

Round 1

1. 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

2. 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

3. ENERGY

Toss Up: Short Answer

Used normally, a 150-watt, 120 volt light bulb requires how many amps of current?

Bonus Answer: 1.25 Amps

Bonus: Short Answer

If 10 joules of energy are required to move 5 coulombs of charge between two points, the potential difference between the two points is equal to how many volts?

Bonus Answer: 2 volts

4. 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 $3/5$. To what value is the $\tan(A)$ equal?

Bonus Answer: $3/4$

5. 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

6. 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

7. BIOLOGY**Toss Up: Multiple Choice**

Proteonomics 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

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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8. CHEMISTRY

Toss Up: Multiple Choice

The Standard Gibb's 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

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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

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9. 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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10. ENERGY

Toss Up: Short Answer

Order the following fuels by extractable energy per pound, from least to greatest. uranium, thorium, gasoline, coal

Bonus Answer: coal, gasoline, uranium, thorium

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Bonus: Multiple Choice

Which is the leading source of carbon monoxide emissions in the US?

- W) forest fires
- X) vehicles
- Y) factories
- Z) lightning

Bonus Answer: X

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11. MATHEMATICS

Toss Up: Short Answer

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

Bonus Answer: $(4/3) \pi R^3$

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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)

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12. 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

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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

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13. ENERGY

Toss Up: Multiple Choice

In what bulk form is the most energy stored?

- W) compressed gases
- X) water behind dams
- Y) chemical batteries
- Z) temperature gradients

Toss Up Answer: X

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Bonus: Short Answer

Which country has the highest amount of solar power per capita?

Bonus Answer: Germany

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14. 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)

15. 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

Bonus: Short Answer

In how many directions does muscovite break (cleave)?

Bonus Answer: 1 (one)

16. 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

17. 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)

18. 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

19. 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

20. 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)

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)

21. ENERGY

Toss Up: Short Answer

Who was the Joule named after?

Bonus Answer: James Joule

Bonus: Short Answer

Who was the watt named after?

Bonus Answer: James Watt

22. CHEMISTRY

Toss Up: Multiple Choice

For the unfolding reaction of Protein G, $\Delta H^\circ = 210.6 \text{ kJ/mol}$, 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

23. ENERGY

Toss Up: Short Answer

What is the most common sulfur compound that occurs naturally in natural gas?

Bonus Answer: HYDROGEN SULFIDE

Bonus: Short Answer

Earth's core is kept hot by the radioactive decay of several radioactive substances, including Uranium-235 and 238; name the other two heat-producing isotopes which are also significant contributors to the radioactive heat production of the Earth.

Bonus Answer: POTASSIUM-40 AND THORIUM-232 (Question is very hard?)

24. 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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25. MATHEMATICS

Toss Up: Multiple Choice

If a regular hexagon has a side length of 2, what is its area?

- W) $3\sqrt{6}$
- X) $6\sqrt{3}$
- Y) $\sqrt{18}$
- Z) $6\sqrt{2}$

Toss Up Answer: X

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Bonus: Multiple Choice

If $f(x)$ is $(\ln(x^2))/(e^x)$, what is $f'(x)$ in simplest form?

- W) $((x^2)/2x + \ln(x^2))/(e^{2x})$
- X) $((2/x) - \ln(x^2))/(e^2)$
- Y) $(\ln(4/x))/(e^{2x})$
- Z) $((2x/(x^2)) - \ln(x^2))/(e^{2x})$

Bonus Answer: X

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