

## Round 36

### 1. 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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### 2. PHYSICS

Writer: Mohammed Jamil

Toss Up: Short Answer

A 1-kilogram ball is thrown into the air with an initial velocity of 30 m/sec. How high in the air did it travel ?

Bonus Answer: 46 meters

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Bonus: Short Answer

What is the velocity of an 500-kilogram elevator that has 4,000 joules of energy?

Bonus Answer: 4 m/sec

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### 3. PHYSICS

Writer: Charles Zhang

Toss Up: Multiple Choice

What is the thrust of a rocket ejecting fuel at 200 kg/s and with an exhaust velocity of 1500 m/s?

- W) 30000 newton meters
- X) 60000 newton meters
- Y) 90000 newton meters
- Z) 300000 newton meters

Toss Up Answer: W

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Bonus: Multiple Choice

A solid disk with a rotational inertia of  $5 \text{ kg}\cdot\text{m}^2$  (READ AS: kilogram meters squared) and a radius of 0.25 m rotates on a fixed axis perpendicular to the disk and through its center. If a force of 2 N is applied tangentially to the disk, what is the work done by the force after half of a revolution to the nearest tenth?

- W) 0.4 J
- X) 0.8 J
- Y) 1.6 J
- Z) 3.1 J

Bonus Answer: Y

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### 4. PHYSICS

Writer: Charles Zhang

Toss Up: Short Answer

A heated 8 kg ring with a radius of 4m cools as it rotates, causing it to shrink to a radius of 2m. If it was initially rotating at 6 rad/s, what is it's final angular velocity?

**Bonus Answer: 24 rad/s**

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**Bonus: Short Answer**

A 120-N child sits on a light swing and is pulled back and held with a horizontal force of 90 N. What is the magnitude of the tension force in each of the two supporting ropes?

**Bonus Answer: 75 N**

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## 5. PHYSICS

**Writer: Aaron Gee**

**Toss Up: Multiple Choice**

A block of metal which weighs 60 newtons in air and 40 newtons under water has a density, in kilograms per meter cubed of

- W) 2400
- X) 1000
- Y) 3000
- Z) 5000

**Toss Up Answer: Y**

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**Bonus: Multiple Choice**

A ball leaves a girl's hand with an upward velocity of 6 meters per second. What is the maximum height of the ball above the girl's hand?

- W) 10
- X) 6
- Y) 1.8
- Z) 2.8

**Bonus Answer: Y**

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## 6. 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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## 7. MATHEMATICS

**Writer: Ivan Zhang**

**Toss Up: Multiple Choice**

What is asymptote of the function:  $f(x) = 1/x$ ?

- W)  $y = 0$
- X)  $x = 0$
- Y)  $x = 0, y = 1$
- Z)  $x = 0, y = 0$

**Toss Up Answer: Z**

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**Bonus: Short Answer**

Plugging the divergent series,  $1 + 2 + 3 + 4 + \dots$ , into the Riemann Zeta Function results in which number?

**Bonus Answer: -1/12**

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## 8. MATHEMATICS

**Writer: Larry Wong**

**Toss Up: Short Answer**

What is the distance in space between the points with coordinates  $(-3, 6, 7)$  and  $(2, -1, 4)$ ?

**Bonus Answer: 9.11**

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**Bonus: Multiple Choice**

The diameter and height of a right circular cylinder are equal. If the volume of the cylinder is 2, what is the height of the cylinder?

- W) 1.37
- X) 1.08
- Y) 0.86
- Z) 0.8

**Bonus Answer: W**

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## 9. MATHEMATICS

**Writer: Larry Wong**

**Toss Up: Multiple Choice**

If  $\log_x(1/8) = -3/2$ , then  $x$  is equal to

- W) -4
- X) 4
- Y)  $1/4$
- Z) 10

**Toss Up Answer: X**

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**Bonus: Multiple Choice**

$f$  is a function such that  $f(x) < 0$ . The graph of the new function  $g$  defined by  $g(x) = |f(x)|$  is a reflection of the graph of  $f$

- W) on the  $y$  axis
- X) on the  $x$  axis
- Y) on the line  $y = x$
- Z) on the line  $y = -x$

