

ROUND 6A

TOSS-UP

1) Earth and Space – *Multiple Choice* Which of the following processes help to form new mountains?

- W) Lithification
- X) Volcanic eruptions
- Y) Earthquakes
- Z) Denudation

ANSWER: X) VOLCANIC ERUPTIONS

BONUS

1) Earth and Space – *Short Answer* The red or pink color commonly seen in quartzite is due to oxides of what element?

ANSWER: IRON

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### TOSS-UP

2) Biology – *Multiple Choice* Which of the following does not play a role in protein digestion?

- W) Trypsin
- X) Pepsin
- Y) Carboxypeptidase [*car-box-ee-pep-tih-days*]
- Z) Dextrinase [*dex-trih-nays*]

ANSWER: Z) DEXTRINASE

### BONUS

2) Biology – *Short Answer* What botany term is used to describe horizontal shoots that grow just below the surface?

ANSWER: RHIZOMES

### TOSS-UP

3) Math – *Short Answer* If a 52 foot-long wire is bent to form a square, what is the length of the square's diagonal?

Answer: 13 times the square root of 2

### BONUS

3) Math – *Short Answer* Robert is asked by his teacher to subtract 3 from a number and divide the result by 9. Instead, he subtracts 9 and then divides the result by 3, giving him 43. What is the correct answer to the teacher's question?

ANSWER: 15



### TOSS-UP

4) Energy – *Short Answer* If an electron is excited to the  $n = 4$  energy level in hydrogen, what is the maximum number of emission lines you would observe?

ANSWER: 6

### BONUS

4) Energy – *Short Answer* Most photosynthetically active radiation occurs in what 2 zones of the electromagnetic spectrum?

ANSWER: VISIBLE AND INFRARED

### TOSS-UP

5) Chemistry – *Short Answer* What is the electronic geometry of a molecule with  $sp^3$  hybridization at its central atom?

ANSWER: TETRAHEDRAL (ACCEPT: TETRAHEDRAL GEOMETRY)

### BONUS

5) Chemistry – *Short Answer* What chemical law predicts the response of a system at equilibrium to a perturbation in temperature, concentration, volume, or pressure by stating that the equilibrium shifts to counteract the change?

ANSWER: LE CHATELIER'S PRINCIPLE

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TOSS-UP

6) Physics – *Multiple Choice* After combing your hair, the comb becomes electrically charged. You then use the comb to pick up electrically neutral bits of paper, without making contact between the comb and the paper. What process allowed you to pick up the paper bits?

- W) Conduction
- X) Insulation
- Y) Magnetization
- Z) Polarization

ANSWER: Z) POLARIZATION

BONUS

6) Physics – *Short Answer* What classic experiment used a squeeze-bulb atomizer to spray a mist of charged oil droplets between parallel plate electrodes?

ANSWER: MILLIKAN OIL-DROP EXPERIMENT (ACCEPT: OIL DROP EXPERIMENT)

TOSS-UP

7) Earth and Space – *Multiple Choice* An outflow of charged particles from the sun that escapes the sun's outer atmosphere is called:

- W) Solar discharge
- X) Solar flare
- Y) Solar wind
- Z) Solar gust

ANSWER: Y) SOLAR WIND

BONUS

7) Earth and Space – *Multiple Choice* When the air is saturated with moisture, which of the following statements is false?

- W) Relative humidity is equal to 100%
- X) Air temperature is equal to the dew point temperature
- Y) Air temperature is equal to the wet bulb temperature
- Z) An increase in temperature will produce condensation

ANSWER: Z) AN INCREASE IN TEMPERATURE WILL PRODUCE CONDENSATION



TOSS-UP

8) Biology – *Multiple Choice* Which of the following phases is typically the longest in a normal cell's life cycle?

- W) Interphase
- X) Metaphase
- Y) Prophase
- Z) Anaphase

ANSWER: W) INTERPHASE

BONUS

8) Biology – *Short Answer* What color does the normal human eye see when all cone opsins are stimulated equally?

