

Round 36

1. PHYSICS

Writer: Aaron Gee

Toss Up: Multiple Choice

A pendulum which is suspended from the ceiling of a railroad car is observed to hang at an angle of 10 degrees to the right of vertical. Which of the following answers could explain this phenomena?

- W) The railroad car is at rest
- X) The railroad car is accelerating to the left.
- Y) The railroad car is accelerating to the right.
- Z) Huh?

Toss Up Answer: X

Bonus: Multiple Choice

Two forces have magnitudes of 11 newtons and 5 newtons. The magnitude of their sum could NOT be equal to which of the following values?

- W) 16
- X) 5
- Y) 9
- Z) 7

Bonus Answer: X

2. MATHEMATICS

Writer: Jason Weng

Toss Up: Multiple Choice

If x is positive, what is the minimum value of $2x + (2/x)$?

- W) 1
- X) 2
- Y) 3
- Z) 4

Toss Up Answer: Z

Bonus: Multiple Choice

What is $f(15)$ if $f(x) = 2\sin(x)\cos(x)$, where x is in degrees?

- W) $(\sqrt{3})/2$
- X) $1/(\sqrt{3})$
- Y) $1/2$
- Z) 1

Bonus Answer: Y

3. PHYSICS

Writer: Aaron Gee

Toss Up: Multiple Choice

The work done by a friction force is

- W) always -

- X) always 0
- Y) either positive or negative depending upon the situation.
- Z) always +

Toss Up Answer: W

Bonus: Multiple Choice

: As defined in physics, work is:

- W) scalar quantity
- X) always a positive quantity
- Y) a vector quantity
- Z) always 0

Bonus Answer: W

4. MATHEMATICS

Writer: Ashneel Das

Toss Up: Multiple Choice

How many zeroes does the equation $x^3 + 6x^2 + 11x + 6 = 0$ have?

- W) 1
- X) 2
- Y) 3
- Z) 4

Toss Up Answer: Y

Bonus: Short Answer

Find the solution(s) of the following system of linear equations: $2x + 4y = 6$, $x + 2y = 5$

Bonus Answer: No solutions

5. 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.

6. MATHEMATICS

Writer: Andrew Chen

Toss Up: Short Answer

How many ways are there to distribute 4 identical blue balls and 3 identical red balls among 3 people?

Bonus Answer: 315 (accept $21 \cdot 15$)

Bonus: Short Answer

What are all possible shapes that are yielded by inverting a circle across another circle?

Bonus Answer: circle, line

7. 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.

8. MATHEMATICS

Writer: Andrew Chen

Toss Up: Short Answer

Prime factorize 273.

Bonus Answer: $3 \cdot 7 \cdot 13$

Bonus: Multiple Choice

Which of the following numbers is a root of unity?

W) $1 + i$

X) $\frac{1}{2} + (\frac{1}{2})(\sqrt{3})(i)$

Y) $3 + 4i$

Z) $(\frac{1}{2})(\sqrt{2}) + (\frac{3}{2})(\sqrt{2})(i)$

Bonus Answer: X

9. 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)

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

10. BIOLOGY

Writer: Zoe Orlin

Toss Up: Short Answer

What are the 5 senses?

Bonus Answer: Taste smell sight hearing touch

Bonus: Short Answer

What is an important component to "taste"?

Bonus Answer: Smell!

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11. 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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12. BIOLOGY

Writer: Zoe Orlin

Toss Up: Short Answer

What is the powerhouse of the cell?

Bonus Answer: Mitochondria!!!

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Bonus: Short Answer

What do you use to see?

Bonus Answer: Eyes

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13. CHEMISTRY

Writer: Nicholas Adit

Toss Up: Multiple Choice

The shape of a PCl_3 molecule is described as

W) bent

X) trigonal pyramidal

Y) linear

Z) trigonal planar

Toss Up Answer: X

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Bonus: Short Answer

Twenty-five percent of element X exists as ^{210}X and 75 percent of it exists as ^{214}X . What is the atomic weight of element X?

Bonus Answer: 211

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14. BIOLOGY

Writer: Olivia Gallager

Toss Up: Short Answer

What type of immune cell is involved in humoral immunity?

Bonus Answer: B cells

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Bonus: Short Answer

What is the most common type of immunoglobulin?

Bonus Answer: Immunoglobulin G

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15. CHEMISTRY

Writer: Olivia Gallager

Toss Up: Short Answer

What are the numbers of sigma bonds and pi bonds, in ethyne, respectively?

Bonus Answer: 3 sigma bonds, 2 pi bonds

Bonus: Short Answer

Pi bonds are created by the overlap of what type of orbital?

Bonus Answer: p, p orbitals

16. 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

Bonus: Multiple Choice

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

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

Bonus Answer: Z

17. CHEMISTRY

Writer: Olivia Gallager

Toss Up: Multiple Choice

Which of the following has the largest ionic radius?

- W) Li
- X) Be
- Y) Na
- Z) Mg

Toss Up Answer: X

Bonus: Short Answer

Why does Oxygen have a smaller atomic radius than boron?

Bonus Answer: Effective nuclear charge

18. BIOLOGY

Writer: Calvin Vuong

Toss Up: Multiple Choice

Which of the following statements concerning photosynthetic light reactions is false?

- W) Photosystem I contains the P700 reaction center.
- X) The electron transport chain following photosystem I drives chemiosmosis.
- Y) NADPH is the final electron acceptor.

Z) Electrons are replenished in photosystem II by the splitting of water.

Toss Up Answer: X

Bonus: Multiple Choice

Which of the following molecules is not present in the electron transport chain immediately following photosystem II?

W) cytochrome complex

X) plastoquinone

Y) ferredoxin

Z) plastocyanin

Bonus Answer: Y

19. CHEMISTRY

Writer: Olivia Gallager

Toss Up: Multiple Choice

Which of the following describes the reaction that involves a hydrocarbon chain and H₂ 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(NH₃) have?

Bonus Answer: tetrahedral, tetrahedron also accepted

20. 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

21. EARTH and SPACE

Writer: Jan Wojcik

Toss Up: Short Answer

By name or number, which of the following is not a mineral: diamond, gold, coal, silt

Bonus Answer: Coal and silt (accept 3 and 4)

Bonus: Short Answer

The Mohs scale is used to measure mineral hardness. By name or number order the following minerals in increasing

order: Fluorite, Gypsum, Quartz, Talc

Bonus Answer: Talc, Gypsum, Fluorite, Quartz (accept 1 2 3 4, in that order)

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22. 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

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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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23. EARTH and SPACE

Writer: Jan Wojcik

Toss Up: Short Answer

Name the soil horizon that contains a mixture of organic matter and highly altered mineral matter and is dark in color.

Bonus Answer: A-horizon

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Bonus: Short Answer

By name or number, which of the following phenomena cause acidification in agricultural soils:

1) Leaching of excess nitrate

2) Build-up in mostly plant-based organic matter

3) Removal of plant and animal products

4) Addition of nitrogen based fertilisers

Bonus Answer: All of them (accept 1,2,3,4)

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24. 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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25. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Short Answer

In which atmospheric level does the "good" ozone preside?

Bonus Answer: Stratosphere

Bonus: Short Answer

In which atmospheric level does the "bad" ozone reside?

Bonus Answer: Troposphere
