Round 18

1. BIOLOGY

Writer: Calvin Vuong

Toss Up: Short Answer

The kinases that perform cellular activities throughout the cell cycle are allosterically regulated by what molecules?

Bonus Answer: cyclins

Bonus: Multiple Choice

Synapsis begins during which stage of prophase I?

W) leptotene

X) zygotene

Y) diplotene

Z) diakinesis

Bonus Answer: X

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2. PHYSICS

Writer: William Xiang

Toss Up: Short Answer

Name all of the following that are vector quantities: Weight, Distance, Velocity, Energy, Watt

Bonus Answer: Weight, Velocity

Bonus: Multiple Choice

A man wishes to pull a crate 15 m across a rough floor by exerting a force of 100 N. The coefficient of kinetic friction is 0.25. For the man to do the least work, the angle between the force and the horizontal should be

W) 0 degrees

X) 14 degrees

Y) 43 degrees

Z) 66 degrees

Bonus Answer: W

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3. BIOLOGY

Writer: Calvin Vuong

Toss Up: Multiple Choice

The majority of photosynthesis occurs in which part of the leaf?

W) the veins

X) the lower paliside layer

Y) the upper paliside layer

Z) the stomata

Toss Up Answer: Y

Bonus: Short Answer

What is the final electron receptor in photosynthetic light reactions?

Bonus Answer: NADP+ (Accept: NADPH)

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4. MATHEMATICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

Which of the following sets has the greatest cardinality?

W) The set of all real numbers
X) The set of all integers
Y) The set of all rational numbers
Z) They all have the same cardinality
Toss Up Answer: Z

Bonus: Short Answer
If set A has a cardinality of 5, set B has a cardinality of 6, and set A and B are disjoint sets, what is the cardinality of the union of set A and B?
Bonus Answer: 11

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5. PHYSICS

Writer: William Xiang
Toss Up: Short Answer
Name all of the following that are NOT correct units for work: Joule, Newton*meter, Watt, ft*lb, Volt
Bonus Answer: Watt, Volt

Bonus: Multiple Choice
An 80-N crate slides with constant speed a distance of 5.0 m downward along a rough slope that makes an angle of 30 degrees with the horizontal. The work done by the force of gravity is:
W) -400 J
X) -200 J
Y) 200 J
Z) 400 J

Bonus Answer: Y

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6. MATHEMATICS

Writer: Calvin Aw
Toss Up: Short Answer
Express 122121 base 3 in base 9.
Bonus Answer: 577

Bonus: Short Answer
1011101 base 2 is what in base 7?
Bonus Answer: 151

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7. PHYSICS

Writer: William Xiang
Toss Up: Short Answer
Suppose that the fundamental dimensions are taken to be: force (F), velocity (V), and time (T). Find the dimensions of potential energy in simplest form.
Bonus Answer: FVT

Bonus: Multiple Choice
A projectile of mass 0.50kg is fired with an initial speed of 10 m/x at an angle of 60 degrees above the horizontal. The potential energy of the projectile-Earth system (relative potential energy when the projectile is at ground level) is:
W) 25 J
X) 18.75 J
Y) 12.5 J

Z) 6.25 J

Bonus Answer: X

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8. MATHEMATICS

Writer: Calvin Aw

Toss Up: Short Answer

If 2x+y=5 and 2y+x=6, find (x-y)^2

Bonus Answer: 1

Bonus: Short Answer

Given a 3-4-5 right triangle, find the area of its inscribed circle.

Bonus Answer: pi

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9. BIOLOGY

Writer: Calvin Vuong

Toss Up: Multiple Choice

The majority of ATP molecules generated from cellular respiration comes from which process?

W) glycolysis

X) pyruvate oxidation

Y) the Krebs cycle

Z) chemiosmosis

Toss Up Answer: Z

Bonus: Short Answer

How many ATP molecules on average does chemiosmosis produce per glucose?

Bonus Answer: Accept: 26, 28, or both.

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10. CHEMISTRY

Writer: Ahmad Alnasser

Toss Up: Short Answer

Which element is the more electronegative?

Bonus Answer: Flourine

Bonus: Short Answer

Name all the atoms that are diatomic.

Bonus Answer: Hydrogen (H2)

Nitrogen (N2)

Oxygen (O2)

Fluorine (F2)

Chlorine (Cl2)

Iodine (I2)

Bromine (Br2)

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11. EARTH and SPACE

Writer: Yae June Lee

Toss Up: Multiple Choice

What is the relationship between size of a particle and the capillarity of soil?

W) As soil particle increases, capillarity increases.

X) As soil size increases, capillarity decreases.

Y) As soil size increases, capillarity stays the same.
Z) As soil size increases, the capillarity curves in a parabola.
Toss Up Answer: X

Bonus: Short Answer
Why do polar jet streams vary throughout the seasons?
Bonus Answer: The rays of the sun shift north of the equator during the summer.

