

## ROUND 11A

---

### TOSS-UP

1) Physical Science – *Short Answer* What subatomic particles are hadrons, such as protons and neutrons, composed of?

ANSWER: QUARKS

### BONUS

1) Physical Science – *Short Answer* An alpha particle is equivalent to the nucleus of what element?

ANSWER: HELIUM

~~~~~

### TOSS-UP

2) Energy – *Multiple Choice* In the most common type of geothermal power plant, what rotates the turbines?

- W) Steam
- X) Water
- Y) Ice
- Z) Hot air

ANSWER: W) STEAM

### BONUS

2) Energy – Artificial photosynthesis is being explored as a new type of renewable energy. What is the name of the second, reduction stage of photosynthesis?

ANSWER: CALVIN-BENSON CYCLE (ACCEPT LIGHT-INDEPENDENT REACTIONS)

### TOSS-UP

3) Math – *Short Answer* Solve the following equation for  $x$ :  $-2x^2 + 2 = 0$ .

ANSWER: 1 AND -1 (MUST PROVIDE BOTH ANSWERS)

### BONUS

3) Math – *Short Answer* A right circular cone has volume 72 cubic inches. A second cone has half the radius and three times the height of the first cone. In cubic inches, what is the volume of the second cone?

ANSWER: 54

~~~~~

### TOSS-UP

4) Earth and Space – *Multiple Choice* Where on an Hertzsprung-Russel diagram would one find a red supergiant?

- W) Bottom left
- X) Bottom right
- Y) Top left
- Z) Top right

ANSWER: Z) TOP RIGHT

### BONUS

4) Earth and Space – *Multiple Choice* What is the term for a water-bearing layer of permeable, underground rock?

- W) Aquifer
- X) Aquitard
- Y) Fjord
- Z) Clay

ANSWER: W) AQUIFER

### TOSS-UP

5) General Science – *Multiple Choice* What is the study of woody plants?

- W) Botany
- X) Horticulture
- Y) Dendrology
- Z) Mycology

ANSWER: Y) DENDROLOGY

### BONUS

5) General Science – *Short Answer* In photosynthesis, the energy from light is used to split what molecule?

ANSWER: WATER

---

### TOSS-UP

6) Life Science – *Short Answer* What term is used by biologists to describe an organism's appearance or observable traits?

ANSWER: PHENOTYPE

### BONUS

6) Life Science – *Short Answer* What muscle is responsible for extending the arm at the elbow?

ANSWER: TRICEPS BRACHII (ACCEPT: TRICEPS)

**TOSS-UP**

7) Math – *Short Answer* What is the area of the smallest possible square that contains a circle of radius 5?

ANSWER: 100

**BONUS**

7) Math – *Short Answer* What is the area of a right triangle with hypotenuse 10 and one leg of length 4?

ANSWER: 4 times the square root of 21



**TOSS-UP**

8) Earth and Space – *Multiple Choice* What rock texture is characterized by broken fragments of older rocks?

- W) Foliated
- X) Nonfoliated
- Y) Clastic
- Z) Bioturbated

ANSWER: Y) CLASTIC

**BONUS**

8) Earth and Space – *Short Answer* Identify all of the following three objects that are known to have a dipolar magnetic field: 1) Earth; 2) Jupiter; 3) Earth's moon.

ANSWER: 1 AND 2

### TOSS-UP

9) Energy – *Short Answer* What type of nuclear reactor produces fissile fuel as a waste product?

ANSWER: BREEDER REACTORS

### BONUS

9) Energy – *Short Answer* One major trouble with using absolute ethanol as a fuel source is that ethanol forms an azeotrope with what ubiquitous liquid?

ANSWER: WATER



### TOSS-UP

10) Life Science – *Multiple Choice* Which of the following is the region of the body where the thyroid gland is located?

- W) Neck
- X) Abdomen
- Y) Brain
- Z) Arm pit

ANSWER: W) NECK

### BONUS

10) Life Science – *Multiple Choice* Which of the following is an example of metamorphosis?

- W) A rabbit giving birth to eight young
- X) A bumble bee larva forming a puparium and emerging as a mature adult
- Y) A baby bird emerging from the egg
- Z) A stink bug transitioning through multiple instars eventually becoming a mature adult

ANSWER: X) A BUMBLE BEE LARVA FORMING A PUPARIUM AND EMERGING AS A MATURE ADULT

### TOSS-UP

11) General Science – *Multiple Choice* Cell membranes are described as fluid mosaic models consisting of proteins embedded in a bilayer of phospholipids. Which of the following components of a plant cell do NOT contain two of these bilayers?

- W) Chloroplast
- X) Mitochondria
- Y) Endoplasmic reticulum
- Z) Nucleus

ANSWER: Y) ENDOPLASMIC RETICULUM

### BONUS

11) General Science – *Short Answer* Johannes Kepler's laws of planetary motion were based upon observations of what planet?

ANSWER: MARS



### TOSS-UP

12) Physical Science – *Short Answer* Identify all of the following three substances that are considered basic: 1) Vinegar; 2) Ammonia; 3) Milk.

ANSWER: 2

### BONUS

12) Physical Science – *Short Answer* At what temperature do the Celsius and Fahrenheit scales have the same value?