**Bonus Answer: X**

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## 10. BIOLOGY

**Writer: Mohammed Jamil**

**Toss Up: Multiple Choice**

When outside of the lymph vessel, the lymph is called

- W) Interstitial Fluid
- X) Hemocel
- Y) Plasma
- Z) Blood

**Toss Up Answer: W**

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**Bonus: Multiple Choice**

Which of the following is not true about platelets

- W) They are involved in blood clotti
- X) They are present in blood
- Y) They are cells that broke away from megakaryocytes
- Z) They have cytoplasm

**Bonus Answer: Y**

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## 11. BIOLOGY

**Writer: Josh Tish**

**Toss Up: Multiple Choice**

The amino acid sequences encoded by the red and green visual pigment genes in humans are 96% identical. These two loci are found close together on the X chromosome. What mechanism most likely led to the evolution of these two genes?

- W) Horizontal gene transfer followed by sequence divergence
- X) Gene duplication followed by sequence divergence
- Y) Inversion of the human X chromosome
- Z) Polyploidization

**Toss Up Answer: X**

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**Bonus: Multiple Choice**

Genetic drift is best described as:

- W) evolutionary change due to natural selection.
- X) changes in the proportion of homozygous recessive individuals due to random mating.
- Y) a random change in allele frequencies that benefits the population.
- Z) evolutionary change due to random events.

**Bonus Answer: Z**

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## 12. BIOLOGY

**Writer: Josh Tish**

**Toss Up: Multiple Choice**

SNPs can be characterized by all of the following EXCEPT for:

- W) always causing diseases.
- X) being common in a population.
- Y) acting as a point mutation.
- Z) acting as a transition mutation.

**Toss Up Answer: W**

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**Bonus: Short Answer**

Which of the following cells are phagocytic?

- 1.Megakerocyte
- 2.Dendritic cells
- 3.Natural killer cells
- 4.Neutrophils
- 5.Monocytes

**Bonus Answer: 2, 4, 5**

**(Dendritic cells, Neutrophils, Monocytes)**

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### 13. BIOLOGY

**Writer: Josh Tish**

**Toss Up: Multiple Choice**

A female lizard washes ashore on an island after riding a floating log for hundreds of miles across the sea. She is the only member of her species to have ever made it to the island. After arriving, she lays 20 fertile eggs that hatch and form the basis of a lizard population on the island. Which of the following is NOT a likely result?

- W) The new island population will have less genetic diversity than the ancestral population.
- X) Mutation will add new alleles to the new population and thus increase its genetic diversity over time.
- Y) There will be little or no gene exchange between the new population and the ancestral population.
- Z) The new island population will have greater genetic diversity than the ancestral population.

**Toss Up Answer: Z**

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**Bonus: Multiple Choice**

Loss of heterozygosity can be caused by all of the following EXCEPT:

- W) genetic drift.
- X) positive frequency-dependent selection.
- Y) heterozygote advantage.
- Z) inbreeding.

**Bonus Answer: Y**

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### 14. BIOLOGY

**Writer: Mohammed Jamil**

**Toss Up: Multiple Choice**

Which of the following processes in cellular respiration produce the most ATP

- W) Glycolysis
- X) Link Reaction
- Y) Krebs Cycle
- Z) Oxidative Phosphorylation

**Toss Up Answer: Z**

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**Bonus: Multiple Choice**

Which of the following is not used in cellular respiration

- W) Glucose
- X) NADH
- Y) FADH<sub>2</sub>
- Z) NADPH

**Bonus Answer: Z**

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## **15. BIOLOGY**

**Writer: Mohammed Jamil**

**Toss Up: Multiple Choice**

Surfactant helps to prevent the alveoli from collapsing by:

- W) humidifying the air before it enters
- X) Reducing the surface tension of alveolar fluid
- Y) warming the air before it enters
- Z) protecting the surface of alveoli from dehydration and other environmental variations

**Toss Up Answer: X**

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**Bonus: Multiple Choice**

Respiratory control centers are located in the

- W) midbrain and medulla
- X) pons and midbrain
- Y) medulla and pons
- Z) upper spinal chord and medulla

**Bonus Answer: Y**

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## **16. BIOLOGY**

**Writer: Jason Weng**

**Toss Up: Short Answer**

What organelle in a human cell is responsible for breaking down waste material?

