

ROUND 6A

TOSS-UP

1) Earth and Space – *Multiple Choice* Which of the following elements most often limits primary production in freshwater lakes?

- W) Oxygen
- X) Calcium
- Y) Carbon
- Z) Phosphorus

ANSWER: Z) PHOSPHORUS

BONUS

1) Earth and Space – *Short Answer* Identify all of the following three statements that are true of woolly mammoths: 1) They once lived in North America; 2) They had ivory tusks; 3) They evolved in the Devonian Period.

ANSWER: 1 AND 2

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### TOSS-UP

2) Biology – *Multiple Choice* One species resembles another species that is poisonous. What is this phenomenon called?

- W) Commensalism [*kah-MEN-sul-ism*]
- X) Mutualism
- Y) Batesian mimicry [*BAIT-see-in MIM-ih-kree*]
- Z) Mullerian mimicry [*muhl-AIR-ee-an MIM-ih-kree*]

ANSWER: Y) BATESIAN MIMICRY

### BONUS

2) Biology – *Multiple Choice* What human organ utilizes the most glucose in the body?

- W) Liver
- X) Heart
- Y) Lungs
- Z) Brain

ANSWER: Z) BRAIN

**TOSS-UP**

3) Physics – *Short Answer* To three significant figures, at what temperature, in kelvins, does pure water boil at sea level?

ANSWER: 373

**BONUS**

3) Physics – *Short Answer* In a several step production process, the efficiency of Stage 1 is 45 percent, the efficiency of Stage 2 is 85 percent, and the efficiency of Stage 3 is 15 percent. To the nearest whole number percent, what is the overall efficiency of process?

ANSWER: 6



**TOSS-UP**

4) Math – *Short Answer* What is the degree measure of each interior angle in a regular hexagon?

ANSWER: 120

**BONUS**

4) Math – *Multiple Choice* Which of the following is true regarding the graph of  $y = -x^3$  at  $x = -2$ ?

- W) increasing and concave up
- X) increasing and concave down
- Y) decreasing and concave up
- Z) decreasing and concave down

ANSWER: Y) DECREASING AND CONCAVE UP

**TOSS-UP**

5) Chemistry – *Multiple Choice* What is the maximum number of electrons that the 3d level can hold?

- W) 2
- X) 6
- Y) 10
- Z) 14

ANSWER: Y) 10

**BONUS**

5) Chemistry – *Multiple Choice* Under aqueous conditions, which of the following reactions would generate a precipitate?

- W) Ammonium chloride mixed with potassium hydroxide
- X) Calcium chloride mixed with potassium nitrate
- Y) Calcium carbonate mixed with hydrochloric acid
- Z) Barium chloride mixed with potassium sulfate

ANSWER: Z) BARIUM CHLORIDE MIXED WITH POTASSIUM SULFATE

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TOSS-UP

6) Energy – *Short Answer* What refinery process is used to separate components of petroleum based on their boiling points?

ANSWER: DISTILLATION (ACCEPT: FRACTIONAL DISTILLATION)

BONUS

6) Energy – *Short Answer* Landfill gas, a potential source of energy, is mostly composed of what specific hydrocarbon?

ANSWER: METHANE

TOSS-UP

7) Chemistry – *Short Answer* The +3 oxide of what element is added to molten silicate to generate a glass with a low thermal expansion coefficient that is used for lab glassware?

ANSWER: BORON

BONUS

7) Chemistry – *Short Answer* Rank the following three gaseous phase monatomic elements in ascending order of electron affinity: 1) Boron; 2) Silicon; 3) Chlorine.

ANSWER: 1, 2, 3



TOSS-UP

8) Physics – *Short Answer* Measured in newtons, what is the magnitude of the centripetal force on a 10-kilogram object traveling along a circular path with a radius of 50 meters at a velocity of 20 meters per second?

ANSWER: 80

BONUS

8) Physics – *Short Answer* A large block of ice is placed in a water bath maintained at 80 degrees Celsius. After some time, one half of the mass of the ice block has melted. What is the temperature, in degrees Celsius, of the surface of the remaining ice?

ANSWER: 0

TOSS-UP

9) Biology – *Multiple Choice* Plant cells are distinguished from animal cells by having:

- W) A large central vacuole, chloroplasts, and a cell wall made of cellulose
- X) A large central vacuole, mitochondria, and a nucleus
- Y) A cell wall made of cellulose, Golgi apparatus, and chloroplasts
- Z) Chloroplasts, mitochondria, and a nucleus

ANSWER: W) A LARGE CENTRAL VACUOLE, CHLOROPLASTS, AND A CELL WALL MADE OF CELLULOSE

BONUS

9) Biology – *Multiple Choice* Which of the following plant hormones plays the largest role in the germination of a seed?

