

MIDDLE SCHOOL - ROUND 6A

TOSS-UP

1) Earth and Space – *Short Answer* The term "dirty snowball", coined by astronomer Fred Whipple in 1950, refers to what category of space objects?

ANSWER: COMETS

BONUS

1) Earth and Space – *Multiple Choice* On a summer night you notice that the zenith is in the constellation Cygnus [*SIG-nus*]. Which of the following constellations would be highest above the horizon?

W) Orion [*oh-RYE-on*]

X) Sagittarius

Y) Lyra [*LYE-rah*]

Z) Ursa Major

ANSWER: Y) LYRA

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### TOSS-UP

2) Math – *Short Answer* What is the coefficient of the  $ac$  term in the trinomial expansion of open parenthesis  $3a - 4b - 5c$  close parenthesis squared?

ANSWER: -30

### BONUS

2) Math – *Short Answer* What are the mean and median, respectively, of the following list of six numbers: 9, 7, 4, 7, 5, 1?

ANSWER: 5.5 AND 6 (ACCEPT:  $5\frac{1}{2}$ ,  $11/2$  for mean)

**TOSS-UP**

3) Physical Science – *Multiple Choice* Feet per minute is a unit for which of the following quantities?

- W) Speed
- X) Acceleration
- Y) Position
- Z) Energy

ANSWER: W) SPEED

**BONUS**

3) Physical Science – *Short Answer* Identify all of the following three mixtures that are heterogeneous to the naked eye: 1) A watermelon; 2) Mayonnaise; 3) Vinegar.

ANSWER: 1



**TOSS-UP**

4) Earth and Space – *Short Answer* A flood arises within minutes due to heavy rains. Meteorologists refer to such a flood as what?

ANSWER: FLASH FLOOD

**BONUS**

4) Earth and Space – *Short Answer* Place the following three types of clouds in order of increasing altitude: 1) Altocumulus, 2) Stratus, 3) Cirrus.

ANSWER: 2, 1, 3

**TOSS-UP**

5) Energy – *Short Answer* What type of vehicle fuel consists of long chain alkyl [*AL-keel*] esters that are produced from biomass?

ANSWER: BIODIESEL

**BONUS**

5) Energy – *Short Answer* Researchers at Jefferson Lab are investigating the structure of nucleons at various energy scales to test the predictions of QCD. The rest mass energy of a nucleon is derived primarily from the mass of quarks, plus the energy of what exchange bosons [*BOH-sawnz*]?

ANSWER: GLUONS

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TOSS-UP

6) Life Science – *Short Answer* What polymer is the primary component of the cell wall in maize?

ANSWER: CELLULOSE

BONUS

6) Life Science – *Short Answer* In the ABO blood system, if a child has parents that are A type and B type, they can have AB type blood. This is an example of what type of genetic interaction?

ANSWER: CODOMINANCE

TOSS-UP

7) Physical Science – *Short Answer* Rank the following three solutions in terms of increasing acidity:
1) pH 7 solution; 2) pH 13 solution; 3) pH 2 solution.

ANSWER: 2, 1, 3

BONUS

7) Physical Science – *Short Answer* The complete combustion of methane results in the formation of water and what other molecule?

ANSWER: CARBON DIOXIDE (ACCEPT: CO₂)

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**TOSS-UP**

8) Math – *Short Answer* What is the equation of the horizontal line that passes through the point with coordinates (3, 4)?

ANSWER:  $y = 4$

**BONUS**

8) Math – *Short Answer* Two triangles are similar with scale factor  $\frac{3}{4}$ . If the area of the larger triangle is 96, what is the area of the smaller triangle?

ANSWER: 54

**TOSS-UP**

9) Life Science – *Multiple Choice* The skull of a new mammalian species is found and all of the teeth are sharp and angled. Based on this data, which of the following is the most reasonable conclusion?

- W) It was a carnivore
- X) It was an herbivore
- Y) It was an omnivore
- Z) It was a parasite

ANSWER: W) IT WAS A CARNIVORE

**BONUS**

9) Life Science – *Short Answer* Most bacteria move around by using what rotor-like structures?

ANSWER: FLAGELLA

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TOSS-UP

10) Energy – *Short Answer* Steam reforming is a process used to produce hydrogen gas. What molecule is used as a fuel for steam reforming?

ANSWER: METHANE

BONUS

10) Energy – *Short Answer* DOE-sponsored researchers recently demonstrated that the replacement of iron with iridium [*ih-RID-ee-um*] in an oxygen-binding human muscle protein exhibited catalytic ability. What protein did they use?

ANSWER: MYOGLOBIN

TOSS-UP

11) Earth and Space – *Multiple Choice* Which geologic eon starts at the formation of the earth?

- W) Paleozoic [*PAY-leo-ZO-ik*]
- X) Cenozoic [*SEN-oh-ZOH-ik*]
- Y) Hadean [*HAY-dee-en*]
- Z) Proterozoic [*proh-tair-oh-ZOH-ik*]

ANSWER: Y) HADEAN

BONUS

11) Earth and Space – *Short Answer* Identify all of the following three structures that are surface features of the moon: 1) Mare Tranquillitatis [*tran-kwilih-TAH-tis*]; 2) Oceanus Procellarum [*proh-sell-AR-um*]; 3) Olympus Mons.

ANSWER: 1 AND 2



TOSS-UP

12) Math – *Short Answer* A rectangle has an area of 200 square meters. It can be divided into 2 congruent squares with one segment. In meters, what is the perimeter of the rectangle?

