

Round 7

1. 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

Bonus: Short Answer

Which attractive force is the major cause of condensation?

Bonus Answer: London Dispersion Forces (accept: London Forces)

2. MATHEMATICS

Writer: Hanna Yang

Toss Up: Short Answer

Compute: $\sqrt{(3^4 \cdot 5 - 60)^2}$

Bonus Answer: 0

Bonus: Short Answer

Compute $(34/17 - 2 + 5) * (96 + -144) * (1/(46 - 130/5))$

Bonus Answer: -12

3. CHEMISTRY

Writer: Prangon Ghose

Toss Up: Multiple Choice

The evaporation of any liquid is expected to have

- W) a positive ΔH and a negative ΔS
- X) a negative ΔH and a negative ΔS
- Y) a positive ΔH and a positive ΔS
- Z) a positive ΔH and a negative ΔS

Toss Up Answer: Y

Bonus: Multiple Choice

The rate of reaction will be large if

- W) ΔG is a large negative number
- X) ΔS is a large negative number
- Y) ΔH is a large negative number
- Z) None of the above

Bonus Answer: Z

4. PHYSICS

Writer: Shantanu Jha

Toss Up: Short Answer

If the sound intensity is 10,000 times the threshold of hearing then what is the intensity in decibels?

Bonus Answer: 40dB

Bonus: Short Answer

At what standard frequency would 60 decibels have a loudness of 60 phons?

Bonus Answer: 1000Hz

5. CHEMISTRY

Writer: Prangon Ghose

Toss Up: Multiple Choice

Which of the following can be precisely determined for a chemical substance?

W) Entropy

X) Enthalpy

Y) Free Energy

Z) All of the Above

Toss Up Answer: W

Bonus: Short Answer

In a rate law, what are the units of k when the order is 3?

Bonus Answer: $L^2 \text{ mol}^{-2} \text{ s}^{-1}$

6. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

What is the S.I. unit for luminous intensity?

W) Lumen

X) Candela

Y) Newton

Z) Watts

Toss Up Answer: X

Bonus: Multiple Choice

For an isotropic source how many candelas equals 3 lumens?

W) 12π

X) 10π

Y) 4π

Z) 2π

Bonus Answer: W

7. EARTH and SPACE

Writer: Zoe Orlin

Toss Up: Short Answer

What is the driving force behind all erosion?

Bonus Answer: Gravity

Bonus: Short Answer

What type of body of water does the most erosion?

Bonus Answer: Streams

8. CHEMISTRY

Writer: Nicholas Adit

Toss Up: Multiple Choice

Which of the following statements is NOT true for the element of sodium?

- W) It has an oxidation state of +1
- X) It forms a basic solution with water
- Y) It gives off a bright red color when burned
- Z) It reacts with a halogen to form a salt

Toss Up Answer: Y

Bonus: Short Answer

Which of the following are products made from the reaction $\text{H}_2\text{SO}_4(\text{aq}) + \text{Ba}(\text{OH})_2(\text{aq}) \rightarrow ?$ I) $\text{O}_2(\text{g})$ II) $\text{H}_2\text{O}(\text{l})$ III) $\text{BaSO}_4(\text{s})$

Bonus Answer: II and III

9. EARTH and SPACE

Writer: Zoe Orlin

Toss Up: Short Answer

What determines a mineral's properties?

Bonus Answer: The internal arrangement of its atoms.

Bonus: Short Answer

What type of currents cause plates to move in the mantle?

Bonus Answer: Convection currents

10. BIOLOGY

Writer: Calvin Vuong

Toss Up: Multiple Choice

Exocytotic vesicles are most frequently exported via the

- W) endoplasmic reticulum
- X) the nuclear envelope
- Y) the trans Golgi
- Z) the cis Golgi

Toss Up Answer: Y

Bonus: Multiple Choice

Endosomes formed as a result of receptor-mediated endocytosis are most frequently coated with which type of proteins?

- W) G proteins
- X) clathrins
- Y) pseudopodium
- Z) microtubules

Bonus Answer: X

11. EARTH and SPACE

Writer: Zoe Orlin

Toss Up: Multiple Choice

In the Northern Hemisphere, the Coriolis force deflects in which direction?

- W) Up

X) Down

Y) Right

Z) Left

Toss Up Answer: Y

Bonus: Short Answer

The altitude of Polaris is equal to...

Bonus Answer: Your latitude

12. CHEMISTRY

Writer: Prangon Ghose

Toss Up: Short Answer

In a rate law, what are the units of k when the order is 1?

Bonus Answer: s^{-1}

Bonus: Short Answer

In a rate law, what are the units of k when the order is 5?

Bonus Answer: $L^4 mol^{-4} s^{-1}$

13. BIOLOGY

Writer: Calvin Vuong

Toss Up: Short Answer

Name all of the following that are amphipathic: integral proteins, cholesterol, phospholipids, triacylglycerol, mannose

Bonus Answer: integral proteins and phospholipids

Bonus: Multiple Choice

Which of the following is not true about a part of the phospholipid?

W) They contain two fatty acid chains.

X) Their heads contain a net charge.

