

Round 2

1. ENERGY

Writer: Stuyvesant

Toss Up: Short Answer

Which compound in the atmosphere contributes the most to the greenhouse effect?

Bonus Answer: Water (accept: H₂O or dihydrogen monoxide)

Bonus: Short Answer

What is China's largest renewable energy source?

Bonus Answer: Hydropower (accept: Hydro)

2. BIOLOGY

Writer: Stuyvesant

Toss Up: Short Answer

Which amino acid would constitute a disulfide bridge?

Bonus Answer: Cysteine

Bonus: Short Answer

What is the name of the cellular machinery that removes introns?

Bonus Answer: Spliceosome

3. EARTH and SPACE

Writer: Stuyvesant

Toss Up: Short Answer

Which type of star will live for the longest period of time?

Bonus Answer: Red Dwarfs (they can live for 1 trillion years or so)

Bonus: Multiple Choice

What resonance does Pluto have with Neptune which ensures that the celestial objects will never impact each other?

W) 2:1

X) 3:2

Y) 5:2

Z) 5:4

Bonus Answer: X

4. BIOLOGY

Writer: Centennial

Toss Up: Short Answer

Name all of the following that are usually characteristics of monocots: (1) Petals in multiples of three, (2) taproot present, (3) vascular bundles arranged in a ring, (4) parallel veins

Bonus Answer: (1) Petals in multiples of three, and (4) parallel veins

Bonus: Short Answer

Name all of the following that are monocots: corn, crabgrass, red bean

Bonus Answer: Corn and crabgrass

5. PHYSICS

Writer: American Heritage

Toss Up: Multiple Choice

Jed and Sirajri both begin listening to a 60 minute album, Coloring Book by Chance the Rapper, at the same time. Jed then gets into a spaceship where he travels at 80% of the speed of light. Who finishes the album first, and how much of the album is left for the second person?

- W) Jed finishes 48 minutes before Sirajri
- X) Jed finishes 40 minutes before Sirajri
- Y) Sirajri finishes 48 minutes before Jed
- Z) Sirajri finishes 40 minutes before Jed

Toss Up Answer: Z

Bonus: Multiple Choice

Which of the following statements about the standard model is false?

- W) The Z gauge boson is less massive than the W+ gauge boson
- X) There are 8 kinds of gluons
- Y) All 12 elementary particles in the standard model are fermions
- Z) The charm quark is a second generation particle

Bonus Answer: W

6. ENERGY

Writer: Stuyvesant

Toss Up: Multiple Choice

In a conventional light bulb, what is the ratio of light energy to the heat energy produced?

- W) 1:9
- X) 3:2
- Y) 1:1
- Z) 7:3

Toss Up Answer: W

Bonus: Multiple Choice

The arctic is estimated to hold what percent of the worlds what percent of the world's undiscovered oil and natural gas reserves?

- W) 7%
- X) 13%
- Y) 22%
- Z) 35%

Bonus Answer: Y

7. PHYSICS

Writer: Stuyvesant

Toss Up: Short Answer

Maxwell's equations are to electric and magnetic fields as what equation is to the wave function for a particle?

Bonus Answer: Shcrodinger's

Bonus: Multiple Choice

A non-relativistic free electron has kinetic energy K. If its wavelength doubles, what is its kinetic energy in terms of K?

- W) 4K

- X) $K/4$
- Y) K
- Z) $K/2$

Bonus Answer: X

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8. MATHEMATICS

Writer: Stuyvesant

Toss Up: Multiple Choice

If the test scores of Mr. Coco's Calculus test are assumed to have a normal distribution, and if the mean test score was 91, what can be said about the median test score of that test?

- W) The median was lower than 91
- X) The median was higher than 91
- Y) The median was 91
- Z) The median cannot be determined

Toss Up Answer: Y

Bonus: Multiple Choice

The z-score for Steven's physics test grade was found to be 0.375. If he scored a 94 on the test, and the standard deviation was 8, what was the mean test score on the physics test?