ANSWER: 60

BONUS

12) Math – *Multiple Choice* There are 50 attendees at a basketball camp. If 40% are male and 30% are left-handed, what is the largest possible number of campers who are right-handed and female?

ANSWER: 30

TOSS-UP

13) Earth and Space – *Short Answer* Arecibo [*ah-ray-SEE-boh*] Observatory contains a 300-meter-wide dish made of aluminum panels that are open to the air. What region of the electromagnetic spectrum is observed there?

ANSWER: RADIO

BONUS

13) Earth and Space – *Short Answer* Identify all of the following three forms of heat transfer that significantly contribute to the movement of heat within the Sun: 1) Conduction; 2) Convection; 3) Radiation.

ANSWER: 2 AND 3

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**TOSS-UP**

14) Physical Science – *Short Answer* What is the adjective for the class of reactions that release thermal energy into their surroundings?

ANSWER: EXOTHERMIC

**BONUS**

14) Physical Science – *Short Answer* Identify all of the following three physical processes that involve particles absorbing energy: 1) Freezing; 2) Boiling; 3) Sublimation.

ANSWER: 2 AND 3

**TOSS-UP**

15) Energy – *Short Answer* Scientists at Fermilab have found evidence that a certain type of particle may not oscillate randomly from one to another of its three possible flavors, resulting in different fractional amounts of these states. What is this type of particle?

ANSWER: NEUTRINO

**BONUS**

15) Energy – *Short Answer* The top quark was first discovered at what particle accelerator located at Fermilab?

ANSWER: TEVATRON



**TOSS-UP**

16) Life Science – *Multiple Choice* During which of the following activities would you expect there to be the highest concentration of lactic acid in the leg muscles of a human?

- W) Sprinting a long distance
- X) Walking a short distance
- Y) Drinking water
- Z) Sleeping

ANSWER: W) SPRINTING A LONG DISTANCE

**BONUS**

16) Life Science – *Short Answer* What drug, found in the 1960s to cause birth defects, was prescribed for morning sickness but was later discovered to contain an isomer that acted as a teratogen [*teh-RAT-oh-jen*]?

ANSWER: THALIDOMIDE

**TOSS-UP**

17) Physical Science – *Multiple Choice* Which of the following purification techniques is most appropriate for separating a mixture of sand and water?

- W) Distillation
- X) Filtration
- Y) Extraction
- Z) Recrystallization

ANSWER: X) FILTRATION

**BONUS**

17) Physical Science – *Short Answer* Rank the following four molecules in increasing order of molecular weight: 1) Carbon dioxide; 2) Carbon monoxide; 3) Water; 4) Hydrogen peroxide.

ANSWER: 3, 2, 4, 1



**TOSS-UP**

18) Math – *Short Answer* Simplify the fraction with numerator 36 minus 54 and denominator 3.

ANSWER: -6

**BONUS**

18) Math – *Short Answer* For the function  $f$  of  $x = x^2 - 10$ , evaluate  $f$  of open parenthesis  $2a$  close parenthesis minus  $2f$  of  $a$  when  $a = 6$ .

ANSWER: 82

**TOSS-UP**

19) Earth and Space – *Multiple Choice* The San Andreas Fault in California is what type of fault?

- W) Compression
- X) Normal
- Y) Reverse
- Z) Strike-slip

ANSWER: Z) STRIKE-SLIP

**BONUS**

19) Earth and Space – *Short Answer* What number denotes the most damaging tornado strength on the Enhanced Fujita scale?

ANSWER: 5



**TOSS-UP**

20) Life Science – *Short Answer* What portion of the endoplasmic reticulum [*reh-TIK-yoo-lum*] does not have ribosomes [*RYE-beh-sohms*] on the surface?

ANSWER: SMOOTH (ACCEPT: SMOOTH ER, SMOOTH ENDOPLASMIC RETICULUM)

**BONUS**

20) Life Science – *Short Answer* Identify all of the following three organelles that both plants and animals possess: 1) Mitochondrion; 2) Chloroplast; 3) Nucleus.

ANSWER: 1 AND 3

**TOSS-UP**

21) Math – *Multiple Choice* A wolf travels 6 miles in 7 hours. If it continues at that rate, which of the following is closest to the distance, in miles, it would travel in 100 hours?

- W) 80
- X) 85
- Y) 90
- Z) 95

ANSWER: X) 85

**BONUS**

21) Math – *Short Answer* A bag contains 50 identically-sized marbles. Exactly 10% are purple, 20% are blue, 30% are orange, and the rest are red. What is the probability of randomly selecting first a blue marble, replacing it, and then selecting a red one?

ANSWER: 8% (ACCEPT: 2/25, 0.08)

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TOSS-UP

22) Life Science – *Short Answer* What general term describes glands that secrete hormones into the bloodstream?

ANSWER: ENDOCRINE

BONUS

22) Life Science – *Short Answer* Cells contain a network of structural fibers that enable them to maintain their shape and to move. What is this network called?

ANSWER: CYTOSKELETON

TOSS-UP

23) Physical Science – *Short Answer* James Chadwick proposed that the nucleus contains not only protons, but what other subatomic particles?

ANSWER: NEUTRONS

BONUS

23) Physical Science – *Short Answer* Identify all of the following three statements that are true of forces:

1) An object in orbit around the Earth is no longer experiencing Earth's gravity; 2) If an object is at rest, there are no forces acting upon it; 3) Forces can only be applied via contact.

ANSWER: NONE