

## Round 12

### 1. EARTH and SPACE

Writer: Janine Goh

Toss Up: Short Answer

Which is the new satellite/telescope replacing Hubble?

Bonus Answer: James Webb Space Telescope

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Bonus: Short Answer

Why is Mars red?

Bonus Answer: Oxidised iron on Mars' surface

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### 2. 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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### 3. MATHEMATICS

Writer: Jessica Titensky

Toss Up: Short Answer

What is the amplitude of  $y=4\sin(5x+3)$

Bonus Answer: 4

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Bonus: Short Answer

What is the period of  $y=4\sin(5x+3)$  rounded to the nearest 100th

Bonus Answer: 1.26

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### 4. BIOLOGY

Writer: Jason Mohabir

Toss Up: Multiple Choice

Proteomics is the study of

W) sets of proteins

X) sets of proteins in a specific organelle

Y) entire set of expressed proteins in a cell

Z) proteins encapsulated in vesicles

Toss Up Answer: Y

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Bonus: Multiple Choice

The computational methodology that tries to find the best matching between two molecules, a receptor and ligand called:

W) molecular matching

- X) molecular docking
- Y) molecular fitting
- Z) molecule affinity checking

**Bonus Answer: X**

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## 5. 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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## 6. BIOLOGY

**Writer: Ivan Zhang**

**Toss Up: Multiple Choice**

What is the name given to the crosses that occur when maternal and paternal DNA intertwine?

- W) polymerase
- X) chiasmata
- Y) zona pellucida
- Z) cambium

**Toss Up Answer: X**

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**Bonus: Short Answer**

What is the name given to the follicle cells surrounding an egg that has left the ovary?

**Bonus Answer: corona radiata**

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## 7. CHEMISTRY

**Writer: Shantanu Jha**

**Toss Up: Multiple Choice**

What term describes a particular way that ions and molecules bind metal ions?

- W) Chelation
- X) Supposition
- Y) Coordination
- Z) Fluxing

**Toss Up Answer: W**

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**Bonus: Multiple Choice**

Crystals which acquire a charge when compressed, twisted or distorted are said to be what?

- W) Ceramic
- X) Transduced
- Y) Magnetostricted

Z) Piezoelectric

**Bonus Answer: Z**

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## 8. BIOLOGY

**Writer: Ahmad Alnasser**

**Toss Up: Multiple Choice**

The structure of bone tissue suits the function. Which of the following bone tissues is adapted to support weight and withstand tension stress?

- W) Spongy bone
- X) Irregular bone
- Y) Compact bone
- Z) Trabecular bone

**Toss Up Answer: Y**

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**Bonus: Short Answer**

Which hormone increases osteoclast activity to release more calcium ions into the bloodstream?

**Bonus Answer: Parathyroid Hormone**

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## 9. PHYSICS

**Writer: Charles Zhang**

**Toss Up: Multiple Choice**

A 2 kg ball is dropped from 10m. Another 2 kg ball is thrown upwards at 5 m/s. What is the acceleration of the center of mass of these two balls in terms of g, the gravitational acceleration on Earth?

- W) 2g
- X) g
- Y) 5g
- Z) 10g

**Toss Up Answer: X**

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**Bonus: Multiple Choice**

Two astronauts are in gravity-free space. Astronaut A is 120 kg and Astronaut B is 90 kg. If A pushes B away, with B moving at 0.5 m/s, what is Astronaut A's final speed rounded to the tenth?

- W) 0
- X) 0.38
- Y) 0.5
- Z) 0.68

**Bonus Answer: X**

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## 10. BIOLOGY

**Writer: Calvin Vuong**

**Toss Up: Multiple Choice**

Which of the following hormones does not promote, directly or indirectly, spermatogenesis?

- W) prostaglandins
- X) luteinizing hormone
- Y) follicle stimulating hormone
- Z) gonadotropin releasing hormone

**Toss Up Answer: W**

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**Bonus: Multiple Choice**

Which hormone is synthesized in the hypothalamus and released via the posterior pituitary gland?

- W) prolactin
- X) thyroid-stimulating hormone
- Y) adrenocorticotrophic hormone
- Z) vasopressin

**Bonus Answer: Z**

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## 11. PHYSICS

**Writer: Jan Wojcik**

**Toss Up: Multiple Choice**

There is a 4kg block at rest. It spontaneously explodes into two pieces traveling in opposite directions. One piece weighing 1 kilogram travels to the left at 4 m/s. What direction and speed was the other block traveling in?

- W) 4/3 m/s to the left
- X) 3/4 m/s to the right
- Y) 4/3 m/s to the right
- Z) 4 m/s to the left

**Toss Up Answer: Y**

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**Bonus: Multiple Choice**

Under small velocities, objects that collide do not conserve their total energy. However, under relativistic velocities, collisions always conserve their total energy. Why is this so?

- W) Under relativistic velocities, mass and energy are interchangeable, and since mass can't be destroyed, neither can initial nor final energy.
- X) Under small velocities, the frictional force during collision felt by two objects is large, whereas under relativistic velocities, the frictional force is negligible and energy is conserved.
- Y) Under relativistic velocities, objects obtain relativistic masses which makes them gain more mass and makes up the lost energy in a regular collision.
- Z) Under small velocities, particles lose parts of their masses while in motion, leading to a loss of energy after collision.

