

Round 16

1. CHEMISTRY

Writer: Seiji Yawata

Toss Up: Multiple Choice

What is the pH of distilled water?

W) 6.5

X) 6.7

Y) 7

Z) Depends on the temperature

Toss Up Answer: Z

Bonus: Multiple Choice

What is one of the hydrolysis product when Magnesium carbide is hydrolysed with water?

W) Propadiene

X) Propyne

Y) Methane

Z) There is insufficient information

Bonus Answer: Z

2. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

Whose law defines the relationship between angle of incidence and of refraction?

W) Snell's

X) DeBroglie's

Y) Kepler's

Z) Carnot's

Toss Up Answer: W

Bonus: Short Answer

What are the names of Hydrogen's three isotopes?

Bonus Answer: Protium, Deuterium, Tritium (accept: Hydrogen, Deuterium, Tritium)

3. MATHEMATICS

Writer: Justin Lam

Toss Up: Short Answer

On which point does $y = 10x + 8$ and $y = x + 5$ intersect?

Bonus Answer: $(-1/3, 14/3)$

Bonus: Short Answer

How many distinct roots does the cubic equation $y = x^3 - 4x^2 + 4x$ have?

Bonus Answer: It has 2 roots.

(Explanation: It intersects the x-axis twice, once at $x = 0$ and once at $x = 2$.)

4. EARTH and SPACE

Writer: Zoe Orlin

Toss Up: Multiple Choice

Moonquakes occur due to

- W) Asteriods
- X) Tidal stresses
- Y) Rotation irregularities
- Z) Moonquakes do not happen

Toss Up Answer: X

Bonus: Short Answer

By magnitude, where did the largest earthquake ever happen?

Bonus Answer: Chile

5. MATHEMATICS

Writer: Hanna Yang

Toss Up: Multiple Choice

If 8 moles dig 8 holes in 8 years, how many holes can 4 moles dig in 1461 days?

- W) 1
- X) 2
- Y) 4
- Z) 8

Toss Up Answer: X

Bonus: Short Answer

If 9 moles dig 24 holes in 10 days, how many holes can 3 moles dig in 5 days?

Bonus Answer: 4

6. EARTH and SPACE

Writer: Seiji Yawata

Toss Up: Multiple Choice

The Cascadia Subduction Zone separates the North American Plate and the

- W) Caribbean Plate
- X) Juan de Fuca Plate
- Y) Okhotsk Plate
- Z) Cocos Plate

Toss Up Answer: X

Bonus: Short Answer

During which geologic period did Pangaea start breaking up?

Bonus Answer: Jurassic

7. MATHEMATICS

Writer: Steven Litvack-Winkler

Toss Up: Multiple Choice

Triangle ABC is similar to triangle DEF. If triangle ABC has an area of 27, triangle DEF has an area of 3, and AC=12, then compute DF.

- W) 9
- X) 36
- Y) $2\sqrt{3}$
- Z) 4

Toss Up Answer: Z

Bonus: Multiple Choice

What is the surface area, in terms of pi, of a cone if the slant height is 13 and the radius of the base is 5.

- W) 10 pi
- X) 20 pi
- Y) 30 pi
- Z) $10\sqrt{3}\pi + 20$

Bonus Answer: X

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8. EARTH and SPACE

Writer: Jan Wojcik

Toss Up: Multiple Choice

What is the chemical formula for quartz?

- W) Si
- X) SiO
- Y) SiO₂
- Z) SiO₄

Toss Up Answer: Y

Bonus: Multiple Choice

What is the crystal form of sodium chloride?

- W) halite
- X) calcite
- Y) chlorite
- Z) natrite

Bonus Answer: W

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9. PHYSICS

Writer: George Zhou

Toss Up: Multiple Choice

A metallic cylindrical conductor is used to produce some heat by applying a constant voltage between its two ends. You want to double the heat released. Which of the following is the most appropriate thing to be done?

