Round 29

1. EARTH and SPACE

Writer: Zoe Orlin

Toss Up: Multiple Choice

What was the magnitude of the largest earthquake ever?

W) 9

X) 9.1

Y) 9.3

Z) 9.6

Toss Up Answer: Z

Bonus: Multiple Choice

How much north does the Earth's magnetic north pole move per year?

W) 30 miles

X) 35 miles

Y) 40 miles

Z) 50 miles

Bonus Answer: Z

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2. CHEMISTRY

Writer: Shanjeed Ali

Toss Up: Short Answer

What is the energy level and orbital of the outermost electrons in a ground state sulfur atom?

Bonus Answer: 3p

Bonus: Short Answer

What is the maximum number of covalent bonds sulfur can form?

Bonus Answer: 6

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3. EARTH and SPACE

Writer: Shanjeed Ali

Toss Up: Multiple Choice

Where is the Great Rift Valley located?

W) Western Africa

X) Eastern Asia

Y) Eastern Africa

Z) Western Asia

Toss Up Answer: Y

Bonus: Multiple Choice

Which of these countries does the Great Rift Valley not run through?

W) Tanzania

X) Kenya

Y) Burundi

Z) Angola

Bonus Answer: Z

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4. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

What quantity of a magnet determines the torque it will experience in an external magnetic field?

W) Multipole Expansion

X) Dipole Inversion

Y) Magnetic Moment

Z) Hysteresis Loop

Toss Up Answer: Y

Bonus: Multiple Choice

What Dutch physicist, living from 1626-1695, pioneered the use of the pendulum in clocks?

W) Willems Gravesande

X) Hans Christian Oersted

Y) Nicolas Hartsoeker

Z) Christiaan Huygens

Bonus Answer: Z

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5. 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

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6. PHYSICS

Writer: Aaron Gee

Toss Up: Multiple Choice

Radiocarbon is produced in the atmosphere as a result of?

W) collision between fast neutrons and nitrogen nuclei present in the atmosphere

X) action of ultraviolet light from the sun on atmospheric oxygen

Y) action of solar radiations particularly cosmic rays on carbon dioxide present in the atmosphere

Z) lightning discharge in atmosphere

Toss Up Answer: W

Bonus: Multiple Choice

Nuclear sizes are expressed in a unit named

W) Fermi
X) angstrom
Y) newton
Z) Tesla

Bonus Answer: W

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7. MATHEMATICS

Writer: Shamaul Dilmohamed

Toss Up: Multiple Choice

The sum (1+3+3^2+... 3^n) is equal to which of the following?
W) 2 * 3^n
X) 4 * 3^n
Y) (3^(n+1)+1)/2
Z) (3^(n+1)-1)/2

Toss Up Answer: Z

Bonus: Short Answer

In space, what is the graph of the equation x^2 = y?

Bonus Answer: A parabolic cylinder

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8. PHYSICS

Writer: Aaron Gee

Toss Up: Multiple Choice

A block of metal which weighs 60 newtons in air and 40 newtons under water has a density, in kilograms per meter cubed of

W) 2400
X) 1000
Y) 3000
Z) 5000

Toss Up Answer: Y

Bonus: Multiple Choice

A ball leaves a girl's hand with an upward velocity of 6 meters per second. What is the maximum height of the ball above the girl's hand?

W) 10
X) 6
Y) 1.8
Z) 2.8

Bonus Answer: Y

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9. CHEMISTRY

Writer: Nicholas Adit

Toss Up: Multiple Choice

What is the fourth most abundant element on Earth?
W) Oxygen

X) Carbon
Y) Sulfur
Z) Argon
Toss Up Answer: X

Bonus: Short Answer
What metal forms compounds that give a grayish-white color?
Bonus Answer: Lead

