

**ROUND 12**

**TOSS-UP**

1) PHYSICS *Multiple Choice* Kepler's third law states that the square of a planet's period is proportional to the:

- W) cube of its average distance from the sun
- X) square root of its average distance from the sun
- Y) cube of its average distance from its two neighboring planets
- Z) square of its average distance from the sun

ANSWER: W) CUBE OF ITS AVERAGE DISTANCE FROM THE SUN

**BONUS**

1) PHYSICS *Short Answer* Order the following 4 categories of electromagnetic radiation from the LOWEST frequency to the HIGHEST: Ultraviolet, VHF TV, AM radio, radiation from 60 hertz AC current

ANSWER: RADIATION FROM 60 HERTZ AC CURRENT; AM RADIO; VHF TV; ULTRAVIOLET

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**TOSS-UP**

2) CHEMISTRY *Multiple Choice* A substance's heat of sublimation at a given temperature is equal to which of the following at the same temperature:

- W) heat of fusion
- X) heat of vaporization
- Y) heat of fusion plus heat of vaporization
- Z) heat of fusion minus heat of vaporization

ANSWER: Y) HEAT OF FUSION PLUS HEAT OF VAPORIZATION

**BONUS**

2) CHEMISTRY *Short Answer* Order the following 4 acids from the strongest to the weakest: nitric acid; perchloric acid; hydrochloric acid; acetic acid

ANSWER: PERCHLORIC ACID; HYDROCHLORIC ACID; NITRIC ACID; ACETIC ACID

**TOSS-UP**

3) **BIOLOGY** *Multiple Choice* Which of the following molecules is best described as recognizing a specific nucleotide sequence and sniping the DNA at or near this recognition site:

- W) restriction enzyme
- X) DNA polymerase
- Y) RNA polymerase
- Z) DNA ligase

ANSWER: W) RESTRICTION ENZYME

**BONUS**

3) **BIOLOGY** *Multiple Choice* A double membrane is found in the:

- W) endoplasmic reticulum and nucleus
- X) nucleus and golgi (pronounced: GOAL-gee)
- Y) lysosomes and golgi
- Z) nucleus and chloroplasts

ANSWER: Z) NUCLEUS AND CHLOROPLASTS

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**TOSS-UP**

4) **ASTRONOMY** *Multiple Choice* Which of the following constellations can be seen highest in the November sky of the northern hemisphere?

- W) Orion
- X) Cassiopeia
- Y) Mensa
- Z) Cancer

ANSWER: X) CASSIOPEIA

**BONUS**

4) **ASTRONOMY** *Short Answer* The Stefan-Boltzman Law states that the energy emitted from a black body varies with what power of the temperature?

ANSWER: FOURTH

### TOSS-UP

5) MATH *Multiple Choice* Which of the following Venn diagrams would best represent a relationship where sets A and B have no elements in common:

- W) 2 non-overlapping shaded circles
- X) portions of circles A and B are overlapped and the intersection point is shaded
- Y) circle A is entirely within circle B and only circle A is shaded
- Z) only circle A is shown

ANSWER: W) 2 NON-OVERLAPPING SHADED CIRCLES

### BONUS

5) MATH *Short Answer* Use the Binomial Theorem to expand and simplify the following equation:  $(1 - 2x)^3$

ANSWER :  $1 - 6x + 12x^2 - 8x^3$

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### TOSS-UP

6) EARTH SCIENCE *Multiple Choice* What is the study of the size and shape of the Earth, the measurement of terrestrial gravitational forces, and the location of fixed points on the earth's surface:

- W) geography
- X) geology
- Y) geotropy
- Z) geodesy

ANSWER: Z) GEODESY

### BONUS

6) EARTH SCIENCE *Multiple Choice* Which of the following types of magma would LEAST likely be involved in a nonexplosive volcanic eruption:

- W) basaltic magma
- X) a relatively viscous magma
- Y) a relatively low silica content magma
- Z) a relatively high-temperature magma

ANSWER: X) A RELATIVELY VISCOUS MAGMA

**TOSS-UP**

7) GENERAL SCIENCE *Multiple Choice* A type of lens aberration whereby the lens cannot focus the image of a flat subject onto a flat surface is called:

- W) barrel distortion
- X) chromatic aberration
- Y) field curvature
- Z) spherical aberration

ANSWER: Y) FIELD CURVATURE

**BONUS**

7) GENERAL SCIENCE *Multiple Choice* One of the major challenges to making more accurate atomic clocks was:

- W) high atomic frequencies were difficult to monitor
- X) maintaining constant atomic vibrations
- Y) finding pure elementary samples for studies
- Z) cosmic ray interference disrupts the accurate measurements of atomic vibrations

ANSWER: W) HIGH ATOMIC FREQUENCIES ARE DIFFICULT TO MONITOR

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**TOSS-UP**

8) COMPUTER SCIENCE *Multiple Choice* A hardware frame and set of electrical connection interfaces that enable a notebook computer to effectively serve as a desktop computer is called a:

- W) docking station
- X) local bus
- Y) proxy interface
- Z) swapping deck

ANSWER: W) DOCKING STATION

**BONUS**

8) COMPUTER SCIENCE *Multiple Choice* A client-server architecture is also known as:

- W) peer-to-peer architecture
- X) mainframe architecture
- Y) two-tier architecture
- Z) docking architecture

ANSWER: Y) TWO-TIER ARCHITECTURE

### TOSS-UP

9) PHYSICS *Short Answer* What is the resistance, in ohms, of an electric curling iron that draws 10 amps on a 120 volt line?

