Round 31

1. BIOLOGY

Writer: Calvin Vuong

Toss Up: Multiple Choice

Where do the microtubules of the spindle originate during mitosis in both plant and animal cells?

W) centromere

X) centrosome

Y) centriole

Z) kinetochore

Toss Up Answer: Y

Bonus: Multiple Choice

If cells in the process of dividing are subjected to colchicine, at which stage will mitosis be arrested?

W) anaphase

X) prophase

Y) metaphase

Z) interphase

Bonus Answer: Y

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2. ENERGY

Writer: Ivan Zhang

Toss Up: Multiple Choice

Which of the following outputs the most energy?

W) Coal

X) Natural Gas

Y) Petroleum

Z) Surface Oil

Toss Up Answer: W

Bonus: Short Answer

What is the powerhouse of the cell?

Bonus Answer: Mitochondria

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3. CHEMISTRY

Writer: Olivia Gallager

Toss Up: Multiple Choice

cis 1,2 chloro-ethene and trans 1,2 chloro-ethene differ in which of the following?

W) electron geometry

X) enthalpy

Y) entropy

Z) boiling point

Toss Up Answer: Z

Bonus: Short Answer

In an acid/base reaction, which (acid or base) is the electrophile?

Bonus Answer: acid

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4. BIOLOGY

Writer: Calvin Vuong

Toss Up: Multiple Choice

A eukaryotic cell has synthesized a primary mRNA transcript. Which of the following DOES NOT happen to it before it leaves the nucleus?

W) a guanosine cap is added to the 5' end

X) a polyadenylation signal is added to the 3' end as an untranslated region

Y) a poly-A tail is added to the 3' end

Z) introns are excised

Toss Up Answer: X

Bonus: Short Answer

The modified mRNA codes for insulin protein to be secreted by the cell. During translation, which molecule is responsible for bringing the the ribosome, mRNA, and forming polypeptide to the ER membrane?

Bonus Answer: signal recognition particle (ACCEPT: SRP)

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5. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Multiple Choice

In which state is the oldest North American lake located?

W) California

X) Minnesota

Y) Ohio

Z) Utah

Toss Up Answer: W

Bonus: Short Answer

What is the densest naturally occurring element?

Bonus Answer: Osmium

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6. BIOLOGY

Writer: Calvin Vuong

Toss Up: Multiple Choice

Which of the following statements concerning photosynthetic light reactions is false?

W) Photosystem I contains the P700 reaction center.

X) The electron transport chain following photosystem I drives chemiosmosis.

Y) NADP+ is the final election acceptor.

Z) Electrons are replenished in photosystem II by the splitting of water.

Toss Up Answer: X

Bonus: Multiple Choice

Which of the following molecules is not present in the electron transport chain immediately following photosystem II?

W) cytochrome complex

X) plastoquinone

Y) ferredoxin

Z) plastocyanin

Bonus Answer: Y

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7. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Short Answer

What spectral type does the star Betelgeuse fall into?

Bonus Answer: M

Bonus: Multiple Choice

When was the last major supernova in the Milky Way detected?

W) 1604

X) 1863

Y) 1973

Z) 1989

Bonus Answer: W

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8. BIOLOGY

Writer: Calvin Vuong

Toss Up: Multiple Choice

ATP is directly produced from glycolysis by which of the following?

W) respiration

X) oxidative phosphorylation

Y) substrate level phosphorylation

Z) pyruvate oxidation

Toss Up Answer: Y

Bonus: Short Answer

What enzyme is responsible for converting fructose6-phosphate to fructose 1,6-biphosphate in the energy investment phase of glycolysis?

Bonus Answer: phosphofructokinase

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9. ENERGY

Writer: George Papastefanou

Toss Up: Multiple Choice

Which material takes the least energy and C02 to produce?

W) Wood

X) Aluminum

Y) Glass

Z) HDPE (High Density Polyethylene Plastic)

Toss Up Answer: W

Bonus: Short Answer

What electrophysical process is behind wireless charging?

