Round 14

1. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

What specific type of semiconductor is produced by adding
phosphorus to silicon?

Bonus Answer: N-Type

Bonus: Short Answer

How many turns are in the secondary coil of a transformer that has a
primary coil with 20,000 turns and is designed to step down 12,000 volts AC to 120 volts AC?

Bonus Answer: 200

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2. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Multiple Choice

Which of the following minerals has the highest number on the Mohs hardness scale?
W) Apatite
X) Fluorite
Y) Quartz
Z) Orthoclase

Toss Up Answer: Y

Bonus: Short Answer

What are the three most abundant elements in Earth’s crust?

Bonus Answer: Oxygen, Silicon, Aluminum

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3. MATHEMATICS

Writer: Hanna Yang

Toss Up: Multiple Choice

What do the numbers in the nth row of Pascal's Triangle sum to?
Give your answer in terms of n.
W) 2n
X) 2^n
Y) n^2
Z) n^3

Toss Up Answer: X

Bonus: Multiple Choice

Find the number of ordered pairs (a,b), where a and b are nonnegative integers, such that a+b=10.
W) 100
X) 10
Y) 11
Z) 12

Bonus Answer: Y

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4. EARTH and SPACE

Writer: Nicholas Parker Ng

Toss Up: Multiple Choice

The most abundant sedimentary rocks are

W) Limestone

X) Mudrocks

Y) Arkoses

Z) Evaporites

Toss Up Answer: X

Bonus: Short Answer

Dolostone is formed by the addition of what to limestone?

Bonus Answer: Magnesium

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5. CHEMISTRY

Writer: Prangon Ghose

Toss Up: Short Answer

What is the most abundant element in the human body by mass?

Bonus Answer: Oxygen

Bonus: Short Answer

What naturally occurring radioactive element is so common in homes that testing for its presence is often advisable?

Bonus Answer: Radon (accept: Rn)

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6. EARTH and SPACE

Writer: Matthew Lee

Toss Up: Short Answer

As it pertains to, say, a recent rain storm, what zone would lie right above the impermeable bedrock?

Bonus Answer: zone of saturation

Bonus: Short Answer

In the zone of aeration, groundwater is present between spaces and cracks in soil and rock grains. What is this groundwater known as?

Bonus Answer: capillary water

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7. BIOLOGY

Writer: Calvin Vuong

Toss Up: Short Answer

What cytoskeletal component forms the cleavage furrow during cytokinesis?

Bonus Answer: Microfilaments (Accept: actin)

Bonus: Short Answer

Microtubules are composed of what subunits?

Bonus Answer: tubulin (accept: alpha and beta tubulin dimers)

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8. EARTH and SPACE

Writer: Nicholas Parker Ng

Toss Up: Multiple Choice

Which of the following are sheet silicates?

W) Micas and clay minerals

X) pyroxenees and amphobles

Y) olivine and feldspar

Z) staurolite and quartz

Toss Up Answer: W

Bonus: Multiple Choice

The most common intermediate volcanic rock is

W) Andesite

X) Basalt

Y) Rhyolite

Z) Diorite

Bonus Answer: W

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9. PHYSICS

Writer: Andrew Chen (Senior)

Toss Up: Short Answer

Given a 5 meter length of gold wire with a radius of 0.05 meters with a resistivity of 2.2*10^-8, find the resistance in the wire.

Bonus Answer: 4.4*10^-5 ohms

Bonus: Multiple Choice

Given the following quantities chose the answer that contains only vector quantities.

W) Length, force, momentum

X) Momentum, temperature, work

Y) displacement, acceleration, velocity

Z) entropy, pressure, mass

Bonus Answer: Y

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10. MATHEMATICS

Writer: Janine Goh

Toss Up: Short Answer

In what type or types of triangle can the angle bisector, the altitude and the median be the same line?

Bonus Answer: Isosceles and equilateral triangle

Bonus: Short Answer

Find the other roots of x^3 + 6x^2 -13x - 42 if one of them is -2

Bonus Answer: -7, 3

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11. CHEMISTRY

Writer: Prangon Ghose

Toss Up: Multiple Choice

What do the Neon, Fluorine(1-) and Magnesium(2+) have in common?

W) They are isotopes of each other

X) They are isomers of each other

Y) They are isoelectronic with each other

Z) They have nothing in common

Toss Up Answer: Y

Bonus: Multiple Choice

The half-life of francium-212 is 19 minutes. How many minutes will it take for 1 gram of this isotope to decay to 0.125 grams?

W) 4.75 min

X) 9.5 min

Y) 38 min

Z) 57 min

Bonus Answer: Z

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12. BIOLOGY

Writer: Matthew Lee

Toss Up: Short Answer

What is the process of breaking down fatty acids and converting them to acetyl CoA called?

Bonus Answer: beta oxidation

Bonus: Short Answer

For every 6 molecules of carbon dioxide consumed for photosynthesis, how many molecules of water are consumed?

Bonus Answer: 12

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13. CHEMISTRY

Writer: Shantanu Jha

Toss Up: Multiple Choice

Which quantum number describes the specific orbital of an electron within a subshell?

W) Spin Projection

X) Magnetic

Y) Principal

Z) Azimuthal

Toss Up Answer: X

Bonus: Short Answer

What scientist disproved the caloric theory, which stated that an invisible gas transferred heat between objects?