ANSWER: WHITE

TOSS-UP

9) Energy – *Short Answer* Lithium-ion batteries are finding use in replacing what type of battery, often found in automobiles?

ANSWER: LEAD-ACID BATTERY

BONUS

9) Energy – *Short Answer* What form of renewable energy is responsible for producing the most electricity worldwide?

ANSWER: HYDROELECTRICITY



TOSS-UP

10) Math – *Short Answer* Find the modulus of the complex conjugate of $3 - 4i$.

ANSWER: 5

BONUS

10) Math – *Multiple Choice* If you flip a coin five times, what is the probability that you will get at least two heads?

- W) $31/32$
- X) $13/16$
- Y) $25/32$
- Z) $9/16$

ANSWER: X) $13/16$

TOSS-UP

11) Chemistry – *Short Answer* Identify all of the following three quantities that are considered state functions: 1) Enthalpy; 2) Heat; 3) Volume.

ANSWER: 1 AND 3

BONUS

11) Chemistry – *Multiple Choice* Which of the following solutions, when mixed one-to-one, will exhibit the smallest deviation from Raoult's [*rah-oolt's*] law?

- W) Pentane and water
- X) Pentane and hexane
- Y) Chloroform and acetone
- Z) Water and ethanol

ANSWER: X) PENTANE AND HEXANE

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### TOSS-UP

12) Physics – *Multiple Choice* The electromotive force is defined as:

- W) The maximum electric potential energy stored within a battery
- X) The maximum potential difference between the terminals of a battery
- Y) The force that accelerates electrons through a wire when a battery is connected to it
- Z) The maximum capacitance between the terminals of a battery

ANSWER: X) THE MAXIMUM POTENTIAL DIFFERENCE BETWEEN THE TERMINALS OF A BATTERY

### BONUS

12) Physics – *Short Answer* On a large violin with strings that have a length of 0.5 meters between fixed points, a string has a linear mass density of 40 grams per meter and a fundamental frequency of 20 hertz. Calculate the frequency, in hertz, and wavelength, in centimeters rounded to the nearest integer, of the second overtone.

ANSWER: 60 (FREQUENCY), 33 (WAVELENGTH)

### TOSS-UP

13) Earth and Space – *Multiple Choice* In a soil profile, the oxidation of primary iron-bearing minerals results in which of the following?

- W) The soil becoming coarser grained
- X) The soil profile becoming redder
- Y) The soil profile becoming shallower
- Z) Does not change the soil profile

Answer: X) THE SOIL PROFILE BECOMING REDDER

### BONUS

13) Earth and Space – *Multiple Choice* What determines when a tropical depression or storm is given hurricane status?

- W) Wind speed
- X) Central pressure
- Y) Diameter
- Z) Movement velocity

ANSWER: W) WIND SPEED



### TOSS-UP

14) Math – *Short Answer* If  $\frac{1}{x} - \frac{1}{y} = \frac{1}{z}$ , what does  $z$  equal in terms of  $x$  and  $y$ ?

ANSWER:  $(xy)/(y - x)$  (ACCEPT:  $(-yx)/(x - y)$ )

### BONUS

14) Math – *Short Answer* Identify all of the following three numbers that are evenly divisible by eight:  
1) 1,256,424; 2) 1,216; 3) 662,322.

ANSWER: 1, 2

### TOSS-UP

15) Chemistry – *Multiple Choice* Which of the following quantum numbers describes the shape of the orbital?

- W) Principal
- X) Azimuthal
- Y) Magnetic
- Z) Spin

ANSWER: X) AZIMUTHAL

### BONUS

15) Chemistry – *Multiple Choice* Which of the following is correct regarding a process that follows first-order kinetics?

- W) Reactant concentrations are constant with time
- X) Reactant concentrations decrease linearly with time
- Y) Reactant concentrations decrease quadratically with time
- Z) Reactant concentrations decrease exponentially with time

ANSWER: Z) REACTANT CONCENTRATIONS DECREASE EXPONENTIALLY WITH TIME

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TOSS-UP

16) Biology – *Multiple Choice* What human body cells contain H bands, Z disks and I bands?

