Round 11

1. PHYSICS

Writer: William Xiang

Toss Up: Short Answer

Two trailers, X with mass 500kg and Y with mass 2000kg, are being pulled at the same speed. Find the ratio of the kinetic energy of Y to that of X in simplest terms.

Bonus Answer: 4:1 (or 4 to 1)

Bonus: Multiple Choice

Given a potential energy function U(x), the corresponding force F is in the positive x direction if:

W) U is positive

X) U is negative

Y) U is an increasing function of x

Z) U is a decreasing function of x

Bonus Answer: Z

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2. BIOLOGY

Writer: Josh Tish

Toss Up: Multiple Choice

When the temperature increases, which of the following statements
is not true?

W) Dissolved oxygen decreases at higher temperatures and higher salinity.

X) Many corals die when the temperature exceeds 86°F.

Y) Metabolic reactions are less likely to achieve their activation energy.

Z) The amount of carbon dioxide that can be absorbed by the ocean decreases.

Toss Up Answer: Y

Bonus: Multiple Choice

Which of the following carbohydrates contain α-1, 4-linkages?

W) amylose

X) Cellulose

Y) Deoxyarabinose

Z) Glucose

Bonus Answer: W

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3. CHEMISTRY

Writer: Prangon Ghose

Toss Up: Short Answer

Who is credited with the discovery of the neutron in 1932?

Bonus Answer: James Chadwick (accept: Chadwick)

Bonus: Short Answer

Who patented the common dry cell?

Bonus Answer: GEORGES LECLANCHÉ (accept: LECLANCHÉ)

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4. BIOLOGY

Writer: Ivan Zhang

Toss Up: Multiple Choice

Which of the following is the most common organic compound on Earth?

W) chitin

X) glucose

Y) phospholipids

Z) cellulose

Toss Up Answer: Z

Bonus: Multiple Choice

Which of the following syndrome occurs in women born with only 1 X chromosome?

W) Marfan Syndrome

X) Turner Syndrome

Y) Prader-Willi syndrome

Z) Porphyria

Bonus Answer: X

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5. PHYSICS

Writer: Jan Wojcik

Toss Up: Multiple Choice

There is a 4kg block at rest. It spontaneously explodes into two pieces traveling in opposite directions. One piece weighing 1 kilogram travels to the left at 4 m/s. What direction and speed was the other block traveling in?

W) 4/3 m/s to the left

X) 3/4 m/s to the right

Y) 4/3 m/s to the right

Z) 4 m/s to the left

Toss Up Answer: Y

Bonus: Multiple Choice

Under small velocities, objects that collide do not conserve their total energy. However, under relativistic velocities, collisions always conserve their total energy. Why is this so?

W) Under relativistic velocities, mass and energy are interchangeable, and since mass can't be destroyed, neither can initial nor final energy.

X) Under small velocities, the frictional force during collision felt by two objects is large, whereas under relativistic velocities, the frictional force is negligible and energy is conserved.

Y) Under relativistic velocities, objects obtain relativistic masses which makes them gain more mass and makes up the lost energy in a regular collision.

Z) Under small velocities, particles lose parts of their masses while in motion, leading to a loss of energy after collision.

Bonus Answer: W

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6. BIOLOGY

Writer: Siam Muquit

Toss Up: Multiple Choice

Which of these is not characteristic of an r-selecting species?

W) Small physical size

X) Short life span

Y) Parental care
Z) Variable and unpredictable mortality
Toss Up Answer: Y

Bonus: Short Answer
For each of the following, state whether it is an r-strategist or k-strategist: Oyster, Garden weeds, Desert flowers, Humans
Bonus Answer: Oyster: r-strategist; Garden weeds: r-strategist; Desert flowers: r-strategist; Humans: k-strategist

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7. MATHEMATICS

Writer: Aaron Gee
Toss Up: Short Answer
If you roll 2 fair dice simultaneously, what is the probability, given as a fraction, that you will roll the number 6 on AT LEAST one die?
Bonus Answer: 11/36

Bonus: Short Answer
Find the sum of all interior angles, in degrees, in a regular polygon having 14 sides
Bonus Answer: 2160 degrees

