device Performance Console
- X) Device Add/Remove
- Y) Device Changer
- Z) Device Manager

ANSWER: Z) DEVICE MANAGER

TOSS-UP

9) CHEMISTRY *Multiple Choice* Which of the following is a manufactured fiber composed of regenerated cellulose or of regenerated cellulose in which substituents have replaced more than 15% of the hydrogens of the hydroxyl groups:

- W) polyester
- X) silk
- Y) rayon
- Z) nylon

ANSWER: Y) RAYON

BONUS

9) CHEMISTRY *Short Answer* If the temperature of a 4L tank of gas changes from 200K to 500K, at constant pressure what is the new volume of gas, in liters:

ANSWER: 10

(Solution: $V_1/T_1 = V_2/T_2$; $4\text{L}/200\text{K} = V_2/500\text{K}$; $=10\text{L}$)

TOSS-UP

10) PHYSICS *Short Answer* According to the work of Coulomb, if the charge on either one of two tiny objects was doubled, by what multiple would the total force on the particles increase?

ANSWER: 2 TIMES

BONUS

10) PHYSICS *Multiple Choice* In the Bragg equation which is conventionally written as, $n\lambda = 2d \sin \mathbf{N}$ (Read as: n lambda equals two d sine phi), which of the following is the correct description of the angle phi:

- W) the complementary angle with respect to the normal to the crystal surface
- X) the angle between the incident ray and the normal to the crystal surface
- Y) the angle between the incident ray and the crystal surface
- Z) the internal angle of reflection of the crystal

ANSWER: Y) THE ANGLE BETWEEN THE INCIDENT RAY AND THE CRYSTAL SURFACE

TOSS-UP

11) BIOLOGY *Short Answer* What scientist in 1936, building on the discoveries of Szent-Gyorgyi, (Pronounced: SENT- GEE-or-gee) postulated the basic reactions of the tricarboxylic (read as: tri-car-box-ill-ick) acid cycle?

ANSWER: KREBS

BONUS

11) BIOLOGY *Multiple Choice* At which of the following wavelengths will photosynthesis in a spinach plant be greatest:

- W) 475 nanometers
- X) 550 nanometers
- Y) 600 nanometers
- Z) 750 nanometers

ANSWER: W) 475 NANOMETERS

TOSS-UP

12) ASTRONOMY *Multiple Choice* Which of the following planets sees the Sun rising from the west and setting in the east during its Autumn and Spring equinoxes?

- W) Mars
- X) Saturn
- Y) Uranus
- Z) Mercury

ANSWER: Y) URANUS

BONUS

12) ASTRONOMY *Short Answer* Who is the author of the book titled “On the Revolution of the Heavenly Spheres” which rejected the Earth-centric universe?

ANSWER: COPERNICUS

TOSS-UP

13) MATH *Short Answer* What percent of a normally distributed sample lies within 2 standard deviations of the mean?

ANSWER: 95%

BONUS

13) MATH *Short Answer* What is the smallest integer that satisfies the following inequality:

$$\frac{x}{2} + \frac{x}{3} > 5$$

ANSWER: 7

TOSS-UP

14) EARTH SCIENCE *Multiple Choice* A wave base is defined as the depth below an ocean wave in deep water below which stirring due to wind is negligible, and is approximately equal to:

- W) $1/8^{\text{th}}$ of its wavelength
- X) $1/4$ of its wavelength
- Y) $1/2$ of its wavelength
- Z) $3/4$ of its wavelength

ANSWER: Y) $1/2$ OF ITS WAVELENGTH

BONUS

14) EARTH SCIENCE *Multiple Choice* A clastic particle falling within the size range of $1/16^{\text{th}}$ mm to 2 mm is called:

- W) silt
- X) sand
- Y) clay
- Z) pebble

ANSWER: X) SAND

TOSS-UP

15) GENERAL SCIENCE *Multiple Choice* Which of the following woods is most desirable for fence posts in wet environments:

- W) locust
- X) oak
- Y) alder
- Z) hickory

ANSWER: W) LOCUST

BONUS

15) GENERAL SCIENCE *Multiple Choice* BenzoPyrenes are food toxins that can be found in low concentrations in:

- W) charcoal-broiled meats
- X) uncooked shellfish
- Y) raw eggs
- Z) wild mushrooms

ANSWER: W) CHARCOAL-BROILED MEATS

TOSS-UP

16) COMPUTER SCIENCE *Short Answer* The elapsed time between the initiation of a request for data and the receipt of the first bit or byte of that data is called:

ANSWER: ACCESS TIME (ACCEPT: DISK ACCESS TIME)

BONUS

16) COMPUTER SCIENCE *Multiple Choice* Which of the following is a port that transmits data in a sort of wave, 8 bits across, in which each bit goes in the same direction at the same time:

- W) LPT
- X) serial
- Y) USB
- Z) FireWire

ANSWER: W) LPT

TOSS-UP

17) CHEMISTRY *Multiple Choice* A substance with an acid dissociation constant, or K_a , of 1×10^{-9} would be considered a:

- W) weak acid
- X) strong acid
- Y) weak base
- Z) strong base

ANSWER: W) WEAK ACID

BONUS

17) CHEMISTRY *Short Answer* Which Law states that the rate of effusion of a gas is inversely proportional to the square root of its molar mass?

