

ROUND 16A

TOSS-UP

1) General Science – *Short Answer* What energy in a nucleus is equivalent to the mass defect?

ANSWER: BINDING ENERGY

BONUS

1) General Science – *Short Answer* Identify all of the following three diseases that are considered autoimmune disorders: 1) Lupus; 2) Acquired Immune Deficiency Syndrome; 3) Multiple Sclerosis.

ANSWER: 1 AND 3

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### TOSS-UP

2) Life Science – *Multiple Choice* What organ in the human body is responsible for storing glucose in the form of glycogen?

- W) Pancreas
- X) Kidney
- Y) Liver
- Z) Spleen

ANSWER: Y) LIVER

### BONUS

2) Life Science – *Multiple Choice* A scientist performs a Gram stain on an unknown strain of bacteria and observes that the bacteria are stained purple. What does this indicate about the bacteria?

- W) Their nuclei are high in collagen
- X) Their cell walls contain large amounts of peptidoglycan
- Y) Their cell walls are surrounded by lipotoxins
- Z) They contain membrane bound organelles

ANSWER: X) THEIR CELL WALLS CONTAIN LARGE AMOUNTS OF PEPTIDOGLYCAN

### TOSS-UP

3) Math – *Multiple Choice* Three identical circular plates sit at the very edge of a small square table. The plates are all tangent to each other, have collinear centers, and exactly fit the length of the table. The circumference of each plate is  $12\pi$  inches. How many inches long is the table?

- W) 36
- X) 72
- Y)  $36\pi$
- Z)  $72\pi$

ANSWER: W) 36

### BONUS

3) Math – *Short Answer* Find the surface area of a square pyramid whose base has sides of length 4 and a slant height of 6.

ANSWER: 64



### TOSS-UP

4) Earth and Space – *Multiple Choice* What was the heaviest element produced during the big bang nucleosynthesis?

- W) Hydrogen
- X) Helium
- Y) Lithium
- Z) Beryllium

ANSWER: Y) LITHIUM

### BONUS

4) Earth and Space – *Short Answer* What is the term for the small, atmospheric particles onto which water vapor condenses to form clouds?

ANSWER: CONDENSATION NUCLEI (ACCEPT: CLOUD CONDENSATION NUCLEI, CCN)

### TOSS-UP

5) Physical Science – *Multiple Choice* Compared to cooler air, warm air can hold:

- W) More water vapor
- X) Less water vapor
- Y) The same amount of water vapor
- Z) Less water vapor, depending upon the humidity

ANSWER: W) MORE WATER VAPOR

### BONUS

5) Physical Science – *Multiple Choice* Two electrons can occupy the same orbital if what value is different?

- W) Principal quantum number
- X) Angular momentum quantum number
- Y) Magnetic quantum number
- Z) Spin quantum number

ANSWER: Z) SPIN QUANTUM NUMBER

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TOSS-UP

6) General Science – *Multiple Choice* Which of the following is typically used to sterilize laboratory glassware:

- W) Dishwasher
- X) Freeze dryer
- Y) Autoclave
- Z) Centrifuge

ANSWER: Y) AUTOCLAVE

BONUS

6) General Science – *Short Answer* What paradox, first published in 1826, suggested that in a static universe, the night sky would appear to be perpetually bright?

ANSWER: OLBERS' PARADOX

TOSS-UP

7) Physical Science – *Short Answer* How many hydrogen atoms are contained in dichlorodifluoromethane?

ANSWER: ZERO

BONUS

7) Physical Science – *Short Answer* What term is used to describe the electrons in the highest energy level of an atom?

ANSWER: VALENCE



TOSS-UP

8) Math – *Short Answer* Determine the area of an equilateral triangle with side length square root of 3.

ANSWER: (3 times the square root of 3)/4

BONUS

8) Math – *Short Answer* Sam places 2 red shirts and one green shirt in a bag. He places 3 blue pairs of shorts and one brown pair of shorts in a separate bag. He also places 3 pairs of white socks in a third bag. If he draws once from each bag, what is the probability that he will create a red, white, and blue outfit?

ANSWER: 50% (ACCEPT: 1/2)

TOSS-UP

9) Life Science – *Multiple Choice* Unlike eutherians, both monotremes and marsupials are associated with which of the following?

- W) No nipples
- X) Embryonic development outside the uterus
- Y) Egg laying
- Z) Found in Australia and Africa

ANSWER: X) EMBRYONIC DEVELOPMENT OUTSIDE THE UTERUS

BONUS

9) Life Science – *Multiple Choice* Which of the following functional groups is possessed by alcohols?

- W) Carbonyl
- X) Thiol [*thigh-ol*]
- Y) Hydroxyl [*high-drok-sil*]
- Z) Ketone

ANSWER: Y) HYDROXYL

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### TOSS-UP

10) Energy – *Multiple Choice* Raw natural gas contains approximately 5 percent of which of the following gases?

- W) Octane
- X) Propane
- Y) Butanol
- Z) Methane

ANSWER: X) PROPANE

### BONUS

10) Energy – *Short Answer* Adding hydrogen gas to compressed natural gas reduces the emission of pollutants that contain oxygen and what other element?

ANSWER: NITROGEN

### TOSS-UP

11) Earth and Space – *Multiple Choice* Reverse and normal faults are both examples of what general type of fault?

- W) Strike-slip fault
- X) Dip-slip fault
- Y) Transform fault
- Z) Conservative fault

ANSWER: X) DIP-SLIP FAULT

### BONUS

11) Earth and Space – *Multiple Choice* Over the Earth's history, ice ages have occurred approximately how often?

