

Round 3

1. MATHEMATICS

Writer: Andrew Chen (Senior)

Toss Up: Short Answer

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

Bonus Answer: 1260 degrees

Bonus: Short Answer

How many edges does an octahedral prism have?

Bonus Answer: 24 edges

2. CHEMISTRY

Writer: Andrew Chen (Senior)

Toss Up: Multiple Choice

When 50 mL of stock solution of 6M NaCl (aq) is diluted into a 150 mL solution what will be the molarity of the diluted solution?

W) 3M

X) 2M

Y) 1M

Z) 6M

Toss Up Answer: X

Bonus: Short Answer

What is the given equation for calculating molarity?

Bonus Answer: Moles of solute divided by liters of solution

3. MATHEMATICS

Writer: Jessica Titensky

Toss Up: Short Answer

Convert CD from hexadecimal to decimal

Bonus Answer: 205

Bonus: Short Answer

Convert CD from hexadecimal to binary

Bonus Answer: 11001101

4. CHEMISTRY

Writer: Andrew Chen (Senior)

Toss Up: Multiple Choice

Given the following ions, Na⁺, Br⁻, Ag⁺, and Cu²⁺ which ion has the greatest atomic radius?

W) Na⁺

X) Br⁻

Y) Ag⁺

Z) Cu²⁺

Toss Up Answer: Y

Bonus: Short Answer

Name the group of elements with the least electronegativity.

Bonus Answer: Noble gases (Group 18)

5. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

An electric vehicle has two stages. If the first stage, the battery, has an efficiency of 90% and the second stage, the inverter, has an efficiency of 80%, calculate the approximate overall efficiency of the vehicle.

Bonus Answer: 72%

Bonus: Multiple Choice

Which of the following is congruent to $(n + 1)$ modulus n ?

- W) 0
- X) 1
- Y) $n-1$
- Z) $n-2$

Bonus Answer: W

6. EARTH and SPACE

Writer: Andrew Chen (Senior)

Toss Up: Multiple Choice

Which type of weather front is represented by alternating purple spikes and semicircles?

- W) Cold front
- X) Warm front
- Y) Occluded front
- Z) Stationary front

Toss Up Answer: Y

Bonus: Short Answer

What weather front is formed as a cold air mass pushes under a warm air mass?

Bonus Answer: Cold front

7. CHEMISTRY

Writer: Andrew Chen (Senior)

Toss Up: Multiple Choice

Choose the strongest acid from the choices below.

- W) Hydrochloric acid
- X) Hydrobromic acid
- Y) Hydroiodic acid
- Z) Hydrofluoric acid

Toss Up Answer: Y

Bonus: Short Answer

What are the conjugate bases of HCl, HBr, and HI?

Bonus Answer: Cl⁻, Br⁻, I⁻

8. EARTH and SPACE

Writer: Andrew Chen (Senior)

Toss Up: Multiple Choice

The San Andreas fault is what specific type of fault line?

- W) Transform plate boundary

- X) Normal fault
- Y) Reverse fault
- Z) Strike slip fault

Toss Up Answer: Z

Bonus: Short Answer

There are different types of seismic waves, body waves and surface waves. Name the two different types of body waves.

Bonus Answer: P waves and S waves

9. BIOLOGY

Writer: Ivan Zhang

Toss Up: Multiple Choice

Which of the following is not an anabolic steroid?

- W) Fenestrane
- X) Stanozolol
- Y) Fortesta
- Z) Deca-Durabolin

Toss Up Answer: W

Bonus: Short Answer

Which scientist became known as the founder of molecular biology due to their discovery of the spiral structure of proteins?

Bonus Answer: Linus Pauling

10. PHYSICS

Writer: Aaron Gee

Toss Up: Multiple Choice

Aaron, whose mass is 45 kilograms, is riding his 5.0 kilogram skateboard down the sidewalk with a constant speed of 6.0 meters per second when he rolls across a 10.0 meter long patch of sand on the pavement. The sand provides force of friction of 6.0 newtons. What is Aaron's speed in meters per second as he emerges from the sand?

- W) 0
- X) 1.8
- Y) 3.8
- Z) 5.8

Toss Up Answer: Z

Bonus: Short Answer

Which of the following does NOT contain a scalar quantity? Force, energy, or acceleration?

Bonus Answer: Acceleration

11. BIOLOGY

Writer: Ivan Zhang

Toss Up: Short Answer

What family are fruit flies apart of?

Bonus Answer: Drosophilidae

Bonus: Short Answer

Which species of animals are the most abundant on Earth?

Bonus Answer: nematodes

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12. MATHEMATICS

Writer: Jessica Titensky

Toss Up: Short Answer

What is the slope of the tangent line to $e^{(2x)}$ at $x=3$

Bonus Answer: $2e^6$

Bonus: Short Answer

What is the slope of the tangent line to $\ln(2x)$ at $x=3$

Bonus Answer: $1/3$

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13. 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

Bonus: Short Answer

What are the three general types of magma?

Bonus Answer: Basaltic magma, Andesitic magma, and Rhyolitic magma

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14. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

In a totally inelastic collision, what happens to the two colliding objects?

Bonus Answer: They STICK together!

Bonus: Short Answer

r For a uniformly rotating object, what do we call the rate of change in the angle through which the object turns in one second?

