

## Round 16

### 1. MATHEMATICS

Writer: Elias Milborn

Toss Up: Short Answer

Giving your answer as up, down, left, or right, the graph of the equation  $x = 5y - 8y^2 - 1$  opens in which direction

Bonus Answer: left

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Bonus: Short Answer

If chord AB is 8 units from the center of a circle O with a radius of 17, what is the length of chord AB?

Bonus Answer: 30

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### 2. BIOLOGY

Writer: Larry Wong

Toss Up: Short Answer

What is the genus of the common domestic dog?

Bonus Answer: Canis

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Bonus: Short Answer

What family does the *Carcharodon carcharias* belong to?

Bonus Answer: Lamnidae

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### 3. CHEMISTRY

Writer: Shantanu Jha

Toss Up: Multiple Choice

Which quantum number describes the specific orbital of an electron within a subshell?

W) Spin Projection

X) Magnetic

Y) Principal

Z) Azimuthal

Toss Up Answer: X

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Bonus: Short Answer

What scientist disproved the caloric theory, which stated that an invisible gas transferred heat between objects?

Bonus Answer: James Prescott Joule (accept: James Joule)

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### 4. PHYSICS

Writer: Nicholas Adit

Toss Up: Multiple Choice

Negative charges are accelerated by electric fields toward points

W) at lower electric potentials

X) at higher electric potentials

Y) where the electric field is weaker

Z) where the electric field is stronger

Toss Up Answer: X

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Bonus: Multiple Choice

The potential at point A in an electric field is 10V higher than at point B. If a negative charge,  $q = -2$  C, is moved from point A to point B, then the potential energy of this charge will

W) decrease by 20 J

- X) decrease by 5 J
- Y) increase by 5 J
- Z) increase by 20 J

**Bonus Answer: Z**

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## 5. CHEMISTRY

**Writer: Elias Milborn**

**Toss Up: Multiple Choice**

Which of the following is a weak electrolyte?

- W) ammonia
- X) dilute sulfuric acid
- Y) 1 Molar sulfuric acid
- Z) dilute perchloric acid

**Toss Up Answer: W**

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**Bonus: Short Answer**

What is the most common name for the conformation for the ring structure of cyclohexane adopts to reach a strain-free value?

**Bonus Answer: Chair**

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## 6. EARTH and SPACE

**Writer: Zoe Orlin**

**Toss Up: Multiple Choice**

How many miles per hour is the Earth moving?

- W) 65,000
- X) 67,000
- Y) 69,000
- Z) 70,000

**Toss Up Answer: X**

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**Bonus: Short Answer**

When magma hardens into rock, which type of rock is it?

**Bonus Answer: Igneous**

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## 7. MATHEMATICS

**Writer: Elias Milborn**

**Toss Up: Multiple Choice**

Which of the following is an accurate representation of the inverse of  $f(x) = x^3 - 5$ ?

- W)  $x^3 - 5$
- X)  $(x - 5)^3$
- Y)  $(x - 5)^{(1/3)}$
- Z)  $1/(x-5)^3$

**Toss Up Answer: Y**

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**Bonus: Short Answer**

The three sides of a triangle are 5cm, 6cm, and 8cm. What is the cosine of the smallest angle in reduced fractional form?

**Bonus Answer: 25/32**

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## 8. EARTH and SPACE

Writer: Zoe Orlin

Toss Up: Multiple Choice

Rounded to the nearest thousand, what is the circumference of the globe?

W) 25,000

X) 26,000

Y) 27,000

Z) 28,000

Toss Up Answer: W

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Bonus: Short Answer

In which country are the oldest rocks on Earth located?

Bonus Answer: Canada

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## 9. CHEMISTRY

Writer: Elias Milborn

Toss Up: Short Answer

What is the IUPAC name for  $\text{SnCl}_2 \cdot 6\text{H}_2\text{O}$ ?

Bonus Answer: Tin (II) Chloride Hexahydrate

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Bonus: Multiple Choice

Which of the following elements has the valence electron configuration of  $3s^2 3p^3$ ?