- W) The length should be doubled
- X) The radius should be doubled
- Y) Both the length as well as the radius should be halved
- Z) Both the length as well as the radius should be doubled

Toss Up Answer: Z

Bonus: Short Answer

A parallel plate capacitor of capacitance 10 micro F is charged to 50 micro C using a battery, and is then disconnected from the circuit. How much energy in micro joules is required to pull apart the plates such that the distance between them is doubled?

Bonus Answer: 125

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10. BIOLOGY

Writer: Aaron Gee

Toss Up: Multiple Choice

Which of the following tissues is MOST directly responsible for

the increased diameter of a tree trunk from year to year?

- W) apical meristem
- X) pericycle
- Y) vascular cambium
- Z) pith

Toss Up Answer: Y

Bonus: Short Answer

Name all of the following 3 metabolic processes which directly require oxygen: glycolysis; alcohol fermentation; electron transport system

Bonus Answer: Electron transport system

11. CHEMISTRY

Writer: Andrew Chen (Senior)

Toss Up: Short Answer

Each element has its own electron configuration. What is the electron configuration of chromium (Cr).

Bonus Answer: [Ar] 3d⁵ 4s¹ (Also accept 1s² 2s² 2p⁶ 3s² 3p⁶ 3d⁵ 4s¹)

Bonus: Multiple Choice

There are various numbers of pi and sigma bonds in certain compounds. Which of the choices below best describes the number of pi and sigma bonds ethyne (acetylene) has?

- W) 1 pi bonds and 4 sigma bonds
- X) 3 pi bonds and 2 sigma bonds
- Y) 2 pi bonds and 3 sigma bonds
- Z) 4 pi bonds

Bonus Answer: Y

12. 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

Bonus: Short Answer

What is the purpose of topoisomerase?

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

13. CHEMISTRY

Writer: Elias Milborn

Toss Up: Multiple Choice

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

- W) 9.1×10^{-31}
- X) 8.2×10^{-14}
- Y) 1/1836

Z) 0.51

Toss Up Answer: Y

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

14. BIOLOGY

Writer: Matthew Lee

Toss Up: Short Answer

What molecule or one of its derivatives serves as the final electron acceptor in fermentation?

Bonus Answer: Pyruvate

Bonus: Short Answer

In alcoholic fermentation, pyruvate is converted to a compound which acts as the final electron acceptor, being converted to ethanol in the process. What is this compound called?

Bonus Answer: Acetaldehyde

15. PHYSICS

Writer: Nicholas Adit

Toss Up: Multiple Choice

A light ray passes through a prism, causing a dispersion of light. Which color will have the greatest angle of deviation?

W) Red

X) Yellow

Y) Green

Z) Blue

Toss Up Answer: Z

Bonus: Short Answer

Put the following electromagnetic waves in order of increasing wavelength: Microwaves, Ultraviolet, Gamma Rays, Radio Waves, Visible Light, Infrared, X-rays.

Bonus Answer: Gamma Rays, X-rays, Ultraviolet, Visible Light, Infrared, Microwaves, Radio Waves

16. 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

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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17. EARTH and SPACE

Writer: Jan Wojcik

Toss Up: Multiple Choice

Which of the following statements is FALSE regarding the volcano in each statement?

- W) Shield volcanoes can stretch up to 3 or 4 miles in diameter
- X) Cinder cone volcanoes rarely rise past 1,000 feet in elevation
- Y) Stratovolcanoes are some of the smallest volcanoes in the world
- Z) Volcanic domes commonly occur within the craters or on the flanks of large composite volcanoes

Toss Up Answer: Y

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Bonus: Multiple Choice

Which of the following statements is true regarding stratovolcanoes?

- W) Most commonly occur at subduction zones
- X) They produce basaltic magma
- Y) Their eruptions are infrequent
- Z) They are never dormant

Bonus Answer: W

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18. CHEMISTRY

Writer: Nicholas Adit

Toss Up: Multiple Choice

Which of the following hydrocarbons have the highest boiling point.

