

## ROUND 15A

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### TOSS-UP

1) Physical Science – *Short Answer* At a material's melting point, what intrinsic quantity does NOT change as more heat energy is added to the system?

ANSWER: TEMPERATURE

### BONUS

1) Physical Science – *Short Answer* If a photon has a wavelength of 300 nanometers, then, in scientific notation with one significant figure, what is its frequency in hertz?

ANSWER:  $1 \times 10^{15}$

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### TOSS-UP

2) Energy – *Multiple Choice* What element is currently the most promising nuclear fuel alternative to uranium due to its greater abundance and better resistance to proliferation?

- W) Thorium
- X) Protactinium [*proh-tak-TIN-ee-um*]
- Y) Neptunium
- Z) Plutonium

ANSWER: W) THORIUM

### BONUS

2) Energy – *Short Answer* Identify all of the following three lightbulbs that have a filament that must be heated to create visible light: 1) Incandescent; 2) Compact fluorescent; 3) Halogen.

ANSWER: 1, 3 (ALSO ACCEPT: INCANDESCENT AND HALOGEN)

**TOSS-UP**

3) Life Science – *Short Answer* What is the process that occurs when changes in allele frequencies are caused by random chance?

ANSWER: GENETIC DRIFT

**BONUS**

3) Life Science – *Multiple Choice* Which of the following classifications would be inclusive of eucalyptus, cattails, duckweed and buttercups?

- W) Angiosperms
- X) Dicots
- Y) Monocots
- Z) Chlorophyta [*klor-oh-FYE-tah*]

ANSWER: W) ANGIOSPERMS

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**TOSS-UP**

4) General Science – *Multiple Choice* What scientist was most responsible for the widespread adoption of antiseptics during surgical procedures?

- W) Edward Jenner
- X) Louis Pasteur
- Y) Joseph Lister
- Z) Alexander Fleming

ANSWER: Y) JOSEPH LISTER

**BONUS**

4) General Science – *Multiple Choice* To minimize exposure to histoplasmosis, soil samples should be which of the following?

- W) Collected from confirmed archeological sites
- X) Handled only in a fume hood
- Y) Inoculated prior to handling
- Z) Free of chicken, pigeon, or bat droppings

ANSWER: Z) FREE OF CHICKEN, PIGEON, OR BAT DROPPINGS

**TOSS-UP**

5) Math – *Multiple Choice* When a right triangular region is rotated about one of its legs, what solid is formed?

- W) Right circular cone
- X) Right circular cylinder
- Y) Right triangular pyramid
- Z) Right triangular prism

ANSWER: W) RIGHT CIRCULAR CONE

**BONUS**

5) Math – *Short Answer* What is the area of the triangular region formed by the lines with equations  $x = 2$ ,  $y = -1$ , and  $y = 2x + 1$ ?

ANSWER: 9

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**TOSS-UP**

6) Earth and Space – *Multiple Choice* Which of the following processes happens at the slowest rate?

- W) Rise and fall of tides
- X) Uplift of mountains
- Y) Recycling of seawater
- Z) Regrowth of burnt vegetation

ANSWER: X) UPLIFT OF MOUNTAINS

**BONUS**

6) Earth and Space – *Short Answer* Half Dome in Yosemite National Park is a portion of what type of massive granitic intrusive igneous structure?

ANSWER: BATHOLITH

**TOSS-UP**

7) Earth and Space – *Multiple Choice* What type of coal has the highest carbon content?

- W) Lignite
- X) Bituminous [*bih-TOOM-in-us*]
- Y) Anthracite
- Z) Peat

ANSWER: Z) PEAT

**BONUS**

7) Earth and Space – *Multiple Choice* Through which of the following parts of Earth's interior would an S-wave NOT travel?

- W) Lithosphere
- X) Asthenosphere
- Y) Lower mantle
- Z) Outer core

ANSWER: Z) OUTER CORE

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**TOSS-UP**

8) Physical Science – *Multiple Choice* Which of the following four processes is endothermic?

