

## Round 16

### 1. BIOLOGY

Writer: Shanjeed Ali

Toss Up: Multiple Choice

Which of the following is not an phyla in the kingdom animalia?

W) Chordata

X) Lycophyta

Y) Bryozoa

Z) Cnidaria

Toss Up Answer: X

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Bonus: Short Answer

What is the order of the house mouse, mus musculus?

Bonus Answer: Rodentia

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### 2. CHEMISTRY

Writer: Ivan Zhang

Toss Up: Multiple Choice

Which of the following elements has the highest reflectivity?

W) Gold

X) Silver

Y) Mercury

Z) Gallium

Toss Up Answer: X

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Bonus: Short Answer

What is Avogadro number to the nearest ten-thousandths?

Bonus Answer:  $6.0221 \times 10^{23}$

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### 3. BIOLOGY

Writer: Calvin Vuong

Toss Up: Short Answer

Name all of the following that are amphipathic: I) integral proteins, II) cholesterol, III) phospholipids, IV) triacylglycerol, V) mannose

Bonus Answer: I and III only (integral proteins and phospholipids)

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Bonus: Multiple Choice

Which of the following is not true about a part of the phospholipid?

W) They contain two fatty acid chains.

X) Their heads contain a net charge.

Y) They have a phosphate group in their heads.

Z) They have a choline group in their heads.

Bonus Answer: X

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### 4. CHEMISTRY

Writer: Seiji Yawata

Toss Up: Multiple Choice

Which of the following is the most acidic?

W) o-methoxy benzoic acid

- X) benzoic acid
- Y) m-methoxy benzoic acid
- Z) p-methoxy benzoic acid

**Toss Up Answer: W**

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**Bonus: Short Answer**

What is the equivalent weight of  $\text{HNO}_3$  in the reaction: Cu reacts with  $\text{HNO}_3$ , forming  $\text{Cu}(\text{NO}_3)_2$ , NO and water.

**Bonus Answer: 84**

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## 5. MATHEMATICS

**Writer: Ahmad Alnasser**

**Toss Up: Multiple Choice**

Give the range for the following six values 2, 7, 11, 19, 25, 33:

- W) 2
- X) 31
- Y) 33
- Z) 15

**Toss Up Answer: X**

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**Bonus: Short Answer**

Convert  $6/5$  pi radians to degrees

**Bonus Answer: 216**

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## 6. CHEMISTRY

**Writer: Prangon Ghose**

**Toss Up: Multiple Choice**

Which of these gases is expected to condense at the lowest pressure, assuming that the temperature is constant?

- W) Bromomethane
- X) Dibromomethane
- Y) Tetrabromomethane
- Z) They all condense at the same temperature

**Toss Up Answer: Y**

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**Bonus: Short Answer**

Which attractive force is the major cause of condensation?

**Bonus Answer: London Dispersion Forces (accept: London Forces)**

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## 7. BIOLOGY

**Writer: Matthew Lee**

**Toss Up: Short Answer**

What molecule is the phosphorylated intermediate of the ATP-coupled reaction derived from?

The reaction is glutamic acid + ammonia  $\rightarrow$  glutamine. The free energy change is +3.4 kcal/mol.

**Bonus Answer: Glutamic Acid**

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**Bonus: Short Answer**

The evolution of enzymes was traced in an experiment with E. coli. What enzyme was mutated in the experiment?

**Bonus Answer: beta-galactosidase**

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## 8. MATHEMATICS

**Writer: Amrit Hingorani**

**Toss Up: Multiple Choice**

Which of the following distances is longest?

- W) Half a kilometer
- X) Half a decimeter
- Y) 600 meters
- Z) 40 decameters

**Toss Up Answer: Y**

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**Bonus: Short Answer**

What is the name of a line that intersects two or more coplanar lines in different points?

