

## ROUND 12A

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### TOSS-UP

1) Math – *Short Answer* Points A, B, and C all lie on a circle. What is the measure of angle ABC in degrees if it intercepts an arc of  $122^\circ$ ?

ANSWER: 61

### BONUS

1) Math – *Short Answer* What is the volume of a circular cylinder formed by rotating a 7 by 6 rectangular region about one of its longer sides?

ANSWER:  $252\pi$

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### TOSS-UP

2) Earth and Space – *Multiple Choice* In the year 79 AD, the people of Pompeii were asphyxiated and then buried by ash from what volcano?

- W) Mount Pelee
- X) Mount Vesuvius
- Y) Mount Tambora
- Z) Mount Mayon

ANSWER: X) MOUNT VESUVIUS

### BONUS

2) Earth and Space – *Multiple Choice* Which of the following devices would an astronomer most likely use to detect electromagnetic radiation entering the Earth's atmosphere?

- W) Astrolabe
- X) Bolometer
- Y) Refractor telescope
- Z) Optical interferometer

ANSWER: X) BOLOMETER

**TOSS-UP**

3) Math – *Short Answer* A right triangle has sides of length 6, 8, and 10. What is the length of the altitude to the side of length 6?

ANSWER: 8

**BONUS**

3) Math – *Short Answer* The mean of a list of 12 numbers is 14. What number would need to be added to the list to make the mean of the 13-number list 11?

ANSWER: -25

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**TOSS-UP**

4) Energy – *Short Answer* Coke is produced as a byproduct of the burning of what fuel?

ANSWER: COAL

**BONUS**

4) Energy – *Multiple Choice* Electric vehicles convert about 60% of the electrical energy from the grid to power at the wheels. In a gasoline-powered vehicle, which of the following is closest to the percentage of the energy stored in gasoline that is converted to energy at the wheels?

- W) 5
- X) 10
- Y) 20
- Z) 50

ANSWER: Y) 20

**TOSS-UP**

5) Life Science – *Short Answer* What is the term for molecules that are used as endocrine-signaling agents?

ANSWER: HORMONES

**BONUS**

5) Life Science – *Short Answer* What general type of enzyme catalyzes reactions that add phosphate groups to substrates?

ANSWER: KINASES

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**TOSS-UP**

6) Physical Science – *Multiple Choice* Which of the following will produce ions when dissolved in water?

- W) Ethylene [*ETH-il-een*]
- X) Ethylamine [*ethel-ah-MEEN*]
- Y) Ethanol
- Z) Ethyne [*ETH-eye-n*]

ANSWER: X) ETHYLAMINE

**BONUS**

6) Physical Science – *Short Answer* In molecular orbital theory, what type of orbital is always lower in energy than the atomic orbitals from which it is composed?

ANSWER: BONDING ORBITAL

**TOSS-UP**

7) Energy – *Multiple Choice* Which of the following types of electricity generation would be WORST for providing baseload power?

- W) Wind
- X) Hydroelectric
- Y) Biomass
- Z) Coal

ANSWER: W) WIND

**BONUS**

7) Energy – *Multiple Choice* One benefit to storing carbon dioxide in a deep coal seam is the potential capture of what valuable resource, produced when the carbon dioxide displaces it?

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

ANSWER: Z) METHANE

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**TOSS-UP**

8) Physical Science – *Short Answer* What is the term for the relationship between graphite and diamond?

ANSWER: ALLOTROPE

**BONUS**

8) Physical Science – *Short Answer* Identify all of the following three statements that are true of atomic theory:  
1) Hydrogen gas has a mass of 1 AMU; 2) Compounds can contain any real number of atoms; 3) One liter of argon at STP contains the same number of atoms as one liter of neon at STP.

ANSWER: 3

### TOSS-UP

9) Life Science – *Short Answer* In photosynthesis, carbon dioxide, light, and water are converted to sugar, oxygen, and water. From which of the starting materials is the oxygen gas produced?

ANSWER: WATER (ACCEPT: H<sub>2</sub>O)

### BONUS

9) Life Science – *Multiple Choice* Which of the following cell types would be most important for an allergy response?

- W) Neutrophils [*NEW-troh-fills*]
- X) Basophils [*BAY-zoh-fils*]
- Y) Eosinophils [*ee-oh-SIN-oh-filz*]
- Z) Monocytes

ANSWER: X) BASOPHILS

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### TOSS-UP

10) Energy – *Multiple Choice* Hydraulic fracturing is used to release natural gas and oil from what type of geological formation?

- W) Limestone
- X) Shale
- Y) Granite
- Z) Peat

ANSWER: X) SHALE

### BONUS

10) Energy – *Multiple Choice* Typically, gasoline contains hydrocarbons that contain a number of carbon atoms per molecule in which of the following ranges?

- W) From 4 to 12 inclusive
- X) From 13 to 18 inclusive
- Y) From 19 to 26 inclusive
- Z) From 27 to 32 inclusive

ANSWER: W) FROM 4 TO 12 INCLUSIVE

**TOSS-UP**

11) Earth and Space – *Short Answer* What is the name of the layer of the atmosphere that we live in?

ANSWER: TROPOSPHERE

**BONUS**

11) Earth and Space – *Short Answer* The outer layer of the Sun's atmosphere is called what?

