

Round 4

1. MATHEMATICS

Writer: Hussain Waris

Toss Up: Multiple Choice

What conic section is described by the following: the intersection of a cone and some plane parallel to that cone's side such that that intersection is non-empty?

- W) Circle
- X) Parabola
- Y) A point
- Z) Ellipse

Toss Up Answer: X

Bonus: Short Answer

Respectively, give the vertex and the focus of the following parabola: $(y - 3)^2 = 8(x - 5)$?

Bonus Answer: vertex: (5,3); focus: (7,3)

2. CHEMISTRY

Writer: Shihab Karim

Toss Up: Short Answer

What is the most common oxidation state of Oxygen?

Bonus Answer: -2

Bonus: Multiple Choice

Which of the following elements is a halogen?

- W) Lithium
- X) Potassium
- Y) Neon
- Z) Chlorine

Bonus Answer: Z

3. BIOLOGY

Writer: Calvin Vuong

Toss Up: Short Answer

Asexual prokaryotic cell division occurs via which process?

Bonus Answer: binary fission

Bonus: Multiple Choice

Mitosis in protists differ from other forms of eukaryotic mitosis in which way?

- W) Microtubules attach to the chromosome kinetochores.
- X) Chromosomes are condensed in prophase.
- Y) The nuclear envelope is not disassembled and remains intact throughout the process.
- Z) Sister chromatids cross over.

Bonus Answer: Y

4. CHEMISTRY

Writer: Nicholas Adit

Toss Up: Multiple Choice

Which of the following is closest in mass to a proton?

- W) Alpha Particle
- X) Positron
- Y) Neutron
- Z) Hydrogen Molecule

Toss Up Answer: Y

Bonus: Short Answer

What is the amount of calories of heat transferred to the water is when the temperature of a 20-gram sample of water is increased from 10°C to 30°C?

Bonus Answer: 400

5. BIOLOGY

Writer: Zoe Orlin

Toss Up: Multiple Choice

Every cell in a puppy's skin, eyes, and leg muscles contains

- W) equal amounts of ATP
- X) identical genetic information
- Y) proteins that are all identical
- Z) organelles for the synthesis of glucose

Toss Up Answer: X

Bonus: Short Answer

Oxygenated blood contains a high percentage of what tetramer protein?

Bonus Answer: Oxyhemoglobin (DO NOT ACCEPT: hemoglobin)

6. CHEMISTRY

Writer: Ahmad Alnasser

Toss Up: Short Answer

Which element is the more electronegative?

Bonus Answer: Flourine

Bonus: Short Answer

Name all the atoms that are diatomic.

Bonus Answer: Hydrogen (H₂)

Nitrogen (N₂)

Oxygen (O₂)

Fluorine (F₂)

Chlorine (Cl₂)

Iodine (I₂)

Bromine (Br₂)

7. EARTH and SPACE

Writer: Nicholas Parker Ng

Toss Up: Multiple Choice

The metamorphic rock formed from limestone is:

- W) quartzite
- X) slate
- Y) greenstone
- Z) marble

Toss Up Answer: Z

Bonus: Multiple Choice

The direct impact of running water is called

W) bed load

X) meander cutoff

Y) base level

Z) hydraulic action

Bonus Answer: Z

8. CHEMISTRY

Writer: Nicholas Adit

Toss Up: Multiple Choice

Which of the following species is amphoteric?

W) Na_3PO_4

X) HSO_4^-

Y) KOH

Z) HNO_3

Toss Up Answer: X

Bonus: Short Answer

A 600-milliliter container holds 2 moles of $\text{O}_2(\text{g})$, 3 moles of $\text{H}_2(\text{g})$, and 1 mole of $\text{He}(\text{g})$. Total pressure within the container is 760 torr. What is the partial pressure of O_2 ?

Bonus Answer: 253 torr

9. MATHEMATICS

Writer: Janine Goh

Toss Up: Short Answer

What is the quadratic formula?

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

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

10. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

What Irish physicist, living from 1805-1865, made important contributions to his namesake branch of classical mechanics, optics, and algebra?

W) William Parsons

X) William Hamilton

Y) Francis Beaufort

Z) George Boole

Toss Up Answer: X

Bonus: Multiple Choice

What is generated by a Van de Graff generator?

- W) Static Charge
- X) Current
- Y) Nuclear Decay
- Z) Radiation

Bonus Answer: W

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11. 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 6π 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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12. PHYSICS

Writer: Elias Milborn

Toss Up: Multiple Choice

As an object falls to the earth with air resistance present, what happens to the acceleration of the object?

