

## Round 10

### 1. PHYSICS

#### Toss Up: Short Answer

What is the magnitude of the magnetic force caused by an electric current of 10 Amperes flowing perpendicular to a magnetic field of 10 Teslas through a length of 10 meters?

**Bonus Answer: 1000 Newtons**

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#### Bonus: Multiple Choice

Two point charges are placed on the x-axis. The first has a charge of -3 Coulombs and is placed at 0. The second is placed 3 meters to the right of the first and has a charge of 3 Coulombs. What is the dipole moment of these charges?

- W) 9 Coulomb-Meters in the direction of the positive x-axis
- X) 1 Coulomb-Meters in the direction of the positive x-axis
- Y) 9 Coulomb-Meters in the direction of the negative x-axis
- Z) 1 Coulomb-Meters in the direction of the negative x-axis

**Bonus Answer: W**

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### 2. BIOLOGY

#### Toss Up: Multiple Choice

How many amino acids are there?

- W) 18
- X) 20
- Y) 22
- Z) Too many to count.

**Toss Up Answer: Z**

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#### Bonus: Short Answer

In feet, how long is the small intestine?

**Bonus Answer: 20**

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### 3. MATHEMATICS

#### Toss Up: Short Answer

If the log of n is 10, what is the log of 100n?

**Bonus Answer: 12**

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#### Bonus: Short Answer

How many ways are there to seat 5 people around a circular table, if rotations are ignored?

**Bonus Answer: 24**

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### 4. BIOLOGY

#### Toss Up: Multiple Choice

How are insects classified from other arthropods?

- W) The body is divided into four segments.
- X) They are parasites.
- Y) The body is divided into three segments.
- Z) They require water to survive.

**Toss Up Answer: Y**

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**Bonus: Short Answer**

What is the only molecule that exists in all three states of matter on Earth?

**Bonus Answer: Water**

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## 5. CHEMISTRY

**Toss Up: Short Answer**

What is the hybridization of the molecular bonds of Ammonia?

**Bonus Answer: sp<sup>3</sup>**

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**Bonus: Short Answer**

Which element is most likely to act as an ideal gas?

**Bonus Answer: Hydrogen (Accept: H)**

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## 6. CHEMISTRY

**Toss Up: Short Answer**

What is the only letter that does not appear in the Periodic Table of Elements?

**Bonus Answer: J**

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**Bonus: Short Answer**

Which element has the largest atomic radius?

**Bonus Answer: Cesium (Accept: Cs)**

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## 7. ENERGY

**Toss Up: Multiple Choice**

Which country generates the highest percentage of its energy from nuclear power?

W) France

X) China

Y) Britain

Z) Denmark

**Toss Up Answer: W**

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**Bonus: Short Answer**

List the operating temperatures from lowest to highest of these types of fuel cells

PEMFC

PAFC

MCFC

SOFC

**Bonus Answer: 1,2,3,4**

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## 8. PHYSICS

**Toss Up: Short Answer**

What is the total voltage of a circuit with a total current of 10 Amperes running through four resistors placed in parallel, each with a resistance of 4 Ohms?

**Bonus Answer: 10 Volts**

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**Bonus: Short Answer**

What does the abbreviation MOSFET stand for?

**Bonus Answer: Metal-Oxide-Semiconductor Field-Effect Transistor**

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## 9. MATHEMATICS

### Toss Up: Short Answer

If the first term in an arithmetic sequence is 2 and the third term is 6, find the 10th term.

**Bonus Answer: 20**

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### Bonus: Short Answer

Compute the sum of the first 100 positive integers.

**Bonus Answer: 5050**

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## 10. BIOLOGY

### Toss Up: Multiple Choice

What is MYC?

W) Holoenzyme

X) Oncogene

Y) DNA

Z) Scientist name

**Toss Up Answer: X**

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### Bonus: Short Answer

What is the pacemaker of the heart?

**Bonus Answer: SA (sinoatrial) node**

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## 11. EARTH and SPACE

### Toss Up: Multiple Choice

Which of the following minerals breaks in parallel sheets?

W) Pyroxene

X) Halite

Y) Muscovite

Z) Calcite

**Toss Up Answer: Y**

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### Bonus: Multiple Choice

During a supernova, what percentage of the total energy released is composed of neutrinos?

W) 10

X) 50

Y) 75

Z) 99

**Bonus Answer: Z**

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## 12. CHEMISTRY

### Toss Up: Short Answer

What is the coordination number of  $\text{Ag}_2\text{C}_2\text{O}_4$  (Silver Oxalate)?

**Bonus Answer: 2**

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### Bonus: Short Answer

What two elements are liquid at room temperature?

**Bonus Answer: Bromine and Mercury (Accept: Br and Hg)**

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### 13. EARTH and SPACE

#### Toss Up: Short Answer

Order the four gas giants in size from the largest to the smallest.

**Bonus Answer: Jupiter, Saturn, Uranus, Neptune**

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#### Bonus: Multiple Choice

Which one of these statements about Neptune's moon, Triton, is true?

- W) It orbits in retrograde motion.
- X) Its orbit is highly eccentric.
- Y) It fractured billions of years ago and reformed.
- Z) It does not have an atmosphere.

**Bonus Answer: W**

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### 14. EARTH and SPACE

#### Toss Up: Multiple Choice

What upwelling ocean current off the coast of South America causes the most productive marine ecosystem in the world?

