

Round 5

1. BIOLOGY

Writer: Ivan Zhang

Toss Up: Multiple Choice

What makes the fur of polar bears white?

- W) White pigment
- X) No pigment and transparency of fur
- Y) White pigment and transparency of fur
- Z) Transparency of fur

Toss Up Answer: X

Bonus: Short Answer

The term superbugs is usually used to refer to what?

Bonus Answer: Antibiotic-resistant bacteria

2. CHEMISTRY

Writer: Shihab Karim

Toss Up: Short Answer

What is the most common oxidation state of Oxygen?

Bonus Answer: -2

Bonus: Multiple Choice

Which of the following elements is a halogen?

- W) Lithium
- X) Potassium
- Y) Neon
- Z) Chlorine

Bonus Answer: Z

3. EARTH and SPACE

Writer: Shantanu Jha

Toss Up: Multiple Choice

Which of these units is defined as "3.26 light-years"?

- W) Astronomical Unit
- X) Parsec
- Y) Gigasphere
- Z) Kilometer

Toss Up Answer: X

Bonus: Multiple Choice

What are the two neighboring galaxies of the Milky Way known as?

- W) The Keplers
- X) Magellanic Clouds
- Y) Twin Cities
- Z) Petronas Galaxies

Bonus Answer: X

4. 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

5. EARTH and SPACE

Writer: Nicholas Parker Ng

Toss Up: Multiple Choice

The metamorphic rock formed from limestone is:

W) quartzite

X) slate

Y) greenstone

Z) marble

Toss Up Answer: Z

Bonus: Multiple Choice

The direct impact of running water is called

W) bed load

X) meander cutoff

Y) base level

Z) hydraulic action

Bonus Answer: Z

6. CHEMISTRY

Writer: Janine Goh

Toss Up: Short Answer

What activates pepsinogen to change into pepsin?

Bonus Answer: Hydrochloric acid

Bonus: Short Answer

What is the pH of gastric juice to the nearest tenth?

Bonus Answer: 1.5 to 2.5 (or any number in between)

7. EARTH and SPACE

Writer: Olivia Gallager

Toss Up: Short Answer

How many planets in our solar system have moons?

Bonus Answer: 6

Bonus: Short Answer

What layer of the atmosphere lies between the troposphere and mesosphere?

Bonus Answer: Stratosphere

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. MATHEMATICS

Writer: Shihab Karim

Toss Up: Multiple Choice

If the diameter of a circle is 6 inches, what is the area of the circle?

- W) 36π
- X) 9π
- Y) 12π
- Z) 6π

Toss Up Answer: X

Bonus: Short Answer

Find the equation of the line that passes through the point (3,4) and is perpendicular to the line $y = 3x - 2$?

Bonus Answer: $y = -(1/3)x + 5$

10. EARTH and SPACE

Writer: Mohammed Jamil

Toss Up: Multiple Choice

The seasons we experience on the Earth are caused by

- W) the change in the Earth's distance from the sun during the year
- X) the precession of the Earth's pole
- Y) the tilt of the Earth's axis with respect to the ecliptic pole
- Z) the change in the Moon's distance from the Earth during the year

Toss Up Answer: Y

Bonus: Multiple Choice

If we compare two stars of different temperature, the hotter star

- W) will appear redder
- X) emits more energy from each unit area of surface
- Y) will have a brighter apparent magnitude
- Z) will have a brighter absolute magnitude

Bonus Answer: X

11. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

What is the name of the first American physicist to win two Nobel prizes? (very random lol)

Bonus Answer: John Bardeen (can accept just last name?)

Bonus: Multiple Choice

If the resultant force acting on a body of constant mass is zero, the body's momentum is:

W) constant

X) 0

Y) increasing

Z) decreasing

Bonus Answer: W

12. MATHEMATICS

Writer: Ahmad Alnasser

Toss Up: Short Answer

Write an equation for a sine function with an amplitude of $\frac{5}{3}$, a period of $\frac{\pi}{2}$, and a vertical shift of 4 units up.

Bonus Answer: $y = \frac{5}{3}\sin(4x) + 4$

Bonus: Short Answer

Two large and 1 small pumps can fill a swimming pool in 4 hours. One large and 3 small pumps can also fill the same swimming pool in 4 hours. How many hours will it take 4 large and 4 small pumps to fill the swimming pool?

Bonus Answer: 1 hour and 40 minutes

13. PHYSICS

Writer: Shanjeed Ali

Toss Up: Short Answer

How many orbitals are there in the third electron shell?

