Round 24

1. PHYSICS

Writer: Brian Lim

Toss Up: Multiple Choice

Two objects stick together after they collide with each other. What is true about the collision?

W) The collision is elastic

X) The collision is completely inelastic

Y) The total momentum of the system changes

Z) The total kinetic energy of the system stays the same

Toss Up Answer: X

Bonus: Short Answer

An object moving at 10 meters per second relative to a surrounding fluid experiences a drag force of 20 newtons. If the object's speed increases to 20 meters per second, what is the drag force experienced by the object?

Bonus Answer: 80 newtons

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2. CHEMISTRY

Writer: Nten Nylam

Toss Up: Multiple Choice

Which of the following is amphoteric?

W) hydrogen fluoride

X) ammonia

Y) water

Z) magnesium oxide

Toss Up Answer: Y

Bonus: Short Answer

What is the molecular geometry of nitrogen trichloride?

Bonus Answer: trigonal pyramidal (also accept trigonal pyramid)

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3. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Multiple Choice

Which of the following has the lowest specific heat?

W) Copper

X) Granite

Y) Marble

Z) Dry air

Toss Up Answer: W

Bonus: Short Answer

Order the following rock particles from the biggest to the smallest: 1. Sand 2. Silt 3. Pebbles 4. Clay

Bonus Answer: 3, 1, 2, 4

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4. PHYSICS

Writer: Charles Zhang

Toss Up: Short Answer

A plane mirror is in a vertical plane and is rotating about a vertical axis at 100 rpm. A horizontal beam of light is incident on the mirror. The reflected beam will rotate at:

Bonus Answer: 200 rpm (ACCEPT 200)

Bonus: Short Answer

The curvature of a concave spherical mirror is 50 cm^-1. How far away from the mirror does an object need to be placed as to not create an image?

Bonus Answer: 25 cm (ACCEPT 0.25m or equivalent forms)

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5. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Multiple Choice

Which famous astronomer created the “dirty snowball” hypothesis for comets, saying that comets were icy objects containing some dust and rock?

W) Fred Whipple
X) Fred Hoyle
Y) Carl Sagan
Z) Clyde Tombaugh

Toss Up Answer: W

Bonus: Short Answer

Which comet was dubbed the comet of the 20th century, reaching an absolute magnitude value of -0.8 at perihelion?

Bonus Answer: Comet Hale-Bopp

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6. PHYSICS

Writer: Charles Zhang

Toss Up: Multiple Choice

Diffraction plays an important role in which of the following phenomena?

W) The sun appearing as a disk to the naked eye
X) Light being bent through a glass prism
Y) Shouting through a megaphone
Z) A thin soap film displaying colors when light is incident on it

Toss Up Answer: Y

Bonus: Multiple Choice

A beam of light passes though one polarizing filter and through another filter rotated at 45 degrees compared to the first one. If the original intensity of the light was 100 W, what is the new intensity of the polarized light?

W) 50
X) 75
Y) 100
Z) 150

Bonus Answer: W

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7. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Short Answer

What comet was the first one recognized by astronomers to be periodic, with a period of roughly 76 years?

Bonus Answer: Halley’s Comet

Bonus: Short Answer

Located between the A and B rings of Saturn, what famous region stretches 4800 km and is characterized by a lack of

material?

Bonus Answer: Cassini Division

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8. MATHEMATICS

Writer: Justin Lam

Toss Up: Multiple Choice

Which of the following are prime factors of the number 5304?

W) 19

X) 7

Y) 5

Z) 13

Toss Up Answer: Z

Bonus: Short Answer

What integer satisfies the equation y = x^3 - 1 [Read as: x to the third power subtracted by 1] when y = 0 ?

Bonus Answer: x = 1

(Explanation: The factors of the equation is y = (x - 1) (x^2 + x + 1). We want to find an integer solution, so we take the factor x - 1 and set it to zero. By adding one to both sides, we see that x = 1.)

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9. BIOLOGY

Writer: Olivia Gallager

Toss Up: Multiple Choice

Which immune cell does HIV directly target?

W) B Cells

X) Immunoglobulins

Y) CD4 Cells

Z) Killer T Cells

Toss Up Answer: Y

Bonus: Short Answer

Individuals heterozygous for the gene for which genetic disease have increased immunity to malaria?

Bonus Answer: Sickle Cell Anemia

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10. PHYSICS

Writer: Brian Lim

Toss Up: Multiple Choice

What does Thomas Young's Double Slit Experiment demonstrate about light?

W) Light behaves like a particle

X) Light behaves like a wave

Y) The speed of light in a vacuum is 3.00x10^8 meters per second

Z) Light is related to electromagnetism

Toss Up Answer: X

Bonus: Short Answer

In a particular medium, light travels at a speed of 2.0x10^8 meters per second. What is the index of refraction of the medium?

Bonus Answer: 1.5

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11. BIOLOGY

Writer: Olivia Gallager

Toss Up: Short Answer

In the light dependent reactions of photosynthesis, what molecule supplies the initial electrons?

Bonus Answer: H2O OR water

Bonus: Short Answer

In cellular respiration, the Carbon in carbon dioxide that is released comes from what original molecule?

Bonus Answer: glucose

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12. CHEMISTRY

Writer: Nten Nylam

Toss Up: Multiple Choice

Which scientist performed an experiment in which he fired alpha particles at a thin sheet of gold foil?

