

Round 8

1. CHEMISTRY

Writer: Janine Goh

Toss Up: Short Answer

Which group of the periodic table has a fully filled d orbital?

Bonus Answer: Group 12

Bonus: Short Answer

Name 2 elements that behave both as a metal and non-metal

Bonus Answer: Any 2: Boron, silicon, germanium, arsenic, antimony, tellerium, (polonium)

2. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Multiple Choice

Which one of these is NOT true?

- W) All planets revolve in the same direction.
- X) All planets rotate in the same direction.
- Y) The orbits of the planets are all ellipses.
- Z) The orbits of the planets are nearly in the same plane.

Toss Up Answer: X

Bonus: Multiple Choice

Coal is believed to have been principally formed in which of the following types of environment?

- W) river beds
- X) swamps
- Y) volcanic regions
- Z) deserts

Bonus Answer: X

3. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

What is the magnitude of the magnetic force on a point charge with a charge of 1 Coulomb and velocity of 2 meters per second traveling perpendicular to a magnetic field of 2 Tesla?

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

Toss Up Answer: Z

Bonus: Short Answer

What is the name of the force that is the combination of electric and magnetic force on a point charge due to electromagnetic fields?

Bonus Answer: Lorentz Force

4. 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 preside?

Bonus Answer: Troposphere

5. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

What is the resulting electrical potential, in volts, when a charge of 12 coulombs is applied to a 1 farad capacitor?

Bonus Answer: 12 volts

Bonus: Short Answer

If 1000 pounds is applied to a spring with spring constant of 100 pounds per inch on top of a hydraulic piston, how many pounds of force is transferred to the piston?

Bonus Answer: 1,000

6. EARTH and SPACE

Writer: Matthew Lee

Toss Up: Short Answer

In which direction are winds and ocean currents deflected in the Southern Hemisphere?

Bonus Answer: left

Bonus: Multiple Choice

Which of the following does not support the heliocentric model?

- W) Coriolis effect
- X) rotation of the Foucault pendulum
- Y) epicycles
- Z) direct motion

Bonus Answer: Y

7. BIOLOGY

Writer: Calvin Vuong

Toss Up: Short Answer

At which stage of mitosis are chromosomes usually photographed in order to produce a karyotype?

Bonus Answer: metaphase

Bonus: Short Answer

Name all of the following that a homologous pairs of chromosomes share in common.

- I. length
- II. loci of genes
- III. characteristics encoded by their genes
- IV. DNA sequence

Bonus Answer: I, II, III only

8. EARTH and SPACE

Writer: Matthew Lee

Toss Up: Multiple Choice

A hill of unsorted sediments of mixed grain sizes was probably deposited by

- W) ice
- X) wind
- Y) water
- Z) frost action

Toss Up Answer: W

Bonus: Multiple Choice

Which of the following minerals has a pretty strong set of silicon-oxygen bonds but cleaves easily into thin sheets?

- W) olivine
- X) hornblende
- Y) mica
- Z) quartz

Bonus Answer: Y

9. MATHEMATICS

Writer: Shamaul Dilmohamed

Toss Up: Short Answer

What is the name for the rule that states that when you have a limit of indeterminate form as a fraction, it is equal to the limit of the derivative of the numerator over the derivative of the denominator?

Bonus Answer: L'Hopital's rule

Bonus: Short Answer

What famous function, named after a mathematician, takes the infinite sum of the reciprocals of the natural numbers raised to an argument?

Bonus Answer: Riemann zeta function

10. PHYSICS

Writer: Elias Milborn

Toss Up: Multiple Choice

When a resistor, inductor, and capacitor are connected in series to an AC generator, the current through the capacitor must be in phase with the voltage across which of the following?

- W) The capacitor
- X) The resistor
- Y) The entire circuit
- Z) The inductor

Toss Up Answer: Z

Bonus: Short Answer

Which lower case letter is commonly used to denote planck's constant?

Bonus Answer: h

11. CHEMISTRY

Writer: Jan Wojcik

Toss Up: Multiple Choice

According to VSEPR theory, which of the following molecules DOES NOT have a trigonal pyramidal geometry?

- W) NH₃ (read as: Ammonia)
X) BF₃ (read as: Barium trifluoride)
Y) XeF₃ (read as: Xenon trifluoride)
Z) PCl₃ (read as: Phosphorus trichloride)

Toss Up Answer: X

Bonus: Short Answer

By name of number, which of the following molecules have a bent molecular structure?

1. SO₂
2. CO₂
3. OF₂

Bonus Answer: SO₂ and OF₂ (accept 1 and 3)

12. 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 is transcendental? pi, e, i, phi, e times i, $2^{\sqrt{2}}$

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

13. 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 (NOTE: although choice Y forms part of the spliceosome structure, choice Y is not responsible for the catalytic properties and is therefore incorrect)

Bonus: Short Answer

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

Bonus Answer: DNA ligase (ACCEPT: ligase)

14. PHYSICS

Writer: Aaron Gee

Toss Up: Multiple Choice

The constant potential difference across a 2 ohm resistor is 20 volts. How many watts of power are dissipated by this resistor?