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10. PHYSICS

Writer: Charles Zhang
Toss Up: Multiple Choice
A wheel starts from rest and has an angular acceleration that is given by α(t) = (6 rad/s^4)t^2 (READ AS: 6 radians per seconds to the fourth times t squared). What is the angle the wheel turns through after time t?
W) [(1/8)t^4] rad
X) [(1/4)t^4] rad
Y) [(1/2)t^4] rad
Z) [t^4] rad
Toss Up Answer: Y

Bonus: Short Answer
String is wrapped around the periphery of a 5.0-cm radius cylinder, free to rotate on its axis. The string is pulled straight out at a constant rate of 10 cm/s and does not slip on the cylinder. As each small segment of string leaves the cylinder, what does its acceleration change by?
Bonus Answer: 0.2 m/s^2

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11. EARTH and SPACE

Writer: Andrew Chen (Senior)
Toss Up: Multiple Choice
Which of the following compositions of particles would result in the least porosity?
W) Angular particles, loosely packed
X) Sorted particles, closely packed
Y) Rounded particles, loosely packed
Z) Unsorted particles, closely packed
Toss Up Answer: Z

Bonus: Short Answer
Given there is a full moon on Wednesday on which day of the week is it when there is an new moon on the same phase cycle?
Bonus Answer: Thursday

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12. PHYSICS

Writer: Charles Zhang
Toss Up: Short Answer
What is the unit of the quantity 1/(4 PI e_o) (READ AS: 1 over 4 times Pi times epsilon naught), also know as Coulomb's Constant?
Bonus Answer: N*m^2/C^2 (READ AS: newton meters squared over coulomb squared)

Bonus: Short Answer
An time-varying electric field is given by (24t^2 N/C)*i + (30t N/C)*j + (16/t N/C) *k. What is its flux at time t=2 as it

passes through a region in the y-z plane whose area is given by A(t)=2t?

Bonus Answer: 112 N/C

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13. CHEMISTRY

Writer: Nicholas Parker Ng

Toss Up: Multiple Choice

Permalloy steel is an alloy which is 21.2% Fe by mass. How many grams of Fe are present in 1 kg of steel?

W) 212 g

X) 21.2 g

Y) 4.7 g

Z) .212 g

Toss Up Answer: W

Bonus: Short Answer

Astatine, having atomic number 85 on the periodic table, is a radioactive member of the halogens. Give the full electron configuration of At. Arrange the orbitals in order of increasing energy. (Do not use noble gas abbreviations, such as [Xe], for this problem.)

Bonus Answer: 1s22s22p63s23p64s23d104p65s24d105p66s24f145d106p5

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14. PHYSICS

Writer: Charles Zhang

Toss Up: Short Answer

A heated 8 kg ring with a radius of 4m cools as it rotates, causing it to shrink to a radius of 2m. If it was initially rotating at 6 rad/s, what is it's final angular velocity?

Bonus Answer: 24 rad/s

Bonus: Short Answer

A 120-N child sits on a light swing and is pulled back and held with a horizontal force of 90 N. What is the magnitude of the tension force in each of the two supporting ropes?

Bonus Answer: 75 N

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15. CHEMISTRY

Writer: Prangon Ghose

Toss Up: Short Answer

What two chemical elements are found in sphalerite?

Bonus Answer: Zinc and Sulfur (accept: Zn and S)

Bonus: Short Answer

What two chemical elements are found in periclase?

Bonus Answer: Magnesium and Oxygen (accept: Mg and O)

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16. MATHEMATICS

Writer: Jessica Titensky

Toss Up: Short Answer

How many distinct roots does x^3-6x^2+32 have

Bonus Answer: 2

Bonus: Short Answer

What is the remainder when x^3-6x^2+32 is divided by x-1

Bonus Answer: 27

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17. 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

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18. MATHEMATICS

Writer: Elias Milborn

Toss Up: Multiple Choice

What are the solutions for x in the following equation: x^2 - 2x = 8?

W) 0

X) 0 and -2

Y) 4 and -2

Z) -4 and 2

Toss Up Answer: Y

Bonus: Multiple Choice

The sum of the squares of reciprocals of all positive integers equals which of the following?