- W) It remains a constant 9.8 m/s^2
- X) It increases from 0 to 9.8 m/s^2
- Y) It remains at a constant 0 m/s^2
- Z) It decreases from 9.8 to 0 m/s^2

Toss Up Answer: Z

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Bonus: Multiple Choice

Mary and Joe are on a merry-go-round. Mary is seated near the center of rotation and Joe is on the outer edge. Which of the following BEST describes their motion?

- W) Mary has a greater acceleration than Joe
- X) Joe has a greater acceleration than Mary
- Y) neither Joe nor Mary are accelerating
- Z) both Mary and Joe have the same acceleration

Bonus Answer: X

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13. 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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14. 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

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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15. EARTH and SPACE

Writer: Justin Lam

Toss Up: Multiple Choice

Which of the following gases make up the majority of Earth's atmosphere?

- W) Oxygen
- X) Argon
- Y) Carbon dioxide
- Z) Nitrogen

Toss Up Answer: Z

Bonus: Short Answer

What is the name for the scientific theory that describes the movement of plates across the Earth's lithosphere?

Bonus Answer: Plate tectonics

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16. BIOLOGY

Writer: Josh Tish

Toss Up: Multiple Choice

Which of the following would lead to a DECREASE in activity of the Anterior Pituitary gland?

- W) A lack of receptors for Cortisol on the Hypothalamus.
- X) A lack of receptors for Cortisol on the Anterior Pituitary.
- Y) Intravenous injection of a large amount of ACTH.
- Z) A tumor of the Hypothalamus causing it to secrete excess Corticotropin- Releasing Hormone

Toss Up Answer: Y

Bonus: Multiple Choice

What would happen if the Adrenal Cortex was artificially stimulated to produce large amounts of Cortisol?

- W) Less Corticotropin-Releasing Hormone would be released.
- X) More ACTH would be released.

- Y) The activity of the Hypothalamus would increase.
Z) The activity of the Anterior Pituitary would increase.

Bonus Answer: W

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17. 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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18. BIOLOGY

Writer: Calvin Vuong

Toss Up: Multiple Choice

Of the following, which is a second messenger used in cell signaling?

- W) G protein
X) Protein kinase A
Y) adenylyl cyclase
Z) cAMP

Toss Up Answer: Z

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Bonus: Short Answer

Adjacent plant cells most commonly communicate via what intercellular junction?

Bonus Answer: Plasmodesmata (ACCEPT: desmotubule)

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19. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Short Answer

What are two general types of soils that have developed in the United States?

Bonus Answer: pedocals and pedalfers

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Bonus: Short Answer

What are the two most prominent elements dissolved in seawater?

Bonus Answer: Chlorine and Sodium

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20. PHYSICS

Writer: Raafiul Hossain

Toss Up: Short Answer

An educated guess or explanation for an observation or experimental result. Not yet fully accepted as fact is what?

Bonus Answer: Hypothesis

Bonus: Short Answer

A systematic methodology for gathering, organizing and applying knowledge is?

Bonus Answer: A scientific method

21. BIOLOGY

Writer: Shanjeed Ali

Toss Up: Short Answer

Ruminants have the ability to digest what commonly ingested substance that humans cannot digest due to microorganisms in the stomach?

Bonus Answer: Cellulose

Bonus: Short Answer

What is the main site of methane production in ruminants?

Bonus Answer: Rumen, accept first chamber/stomach

22. PHYSICS

Writer: William Xiang

Toss Up: Multiple Choice

A vector extends 6 meters in the x direction and $2\sqrt{3}$ meters in the y direction. The angle this vector makes with the positive x axis is:

- W) 30 degrees
- X) 60 degrees
- Y) 90 degrees
- Z) 180 degrees

Toss Up Answer: W

Bonus: Multiple Choice

A brick slides on a horizontal surface. Which of the following will increase the frictional force on it?

- W) Increasing the surface of contact
- X) Decreasing the surface of contact
- Y) Increasing the mass of the brick
- Z) Decreasing the mass of the brick

Bonus Answer: Y

23. 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)

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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24. EARTH and SPACE

Writer: Nicholas Parker Ng

Toss Up: Multiple Choice

The most abundant sedimentary rocks are

- W) Limestone
- X) Mudrocks
- Y) Arkoses
- Z) Evaporites

Toss Up Answer: X

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Bonus: Short Answer

Dolostone is formed by the addition of what to limestone?

Bonus Answer: Magnesium

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25. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Multiple Choice

What is the driving force present in a supernova explosion?

- W) electromagnetic force
- X) strong nuclear force
- Y) gravitational force
- Z) weak nuclear force

Toss Up Answer: Y

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Bonus: Short Answer

What gas is the Mars atmosphere primarily made up of?

Bonus Answer: Carbon dioxide

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