- W) 150 watts
X) 200 watts
Y) 250 watts
Z) 2000 watts

Toss Up Answer: X

Bonus: Short Answer

The potential difference across a 4 ohm resistor is 20 volts. Assuming that all of the energy dissipated by this resistor is in the form of heat, how many joules of heat are radiated in 10 seconds?

Bonus Answer: 1000 J (joules)

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15. BIOLOGY

Writer: Mohammed Jamil

Toss Up: Multiple Choice

Birds are able to sustain long flights at high altitudes because they

W) can extract oxygen during both inhalation and exhalation

X) use anaerobic metabolism during flight

Y) are able to lower their body temperature during flight

Z) decrease their heart rate during flight

Toss Up Answer: W

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Bonus: Multiple Choice

Carbon monoxide (CO) is toxic to humans because

W) it binds to myoglobin and causes it to denature.

X) it is rapidly converted to toxic CO₂.

Y) it binds to the globin portion of hemoglobin and prevents the binding of O₂.

Z) it binds to the Fe in hemoglobin and prevents the binding of O₂.

Bonus Answer: Z

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16. CHEMISTRY

Writer: Siam Muquit

Toss Up: Short Answer

What is the molecular geometry of ammonia (NH₃)?

Bonus Answer: Trigonal Pyramidal

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Bonus: Multiple Choice

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

W) 0

X) 1

Y) 2

Z) 3

Bonus Answer: Y

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17. BIOLOGY

Writer: Hanna Yang

Toss Up: Multiple Choice

How is oxygen transported in blood?

W) It is dissolved in the blood

X) It is carried by hemoglobin on white blood cells

Y) It is carried by hemoglobin on red blood cells

Z) It is carried by hemoglobin on platelets

Toss Up Answer: Y

Bonus: Short Answer

By name or by number, identify which of the following ways can carbon dioxide be transported in blood?

1. It can be dissolved in the blood
2. It can be carried by hemoglobin on white blood cells
3. It can be carried by hemoglobin on red blood cells
4. It can be carried by hemoglobin on platelets

Bonus Answer: 1 & 3

18. PHYSICS

Writer: Aaron Gee

Toss Up: Multiple Choice

Whose principle or law states that each point on a wavefront may be considered a new wave source?

- W) Snell's Law
- X) Huygen's principle
- Y) Young's Law
- Z) Hertz's Law

Toss Up Answer: X

Bonus: Multiple Choice

The wave nature of light is demonstrated by which of the following?

- W) Diffraction
- X) Color
- Y) Length
- Z) Speed of light

Bonus Answer: W

19. CHEMISTRY

Writer: Nicholas Adit

Toss Up: Short Answer

An ideal gas in a closed inflexible container has a pressure of 6 atmospheres and a temperature of 27°C. What will be the new pressure of the gas if the temperature is decreased to -73°C?

Bonus Answer: 4 atmospheres

Bonus: Multiple Choice

When CO₂ is bubbled through distilled water at 25°C, which of the following is most likely to occur?

- W) Solid carbon will form
- X) The pH of the solution will be reduced
- Y) The water will boil
- Z) Methane gas will be formed

Bonus Answer: X

20. MATHEMATICS

Writer: Siam Muquit

Toss Up: Multiple Choice

What is the derivative of the curve $y = x^3$ at the origin?

- W) 0
- X) 3
- Y) 2
- Z) $\frac{3}{2}$

Toss Up Answer: W

Bonus: Short Answer

Find dy/dx of $y = \sin^2 x$

Bonus Answer: $2 (\sin x) (\cos x)$

21. CHEMISTRY

Writer: Olivia Gallager

Toss Up: Short Answer

In organisms, the bonds in polypeptide chains are formed between which two ends of the amino acid?

Bonus Answer: Carboxyl, amino OR the side with the NH_2 group, the side with the COOH group

Bonus: Short Answer

Fatty acids have three carbon chains attached to what type of molecule?

Bonus Answer: glycerol

22. 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

23. MATHEMATICS

Writer: Hanna Yang

Toss Up: Short Answer

What is the name of the principle that states that 5 avocados cannot be placed in 4 holes without 2 of them being placed in the same one?

Bonus Answer: Pigeonhole Principle

Bonus: Short Answer

In triangle ABC with integer side lengths, $AB = 7$, $BC = 14$, and $AC < 9$. Find AC.

Bonus Answer: 8 (Triangle Inequality)

24. BIOLOGY

Writer: Siam Muquit

Toss Up: Multiple Choice

Kuru is a disease caused by what type of microbe?

W) Bacteria

X) Virus

Y) Prion

Z) Viroid

Toss Up Answer: Y

Bonus: Short Answer

Give the genus and species name of the microbe that causes peptic ulcer disease.

Bonus Answer: *Helicobacter pylori*

25. BIOLOGY

Writer: Matthew Lee

Toss Up: Multiple Choice

A person with type A blood has children with a person with type AB blood. What possible blood types can their offspring be?

W) A only

X) A and AB

Y) A, B, and AB

Z) A, AB, and O

Toss Up Answer: Y

Bonus: Multiple Choice

What sex chromosome system determines gender in birds?

W) X-Y system

X) X-0 system (read as X-zero)

Y) Z-W system

Z) haplo-diploid system

Bonus Answer: Y