**Bonus Answer: Transversal**

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**9. BIOLOGY**

**Writer: Calvin Vuong**

**Toss Up: Multiple Choice**

Which of the following intermolecular interactions is least instrumental in determining a polypeptide's tertiary structure?

- W) hydrophobic interactions
- X) polar interactions
- Y) hydrogen bonding
- Z) disulfide bridges

**Toss Up Answer: Y**

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**Bonus: Short Answer**

Polypeptide folding is aided by which type of cavity-structured proteins?

**Bonus Answer: Chaperonins**

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**10. MATHEMATICS**

**Writer: Jan Wojcik**

**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**

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**Bonus: Multiple Choice**

The z-score for Shantanu'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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**11. EARTH and SPACE**

**Writer: Janine Goh**

**Toss Up: Short Answer**

What is the speed of light in km/hr, in scientific notation, to 2 decimal places?

**Bonus Answer:  $1.08 \times 10^9$**

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**Bonus: Multiple Choice**

How many sub levels does Cesium have?

W) 9

X) 10

Y) 11

Z) 12

**Bonus Answer: Z**

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## 12. MATHEMATICS

**Writer: Raafiul Hossain**

**Toss Up: Short Answer**

What shape is the graph of  $y = x^2 + 1$

**Bonus Answer: parabola**

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**Bonus: Short Answer**

What is the name of the curve that is one possible inverse of a parabola, its shape resembling a heart, and that also appears in the Mandelbrot set?

**Bonus Answer: cardioid**

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## 13. CHEMISTRY

**Writer: Prangon Ghose**

**Toss Up: Short Answer**

What is the empirical formula of glucose?

**Bonus Answer:  $CH_2O$**

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**Bonus: Short Answer**

What is the shape of an Acetylene ( $C_2H_2$ ) molecule?

**Bonus Answer: Linear**

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## 14. EARTH and SPACE

**Writer: Andrew Chen (Senior)**

**Toss Up: Multiple Choice**

What is the name of the igneous rock that is a porous volcanic glass formed by rapidly cooling lava?

W) Obsidian

X) Gabbro

Y) Basalt

Z) Pumice

**Toss Up Answer: Z**

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**Bonus: Short Answer**

What are the three general types of magma?

**Bonus Answer: Basaltic magma, Andesitic magma, and Rhyolitic magma**

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## 15. CHEMISTRY

**Writer: Olivia Gallager**

**Toss Up: Short Answer**

Mass spectrometers shoot which subatomic particle at a sample to ionize it?

**Bonus Answer: electrons**

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**Bonus: Multiple Choice**

Radium-226 is most likely to undergo which type of nuclear decay?

W) electron capture

X) alpha

Y) beta

Z) positron

**Bonus Answer: X**

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## **16. EARTH and SPACE**

**Writer: Shamaul Dilmohamed**

**Toss Up: Multiple Choice**

To the nearest order of magnitude, how thick are Saturn's rings?

W) 10 m

X) 100 m

Y) 1000 m

Z) 10000 m

**Toss Up Answer: W**

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**Bonus: Short Answer**

Which planets have active plate tectonics?

**Bonus Answer: Earth**

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## **17. PHYSICS**

**Writer: Aaron Gee**

**Toss Up: Short Answer**

An infinitely long wire carries a current of three amps. How does the magnetic field outside the wire look like?

**Bonus Answer: Circles the wire**

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**Bonus: Short Answer**

Iron is what type of magnetic material?

**Bonus Answer: ferromagnetic**

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## **18. EARTH and SPACE**

**Writer: Matthew Lee**

**Toss Up: Short Answer**

Put these soil horizons in order of increasing depth: bedrock, organic material and leached zone, broken rock, mineral enriched horizon

**Bonus Answer: organic material and leached zone, mineral enriched horizon, broken rock, bedrock**

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**Bonus: Multiple Choice**

At high elevations in New York State, which is the most common form of physical weathering?