ANSWER: GRAHAMS' LAW

TOSS-UP

18) PHYSICS *Short Answer* According to quantum electrodynamics, what is exchanged that gives rise to the electromagnetic force between 2 charged particles?

ANSWER: PHOTONS

BONUS

18) PHYSICS *Short Answer* What are the spin quantities for a gauge boson, a lepton, and a kaon, respectively?

ANSWER: 1; $\frac{1}{2}$; 0

TOSS-UP

19) BIOLOGY *Short Answer* A nucleosome is composed of what general class of proteins?

ANSWER: HISTONES

BONUS

19) BIOLOGY *Multiple Choice* In the cloning of plants such as orchids, the most desirable tissue to begin culturing in vitro is:

- W) radial cambium
- X) shoot meristematic tissue
- Y) amyloplasts
- Z) stem internodes

ANSWER: X) SHOOT MERISTEMATIC TISSUE

TOSS-UP

20) ASTRONOMY *Short Answer* What is the Greek name meaning sparkling or scorching for the star, alpha Canis Majoris?

ANSWER: SIRIUS

BONUS

20) ASTRONOMY *Multiple Choice* One important difference between spiral and elliptical galaxies is that:

- W) spiral galaxies contain Population II stars
- X) spiral galaxies contain clouds of gas and are still forming stars
- Y) spiral galaxies contain a massive black hole
- Z) spiral galaxies are formed by a more rapid accumulation of mass

ANSWER: X) SPIRAL GALAXIES CONTAIN CLOUDS OF GAS AND ARE STILL FORMING STARS

TOSS-UP

21) MATH *Short Answer* What parameter, usually signified by a lower case r, describes the direction and strength of a straight-line relationship between two quantifiable variables?

ANSWER: CORRELATION (ACCEPT: PEARSON'S CORRELATION or CORRELATION COEFFICIENT or PEARSON'S R, or THE PEARSON PRODUCT MOMENT CORRELATION)

BONUS

21) MATH *Short Answer* In terms of π , what is the area of a sector in a circle whose central angle is 40° bounded by two radii of 6?

ANSWER: 4π

(Solution: $A = n/360 \times \pi r^2$; $= 40/360 \times 36\pi = 4\pi$)

TOSS-UP

22) GENERAL SCIENCE *Multiple Choice* A flurry of recent reports in neurology and psychology points to protein translation in cerebral cortex dendrites leading to changes in synapses vital to what biological process:

- W) voluntary motor control
- X) stem cell repair
- Y) myelination
- Z) learning

ANSWER: Z) LEARNING

BONUS

22) GENERAL SCIENCE *Multiple Choice* A common type of distortion in CRT monitors in which horizontal and vertical lines bend inwards towards the center of the display is called:

- W) spiral distortion
- X) barrel distortion
- Y) trapezoid distortion
- Z) pincushion distortion

ANSWER: Z) PINCUSHION DISTORTION

TOSS-UP

23) CHEMISTRY *Multiple Choice* A racemic mixture is a solution that contains:

- W) a 50:50 mixture of (+) and (-) isomers
- X) greater than 50% of the (+) isomers
- Y) greater than 50% of the (-) isomers
- Z) only one species of isomer

ANSWER: W) A 50:50 MIXTURE OF (+) AND (-) ISOMERS

BONUS

23) CHEMISTRY *Multiple Choice* Separation of proteins by centrifugation in a sucrose density gradient is based on:

- W) size and shape only
- X) size only
- Y) density only
- Z) size, shape, and density

ANSWER: Z) SIZE, SHAPE, AND DENSITY

TOSS-UP

24) PHYSICS *Short Answer* Which 2 of the following 4 parameters most directly yield the product used in the Lawson criterion for nuclear fusion: ion density; fusion temperature; isotope half-life; energy confinement time

ANSWER: ION DENSITY AND ENERGY CONFINEMENT TIME (accept in any order)

BONUS

24) PHYSICS *Multiple Choice* The toroidal magnetic field in the Tokamak fusion confinement is oriented in which of the following directions:

- W) uniformly throughout the toroid
- X) oblique to the toroid axis
- Y) perpendicular to the toroid axis
- Z) parallel to the surface of the toroid

ANSWER: Z) PARALLEL TO THE SURFACE OF THE TOROID

TOSS-UP

25) BIOLOGY *Short Answer* Which germ layer in mammals is predominantly responsible for the gut lining and digestive glands?

ANSWER: ENDODERM

BONUS

25) BIOLOGY *Short Answer* *Shistosoma mansoni* is to shistosomiasis as *Trypanasoma cruzi* (Pronounced as TRY-pana -soma CREW-zeye) is to:

ANSWER: CHAGAS' DISEASE