

## Round 9

### 1. ENERGY

#### Toss Up: Multiple Choice

16) Which uranium oxide is most commonly used in light water reactors?

- W) uranium(IV) oxide
- X) uranium(V) oxide
- Y) uranium(VI) oxide
- Z) Yellowcake

Toss Up Answer: W

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#### Bonus: Multiple Choice

If a 1 kg mouse runs at 5 m/s, what is its approximate energy in electronvolts?

- W)  $4.8 \times 10^{-3}$
- X)  $2.9 \times 10^{15}$
- Y)  $7.8 \times 10^{19}$
- Z)  $4.4 \times 10^{22}$

Bonus Answer: Y

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### 2. PHYSICS

#### Toss Up: Multiple Choice

For what major contribution was Albert Einstein awarded the nobel prize in 1921?

- W) Einstein Field Equations
- X) General Theory of Relativity
- Y) Special Theory of Relativity
- Z) Photoelectric Effect

Toss Up Answer: Z

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#### Bonus: Multiple Choice

Which year in Albert Einstein's life is now known as his "annus mirabilis"?

- W) 1905
- X) 1921
- Y) 1915
- Z) 1928

Bonus Answer: W

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### 3. PHYSICS

#### Toss Up: Multiple Choice

Why do the bubbles from a freshly opened bottle of champagne grow as they rise to the surface?

- W) Fluid pressure falls as the bubble rises in the glass.
- X) The bubble continues to accumulate dissolved gas molecules as it moves through the champagne.
- Y) The bubble does expansive work on the champagne as it loses potential energy.
- Z) Friction with the champagne heats the gas inside the bubble.

Toss Up Answer: X

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#### Bonus: Multiple Choice

The bubbles in a glass of champagne form a steady stream and leave the surface of the glass in regular time intervals. Why is this?

- W) It takes a constant amount of time for gas from the air to make it to the growing bubble.
- X) The bubbles occur due to vibrations in the room that have a constant frequency.
- Y) The bubbles rise when the buoyant force exceeds the adhesive force.
- Z) The bubbles form due to pressure waves in the champagne that have a constant wavelength.

**Bonus Answer: Y**

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## 4. BIOLOGY

**Toss Up: Multiple Choice**

Movement of cell against concentration gradient is called

- W) Gradient
- X) Osmosis
- Y) Diffusion
- Z) Active Transport

**Toss Up Answer: Z**

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**Bonus: Short Answer**

What is the third most common gas found in the air we breathe?

**Bonus Answer: Argon**

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## 5. CHEMISTRY

**Toss Up: Short Answer**

1)An aqueous solution with amount of of OH<sup>-</sup> ions is greater than that of H<sup>+</sup> ions is what

**Bonus Answer: basic**

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**Bonus: Short Answer**

3)Charles law talks about what?

**Bonus Answer: Hot air rising after being heated**

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## 6. EARTH and SPACE

**Toss Up: Multiple Choice**

What star class is used to characterize the hottest stars?

- W) A
- X) B
- Y) M
- Z) O

**Toss Up Answer: Z**

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**Bonus: Short Answer**

Which two moons are larger than the smallest planet in our solar system?

**Bonus Answer: Ganymede and Titan**

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## 7. MATHEMATICS

**Toss Up: Multiple Choice**

The number  $(\sqrt{2})^{(\sqrt{2})}$  is:

- 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. CHEMISTRY**

**Toss Up: Short Answer**

In the standard notation for a voltaic cell, the double vertical line "||" represents

**Bonus Answer: A standard Hydrogen Electrode (Accept: Hydrogen Electrode)**

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**Bonus: Short Answer**

Approximately how long must a current of 5.0 amperes be maintained to electroplate 60 g of calcium from molten Calcium Chloride (Molar Mass = 111 g/mol)? Answer in hours.

**Bonus Answer: 16 hours**

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**9. PHYSICS**

**Toss Up: Short Answer**

Which law says that the total electric flux of a closed surface is equal to the charge enclosed divided by the permittivity?

**Bonus Answer: Gauss's Law**

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**Bonus: Multiple Choice**

What is the electric permittivity of free space?

- W)  $2.27 \times 10^{(-12)}$  Farads / meters
- X)  $8.85 \times 10^{(-12)}$  Farads / meters
- Y)  $8.99 \times 10^{(9)}$  Farads / meters
- Z)  $6.67 \times 10^{(-11)}$  Farads / meters

**Bonus Answer: X**

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**10. BIOLOGY**

**Toss Up: Multiple Choice**

Ordinary table salt is sodium chloride. What is baking soda?

- W) Potassium chloride
- X) Sodium bicarbonate
- Y) Potassium hydroxide
- Z) Potassium carbonate

**Toss Up Answer: X**

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**Bonus: Short Answer**

What is the fourth most abundant element in the universe in terms of mass?

