

## ROUND 12

### TOSS-UP

- 1) PHYSICS *Short Answer* For two sound sources heard simultaneously, one of which vibrates at 50 hertz and the other vibrates at 60 hertz, what is the beat frequency in beats per second?

ANSWER: 10

### BONUS

- 1) PHYSICS *Short Answer* What is the acceleration of a bike traveling in a straight line if the bike slows from 40 km/hr to 10 km/hr in 5 seconds? Give your answer in km/hr/sec.

ANSWER: -6

(Solution:  $a = v_2 - v_1 / \Delta t = (10 - 40)/5 = -6 \text{ Km/hr/s}$ )

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### TOSS-UP

- 2) CHEMISTRY *Short Answer* The formula,  $PV = nRT$ , is a representation of what gas law?

ANSWER: IDEAL GAS LAW

### BONUS

- 2) CHEMISTRY *Multiple Choice* Of the following, which is the strongest acid:

- W) sulfuric
- X) perchloric
- Y) hydrochloric
- Z) phosphoric

ANSWER: X) PERCHLORIC

### TOSS-UP

- 3) **BIOLOGY** *Short Answer* Gel filtration column chromatography will separate proteins based primarily on what physical difference?

ANSWER: SIZE

### BONUS

- 3) **BIOLOGY** *Multiple Choice* A good transmission electron microscope has a resolving power of about:

- W) 0.5 microns
- X) 50 nanometers
- Y) 0.2 nanometers
- Z) 0.01 angstroms

ANSWER: Y) 0.2 NANOMETERS

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### TOSS-UP

- 4) **ASTRONOMY** *Short Answer* According to the Gregorian calendar, in what year AD will the next centurial leap year occur?

ANSWER: 2400

(Solution: Centurial years are leap years if divisible exactly by 400)

### BONUS

- 4) **ASTRONOMY** *Multiple Choice* As understood by the Greek astronomer Aristarchus, horizontal parallax is to shifts of a viewer's position on different points of the Earth, as annual parallax is to shifts of a viewer's position:

- W) as the earth moves around the sun
- X) as the moon moves through the lunar year
- Y) as the sun moves around the earth
- Z) as the celestial sphere moves about the earth

ANSWER: W) AS THE EARTH MOVES AROUND THE SUN

**TOSS-UP**

- 5) MATH *Short Answer* The sine of theta is negative if the angle terminates in what two Quadrants of the Cartesian coordinate system?

ANSWER: III AND IV (ACCEPT: 3 AND 4 OR 3<sup>RD</sup> AND 4)

**BONUS**

- 5) MATH *Short Answer* To the nearest whole number, calculate the maximum height that could be attained for the following equation, where height at time  $t$  is given by the equation:

$$y = 3t^2 - 3t + 15$$

ANSWER: 14

(Solution:  $y' = 6t - 3$ ;  $t = 1/2$  ;  $y = 3(.5)^2 - 3(.5) + 15$ ;  $y = 14.25$ )

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**TOSS-UP**

- 6) EARTH SCIENCE *Multiple Choice* Oxygen and nitrogen molecules in the atmosphere preferentially scatter light of shorter wavelengths causing the sky to appear blue owing to what type of scattering:

- W) Rayleigh
- X) Mie
- Y) Crepuscular
- Z) parallel

ANSWER: W) RAYLEIGH

**BONUS**

- 6) EARTH SCIENCE *Short Answer* It is estimated that about 95% of all tsunamis are initiated by what event?

ANSWER: EARTHQUAKES

### TOSS-UP

- 7) GENERAL SCIENCE *Multiple Choice* A common type of distortion in CRT monitors in which horizontal and vertical lines bend outwards towards the edge of the display is called:
- W) barrel distortion
  - X) pincushion distortion
  - Y) spherical distortion
  - Z) trapezoid distortion

ANSWER: W) BARREL DISTORTION

### BONUS

- 7) GENERAL SCIENCE *Multiple Choice* The largest number of individuals of a particular species that can be maintained indefinitely in a given part of the environment is defined by what ecological term:
- W) biomic load
  - X) biomass limit
  - Y) cohort load
  - Z) carrying capacity

ANSWER: Z) CARRYING CAPACITY

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### TOSS-UP

- 8) COMPUTER SCIENCE *Multiple Choice* Which of the following is a network topology in which all the computers on the network are connected to a central computer:
- W) bus
  - X) star
  - Y) ring
  - Z) mesh

ANSWER: X) STAR

### BONUS

- 8) COMPUTER SCIENCE *Short Answer* What term describes the number of pixels contained on a display monitor, expressed in terms of the number pixels on the horizontal axis and the number on the vertical axis?

