Round 15

1. CHEMISTRY

Writer: Jason Mohabir

Toss Up: Multiple Choice

For the unfolding reaction of Protein G, ΔH° =210.6 kJ/mol, this means that

W) unfolding is not favored enthalpically

X) unfolding is favored enthalpically

Y) the entropy is positive at all temperatures

Z) the entropy is negative at all temperatures

Toss Up Answer: X

Bonus: Multiple Choice

At the midpoint of a temperature transition curve,

W) all of the protein is denatured

X) Keq = 1.0 and $\Delta G = 0$

Y) [Native] = 1/2 [Unfolded] (READ AS: concentration of Native = half of the concentration of Unfolded)

Z) Keq = 0 and $\Delta G = 1.0$

Bonus Answer: X

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2. EARTH and SPACE

Writer: Zoe Orlin

Toss Up: Short Answer

What determines a mineral's properties?

Bonus Answer: The internal arrangement of its atoms.

Bonus: Short Answer

What type of currents cause plates to move in the mantle?

Bonus Answer: Convection currents

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3. PHYSICS

Writer: Aaron Gee

Toss Up: Multiple Choice

In a compound gearing arrangement where a 40-tooth gear drives
an 80-tooth gear which is directly connected to a 50-tooth gear that drives a 100-tooth gear, the total reduction is a factor of:

W) 2

X) 6

Y) 4

Z) 21

Toss Up Answer: Y

Bonus: Multiple Choice

Elastic deformation is BEST described as ...

W) the linear portion of a stress/strain curve

X) 99% elongation

Y) stregnth of a material

Z) deformation

Bonus Answer: W

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4. CHEMISTRY

Writer: Andrew Chen (Senior)

Toss Up: Short Answer

Given the equation HCl (aq) + NaOH (aq) --> NaCl (aq) + H2O (l) and that 10.00 mL of 1.5 M HCl was reacted with 20.00 mL of 0.80 M of NaOH, which compound is the limiting reactant?

Bonus Answer: HCl (Hydrochloric acid)

Bonus: Multiple Choice

In organic chemistry what is the name of the functional group consisting of a central carbon singly bonded to two carbon atoms and doubly bonded to an oxygen atom?

W) amine

X) amide

Y) ether

Z) ketone

Bonus Answer: Z

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5. MATHEMATICS

Writer: Siam Muquit

Toss Up: Multiple Choice

How many roots (real or complex) does x^4 - x^3 - 9x^2 + 7x + 14 = 0 have?

W) 1

X) 2

Y) 3

Z) 4

Toss Up Answer: Z

Bonus: Short Answer

Find all real roots of x^4 - x^3 - 9x^2 + 7x + 14 = 0

Bonus Answer: -1, 2, +/- (sqrt 7)

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6. CHEMISTRY

Writer: Seiji Yawata

Toss Up: Multiple Choice

Which of the following compounds can not exist?

W) PF_5

X) P_4O_{10}

Y) P_4O_6

Z) PH_5

Toss Up Answer: Y

Bonus: Short Answer

Order the following hydrogen halides from the one with the lowest boiling point to one with the highest: HI, HCl, HBr, HF

Bonus Answer: HCl, HBr, HI, HF (2, 3, 1, 4)

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7. MATHEMATICS

Writer: Ahmad Alnasser

Toss Up: Multiple Choice

What is the y-intercept in the equation y = 4x + 3 -2

W) 3

X) 1

Y) -2

Z) 2

Toss Up Answer: X

Bonus: Multiple Choice

If 3x - y = 12, what is (8^x) / (2^y)

W) 2^12

X) 4^4

Y) 8^3

Z) Cannot be determined

Bonus Answer: W

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8. CHEMISTRY

Writer: Olivia Gallager

Toss Up: Short Answer

What are the numbers of sigma bonds and pi bonds, in ethyne, respectively?