W) alternate freezing and melting of water

X) oxidation by oxygen in the atmosphere

Y) dissolving of minerals into solution

Z) abrasion of rocks by wind

**Bonus Answer: W**

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## 19. BIOLOGY

**Writer: Janine Goh**

**Toss Up: Multiple Choice**

How is the lagging strand of DNA synthesised during DNA replication?

W) Semi-conservatively

X) Okazaki Fragments

Y) With topoisomerase

Z) Continuously

**Toss Up Answer: X**

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**Bonus: Short Answer**

What is the purpose of topoisomerase?

**Bonus Answer: Ensure that DNA isn't wound too tightly**

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## 20. PHYSICS

**Writer: Aaron Gee**

**Toss Up: Multiple Choice**

e Often some of the strongest spectral lines in cold interstellar gas are produced by

W) neutral lithium

X) ionized iron

Y) carbon and iron

Z) calcium and sodium

**Toss Up Answer: Z**

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**Bonus: Short Answer**

The cosmic background radiation discovered by Penzias and Wilson closely matches the radiation from a black body with what temperature Kelvin, to the nearest whole number?

**Bonus Answer: 3**

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## 21. BIOLOGY

**Writer: Olivia Gallager**

**Toss Up: Short Answer**

In the light dependent reactions of photosynthesis, what molecule supplies the initial electrons?

**Bonus Answer: H<sub>2</sub>O OR water**

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**Bonus: Short Answer**

In cellular respiration, the Carbon in carbon dioxide that is released comes from what original molecule?

**Bonus Answer: glucose**

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## 22. PHYSICS

**Writer: Charles Zhang**

**Toss Up: Multiple Choice**

An object oscillates with equation  $x = 2\cos(5\pi t)$  (READ AS: x equals 2 times cosine of open parentheses 5 PI times t close parentheses). What is the frequency of the oscillation?

- W) 0.5
- X) 1
- Y) 2.5
- Z) 4

**Toss Up Answer: Y**

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**Bonus: Multiple Choice**

An LC circuit consists of a 5 henry inductor and a 20 farad capacitor connected to a battery in a series circuit. What is the frequency of the oscillation of the current in the circuit?

- W)  $0.05/\pi$  (0.05/PI)
- X)  $0.1/\pi$  (0.1/PI)
- Y)  $2/\pi$  (2/PI)
- Z)  $3/\pi$  (3/PI)

**Bonus Answer: W**

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**23. PHYSICS**

**Writer: Seiji Yawata**

**Toss Up: Short Answer**

A Tesla is an SI derived unit that can be expressed as  $\text{kg}^a \cdot \text{C}^b \cdot \text{s}^c$ . What are the values of a, b and c?

**Bonus Answer: 1, -1, -1**

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**Bonus: Short Answer**

A positron moves through a region in which the electric field is uniform in the x-direction and the magnetic field is uniform in the y-direction. What is the direction of the terminal velocity of the positron?

**Bonus Answer: Positive z direction**

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**24. PHYSICS**

**Writer: Aaron Gee**

**Toss Up: Short Answer**

How many nodes are there in the first overtone in a standing wave of a vibrating guitar string?

**Bonus Answer: 3**

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**Bonus: Short Answer**

If  $g = 9.8$  meters per second squared, to the first decimal place and in newtons, how many newtons of force are required to keep a 450 kilogram slab of granite moving across a horizontal surface at constant speed if there is a kinetic frictional coefficient of 0.20 between the surface and the slab?

**Bonus Answer: 882 N**

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**25. PHYSICS**

**Writer: Mohammed Jamil**

**Toss Up: Short Answer**

A conveyor-belt, horizontally, moves a 600Kg bag a distance of 100 meters through the airport. How much work was done?

**Bonus Answer: No work was done.**

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**Bonus: Short Answer**

A dryer has a power rating of 2500 watts. To dry a few towels this dryer uses 6,750,000 joules of energy. How long

will it take to dry these towels, in minutes

**Bonus Answer: 45 minutes**

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