- W) Combustion of wood
- X) Explosion of TNT
- Y) Condensation of water
- Z) Melting of ice cubes

ANSWER: Z) MELTING OF ICE CUBES

**BONUS**

8) Physical Science – *Short Answer* You double the length of a simple pendulum. By what factor does this multiply the period of the pendulum swing?

ANSWER: SQUARE ROOT OF TWO

**TOSS-UP**

9) General Science – *Multiple Choice* When the slope of a line representing velocity over time is zero, acceleration is:

- W) Negative
- X) Positive
- Y) Infinite
- Z) Zero

ANSWER: Z) ZERO

**BONUS**

9) General Science – *Short Answer* What is the name associated with the large explosion that occurred in Siberia in 1908, flattening 2000 square kilometers of forest?

ANSWER: TUNGUSKA EVENT (ACCEPT: TUNGUSKA)

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**TOSS-UP**

10) Math – *Short Answer* Convert two-six in base 8 to base 10.

ANSWER: 22

**BONUS**

10) Math – *Short Answer* If a right triangular prism has all edges equal to 2, then, to the nearest integer, what is its total surface area?

ANSWER: 15

**TOSS-UP**

11) Life Science – *Multiple Choice* In mammals, in which of the following is the cochlea located?

- W) Trachea
- X) Spleen
- Y) Ear
- Z) Eye

ANSWER: Y) EAR

**BONUS**

11) Life Science – *Multiple Choice* Which of the following blood vessels carries oxygenated blood?

- W) Pulmonary vein
- X) Pulmonary trunk
- Y) Pulmonary artery
- Z) Superior vena cava

ANSWER: W) PULMONARY VEIN

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**TOSS-UP**

12) Energy – *Multiple Choice* Which of the following sources accounts for the largest fraction of consumed renewable energy in the US?

- W) Natural gas
- X) Biomass
- Y) Wind
- Z) Solar

ANSWER: X) BIOMASS

**BONUS**

12) Energy – *Short Answer* Solar water heaters were popular in Florida and California from the 1920s until the mid-1950s. What low-cost fuel displaced solar to heat water in the 1950s?

ANSWER: NATURAL GAS

**TOSS-UP**

13) Earth and Space – *Multiple Choice* The circumstellar habitable zone, or “Goldilocks Zone”, refers to the range of distances from a star within which what substance can exist on an orbiting planet’s surface?

- W) Oxygen gas
- X) Liquid water
- Y) Liquid methane
- Z) Water ice

ANSWER: X) LIQUID WATER

**BONUS**

13) Earth and Space – *Multiple Choice* Which of the following is closest to the distance, in megaparsecs, from Earth to a galaxy that has an apparent radial velocity of 910 kilometers per second?

- W) 7
- X) 10
- Y) 13
- Z) 16

ANSWER: Y) 13



**TOSS-UP**

14) Math – *Short Answer* What is the least common multiple of the three quantities  $6x$ ,  $15x^3$ , and  $18x^3$ ?

ANSWER:  $90x^3$

**BONUS**

14) Math – *Short Answer* A flower bed is formed in the shape of a 135-degree sector of a circle of radius 8 feet. To the nearest foot, what is the perimeter of the flower bed?

ANSWER: 35

### TOSS-UP

15) Life Science – *Multiple Choice* Pyrimidines are important components in nucleic acids, vitamins, drugs, and many other compounds. Which of the following nucleotide bases is NOT a pyrimidine?

- W) Adenine
- X) Cytosine
- Y) Thymine
- Z) Uracil

ANSWER: W) ADENINE

### BONUS

15) Life Science – *Multiple Choice* What is the name of the respiratory disease that is categorized by the inflammation of the mucus membrane?

- W) Asthma
- X) Bronchitis
- Y) Chronic obstructive pulmonary disease
- Z) Emphysema

ANSWER: X) BRONCHITIS

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### TOSS-UP

16) Physical Science – *Multiple Choice* Which of the following is NOT a property of a base?

