

MIDDLE SCHOOL - ROUND 1A

TOSS-UP

1) Life Science – *Multiple Choice* Which of the following cellular components is present in eukaryotes [*YOO-care-ee-oats*], but not prokaryotes [*PRO-care-ee-oats*]?

- W) Ribosome
- X) Nucleus
- Y) Vesicle
- Z) Cell wall

ANSWER: X) NUCLEUS

BONUS

1) Life Science – *Multiple Choice* Which of the following best describes the pathway of aerobic respiration?

- W) Glucose is oxidized and oxygen is reduced
- X) Oxygen is oxidized and glucose is reduced
- Y) Both glucose and oxygen are oxidized
- Z) Both glucose and oxygen are reduced

ANSWER: W) GLUCOSE IS OXIDIZED AND OXYGEN IS REDUCED

TOSS-UP

2) Earth and Space – *Multiple Choice* Which of the following occurs at an ocean-continent convergent boundary?

- W) Two tectonic plates move away from each other
- X) Oceanic crust will subduct under continental crust
- Y) Continental crust will subduct under oceanic crust
- Z) Two tectonic plates slide past each other

ANSWER: X) OCEANIC CRUST WILL SUBDUCT UNDER CONTINENTAL CRUST

BONUS

2) Earth and Space – *Short Answer* Seismic waves propagate through Earth's interior following an earthquake. Identify all of the following three phases of matter through which P-waves can propagate:
1) Solid; 2) Liquid; 3) Gas.

ANSWER: ALL

TOSS-UP

3) Math – *Multiple Choice* Which of the following is not a possible type of triangle?

- W) Acute isosceles
- X) Acute scalene
- Y) Obtuse equilateral
- Z) Obtuse isosceles

ANSWER: Y) OBTUSE EQUILATERAL

BONUS

3) Math – *Short Answer* In the alternating arithmetic sequence with first 3 terms $-7, 9, -11$, what is the sum of the first 11 terms in the sequence?

ANSWER: -17

TOSS-UP

4) Energy – *Short Answer* DOE researchers recently published a study showing that individuals who are overweight at midlife have an increased risk for what neurodegenerative [*NOOR-oh-dee-JEN-ur-ah-tiv*] disease that is commonly associated with tau fibrils and amyloid [*AM-ill-oyd*]-beta plaques?

ANSWER: ALZHEIMER'S DISEASE

BONUS

4) Energy – *Multiple Choice* Argonne National Lab researchers are studying colloids using high-powered microscopes. Which of the following is an example of a colloid?

- W) Energy drink
- X) Salt water
- Y) Soda
- Z) Milk

ANSWER: Z) MILK

TOSS-UP

5) Earth and Space – *Short Answer* The solar system's asteroid belt is a group of asteroids orbiting together between the orbits of which two planets?

ANSWER: MARS AND JUPITER

BONUS

5) Earth and Space – *Multiple Choice* Which of the following best describes the relationship between the velocity of a galaxy with its distance from the Earth?

- W) Linear
- X) Quadratic
- Y) Ternary
- Z) Quaternary

ANSWER: W) LINEAR

TOSS-UP

6) Physical Science – *Short Answer* Rutherford discovered that the nucleus contains what positively-charged particles?

ANSWER: PROTONS

BONUS

6) Physical Science – *Multiple Choice* Which of the following best explains why clouds appear white, but liquid water is transparent?

- W) Interference
- X) Radiation
- Y) Scattering
- Z) Diffraction

ANSWER: Y) SCATTERING

TOSS-UP

7) Life Science – *Short Answer* In mammals, what organ is composed of cardiac muscle tissue?

ANSWER: HEART

BONUS

7) Life Science – *Multiple Choice* Which of the following types of enzymes would most likely be involved in adding a water molecule to a substrate?

- W) Transferase [*TRANS-fer-ace*]
- X) Hydrolase [*HI-dro-lace*]
- Y) Oxidoreductase [*ox-ih-doh-ree-DUK-tase*]
- Z) Lyase [*LIE-ace*]

ANSWER: X) HYDROLASE

TOSS-UP

8) Earth and Space – *Short Answer* What process occurs within the core of the Sun to produce heavy elements and energy from light elements?

ANSWER: FUSION

BONUS

8) Earth and Space – *Short Answer* Identify all of the following three phases of the moon during which the tidal range is at a maximum: 1) New moon; 2) First quarter; 3) Full moon.

ANSWER: 1 AND 3

TOSS-UP

9) Physical Science – *Multiple Choice* Which of the following properties of water is most responsible for the tempering influence of the ocean on climate?

- W) Freezing point
- X) pH
- Y) Heat capacity
- Z) Density

ANSWER: Y) HEAT CAPACITY

BONUS

9) Physical Science – *Short Answer* What is the IUPAC name of AgNO₃?

ANSWER: SILVER NITRATE (ACCEPT: SILVER ONE NITRATE)

TOSS-UP

10) Energy – *Multiple Choice* SunStop is a flexible film developed at the National Renewable Energy Lab that is capable of preventing what form of energy from entering a building through its windows?

- W) Acoustic waves
- X) Infrared light
- Y) Gamma radiation
- Z) Electricity

ANSWER: X) INFRARED LIGHT

BONUS

10) Energy – *Multiple Choice* Scientists at Argonne National Lab are studying liquid crystals that can be found in which of the following devices?

- W) Car engine
- X) External hard drive
- Y) Digital clock
- Z) Headphones

ANSWER: Y) DIGITAL CLOCK

TOSS-UP

11) Math – *Multiple Choice* If m is an integer and $20m$ is divisible by 6, which of the following could be m ?

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

ANSWER: X) 3

BONUS

11) Math – *Short Answer* What is the length of a space diagonal in a right rectangular prism with edges of lengths 5, 6, and 7?

