

## Round 9

### 1. 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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### 2. 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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### 3. 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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### 4. 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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## 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. 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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## 7. 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 sums of all the terms in the seventh row of Pascal's triangle?

**Bonus Answer: 128**

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## 8. 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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## 9. 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 Altai. What phenomenon is mostly responsible for this?

**Bonus Answer: Precession of the equinoxes**

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## 10. 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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## 11. 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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## 12. 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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## 13. 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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## 14. 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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## 15. 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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## 16. 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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## 17. 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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## 18. 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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## 19. 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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## 20. 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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## 21. 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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## 22. 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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## 23. 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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**24. 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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**25. 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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