

Round 1

1. PHYSICS

Toss Up: Multiple Choice

NMR spectroscopy is

- W) diffraction
- X) absorption
- Y) radiation
- Z) emission

Toss Up Answer: X

Bonus: Multiple Choice

NMR is based on

- W) nuclear fission
- X) charge of nucleus
- Y) magnetically moment of the nucleus
- Z) electrical moment of the nucleus

Bonus Answer: Y

2. PHYSICS

Toss Up: Multiple Choice

The force acting between two point charges can be computed using which of the following laws?

- W) Ohm's Law
- X) Ampere's Law
- Y) Coulomb's Law
- Z) Newton's Second Law

Toss Up Answer: Y

Bonus: Short Answer

Five volts are applied across the plates of a parallel plate capacitor. The distance of separation of the plates is .02 meters. What is the magnitude of the electric field inside the capacitor?

Bonus Answer: 250 volts per meter

3. PHYSICS

Toss Up: Multiple Choice

The constant potential difference across a 2 ohm resistor is 20 volts. How many watts of power are dissipated by this resistor?

- W) 150 watts
- X) 200 watts
- Y) 250 watts
- Z) 2000 watts

Toss Up Answer: X

Bonus: Short Answer

The potential difference across a 4 ohm resistor is 20 volts. Assuming that all of the energy dissipated by this resistor is in the form of heat, how many joules of heat are radiated in 10 seconds?

Bonus Answer: 1000 J (joules)

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4. PHYSICS

Toss Up: Short Answer

The constant potential difference across a 2 ohm resistor is 20 volts. How many watts of power are dissipated by this resistor?

Bonus Answer: 200 Watts

Bonus: Multiple Choice

Which of the following scientists is responsible for the exclusion principle which states that two objects may NOT occupy the same space at the same time? Was it:

W) Heisenberg

X) Bohr

Y) Teller

Z) Pauli

Bonus Answer: Z

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5. PHYSICS

Toss Up: Short Answer

What is the name of the first American physicist to win two Nobel prizes? (very random lol)

Bonus Answer: John Bardeen (can accept just last name?)

Bonus: Multiple Choice

If the resultant force acting on a body of constant mass is zero, the body's momentum is:

W) constant

X) 0

Y) increasing

Z) decreasing

Bonus Answer: W

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6. MATHEMATICS

Toss Up: Short Answer

Using an x-y coordinate axis, a parabola is represented by the equation $x^2 = 6y$. The vertex of this parabola is at what coordinate point?

Bonus Answer: (0,0)

Bonus: Short Answer

For a right triangle, the $\sin(A)$ is $\frac{3}{5}$. To what value is the $\tan(A)$ equal?

Bonus Answer: $\frac{3}{4}$

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7. MATHEMATICS

Toss Up: Short Answer

What is the volume of a sphere of radius "R"?

Bonus Answer: (4/3) p R3

Bonus: Short Answer

Using an x-y coordinate axis, a parabola is given by the equation $y = x^2$. Give the x-y coordinates of the focal point for this parabola.

Bonus Answer: (0, 1/4)

8. MATHEMATICS

Toss Up: Multiple Choice

Donald Trump has $10x+5$ apples where $x=3$. How many apples does he have if he eats two of them?

- W) 35
- X) 39
- Y) 30
- Z) 33

Toss Up Answer: Z

Bonus: Short Answer

Donald Trump has a tower consisting of 0.00405×10^{45} grams of gold. How many kilograms of gold is in his tower? Express in scientific notation.

Bonus Answer: 4.05×10^{39} (kilograms of gold)

9. MATHEMATICS

Toss Up: Multiple Choice

$3^{12} = 27^x$. What is the value of x?

- W) $x=12$
- X) $x=4$
- Y) $x=6$
- Z) $x=3$

Toss Up Answer: X

Bonus: Short Answer

$3^{12} + 3^{11} + 3^{10} = b \cdot 3^a$ What is the positive difference between the product and the sum of a and b?

Bonus Answer: 107

10. BIOLOGY

Toss Up: Multiple Choice

The field of biostatistics is also called

- W) statistics in biology
- X) bionemerology
- Y) biometry
- Z) Both W and X

Toss Up Answer: Y

Bonus: Multiple Choice

The word [must be said in a German accent] "statistik" in German means:

- W) calculation
- X) government

- Y) maths
- Z) classification

Bonus Answer: X

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11. BIOLOGY

Toss Up: Multiple Choice

Proteomics is the study of

- W) sets of proteins
- X) sets of proteins in a specific organelle
- Y) entire set of expressed proteins in a cell
- Z) none of these

Toss Up Answer: Y

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Bonus: Multiple Choice

The computational methodology that tries to find the best matching between two molecules, a receptor and ligand called:

- W) molecular matching
- X) molecular docking
- Y) molecular fitting
- Z) molecule affinity checking

Bonus Answer: X

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12. BIOLOGY

Toss Up: Multiple Choice

The BLAST program is used in

- W) Bioinformatics
- X) DNA Sequencing
- Y) Amino acid Sequencing
- Z) DNA Barcoding

Toss Up Answer: W

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Bonus: Multiple Choice

Phylogenetic relationships can be shown by

- W) Dendrogram
- X) Gene bank
- Y) Data retrieving tool
- Z) Data search tool

Bonus Answer: W

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13. BIOLOGY

Toss Up: Multiple Choice

Which protein did Nobel Laureate Christian Anfinsen characterize to come to the conclusion that the native structure is determined only by the protein's amino acid sequence?

