Round 26

1. PHYSICS

Writer: Seiji Yawata

Toss Up: Multiple Choice

Not all laws that hold in an inertial frame hold in a non-inertial frame. An obvious example is the law of inertia. Does the Work-Energy Theorem hold in a non-inertial frame?

W) It only holds in inertial frames.

X) It will not hold in a non-inertial frame unless there aren't any conservative forces at work.

Y) It will hold in a non-inertial frame unless there are non-conservative forces.

Z) It holds for any non-inertial frame.

Toss Up Answer: Z

Bonus: Short Answer

An object is launched on a horizontal surface with an initial speed of 20 m/s, so that it covers a distance of 5 meters in the time interval 4 sec to 5 sec. What is the coefficient of friction between the object and the horizontal surface? Assume gravitational acceleration is 10 m/s^2

Bonus Answer: 1/3

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2. MATHEMATICS

Writer: Elias Milborn

Toss Up: Short Answer

What is the probability of, in no particular order, flipping exactly 2 heads and 2 tails when flipping 4 coins?

Bonus Answer: 3/8 (accept .375 or 37.5%)

Bonus: Short Answer

Given a circle centered at 1,2 what is the slope of a tangent line which passes through the point (3,3)

Bonus Answer: -2

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3. PHYSICS

Writer: Banpreet Singh

Toss Up: Multiple Choice

For general projectile motion, the horizontal component of a projectile's acceleration

W) continuously increases

X) is zero

Y) remains a non-zero constant

Z) continuously decreases

Toss Up Answer: X

Bonus: Multiple Choice

If the acceleration of an object is directed parallel to the velocity vector,

W) the object is not moving

X) the object is turning

Y) the object is slowing down

Z) the object is speeding up

Bonus Answer: Z

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4. 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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5. BIOLOGY

Writer: Josh Tish

Toss Up: Multiple Choice

What is the probability of obtaining offspring with the AAbbCCdd genotype from parents with the genotypes AaBbCcDd and AABbCcDd (assume independent assortment of all gene pairs)?

W) 1/64

X) 1/128

Y) 3/128

Z) none of the above

Toss Up Answer: X

Bonus: Multiple Choice

A red pigment is extracted from a marine alga. Which best supports the hypothesis that the pigment is involved in photosynthesis? The red pigment:

W) has an absorption spectrum similar to the photosynthetic action spectrum for that same marine alga

X) contains iron which is a transition element similar to magnesium.

Y) has a molecular structure similar to that of chlorophyll.

Z) is also found in land plants together with a variety of other pigments and specific enzymes that are related to the action spectrum for photosynthesis.

Bonus Answer: W

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6. MATHEMATICS

Writer: Henry Zheng

Toss Up: Multiple Choice

How many irrational numbers are there between 1 and 6?

W) 3

X) 7

Y) 10

Z) infinitely many

Toss Up Answer: Z

Bonus: Short Answer

In the standard (x,y) coordinate plane, 3 vertices of a rectangle are (2,1), (-1,-1), and (6,5). What is the last vertex of the rectangle?

Bonus Answer: (3, -7)

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7. BIOLOGY

Writer: Josh Tish

Toss Up: Short Answer

After 12 weeks of gestation, what is the principal source of estrogen and progesterone to a human fetus?

Bonus Answer: corpus luteum

Bonus: Multiple Choice

Fat enters the venous system from the digestive system via the:

W) hepatic artery

X) hepatic vein

Y) thoracic duct

Z) hepatic portal system

Bonus Answer: Y

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8. MATHEMATICS

Writer: Henry Zheng

Toss Up: Short Answer

What is the value of x when $2x + 3 = 3x – 4$?

Bonus Answer: 7

Bonus: Multiple Choice

What is the greatest common factor of 42, 126, and 210?

W) 2

X) 6

Y) 21

Z) 42

Bonus Answer: Z

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9. CHEMISTRY

Writer: Siam Muquit

Toss Up: Multiple Choice

Which of the following is an example of a strong nucleophile but a weak base?