Bonus Answer: ANGULAR VELOCITY

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15. CHEMISTRY

Writer: Calvin Vuong

Toss Up: Multiple Choice

The relation between pressure and temperature of two ideal gases is stated in

W) Gay-Lussac's Law

X) Boyle's Law

Y) Charles's Law

Z) Avogadro's Law

Toss Up Answer: W

Bonus: Short Answer

What are the dimensions of the gas constant R in SI base units?

Bonus Answer: $\text{kg m}^2 \text{mol}^{-1} \text{K}^{-1} \text{s}^{-2}$ (accept as a fraction)

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16. PHYSICS

Writer: Aaron Gee

Toss Up: Multiple Choice

A Newton is equal to which of the following?

W) w) kilogram-meter per second

X) x) meter per second squared

Y) y) kilogram-meter per second squared

Z) z) kilogram per meter-second

Toss Up Answer: Y

Bonus: Short Answer

Work is what type of quantity?

Bonus Answer: Scalar quantity.

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17. BIOLOGY

Writer: Ivan Zhang

Toss Up: Short Answer

What is the most abundant element in the human body?

Bonus Answer: Oxygen

Bonus: Short Answer

What is the function of the alveoli?

Bonus Answer: to allow oxygen and carbon dioxide to move between the lungs and bloodstream

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18. CHEMISTRY

Writer: Olivia Gallager

Toss Up: Multiple Choice

Which of the following describes the reaction that involves a hydrocarbon chain and H_2 gas yielding two shorter hydrocarbon chains?

W) Synthesis

X) Cracking

Y) Hydrocracking

Z) Substitution

Toss Up Answer: Y

Bonus: Short Answer

What electron geometry does ammonia (NH_3) have?

Bonus Answer: tetrahedral, tetrahedron also accepted

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19. PHYSICS

Writer: Charles Zhang

Toss Up: Short Answer

What is the German term for the energy released when high voltage electrons decelerate at impact with a metal and is also known as "breaking radiation"?

Bonus Answer: Bremsstrahlung

Bonus: Short Answer

Given that Planck's constant is $4 \times 10^{-15} \text{ eV} \cdot \text{s}$ (READ AS: 4 times 10 to the power of negative 15 electron volt

second), what is the maximum kinetic energy, in electron volts, of an electron released from a metal with work function of 1 eV when a photon of frequency of 300 terahertz strikes the metal's surface?

Bonus Answer: 0.2 electron volts

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20. BIOLOGY

Writer: Aaron Gee

Toss Up: Multiple Choice

Which of the following most closely approximates the number of protein-coding genes in the human genome?

W) 10,000

X) 20,000

Y) 50,000

Z) 100,000

Toss Up Answer: X

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Bonus: Short Answer

Arrange the following to depict the conduction pathway in the vertebrate heart: 1) atrioventricular node, 2) right and left bundle branches, 3) sinoatrial node, 4) Bundle of His, 5) Purkinje fibers.

Bonus Answer: 3) SINOATRIAL NODE

1) ATRIOVENTRICULAR NODE

4) BUNDLE OF HIS

2) RIGHT AND LEFT BUNDLE BRANCHES

5) PURKINJE FIBERS

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21. PHYSICS

Writer: Charles Zhang

Toss Up: Multiple Choice

Two trucks are 50 kilometers apart and traveling toward each other. One automobile is moving at 60km/h and the other is moving at 40km/h mph. How long will it take for them meet?

W) 15 minutes

X) 20 minutes

Y) 24 minutes

Z) 30 minutes

Toss Up Answer: Z

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Bonus: Short Answer

The position of a particle in meters is given by $x(t) = 25t - 3t^3$ (READ AS: 16 times t minus 3 times t cubed) , where the time t is in seconds. The particle is momentarily at rest at what time t rounded to the nearest hundredth?

Bonus Answer: 1.67 seconds, accept 1.67

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22. BIOLOGY

Writer: Matthew Lee

Toss Up: Short Answer

What is the phenomenon that describes the pupil continuously adjusting to different ambient light levels?

Bonus Answer: Pupillary Light Reflex

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Bonus: Short Answer

How large, in degrees, is the visual field for the right eye?

Bonus Answer: 150

23. BIOLOGY

Writer: Matthew Lee

Toss Up: Multiple Choice

Hair cells in the ear form synapses on spiral ganglion cells. These spiral ganglion cells join what nerve that projects to the medulla?

W) VI

X) VIII

Y) X

Z) XII

Toss Up Answer: X

Bonus: Short Answer

What are these hair cells, which have a mechanically gated TRPA1 channel, called?

Bonus Answer: Stereocilia

24. BIOLOGY

Writer: Matthew Lee

Toss Up: Multiple Choice

If I cut your left optic tract, what part of your visual field will you lose?

W) The left temporal section only

X) The left temporal and left nasal sections

Y) The right nasal section only

Z) The right temporal and right nasal sections

Toss Up Answer: Z

Bonus: Short Answer

What is the name of the spot where the left optic tract and the right optic tract intersect?

Bonus Answer: optic chiasm

25. BIOLOGY

Writer: Matthew Lee

Toss Up: Short Answer

What is the G Protein Coupled Receptor for the G protein transducin?

Bonus Answer: Rhodopsin

Bonus: Short Answer

The phototransduction pathway controlled by light striking rhodopsin ultimately affects a sodium channel. What is the second messenger that controls the channel? Be sure to give your answer as "cyclic _ _ _ (Read as: "the word cyclic followed by a three letter acronym)".

Bonus Answer: cGMP (accept: cyclic guanosine monophosphate)