- W) 91
- X) 95
- Y) 92
- Z) 98

Bonus Answer: W

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9. BIOLOGY

Writer: Centennial

Toss Up: Short Answer

Which subunit of $\text{Na}^+/\text{K}^+-\text{ATPase}$ binds the Na^+ ion?

Bonus Answer: The alpha subunit

Bonus: Multiple Choice

Which of the following effects would a toxin that blocked voltage-gated potassium channels be most likely to cause?

- W) A decrease in the strength of the action potential
- X) A decrease in the length of the refractory period
- Y) An increase in the speed of the action potential
- Z) An increase in the strength of the action potential

Bonus Answer: Z

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10. MATHEMATICS

Writer: Stuyvesant

Toss Up: Multiple Choice

Simplify $(\sin 15^\circ \cos 75^\circ - \cos 15^\circ \sin 75^\circ) / (\cos 15^\circ \cos 75^\circ + \sin 15^\circ \sin 75^\circ)$

- W) negative square root of 3
- X) $1/2$
- Y) $-1/2$

Z) square root of 6 minus square root of 2 all over 2

Toss Up Answer: W

Bonus: Short Answer

Compute $(2+2\sqrt{3}i)^6$. [the quantity 2+2 times the square root of 3 time i to the 6th power]

Bonus Answer: 4096

11. ENERGY

Writer: Stuyvesant

Toss Up: Multiple Choice

Which country generates the highest percentage of its energy from nuclear power?

W) Britain

X) China

Y) France

Z) Denmark

Toss Up Answer: Y

Bonus: Short Answer

By name or number, list the operating temperatures from lowest to highest of these types of fuel cells:

1. MCFC

2. PAFC

3. PEMFC

4. SOFC

Bonus Answer: 3,2,1,4

12. PHYSICS

Writer: Stuyvesant

Toss Up: Short Answer

A molecule with a magnetic moment of $83 \text{ N}\cdot\text{m}/\text{T}$ (read as Newton-meters per Tesla) experiences what amount of torque in $\text{N}\cdot\text{m}$ (read as Newton-meter) when subjected to an external magnetic force of 120 teslas?

Bonus Answer: 9960 $\text{N}\cdot\text{m}$

Bonus: Multiple Choice

A certain capacitor, in series with a $720\text{-}\Omega$ resistor, is being charged. At the end of 10 ms (milliseconds) its charge is half the final value. The capacitance is about:

W) $9.6 \mu\text{F}$

X) $14 \mu\text{F}$

Y) $20 \mu\text{F}$

Z) 7.2F

Bonus Answer: Y

13. BIOLOGY

Writer: Granada Hills

Toss Up: Multiple Choice

The organ that produces glucagon is under what organ-system?

W) Musculo-Skeletal

X) Nervous

Y) Endocrine

Z) Circulatory

Toss Up Answer: Z

Bonus: Short Answer

Most pharmaceutical insulin is produced using what species of bacteria?

Bonus Answer: E. Coli

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14. MATHEMATICS

Writer: Centennial

Toss Up: Short Answer

If X and Y are independent random variables with standard deviations of a and b respectively, what is the standard deviation of the quantity $X+2Y$?

Bonus Answer: $\text{Sqrt}(a^2+4b^2)$

Bonus: Short Answer

If X and Y are independent random variables with expected values c and d respectively, what is the expected value of the quantity $X+2Y$?

Bonus Answer: $c+2d$

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15. BIOLOGY

Writer: Granada Hills

Toss Up: Multiple Choice

What part of the brain controls the ability to understand speech?

W) Olfactory

X) Frontal

Y) Broca's Area

Z) Wernicke's Area

Toss Up Answer: Z

Bonus: Short Answer

Which neural tissue facilitates neural messages from the left to the right hemispheres?

Bonus Answer: Corpus Callosum

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16. MATHEMATICS

Writer: Centennial

Toss Up: Short Answer

What is the name for the group of four datasets with nearly identical summary statistics, but drastically different scatterplots?