- W) Every 2 million years
- X) Every 20 million years
- Y) Every 200 million years
- Z) Every 2 billion years

ANSWER: Y) EVERY 200 MILLION YEARS

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TOSS-UP

12) Physical Science – *Multiple Choice* A ball is swinging in a circle on a string in the absence of gravity. When the string length is doubled at the same velocity, the force on the string will be:

- W) Doubled
- X) Quadrupled
- Y) Halved
- Z) Quartered

ANSWER: Y) HALVED

BONUS

12) Physical Science – *Short Answer* Which of Kepler's laws states that a satellite's angular momentum is conserved as it orbits?

ANSWER: SECOND

TOSS-UP

13) Earth and Space – *Short Answer* What law relates the distance between the Milky Way and another galaxy to the speed that galaxy is receding from us?

ANSWER: HUBBLE'S LAW

BONUS

13) Earth and Space – *Short Answer* What is the specific name for the theory that gravity is just a curvature of spacetime?

ANSWER: GENERAL RELATIVITY (DO NOT ACCEPT: RELATIVITY or SPECIAL RELATIVITY)



TOSS-UP

14) General Science – *Short Answer* An Atwood machine can be used to measure what fundamental force?

ANSWER: GRAVITY

BONUS

14) General Science – *Multiple Choice* What can analog signals do that digital signals cannot do?

- W) Carry only discrete values
- X) Transmit binary data
- Y) Transmit information
- Z) Have a continuum of values

ANSWER: Z) HAVE A CONTINUUM OF VALUES

TOSS-UP

15) Math – *Short Answer* What is the greatest integer less than or equal to the square root of 500?

ANSWER: 22

BONUS

15) Math – *Short Answer* Your fully charged cell phone is good for 8 hours. How many minutes remain after using 40% of the battery?

ANSWER: 288



TOSS-UP

16) Life Science – *Short Answer* Certain diseases, like hemophilia, are mostly contracted by men and inherited from their carrier mothers. On what specific chromosome do the genes for these diseases reside?

ANSWER: X CHROMOSOME

BONUS

16) Life Science – *Short Answer* Tapeworms are part of what phylum?

ANSWER: PLATYHELMINTHES

TOSS-UP

17) Energy – *Short Answer* Order the following three types of light bulbs from least efficient to most efficient: 1) LED; 2) Incandescent; 3) Compact fluorescent.

ANSWER: 2, 3, 1

BONUS

17) Energy – *Short Answer* Identify all of the following three statements that are true about propane and its usage for energy: 1) it is a comparatively clean burning fossil fuel; 2) it is supplied to local propane dealers at distribution terminals; 3) it is used to heat asphalt for highway construction and repairs.

ANSWER: 1 AND 3

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### TOSS-UP

18) Life Science – *Short Answer* Aside from neurons, what other general type of cells are found in the nervous system?

ANSWER: GLIAL CELLS (ACCEPT: NEUROGLIA, GLIA)

### BONUS

18) Life Science – *Multiple Choice* Which of the following would be least likely to diffuse through the plasma membrane of a cell?

- W) Estradiol
- X) Cholesterol
- Y) Water
- Z) Fibrinogen

ANSWER: Z) FIBRINOGEN

### TOSS-UP

19) Earth and Space – *Multiple Choice* What quantity is a measure of the amount of light that a star emits that reaches the Earth?

- W) Absolute magnitude
- X) Luminosity
- Y) Temperature
- Z) Apparent magnitude

ANSWER: Z) APPARENT MAGNITUDE

### BONUS

19) Earth and Space – *Short Answer* The Very Large Array is a set of telescopes designed to capture what type of radiation?

ANSWER: RADIO WAVES



### TOSS-UP

20) Math – *Short Answer* In terms of real numbers  $p$  and  $q$ , for what value of  $x$  is the function  $-x^2 + px + q$  maximized?

ANSWER:  $p/2$

### BONUS

20) Math – *Short Answer* Mary went shopping in two stores with her birthday gift money. In the first store, she spent three-fourths of what she had plus \$3. In the second store, she spent two-thirds of what was left plus \$2. She then had \$5 left. How many dollars did she begin with?

ANSWER: 96

### TOSS-UP

21) Energy – *Multiple Choice* Which of the following fuels has an octane rating of greater than 100?

- W) n-heptane
- X) Isopentane
- Y) Hexane
- Z) Propane

ANSWER: Z) PROPANE

### BONUS

21) Energy – *Short Answer* What rating, similar to octane ratings for gasoline, is used to indicate the combustion speed of diesel fuel?

ANSWER: CETANE NUMBER

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TOSS-UP

22) Physical Science – *Short Answer* What quantum number determines the shape of an electron's orbital?

ANSWER: AZIMUTHAL (ACCEPT: ANGULAR MOMENTUM; L)

BONUS

22) Physical Science – *Short Answer* For the decomposition of gaseous N_2O_4 to form two gaseous NO_2 molecules, identify all of the following three changes that would shift the equilibrium to the products: 1) Addition of helium gas; 2) Removal of NO_2 ; 3) Isothermal compression of the container.

ANSWER: 2

TOSS-UP

23) General Science – *Short Answer* What products are formed from the reaction of sodium hydroxide and hydrochloric acid?

ANSWER: WATER AND SALT (ACCEPT: H₂O AND NaCl)

BONUS

23) General Science – *Short Answer* What series of techniques is used for separating mixtures of gases, liquids, or dissolved substances and has variations such as thin layer, column, and liquid?

ANSWER: CHROMATOGRAPHY