W) Niels Bohr

X) Ernest Rutherford

Y) J.J. Thomson

Z) Max Planck

Toss Up Answer: X

Bonus: Multiple Choice

What is the name of the compound FeO?

W) iron monoxide

X) iron oxide

Y) iron (I) oxide

Z) iron (II) oxide

Bonus Answer: Z

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13. PHYSICS

Writer: Benjamin Avrahami

Toss Up: Multiple Choice

How many elements are in between the first two radioactive elements on the Periodic Table?

W) 15

X) 16

Y) 17

Z) 18

Toss Up Answer: Y

Bonus: Short Answer

What is the name for the line dividing the metals and the nonmetals on the periodic table?

Bonus Answer: Amphoteric line or semimetal line or metalloid line

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14. CHEMISTRY

Writer: Hanna Yang

Toss Up: Multiple Choice

Which of the following is a polar molecule?

W) SO2

X) CH4

Y) SF6

Z) BF4

Toss Up Answer: W

Bonus: Short Answer

Fill in the blanks in the following statement to make it true. Ionic compounds are ____ conductors in their solid state, but _____ conductors when dissolved in water.

Bonus Answer: poor; good

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15. BIOLOGY

Writer: Jason Weng

Toss Up: Short Answer

Complete the analogy: RBC is to hematopoietin as platelet is to

Bonus Answer: thrombopoietin

Bonus: Short Answer

Hemocytoblasts can branch into two common progenitor cells. What lineage are erythrocytes part of?

Bonus Answer: Myeloid lineage

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16. MATHEMATICS

Writer: Justin Lam

Toss Up: Short Answer

Factor the following equation: x^3 + 8 (x^2) + 8x + 64

Bonus Answer: (x + 8) (x + 8) (x^2 + 8) or (x^2 + 8) [(x + 8)^2]

Bonus: Multiple Choice

Which of the following is a primitive Pythagorean triple?

W) 9 , 12 , 15

X) 10 , 24 , 26

Y) 3 , 4 , 5

Z) 16 , 30 , 34

Bonus Answer: Y

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17. BIOLOGY

Writer: Janine Goh

Toss Up: Short Answer

What are the two types of amino acids?

Bonus Answer: Polar and non polar R groups

Bonus: Short Answer

What determines the properties of an amino acid?

Bonus Answer: Its variable R group

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18. CHEMISTRY

Writer: Hanna Yang

Toss Up: Short Answer

Name the most reactive member of the alkaline earth metals.

Bonus Answer: Radium

Bonus: Short Answer

By name or by number, Identify the ion(s) that has/have the smallest ionic radius?

Ca 2+, Sr 2+, Mg 2 +, Na +, F -

Bonus Answer: Mg 2+

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19. BIOLOGY

Writer: Janine Goh

Toss Up: Short Answer

What is the purpose of SSBs (single strand binding proteins) in DNA replication?

Bonus Answer: To prevent hybridisation of original parent strands

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Bonus: Short Answer

What is the origin of replication called?

Bonus Answer: Ori

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20. CHEMISTRY

Writer: Hanna Yang

Toss Up: Short Answer

Name the most reactive nonmetal.

Bonus Answer: Fluorine

Bonus: Short Answer

Name the transition metal whose carbide is known to be one of the hardest, is used in drills, saws, and lightbulbs, and has the highest melting point of all pure metals.

Bonus Answer: Tungsten

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21. BIOLOGY

Writer: Janine Goh

Toss Up: Multiple Choice

How is the lagging strand of DNA synthesised during DNA replication?

W) Semi-conservatively

X) Okazaki Fragments

Y) With topoisomerase

Z) Continuously

Toss Up Answer: X

Bonus: Short Answer

What is the purpose of topoisomerase?

Bonus Answer: Ensure that DNA isn't wound to tightly

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22. MATHEMATICS

Writer: Hanna Yang

Toss Up: Multiple Choice

What do the numbers in the nth row of Pascal's Triangle sum to?

Give your answer in terms of n.

W) 2n

X) 2^n

Y) n^2

Z) n^3

Toss Up Answer: X

Bonus: Multiple Choice

Find the number of ordered pairs (a,b), where a and b are nonnegative integers, such that a+b=10.

W) 100

X) 10

Y) 11

Z) 12

Bonus Answer: Y

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23. BIOLOGY

Writer: Nten Nylam

Toss Up: Multiple Choice

Which of the following are true regarding angiosperm seed development?

W) Seeds often develop on leaves

X) They often exist in cone form

Y) Seeds are enclosed within the ovary

Z) Seeds are on the stamen

Toss Up Answer: Y

Bonus: Short Answer

What enzyme catalyses the removal of electrons?

Bonus Answer: oxidase

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24. MATHEMATICS

Writer: Hanna Yang

Toss Up: Multiple Choice

For which of the following values of x is (x^2+x+4)/(x) an integer?

W) 1

X) 4

Y) 3

Z) 5

Toss Up Answer: X

Bonus: Short Answer

Find the remainder when 343x^3+49x^2+14x+1 is divided by 7x - 1.

Bonus Answer: 5

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25. BIOLOGY

Writer: Kerwin Chen

Toss Up: Short Answer

What is the origin of replication of DNA called?

Bonus Answer: Ori

Bonus: Short Answer

What is the ori of Escherichia Coli called?

Bonus Answer: OriC

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