Y) They have a phosphate group in their heads.

Z) They have a choline group in their heads.

Bonus Answer: X

14. MATHEMATICS

Writer: Hanna Yang

Toss Up: Short Answer

What is the slope of a line parallel to $45x=9y+5$?

Bonus Answer: 5

Bonus: Multiple Choice

How many vertical asymptotes does $f(x)=(x^2+2x+1)/(x^3-x)$ have?

W) 0

X) 1

Y) 2

Z) 3

Bonus Answer: Y

15. BIOLOGY

Writer: Calvin Vuong

Toss Up: Multiple Choice

Cellulose and glycogen differ in
W) their alpha/beta glucose configurations
X) branching
Y) their ability to be metabolized
Z) all of the above

Toss Up Answer: Z

Bonus: Short Answer

N-Acetylglucosamine is the monomer of which common polysaccharide?

Bonus Answer: Chitin

16. MATHEMATICS

Writer: Hanna Yang

Toss Up: Multiple Choice

Which of the following is true?
W) -1 is congruent to 1 modulo 5
X) -1 is congruent to 2 modulo 5
Y) -1 is congruent to 3 modulo 5
Z) -1 is congruent to 4 modulo 5

Toss Up Answer: Z

Bonus: Short Answer

Which is larger, 8^{10} or 3^{30}

Bonus Answer: 3^{30}

17. BIOLOGY

Writer: Calvin Vuong

Toss Up: Multiple Choice

Which of the following intermolecular interactions is not exclusive to a single polypeptide's tertiary structure?
W) hydrophobic interactions
X) polar interactions
Y) hydrogen bonding
Z) disulfide bridges

Toss Up Answer: Y

Bonus: Short Answer

Polypeptide folding is aided by which type of cavity-structured proteins?

Bonus Answer: Chaperonins

18. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

A military cannon fires a boy into the air at an angle of 45° above the horizontal, reaching a max height y above his original launch height. The cannon is now aimed so that it fires straight up into the air at an angle of 90° to the horizontal. What is the maximum height reached by the same boy now? (let y represent height)

Bonus Answer: $2y$

Bonus: Short Answer

a

Bonus Answer: a

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19. BIOLOGY

Writer: Calvin Vuong

Toss Up: Multiple Choice

Neurotransmitters are received by which kinds of receptors?

- W) G protein coupled receptors
- X) receptor tyrosine kinases
- Y) ion gated channels
- Z) intracellular receptors

Toss Up Answer: Y

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Bonus: Multiple Choice

Which of the following is the immediate effect of a signal molecule binding to a receptor tyrosine kinase molecule?

- W) It forms a dimer with another receptor tyrosine kinase.
- X) It initiates a phosphorylation cascade.
- Y) It becomes activated with phosphate groups.
- Z) It attaches to a scaffolding protein.

Bonus Answer: W

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20. PHYSICS

Writer: Ahmad Alnasser

Toss Up: Short Answer

A car accelerates from rest at 4 (m/s)^2 . What is the distance traveled by the car in 3 seconds?

Bonus Answer: 18 meters (m)

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Bonus: Multiple Choice

A motor scooter travels east at a speed of 13 m/s. The driver then reverses direction and heads west at 17 m/s. What was the change in velocity of the scooter?

- W) 13 m/s
- X) 17 m/s
- Y) 30 m/s
- Z) 4 m/s

Bonus Answer: Y

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21. 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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22. PHYSICS

Writer: Sean Vaysburd

Toss Up: Short Answer

A car with a mass of one ton collides with a truck with a mass of ten tons. Which applies the greatest force on the other, in Newtons?

Bonus Answer: They both apply an equal force.

Bonus: Short Answer

Which experiences greater acceleration in the collision from a car with a mass of one ton colliding with a truck with a mass of ten tons, and by how many times greater.

Bonus Answer: The car, it will accelerate ten times as much.

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23. BIOLOGY

Writer: Calvin Vuong

Toss Up: Multiple Choice

Introns are hydrolyzed and removed from pre-mRNA by

W) exons

X) spliceosomes

Y) small nuclear ribonucleoproteins

Z) nucleotide-pair substitution

Toss Up Answer: X

Bonus: Short Answer

Okazaki fragments on the lagging strand of DNA are joined by which protein?

Bonus Answer: DNA ligase (ACCEPT: ligase)

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24. PHYSICS

Writer: Sean Vaysburd

Toss Up: Short Answer

If the acceleration is always perpendicular to an object's velocity, what can be deduced about the object's motion?

Bonus Answer: It is circular motion.

Bonus: Short Answer

If the acceleration of an object is opposite its velocity, what can be said about the object's velocity over time? Assume that the direction of the velocity is positive.

Bonus Answer: It is decreasing.

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25. BIOLOGY

Writer: Calvin Vuong

Toss Up: Multiple Choice

Which of the following is a storage protein?

W) aquaporin

X) actin

Y) ovalbumin

Z) AP2

Toss Up Answer: Y

Bonus: Short Answer

Which of the following amino acids has a sulfhydryl group in its side chain?

Bonus Answer: cysteine

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