Bonus Answer: 3 sigma bonds, 2 pi bonds

Bonus: Short Answer

Pi bonds are created by the overlap of what type of orbital?

Bonus Answer: p, p orbitals

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9. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Short Answer

Which planet has the slowest rotation?

Bonus Answer: Venus

Bonus: Multiple Choice

Which planet has the fastest rotation?

W) Jupiter

X) Saturn

Y) Uranus

Z) Neptune

Bonus Answer: W

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10. CHEMISTRY

Writer: Ivan Zhang

Toss Up: Multiple Choice

Which of the following element is not a newly named (as of November 2016) element?

W) nihonium

X) paostinism
Y) moscovium
Z) tennessine

Toss Up Answer: X

Bonus: Multiple Choice
Who reorganized the periodic table based on atomic number?
W) Mendeleev
X) Moseley
Y) Pablo
Z) Escobar

Bonus Answer: X

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11. PHYSICS

Writer: Charles Zhang

Toss Up: Multiple Choice
A 2 kg ball is dropped from 10m. Another 2 kg ball is thrown upwards at 5 m/s. What is the acceleration of the center of mass of these two balls in terms of g, the gravitational acceleration on Earth?
W) 2g
X) g
Y) 5g
Z) 10g

Toss Up Answer: X

Bonus: Multiple Choice
Two astronauts are in gravity-free space. Astronaut A is 120 kg and Astronaut B is 90 kg. If A pushes B away, with B moving at 0.5 m/s, what is Astronaut A's final speed rounded to the tenth?
W) 0
X) 0.38
Y) 0.5
Z) 0.68

Bonus Answer: X

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12. BIOLOGY

Writer: Calvin Vuong

Toss Up: Multiple Choice
Which of the following types of cells do not exhibit density-dependent inhibition concerning reproduction?
W) neurons
X) cells in your liver
Y) cells in a malignant tumor
Z) cells surrounding your stomach

Toss Up Answer: Y

Bonus: Short Answer
Which cell part is most directly responsible for detecting the cell density of its surrounding area in order for the cell to exhibit density-dependent inhibition?

Bonus Answer: extracellular matrix

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13. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

A toy train moves in a circle of 8 meters radius with a speed of 4 meters per second. What is the magnitude of the acceleration of the train?

Bonus Answer: 2 meters per second^2

Bonus: Short Answer

A certain machine exerts a force of 200 newtons on a box whose mass is 30 kilograms. The machine moves the box a distance of 20 meters along a horizontal floor. What amount of work does the machine do on the box?

Bonus Answer: 4000 J (joules)

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14. MATHEMATICS

Writer: Ahmad Alnasser

Toss Up: Short Answer

What is the volume of a sphere of radius "R"?

Bonus Answer: (4/3)piR^3

Bonus: Short Answer

What is the degree of a vertex in a complete graph K_n (K sub n)?

Bonus Answer: (0,0) ; the origin

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15. BIOLOGY

Writer: Matthew Lee

Toss Up: Short Answer

HIV can be treated with a drug cocktail known as HAART. What does HAART stand for?

Bonus Answer: Highly Active Anti-Retroviral Treatment

Bonus: Short Answer

AIDS patients may become afflicted with an extremely rare cancer caused by a certain herpesvirus. What is this cancer called?

Bonus Answer: Kaposi's Sarcoma

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16. PHYSICS

Writer: Prangon Ghose

Toss Up: Short Answer

Just before hitting a nail, a 2 kg hammer is moving at 10 m/s. If the wood exerts a constant 180 N force on the nail, how far does the nail go?

Bonus Answer: 0.6 m

Bonus: Short Answer

What is the velocity of a particle after falling 10 m if its initial velocity is 10 m/s downwards?

Bonus Answer: 10rad(3) m/s

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17. BIOLOGY

Writer: Olivia Gallager

Toss Up: Multiple Choice

Which of the following enzymes makes C4 and CAM species more efficient in hotter, dryer climates?