ANSWER: RESOLUTION

### TOSS-UP

- 9) PHYSICS *Multiple Choice* Which of the following is NOT true about the index of refraction:
- W) it has no units
  - X) the refractive index for air is lower than glass
  - Y) optical devices take advantage of it to improve resolution
  - Z) the refractive index for oil is lower than air

ANSWER: Z) THE REFRACTIVE INDEX FOR OIL IS LOWER THAN AIR

### BONUS

- 9) PHYSICS *Short Answer* To the nearest whole number and in kilometers per hour, what is the speed of a frog swimming at a constant 10 kilometers per hour directly across a river that has a downstream current of 4 kilometers per hour?

ANSWER: 11

(Solution: speed =  $\sqrt{10^2 + 4^2} = \sqrt{116} = 10.8$  km/hr)

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### TOSS-UP

- 10) CHEMISTRY *Short Answer* A chemical reaction between a fat and a base that produces a soap is generally known as what type of reaction?

ANSWER: SAPONIFICATION

### BONUS

- 10) CHEMISTRY *Multiple Choice* Which of the following solutions are immiscible:
- W) carbon tetrachloride and octane
  - X) ethanol and water
  - Y) carbon tetrachloride and water
  - Z) sulfuric acid and water

ANSWER: Y) CARBON TETRACHLORIDE AND WATER

**TOSS-UP**

11) **BIOLOGY** *Short Answer* In what part of the chloroplast is Photosystem Two located?

ANSWER: THYLAKOID MEMBRANE (ACCEPT: THYLAKOID STACK OR THYLAKOIDS)

**BONUS**

11) **BIOLOGY** *Multiple Choice* Which of the following vegetations is NOT properly matched with its biome:

- W) gymnosperms and boreal forest
- X) C4 plants and deserts
- Y) eucalyptus and temperate rain forest
- Z) deciduous forest and Taiga (Pronunciation: tie-ga)

ANSWER: Z) DECIDUOUS FOREST AND TAIGA

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**TOSS-UP**

12) **ASTRONOMY** *Short Answer* How far away, in parsecs, is a star with a parallax of 0.25 arc seconds?

ANSWER: 4

(Solution: distance = 1/ parallax)

**BONUS**

12) **ASTRONOMY** *Short Answer* Assuming there was a full moon was at 11:30 PM at a given place on April 7<sup>th</sup> of a certain year, what date would the full moon occur in the following month?

ANSWER: MAY 6<sup>TH</sup> (ACCEPT: 6<sup>th</sup>)

**TOSS-UP**

- 13) MATH *Multiple Choice* Which of the following best describes a curve generated by a point on the circumference of a circle which rolls on the inside of a fixed circle and whose rolling circle has a diameter one-fourth of that of the fixed circle:

- W) hypercycloid
- X) epicycloid
- Y) hypocycloid
- Z) astroid

ANSWER: Z) ASTROID

**BONUS**

- 13) MATH *Short Answer* Find the solution set of the following inequality:  $\frac{(-x + 3)}{4} > -\frac{2}{3}$

ANSWER:  $x < \frac{17}{3}$

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**TOSS-UP**

- 14) EARTH SCIENCE *Multiple Choice* Which of the following minerals is used as the primary ore of lead:

- W) graphite
- X) galena
- Y) bauxite
- Z) hematite

ANSWER: X) GALENA

**BONUS**

- 14) EARTH SCIENCE *Multiple Choice* Pedogeography is a branch of science that involves the study of the geographic distribution of:

- W) fossils
- X) soils
- Y) rivers
- Z) trees

ANSWER: X) SOILS

**TOSS-UP**

15) GENERAL SCIENCE *Multiple Choice* Operant conditioning is most notably concerned with which of the following:

- W) stimulus response mechanisms
- X) responses influenced by the consequences of the responses
- Y) Hull's postulate theorem approach to theorizing
- Z) theoretical aspects of personality such as free will

ANSWER: X) RESPONSES INFLUENCED BY THE CONSEQUENCES OF THE RESPONSES

**BONUS**

15) GENERAL SCIENCE *Multiple Choice* A severe and chronic deficiency in what vitamin causes the disease known as beriberi:

- W) thiamine
- X) niacin
- Y) vitamin C
- Z) vitamin D

ANSWER: W) THIAMINE

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**TOSS-UP**

16) COMPUTER SCIENCE *Multiple Choice* This more recent messaging protocol, for use via the internet, allows a client to access and manipulate electronic messages on a server as though they were saved locally:

- W) MIME
- X) FTP
- Y) HTTP
- Z) IMAP

ANSWER: Z) IMAP

(Solution: Internet Message Access Protocol)

**BONUS**

16) COMPUTER SCIENCE *Short Answer* SSL, a protocol developed by Netscape to transmit private documents through the internet, stands for what:

ANSWER: SECURE SOCKETS LAYER

### TOSS-UP

17) PHYSICS *Multiple Choice* Which of the following is NOT a type of lepton (PRON: LEP-tawn):

- W) electron
- X) kaon (PRON: KAY-on)
- Y) neutrino
- Z) muon (PRON: MEW-on)

ANSWER: X) KAON

### BONUS

17) PHYSICS *Short Answer* If a car, starting from rest, accelerates constantly at 4 meters /sec<sup>2</sup> for 10 seconds and then undergoes a constant negative acceleration of -4 meters/sec<sup>2</sup> for 3 seconds, how fast is the car traveling, in meters/second, at the end of the 13 seconds?