W) pi^1/2 (read as square root of pi)

X) pi/3

Y) pi^2/6

Z) pi^3/12

Bonus Answer: Y

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19. BIOLOGY

Writer: Mohammed Jamil

Toss Up: Multiple Choice

Which buffer system prevent large changes in pH in the blood during gas exchange

W) Hemoglobin

X) Phosphate

Y) Protein

Z) Bicarbonate

Toss Up Answer: Z

Bonus: Multiple Choice

How many ml of a 0.4 M HCl solution are required to bring the pH of 10 ml of a 0.4 M NaOH solution to 7.0 (neutral

pH)?
W) 4
X) 40
Y) 10
Z) 20

Bonus Answer: Y

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20. MATHEMATICS

Writer: Shamaul Dilmohamed

Toss Up: Multiple Choice

In the Christmas carol “The 12 Days of Christmas”, the singer says that for every day of Christmas, their significant other gives them a quantity of a new gift equal to the current day of Christmas, plus the previous gifts given. For example, on the second day onward, the singer receives 2 turtledoves on each day until the end of Christmas. What is the greatest quantity of a single gift given during the 12 days?
W) 36
X) 40
Y) 42
Z) 48

Toss Up Answer: Y

Bonus: Short Answer

How many total gifts are given in the 12 days of Christmas?

Bonus Answer: 364

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21. BIOLOGY

Writer: Matthew Lee

Toss Up: Multiple Choice

Which of the following is a bacteriostatic antibiotic that works by disrupting protein synthesis?
W) Erythromycin
X) Penicillin
Y) Trimethoprim
Z) Nalidixic acid

Toss Up Answer: W

Bonus: Multiple Choice

In India, during a cholera epidemic of 1926, European men poured a treatment for cholera into village wells unbeknownst to the villagers. What was the treatment?
W) Alcohol
X) antibiotics
Y) Phages
Z) Iodine

Bonus Answer: Y

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22. BIOLOGY

Writer: Calvin Vuong

Toss Up: Multiple Choice

In order to begin the activation of the adaptive immune system, chemokines frequently attract mature dendritic cells to

which bodily area?
W) thymus
X) lymph nodes
Y) the site of infection
Z) kidney

Toss Up Answer: X (NOTE: the answer is NOT Y, because the questions asks specifically about adaptive, not innate, immunity.)

Bonus: Multiple Choice
Which structures in the gut-associated lymphoid tissues, or GALT, function most similarly to lymph nodes in the activation of the adaptive immune response?
W) periarteriolar lymphoid sheaths
X) spleen
Y) Paneth cells
Z) Peyer's patches

Bonus Answer: Z

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23. BIOLOGY

Writer: Josh Tish

Toss Up: Multiple Choice
How does atropine counter the effects of nerve gas?
W) Atropine binds to the nerve gas and inactivates it
X) Atropine inactivates acetylcholinesterase and allows more acetylcholine to cross the synaptic cleft
Y) atropine blocks the acetylcholine receptor which blocks the excess acetylcholine lingering in the synaptic cleft
Z) atropine stimulates the production of an enzyme that breaks down the nerve gas
Toss Up Answer: Y

Bonus: Short Answer
In order to flower, what does a short-day plant need?
Bonus Answer: Night that is longer than a certain critical length

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24. BIOLOGY

Writer: Janine Goh

Toss Up: Short Answer
What determines the properties of an amino acid?
Bonus Answer: It's variable R group

Bonus: Short Answer
Which 2 of the 20 common amino acids can form disulfide bridges?
Bonus Answer: Methionine and Cysteine

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25. BIOLOGY

Writer: Calvin Vuong

Toss Up: Multiple Choice
Barr bodies exist as what structure in the nucleus?
W) euchromatin
X) acetylated histones
Y) heterochromatin

Z) circular DNA

Toss Up Answer: Y

Bonus: Short Answer

In histone acetylation, acetyl groups attach to which amino acid of the histone tails?

Bonus Answer: lysine

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