- W) Cytokinin [*sye-toh-KYE-nin*]
- X) Zeatin [*ZEE-ah-tin*]
- Y) Gibberellins [*jib-er-ELL-ins*]
- Z) Ethylene

ANSWER: Y) GIBBERELLINS

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**TOSS-UP**

10) Math – *Multiple Choice* Which of the following equations is that of a line perpendicular to the line with equation  $4x - 5y = 10$ ?

- W)  $4x - 5y = 12$
- X)  $4x + 5y = 12$
- Y)  $5x - 4y = 10$
- Z)  $5x + 4y = 10$

ANSWER: Z)  $5x + 4y = 10$

**BONUS**

10) Math – *Short Answer* Identify all of the following four properties that are preserved under a translation: 1) Distance; 2) Collinearity; 3) Midpoint; 4) Angle measure.

ANSWER: 1, 2, 3, 4 (ACCEPT: ALL)

**TOSS-UP**

11) Earth and Space – *Short Answer* When subjected to intense heat and pressure, limestone becomes which non-foliated metamorphic rock?

ANSWER: MARBLE

**BONUS**

11) Earth and Space – *Multiple Choice* Addition of which of the following compounds may promote carbon sequestration in the ocean?

- W) Potassium hydroxide
- X) Carbonic acid
- Y) Hydrochloric acid
- Z) Sulfur

ANSWER: W) POTASSIUM HYDROXIDE

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TOSS-UP

12) Energy – *Multiple Choice* Which of the following percentages is closest to the percent of U.S. electricity generated from fossil fuels in 2014?

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

ANSWER: Y) 70

BONUS

12) Energy – *Multiple Choice* Which of the following is NOT a type of nuclear reactor currently used in the United States?

- W) Boiling water
- X) Solid sodium
- Y) Pressurized water
- Z) Liquid metal breeder

ANSWER: X) SOLID SODIUM

TOSS-UP

13) Biology – *Short Answer* Liverworts are a part of which nonvascular plant phylum?

ANSWER: MARCHANTIOPHYTA (ACCEPT: HEPATOPHYTA or HEPATICOPHYTA)

BONUS

13) Biology – *Short Answer* Tetanus is a disease caused by what genus of endospore-forming bacteria?

ANSWER: CLOSTRIDIUM



TOSS-UP

14) Math – *Short Answer* What is the degree of the polynomial $x^2 + 3x^8 + 7x$?

ANSWER: 8

BONUS

14) Math – *Short Answer* Maggie bakes 48 cookies and sells half of them that morning for \$2.50 each. In the afternoon, she sells two-thirds of what she has left at half price. In the late afternoon, she sells the remaining cookies at a dollar each. If each cookie costs 75 cents for her to make, what was her profit, in dollars, for the day?

ANSWER: 52

TOSS-UP

15) Earth and Space – *Short Answer* The Montreal Protocols were a series of international agreements to phase out what harmful pollutants that destroy stratospheric ozone?

ANSWER: CHLOROFLUOROCARBONS (ACCEPT: CFC's; DO NOT ACCEPT: HALOCARBONS)

BONUS

15) Earth and Space – *Multiple Choice* Which of the following is NOT true of tropical forest soils in relation to temperate forest soils?

- W) Tropical forest soils are richer in nutrients
- X) Tropical forest soils experience more intense leaching
- Y) Temperate forest soils retain more organic matter
- Z) Temperate forest soils are thicker

ANSWER: W) TROPICAL FOREST SOILS ARE RICHER IN NUTRIENTS

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### TOSS-UP

16) Chemistry – *Multiple Choice* Under which of the following conditions does the behavior of real gases deviate most from that predicted by the Ideal Gas Law?

- W) Low pressure, low temperature
- X) High pressure, low temperature
- Y) Low pressure, high temperature
- Z) High pressure, high temperature

ANSWER: X) HIGH PRESSURE, LOW TEMPERATURE

### BONUS

16) Chemistry – *Multiple Choice* Which of the following best explains why NaCl has a higher melting point than HCl?