**Bonus Answer: Carbon**

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## 11. EARTH and SPACE

### Toss Up: Multiple Choice

In which constellation is the closest Cepheid variable to Earth?

W) Ursa Minor

X) Lyra

Y) Carina

Z) Sagittarius

**Toss Up Answer: W**

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### Bonus: Short Answer

Polaris will be further to the north celestial pole in 3000 AD than Altair. What phenomenon is mostly responsible for this?

**Bonus Answer: Precession of the equinoxes**

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## 12. CHEMISTRY

### Toss Up: Short Answer

What is the most common isotope of Hydrogen?

**Bonus Answer: Protium**

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### Bonus: Short Answer

What is the hybridization of carbon atoms in alkanes?

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

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## 13. PHYSICS

### Toss Up: Short Answer

What is a famous impossible result of the classical modeling of blackbody intensity as a function of frequency?

**Bonus Answer: "Ultraviolet Catastrophe"**

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### Bonus: Multiple Choice

What is the classical law that attempts to map blackbody intensity as a function of frequency and leads to "ultraviolet catastrophe"?

W) Henderson-Hasselbalch's Law

X) Rayleigh-Jeans Law

Y) Plank's Law

Z) Kirchhoff Law

**Bonus Answer: X**

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## 14. CHEMISTRY

### Toss Up: Short Answer

Which noble gas is heavier than air?

**Bonus Answer: Xenon (Accept: Xe)**

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### Bonus: Short Answer

What is the mass of Sodium Chloride that is in the average human body? Answer in grams.

**Bonus Answer: 250 grams**

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## 15. EARTH and SPACE

### Toss Up: Short Answer

In approximately 4 billion years, another galaxy is predicted to collide with the Milky Way. What is the name of this galaxy?

**Bonus Answer: Andromeda**

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**Bonus: Multiple Choice**

What is the third most abundant element in the universe?

- W) Helium
- X) Lithium
- Y) Carbon
- Z) Oxygen

**Bonus Answer: Z**

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## 16. 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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## 17. EARTH and SPACE

**Toss Up: Short Answer**

What is the term used to describe silt and mud deposited by a stream during periods of high water?

**Bonus Answer: Alluvial**

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**Bonus: Multiple Choice**

Which radioactive element is generally present in smoke detectors today?

- W) Americium
- X) Radium
- Y) Radon
- Z) Actinium

**Bonus Answer: W**

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## 18. EARTH and SPACE

**Toss Up: Multiple Choice**

Which corner of the H-R diagram would a white dwarf most likely be found?

- W) Upper Left
- X) Lower Left
- Y) Upper Right
- Z) Lower Right

**Toss Up Answer: X**

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**Bonus: Short Answer**

What element is the penultimate element formed in the core of a supergiant?

**Bonus Answer: Silicon**

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## 19. 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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## 20. MATHEMATICS

**Toss Up: Short Answer**

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

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

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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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## 21. BIOLOGY

**Toss Up: Multiple Choice**

What is active transport?

W) Transport of substances through a membrane by means of diffusion

X) Transport without energy consumption

Y) Endocytosis of a substance by a membrane

Z) Transport against a concentration gradient

**Toss Up Answer: Z**

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**Bonus: Short Answer**

Caffeine blocks a certain neurotransmitter whose transmission causes drowsiness. What is the name of this neurotransmitter?

**Bonus Answer: Adenosine**

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## 22. BIOLOGY

**Toss Up: Short Answer**

Where are lipids most commonly found in cells?

**Bonus Answer: Cell Membrane (Accept: Membrane)**

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**Bonus: Short Answer**

Where is mRNA synthesized?

**Bonus Answer: Nucleus**

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## 23. 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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## 24. BIOLOGY

**Toss Up: Multiple Choice**

Researchers in 2015 reported that resistance to a certain antibiotic was found in a growing number of bacteria from meat samples in China. What is the name of this antibiotic that treats Gram-negative bacteria?

- W) Colistin
- X) Carbapenems
- Y) Linezolid
- Z) Vancomycin

**Toss Up Answer: W**

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**Bonus: Short Answer**

What is the name of polymer in bacterial walls not found in Gram-negative bacteria?

**Bonus Answer:**

**Peptidoglycan**

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## 25. MATHEMATICS

**Toss Up: Multiple Choice**

What is the geometric mean of the roots of the polynomial  $2x^3 - 2x^2 - 228x - 432$

- W) 4
- X) 6
- Y) 8
- Z) 10

**Toss Up Answer: X**

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**Bonus: Short Answer**

The first term of an arithmetic sequence is  $x$ , and the  $x$ th term is  $x^2$ . If the common difference is equal to 7, and none of the terms are equal, what is the 12th term of the sequence?

**Bonus Answer: 84**

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