Bonus Answer: 9

Bonus: Short Answer

Who discovered the neutron?

Bonus Answer: James Chadwick

14. MATHEMATICS

Writer: Ahmad Alnasser

Toss Up: Short Answer

Find the derivative of: $4x^3 + 18x + 2$

Bonus Answer: $8x^2 + 18$

Bonus: Short Answer

At what point is the slope of the tangent line to the parabola $y = 3x^2 + 5x + 23$ equal to 0?

Bonus Answer: $(-\frac{5}{6}, \frac{251}{12})$

15. 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

16. BIOLOGY

Writer: Jason Mohabir

Toss Up: Short Answer

Nitrogen fixation refers to the direct conversion of atmospheric nitrogen gas into:

Bonus Answer: ammonia (ACCEPT: NH₃, ammonium, NH₄⁺)

Bonus: Short Answer

The transformation of nitrates to gaseous nitrogen is accomplished by microorganisms in a series of biochemical reactions. The process is known as:

Bonus Answer: denitrification

17. CHEMISTRY

Writer: Ivan Zhang

Toss Up: Short Answer

What is the largest ion with an equal amount of protons and neutrons?

Bonus Answer: Ca²⁺

Bonus: Short Answer

Who is regarded as the father of the modern periodic table? (1st and last name)

Bonus Answer: Dmitri Mendeleev

18. BIOLOGY

Writer: Mohammed Jamil

Toss Up: Multiple Choice

When outside of the lymph vessel, the lymph is called

- W) Interstitial Fluid
- X) Hemocel
- Y) Plasma
- Z) Blood

Toss Up Answer: W

Bonus: Multiple Choice

Which of the following is not true about platelets

- W) They are involved in blood clotting
- X) They are present in blood
- Y) They are cells that broke away from megakaryocytes
- Z) They have cytoplasm

Bonus Answer: Y

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19. PHYSICS

Writer: Raafiul Hossain

Toss Up: Short Answer

An educated guess or explanation for an observation or experimental result. Not yet fully accepted as fact is what?

Bonus Answer: Hypothesis

Bonus: Short Answer

A systematic methodology for gathering, organizing and applying knowledge is?

Bonus Answer: A scientific method

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20. BIOLOGY

Writer: William Xiang

Toss Up: Multiple Choice

Which of the following enzymes are not utilized by the human body to break down carbohydrates?

- W) Amylase
- X) Maltase
- Y) Lactase
- Z) Lipase

Toss Up Answer: Z

Bonus: Multiple Choice

Which of the following is a valid difference between animal and plant cells?

- W) Animal cells have a cell membrane whereas plant cells do not.
- X) Animal cells contain mitochondria whereas plant cells cannot.
- Y) Animal cells can contain multiple vacuoles whereas plant cells cannot.
- Z) Animal cells are larger than plant cells.

Bonus Answer: Y

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21. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

Who did not have a unit of electrical measurement named after him?

- W) Voltaire
- X) Georg Ohm
- Y) Andre Ampere
- Z) Charles Coulomb

Toss Up Answer: W

Bonus: Short Answer

It converts electrical energy into electromagnetic radiation and vice versa. Name this device designed to transmit and receive radio waves.

Bonus Answer: Antenna

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22. BIOLOGY

Writer: Olivia Gallager

Toss Up: Short Answer

What part of the brain controls the interaction between the two hemispheres?

Bonus Answer: corpus callosum

Bonus: Short Answer

Which lobe of the brain is known for spatial reasoning and navigation?

Bonus Answer: parietal lobes

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23. 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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24. BIOLOGY

Writer: Shanjeed Ali

Toss Up: Short Answer

Where in the DNA are short tandem repeats usually located?

Bonus Answer: Accept introns OR noncoding DNA

Bonus: Short Answer

Why do DNA molecules travel through the gel in gel electrophoresis?

Bonus Answer: DNA has a negative charge

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25. PHYSICS

Writer: Nicholas Adit

Toss Up: Multiple Choice

For an ohmic conductor, doubling the voltage without changing the resistance will cause the current to

W) decrease by a factor of 2

X) decrease by a factor of 4

Y) increase by a factor of 4

Z) increase by a factor of 2

Toss Up Answer: Z

Bonus: Short Answer

If a 60-watt lightbulb operates at a voltage of 120 V, what is the resistance of the bulb?

Bonus Answer: 240 ohms

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