**Bonus Answer: W**

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## 12. MATHEMATICS

**Writer: Andrew Chen (Senior)**

**Toss Up: Short Answer**

What is the sum of the interior angles of a nonagon?

**Bonus Answer: 1260 degrees**

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**Bonus: Short Answer**

How many edges does an octahedral prism have?

**Bonus Answer: 24 edges**

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## 13. 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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## 14. MATHEMATICS

**Writer: Hussain Waris**

**Toss Up: Multiple Choice**

Which of the following best characterizes every transcendental number?

W) Irrational

X) A linear combination of e or pi in which the coefficients are non-zero

Y) A real number that is not a root of any non-zero polynomial with rational coefficients

Z) e or pi

**Toss Up Answer: W**

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**Bonus: Short Answer**

Which of the following numbers are transcendental numbers: 1) e; 2)  $\sqrt{2}$ ; 3)  $i^i$ ; 4) pi?

**Bonus Answer: e,  $i^i$ , pi [Accept any permutation of 1, 3, and 4]**

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## 15. EARTH and SPACE

**Writer: Benjamin Avrahami**

**Toss Up: Multiple Choice**

At above what size, in cm, does a rock need to be in order to be a boulder?

W) 15.3

X) 25.6

Y) 40.2

Z) 22.9

**Toss Up Answer: X**

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**Bonus: Short Answer**

At which two zones of Earth's atmosphere does the temperature rise as the altitude increases?

**Bonus Answer: Stratosphere and Thermosphere**

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## 16. CHEMISTRY

**Writer: Josh Tish**

**Toss Up: Multiple Choice**

Dissolution of which salt in water results in a decrease in the temperature of the solution?

W)  $\text{KHSO}_4$

X)  $\text{NaOH}$

Y)  $\text{AlCl}_3$

Z)  $\text{NH}_4\text{NO}_3$

**Toss Up Answer: Z**

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**Bonus: Multiple Choice**

What is observed when equal volumes of 0.1 M aqueous

HCl and 0.01 M aqueous Na<sub>2</sub>SO<sub>3</sub> are mixed?  
W) Colorless solution and a white precipitate  
X) Colored solution and a white precipitate  
Y) Colorless solution and a colored precipitate  
Z) Colorless solution, no precipitate, and gas evolution

**Bonus Answer: Z**

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## 17. EARTH and SPACE

**Writer: Andrew Chen (Senior)**

**Toss Up: Multiple Choice**

Sedimentary rocks are formed from accumulation of different sediments. What is the term for a rock made by living organisms or composed of materials from life forms?

- W) Conglomerate
- X) Evaporites
- Y) Crystalline
- Z) Bioclastic

**Toss Up Answer: Z**

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**Bonus: Short Answer**

What category do the following sedimentary rocks fall into: breccia, conglomerate, and shale.

**Bonus Answer: All Clastic sedimentary rocks.**

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## 18. 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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## 19. PHYSICS

**Writer: Aaron Gee**

**Toss Up: Short Answer**

The frequency of a wave is 50 Hertz and its wavelength is 25 meters. What is the velocity of this wave?

**Bonus Answer: 1250 meters/second**

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**Bonus: Short Answer**

The focal length of a concave spherical mirror is equal to 1 meter. What is the radius of curvature of this mirror?

**Bonus Answer: 2 meters**

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## 20. CHEMISTRY

**Writer: Seiji Yawata**

**Toss Up: Multiple Choice**

The last electron of lanthanum enters in the:

W) d orbital

X) s orbital

Y) p orbital

Z) f orbital

**Toss Up Answer: W**

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**Bonus: Multiple Choice**

Which of the following is true for B<sub>3</sub>N<sub>3</sub>H<sub>6</sub>

W) Its name is Nitroborane

X) All the atoms are sp-hybridised

Y) It has 3 lone pairs of electrons

Z) It is isostructural with benzene

**Bonus Answer: Z**

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## 21. PHYSICS

**Writer: Aaron Gee**

**Toss Up: Short Answer**

A 40 kilogram girl climbs a vertical distance of 5 meters in twenty seconds at a constant velocity. How much work has the girl done?

**Bonus Answer: 2000 joules / 1960 joules (accept either)**

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**Bonus: Short Answer**

A machine performs 8 Joules of work in 2 seconds. How much power is delivered by this machine?

**Bonus Answer: 4 Watts**

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## 22. 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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## 23. PHYSICS

**Writer: Prangon Ghose**

**Toss Up: Short Answer**

A sports car dealer claims that his product will accelerate at a constant rate from rest to a speed of 90 km/hr in 8s.

What is the acceleration of the car in m/s<sup>2</sup> to the nearest whole number?

**Bonus Answer: 3 m/s<sup>2</sup>**

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**Bonus: Short Answer**

A rock released at rest from the top of a tower hits the ground after falling for 2 s. What is the height of the tower if air resistance is negligible to the nearest whole number?

**Bonus Answer: 20 m**

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## **24. CHEMISTRY**

**Writer: Shanjeed Ali**

**Toss Up: Multiple Choice**

Which of the following is least reactive with water at room temperature?

- W) Sodium
- X) Potassium
- Y) Rubidium
- Z) Cesium

**Toss Up Answer: W**

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**Bonus: Short Answer**

What is the most abundant alkali metal on earth?

**Bonus Answer: Sodium**

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## **25. 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 x 10<sup>9</sup>**

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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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