

## Round 9

### 1. PHYSICS

#### Toss Up: Short Answer

What is the S.I. unit for Inductance?

**Bonus Answer: Henry**

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#### Bonus: Multiple Choice

Which law states that for any closed loop path, the sum of the length elements times the magnetic field in the direction of the length element is equal to the permeability times the electric current enclosed in the loop?

- W) Faraday's Law of Induction
- X) Kirchhoff's Law
- Y) Coulomb's Law
- Z) Ampere's Law

**Bonus Answer: Z**

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### 2. PHYSICS

#### Toss Up: Short Answer

What is the metric unit for mass?

**Bonus Answer: Kilogram (kg)**

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#### Bonus: Short Answer

What is the SI unit of force?

**Bonus Answer: Newton**

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### 3. PHYSICS

#### Toss Up: Multiple Choice

Any change in the magnetic environment of a coil of wire will cause a voltage (emf) to be "induced" in the coil. Which law summarizes the ways in which voltage can be generated using this method?

- W) Ohm's Law
- X) Faraday's Law
- Y) Pascal's Law
- Z) Coulomb's Law

**Toss Up Answer: X**

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#### Bonus: Short Answer

A magnet is brought close to a flat square coil of 50 loops. The coil is .2 meters on each side, and the magnetic field passing through the coil increased uniformly from 3 Tesla to 8 Tesla in 4 seconds. While that change in magnetic field takes place, using correct signs, what is the induced emf in the coil?

**Bonus Answer: -2.5 Volts**

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### 4. PHYSICS

#### Toss Up: Multiple Choice

The binding energy of a nucleus is the energy that must be supplied to:

- W) Remove a nucleon
- X) Remove an alpha particle
- Y) Remove a beta particle
- Z) Separate the nucleus into its constituent nucleons

**Toss Up Answer: Z**

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**Bonus: Multiple Choice**

A radium atom,  $^{226}\text{Ra}$  emits an alpha particle. The number of protons in the resulting atom is

- W) 84
- X) 85
- Y) 86
- Z) 88

**Bonus Answer: W**

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**5. PHYSICS****Toss Up: Multiple Choice**

An acceptor replacement atom in silicon might have how many electrons in its outer shell?

- W) 3
- X) 4
- Y) 5
- Z) 6

**Toss Up Answer: W**

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**Bonus: Multiple Choice**

When a forward bias is applied to a p-n junction the concentration of electrons on the p side:

- W) increases slightly
- X) decreases slightly
- Y) increases dramatically
- Z) decreases dramatically

**Bonus Answer: Y**

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**6. MATHEMATICS****Toss Up: Short Answer**

What is the limit as  $x$  approaches 0 of  $x^x$ ?

**Bonus Answer: Does not exist. (NOT 1)**

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**Bonus: Short Answer**

Let  $f(x)$  be a function with no real roots. If  $f(3) = 4$ , then in what quadrants can  $f(x)$  be in?

**Bonus Answer: All four quadrants (b.c. there's no specification  $f$  has to be continuous)**

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**7. MATHEMATICS****Toss Up: Multiple Choice**

Unknown to be algebraic or transcendental

- W) Rational
- X) Algebraic irrational
- Y) Transcendental
- Z) Impossible to tell

**Toss Up Answer: Y**

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**Bonus: Short Answer**

Let  $f(x) = ax^7 + bx^3 + cx - 5$ , where  $a, b$ , and  $c$  are real numbers. What is the value of  $f(7)$  if  $f(-7) = 8$ ?

**Bonus Answer: -18**

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## 8. MATHEMATICS

### Toss Up: Multiple Choice

Which of the following distances is longest?

W) Half a kilometer

X) Half a decimeter

Y) 600 meters

Z) 40 decameters

**Toss Up Answer: Y**

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### Bonus: Short Answer

What is the name of a line that intersects two or more coplanar lines in different points?

**Bonus Answer: Transversal**

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## 9. MATHEMATICS

### Toss Up: Short Answer

Completely expand  $(x-2y)^3$

**Bonus Answer:  $x^3 - 6x^2y + 12xy^2 - 8y^3$**

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### Bonus: Short Answer

What is the sum of all the terms in the seventh row of Pascal's triangle?

**Bonus Answer: 128**

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## 10. 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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## 11. BIOLOGY

### Toss Up: Multiple Choice

Which of the following is most closely related to sharks?

W) Trout

X) Blue Gill

Y) Manta Ray

Z) Octopus

**Toss Up Answer: Y**

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### Bonus: Short Answer

Who invented the polio vaccine?