W) Phosphorous

X) Oxygen

Y) Bromine

Z) Nitrogen

Bonus Answer: W

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## 10. PHYSICS

Writer: Nicholas Adit

Toss Up: Multiple Choice

A sphere of charge  $+Q$  is fixed in position. A smaller sphere of charge  $+q$  is placed near the larger sphere and released from rest. The small sphere will move away from the large sphere with

W) decreasing velocity and acceleration

X) decreasing velocity and increasing acceleration.

Y) increasing velocity and decreasing acceleration.

Z) increasing velocity and increasing acceleration.

Toss Up Answer: Y

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Bonus: Short Answer

If the distance between two positive point charges is tripled, then the strength of the electrostatic repulsion between them will decrease by a factor of

Bonus Answer: 9

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## 11. EARTH and SPACE

Writer: Zoe Orlin

Toss Up: Short Answer

Does a person weigh less at the equator or the poles?

Bonus Answer: Equator

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**Bonus: Short Answer**

Does one move faster on the equator or on the poles?

**Bonus Answer: Equator**

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**12. PHYSICS**

**Writer: Nicholas Adit**

**Toss Up: Short Answer**

The mean distance from Saturn to the sun is 9 times greater than the mean distance from Earth to the sun. How long is a Saturn year?

**Bonus Answer: 27 Earth years**

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**Bonus: Short Answer**

An object moves at constant speed in a circular path. True statements about the motion include which of the following?

- I. The velocity is constant.
- II. The acceleration is constant.
- III. The net force on the object is zero since its speed is constant.

**Bonus Answer: None of them (The vectors are changing)**

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**13. MATHEMATICS**

**Writer: Elias Milborn**

**Toss Up: Multiple Choice**

What are the solutions for  $x$  in the following equation:  $x^2 - 2x = 8$ ?

- W) 0
- X) 0 and -2
- Y) 4 and -2
- Z) -4 and 2

**Toss Up Answer: Y**

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**Bonus: Multiple Choice**

The sum of the squares of reciprocals of all positive integers equals which of the following?

- W)  $\pi^{1/2}$  (read as square root of  $\pi$ )
- X)  $\pi/3$
- Y)  $\pi^2/6$
- Z)  $\pi^3/12$

**Bonus Answer: Y**

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**14. PHYSICS**

**Writer: Shanjeed Ali**

**Toss Up: Short Answer**

How many orbitals are there in the third electron shell?

**Bonus Answer: 9**

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**Bonus: Short Answer**

Who discovered the neutron?

**Bonus Answer: James Chadwick**

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## 15. CHEMISTRY

Writer: Elias Milborn

Toss Up: Multiple Choice

What is the mass of an electron relative to a proton?

W)  $9.1 \times 10^{-31}$

X)  $8.2 \times 10^{-14}$

Y) 1/1836

Z) 0.51

Toss Up Answer: Y

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Bonus: Multiple Choice

Which of the following is not a component of a phospholipid?

W) water

X) glycerol

Y) fatty acid

Z) phosphate group

Bonus Answer: W

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## 16. MATHEMATICS

Writer: Calvin Aw

Toss Up: Short Answer

What was the first name of the person who discovered the Fibonacci Sequence?

Bonus Answer: Leonardo

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Bonus: Short Answer

What is the full name of the man who invented the Power of a Point?

Bonus Answer: Jacob Steiner

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## 17. PHYSICS

Writer: Nicholas Adit

Toss Up: Multiple Choice

An object of mass 2 kg has a linear momentum of magnitude 6 kg • m/s. What is this object's kinetic energy?

W) 3 J

X) 6 J

Y) 9 J

Z) 12 J

Toss Up Answer: Y

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Bonus: Short Answer

Two objects, one of mass 3 kg and moving with a speed of 2 m/s and the other of mass 5 kg and speed 2 m/s, move toward each other and collide head-on. If the collision is perfectly inelastic, find the speed of the objects after the collision.

Bonus Answer: 0.5 m/s

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## 18. CHEMISTRY

Writer: Elias Milborn

Toss Up: Multiple Choice

Which of the following elements, in gaseous state, has the highest electron affinity?