**Bonus Answer: Lysosome**

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**Bonus: Short Answer**

Order the following from the least specific to the most: Species, Family, Order, Phylum

**Bonus Answer: Phylum, Order, Family, Species (4, 3, 2, 1)**

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## **17. BIOLOGY**

**Writer: Jason Weng**

**Toss Up: Short Answer**

How many subunits does a tubulin protein have?

**Bonus Answer: 2**

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**Bonus: Short Answer**

The blood enter systemic circulation via the aorta, and returns to the heart via what common vein?

**Bonus Answer: Vena Cava (accept superior or inferior vena cava)**

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## **18. CHEMISTRY**

**Writer: Prangon Ghose**

**Toss Up: Multiple Choice**

What do the Neon, Fluorine(1-) and Magnesium(2+) have in common?

- W) They are isotopes of each other
- X) They are isomers of each other
- Y) They are isoelectronic with each other
- Z) They have nothing in common

**Toss Up Answer: Y**

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**Bonus: Multiple Choice**

The half-life of francium-212 is 19 minutes. How many minutes will it take for 1 gram of this isotope to decay to 0.125 grams?

W) 4.75 min

X) 9.5 min

Y) 38 min

Z) 57 min

**Bonus Answer: Z**

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**19. CHEMISTRY**

**Writer: Prangon Ghose**

**Toss Up: Short Answer**

What is the element formed by the beta decay of Carbon-14?

**Bonus Answer: Nitrogen-14**

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**Bonus: Short Answer**

If the abundance of Lithium-6 (6.0 amu) is 7.500% and the abundance of Lithium-7 (7.0 amu) is 92.500%, what is the average atomic mass to the tenth place?

**Bonus Answer: 6.9 amu**

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**20. CHEMISTRY**

**Writer: Prangon Ghose**

**Toss Up: Short Answer**

What is the correct formula for Aluminum Oxide?

**Bonus Answer: Al<sub>2</sub>O<sub>3</sub> (accept: Aluminum 2 Oxygen 3)**

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**Bonus: Short Answer**

What is the formal charge of oxygen in H<sub>3</sub>O<sup>+</sup>?

**Bonus Answer: +1 (do not accept 1)**

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**21. CHEMISTRY**

**Writer: Prangon Ghose**

**Toss Up: Short Answer**

What is the empirical formula of glucose?

**Bonus Answer: CH<sub>2</sub>O**

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**Bonus: Short Answer**

What is the shape of an Acetylene (C<sub>2</sub>H<sub>2</sub>) molecule?

**Bonus Answer: Linear**

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**22. CHEMISTRY**

**Writer: Prangon Ghose**

**Toss Up: Short Answer**

What two chemical elements are found in sphalerite?

**Bonus Answer: Zinc and Sulfur (accept: Zn and S)**

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**Bonus: Short Answer**

What two chemical elements are found in periclase?

**Bonus Answer: Magnesium and Oxygen (accept: Mg and O)**

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**23. EARTH and SPACE**

**Writer: Shamaul Dilmohamed**

**Toss Up: Multiple Choice**

Which one of these is NOT true?

- W) All planets revolve in the same direction.
- X) All planets rotate in the same direction.
- Y) The orbits of the planets are all ellipses.
- Z) The orbits of the planets are nearly in the same plane.

**Toss Up Answer: X**

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**Bonus: Multiple Choice**

Coal is believed to have been principally formed in which of the following types of environment?

- W) river beds
- X) swamps
- Y) volcanic regions
- Z) deserts

**Bonus Answer: X**

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**24. EARTH and SPACE**

**Writer: Shamaul Dilmohamed**

**Toss Up: Multiple Choice**

The principal mineral in most sand beaches is

- W) quartz
- X) orthoclase
- Y) magnetite
- Z) muscovite

**Toss Up Answer: W**

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**Bonus: Short Answer**

What geological event will allow you to see Bishop's ring?

**Bonus Answer: a volcanic eruption**

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**25. EARTH and SPACE**

**Writer: Shamaul Dilmohamed**

**Toss Up: Multiple Choice**

In which state is the oldest North American lake located?

- W) California
- X) Minnesota
- Y) Ohio
- Z) Utah

**Toss Up Answer: W**

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**Bonus: Short Answer**



What is the densest naturally occurring element?

**Bonus Answer: Osmium**

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