

Round 7

1. MATHEMATICS

Writer: Aaron Gee

Toss Up: Short Answer

What is the volume of a sphere of radius "R"?

Bonus Answer: $(4/3) \pi R^3$

Bonus: Short Answer

Using an x-y coordinate axis, a parabola is given by the equation $y = x^2$. Give the x-y coordinates of the focal point for this parabola.

Bonus Answer: (0, 1/4)

2. PHYSICS

Writer: Shantanu Jha

Toss Up: Short Answer

What fuel is mostly used in a nuclear power-generation station?

Bonus Answer: Uranium-235 (Do not accept: Uranium or Uranium-238)

Bonus: Multiple Choice

Dark energy and dark matter comprise approximately how much of the known universe?

W) 50%

X) 75%

Y) 95%

Z) 99%

Bonus Answer: Y

3. EARTH and SPACE

Writer: Zoe Orlin

Toss Up: Short Answer

What is the main driving force behind all erosion?

Bonus Answer: Gravity

Bonus: Short Answer

What type of body of water causes erosion to happen quickly?

Bonus Answer: fast flowing streams and rivers

4. BIOLOGY

Writer: Ivan Zhang

Toss Up: Multiple Choice

Which of the following conditions causes an autoimmune response to eating gluten?

W) Anaplasmosis

X) Anisakiasis

Y) celiac disease

Z) Candidiasis

Toss Up Answer: Y

Bonus: Multiple Choice

What is colony collapse disorder characterized by?

- W) The disappearance of many male worker bees
- X) The death of the queen bee
- Y) The destruction of the honey produced by bees
- Z) The destruction of the structure of a bee hive

Bonus Answer: W

5. 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

What is the altitude of Polaris equal to?

Bonus Answer: Your latitude

6. 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)

7. BIOLOGY

Writer: Zoe Orlin

Toss Up: Short Answer

What is climax vegetation?

Bonus Answer: The dominant type of vegetation in a biome

Bonus: Short Answer

What is the climax vegetation of the tundra?

Bonus Answer: Mosses and/or lichens

8. MATHEMATICS

Writer: George Zhou

Toss Up: Multiple Choice

$3^{12}=27^x$. What is the value of x?

W) $x=12$

X) $x=4$

Y) $x=6$

Z) $x=3$

Toss Up Answer: X

Bonus: Short Answer

$3^{12}+3^{11}+3^{10}=b \cdot 3^a$ What is the positive difference between the product and the sum of a and b?

Bonus Answer: 107

9. 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

10. MATHEMATICS

Writer: Hanna Yang

Toss Up: Multiple Choice

Which of the following is a triangular number?

W) 2

X) 6

Y) 9

Z) 11

Toss Up Answer: X

Bonus: Short Answer

What is the greatest common factor of 456 and 460?

Bonus Answer: 4

11. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Short Answer

What volcano has erupted in the years 79 A.D., 1139, 1631, 1779, 1793, 1872, 1906, and 1944?

Bonus Answer: Vesuvius

Bonus: Short Answer

What is the name of the very old mountain belt located in southern Missouri and Northern Arkansas?

Bonus Answer: the ozarks

12. MATHEMATICS

Writer: Benjamin Avrahami

Toss Up: Short Answer

If the capstone is taken off the Great Pyramid of Giza, then it is no longer a pyramid but a what?

Bonus Answer: A frustum

Bonus: Multiple Choice

Which one of these is Euclid's parallel postulate?

W) If a line intersects one of two parallel lines, both of which are coplanar with the original line, then it will also intersect with the other line.

X) If a line segment intersects two straight lines forming two interior angles on the same side that sum to less than two right angles, then the two lines, if extended indefinitely, meet on the side on which the angles sum to less than two right angles.

Y) In a plane, given a line and a point not on it, exactly one line parallel to the given line can be drawn through the point.

Z) For any acute angle A and any point D in the interior of angle A, there exists a line through D and not through A which intersects both sides of angle A.

Bonus Answer: X

13. PHYSICS

Writer: Prangon Ghose

Toss Up: Short Answer

If a 5000 kg truck is traveling at 30 m/s, how high must a ramp be to bring the truck to a complete stop?