W) phosphofructokinase

X) Rubisco

Y) DNA polymerase

Z) PEP Carboxylase

Toss Up Answer: Z

Bonus: Short Answer

During the light dependent reactions, on what membrane does ATP synthesis take place via ATP Synthase?

Bonus Answer: thylakoid, thylakoid membrane

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18. MATHEMATICS

Writer: Ahmad Alnasser

Toss Up: Short Answer

In a normal distribution, approximately what percentage of the sample, to the nearest whole number, falls within 4 standard deviations of the mean:

Bonus Answer: 100%

Bonus: Multiple Choice

Which of the following properties would you use to compute the chances of rolling either a 7 or an 11 with a pair of dice:

W) multiplicative

X) conditional

Y) independent

Z) additive

Bonus Answer: Z

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19. PHYSICS

Writer: Prangon Ghose

Toss Up: Short Answer

A bullet with mass 0.01 kg and a velocity of 300 m/s is aimed at a wood block on a table. If the mass of the block is 1 kg and the bullet is embedded in the wood block, what is the final velocity of the system?

Bonus Answer: 3 m/s

Bonus: Short Answer

A 0.400 kg soccer ball approaches a player horizontally with a speed of 15 m/s. The player illegally strikes the ball with her hand and causes it to move in the opposite direction with a speed of 22 m/s. What impulse was delivered to the ball by the player to the nearest whole number?

Bonus Answer: -15 kgm/s

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20. BIOLOGY

Writer: Matthew Lee

Toss Up: Short Answer

What molecule or one of its derivatives serves as the final electron acceptor in fermentation?

Bonus Answer: Pyruvate

Bonus: Short Answer

In alcoholic fermentation, pyruvate is converted to a compound which acts as the final electron acceptor, being converted to ethanol in the process. What is this compound called?

Bonus Answer: Acetaldehyde

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21. PHYSICS

Writer: Mohammed Jamil

Toss Up: Short Answer

A horse moves a sleigh 10 meters by applying a horizontal 60-newton force on its harness for 2 minutes. What is the power of the horse?

Bonus Answer: 5 Watts

Bonus: Short Answer

A force of 100 newtons is used to move an object a distance of 15 meters. Find the time the force is applied to achieve a power of 25 Watts.

Bonus Answer: 60 seconds

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22. BIOLOGY

Writer: Shanjeed Ali

Toss Up: Short Answer

In DNA, to which carbon of the sugar is the nitrogenous base bonded?

Bonus Answer: Accept one OR one prime

Bonus: Short Answer

On which carbon of the sugar is the hydroxyl group located?

Bonus Answer: Accept three OR three prime

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23. EARTH and SPACE

Writer: Justin Lam

Toss Up: Short Answer

What is the shape of the path planets take around the sun?

Bonus Answer: Elliptical

Bonus: Short Answer

Name three of the closest stars to Earth, not including the Sun.

Bonus Answer: Three of the following: Proxima Centauri, Alpha Centauri A, Alpha Centauri B, Barnard, Wolf, Luyten, Sirius

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24. BIOLOGY

Writer: Shanjeed Ali

Toss Up: Multiple Choice

What stimulates root branching in plants?

W) Gibberellin

X) Auxin

Y) Ethylene

Z) Cytokinin

Toss Up Answer: X

Bonus: Multiple Choice

A plant with low levels of gibberellin will have:

W) high levels of ethylene
X) decreased levels of lignin
Y) undeveloped leaves
Z) decreased growth

Bonus Answer: Z

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25. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Multiple Choice

What is the defining characteristic of the classification of types of supernovas?
W) total energy released
X) elemental spectral lines
Y) duration of the supernova
Z) size of the initial star

Toss Up Answer: X

Bonus: Short Answer

What element is released in a Type IA supernova that is not released in other Type I supernovae?

Bonus Answer: silicon

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