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12. CHEMISTRY

Writer: Mohammed Haque
Toss Up: Short Answer
What is the electron configuration for Fluorine?
Bonus Answer: 1s^2 2s^2 2p^5

Bonus: Short Answer
What is the noble gas configuration of Fluorine ?
Bonus Answer: [He]2s^2 2p^5

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13. PHYSICS

Writer: William Xiang
Toss Up: Multiple Choice
Two particles interact by conservative forces. In addition, an external force acts on each particle. They complete round trips, ending at the points where they started. Which of the following must have the same values at the beginning and tend of this trip?
W) the total kinetic energy of the two-particle system
X) the potential energy of the two-particle system
Y) the total linear momentum of the two-particle system
Z) the mechanical energy of the two-particle system

Toss Up Answer: X

Bonus: Multiple Choice
A force of 10 N holds an ideal spring with a 20 N/m spring constant in compression. The potential energy stored in the spring is:
W) 0.5J
X) 2.5J
Y) 5J
Z) 10J

Bonus Answer: X

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14. CHEMISTRY

Writer: Olivia Gallager
Toss Up: Short Answer
How many sigma and pi bonds does 1,3 butdiene have, respectively?
Bonus Answer: 3 sigma, 2 pi

Bonus: Short Answer
S orbital overlap has what shape?
Bonus Answer: spherical, sphere

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15. EARTH and SPACE

Writer: Yae June Lee

Toss Up: Multiple Choice

What happened to the melted rock after it goes through solidification to form basalt?

W) It occurred rapidly, with fine grained minerals

X) Slowly, coarse grained minerals

Y) Rapidly, coarse trained minerals

Z) Slowly, fine grained minerals

Toss Up Answer: W

Bonus: Short Answer

What are two surface traits that affect the rate of surface runoff?

Bonus Answer: Slope of land surface, soil type or composition, vegetation, porosity of soil, soil saturation.(any two of these answers are acceptable.)

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16. 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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17. EARTH and SPACE

Writer: Prangon Ghose

Toss Up: Multiple Choice

Which planet's tilt of the axis is closest to that of Mars?

W) Mercury

X) Venus

Y) Earth

Z) Jupiter

Toss Up Answer: Y

Bonus: Multiple Choice

Which planet rotates the fastest in our solar system?

W) Earth

X) Jupiter

Y) Pluto

Z) Uranus

Bonus Answer: X

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18. BIOLOGY

Writer: Calvin Vuong

Toss Up: Multiple Choice

Why are carbohydrates and fats considered high energy foods?

W) They have a lot of oxygen atoms.

X) They can have very long carbon skeletons.

Y) They have a lot of electrons associated with hydrogen.

Z) They are easily reduced.

Toss Up Answer: Y

Bonus: Multiple Choice

Substrate-level phosphorylation accounts for approximately what percentage of the ATP formed by the reactions of glycolysis?

W) 0

X) 2

Y) 10

Z) 100

Bonus Answer: Z

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19. MATHEMATICS

Writer: Calvin Aw

Toss Up: Short Answer

An arithmetic progression has 10 terms. Find the maximum distance between any 2 terms if the minimum value for any term is 0 and the maximum is 100, inclusive.

Bonus Answer: 99

Bonus: Short Answer

Find the number of factors of 967*515

Bonus Answer: 8

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20. PHYSICS

Writer: William Xiang

Toss Up: Short Answer

A woman pushes a 25-kg shopping cart 10 meters along a frictionless horizontal surface. What is the total work exerted by the woman on the cart?

Bonus Answer: 0 Joules

Bonus: Multiple Choice

A 0.50kg block attached to an ideal spring with a spring constant of 80 N/m oscillates on a horizontal frictionless surface. The total mechanical energy is 0.12J. The greatest extensions from this equilibrium length is:

W) 1.5 * 10^-3 m

X) 3.0 * 10^-3 m

Y) 0.039 m

Z) 0.054 m

Bonus Answer: Z

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21. CHEMISTRY

Writer: Seiji Yawata

Toss Up: Multiple Choice

Which of the following statements is true?

W) Hydrogen peroxide has a planar structure

X) Tritium is radioactive and emits alpha particles

Y) H_2 is insoluble in water

Z) Hydrogen constitutes 70% of the Earth's crust by mass

Toss Up Answer: Y

Bonus: Multiple Choice

Which of the following gas mixtures is not applicable to Dalton's law of Partial Pressures?

W) CO_2 and N_2

X) CO_2 and CO

Y) SO_2 and O_2

Z) N_2 and CO

Bonus Answer: Y

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22. BIOLOGY

Writer: Calvin Vuong

Toss Up: Short Answer

How many molecules of carbon dioxide are produced per turn of the Krebs cycle?

Bonus Answer: 2

Bonus: Multiple Choice

A molecule of carbon dioxide is released in the Krebs cycle during the oxidation of which molecule?

W) citrate

X) succinyl CoA

Y) malate

Z) alpha-Ketoglutarate

Bonus Answer: Z

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23. BIOLOGY

Writer: Siam Muquit

Toss Up: Multiple Choice

Which of the following is thought to have underwent secondary endosymbiosis?

W) Ciliate

X) Dinoflagellates

Y) Diatoms

Z) Algae

Toss Up Answer: Z

Bonus: Short Answer

From what specific class of bacteria are mitochondria thought to originate from?

Bonus Answer: Alpha proteobacteria

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24. 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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25. BIOLOGY

Writer: Calvin Vuong

Toss Up: Multiple Choice

Which of the following is not an electron carrier involved cellular respiration?

W) NADH

X) FADH2

Y) NADPH

Z) NAD+

Toss Up Answer: Y

Bonus: Multiple Choice

For each turn of the Krebs cycle, how many electron carriers are produced?

W) 3 FADH2 and 1 NADH

X) 6 NADH and 2 FADH2

Y) 3 NAD+ and 1 FAD

Z) 3 NADH and 1 FADH2

Bonus Answer: Z

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