

## ROUND 3A

---

### TOSS-UP

1) General Science – *Multiple Choice* Which of the following is closest to the ratio of nitrogen molecules to oxygen molecules in the air?

- W) 1 to 4
- X) 1 to 3
- Y) 3 to 1
- Z) 4 to 1

ANSWER: Z) 4 TO 1

### BONUS

1) General Science – *Short Answer* Assuming that the following numbers represent measurements, and giving your answer with the correct number of significant figures, simplify the following expression:  
 $2.5 + 0.50 + 0.055$  [*two point five plus zero point five zero plus zero point zero five five*].

ANSWER: 3.1

---

### TOSS-UP

2) Math – *Short Answer* Evaluate the following expression: 14 minus 6 times 5

ANSWER: -16

### BONUS

2) Math – *Short Answer* A right triangle has leg lengths 3 and 4. A similar triangle has its shorter leg of length 12. What is the length of the hypotenuse in the larger triangle?

ANSWER: 20

**TOSS-UP**

3) Energy – *Short Answer* What is the Earth's most abundant energy source?

ANSWER: THE SUN (ACCEPT SOLAR ENERGY)

**BONUS**

3) Energy – *Multiple Choice* Approximately 45% of biomass energy production in the US comes from what fuel source?

- W) Landfill gas
- X) Solid waste
- Y) Wood
- Z) Biogas

ANSWER: Y) WOOD

~~~~~  
**TOSS-UP**

4) Physical Science – *Multiple Choice* One kilogram of which of the following has the most energy?

- W) Ice at 0 degrees Celsius
- X) Water at 0 degrees Celsius
- Y) Water at 100 degrees Celsius
- Z) Steam at 100 degrees Celsius

ANSWER: Z) STEAM AT 100 DEGREES CELSIUS

**BONUS**

4) Physical Science – *Short Answer* What element in coal has the greatest mass fraction?

ANSWER: CARBON

**TOSS-UP**

5) Earth and Space – *Short Answer* In what layer of Earth's atmosphere does nearly all weather occur?

ANSWER: TROPOSPHERE

**BONUS**

5) Earth and Space – *Short Answer* In general, what is the minimum number of land-based seismic station measurements needed to determine the location of an earthquake?

ANSWER: THREE

~~~~~

**TOSS-UP**

6) Life Science – *Short Answer* What term is used to describe organisms that help break down existing plant or animal tissue?

ANSWER: DECOMPOSER (ACCEPT: SAPROTROPH OR SAPPROBE; DO NOT ACCEPT: DETRITIVORE)

**BONUS**

6) Life Science – *Multiple Choice* If birth and death rates are equal and a population is growing, what is the most likely relationship between immigration and emigration?

- W) More immigration than emigration
- X) Less immigration than emigration
- Y) The same amount of immigration as emigration
- Z) Emigration, but no immigration

ANSWER: W) MORE IMMIGRATION THAN EMIGRATION

**TOSS-UP**

7) Earth and Space – *Short Answer* What two elements primarily make up the core of the Earth?

ANSWER: IRON AND NICKEL

**BONUS**

7) Earth and Space – *Multiple Choice* Most of the CO<sub>2</sub> presently entering Earth's atmosphere is generated by human activities. Which of the following is closest to the percentage of CO<sub>2</sub> released into the atmosphere by land and sea volcanoes combined?

- W) 1
- X) 5
- Y) 10
- Z) 15

ANSWER: W) 1



**TOSS-UP**

8) General Science – *Short Answer* If you were to design an experiment to see how high a ball bounces in response to the height from which it is dropped, what would be your independent variable?

ANSWER: HEIGHT FROM WHICH IT IS DROPPED (DO NOT ACCEPT: HEIGHT)

**BONUS**

8) General Science – *Short Answer* What temperature in degrees Celsius is equivalent to 50 degrees Fahrenheit?

ANSWER: 10

**TOSS-UP**

9) Life Science – *Multiple Choice* Prokaryotic cells divide by the process of:

- W) Fusion
- X) Osmosis
- Y) Mitosis
- Z) Binary fission

ANSWER: Z) BINARY FISSION

**BONUS**

9) Life Science – *Multiple Choice* What is the limiting factor for phytoplankton productivity in the tropical open ocean?

- W) Temperature
- X) Sunlight
- Y) Salinity
- Z) Nutrients

ANSWER: Z) NUTRIENTS

~~~~~  
**TOSS-UP**

10) Math – *Multiple Choice* A hula hoop with a radius of 20 inches is cut into 5 congruent pieces. What is the length of each piece?

- W)  $4\pi$
- X)  $5\pi$
- Y)  $8\pi$
- Z)  $10\pi$

ANSWER: Y)  $8\pi$

**BONUS**

10) Math – *Short Answer* Two dice are tossed. What is the probability that both results are five or higher?

ANSWER: 1/9

**TOSS-UP**

11) Physical Science – *Short Answer* What scientist first proposed that energy is quantized in order to explain the emission spectrum of a black body?

ANSWER: MAX PLANCK

**BONUS**

11) Physical Science – *Multiple Choice* Which of the following can be said about a single, unchanging mass M that is moving at a constant speed?

- W) The object's kinetic energy is a constant
- X) No outside forces act on the object
- Y) The object's potential energy is a constant
- Z) No internal forces act on the object

ANSWER: W) THE OBJECT'S KINETIC ENERGY IS A CONSTANT

~~~~~

**TOSS-UP**

12) Energy – *Multiple Choice* What country is the world's largest producer of natural gas?

- W) Austria
- X) United States
- Y) Russia
- Z) Kazakhstan [*KAZ-ak-stahn*]

ANSWER: X) UNITED STATES

**BONUS**

12) Energy – *Multiple Choice* In 2014, the United States and China agreed to reduce their greenhouse gas emissions. The US agreed to reduce emissions from the 2005 level by 2025 by what percentage range?