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8. BIOLOGY

Writer: Janine Goh
Toss Up: Short Answer
In DNA replication, the lagging strand is replicated in what fragments?
Bonus Answer: Okazaki

Bonus: Short Answer
Sickle-cell anemia is caused by what type of mutation?
Bonus Answer: Point mutation/deletion

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9. EARTH and SPACE

Writer: Matthew Lee
Toss Up: Multiple Choice
Which of these factors has the least influence on the velocity of a stream?
W) discharge
X) channel shape
Y) roughness of stream bottom
Z) gradient

Toss Up Answer: Y

Bonus: Multiple Choice
Where does water flow fastest in the meanders of a stream?
W) near the inside of the stream bend
X) near the outside of the stream bend
Y) near the center of the stream
Z) the velocity is equal everywhere

Bonus Answer: X

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10. MATHEMATICS

Writer: Jessica Titensky

Toss Up: Short Answer

What is tan(arcsin(9/41))

Bonus Answer: 9/40

Bonus: Short Answer

What is sin(arccot(tan(arccos(3/5))))

Bonus Answer: 3/5

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11. PHYSICS

Writer: Aaron Gee

Toss Up: Multiple Choice

If the atomic mass of carbon-12 is exactly 12 atomic mass units,
why is the atomic mass of carbon not exactly 12 when listed on the Periodic Table?
W) mass deficit
X) neutrons are not the same mass as protons
Y) it adds mass of electrons
Z) the presence in nature of about 1.1% carbon-13

Toss Up Answer: Z

Bonus: Short Answer

If 2500 pounds is applied to a spring with spring constant of 100
pounds per inch on top of a hydraulic piston, how many pounds of force is transferred to the piston:

Bonus Answer: 2500

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12. EARTH and SPACE

Writer: Nicholas Parker Ng

Toss Up: Multiple Choice

The ozone is in what layer
W) Stratosphere
X) Troposphere
Y) Hydrosphere
Z) Mesosphere

Toss Up Answer: W

Bonus: Multiple Choice

Atmospheric convection is driven by
W) Ocean currents
X) Evaporation of oceans
Y) Unequal heating by the sun
Z) Fluctuations of the Earth's magnetic field

Bonus Answer: Y

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13. BIOLOGY

Writer: Olivia Gallager

Toss Up: Short Answer

Defects in the myelin sheath lead to what disease?

Bonus Answer: Multiple Sclerosis

Bonus: Short Answer

From which parent do we inherit mitochondrial DNA?

Bonus Answer: Mothers, maternal

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14. EARTH and SPACE

Writer: Matthew Lee

Toss Up: Multiple Choice

Which type of air mass is dominant in Central Canada?

W) continental arctic

X) continental polar

Y) maritime polar

Z) maritime tropical

Toss Up Answer: X

Bonus: Multiple Choice

A stationary front is symbolized by which of the following:

W) triangles only

X) semicircles only

Y) triangles and semicircles on opposite sides of a line

Z) triangles and semicircles on same side of a line

Bonus Answer: Y

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15. 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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16. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Short Answer

What is the most common galaxy type in our universe?

Bonus Answer: Spiral

Bonus: Multiple Choice

Astronomers use cepheids principally as measures of what?

W) size

X) speed

Y) chemical composition

Z) distance

Bonus Answer: Z

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17. MATHEMATICS

Writer: Steven Litvack-Winkler

Toss Up: Multiple Choice

Find the points of intersection of the following curves:

y = sqrt(x^2 - x + 29)

y = x + 2

W) (5,7)

X) (sqrt(2) - 1, sqrt(2) + 1)

Y) (sqrt(29) - 1, sqrt(29) + 1)

Z) (2,4)

Toss Up Answer: W

Bonus: Multiple Choice

Which of the following expressions is not divisible by 9

W) 5^3 + 7^3

X) 4^5 + 2^5

Y) 10^3 - 7^3

Z) 9^7 - 6^7

Bonus Answer: W

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18. CHEMISTRY

Writer: Shanjeed Ali

Toss Up: Multiple Choice

Which of the following is least reactive with water at room temperature?