- W) Reacts with carbonates to form carbon dioxide
- X) Has a bitter taste
- Y) Turns litmus paper blue
- Z) Feels slippery

ANSWER: W) REACTS WITH CARBONATES TO FORM CARBON DIOXIDE

### BONUS

16) Physical Science – *Short Answer* A particle has a position defined by the equation  $x = 6t^2 + 3t + 18$ . What is the average velocity of the particle between  $t = 2$  and  $t = 5$ ?

ANSWER: 45



**TOSS-UP**

17) General Science – *Multiple Choice* Which of the following are characteristics of a strong hypothesis?

- W) Simple and generic
- X) Complex and specific
- Y) Falsifiable and testable
- Z) Specific and provable

ANSWER: Y) FALSIFIABLE AND TESTABLE

**BONUS**

17) General Science – *Short Answer* Arrange the following four classifications of humans in order from least to most specific: 1) Hominidae; 2) Sapiens; 3) Chordata; 4) Primate.

ANSWER: 3, 4, 1, 2 (ALSO ACCEPT: CHORDATA, PRIMATE, HOMINIDAE, SAPIENS)

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**TOSS-UP**

18) Energy – *Multiple Choice* Which of the following is introduced at the cathode of a hydrogen fuel cell?

- W) Hydrogen
- X) Oxygen
- Y) Water
- Z) Protons

ANSWER: X) OXYGEN

**BONUS**

18) Energy – *Multiple Choice* When at half of its flow capacity, the typical percent efficiency range of a modern wheel micro-hydropower system is which of the following?

- W) 10 - 30
- X) 30 - 50
- Y) 50 - 70
- Z) 70 - 90

ANSWER: Y) 50 - 70

**TOSS-UP**

19) Math – *Short Answer* What is 87 times 73?

ANSWER: 6351

**BONUS**

19) Math – *Short Answer* Using the origin as center, the point with coordinates (1, 2) is dilated by a factor of 2, and then the result is rotated by 90 degrees counterclockwise. What are the coordinates of the final image point?

ANSWER: (-4, 2)

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**TOSS-UP**

20) Life Science – *Multiple Choice* What is the endocrine gland that controls how the body regulates metabolism and is associated with Graves' disease?

- W) Pineal gland
- X) Adrenal gland
- Y) Thyroid gland
- Z) Pituitary gland

ANSWER: Y) THYROID GLAND

**BONUS**

20) Life Science – *Multiple Choice* In plants, what cells secrete the waxy cuticle that protects plants from water loss?

- W) Epidermal cells
- X) Guard cells
- Y) Xylem cells
- Z) Phloem cells

ANSWER: W) EPIDERMAL CELLS

**TOSS-UP**

21) Physical Science – *Short Answer* What category of simple machine is responsible for both opening and joining the teeth in a zipper?

ANSWER: WEDGE

**BONUS**

21) Physical Science – *Short Answer* What is the term for the broad group of metabolic reactions that break down large molecules into smaller ones and release energy?

ANSWER: Catabolism



**TOSS-UP**

22) Earth and Space – *Short Answer* What anion is the most common form of dissolved inorganic carbon in the Earth's oceans?

ANSWER: BICARBONATE

**BONUS**

22) Earth and Space – *Short Answer* What theoretical limit, approximately 1.4 solar masses, constrains the maximum mass that a white dwarf can attain?

ANSWER: CHANDRASEKHAR LIMIT

### TOSS-UP

23) Physical Science – *Short Answer* If an isotope with a mass number of 208 decays by one alpha particle, what is the mass number of the resulting atom?

ANSWER: 204

### BONUS

23) Physical Science – *Short Answer* A circuit has 4 resistors of 3, 4, 5, and 6 ohms, respectively. The 6 ohm and 3 ohm resistors are in parallel and that combination is in series with the 4 ohm and 5 ohm resistors. If a 7-amp current is passed through the circuit, then, in volts, what is the potential difference across the circuit?

ANSWER: 77