Bonus Answer: Anscombe's quartet

Bonus: Short Answer

X is a random variable with a uniform distribution with width w of values. In terms of w, what is the standard deviation of X?

Bonus Answer: $\text{Sqrt}(w^2/12)$

17. CHEMISTRY

Writer: Stuyvesant

Toss Up: Short Answer

What is the name of the elements in Group 16?

Bonus Answer: Chalcogens (Accept: Chalcogen, Oxygen Family)

Bonus: Short Answer

When Carbonic acid is created what does it always decompose into?

Bonus Answer: Dihydrogen Monoxide and Carbon Dioxide (Accept: H₂O and CO₂, Water and CO₂)

18. EARTH and SPACE

Writer: Stuyvesant

Toss Up: Short Answer

By name or number, list the following classes of stars from hottest to coolest:

1. Class K
2. Class O
3. Class A
4. Class B

Bonus Answer: 2,4,3,1

Bonus: Short Answer

What are the brightest events in the universe?

Bonus Answer: Gamma Ray Bursts

19. MATHEMATICS

Writer: Centennial

Toss Up: Short Answer

What is the exact average value of x^2+3x-2 from $x=3$ to $x=6$?

Bonus Answer: 195/6

Bonus: Multiple Choice

With which of the following n th terms will an infinite series converge?

- W) $1/n$
- X) $\ln n$
- Y) $\sin n$
- Z) $1/n^3$

Bonus Answer: Z

20. EARTH and SPACE

Writer: Centennial

Toss Up: Multiple Choice

Which of the following was eventually proposed to explain the Pioneer anomaly?

- W) Radiation pressure
- X) Outgassing from spacecraft parts
- Y) Solar wind
- Z) Previously undiscovered planets

Toss Up Answer: W

Bonus: Short Answer

What phenomenon was used to measure the speed of the Pioneer spacecraft?

Bonus Answer: Doppler Effect

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21. CHEMISTRY

Writer: Centennial

Toss Up: Short Answer

What is the most significant component in duralumin, other than aluminum?

Bonus Answer: Copper

Bonus: Short Answer

The addition of copper makes the alloy susceptible to which process, from which pure aluminum is usually protected?

Bonus Answer: Corrosion

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22. EARTH and SPACE

Writer: Centennial

Toss Up: Multiple Choice

Which of the following compounds made up most of Mt. St. Helens' ash?

W) Magnesium oxide

X) Aluminum oxide

Y) Silicon dioxide

Z) Sodium oxide

Toss Up Answer: Y

Bonus: Short Answer

What mineral forms the dome of Mt. St. Helens?

Bonus Answer: Dacite

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23. CHEMISTRY

Writer: Centennial

Toss Up: Short Answer

63/37 leaded solder is this type of mixture, which melts at once instead of melting as components.

Bonus Answer: Eutectic

Bonus: Short Answer

Apart from tin whiskers, lead-free solder also suffers from this problem at low temperatures.

Bonus Answer: Tin pest

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24. CHEMISTRY

Writer: Granada Hills

Toss Up: Short Answer

Helium has a molar mass of 4 grams per mole and effuses at a rate of 10 moles per minute. If you have an unknown gas with a molar mass of 16 grams per mole, How many moles per minute would it effuse at?

Bonus Answer: 5

Bonus: Short Answer

By name or number, indicate all of the following choices that would undergo SN1.

I. 2-bromo-2-methylpropane

II. $\text{CH}_3\text{CHCHCH}_2\text{Cl}$

III. Polyethylene

Bonus Answer: I only

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25. CHEMISTRY

Writer: Granada Hills

Toss Up: Multiple Choice

What is the name of the group of the periodic table that includes selenium?

W) Halogens

X) Noble gases

Y) Alkali metals

Z) Chalcogens

Toss Up Answer: Z

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Bonus: Short Answer

What is the general name of the compounds that are highly toxic and are formed from reacting ammonia with baking soda?

Bonus Answer: Chloramines

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