Bonus Answer: James Prescott Joule (accept: James Joule)

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14. PHYSICS

Writer: Charles Zhang

Toss Up: Short Answer

A plane mirror is in a vertical plane and is rotating about a vertical axis at 100 rpm. A horizontal beam of light is incident on the mirror. The reflected beam will rotate at:

Bonus Answer: 200 rpm (ACCEPT 200)

Bonus: Short Answer

The curvature of a concave spherical mirror is 50 cm^-1. How far away from the mirror does an object need to be placed as to not create an image?

Bonus Answer: 25 cm (ACCEPT 0.25m or equivalent forms)

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15. CHEMISTRY

Writer: George Papastefanou

Toss Up: Short Answer

What is the last element of the periodic table to occur naturally on Earth?

Bonus Answer: Plutonium, element 94

Bonus: Short Answer

Which element is most abundant in the entire Earth?

Bonus Answer: Iron (do not accept Oxygen, that's just the crust)

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16. PHYSICS

Writer: Aaron Gee

Toss Up: Multiple Choice

A pendulum which is suspended from the ceiling of a railroad car is observed to hang at an angle of 10 degrees to the right of vertical. Which of the following answers could explain this phenomena?

W) The railroad car is at rest
X) The railroad car is accelerating to the left.
Y) The railroad car is accelerating to the right.
Z) Huh?

Toss Up Answer: X

Bonus: Multiple Choice

Two forces have magnitudes of 11 newtons and 5 newtons. The magnitude of their sum could NOT be equal to which of the following values?

W) 16
X) 5
Y) 9
Z) 7

Bonus Answer: X

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17. MATHEMATICS

Writer: Calvin Vuong

Toss Up: Short Answer

What is the 451st derived function of y = e^x?

Bonus Answer: y = e^x (DO NOT ACCEPT: e^x)

Bonus: Short Answer

What is the 451st derived function of y = -sin(e^x)?

Bonus Answer: y = cos(e^x) * (e^x)^451 (ACCEPT: y = cos(e^x) * (e^451x)) (DO NOT ACCEPT: any expression w/o y =)

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18. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

In a totally inelastic collision, what happens to the two colliding objects?

Bonus Answer: They STICK together!

Bonus: Short Answer

r For a uniformly rotating object, what do we call the rate of change

in the angle through which the object turns in one second?

Bonus Answer: ANGULAR VELOCITY

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19. BIOLOGY

Writer: Matthew Lee

Toss Up: Short Answer

What is the process of electrons being shuttled between Photosystem I and the cytochrome complex called?

Bonus Answer: cyclic electron flow

Bonus: Multiple Choice

In linear electron flow during the light reactions, electrons shuttled by Plastocyanin reduce what molecule?

W) P700

X) P680

Y) Plastoquinone

Z) Ferredoxin

Bonus Answer: W

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20. PHYSICS

Writer: Prangon Ghose

Toss Up: Short Answer

A sports car dealer claims that his product will accelerate at a constant rate from rest to a speed of 90 km/hr in 8s. What is the acceleration of the car in m/s^2 to the nearest whole number?

Bonus Answer: 3 m/s^2

Bonus: Short Answer

A rock released at rest from the top of a tower hits the ground after falling for 2 s. What is the height of the tower if air resistance is negligible to the nearest whole number?

Bonus Answer: 20 m

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21. BIOLOGY

Writer: Siam Muquit

Toss Up: Multiple Choice

What is the typical size range for a prokaryote?

W) .1 - 1.0 micrometer

X) .5 - 5.0 micrometer

Y) 1-10 micrometer

Z) 10-100 micrometer

Toss Up Answer: X

Bonus: Short Answer

What is the name for the factor that allows a bacteria to become a donor during conjugation?

Bonus Answer: F factor (accept fertility factor)

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22. MATHEMATICS

Writer: Jessica Titensky

Toss Up: Short Answer

Convert CD from hexadecimal to decimal

Bonus Answer: 205

Bonus: Short Answer

Convert CD from hexadecimal to binary

Bonus Answer: 11001101

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23. CHEMISTRY

Writer: Nicholas Parker Ng

Toss Up: Multiple Choice

The longest wavelength absorption in the UV visible spectrum of acetone, CH3COCH3, occurs at 335 nm. Predict the energy required to excite an electron from a lone pair orbital on the oxygen atom to an antibonding orbital centred on the carbonyl group.

W) 3.7 eV

X) .27 eV

Y) 2.99 eV

Z) 1.67 eV

Toss Up Answer: W

Bonus: Multiple Choice

The Pauling electronegativities of fluorine and chlorine are 4.0 and 3.0 respectively. Estimate the dipole moment of chlorine monofluoride, ClF.

W) 4 D

X) 3 D

Y) 1.6 D

Z) 1 D

Bonus Answer: Z

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24. BIOLOGY

Writer: Calvin Vuong

Toss Up: Short Answer

Glycoproteins are mainly synthesized by ribosomes attached to which structure?

Bonus Answer: the rough endoplasmic reticulum (accept: rough ER; do NOT accept: ER or endoplasmic reticulum)

Bonus: Short Answer

Drugs like barbiturates commonly increase the size of which endomembrane organelle?

Bonus Answer: the smooth endoplasmic reticulum

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