

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

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

2. 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

3. 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

4. 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

5. 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

6. 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

Bonus: Short Answer

Compute the sum of the first 100 positive integers.

Bonus Answer: 5050

7. MATHEMATICS

Toss Up: Short Answer

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

Bonus Answer: 132

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

8. 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

Bonus: Short Answer

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

Bonus Answer: 3/5

9. 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

10. 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

11. 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

12. 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

13. 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

Bonus: Short Answer

What is the major excitatory neurotransmitter in the brain?

Bonus Answer: Glutamate

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14. CHEMISTRY

Toss Up: Short Answer

What is the hybridization of the molecular bonds of Ammonia?

Bonus Answer: sp³

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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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15. 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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16. CHEMISTRY

Toss Up: Short Answer

What is the coordination number of Ag₂C₂O₄ (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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17. 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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18. CHEMISTRY

Toss Up: Multiple Choice

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

W) Ag₂CrO₄ and AgBr (Read as: Silver Chromate and Silver Bromide)

X) Ag₂SO₄ and CaSO₄ (Read as: Silver Sulfate and Calcium Sulfate)

Y) PbCl₂ and PbSO₄ (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

19. 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

20. 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

21. 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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22. 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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23. 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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24. 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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25. 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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