- W) CH₄
- X) C₂H₆
- Y) C₃H₈
- Z) C₄H₁₀

Toss Up Answer: Z

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Bonus: Multiple Choice

Alloys are mixtures of metallic substances. Which of the following pairs are matched INCORRECTLY?

- W) Steel - iron and copper
- X) Brass - copper and zinc
- Y) Pewter - tin, copper, bismuth, and antimony
- Z) Sterling silver - silver and copper

Bonus Answer: W

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19. BIOLOGY

Writer: Shanjeed Ali

Toss Up: Short Answer

Platelets are pieces of what type of cell?

Bonus Answer: Megakaryocytes

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Bonus: Multiple Choice

Where do erythrocytes develop?

- W) spleen
- X) trabecular bone
- Y) cortical bone
- Z) bone marrow

Bonus Answer: Z

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20. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Multiple Choice

Which of the following elements is found in the earth's crust as a native element?

- W) argon
- X) silicon
- Y) chlorine
- Z) oxygen

Toss Up Answer: X

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Bonus: Multiple Choice

In geological studies, cemented volcanic ash is called:

- W) caldera
- X) a-a
- Y) lava
- Z) tuff

Bonus Answer: Z

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21. PHYSICS

Writer: Charles Zhang

Toss Up: Multiple Choice

A 2-kg object is moving to the right at 3m/s. A 4-N force is applied to the left of the object and then removed after the object has traveled an additional 5m. The work done by this force is:

- W) 20 joules
- X) 15 joules
- Y) 13 joules
- Z) -20 joules

Toss Up Answer: Z

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Bonus: Short Answer

A 20kg dog initially runs at 10 m/s. What is the dog's final speed if 3000 joules of work is done on it?

Bonus Answer: 20

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22. EARTH and SPACE

Writer: Nicholas Parker Ng

Toss Up: Multiple Choice

The "firn line" on a glacier marks:

- W) The dividing line between the zones of accumulation and ablation

- X) The elevation above which snow never melts
- Y) The elevation where the average annual temperature is below freezing
- Z) The timber line, or elevation above which trees do not grow

Toss Up Answer: W

Bonus: Short Answer

During the Pleistocene, large lakes covered parts of the Western U.S. These lakes are known as:

Bonus Answer: Pluvial lakes (accept paleolakes)

23. PHYSICS

Writer: Charles Zhang

Toss Up: Multiple Choice

Block A, with a mass of 4 kg, is moving with a speed of 3.0m/s while block B, with a mass of 8 kg, is moving in the opposite direction with a speed of 3.0m/s. The center of mass of the two block-system is moving with a velocity of:

- W) 1.0 m/s in the same direction as B
- X) 1.3 m/s in the same direction as A
- Y) 4.0 m/s in the same direction as B
- Z) 6.0 m/s in the same direction as A

Toss Up Answer: W

Bonus: Multiple Choice

A 60kg hunter gets a rope around a 300kg polar bear. They are stationary, 12m apart, on frictionless level ice. When the hunter pulls the polar bear to him, the polar bear will move:

- W) 0.5 m
- X) 2 m
- Y) 4 m
- Z) 7m

Bonus Answer: X

24. BIOLOGY

Writer: Calvin Vuong

Toss Up: Short Answer

What molecules prevent DNA strands from reziping after helicase unzips the strands during DNA replication?

Bonus Answer: single stranded binding proteins

Bonus: Short Answer

DNA ligase joins what in the lagging strand of DNA during DNA replication?

Bonus Answer: Okazaki fragments

25. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

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?

Bonus Answer: 1.8 meters

Bonus: Short Answer

A boy throws a ball vertically upward with a velocity of 6 meters per second. How long does it take the ball to return to

the boy's hand?

Bonus Answer: 1.22 seconds

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