

## MIDDLE SCHOOL - ROUND 1

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### TOSS-UP

- 1) Life Science – *Short Answer* What is the term for chemicals that are used to transmit impulses from one neuron to another?

ANSWER: NEUROTRANSMITTERS

### BONUS

- 1) Life Science – *Short Answer* What is the term for the point on a stem at which a leaf is attached?

ANSWER: NODE

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### TOSS-UP

- 2) Earth and Space – *Short Answer* Satellites that stay above the same spot on Earth while in orbit are in what type of orbit?

ANSWER: GEOSTATIONARY (ACCEPT: GEOSYNCHRONOUS EARTH ORBIT; DO NOT ACCEPT GEOSYNCHRONOUS)

### BONUS

- 2) Earth and Space – *Short Answer* Kepler's laws of planetary motion were empirically determined from data collected by what Danish astronomer?

ANSWER: TYCHO BRAHE [*TEE-koh BRAH-hay*]

## **TOSS-UP**

3) Math – *Short Answer* What is the discriminant of the quadratic polynomial  $2x^2 + 7x + 3$ ?

ANSWER: 25

## **BONUS**

3) Math – *Short Answer* Purity of gold is measured in karats, with 100% pure gold being 24 karats. To the nearest whole number, what percent pure is 14-karat gold?

ANSWER: 58

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## **TOSS-UP**

4) Energy – *Multiple Choice* Scientists at Argonne National Lab have been studying the drinking mechanisms in mosquitoes. They watched liquid flow through the proboscis [**pro-BOSS-is**] using synchrotron X-rays to penetrate the exoskeleton, which is made of what material?

- W) Chitin [**KYE-tin**]
- X) Keratin
- Y) Cellulose
- Z) Maltose

ANSWER: W) CHITIN

## **BONUS**

4) Energy – *Multiple Choice* Researchers at Los Alamos National Lab are using direct numerical simulations to study the interaction of shock waves with fluid flow. Which of the following equations or sets of equations is most relevant in modeling the motion of fluids like water?

- W) Schrodinger [**SHROH-dinger**] equation
- X) Maxwell's equations
- Y) Einstein field equations
- Z) Euler equations

ANSWER: Z) EULER EQUATIONS

## **TOSS-UP**

5) Earth and Space – *Multiple Choice* Seismic activity in the ocean may lead to what destructive phenomenon?

- W) Tsunamis
- X) Monsoons
- Y) Storm surge
- Z) Hurricanes

ANSWER: W) TSUNAMIS

## **BONUS**

5) Earth and Space – *Short Answer* Identify all of the following three stream features that result from deposition: 1) Cut bank; 2) Point bar; 3) Delta.

ANSWER: 2, 3

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## **TOSS-UP**

6) Physical Science – *Multiple Choice* Which of the following substances has a pH value that is less than 7?

- W) Vinegar
- X) Sodium bicarbonate
- Y) Soapy water
- Z) Ammonia

ANSWER: W) VINEGAR

## **BONUS**

6) Physical Science – *Short Answer* To one significant figure, what is the mass percent of hydrogen in water?

ANSWER: 10

## **TOSS-UP**

7) Life Science – *Short Answer* What is the term for an automatic response to a stimulus, such as sneezing or blinking?

ANSWER: REFLEX

## **BONUS**

7) Life Science – *Short Answer* What region in the eukaryotic nucleus is the site of initial rRNA synthesis?

ANSWER: NUCLEOLUS

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## **TOSS-UP**

8) Earth and Space – *Short Answer* The Milky Way, Andromeda, and Maffei 1 [**MAF-eye-one**] are examples of what systems that can be found in space?

ANSWER: GALAXY (DO NOT ACCEPT: SPIRAL GALAXY, ELLIPTICAL GALAXY)

## **BONUS**

8) Earth and Space – *Short Answer* What planet was hypothesized to exist by mathematician Urbain Leverrier [**luh-vair-ee-ay**] due to observed discrepancies in Uranus's orbit?

ANSWER: NEPTUNE

## **TOSS-UP**

9) Physical Science – *Short Answer* What is the SI derived unit for frequency?

ANSWER: HERTZ

## **BONUS**

9) Physical Science – *Short Answer* The volume of a balloon is expanded from one liter to five liters. The temperature is held constant at 20 degrees Celsius and the initial pressure was 10 atmospheres. In atmospheres, what is the new pressure?

ANSWER: 2

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## **TOSS-UP**

10) Energy – *Short Answer* Researchers at the National Energy Technology Lab have recovered pressurized ocean cores from the Gulf of Mexico that contain methane hydrates. When the methane that is extracted from these cores is fully combusted in oxygen to drive a heat engine, what are the two end products?

ANSWER: CARBON DIOXIDE AND WATER (ACCEPT: CARBON DIOXIDE AND STEAM, CO<sub>2</sub> and H<sub>2</sub>O)

## **BONUS**

10) Energy – *Short Answer* Researchers at Brookhaven National Lab are constructing geometric figures out of DNA. One of these figures is a regular polyhedron with triangular faces and six vertices. What is the name for this polyhedron?

ANSWER: OCTAHEDRON (ACCEPT: REGULAR OCTAHEDRON)

## **TOSS-UP**

11) Math – *Multiple Choice* Which of the following is closest to the percent increase in the speed of a car that accelerates from 21.7 to 85.1 miles per hour?

- W) 192
- X) 292
- Y) 392
- Z) 492

ANSWER: X) 292

## **BONUS**

11) Math – *Short Answer* What is the total surface area of a rectangular box having edge lengths of 4, 6, and 7?

ANSWER: 188

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## **TOSS-UP**

12) Physical Science – *Multiple Choice* The atomic number of molybdenum [**muh-LIB-den-um**] is 42. What does this number indicate?