Bonus Answer: 45 m

Bonus: Short Answer

A 1 kg radio controlled car is traveling at 10 m/s. When the car is 5 m from a cliff, the operator hits the brakes. How much force is required to stop the car?

Bonus Answer: 10 N

14. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Multiple Choice

Which of the following has the lowest specific heat?

W) Copper

X) Granite

Y) Marble

Z) Dry air

Toss Up Answer: W

Bonus: Short Answer

Order the following rock particles from the biggest to the smallest: 1. Sand 2. Silt 3. Pebbles 4. Clay

Bonus Answer: 3, 1, 2, 4

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15. PHYSICS

Writer: Raafiul Hossain

Toss Up: Short Answer

The speedometer in your car tells you what

Bonus Answer: instantaneous speed

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Bonus: Short Answer

Projectile 'A' is fired at an angle of 50° above the horizontal; projectile 'B' is fired with the same speed at an angle of 40° above the horizontal. Assuming level ground and negligible air resistance, what is true about range and height of both objects?

Bonus Answer: A' will reach a smaller height and have a greater range than 'B'.

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16. CHEMISTRY

Writer: Prangon Ghose

Toss Up: Multiple Choice

If the rate of a reaction decreases fourfold when the concentration of a reactant is halved, what is the order of the reaction with respect to that reactant?

W) zero order

X) first order

Y) second order

Z) third order

Toss Up Answer: Y

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Bonus: Short Answer

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

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

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17. 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

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Bonus: Short Answer

Work is what type of quantity?

Bonus Answer: Scalar quantity.

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18. BIOLOGY

Writer: Shanjeed Ali

Toss Up: Short Answer

Which two scientists proved that DNA replication was semi-conservative?

Bonus Answer: Meselson and Stahl

Bonus: Short Answer

Meselson and Stahl replaced an element in DNA with an isotope in order to tag the original DNA molecule. Which element did they replace?

Bonus Answer: Nitrogen

19. PHYSICS

Writer: Raafiul Hossain

Toss Up: Short Answer

What is energy measured in?

Bonus Answer: Joules

Bonus: Short Answer

What is the unit of charge?

Bonus Answer: Coulomb

20. 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

21. BIOLOGY

Writer: Josh Tish

Toss Up: Multiple Choice

Select the description that most correctly describes the term recessive:

- W) A weak phenotype.
- X) An allele that confers a weak phenotype.
- Y) A phenotype conferred when only one copy of an allele is present.
- Z) A phenotype conferred when two copies of an allele are present.

Toss Up Answer: Z

Bonus: Multiple Choice

Which of the following interactions is most responsible for the

structural stability of soluble globular proteins?

W) Dipole-dipole interactions.

X) Electrostatic interactions.

Y) Hydrogen bonds.

Z) The Hydrophobic Effect.

Bonus Answer: Z

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22. CHEMISTRY

Writer: Olivia Gallager

Toss Up: Short Answer

What is the name for a molecule with tetrahedral electron geometry but only three substituent groups?

Bonus Answer: trigonal pyramidal

Bonus: Multiple Choice

Which of the following is not an ionic compound?

W) NaCl

X) HF

Y) FeCl₃

Z) H₂SO₄

Bonus Answer: X

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23. 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

Bonus: Short Answer

Adjacent plant cells most commonly communicate via what intercellular junction?

Bonus Answer: Plasmodesmata (ACCEPT: desmotubule)

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24. CHEMISTRY

Writer: Siam Muquit

Toss Up: Multiple Choice

A precipitation reaction is an example of which of the following reactions?

W) Combustion

X) Substitution

Y) Single Displacement

Z) Double Displacement

Toss Up Answer: Z

Bonus: Short Answer

By name or number, which of the following would be a precipitate in aqueous solution?

1. Silver sulfide

2. Potassium nitrate
3. Strontium hydroxide
4. Lead(II) fluoride

Bonus Answer: Silver sulfide, Lead(II) fluoride OR (1, 4 only)

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25. BIOLOGY

Writer: Shamaul Dilmohamed

Toss Up: Short Answer

What is the name given to the jellylike substance filling the chamber behind the lens of the human eye?

Bonus Answer: vitreous humor

Bonus: Short Answer

Name the clear watery liquid that surrounds the brain and spinal cord and fills the four cavities or ventricles of the brain.

Bonus Answer: Cerebrospinal Fluid

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