ANSWER: CORONA

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**TOSS-UP**

12) Math – *Short Answer* What is the largest three-digit integer for which the digits sum to 16?

ANSWER: 970

**BONUS**

12) Math – *Short Answer* Solve the following equation for x over the negative integers:  $x^4 - 15x^2 + 54 = 0$

ANSWER: -3

**TOSS-UP**

13) Earth and Space – *Short Answer* What is the term for the unconsolidated material deposited by a stream?

ANSWER: ALLUVIUM

**BONUS**

13) Earth and Space – *Short Answer* What Danish explorer began exploration of the seas off Alaska and northeastern Siberia and discovered the sea route around Siberia to China?

ANSWER: VITUS BERING

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**TOSS-UP**

14) Physical Science – *Short Answer* In mechanics, what name is given to the useful quantity that is equal to the sum of the kinetic energy and the potential energy of an object?

ANSWER: TOTAL ENERGY (ACCEPT: MECHANICAL ENERGY, TOTAL MECHANICAL ENERGY)

**BONUS**

14) Physical Science – *Short Answer* Identify all of the following three units that could be used to measure acceleration: 1) Meters per second squared; 2) Newtons per kilogram; 3) Kilometers per hour.

ANSWER: 1 AND 2

**TOSS-UP**

15) Earth and Space – *Short Answer* On a meteorological map, lines are drawn to connect areas of equal pressure. What is the term for these lines?

ANSWER: ISOBARS

**BONUS**

15) Earth and Space – *Multiple Choice* Saturn's moon Titan has a dense atmosphere composed primarily of what gas?

- W) Oxygen
- X) Hydrogen sulfide
- Y) Nitrogen
- Z) Argon

ANSWER: Y) NITROGEN

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**TOSS-UP**

16) Life Science – *Short Answer* During what phase of mitosis [*my-TOW-sis*] do sister chromatids [*CROW-mah-tids*] split and move towards opposite ends of the cell?

ANSWER: ANAPHASE

**BONUS**

16) Life Science – *Multiple Choice* Which of the following organisms has a hydrostatic skeleton?

- W) Human
- X) Sea star
- Y) Fish
- Z) Lobster

ANSWER: X) SEA STAR



**TOSS-UP**

17) Physical Science – *Multiple Choice* Silver nitrate reacts with copper metal to form copper nitrate and silver metal. What type of reaction is this?

- W) Combustion
- X) Double displacement
- Y) Redox [**REE-dox**]
- Z) Neutralization

ANSWER: Y) REDOX

**BONUS**

17) Physical Science – *Multiple Choice* A very light weight black film is hung by a thin thread in a vacuum chamber. You shine a laser beam onto the surface of the black film and you notice the film is deflected away from the laser and hangs at a slight angle relative to the vertical. This observation shows that light has which of the following?

- W) Momentum
- X) Electrical charge
- Y) Polarization
- Z) Mass

ANSWER: W) MOMENTUM

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**TOSS-UP**

18) Math – *Short Answer* Given  $f$  inverse of  $x$  equals  $1/x$ , what is  $f(x)$ ?

ANSWER:  $1/x$

**BONUS**

18) Math – *Short Answer* To the nearest integer, what is 123 decreased by 37%?

ANSWER: 77

**TOSS-UP**

19) Earth and Space – *Multiple Choice* What is the minimum number of seismic stations required to determine the epicenter of an earthquake?

- W) 2
- X) 3
- Y) 4
- Z) 5

ANSWER: X) 3

**BONUS**

19) Earth and Space – *Short Answer* In most of the Northern hemisphere, constellations such as Ursa minor and Ursa major do not ever dip below the horizon. What is the adjective that describes this property?

ANSWER: CIRCUMPOLAR

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**TOSS-UP**

20) Life Science – *Short Answer* Southern blots are used to analyze what macromolecule?

ANSWER: DNA (ACCEPT: DEOXYRIBONUCLEIC ACID)

**BONUS**

20) Life Science – *Multiple Choice* Which of the following fix nitrogen in soil?

- W) Evergreens
- X) Legumes
- Y) Succulents
- Z) Grasses

ANSWER: X) LEGUMES

**TOSS-UP**

21) Physical Science – *Short Answer* According to VSEPR theory, what is the molecular geometry of methane?

ANSWER: TETRAHEDRAL

**BONUS**

21) Physical Science – *Short Answer* A student is spinning a yo-yo in a vertical loop. When the yo-yo is at the top of the loop, in what direction is the acceleration vector of the yo-yo pointing?

ANSWER: DOWN

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**TOSS-UP**

22) Math – *Short Answer* What is the log base 2 of 128?

ANSWER: 7

**BONUS**

22) Math – *Short Answer* Two lines in space are each perpendicular to a third line. Identify all of the following three relationships that could be true of the first two lines: 1) They are perpendicular; 2) They are parallel; 3) They are skew.

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

### **TOSS-UP**

23) Life Science – *Short Answer* In what type of plant ground tissue are cell walls generally impregnated with lignin?

ANSWER: SCLERENCHYMA

### **BONUS**

23) Life Science – *Short Answer* What type of biological structures have no apparent function, but resemble structures that are found in the evolutionary history of an organism?

ANSWER: VESTIGIAL STRUCTURES