- W) HCl can form hydrogen bonds, while NaCl cannot
- X) HCl has stronger London dispersion forces
- Y) HCl is a molecular compound, while NaCl is an ionic compound
- Z) HCl is a network compound, while NaCl is a molecular compound

ANSWER: Y) HCl IS A MOLECULAR COMPOUND, WHILE NaCl IS AN IONIC COMPOUND

**TOSS-UP**

17) Physics – *Short Answer* A block rests upon an incline of an unknown angle. If the coefficient of static friction between the block and the incline is one-third times the square root of 3, and the block is just barely held by friction, what is the angle of the incline to the horizontal, to the nearest degree?

ANSWER: 30

**BONUS**

17) Physics – *Multiple Choice* An elevator is moving downward with decreasing speed. What are the directions of its velocity and acceleration?

- W) Both are upward
- X) Both are downward
- Y) Velocity is upward and acceleration is downward
- Z) Velocity is downward and acceleration is upward

ANSWER: Z) VELOCITY IS DOWNWARD AND ACCELERATION IS UPWARD



**TOSS-UP**

18) Energy – *Multiple Choice* Demand Side Management, as part of smart grids, is a combination of programs that allows which of the following?

- W) Customers to change their energy consumption patterns based on a varying rate of the cost of electricity
- X) Generators to change their production patterns based on a varying rate of the cost of electricity
- Y) Utilities to refund money to customers
- Z) Meter readers to be replaced by automated smart electricity meters

ANSWER: W) CUSTOMERS TO CHANGE THEIR ENERGY CONSUMPTION PATTERNS BASED ON A VARYING RATE OF THE COST OF ELECTRICITY

**BONUS**

18) Energy – *Multiple Choice* If a power station is referred to as an underground power station, what kind of energy does it generate?

- W) Hydroelectric
- X) Geothermal
- Y) Nuclear
- Z) Biomass

ANSWER: W) HYDROELECTRIC

### TOSS-UP

19) Earth and Space – *Short Answer* In what constellation is our Galactic center located?

ANSWER: SAGITTARIUS

### BONUS

19) Earth and Space – *Multiple Choice* Which of the following best describes the composition of Earth's core?

- W) 78% silicon oxide
- X) Mainly iron silicates
- Y) An iron-nickel alloy
- Z) Mainly iron and potassium compounds

ANSWER: Y) AN IRON-NICKEL ALLOY

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### TOSS-UP

20) Biology – *Multiple Choice* If the only method of introducing genetic variation into a sample population of *E. coli* is by spontaneous mutation, which of the following is the best way to increase the prevalence of beneficial mutations over many generations?

- W) Conjugation
- X) Binary fission
- Y) Transduction
- Z) Horizontal gene transfer

ANSWER: X) BINARY FISSION

### BONUS

20) Biology – *Short Answer* What is the name for skeletal muscle cells containing multiple nuclei?

ANSWER: SYNCYTIUM (ACCEPT: SYMPLASM)

**TOSS-UP**

21) Physics – *Short Answer* What is the name given to light produced when a charged particle passes through a material at a speed faster than the phase velocity of light in that material?

ANSWER: CHERENKOV RADIATION (ACCEPT: VALIVOV-CHERENKOV RADIATION)

**BONUS**

21) Physics – *Multiple Choice* Ignoring temperature changes, how much of a pressure increase, in pascals, does a diver feel at 100 meters below the surface of a fresh-water lake?

- W) 9,800
- X) 98,000
- Y) 980,000
- Z) 9,800,000

ANSWER: Y) 980,000

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TOSS-UP

22) Chemistry – *Multiple Choice* Which type of hybridization is found in the central atom of carbon dioxide?

- W) sp [*s-p*]
- X) sp² [*s-p-2*]
- Y) sp³ [*s-p-3*]
- Z) sp⁴ [*s-p-4*]

ANSWER: W) SP

BONUS

22) Chemistry – *Short Answer* What type of fluid undergoes large changes in density in response to small changes in pressure and temperature, and can be formed by heating carbon dioxide above 31 degrees Celsius at pressures above 72.8 atmospheres?

ANSWER: SUPERCRITICAL FLUID

TOSS-UP

23) Math – *Short Answer* The complex number -4 lies on the boundary between what two quadrants in the complex plane?

ANSWER: 2 AND 3 (ACCEPT: SECOND AND THIRD)

BONUS

23) Math – *Short Answer* Solve the following equation for x : negative 8 plus the absolute value of open parenthesis 4 minus $3x$ close parenthesis equals 20.

ANSWER: $-8, 32/3$ (ACCEPT: $10 \frac{2}{3}$ for $32/3$)