ANSWER: NEGATIVE 40

### TOSS-UP

13) Earth and Space – *Multiple Choice* What type of fault is characterized by two tectonic plates that slide past one another horizontally?

- W) Transform fault
- X) Normal fault
- Y) Reverse fault
- Z) Fracture zone

ANSWER: W) TRANSFORM FAULT

### BONUS

13) Earth and Space – *Multiple Choice* In which of the following locations could a hurricane never develop?

- W) North Pacific
- X) North Atlantic
- Y) South Pacific
- Z) Equator

ANSWER: Z) EQUATOR

~~~~~

### TOSS-UP

14) Life Science – *Multiple Choice* Which of the following best describes the relationship between epiphytes and the trees they live on?

- W) Mutualism
- X) Commensalism
- Y) Amensalism
- Z) Parasitism

ANSWER: X) COMMENSALISM

### BONUS

14) Life Science – *Short Answer* Identify all of the following three choices that arise, directly or indirectly, from meristematic activity: 1) Leaves; 2) Dermal tissue; 3) Xylem.

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

### TOSS-UP

15) Physical Science – *Multiple Choice* Which of the following standard units is defined in terms of a physical object?

- W) Kilogram
- X) Meter
- Y) Second
- Z) Liter

ANSWER: W) KILOGRAM

### BONUS

15) Physical Science – *Multiple Choice* Two physics students can push on a box of mass  $M$  and give it acceleration  $A$ . How many students would be required to give a box of  $0.5M$  an acceleration of  $3A$ ?

- W) 2
- X) 3
- Y) 4
- Z) 6

ANSWER: X) 3

~~~~~

### TOSS-UP

16) General Science – *Short Answer* In many drugs, hydrogens are replaced with what element that is similar in size to hydrogen but is much more electronegative?

ANSWER: FLUORINE

### BONUS

16) General Science – *Multiple Choice* Which of the following statements about the magnetic north pole is NOT true?

- W) It is currently in the same place as the geographic north pole
- X) It is constantly moving to the north-west
- Y) It is south of the geographic north pole
- Z) It was once the magnetic south pole, and will likely be again

ANSWER: W) IT IS CURRENTLY IN THE SAME PLACE AS THE GEOGRAPHIC NORTH POLE

**TOSS-UP**

17) Math – *Short Answer* What is the greatest common factor of 36 and 48?

ANSWER: 12

**BONUS**

17) Math – *Short Answer* The base-six numeral 124 [*one-two-four*] is equivalent to what in base 10?

ANSWER: 52



**TOSS-UP**

18) Energy – *Short Answer* Order the following four types of coal from greatest to least in energy density: 1) Subbituminous; 2) Anthracite; 3) Lignite; 4) Bituminous.

ANSWER: 2, 4, 1, 3

**BONUS**

18) Energy – *Short Answer* A 100-watt lightbulb is left on between 8:00 am and 5:00 pm. How many kilowatt-hours of energy were consumed?

ANSWER: 0.9

### TOSS-UP

19) Math – *Short Answer* Two jokers are inserted into a standard 52-card deck. If one card is drawn at random, what is the probability that a joker is drawn?

ANSWER: 1/27

### BONUS

19) Math – *Short Answer* To the nearest whole number, what is the slant height of a right circular cone with radius 8 and a height 4?

ANSWER: 9

~~~~~

### TOSS-UP

20) Earth and Space – *Multiple Choice* Which of the following types of magmas has the greatest percentage of dissolved gas?

- W) Ultramafic
- X) Basaltic
- Y) Andesitic
- Z) Rhyolitic

ANSWER: Z) RHYOLITIC

### BONUS

20) Earth and Space – *Multiple Choice* What layer of the Sun's atmosphere is hidden during totality?

- W) Corona
- X) Chromosphere
- Y) Photosphere
- Z) Solar wind

ANSWER: Y) PHOTOSPHERE

### TOSS-UP

21) Life Science – *Short Answer* What is the term for the fluid inside of the chloroplast?

ANSWER: STROMA

### BONUS

21) Life Science – *Multiple Choice* Which of the following is the causative agent for some cases of familial fatal insomnia, Creutzfeld-Jacob disease, and kuru?

- W) Bacteria
- X) Virus
- Y) Prion [*pry-on*]
- Z) Protist

ANSWER: Y) PRION

---

### TOSS-UP

22) Physical Science – *Short Answer* What is the momentum, in newton seconds, of a 15 kilogram object moving at 13 meters per second?

ANSWER: 195

### BONUS

22) Physical Science – *Short Answer* Giving your answers in scientific notation to two significant figures, how many atoms of nitrogen and oxygen, respectively, are found in one mole of dinitrogen tetraoxide?

ANSWER: NITROGEN:  $1.2 \times 10^{24}$  OXYGEN:  $2.4 \times 10^{24}$

### **TOSS-UP**

23) General Science – *Short Answer* In an experiment on the effects of sugar on rat hyperactivity, rats in group 1 are given plain water, while rats in group 2 are given sugar water. What is the name for group 1?

ANSWER: CONTROL

### **BONUS**

23) General Science – *Short Answer* With what celestial bodies is Hawking radiation associated?

ANSWER: BLACK HOLES