- W) Fluorine
- X) bromine
- Y) sulfur
- Z) chlorine

**Toss Up Answer: W**

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**Bonus: Multiple Choice**

In order to calculate the heat of fusion for a piece of ice placed in warm water, you must know:

- W) The energy released by the warm water and the mass of the water
- X) The energy released by the warm water and the mass of the ice
- Y) the energy released by the ice and the mass of the warm water
- Z) the energy released by the ice and the mass of the ice

**Bonus Answer: X**

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**19. BIOLOGY**

**Writer: Elias Milborn**

**Toss Up: Short Answer**

What scientist in 1936, building on the discoveries of Szent-Gyorgyi [SENT-GEE-or-gee], postulated the basic reactions of the tricarboxylic acid cycle?

**Bonus Answer: Krebs**

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**Bonus: Short Answer**

If a plant that is heterozygous for each of three independently-assorting traits is allowed to self-fertilize, what portion of the offspring would be heterozygous for all three traits?

**Bonus Answer: 1/8**

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**20. BIOLOGY**

**Writer: Yae June Lee**

**Toss Up: Short Answer**

Why do we need oxygen for cellular respiration?

**Bonus Answer: Oxygen is the final electron acceptor for cellular respiration.**

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**Bonus: Short Answer**

How are saturated fat and unsaturated fat different?(refer to bonds)

**Bonus Answer: Saturated fats are single bonded, and straight. Unsaturated fats are double bonds and curved.**

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**21. BIOLOGY**

**Writer: Yae June Lee**

**Toss Up: Short Answer**

Which plant tissue conducts water from the roots to the leaves?

**Bonus Answer: Xylem**

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**Bonus: Multiple Choice**

Which system rids of nitrogenous waste?

- W) Digestive system
- X) Integumentary system
- Y) Respiratory system
- Z) Urinary system

**Bonus Answer: Z**

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## **22. BIOLOGY**

**Writer: Yae June Lee**

**Toss Up: Short Answer**

What type of endocytosis is used when it uses pseudopods to move cells between membranes?

**Bonus Answer: Receptor mediated endocytosis.**

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**Bonus: Multiple Choice**

How can small intestine increase its surface area?

- W) Rugae
- X) Villi
- Y) Cecae
- Z) Sphincters

**Bonus Answer: X**

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## **23. BIOLOGY**

**Writer: Siam Muquit**

**Toss Up: Multiple Choice**

Kuru is a disease caused by what type of microbe?

- W) Bacteria
- X) Virus
- Y) Prion
- Z) Viroid

**Toss Up Answer: Y**

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**Bonus: Short Answer**

Give the genus and species name of the microbe that causes peptic ulcer disease.

**Bonus Answer: Helicobacter pylori**

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## **24. BIOLOGY**

**Writer: Siam Muquit**

**Toss Up: Multiple Choice**

Which term describes organisms that can only tolerate a narrow range of temperatures?

- W) Eurythermal
- X) Stenothermal
- Y) Acrithermal
- Z) Anglothermal

**Toss Up Answer: X**

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**Bonus: Multiple Choice**

What is the name of the ecological phenomenon, related to the Small Population hypothesis, that describes a species' path to extinction due to inbreeding and genetic drift?

- W) Inbreeding depression
- X) Outbreeding depression
- Y) Extinction cascade
- Z) Extinction vortex

**Bonus Answer: Z**

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## **25. BIOLOGY**

**Writer: Elias Milborn**

**Toss Up: Short Answer**

What is the main respiratory pigment of skeletal muscle cells?

**Bonus Answer: Myoglobin**

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**Bonus: Multiple Choice**

If a parent organism experiences a mutation, then all subsequent offspring of that individual will:

- W) always carry the mutated gene, but only as a recessive.
- X) Always carry the gene, but never express it phenotypically
- Y) only carry the mutated gene if it is heritable
- Z) never carry the gene as mutations can never be heritable

**Bonus Answer: Y**

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