Bonus Answer: Induction

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10. BIOLOGY

Writer: Josh Tish

Toss Up: Multiple Choice

The majority of proteins exist as homo-oligomers rather than hetero-oligomers. Which of the following is not a reason that quaternary structures are homo-oligomers?

W) Aggregation of identical subunits gives rise to symmetry and possible allosteric interactions.

X) A slow post-translational process favors a quaternary structure with the homo-oligomers held together by covalent bonds.
Y) Homodimers may increase binding specificity and stability.
Z) Homo-oligomerization results in a genetic savings with lower energy demand.

Toss Up Answer: X

Bonus: Multiple Choice
Which of the following is not an action of epinephrine or norepinephrine?
W) Glycogen broken down to glucose.
X) Increased gastric motility and secretion.
Y) Increased blood pressure.
Z) Increased salivation.

Bonus Answer: X

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11. ENERGY

Writer: Aaron Gee

Toss Up: Short Answer
What is the most common sulfur compound that occurs naturally in natural gas?
Bonus Answer: HYDROGEN SULFIDE

Bonus: Short Answer
Earth's core is kept hot by the radioactive decay of several radioactive substances, including Uranium-235 and 238; name the other two heat-producing isotopes which are also significant contributors to the radioactive heat production of the Earth.
Bonus Answer: POTASSIUM-40 AND THORIUM-232 (Question is very hard?)

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12. BIOLOGY

Writer: Matthew Lee

Toss Up: Multiple Choice
If I cut your left optic tract, what part of your visual field will you lose?
W) The left temporal section only
X) The left temporal and left nasal sections
Y) The right nasal section only
Z) The right temporal and right nasal sections
Toss Up Answer: Z

Bonus: Short Answer
What is the name of the spot where the left optic tract and the right optic tract intersect?
Bonus Answer: optic chiasm

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13. ENERGY

Writer: Aaron Gee

Toss Up: Short Answer
Cadmium and boron are used in a nuclear reactor to absorb which subatomic particle?
Bonus Answer: Neutron

Bonus: Short Answer

The electrical resistance of a semiconducting wire is least likely to be
reduced by a decrease in which of the following four wire characteristics?
Radius, Melting Point, Length, or Temperature?

Bonus Answer: Melting Point

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14. CHEMISTRY

Writer: Olivia Gallager

Toss Up: Short Answer

How many sigma and pi bonds does 1,3 butadiene have, respectively?

Bonus Answer: 9 sigma, 2 pi

Bonus: Short Answer

S orbital overlap has what shape?

Bonus Answer: spherical, sphere

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15. MATHEMATICS

Writer: George Papastefanou

Toss Up: Short Answer

What is the tangent of (27(pi)/4)

Bonus Answer: -1

Bonus: Short Answer

With a 5 percent compound interest rate, how long, to the nearest year, will it take a sum of money to double?

Bonus Answer: 14 years

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16. CHEMISTRY

Writer: Olivia Gallager

Toss Up: Multiple Choice

Which of the following is a strong nucleophile?
W) ethanol
X) butanol
Y) Bromide
Z) t-butoxide

Toss Up Answer: Y

Bonus: Multiple Choice

What causes Coordination compounds to be different colors
W) ΔE
X) s orbital overlap
Y) VESPR
Z) p orbital overlap

Bonus Answer: W

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17. MATHEMATICS

Writer: Andrew Chen (Senior)

Toss Up: Short Answer

A square is inscribed within a circle with a radius of 2.5 cm. To the nearest tenths place what is the area of the square?

Bonus Answer: 12.5 cm^2

Bonus: Multiple Choice

Given the parabola y=4x^2+2x-10 what is the equation of the line tangent to it at the point (0,-10)?

W) y=2x+10

X) y=2x-5

Y) y=5x-8

Z) y=2x-10

Bonus Answer: Z

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18. CHEMISTRY

Writer: Siam Muquit

Toss Up: Short Answer

By name or number, which of the following is associated with inversion of stereochemistry?