- W) 12-14
- X) 19-21
- Y) 26-28
- Z) 33-35

ANSWER: Y) 26-28

**TOSS-UP**

13) Earth and Space – *Multiple Choice* In what geologic era did dinosaurs live?

- W) Jurassic
- X) Paleozoic
- Y) Mesozoic
- Z) Cenozoic

ANSWER: Y) MESOZOIC

**BONUS**

13) Earth and Space – *Short Answer* From the following four measurements made on a collection of stars, identify the two that can be plotted against each other to create an H-R diagram: 1) Absolute magnitude; 2) Age; 3) Temperature; 4) Mass.

ANSWER: 1 AND 3 (ABSOLUTE MAGNITUDE AND TEMPERATURE)

~~~~~  
**TOSS-UP**

14) Physical Science – *Short Answer* What is the term for the minimum amount of energy required to remove an electron from an atom in the gaseous phase?

ANSWER: IONIZATION ENERGY

**BONUS**

14) Physical Science – *Multiple Choice* Which of the following is a rare earth metal?

- W) Lutetium [*loo-TEE-shum*]
- X) Gallium
- Y) Bismuth [*BIZ-muth*]
- Z) Osmium

ANSWER: W) LUTETIUM

**TOSS-UP**

15) Life Science – *Short Answer* What type of symbiosis benefits both organisms involved?

ANSWER: MUTUALISM

**BONUS**

15) Life Science – *Short Answer* Monocytes develop into what phagocytic cells?

ANSWER: MACROPHAGES (ACCEPT: MONONUCLEAR PHAGOCYTES, DENDRITIC CELLS)

~~~~~  
**TOSS-UP**

16) Energy – *Multiple Choice* Which of the following elements is commonly used to control the chain reaction inside the reactor vessel of a nuclear power plant?

- W) Boron
- X) Nitrogen
- Y) Hydrogen
- Z) Carbon

ANSWER: W) BORON

**BONUS**

16) Energy – *Multiple Choice* Which of the following types of coal has the highest carbon content?

- W) Anthracite
- X) Lignite
- Y) Sub-bituminous
- Z) Bituminous

ANSWER: W) ANTHRACITE



**TOSS-UP**

17) Math – *Short Answer* What is the multiplicative inverse of  $-1/5$ ?

ANSWER:  $-5$

**BONUS**

17) Math – *Short Answer* You are going to meet a friend at a skate park that is 4 miles from your house. You will ride your bike at a constant rate of 10 miles per hour. Your friend lives 1.5 miles from the skate park and will walk at a constant rate of 3 miles per hour. If each of you starts from your respective houses, how many minutes before you leave should your friend leave, so that you meet at the skate park at the same time?

ANSWER: 6

~~~~~  
**TOSS-UP**

18) General Science – *Multiple Choice* Which of the following is true about your area if a weather watch is issued?

- W) A weather hazard may develop
- X) There is a weather hazard forming
- Y) There is an active weather hazard with potential for significant damage
- Z) A weather hazard has caused significant damage

ANSWER: W) A WEATHER HAZARD MAY DEVELOP

**BONUS**

18) General Science – *Multiple Choice* A biology teacher is working with bacterial cultures in class and does not properly seal the inoculated samples. This poses the highest health risk for which of the following groups of students?

- W) Students who have not been immunized
- X) Students with autoimmune disorders
- Y) The youngest students
- Z) All of the students equally

ANSWER: X) STUDENTS WITH AUTOIMMUNE DISORDERS

**TOSS-UP**

19) Math – *Short Answer* What is the leading coefficient of the polynomial  $x^4 - 2x^2 - 2x + 4$ ?

ANSWER: 1

**BONUS**

19) Math – *Short Answer* How many positive integers less than 300 are divisible by 3 but not by 21?

ANSWER: 85

~~~~~  
**TOSS-UP**

20) Physical Science – *Short Answer* What idealized object absorbs all radiation directed at it and emits all of its energy in the form of electromagnetic radiation?

ANSWER: BLACK BODY

**BONUS**

20) Physical Science – *Multiple Choice* Which of the following is an extensive property of a material?

- W) Temperature
- X) Volume
- Y) Electrical conductivity
- Z) Density

ANSWER: X) VOLUME

**TOSS-UP**

21) Earth and Space – *Short Answer* What is the equivalent of the Aurora Borealis in the Southern hemisphere?

ANSWER: AURORA AUSTRALIS (ACCEPT: SOUTHERN LIGHTS)

**BONUS**

21) Earth and Space – *Multiple Choice* Which of the following is closest to the number of major and minor tectonic plates into which Earth's lithosphere is divided?

- W) 5
- X) 15
- Y) 25
- Z) 35

ANSWER: X) 15

~~~~~  
**TOSS-UP**

22) Life Science – *Short Answer* Rickets is caused by a deficiency of what vitamin?

ANSWER: VITAMIN D

**BONUS**

22) Life Science – *Multiple Choice* A small population of native red-backed salamanders is migrating downhill towards a vernal pool. Along the way, half of the population is lost while crossing a road. This would possibly lead to which of the following outcomes?

- W) Genetic drift
- X) More competition among members of the population
- Y) Increased body size
- Z) Stationary individuals that do not migrate to vernal pools

ANSWER: W) GENETIC DRIFT

**TOSS-UP**

23) Math – *Short Answer* In which quadrant does the point (3, -4) lie?

ANSWER: FOURTH (ACCEPT: 4)

**BONUS**

23) Math – *Short Answer* If a 15-degree sector of a circle has area  $20\pi$ , then, to the nearest whole number, what is the radius of the circle?

ANSWER: 22