- W) Gulf Stream
- X) South Pacific Gyre
- Y) Humboldt Current
- Z) Cromwell Current

**Toss Up Answer: Y**

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#### Bonus: Short Answer

What compound makes Neptune blue?

**Bonus Answer: Methane**

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### 15. MATHEMATICS

#### Toss Up: Short Answer

Find the perimeter of a right triangle with legs 11 and 60.

**Bonus Answer: 132**

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#### Bonus: Short Answer

In a 15-75-90 degrees right triangle with hypotenuse 4, what are the lengths of the shorter and longer leg, respectively? Exact answers please.

**Bonus Answer: radical 6 - radical 2, radical 6 + radical 2**

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### 16. CHEMISTRY

#### Toss Up: Short Answer

What is the stoichiometric point when exactly enough titrant is used to react?

**Bonus Answer: Equivalence Point**

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#### Bonus: Short Answer

What is the point in a titration at which an indicator changes color?

**Bonus Answer: Endpoint**

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### 17. MATHEMATICS

#### Toss Up: Short Answer

If Bruce can do a job in 3 hours, and Clark can do the same job in 4 hours, how long, in hours, will it take them to do

the job if they work together? You may leave your answer as a fraction.

**Bonus Answer: 12/7**

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**Bonus: Short Answer**

What is the eccentricity of an ellipse with  $a = 5$  and  $b = 4$ ?

**Bonus Answer: 3/5**

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## 18. PHYSICS

**Toss Up: Short Answer**

What is the unit of a Poynting vector?

**Bonus Answer: Watt/meter<sup>2</sup> (accept equivalent variations)**

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**Bonus: Short Answer**

What's the order of magnitude of a Poynting vector of an EM wave, where the amplitude of the electric field is 300 N/C (newton per coulomb) and the amplitude of the magnetic field is 400 tesla?

**Bonus Answer: 11**

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## 19. EARTH and SPACE

**Toss Up: Short Answer**

The Kappa Cygnids and the Northern Delta Aquarids are names for what phenomena?

**Bonus Answer: Meteor Showers**

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**Bonus: Short Answer**

What substance is responsible for Neptune's blue-green color?

**Bonus Answer: Methane gas (accept methane)**

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## 20. BIOLOGY

**Toss Up: Multiple Choice**

What is another name for the cell body of neurons?

W) Stroma

X) Soma

Y) Cellulite

Z) Thylakoid

**Toss Up Answer: X**

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**Bonus: Short Answer**

What molecule do Ras protein's hydrolyze?

**Bonus Answer: GTP**

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## 21. PHYSICS

**Toss Up: Short Answer**

What is the equivalent capacitance of three Capacitors - each of 9 micro Farad Capacitance - placed in parallel?

**Bonus Answer: 27 micro Farads**

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**Bonus: Short Answer**

Determine the amount of charge stored on either plate of a capacitor of 4 micro Farads when connected across a 12 Volt battery.

**Bonus Answer: 48 micro Coulombs,  $4.8 \times 10^{-5}$  Coulombs**

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## 22. BIOLOGY

**Toss Up: Multiple Choice**

Which part of the brain is associated with coordinated movement?

- W) Cerebrum
- X) Cerebellum
- Y) Diencephalon
- Z) Corpus Callosum

**Toss Up Answer: X**

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**Bonus: Short Answer**

What is the major excitatory neurotransmitter in the brain?

**Bonus Answer: Glutamate**

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**23. CHEMISTRY****Toss Up: Multiple Choice**

For which of the following can the K<sub>sp</sub> values be compared to determine relative molar solubilities?

- W) Ag<sub>2</sub>CrO<sub>4</sub> and AgBr (Read as: Silver Chromate and Silver Bromide)
- X) Ag<sub>2</sub>SO<sub>4</sub> and CaSO<sub>4</sub> (Read as: Silver Sulfate and Calcium Sulfate)
- Y) PbCl<sub>2</sub> and PbSO<sub>4</sub> (Read as: Lead two Chloride and Lead two Sulfate)
- Z) ZnS and AgI (Read as: Zinc Sulfide and Silver Iodide)

**Toss Up Answer: Z**

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**Bonus: Short Answer**

What is the molecular geometry associated with a coordination number of 6?

**Bonus Answer: Octahedral**

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**24. CHEMISTRY****Toss Up: Multiple Choice**

When the reaction of Silver Nitrate (aqueous) and Sodium Chloride (aqueous) goes to completion, what is formed?

- W) A Gas
- X) Water
- Y) An Acid
- Z) A Precipitate

**Toss Up Answer: Z**

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**Bonus: Multiple Choice**

When does the value of pH equal the value of pK<sub>a</sub>?

- W) when [HA]=[A<sup>-</sup>] (Read as: the molarity of the conjugate base equals the molarity of the conjugate acid)
- X) at the end point of a titration
- Y) everywhere in the buffer region
- Z) in the Henderson-Hasselbach equation

**Bonus Answer: W**

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**25. EARTH and SPACE****Toss Up: Short Answer**

All of Saturn's moons are composed predominantly of what substance?

**Bonus Answer: Ice**

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**Bonus: Short Answer**

What are the scientific names for the two regions of a sunspot?

**Bonus Answer: Umbra and penumbra**

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