ANSWER: 12

(Solution:  $I = V/R$ ,  $R = V/I$ ,  $R = 120/10 = 12$  ohms)

### BONUS

9) PHYSICS *Short Answer* Consider a marble rolling in a straight path at 25 meters per second that slows to 15 meters per second in 5 seconds. In meters per second squared, what is the marble's average acceleration?

ANSWER: -2 (DO NOT ACCEPT: 2 OR +2)

(Solution:  $(15-25) / 5 = -2 \text{ m/s}^2$ )

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### TOSS-UP

10) CHEMISTRY *Multiple Choice* In the equation for Gibbs-free energy, if  $\Delta H$  (read as: delta H) of a reaction is negative and  $\Delta S$  (read as: delta S) is negative, then the reaction will occur:

- W) spontaneously at all temperatures
- X) nonspontaneously at all temperatures
- Y) spontaneously only at high temperatures
- Z) spontaneously only at low temperatures

ANSWER: Z) SPONTANEOUSLY ONLY AT LOW TEMPERATURES

### BONUS

10) CHEMISTRY *Short Answer* Heating ethylene in the presence of water vapor at 300°C and under high pressure, is a common industrial method of producing billions of pounds of what substance?

ANSWER: ETHANOL (ACCEPT: ETHYL ALCOHOL)

**TOSS-UP**

11) **BIOLOGY** *Multiple Choice* Which of the following cells would NOT typically be found in the peripheral circulation:

- W) Polymorphonuclear leukocyte
- X) plasma cell
- Y) reticulocyte
- Z) erythroblasts

ANSWER: Z) ERYTHROBLASTS

**BONUS**

11) **BIOLOGY** *Multiple Choice* The coat of a plant seed is typically derived from which of the following:

- W) the hypoderm
- X) the carpel
- Y) the micropyle
- Z) the integument

ANSWER: Z) THE INTEGUMENT

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**TOSS-UP**

12) **ASTRONOMY** *Short Answer* How many degrees of arc are in 6 hours of right ascension?

ANSWER: 90 DEGREES

**BONUS**

12) **ASTRONOMY** *Short Answer* Which 2 of the following 5 minor planets have the largest diameters: Eros, Juno, Ceres, Amor, Apollo

ANSWER: CERES AND JUNO

**TOSS-UP**

13) MATH *Multiple Choice* Which of the following angles would be located in Quadrant IV of a rectangular coordinate system:

- W)  $2/3$  rev
- X)  $-480^\circ$
- Y)  $3/16$  rev
- Z)  $0.8$  rev

ANSWER: Z)  $0.8$  REV

**BONUS**

13) MATH *Short Answer* In the following number sequence, what are the values for a, b and c:  
a, b, 38, 22, 14, 10, c

ANSWER: a = 134; b = 70; c = 8

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**TOSS-UP**

14) EARTH SCIENCE *Multiple Choice* A number of “8” on the Beaufort Scale indicates a wind speed of:

- W) 7 – 10 knots
- X) 17 – 21 knots
- Y) 34 – 40 knots
- Z) 40 – 64 knots

ANSWER: Y) 34 – 40 KNOTS

**BONUS**

14) EARTH SCIENCE *Multiple Choice* In what 5-year period did the U.S. experience the highest level of North Atlantic hurricane activity:

- W) 1970 - 1975
- X) 1980 - 1985
- Y) 1985 - 1990
- Z) 1995 - 2000

ANSWER: Z) 1995 - 2000

**TOSS-UP**

15) GENERAL SCIENCE *Multiple Choice* In the oceanic ecosystem, which zone is defined by the depth of light penetration:

- W) probiotic
- X) euphotic
- Y) photobiotic
- Z) bathyal

ANSWER: X) EUPHOTIC

**BONUS**

15) GENERAL SCIENCE *Multiple Choice* Most manufactured glass used to make bottles, tableware, lamp bulbs, and window and plate glass, is of what composition:

- W) potassium silicate
- X) borosilicate
- Y) soda-lime
- Z) lead

ANSWER: Y) SODA-LIME

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**TOSS-UP**

16) COMPUTER SCIENCE *Multiple Choice* Which of the following is NOT a protocol associated with the workings of the internet:

- W) POP3
- X) FTP
- Y) HTML
- Z) TFT

ANSWER: Z) TFT

(Solution: TFT = Thin Film Transistor)

**BONUS**

16) COMPUTER SCIENCE *Short Answer* In the BASIC programming language, what does the acronym BASIC stand for?