- W) catalase
- X) ribonuclease A

Y) luciferase

Z) amylase

Toss Up Answer: X

Bonus: Short Answer

What is the name of the thought experiment that postulates that because of the very large number of degrees of freedom in an unfolded polypeptide chain, the molecule has an astronomical number of possible conformations?

Bonus Answer: Levinthal's paradox OR Levinthal

14. BIOLOGY

Toss Up: Multiple Choice

Metastasis involves

W) decreased levels of proteins that regulate metalloproteins

X) programmed cell death

Y) closing of aromatic rings

Z) bioinformatic analysis of clinical trial

Toss Up Answer: W

Bonus: Multiple Choice

BRAC1, an inherited form of breast cancer, regulates cell division by

W) binding to a DNA sequence

X) binding to the protein RAD 51 which repairs DNA damage

Y) complexing with cyclins

Z) binding to the cell outer membrane

Bonus Answer: X

15. BIOLOGY

Toss Up: Short Answer

Defects in the myelin sheath lead to what disease?

Bonus Answer: Multiple Sclerosis

Bonus: Short Answer

From which parent do we inherit mitochondrial DNA?

Bonus Answer: Mothers, maternal

16. BIOLOGY

Toss Up: Short Answer

What part of the brain controls the interaction between the two hemispheres?

Bonus Answer: corpus callosum

Bonus: Short Answer

Which lobe of the brain is known for spatial reasoning and navigation?

Bonus Answer: parietal lobes

17. CHEMISTRY

Toss Up: Multiple Choice

What is the oxidation state of Manganese in the permanganate ion?

W) +5

X) +7

Y) +2

Z) -2

Toss Up Answer: X

Bonus: Short Answer

What is the oxidation state of molecular oxygen?

Bonus Answer: 0

18. CHEMISTRY

Toss Up: Multiple Choice

The Standard Gibbs free energy, ΔG° , is

W) the residual energy present in the reactants at equilibrium

X) the residual energy present in the products at equilibrium

Y) the energy required to convert one mole of reactants to one mole of products

Z) the difference in the residual energy of reactants and products at equilibrium

Toss Up Answer: X

Bonus: Multiple Choice

If the enthalpy change for a reaction is zero, ΔG° is equal to

W) $T\Delta S^\circ$

X) $T\Delta S^\circ$

Y) $-\Delta H^\circ$

Z) $\ln K_{eq}$

Bonus Answer: X

19. CHEMISTRY

Toss Up: Multiple Choice

For the unfolding reaction of Protein G, $\Delta H^\circ = 210.6$ kJ/mol, this means that

W) unfolding is favored enthalpically

X) unfolding is favored enthalpically

Y) the entropy is positive at all temperatures

Z) the entropy is negative at all temperatures

Toss Up Answer: X

Bonus: Multiple Choice

At the midpoint of a temperature transition curve,

W) half of the protein is denatured

X) $K_{eq} = 1.0$ and $\Delta G = 0$

Y) $[Native] = [Unfolded]$ (Read as concentration of Native = concentration of Unfolded)

Z) All of these

Bonus Answer: Z

20. CHEMISTRY

Toss Up: Short Answer

During glycolysis, electrons removed from glucose are passed to

Bonus Answer: NAD⁺

Bonus: Multiple Choice

A biological redox reaction always involves

- W) an oxidizing agent
- X) a gain of electrons
- Y) a reducing agent
- Z) All of the Above

Bonus Answer: Z

21. CHEMISTRY

Toss Up: Multiple Choice

cis 1,2 chloro-ethene and trans 1,2 chloro-ethene differ in which of the following?

- W) electron geometry
- X) enthalpy
- Y) entropy
- Z) boiling point

Toss Up Answer: Z

Bonus: Short Answer

In an acid/base reaction, which (acid or base) is the electrophile?

Bonus Answer: acid

22. CHEMISTRY

Toss Up: Short Answer

What is the name for a molecule with tetrahedral electron geometry but only three substituent groups?

Bonus Answer: trigonal pyramidal

Bonus: Multiple Choice

Which of the following is not an ionic compound?

- W) NaCl
- X) HF
- Y) FeCl₃
- Z) H₂SO₄

Bonus Answer: X

23. EARTH and SPACE

Toss Up: Multiple Choice

Which is not a type of rock?

- W) sedimentary
- X) metamorphic
- Y) igneous
- Z) elementary

Toss Up Answer: Z

Bonus: Short Answer

Which type of rock is formed from magma?

Bonus Answer: igneous rock

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24. EARTH and SPACE

Toss Up: Multiple Choice

Which of the following pairs of minerals share the same cleavage?

W) Fluorite and Calcite

X) Mica and Galena

Y) Cryolite and Fluorite

Z) Halite and Sylvite

Toss Up Answer: Z

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Bonus: Short Answer

In how many directions does muscovite break (cleave)?

Bonus Answer: 1 (one)

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25. EARTH and SPACE

Toss Up: Short Answer

By name or number, which of the following is not a mineral: diamond, gold, coal, silt

Bonus Answer: Coal and silt (accept 3 and 4)

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Bonus: Short Answer

The Mohs scale is used to measure mineral hardness. By name or number order the following minerals in increasing order: Fluorite, Gypsum, Quartz, Talc

Bonus Answer: Talc, Gypsum, Fluorite, Quartz (accept 1 2 3 4, in that order)

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