

Round 32

1. EARTH and SPACE

Writer: Seiji Yawata

Toss Up: Multiple Choice

New York City is primarily composed of sediments that were metamorphosed during the Taconic and Acadian orogenies roughly:

- W) 450 million years ago
- X) 550 million years ago
- Y) 650 million years ago
- Z) 750 million years ago

Toss Up Answer: W

Bonus: Short Answer

When the earth is closest to the sun, what season is it in the Southern Hemisphere?

Bonus Answer: Summer

2. CHEMISTRY

Writer: Siam Muquit

Toss Up: Short Answer

What is the molecular geometry of ammonia (NH₃)?

Bonus Answer: Trigonal Pyramidal

Bonus: Multiple Choice

How many lone pairs are in Xenon tetrafluoride (XeF₄)?

- W) 0
- X) 1
- Y) 2
- Z) 3

Bonus Answer: Y

3. EARTH and SPACE

Writer: Seiji Yawata

Toss Up: Multiple Choice

The Cascadia Subduction Zone separates the North American Plate and the

- W) Caribbean Plate
- X) Juan de Fuca Plate
- Y) Okhotsk Plate
- Z) Cocos Plate

Toss Up Answer: X

Bonus: Short Answer

During which geologic period did Pangaea start breaking up?

Bonus Answer: Jurassic

4. BIOLOGY

Writer: Shanjeed Ali

Toss Up: Multiple Choice

The purpose of Glial cells is to

- W) insulate and protect neurons

- X) insulate and protect endothelial cells
- Y) protect the body from viral diseases
- Z) reinforce smooth muscle

Toss Up Answer: W

Bonus: Short Answer

Blood is to the circulatory system as hemolymph is to the

Bonus Answer: hemocoel

5. PHYSICS

Writer: William Xiang

Toss Up: Multiple Choice

Vectors A and B each have magnitude L. What is the cross product of these vectors if the angle between them when drawn with their tails at the same point is 60 degrees.

- W) Zero
- X) $L/2$
- Y) L^2
- Z) $(L^2)/2$

Toss Up Answer: Z

Bonus: Multiple Choice

Which of the following is true when a system is at equilibrium?

- W) The object is at rest.
- X) The object is not accelerating.
- Y) The object is at constant velocity.
- Z) Internal forces sum to zero.

Bonus Answer: X

6. BIOLOGY

Writer: Shanjeed Ali

Toss Up: Short Answer

What are the purine bases in DNA?

Bonus Answer: Adenine and guanine

Bonus: Short Answer

What are the pyrimidine bases in RNA?

Bonus Answer: Cytosine and uracil

7. CHEMISTRY

Writer: Nicholas Adit

Toss Up: Multiple Choice

A solution of H_2SO_3 is found to have a hydrogen ion concentration of 1×10^{-3} molar at $25^\circ C$. What is the hydroxide ion concentration in the solution?

- W) 1×10^{-1}
- X) 1×10^{-3}
- Y) 1×10^{-11}
- Z) 1×10^{-13}

Toss Up Answer: Y

Bonus: Short Answer

If the pH of a solution is changed from 1 to 3 with the addition of an antacid, what percentage of $[H^+]$ was neutralized?

Bonus Answer: 99%

8. MATHEMATICS

Writer: Siam Muquit

Toss Up: Short Answer

Given $y = |x - 6|$, what is the derivative at $x = 6$?

Bonus Answer: The derivative does not exist

Bonus: Short Answer

Find the derivative of x^3 / x^2

Bonus Answer: 1

9. EARTH and SPACE

Writer: Elias Milborn

Toss Up: Short Answer

Pandora is a moon of which planet?

Bonus Answer: Saturn

Bonus: Multiple Choice

Sea water is approximately what percent salt by mass?

W) 1%

X) 2%

Y) 4%

Z) 8%

Bonus Answer: Y

10. MATHEMATICS

Writer: Shamaul Dilmohamed

Toss Up: Short Answer

What type of number is defined as a number that is not a root of a polynomial with rational coefficients?

Bonus Answer: Transcendental numbers

Bonus: Short Answer

Of the following, which of these numbers of transcendental? π , e , i , ϕ , $e \times i$, $2^{\sqrt{2}}$

Bonus Answer: π , e , $e \times i$, $2^{\sqrt{2}}$

11. PHYSICS

Writer: Shihab Karim

Toss Up: Multiple Choice

As defined in physics, speed is:

W) a vector quantity

X) always negative

Y) always zero

Z) always positive

Toss Up Answer: Z

Bonus: Multiple Choice

Electric current may be expressed in which one of the following units?

- W) joules/coulomb
- X) coulombs/second
- Y) coulombs/volt
- Z) ohms/second

Bonus Answer: X

12. MATHEMATICS

Writer: Raafiul Hossain

Toss Up: Short Answer

The surface area of a sphere is how many times the area of a circle?

Bonus Answer: 4

Bonus: Short Answer

What is the area of a cone?

Bonus Answer: $(\pi)r^2h$

13. BIOLOGY

Writer: Shanjeed Ali

Toss Up: Short Answer

Which two monosaccharides make up lactose?

Bonus Answer: Glucose and galactose

Bonus: Short Answer

Which two monosaccharides make up sucrose?

Bonus Answer: Glucose and fructose

14. MATHEMATICS

Writer: Raafiul Hossain

Toss Up: Multiple Choice

A statement about a relationship between natural quantities. The statement has been tested many times, and has not been contradicted. What is it?