1. Sn1
2. Sn2
3. E1
4. E2

Bonus Answer: Sn2 only (2 only)

Bonus: Short Answer

Which rule states that in E1 and E2 reactions, the more substituted double bond is more likely to occur?

Bonus Answer: Saytzeff rule

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19. MATHEMATICS

Writer: Jessica Titensky

Toss Up: Short Answer

How many seconds are in a day

Bonus Answer: 86400

Bonus: Multiple Choice

How many days are in a second

W) 1.16*10^-3

X) 1.16*10^-4

Y) 1.16*10^-5

Z) 1.16*10^-6

Bonus Answer: Y

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20. ENERGY

Writer: Elias Milborn

Toss Up: Multiple Choice

Which of the following is measured by total harmonic distortion, a standard for gauging the quality of power provided to customers?

W) How distorted the waveform is from a pure sinusoidal waveform

X) How distorted the waveform is from a triangular waveform

Y) The difference between a sinusoidal waveform and a triangular waveform

Z) the maximum value of a sinusoidal wave form with respect to the reference point of the waveform

Toss Up Answer: W

Bonus: Multiple Choice

Which of the following is NOT an accurate representation of a limitation on the production and use of bioplastics?

W) using crops for plastic diverts plants from the food supply

X) bioplastics are unlikely to disintegrate in a landfill

Y) bioplastics produce a variety of pollutants when burned

Z) Individuals at home would find it more difficult to compost bioplastics

Bonus Answer: Y

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21. MATHEMATICS

Writer: Ahmad Alnasser

Toss Up: Multiple Choice

Which of the following the derivative with the highest degree?

W) X^2 (x squared)

X) 20

Y) 104

Z) 3x

Toss Up Answer: W

Bonus: Short Answer

Find y' = dy/dx for x3 + y3 = 4 . (x cubed + y cubed)

Bonus Answer: -x^2/y^2 (negative x squared over y squared)

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22. MATHEMATICS

Writer: Benjamin Avrahami

Toss Up: Short Answer

In simplest form, express the surface area to volume ratio of a cube with side length s.

Bonus Answer: 6:s

Bonus: Short Answer

Calculate the harmonic mean of the first two perfect numbers and 10.

Bonus Answer: 4 * sqrt(105)

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23. MATHEMATICS

Writer: Hussain Waris

Toss Up: Multiple Choice

A set is countable:

W) If and only if it is finite.

X) If and only if a surjection can be made between the set ant he natural numbers.

Y) If it has the same cardinality as some subset of the natural numbers.

Z) If it has the same cardinality as some subset of the real numbers.

Toss Up Answer: Y

Bonus: Short Answer

Who was the famous German mathematician that invented Set Theory and effectively proved the unaccountableness of the reals?

Bonus Answer: Georg Cantor (accept Cantor)

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24. MATHEMATICS

Writer: Steven Litvack-Winkler

Toss Up: Multiple Choice

For real numbers x and y on the closed interval from 0 to 1, let a=xy and b=(1-x)(1-y). Find the maximum value over all choices of x and y for the minimum of a and b.

W) 0

X) 1/4

Y) 1/2

Z) 1

Toss Up Answer: X

Bonus: Short Answer

One definition of the Cantor set is the set of all numbers x between 0 and 1 such that x has only the digits 0 and 2 in it's base 3 representation. Which of the following numbers is in the Cantor set.

I. 1/4

II. 1/2

III. 5/26

IV. 7/10

Bonus Answer: 4 only

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25. MATHEMATICS

Writer: Benjamin Avrahami

Toss Up: Multiple Choice

What is the smallest positive 'taxicab' number?

W) 87

X) 91

Y) 95

Z) 100

Toss Up Answer: X

Bonus: Short Answer

To what power do you have to raise any number for it to be 0, 1, or -1 in mod 7?

Bonus Answer: 3

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