- W) Every atom has 42 total protons & neutrons in the nucleus
- X) Every atom has a mass of 42 a.m.u.
- Y) Every atom has 42 protons in the nucleus
- Z) Every atom will form bonds that measure 42 degrees

ANSWER: Y) EVERY ATOM HAS 42 PROTONS IN THE NUCLEUS

## **BONUS**

12) Physical Science – *Short Answer* In the balanced equation for the complete combustion of methane, what is the coefficient in front of methane?

ANSWER: 1

**TOSS-UP**

13) Life Science – *Short Answer* What group of mammals lays eggs?

ANSWER: MONOTREMES

**BONUS**

13) Life Science – *Short Answer* During what phase of mitosis do chromosomes line up in the middle of the cell?

ANSWER: METAPHASE

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**TOSS-UP**

14) Math – *Short Answer* If set A contains the four elements 1, 3, 5, and 7, and set B contains the four elements 1, 2, 3, and 4, then what elements are in the intersection of sets A and B?

ANSWER: 1 AND 3

**BONUS**

14) Math – *Short Answer* What are the slope and y-intercept of the line containing the points  $(-12, -2)$  and  $(-8, 8)$ ?

ANSWER: SLOPE =  $5/2$  AND y-INTERCEPT = 28 (ACCEPT FOR SLOPE:  $2\frac{1}{2}$ , 2.5)

## **TOSS-UP**

15) Earth and Space – *Multiple Choice* Oceanographers use which of the following terms to describe global ocean circulation patterns?

- W) Density conveyor
- X) Isostatic conveyor
- Y) Thermohaline [*thermo-HAY-line*] conveyor
- Z) Carbonate conveyor

ANSWER: Y) THERMOHALINE CONVEYOR

## **BONUS**

15) Earth and Space – *Short Answer* Barchan [*bar-KAHN*] and transverse are types of what geologic feature?

ANSWER: DUNES (ACCEPT: SAND DUNES)

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## **TOSS-UP**

16) Physical Science – *Short Answer* In millivolts, what voltage is needed to produce a current of 3 milliamperes over a piece of metal with a resistance of 2 ohms?

ANSWER: 6

## **BONUS**

16) Physical Science – *Short Answer* Suppose that a projectile was thrown vertically downwards from a height of 10 meters. If its speed at the ground was 20 meters per second, then to the nearest meter per second, what was its initial velocity?

ANSWER: 14

## **TOSS-UP**

17) Math – *Short Answer* Giving your answer as a fraction, what is the reciprocal of 4.5?

ANSWER: 2/9

## **BONUS**

17) Math – *Short Answer* 4 blue marbles, 3 green marbles, and 3 red marbles are in a jar. Two marbles are selected without replacement. What is the probability that the two marbles are the same color?

ANSWER: 4/15

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## **TOSS-UP**

18) Life Science – *Multiple Choice* Hirudinea [**HEER-oo-din-ee-ah**] is a class that contains which of the following organisms?

- W) Tapeworms
- X) Hagfish
- Y) Centipedes
- Z) Leeches

ANSWER: Z) LEECHES

## **BONUS**

18) Life Science – *Short Answer* The human eye focuses light through the lens onto what photosensitive structure?

ANSWER: RETINA

## **TOSS-UP**

19) Earth and Space – *Short Answer* Earth’s magnetic field arises from movement in its outer core that is primarily composed of what two metals?

ANSWER: NICKEL AND IRON

## **BONUS**

19) Earth and Space – *Short Answer* Rank the following three minerals in order of increasing Mohs hardness: 1) Fluorite; 2) Apatite; 3) Quartz.

ANSWER: 1, 2, 3

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## **TOSS-UP**

20) Energy – *Short Answer* Scientists at Los Alamos National Lab are studying a group of pumps associated with Gram-negative and Gram-positive organisms. These organisms are part of what domain?

ANSWER: EUBACTERIA (ACCEPT: BACTERIA)

## **BONUS**

20) Energy – *Short Answer* Researchers at Oak Ridge National Lab used chemical vapor deposition to grow large monolayer films of what form of carbon, touted for its unprecedented strength and high electrical conductivity?

ANSWER: GRAPHENE

## **TOSS-UP**

21) Math – *Short Answer* What is the circumference of a circle of radius 7?

ANSWER:  $14\pi$

## **BONUS**

21) Math – *Short Answer* Identify all of the following 4 terms that apply to the sequence with  $n$ th term given by  $3n - 2$ : 1) geometric; 2) arithmetic; 3) increasing; 4) decreasing.

ANSWER: 2 AND 3

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## **TOSS-UP**

22) Life Science – *Multiple Choice* Which of the following best describes how fungi feed?

- W) They are chemoautotrophs
- X) They are photoautotrophs
- Y) They are heterotrophs
- Z) Some are photoautotrophs, while others are chemoautotrophs

ANSWER: Y) THEY ARE HETEROTROPHS

## **BONUS**

22) Life Science – *Short Answer* What is the adjective for the part of the human nervous system that is divided into the sensory division and the motor division?

ANSWER: PERIPHERAL

## **TOSS-UP**

23) Physical Science – *Short Answer* The cosmic background radiation originating from the big bang has been redshifted into what part of the electromagnetic spectrum?

ANSWER: MICROWAVE

## **BONUS**

23) Physical Science – *Short Answer* Rank the following three objects in terms of increasing momentum: 1) A one-ton car traveling at 10 meters per second; 2) A one-and-a-half-ton car traveling at 10 meters per second; 3) A one-ton car traveling at 20 meters per second.

ANSWER: 1, 2, 3