W) CH_3OH

X) OH^-

Y) I^-

Z) F^-

Toss Up Answer: Y

Bonus: Short Answer

By name or number, which of the following are second order reactions? Sn1, Sn2, E1, E2

Bonus Answer: Sn2 and E2 only (accept 2, 4 only)

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10. EARTH and SPACE

Writer: Seiji Yawata

Toss Up: Multiple Choice

In oceans, waves and surf current are generated by:

W) El Nino

X) salinity and temperature gradients

Y) the intertropical convergence zone

Z) wind

Toss Up Answer: Z

Bonus: Multiple Choice

During which of the following geological subdivisions was glaciation minimal on Earth?

W) Quaternary Period

X) Holocene Epoch

Y) Cretaceous Period

Z) Pleistocene Epoch

Bonus Answer: Y

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11. CHEMISTRY

Writer: Ashneel Das

Toss Up: Multiple Choice

Which of the following molecules has the greatest Van't Hoff factor?

W) $CaCl_2$

X) NaCl

Y) $C_6H_{12}O_6$

Z) KBr

Toss Up Answer: W

Bonus: Multiple Choice

Which of the following has the highest melting point?

W) NaCl

X) Carbon

Y) Water

Z) Helium

Bonus Answer: X

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12. BIOLOGY

Writer: Josh Tish

Toss Up: Multiple Choice

An individual suffers brain damage that results in respiratory failure. Which region of the brain was most likely damaged?

W) Substantia nigra

X) Pons

Y) Red nucleus

Z) Reticular formation

Toss Up Answer: X

Bonus: Multiple Choice

A man and a woman get married and soon learn that they both have a rare, genetically inherited recessive disorder that makes them prone to dizziness. Worried about the fate of their children, they seek the advice of a genetic counselor. She sequences their genomes and assures them that
none of their children will have the disorder. What information would she have to obtain from the sequencing procedure that allows her to make this claim?

W) The dizziness phenotype in the man is due to a mutation in a gene other than the gene responsible for the woman’s phenotype.

X) The dizziness disorder is an autosomal recessive trait.
Y) The man and the woman are related genetically causing the same dizziness phenotype.
Z) It is impossible for the man and the woman to have unaffected children - the genetic counselor is wrong.

Bonus Answer: W

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13. CHEMISTRY

Writer: Seiji Yawata

Toss Up: Multiple Choice

What is the pH of distilled water?
W) 6.5
X) 6.7
Y) 7
Z) Depends on the temperature

Toss Up Answer: Z

Bonus: Multiple Choice

What is one of the hydrolysis product when Magnesium carbide is hydrolysed with water?
W) Propadiene
X) Propyne
Y) Methane
Z) There is insufficient information

Bonus Answer: Z

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14. BIOLOGY

Writer: Hanna Yang

Toss Up: Short Answer

What is the name of the process wherein osteoblasts lay down new bone material?

Bonus Answer: Ossification, Osteogenesis, Bone Tissue Formation

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Bonus: Short Answer

What is the name of the structure within a bone that creates a network containing blood vessels?

Bonus Answer: Haversian Canals

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15. CHEMISTRY

Writer: Siam Muquit

Toss Up: Multiple Choice

Which of these is a weak electrolyte?
W) $C_6H_{12}O_6$
X) $MgCl_2$
Y) $NaC_2H_3O_2$
Z) NH_4OH

Toss Up Answer: Z

Bonus: Short Answer

By name or number, which of the following can conduct electricity in solution? Hydrocarbons, salts, weak acids, strong acids?

Bonus Answer: Salts, weak acids, strong acids (2, 3, and 4 only)

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16. EARTH and SPACE

Writer: Seiji Yawata

Toss Up: Multiple Choice

Which of the following is a sedimentary rock?

W) slate

X) marble

Y) basalt

Z) sandstone

Toss Up Answer: Z

Bonus: Short Answer

What is the name for the outer shadow cast during eclipses, which gives rise to a partial eclipse?

Bonus Answer: Penumbra

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17. PHYSICS

Writer: Banpreet Singh

Toss Up: Short Answer

A flatbread truck is carrying a crate along a level road. The coefficient of static friction between the load and the bed is 0.4. The truck accelerates forward and the crate stays in its place on the truck bed. In what direction is the force that the bed exerts on the crate?

Bonus Answer: Forward

Bonus: Multiple Choice

James and John dive from an overhang into the lake below. James simply drops straight down from the edge. John takes a running start and jumps with an initial horizontal velocity of 25 m/s. Compare the time it takes each to reach the lake below.