W) Sodium

X) Potassium

Y) Rubidium

Z) Cesium

Toss Up Answer: W

Bonus: Short Answer

What is the most abundant alkali metal on earth?

Bonus Answer: Sodium

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19. PHYSICS

Writer: Charles Zhang

Toss Up: Short Answer

What's the stopping potential, in eV/C (READ AS: electron volts per coulomb) of a photoelectron ejected from a metal with work function of 1eV when the incident photon's energy is 3.5 eV?

Bonus Answer: 2.5 eV/C

Bonus: Multiple Choice

Two students conduct separate Compton scattering experiments with visible light and x-rays. The scattered radiation is observed at the same scattering angle. Which of the following statements about the observed results is true?

W) the x rays have the greater shift in wavelength and the greater change in photon energy

X) the two radiations have the same shift in wavelength and the visible light has the greater change in photon energy

Y) the two radiations have the same shift in wavelength and the same change in photon energy

Z) the two radiations have the same shift in wavelength and the x rays have the greater change in photon energy

Bonus Answer: Z

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20. CHEMISTRY

Writer: Mohammed Jamil

Toss Up: Short Answer

What can be identified using the Tyndall Effect?

Bonus Answer: A colloid

Bonus: Multiple Choice

Which of the following would make a weak electrolyte

W) Acetic Acid

X) Nitric Acid

Y) Sodium Chloride

Z) Hydrochloric Acid

Bonus Answer: W

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21. BIOLOGY

Writer: Ahmad Alnasser

Toss Up: Multiple Choice

A trend toward the decrease in the size of plants on the slopes of mountains as altitudes increase is an example of

W) a cline

X) a bottleneck

Y) relative fitness

Z) geographic variation

Toss Up Answer: W

Bonus: Short Answer

If thermoregulation is considered to be a secondary function of the large ears of jackrabbits, then the primary function of the ears is

Bonus Answer: to detect predators

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22. CHEMISTRY

Writer: Elias Milborn

Toss Up: Multiple Choice

Which of the following is a weak electrolyte?

W) ammonia

X) dilute sulfuric acid

Y) 1 Molar sulfuric acid

Z) dilute perchloric acid

Toss Up Answer: W

Bonus: Short Answer

What is the most common name for the conformation for the ring structure of cyclohexane adopts to reach a strain-free value?

Bonus Answer: Chair

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23. MATHEMATICS

Writer: Elias Milborn

Toss Up: Short Answer

On a blueprint, if 3/4 of an inch represents 1 foot, then 2 inches will represent what distance, in feet, expressed as the most reduced simple fraction?

Bonus Answer: 8/3

Bonus: Short Answer

Assuming that the probability of A is 0.3, the probability of B is 0.3, and the probability of A union B is 0.5, providing your answer as decimals to the nearest 10th, what are the probabilities respectively of A intersection B and the complement of the quantity A union B?

Bonus Answer: 0.1 and 0.5

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24. CHEMISTRY

Writer: Ahmad Alnasser

Toss Up: Multiple Choice

Boyle's Law relates:

W) pressure to volume

X) pressure to mols

Y) volume to mols

Z) temperature to volume

Toss Up Answer: W

Bonus: Short Answer

A container holds 500. mL of CO_2 at 20.° C and 742 torr. What will be the volume of the CO_2 if the pressure is increased to 795 torr?

Bonus Answer: 467 ml

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25. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

What is stated by Kirchhoff's First Law?

W) The description of the force interacting between static electrically charged particles.

X) The algebraic sum of currents in a network of conductors meeting at a point is zero.

Y) The algebraic sum of the products of the resistances of the conductors and the currents in them in a closed loop is equal to the total emf available in that loop.

Z) The net electric flux through any closed surface is equal to 1⁄ε times the net electric charge within that closed

surface.

Toss Up Answer: X

Bonus: Multiple Choice

If two 4-Farad capacitors and one 6-Farad are connected in parallel, what is the equivalent capacitance three capacitors?

W) 14 Farads

X) 4.66 Farads

Y) 1.5 Farads

Z) 1 Farad

Bonus Answer: W

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