

Round 10

1. MATHEMATICS

Toss Up: Short Answer

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

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

Bonus: Short Answer

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

Bonus Answer: 128

2. 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

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

3. 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

Bonus: Multiple Choice

What is the third most abundant element in the universe?

W) Helium

X) Lithium

Y) Carbon

Z) Oxygen

Bonus Answer: Z

4. 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

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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5. CHEMISTRY

Toss Up: Short Answer

What is the hybridization of the molecular bonds of Ammonia?

Bonus Answer: sp³

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

Bonus: Short Answer

Which element has the largest atomic radius?

Bonus Answer: Cesium (Accept: Cs)

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7. MATHEMATICS

Toss Up: Short Answer

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

Bonus Answer: 12

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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8. 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

Bonus: Multiple Choice

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

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

Bonus Answer: Y

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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. 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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11. 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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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: Multiple Choice

Which of the following minerals breaks in parallel sheets?

- W) Pyroxene
- X) Halite
- Y) Muscovite
- Z) Calcite

Toss Up Answer: Y

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

14. 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

Bonus: Short Answer

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

Bonus Answer:

Peptidoglycan

15. 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

Bonus: Short Answer

In feet, how long is the small intestine?

Bonus Answer: 20

16. 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

Bonus: Short Answer

What does the abbreviation MOSFET stand for?

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

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17. PHYSICS

Toss Up: Short Answer

What is the unit of a Ponyting vector?

Bonus Answer: Watt/meter² (accept equivalent variations)

Bonus: Short Answer

What's the order of magnitude of a Ponyting 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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18. 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

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 batter.

Bonus Answer: 48 micro Coulombs, 4.8×10^{-5} Coulombs

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19. 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

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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20. CHEMISTRY

Toss Up: Short Answer

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

Bonus Answer: Equivalence Point

Bonus: Short Answer

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

Bonus Answer: Endpoint

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21. 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

Bonus: Short Answer

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

Bonus Answer: Water

22. BIOLOGY

Toss Up: Multiple Choice

What is MYC?

- W) Holoenzyme
X) Oncogene
Y) DNA
Z) Scientist name

Toss Up Answer: X

Bonus: Short Answer

What is the pacemaker of the heart?

Bonus Answer: SA (sinoatrial) node

23. 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

Bonus: Short Answer

What molecule do Ras protein's hydrolyze?

Bonus Answer: GTP

24. CHEMISTRY

Toss Up: Multiple Choice

For which of the following can the Ksp values be compared to determine relative molar solubilities?

- W) Ag_2CrO_4 and AgBr (Read as: Silver Chromate and Silver Bromide)
X) Ag_2SO_4 and CaSO_4 (Read as: Silver Sulfate and Calcium Sulfate)
Y) PbCl_2 and PbSO_4 (Read as: Lead two Chloride and Lead two Sulfate)
Z) ZnS and AgI (Read as: Zinc Sulfide and Silver Iodide)

Toss Up Answer: Z

Bonus: Short Answer

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

Bonus Answer: Octahedral

25. 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

Bonus: Multiple Choice

When does the value of pH equal the value of pKa?

W) when $[HA]=[A^-]$ (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