ANSWER: BEGINNERS ALL-PURPOSE SYMBOLIC INSTRUCTIONAL CODE

### TOSS-UP

17) PHYSICS *Multiple Choice* Wein's law expresses the relationship between the wavelength at the peak emission in black body radiation and:

- W) the change in pressure
- X) the black body's structure
- Y) the temperature in Kelvins
- Z) the interference patterns of associated electrons

ANSWER: Y) THE TEMPERATURE IN KELVINS

### BONUS

17) PHYSICS *Short Answer* Assuming  $g = 10.0 \text{ m/sec}^2$  and friction is 0, if a rock is thrown vertically upward at 10.0 m/sec, how far up in meters will it be after 1 second?

ANSWER: 5 METERS

(Solution:  $d = V_0t + \frac{1}{2}at^2 = 10 \times 1 - \frac{1}{2}10 \times 1^2 = 10 - 5 = 5$  meters)

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### TOSS-UP

18) CHEMISTRY *Multiple Choice* A ketone is a class of compounds that contains a carbonyl group bonded to:

- W) 2 carbon atoms
- X) 2 hydrogen atoms
- Y) 2 nitrogen atoms
- Z) 1 hydrogen and 1 carbon atom

ANSWER: W) 2 CARBON ATOMS

### BONUS

18) CHEMISTRY *Short Answer* What is the primary product produced when ethyl alcohol is heated to 170°C in the presence of 95% sulfuric acid?

ANSWER: ETHYLENE

**TOSS-UP**

19) BIOLOGY *Short Answer* Of the primary, secondary, tertiary and quaternary levels of protein structure, at what level would a beta-pleated sheet be placed?

ANSWER: SECONDARY

**BONUS**

19) BIOLOGY *Short Answer* Exchange of DNA among chromosomes occurs in what phase of meiosis-one?

ANSWER: PROPHASE (ACCEPT: PROPHASE-ONE)

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**TOSS-UP**

20) MATH *Short Answer* What is the most common statistical term for the assumption, when comparing sample means, that there is no significant difference between the two samples?

ANSWER: NULL HYPOTHESIS

**BONUS**

20) MATH *Multiple Choice* Using the Cartesian coordinate system, find the distance between the points (-4, 3) and (2, 6):

W)  $3\sqrt{5}$

X)  $\sqrt{12}$

Y) 3

Z)  $5\sqrt{3}$

ANSWER: W)  $3\sqrt{5}$

**TOSS-UP**

21) EARTH SCIENCE *Multiple Choice* Which of the following is NOT associated with sedimentary rocks:

- W) bedding
- X) fossils
- Y) foliation
- Z) ripple marks

ANSWER: Y) FOLIATION

**BONUS**

21) EARTH SCIENCE *Multiple Choice* Also known as mock suns or parhelia, what is the name for a pair of brightly colored spots, one on either side of the sun, that are caused by sunlight passing through a thin layer of ice crystals:

- W) sun pillars
- X) cloud iridescence
- Y) sundogs
- Z) silver lining

ANSWER: Y) SUNDOGS

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**TOSS-UP**

22) GENERAL SCIENCE *Multiple Choice* Rust is a plant disease that attacks cereal plants such as wheat and rye and is caused by a:

- W) virus
- X) larval insect
- Y) bacterium
- Z) fungus

ANSWER: Z) FUNGUS

**BONUS**

22) GENERAL SCIENCE *Short Answer* Thin layer chromatography most commonly employs what substance as the matrix for the chromatographic separation?

ANSWER: SILICA (ACCEPT: SILICA GEL)

**TOSS-UP**

23) PHYSICS *Multiple Choice* Fermi noted that the biggest advantage of bombarding nuclei with neutrons was because:

- W) they have no electric charge
- X) they were easily produced in large numbers
- Y) they often interacted with electrons
- Z) they seldom had enough energy to split the nucleus

ANSWER: W) THEY HAVE NO ELECTRIC CHARGE

**BONUS**

23) PHYSICS *Short Answer* What is the name of the particle detector in Ontario that is buried 2 kilometers underground in a nickel mine?

ANSWER: SNO (ACCEPT: SUDBURY NEUTRINO DETECTOR OR SUDBURY NEUTRINO OBSERVATORY)

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**TOSS-UP**

24) CHEMISTRY *Multiple Choice* Which of these substances is NOT attacked by hydrochloric acid:

- W) iron
- X) calcite
- Y) barium phosphate
- Z) n-heptane

ANSWER: Z) N-HEPTANE

**BONUS**

24) CHEMISTRY *Short Answer* A chemical reaction in which esters are hydrolyzed under basic conditions to give an alcohol and a salt of the acid is generally known as what type of reaction?

ANSWER: SAPONIFICATION

**TOSS-UP**

25) BIOLOGY *Short Answer* The most common method used by Beadle and Tatum in generating mutant molds for their metabolic studies was to expose the molds to what?

ANSWER: X-RAYS

**BONUS**

25) BIOLOGY *Short Answer* Which 2 of the following 4 amino acids contain nonpolar R groups? serine; glutamine; leucine; (read as: lew-seen), phenylalanine (read as: FEE-nal-AL-a-noon)

ANSWER: LEUCINE; PHENYLALANINE