- W) Neurons
- X) Adipocytes [*uh-dip-oh-sights*]
- Y) Skeletal muscle
- Z) Osteocytes [*os-tee-oh-sights*]

ANSWER: Y) SKELETAL MUSCLE

BONUS

16) Biology – *Short Answer* In 1961, it was demonstrated that fibroblast cells can only divide about 50 times in culture, at which point the cell cycle halts before DNA replication. The reason for this limit on cell division, also called the Hayflick limit, is due to the loss of what chromosomal caps?

ANSWER: TELOMERES

TOSS-UP

17) Energy – *Short Answer* Identify all of the following three values that can never be negative: 1) Entropy; 2) Change in entropy; 3) Bond enthalpy for breaking a bond.

ANSWER: 1, 3

BONUS

17) Energy – *Short Answer* In a photovoltaic cell, what is generally the positive charge carrier?

ANSWER: HOLE



TOSS-UP

18) PHYSICS – *Multiple Choice* Which of the following components of a car provides the best example of a damped oscillator?

- W) Brakes
- X) Shock absorbers
- Y) Rack-and-pinion steering column
- Z) Differential

ANSWER: X) SHOCK ABSORBERS

BONUS

18) Physics – *Short Answer* What is the change in potential energy, to the nearest one hundred joules, associated with a 100 kilogram rollercoaster descending 20.0 meters?

ANSWER: 19600

TOSS-UP

19) Earth and Space – *Multiple Choice* Which of the following air masses is the densest?

- W) Continental tropical
- X) Continental polar
- Y) Maritime tropical
- Z) Maritime polar

ANSWER: X) CONTINENTAL POLAR

BONUS

19) Earth and Space – *Multiple Choice* When is a strong temperature inversion most likely to form?

- W) On a warm, windy night
- X) On a cool, windy night
- Y) On a rainy night with light winds
- Z) On a clear night with light winds

ANSWER: Z) ON A CLEAR NIGHT WITH LIGHT WINDS



TOSS-UP

20) Biology – *Multiple Choice* Which of the following hormones is derived from cholesterol?

- W) Substance P
- X) Indoleacetic acid
- Y) Testosterone
- Z) Prolactin

ANSWER: Y) TESTOSTERONE

BONUS

20) Biology – *Short Answer* Cadherins [*kuh-deer-ins*] are components of what type of cell junction?

ANSWER: ADHERENS JUNCTIONS

TOSS-UP

21) Math – *Short Answer* A basketball player makes 6 baskets during a game, each worth 2 or 3 points. How many different possible values exist for the total points scored by the player?

ANSWER: 7

BONUS

21) Math – *Short Answer* How many positive integral factors exist for 1800?

ANSWER: 36



TOSS-UP

22) Chemistry – *Short Answer* Identify all of the following three compounds that would form a solid state composed of molecules interacting through hydrogen bonds: 1) Water; 2) Acetone; 3) Silicon dioxide.

ANSWER: 1

BONUS

22) Chemistry – *Short Answer* Identify all of the following three statements concerning beryllium that are true: 1) Beryllium has a higher melting point than both magnesium and calcium; 2) Beryllium chloride has a higher ionic character than magnesium chloride; 3) Beryllium has a filled 2s subshell.

ANSWER: 1 AND 3

TOSS-UP

23) Physics – *Short Answer* What particles did Rutherford fire at gold foil in order to discover the nuclear model of the atom?

ANSWER: ALPHA PARTICLES

BONUS

23) Physics – *Short Answer* A skateboarder is travelling down a quarter-circle curved ramp, where the whole circle has a perimeter of 20π meters. Ignoring the spinning of the skateboard's wheels, what is the skateboarder's speed, in meters per second and to the nearest whole number, at the bottom of the ramp?

ANSWER: 14