W) Cannot be determined without knowing the mass of both James and John.

X) James and John will reach the surface of the lake at the same time.

Y) John reaches the lake first.

Z) James reaches the lake first.

Bonus Answer: X

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18. BIOLOGY

Writer: Justin Lam

Toss Up: Multiple Choice

Which of the following stages in cellular respiration generates the most ATP (Adenosine triphosphate) ?

W) Krebs Cycle

X) Glycolysis

Y) Electron Transport Chain

Z) Pyruvate Oxidation

Toss Up Answer: Y

Bonus: Short Answer

In cellular respiration, there are two main electron carriers produced. What are their chemical formulas?

Bonus Answer: NADH and FADH2 (Some may mention the "empty forms" of these electron carriers: NAD+ and FAD ; those answers are acceptable as well).

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19. CHEMISTRY

Writer: Siam Muquit

Toss Up: Multiple Choice

A precipitation reaction is an example of which of the following reactions?

W) Combustion

X) Substitution

Y) Single Displacement

Z) Double Displacement

Toss Up Answer: Z

Bonus: Short Answer

By name or number, which of the following would be a precipitate in aqueous solution? Silver sulfide, Potassium nitrate, Strontium hydroxide, Lead(II) fluoride

Bonus Answer: Silver sulfide, Lead(II) fluoride OR (1, 4 only)

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20. BIOLOGY

Writer: Justin Lam

Toss Up: Short Answer

In photosynthesis, what are the three products released from hydrolysis?

Bonus Answer: Hydrogen or Hydrogen Ions (H+) , Oxygen or Oxygen Gas , and Electrons

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Bonus: Multiple Choice

Which of the following carbohydrates the human body can NOT digest?

W) Fructose

X) Cellulose

Y) Sucrose

Z) Dextrose

Bonus Answer: X

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21. EARTH and SPACE

Writer: Benjamin Avrahami

Toss Up: Multiple Choice

Since Pumice and Rhyolite are both extrusive felsic rocks, they both have:

W) Vesicles and low density

X) No vesicles and silicon

Y) Magnesium and high density

Z) Low density and aluminum

Toss Up Answer: Z

Bonus: Short Answer

By name or number, order these materials from lowest specific heat to highest specific heat: Ice, (liquid) water, water vapor, iron

Bonus Answer: Iron, water vapor, ice, liquid water (4, 3, 1, 2)

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22. 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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23. BIOLOGY

Writer: Justin Lam

Toss Up: Multiple Choice

Which of the following polysaccharides is commonly found in the exoskeleton of insects?

W) Cellulose

X) Chitin

Y) Starch

Z) Glycogen

Toss Up Answer: X

Bonus: Multiple Choice

In which stage of cellular respiration is glucose broken down into two pyruvate molecules?

W) Krebs Cycle

X) Electron Transport Chain

Y) Glycolysis

Z) Oxidative Phosphorylation

Bonus Answer: Y

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24. PHYSICS

Writer: Charles Zhang

Toss Up: Short Answer

A heat engine does positive work W as it absorbs energy Q_h (READ AS: Q sub h) from a heat reservoir and transfers energy Q_c (READ AS: Q sub c) to a cold reservoir. What is the efficiency of the heat engine in terms of Q_h, Q_c, and W?

Bonus Answer: W/Q_h

Bonus: Multiple Choice

For Christmas, Bobby Tables got a heater with a coefficient of performance of 10. If the heater transfers 50 kilojoules of heat into the room in 2 seconds, what is the power of the heater in kilowatts?

W) 1

X) 2.4

Y) 2.1

Z) 2.5

Bonus Answer: Z

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25. BIOLOGY

Writer: Hanna Yang

Toss Up: Multiple Choice

How is oxygen transported in blood?

W) It is dissolved in the blood

X) It is carried by hemoglobin on white blood cells

Y) It is carried by hemoglobin on red blood cells

Z) It is carried by hemoglobin on platelets

Toss Up Answer: Y

Bonus: Short Answer

By name or by number, identify which of the following was can carbon dioxide be transported in blood?

1. It can be dissolved in the blood
2. It can be carried by hemoglobin on white blood cells
3. It can be carried by hemoglobin on red blood cells
4. It can be carried by hemoglobin on platelets

Bonus Answer: 1 & 3

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