ANSWER: 28

(Solution:  $V_f = V_o + at = 40 + (-4) \times (3) = 28$ )

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### TOSS-UP

18) CHEMISTRY *Multiple Choice* Which of these organic compounds has more than two rings in its molecular structure:

- W) xylene
- X) cholesterol
- Y) tetrahydrofuran
- Z) glycine

ANSWER: X) CHOLESTEROL

### BONUS

18) CHEMISTRY *Short Answer* When ethene undergoes hydrogenation in the presence of a catalyst, what compound is formed?

ANSWER: ETHANE

**TOSS-UP**

19) BIOLOGY *Short Answer* Apoptosis is primarily under the control of what gene?

ANSWER: P 53

**BONUS**

19) BIOLOGY *Multiple Choice* Which of the following is a rare amino acid but a common constituent of collagen:

- W) tyrosine (Pron: tie-row-seen)
- X) proline
- Y) 4-hydroxyproline (Pron: 4-hydroxy-pro-leen)
- Z) 2-iodotyrosine (Pron: 2-eye-od-oh-tie-row-seen)

ANSWER: Y) 4-HYDROXYPROLINE

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**TOSS-UP**

20) MATH *Multiple Choice* Which of the following is considered an even trigonometric function:

- W) sine
- X) cosine
- Y) tangent
- Z) cosecant

ANSWER: X) COSINE

**BONUS**

20) MATH *Short Answer* Given the following sets of points, Q (0, 0) and P (6, 5), find the distance between them:

ANSWER:  $\sqrt{61}$  (ACCEPT: 7.81)

(Solution:  $r^2 = (x_1 - 0)^2 + (y_1 - 0)^2; = (6)^2 + (5)^2; = \sqrt{61}$ )

**TOSS-UP**

21) EARTH SCIENCE *Multiple Choice* Deserts lying immediately east of the Cascade and Sierra Nevada mountain ranges are examples of what type of desert:

- W) coastal
- X) continental
- Y) rainshadow
- Z) subtropical

ANSWER: Y) RAINSHADOW

**BONUS**

21) EARTH SCIENCE *Multiple Choice* The mistral, a cold, dry wind that flows under the influence of gravity down the Rhone Valley in France and out onto the Mediterranean sea, is an example of what type of wind:

- W) Chinook
- X) polar
- Y) katabatic
- Z) sea breeze

ANSWER: Y) KATABATIC

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**TOSS-UP**

22) GENERAL SCIENCE *Multiple Choice* Aflatoxin (Pron: aff-luh-toxin) is a toxin that is most likely found in which of the following:

- W) moldy nuts
- X) barbequed meats
- Y) processed meats
- Z) raw shellfish

ANSWER: W) MOLDY NUTS

**BONUS**

22) GENERAL SCIENCE *Short Answer* What is the alternate common term for the f-number in a typical camera lens?

ANSWER: APERTURE (ACCEPT: DIAMETER)

**TOSS-UP**

- 23) PHYSICS *Multiple Choice* In Planck's equation  $E = hv$ , (pronounced: E equals h new),  $h$  represents which of the following:
- W) photon energy in joules
  - X) photon speed in kilometers per second
  - Y) Planck's constant
  - Z) the quantum energy of a single electron

ANSWER: Y) PLANCK'S CONSTANT

**BONUS**

- 23) PHYSICS *Multiple Choice* Which of the following types of materials make the best high-temperature superconductors:
- W) metals
  - X) non-metals
  - Y) gasses
  - Z) transuranics

ANSWER: X) NON-METALS

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**TOSS-UP**

- 24) CHEMISTRY *Multiple Choice* Which of the following is the most accurate name for a molecule of glycerol with all three hydroxyl groups esterified to fatty acids :
- W) triacylglycerol
  - X) fatty glycerol
  - Y) esterified lipid
  - Z) triesterglyceride

ANSWER: W) TRIACYLGLYCEROL

**BONUS**

- 24) CHEMISTRY *Short Answer* What is the general term for a cold-welding process for zinc coating of steel parts, which results in a thin, uniform zinc coating of controlled thickness?

ANSWER: GALVANIZATION (ACCEPT: MECHANICAL GALVANIZATION)

### TOSS-UP

- 25) BIOLOGY *Short Answer* Ergocalciferol (Pron: er-go-kal-sif-er-ol) and cholecalciferol (Pron: kol-kal-sif-er-ol) are names for two forms of what vitamin?

ANSWER: VITAMIN D

### BONUS

- 25) BIOLOGY *Multiple Choice* Which of the following plants fixes CO<sub>2</sub> by crassulacean (Pron: krass-you-lay-see-un) acid metabolism:

- W) sedum (Pron: see-dum)
- X) water lily
- Y) parsley
- X) tomato

ANSWER: W) SEDUM