**Bonus Answer: Jonas Salk**

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## 12. BIOLOGY

**Toss Up: Multiple Choice**

Which of these human diseases is not caused by roundworms?

W) Filariasis

X) Ancylostomiasis

Y) Ascariasis

Z) Typhoid fever

**Toss Up Answer: Z**

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**Bonus: Short Answer**

What hormone causes vesicles carrying aquaporins to embed in the membranes of cells in the collecting duct?

**Bonus Answer: ADH (Antidiuretic hormone)**

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**13. BIOLOGY**

**Toss Up: Multiple Choice**

How many cotyledons do edicts have?

W) 5

X) 1

Y) 0

Z) 2

**Toss Up Answer: Z**

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**Bonus: Short Answer**

How many stages in a butterfly's life cycle?

**Bonus Answer: Four (4)**

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**14. CHEMISTRY**

**Toss Up: Short Answer**

Which element is a dark red liquid at room temperature?

**Bonus Answer: Bromine**

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**Bonus: Short Answer**

What is the combining capacity of Calcium?

**Bonus Answer: 2**

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**15. CHEMISTRY**

**Toss Up: Short Answer**

What is the name of a mixture of metals?

**Bonus Answer: Alloy**

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**Bonus: Short Answer**

What is the name given to all Group 16 elements?

**Bonus Answer: Chalcogens**

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**16. 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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## 17. 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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## 18. 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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## 19. 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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## 20. CHEMISTRY

Toss Up: Multiple Choice

For which of the following can the  $K_{sp}$  values be compared to determine relative molar solubilities?

W)  $\text{Ag}_2\text{CrO}_4$  and  $\text{AgBr}$  (Read as: Silver Chromate and Silver Bromide)

X)  $\text{Ag}_2\text{SO}_4$  and  $\text{CaSO}_4$  (Read as: Silver Sulfate and Calcium Sulfate)

Y)  $\text{PbCl}_2$  and  $\text{PbSO}_4$  (Read as: Lead two Chloride and Lead two Sulfate)

Z)  $\text{ZnS}$  and  $\text{AgI}$  (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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## 21. EARTH and SPACE

Toss Up: Short Answer

What body is the most volcanic in the solar system?

Bonus Answer: Io

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Bonus: Short Answer

What effect gives Io the energy for this volcanic activity?

Bonus Answer: Tidal heating (accept: tidal friction, tidal forces, tidal forces by Jupiter, tidal forces by Jupiter and its

moons)

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## 22. EARTH and SPACE

**Toss Up: Short Answer**

From what body do astronomers believe most comets originate?

**Bonus Answer: The Oort Cloud**

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**Bonus: Short Answer**

Which tail of a comet is always directed in the opposite direction of the Sun?

**Bonus Answer: The ion tail (accept: gas tail. Reject dust tail as incorrect.)**

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## 23. EARTH and SPACE

**Toss Up: Short Answer**

Which planet in the solar system has the greatest albedo?

**Bonus Answer: Venus**

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**Bonus: Multiple Choice**

What gas is most abundant in the troposphere of Venus?

- W) Carbon dioxide
- X) Nitrogen
- Y) Sulfur dioxide
- Z) Methane

**Bonus Answer: W**

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## 24. EARTH and SPACE

**Toss Up: Multiple Choice**

What is defined to be the distance from the Sun, to a body whose stellar parallax is one arcsecond?

- W) astronomical unit
- X) Schwarzschild radius
- Y) parsec
- Z) light-second

**Toss Up Answer: Y**

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**Bonus: Multiple Choice**

An amateur astronomer observes a star over the course of a year and finds that from January 1 to June 1, the star's position on the celestial sphere shifts by 3 arcseconds. How far is the star from the Earth, to the nearest tenth of a parsec?

- W) 3
- X) 0.3
- Y) 1.5
- Z) 0.7

**Bonus Answer: Z**

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## 25. ENERGY

**Toss Up: Multiple Choice**

A metal coin and a plastic coin are heated to the same temperature. The two coins have the same size and shape, are dropped into the same tub of cold water at the same time, and are left for 30 seconds. Which coin will have the lower

temperature?

W) Metal coin

X) Plastic Coin

Y) Both coins will have the same temperature

Z) Cannot be determined

**Toss Up Answer: W**

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**Bonus: Short Answer**

What is the general name for material that is used to block the flow of heat?

**Bonus Answer: Insulator**

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