- W) Fact
- X) Hypothesis
- Y) Law
- Z) Theory

Toss Up Answer: Y

Bonus: Multiple Choice

A framework that includes many well-tested and verified hypotheses about one or more aspects of the natural world.

- W) Fact
- X) Hypothesis
- Y) Law
- Z) Theory

Bonus Answer: Z

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15. PHYSICS

Writer: William Xiang

Toss Up: Short Answer

A ball is thrown with an initial velocity of 10 meters per second off the top of a 30 foot building, at an angle 30 degrees above the horizontal. Assuming there is no air friction and the scenario occurs on Jupiter where objects have a gravitational acceleration of 25 meters per second squared, find the time it takes, in seconds, for the ball to reach ground level. Round to the nearest tenth.

Bonus Answer: 0.4

Bonus: Multiple Choice

A boy in freefall swings a ball tied to a string around in horizontal circles. Assuming no air friction, which of the following forces are NOT acting ball?

- W) Centripetal Force
- X) Centrifugal Force
- Y) Gravitational Force
- Z) Normal Force

Bonus Answer: Z

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16. CHEMISTRY

Writer: Nicholas Adit

Toss Up: Multiple Choice

What happens in a hydrogen atom when an electron jumps from an excited energy state to a more stable energy state?

- W) electromagnetic radiation is emitted by the atom
- X) electromagnetic radiation is absorbed by the atom
- Y) the atom becomes a positively charged ion
- Z) the atom becomes a negatively charged ion

Toss Up Answer: W

Bonus: Short Answer

A closed 5-liter vessel contains a sample of neon gas. The temperature inside the container is 25°C, and the pressure is 1.5 atmospheres. (The gas constant, R, is equal to 0.08 L·atm/mol·K.) If the neon gas in the vessel is replaced with an equal molar quantity of helium gas, which of the following properties of the gas in the container will be changed?

- I. Pressure
- II. Temperature
- III. Density

Bonus Answer: III only

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17. PHYSICS

Writer: William Xiang

Toss Up: Multiple Choice

Which of the following quantities are vector?

- W) Work
- X) Speed
- Y) Torque
- Z) Power

Toss Up Answer: Y

Bonus: Multiple Choice

Which of the following terms is NOT commonly used to represent a higher-order derivative of displacement?

W) Acceleration

X) Jounce

Y) Lock

Z) Spin

Bonus Answer: Z

18. CHEMISTRY

Writer: Prangon Ghose

Toss Up: Short Answer

What is the chemical formula of tetraphosphorus decaoxide?

Bonus Answer: P₄O₁₀

Bonus: Short Answer

What is the bond order of the central atom in CO₃⁽⁻²⁾?

Bonus Answer: 4/3 (accept: 1 1/3)

19. PHYSICS

Writer: William Xiang

Toss Up: Multiple Choice

What is the magnitude of a vector 4 meters in the x direction, 1 meter in the y direction, and 8 meters in the z direction?

W) 7 meters

X) 9 meters

Y) 11 meters

Z) 13 meters

Toss Up Answer: X

Bonus: Short Answer

Unit X equals " $\sqrt{A/B}$ " and is in units " $(\text{Mass} \cdot \text{Time}) / \text{Length}^2$ ". If A has units " $\text{Length} / \text{Time}$ ", what are the units of B?

Bonus Answer: $\text{Length}^5 / (\text{Mass}^2 \cdot \text{Time}^3)$

20. BIOLOGY

Writer: Shanjeed Ali

Toss Up: Short Answer

What term describes the number of times a normal human cell population can divide?

Bonus Answer: Hayflick limit

Bonus: Multiple Choice

What controls the Hayflick limit?

W) apoptosis

X) length of telomeres

Y) genomic instability

Z) genetic drift

Bonus Answer: X

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21. 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}

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Bonus: Short Answer

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

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

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22. BIOLOGY

Writer: Shanjeed Ali

Toss Up: Multiple Choice

The phenomenon by which diploid cells cease to divide is known as

- W) parthenogenesis
- X) alternation of generations
- Y) cellular senescence
- Z) lysis

Toss Up Answer: Y

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Bonus: Short Answer

What country has the highest human life expectancy?

Bonus Answer: Japan

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23. BIOLOGY

Writer: Siam Muquit

Toss Up: Multiple Choice

Which disease was famously eradicated in 1977?

- W) Polio
- X) Smallpox
- Y) Mumps
- Z) AIDS

Toss Up Answer: X

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Bonus: Short Answer

Which human body system is attacked by AIDS?

Bonus Answer: Immune system

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24. BIOLOGY

Writer: Siam Muquit

Toss Up: Multiple Choice

Which pair of organisms is correctly matched with the interspecific interaction?

- W) Commensalism: Clownfish and sea anemone
- X) Parasitism: Whales and barnacles
- Y) Mutualism: Oxpecker and rhino
- Z) Predation: Apes and bees

Toss Up Answer: Y

Bonus: Short Answer

List the 5 types of interspecific interaction.

Bonus Answer: Predation, Commensalism, Parasitism, Mutualism, Neutral

25. BIOLOGY

Writer: Shanjeed Ali

Toss Up: Short Answer

How many ATP molecules are produced by the Calvin cycle?

Bonus Answer: 0

Bonus: Short Answer

How many ATP are used in the Calvin cycle to make one glucose molecule?

Bonus Answer: 18
