

## Round 2

### 1. MATHEMATICS

Writer: Aaron Gee

Toss Up: Multiple Choice

Solve the following equation for x:

$$x^2 - 20x + 19 = 0$$

W) 9, 10

X) 10 and 9

Y) 21 and 19

Z) 19 and 1

Toss Up Answer: Z

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Bonus: Short Answer

Convert log base 4 of 53 into a base 10 expression:

Bonus Answer:  $\log 53 / \log 4$

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### 2. PHYSICS

Writer: Aaron Gee

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

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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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### 3. EARTH and SPACE

Writer: Janine Goh

Toss Up: Short Answer

Which scientist came up with the laws of planetary motion?

Bonus Answer: Kepler

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Bonus: Short Answer

Which constellation is the star that remains stationary in northern hemisphere part of?

Bonus Answer: Ursa Minor

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### 4. BIOLOGY

Writer: Mohammed Jamil

Toss Up: Multiple Choice

Which of the following is not one of the basic tastes

W) sweetness

X) saltiness

- Y) umami
- Z) spiciness

**Toss Up Answer: Z**

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**Bonus: Multiple Choice**

In classical conditioning, an unlearned, inborn reaction to an unconditioned stimulus is a(n)

- W) unconditioned stimulus
- X) conditioned stimulus
- Y) conditioned response
- Z) unconditioned response

**Bonus Answer: Z**

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## 5. PHYSICS

**Writer: Shihab Karim**

**Toss Up: Multiple Choice**

As defined in physics, speed is:

- W) a vector quantity
- X) always negative
- Y) always zero
- Z) always positive

**Toss Up Answer: Z**

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**Bonus: Multiple Choice**

Electric current may be expressed in which one of the following units?

- W) joules/coulomb
- X) coulombs/second
- Y) coulombs/volt
- Z) ohms/second

**Bonus Answer: X**

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## 6. EARTH and SPACE

**Writer: Andrew Chen (Senior)**

**Toss Up: Short Answer**

Given the three types of volcanoes, composite, cindercone and shield volcanoes which type of volcano is Mount Vesuvius?

**Bonus Answer: Composite volcano (Also accept stratovolcano)**

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**Bonus: Multiple Choice**

Viscosity of magma depends on silica content and temperature, from the choices which type of magma has the highest viscosity?

- W) rhyolitic magma
- X) basaltic magma
- Y) andesitic magma
- Z) mafic magma

**Bonus Answer: W**

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## **7. PHYSICS**

**Writer: Nicholas Adit**

**Toss Up: Multiple Choice**

A force  $F$  of strength 20 N acts on an object of mass 3 kg as it moves a distance of 4 m. If  $F$  is perpendicular to the 4 m displacement, the work it does is equal to

W) 0 J

X) 60 J

Y) 80 J

Z) 600 J

**Toss Up Answer: W**

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**Bonus: Short Answer**

Under the influence of a force, an object of mass 4 kg accelerates from 3 m/s to 6 m/s in 8 s. How much work was done on the object during this time?

**Bonus Answer: 54 J**

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## **8. CHEMISTRY**

**Writer: Ahmad Alnasser**

**Toss Up: Short Answer**

Which element is the more electronegative?

**Bonus Answer: Flourine**

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**Bonus: Short Answer**

Name all the atoms that are diatomic.

**Bonus Answer: Hydrogen (H<sub>2</sub>)**

Nitrogen (N<sub>2</sub>)

Oxygen (O<sub>2</sub>)

Fluorine (F<sub>2</sub>)

Chlorine (Cl<sub>2</sub>)

Iodine (I<sub>2</sub>)

Bromine (Br<sub>2</sub>)

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## **9. PHYSICS**

**Writer: Nicholas Adit**

**Toss Up: Multiple Choice**

What is the wavelength of a 5 Hz wave that travels with a speed of 10 m/s ?

W) 0.25 m

X) 0.5 m

Y) 1 m

Z) 2 m

**Toss Up Answer: Z**

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**Bonus: Short Answer**

A string, fixed at both ends, supports a standing wave with a total of 4 nodes. If the length of the string is 6 m, what is the wavelength of the wave?

**Bonus Answer: 4 m**

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## **10. BIOLOGY**

**Writer: Zoe Orlin**

**Toss Up: Multiple Choice**

Global warming has been linked to a decrease in

- W) the size of polar icecaps
- X) temperature of Earth
- Y) rate of species extinction
- Z) rate of carbon dioxide production

**Toss Up Answer: W**

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**Bonus: Multiple Choice**

Why is a mushroom a heterotroph?

- W) it manufactures its own food
- X) It divides by mitosis
- Y) It transforms light energy into chemical energy
- Z) It obtains nutrients from the environment

**Bonus Answer: Z**

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## 11. PHYSICS

**Writer: Hanna Yang**

**Toss Up: Multiple Choice**

Which of the following is true about a light wave?

- W) Its energy is directly proportional to its wavelength.
- X) Its energy is directly proportional to its frequency.
- Y) Its energy is directly proportional to its amplitude.
- Z) Its energy is not related to any other of its properties.

**Toss Up Answer: X**

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**Bonus: Short Answer**

Find the electrostatic force between two perfect spheres, both with charge 1 and are 1 meter apart from each other. Give your answer in scientific notation.

**Bonus Answer:  $8.99 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2$**

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## 12. CHEMISTRY

**Writer: Prangon Ghose**

**Toss Up: Short Answer**

What is the chemical formula of tetraphosphorus decaoxide?

**Bonus Answer: P<sub>4</sub>O<sub>10</sub>**

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**Bonus: Short Answer**

What is the bond order of the central atom in CO<sub>3</sub><sup>(-2)</sup>?