ANSWER: $\sqrt{110}$

TOSS-UP

12) Physical Science – *Multiple Choice* Which of the following energy transformations occurs in your muscles when you jump into the air?

- W) Thermal to kinetic
- X) Chemical to kinetic
- Y) Kinetic to chemical
- Z) Thermal to potential

ANSWER: X) CHEMICAL TO KINETIC

BONUS

12) Physical Science – *Multiple Choice* Which of the following phases of matter can change shape, but is nearly incompressable?

- W) Gas
- X) Liquid
- Y) Solid
- Z) Plasma

ANSWER: X) LIQUID

TOSS-UP

13) Life Science – *Multiple Choice* A liver cell is slowly dying because it can not break down toxins. What organelle is likely defective in this cell?

- W) Golgi [*GOAL-jee*] complex
- X) Mitochondria
- Y) Ribosome
- Z) Endoplasmic reticulum [*reh-TIK-yoo-lum*]

ANSWER: Z) ENDOPLASMIC RETICULUM

BONUS

13) Life Science – *Multiple Choice* Which of the following terms best describes groups of rabbits, foxes, deer, and birds living in a temperate deciduous forest?

- W) Population
- X) Community
- Y) Habitat
- Z) Niche

ANSWER: X) COMMUNITY

TOSS-UP

14) Math – *Short Answer* Sam completely fills a box with sand. The box is a right rectangular prism measuring 2 feet by 16 feet by 2 feet. His friend Max has a box in the shape of a cube. Max takes the sand from Sam's box and dumps it into his cube, exactly filling it. How many feet tall is Max's box?

ANSWER: 4

BONUS

14) Math – *Short Answer* Give one of the linear factors of $6x^2 - 31x + 35$

ANSWER: $3x - 5$ OR $2x - 7$ (must give at least one)

TOSS-UP

15) Earth and Space – *Multiple Choice* Which of the following is considered a mineral?

- W) Pearl
- X) Coal
- Y) Ice
- Z) Peat

ANSWER: Y) ICE

BONUS

15) Earth and Space – *Short Answer* Identify all of the following three glacial features that provide information about the direction a glacier flowed. 1) Striations; 2) Drumlins; 3) Basal slip.

ANSWER: 1 AND 2

TOSS-UP

16) Physical Science – *Short Answer* Dry ice is the solid form of what molecule?

ANSWER: CARBON DIOXIDE (ACCEPT: CO₂)

BONUS

16) Physical Science – *Short Answer* Identify all of the following three quantities that can be determined about a particular atomic nucleus with only the name of the element and the periodic table: 1) Mass number; 2) Atomic mass; 3) Atomic number.

ANSWER: 3

TOSS-UP

17) Math – *Short Answer* If x and y are directly proportional, and x is 7 when y is 13, what is x when y is 39?

ANSWER: 21

BONUS

17) Math – *Short Answer* Fifty students at Maple Grove Academy take French or Spanish. If 10 take both and 25 take French, how many take Spanish but not French?

ANSWER: 25

TOSS-UP

18) Life Science – *Short Answer* Most metabolic pathways in biology are regulated so that the product of a pathway inhibits the enzymes in that pathway. What is this inhibition scheme called?

ANSWER: NEGATIVE FEEDBACK (ACCEPT: FEEDBACK INHIBITION)

BONUS

18) Life Science – *Multiple Choice* Which of the following types of joints can be found in the knuckles of a human index finger?

- W) Saddle
- X) Pivot
- Y) Gliding
- Z) Ellipsoid

ANSWER: Z) ELLIPSOID

TOSS-UP

19) Earth and Space – *Short Answer* In our solar system, what planet has the fastest orbital velocity around the Sun?

ANSWER: MERCURY

BONUS

19) Earth and Space – *Multiple Choice* Crater counting is a method that can be used to estimate what feature of a moon or planet?

- W) Age
- X) Composition
- Y) Mass
- Z) Orbital velocity

ANSWER: W) AGE

TOSS-UP

20) Energy – *Short Answer* Researchers at the Joint BioEnergy Institute are improving the efficiency of the biofuel cycle. What is the name of the step of this cycle during which bacteria are used to convert monosaccharides to ethanol?

ANSWER: FERMENTATION

BONUS

20) Energy – *Multiple Choice* Scientists at Brookhaven National Lab are studying catalysts for the conversion of carbon dioxide to methanol. What general type of reaction is this?

- W) Synthesis
- X) Redox
- Y) Single replacement
- Z) Decomposition

ANSWER: X) REDOX

TOSS-UP

- 21) Math – *Short Answer* Two cross-country runners want to finish their 5-kilometer practice run at the same time. The runners run at rates covering one kilometer in 5.5 minutes and 7.5 minutes, respectively. How many minutes of head start should the faster runner give the slower runner?

ANSWER: 10

BONUS

- 21) Math – *Short Answer* What is the length of the hypotenuse of the right triangle with vertices at (4, 4), (10, 4), and (4, 8)?

ANSWER: $2\sqrt{13}$

TOSS-UP

- 22) Life Science – *Short Answer* What cellular organelle is responsible for forming proteins from amino acids?

ANSWER: RIBOSOME

BONUS

- 22) Life Science – *Short Answer* What is the general term for cells that have half as many chromosomes as diploid cells?

ANSWER: HAPLOID CELLS (ACCEPT: HAPLOID)

TOSS-UP

23) Physical Science – *Short Answer* In kilogram-meters per second, what is the momentum of a 20-kilogram cart traveling at 3 meters per second?

ANSWER: 60

BONUS

23) Physical Science – *Short Answer* Aside from momentum, what other general physical quantity can be expressed with the units of kilogram-meters per second?

ANSWER: IMPULSE