

Stuyvesant

1. Physics

Toss Up: Multiple Choice

Radiocarbon is produced in the atmosphere as a result of?

- W) collision between fast neutrons and nitrogen nuclei present in the atmosphere
- X) action of ultraviolet light from the sun on atmospheric oxygen
- Y) action of solar radiations particularly cosmic rays on carbon dioxide present in the atmosphere
- Z) lightning discharge in atmosphere

Toss Up Answer: W

Bonus: Multiple Choice

What type of radiation is both the most penetrating and the most effectively stopped if blocked by a hydrogen-rich material?

- W) Alpha
- X) Beta
- Y) Gamma
- Z) Neutron

Bonus Answer: Z

2. Energy

Toss Up: Short Answer

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

Toss Up Answer: Water (accept: H2O or dihydrogen monoxide)

Bonus: Short Answer

What is China's largest renewable energy source?

Bonus Answer: Hydropower (accept: Hydro)

3. Energy

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 world's undiscovered oil and natural gas reserves?

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

Bonus Answer: Y

4. Energy

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

5. Earth and Space Science

Toss Up: Multiple Choice

Which of the following rocks is responsible for the formation of black sand?

- W) Quartzite
- X) Schist
- Y) Slate
- Z) Basalt

Toss Up Answer: Z

Bonus: Short Answer

What is the scale used to measure the hardness of minerals?

Bonus Answer: Moh Scale (accept: Moh)

6. Earth and Space Science

Toss Up: Short Answer

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

Toss Up 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

7. Earth and Space Science

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

Toss Up Answer: 2,4,3,1

Bonus: Short Answer

What are the brightest events in the universe?

Bonus Answer: Gamma Ray Bursts

8. Chemistry

Toss Up: Multiple Choice

What form of hybridization is found in Sulfur Hexafluoride?

W) sp³

X) sp³d²

Y) sp³d³

Z) sp⁴d³

Toss Up Answer: X

Bonus: Multiple Choice

Which of the following amino acids is aromatic?

W) Tryptophan

X) Glutamic Acid

Y) Methionine

Z) Lysene

Bonus Answer: W

9. Chemistry

Toss Up: Multiple Choice

Which of the following is the ionic charge of the Dimercury ion?

W) 1+

X) 0

Y) 2+

Z) 1-

Toss Up Answer: Y

Bonus: Short Answer

What is the electron configuration of Iron(III)? Include its full electron configuration.

Bonus Answer: 1s² 2s² 2p⁶ 3s² 3p⁶ 3d⁵

10. Chemistry

Toss Up: Short Answer

What is the name of the elements in Group 16?

Toss Up 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)

11. Biology

Toss Up: Short Answer

In eukaryotes, which enzyme proofreads while DNA replication takes place?

Toss Up Answer: DNA Polymerase (accept DNA Polymerase III)

Bonus: Short Answer

What is the general name for a point mutation in which a single nucleotide change results in a codon that codes for a different amino acid?

Bonus Answer: Missense Mutation

12. Biology

Toss Up: Multiple Choice

Modern research has shown that silent mutations can be harmful in all of the following ways except:

W) Causing a short pause during codon-anticodon pairing in translation

X) Reducing the stability of the mRNA's 3D structure

Y) Causing improper splicing of the primary transcript

Z) Slowing the rate of transport of mRNA across the nuclear membrane

Toss Up Answer: Z

Bonus: Short Answer

What was the first codon-amino acid pair to be identified? (Give both the codon and the amino acid)

Bonus Answer: UUU and phenylalanine

13. Biology

Toss Up: Short Answer

Which amino acid would constitute a disulfide bridge?

Toss Up Answer: Cysteine

Bonus: Short Answer

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

Bonus Answer: Spliceosome

14. Mathematics

Toss Up: Multiple Choice

What statistical average is most appropriate to use when the quantities being averaged when one or more of the quantities are not necessarily bounded?

W) Geometric Mean

X) Median

Y) Harmonic Mean

Z) Arithmetic Mean

Toss Up Answer: Z

Bonus: Short Answer

You pick two cards at random without replacement from a standard, 52 card deck. Compute the probability that exactly one is a heart.

Bonus Answer: 13/34

15. Mathematics

Toss Up: Multiple Choice

Which of the following expressions in x grows fastest?

W) $(3)^x$

X) $2^{(2x)}$

Y) $(x)^2$

Z) $10 \cdot (3/2)^x$

Toss Up Answer: X

Bonus: Short Answer

Given $504 = 2^3 \times 3^2 \times 7$ [504 equals 2 cubed times 3 squared times 7], compute the sum of the positive divisors of 504.

Bonus Answer: 1560

16. Mathematics

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

17. Mathematics

Toss Up: Multiple Choice

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

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

18. Physics

Toss Up: Short Answer

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

Toss Up Answer: Schrodinger'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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19. Physics

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?

Toss Up Answer: 9960 $\text{N}\cdot\text{m}$

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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) $9.6 \text{ }\mu\text{F}$
- X) $14 \text{ }\mu\text{F}$
- Y) $20 \text{ }\mu\text{F}$
- Z) 7.2F

Bonus Answer: Y

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