**Bonus Answer: 4/3 (accept: 1 1/3)**

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## 13. PHYSICS

**Writer: William Xiang**

**Toss Up: Multiple Choice**

A standard 1-kg mass is attached to a compressed spring and the spring is released. If the mass initially has an acceleration of 5.6m/s<sup>2</sup>, the force of the spring has a magnitude of:

- W) 0N

- X) 2.8N
- Y) 5.6N
- Z) 11.2N

**Toss Up Answer: Y**

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**Bonus: Multiple Choice**

A 42-kg man stands in an elevator that has a downward acceleration of  $3.4\text{m/s}^2$ . The force exerted by him on the floor is about:

- W) 12N
- X) 270N
- Y) 340N
- Z) 412N

**Bonus Answer: X**

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## 14. CHEMISTRY

**Writer: Raafiul Hossain**

**Toss Up: Short Answer**

Is HCL a strong acid?

**Bonus Answer: Yes**

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**Bonus: Short Answer**

Is NAOH a strong base?

**Bonus Answer: Yes**

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## 15. BIOLOGY

**Writer: Hanna Yang**

**Toss Up: Multiple Choice**

Which of the following is a retrovirus?

- W) HIV
- X) Hepatitis B virus
- Y) Poliovirus
- Z) Influenza A virus

**Toss Up Answer: W**

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**Bonus: Short Answer**

Where do DNA viruses usually replicate?

**Bonus Answer: In the nucleus.**

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## 16. CHEMISTRY

**Writer: Nicholas Adit**

**Toss Up: Short Answer**

In 12.4 hours, a 100 gram sample of an element decays so that its mass is 25 grams. What is the approximate half-life of this radioactive substance?

**Bonus Answer: 6.2 hours**

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**Bonus: Multiple Choice**

Which of the following will raise the boiling point of a sample of water?

- W) Heat the water

- X) Mix gasoline into the water
- Y) Bring the water to a higher altitude
- Z) Dissolve table sugar in the water

**Bonus Answer: Z**

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## 17. BIOLOGY

**Writer: Zoe Orlin**

**Toss Up: Multiple Choice**

What is the main function of a vacuole in a cell?

- W) storage
- X) coordination
- Y) synthesis of molecules
- Z) release of energy

**Toss Up Answer: W**

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**Bonus: Multiple Choice**

If 15% of a DNA sample is made up of thymine, T, what percentage is made up of cytosine, C?

- W) 15%
- X) 35%
- Y) 70%
- Z) 85%

**Bonus Answer: X**

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## 18. MATHEMATICS

**Writer: Ivan Zhang**

**Toss Up: Multiple Choice**

What is the square root of 2 (to the nearest tenths)?

- W) 1.7
- X) 1.5
- Y) 1.3
- Z) 1.4

**Toss Up Answer: Z**

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**Bonus: Short Answer**

What is the equation of a circle with circumference  $6\pi$  that is positioned 3 points above the x axis and 4 points before the y axis?

**Bonus Answer:  $(x-4)^2 + (y+3)^2 = 9$**

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## 19. CHEMISTRY

**Writer: Andrew Chen (Senior)**

**Toss Up: Multiple Choice**

When 50 mL of stock solution of 6M NaCl (aq) is diluted into a 150 mL solution what will be the molarity of the diluted solution?

- W) 3M
- X) 2M
- Y) 1M
- Z) 6M

**Toss Up Answer: X**

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**Bonus: Short Answer**

What is the given equation for calculating molarity?

**Bonus Answer: Moles of solute divided by liters of solution**

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## **20. MATHEMATICS**

**Writer: Aaron Gee**

**Toss Up: Multiple Choice**

Which of the following has the largest amplitude?

W)  $9\sin(x) - 2$

X)  $2\cos(6x) + 5$

Y)  $\cos(2x)$

Z)  $4\sin(10x)$

**Toss Up Answer: W**

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**Bonus: Short Answer**

What power of 2 is closest to 255?

**Bonus Answer: 8**

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## **21. BIOLOGY**

**Writer: Shanjeed Ali**

**Toss Up: Short Answer**

Who discovered that DNA has equal amounts of adenine and thymine as well as equal amounts of guanine and cytosine?

**Bonus Answer: Accept Erwin Chargaff OR Chargaff**

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**Bonus: Short Answer**

What method was used to obtain Photograph 51, which was used to determine the structure of DNA?

**Bonus Answer: X-ray diffraction**

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## **22. EARTH and SPACE**

**Writer: Prangon Ghose**

**Toss Up: Short Answer**

What is the name of the largest volcanic mountain on Mars?

**Bonus Answer: Olympus Mons**

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**Bonus: Short Answer**

Which spacial event marks the beginning of spring in the Northern Hemisphere

**Bonus Answer: Vernal Equinox (Accept: Spring Equinox)**

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## **23. MATHEMATICS**

**Writer: Janine Goh**

**Toss Up: Short Answer**

What is the quadratic formula?

**Bonus Answer:  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$**

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**Bonus: Short Answer**

Solve for y if  $x = \frac{5}{6}y + \frac{116}{3}y + \frac{4}{2}$  in terms of x

**Bonus Answer:  $y = \frac{(x-2)}{78}$**

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## 24. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Short Answer

What are lines on a topographic map that connect points at the same elevation called?

Bonus Answer: Contour lines

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Bonus: Multiple Choice

In which state is the most bituminous coal produced?

W) Kentucky

X) Pennsylvania

Y) Wyoming

Z) West Virginia

Bonus Answer: Z

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## 25. BIOLOGY

Writer: Zoe Orlin

Toss Up: Short Answer

The broad climatic zones that Earth's environments are organized into are called

Bonus Answer: BIOMES

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Bonus: Short Answer

What biome makes up the majority of NY State?

Bonus Answer: temperate forest biome

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