Round 16

1. EARTH and SPACE

Writer: Justin Lam

Toss Up: Short Answer

What is the shape of the path planets take around the sun?

Bonus Answer: Elliptical

Bonus: Short Answer

Name three of the closest stars to Earth.

Bonus Answer: Three of the following: Sun, Alpha Centauri, Barnard, Wolf, Luyten, Sirius

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2. MATHEMATICS

Writer: Justin Lam

Toss Up: Short Answer

On which point does y = 10x + 8 and y = x + 5 intersect?

Bonus Answer: (- 1 / 3 , 14 / 3)

Bonus: Short Answer

How many roots does the cubic equation y = x^3 - 4x^2 + 4x have?

Bonus Answer: It has 2 roots.

(Explanation: It intersects the x-axis twice, once at x = 0 and once at x = 2.)

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3. EARTH and SPACE

Writer: Janine Goh

Toss Up: Short Answer

Name 3 dwarf planets

Bonus Answer: Pluto, Ceres, Makemake, Eris, Haumea (any 3)

Bonus: Short Answer

Which coloured stars are the hottest?

Bonus Answer: Blue

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4. CHEMISTRY

Writer: Janine Goh

Toss Up: Multiple Choice

Who discovered electronegativity?

W) Linus Pauling

X) Ernest Rutherford

Y) Harold Urey

Z) Carl Bosch

Toss Up Answer: W

Bonus: Short Answer

List 2 gases used in the Miller-Urey experiment

Bonus Answer: Hydrogen, Water, Ammonia, Methane

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5. MATHEMATICS

Writer: Justin Lam

Toss Up: Short Answer

What is the volume of a sphere if the radius is 7 inches? (use 22 / 7 for pi) You may either use fractions or decimals rounded to the nearest hundredth as your answer.

Bonus Answer: V = 4312 / 3 cubic inches

or V = 1437. 33 cubic inches

(they must include the correct units)

Bonus: Short Answer

Find the surface area of a rectangular prism if the length is 2 inches, the width is 3 inches, and the height is 2 inches.

Bonus Answer: V = 32 square inches

(they must include the correct units)

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6. PHYSICS

Writer: Seiji Yawata

Toss Up: Multiple Choice

Light from a monochromatic lamp is shone upon a sheet of metal, and yet, the photoelectric effect is not observed. What change in the setup will most likely result in an observed photoelectric effect?

W) Increasing the brightness of the lamp

X) Moving the lamp closer to the sheet of metal

Y) Decreasing the wavelength of the light

Z) Increasing the surface area of the sheet of metal

Toss Up Answer: Y

Bonus: Short Answer

An electric current of 1 Ampere is flowing along an infinite horizontal wire in the x-axis. At x = 0 m the wire splits into a circle of radius 0.05 m and then comes back together at x = 4 m. What is the magnitude in Tesla of the magnetic field in the middle of this loop of wire?

Bonus Answer: 0

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7. EARTH and SPACE

Writer: Janine Goh

Toss Up: Short Answer

Which is the new satellite/telescope replacing Hubble?

Bonus Answer: James Webb Space Telescope

Bonus: Short Answer

Why is Mars red?

Bonus Answer: Oxidised iron on Mars' surface

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8. 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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9. CHEMISTRY

Writer: Olivia Gallager

Toss Up: Short Answer

In organisms, the bonds in polypeptide chains are formed between which two ends of the amino acid?

Bonus Answer: Carboxyl, amino OR the side with the NH2 group, the side with the COOH group

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Bonus: Short Answer

Fatty acids have three carbon chains attached to what type of molecule?

Bonus Answer: glycerol

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10. 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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11. BIOLOGY

Writer: Hanna Yang

Toss Up: Multiple Choice

Which of the following cells come from megakaryocytes?
W) Erythrocytes
X) Leukocytes
Y) Blood Thrombocytes
Z) Osteocytes

Toss Up Answer: Y

Bonus: Multiple Choice

Which of the following diseases is caused by a point mutation?
W) Huntington's Disease
X) Hemophilia B
Y) Cystic Fibrosis
Z) Tay-Sachs Disease

Bonus Answer: X

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12. 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) ∆E

X) s orbital overlap

Y) VESPR

Z) p orbital overlap

Bonus Answer: W

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13. 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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14. 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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15. CHEMISTRY

Writer: Siam Muquit

Toss Up: Multiple Choice

The modified form of the Ideal Gas Law includes which of the following?

W) Higher pressure, Higher Volume

X) Higher pressure, Lower volume

Y) Lower Pressure, Higher volume

Z) Lower pressure, Lower volume

Toss Up Answer: Y

Bonus: Short Answer

Rank the following gases in order from least ideal to most ideal: He, N2, HCl, SF6

Bonus Answer: He, N2, SF6, HCl (accept 1,2,4,3)

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16. MATHEMATICS

Writer: Janine Goh

Toss Up: Short Answer

What is the quadratic formula?

Bonus Answer: x = (-b +/- sqrt (b^2 - 4ac))/2a

Bonus: Short Answer

Solve for y if x = 5/6 y + 116/3 y + 4/2 in terms of x

Bonus Answer: y = (x-2)/78

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17. CHEMISTRY

Writer: Ivan Zhang

Toss Up: Multiple Choice

Which of the following is the most electronegative element?

W) Carbon

X) Vanadium

Y) Selenium

Z) Fluorine

Toss Up Answer: Z

Bonus: Short Answer

What is the name given to the hybrid orbital created with a steric number of 3?

Bonus Answer: 2sp^2

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18. 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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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. PHYSICS

Writer: Prangon Ghose

Toss Up: Multiple Choice

In a hockey game, a 0.1 kg puck is slide on the ice at 40 m/s horizontally towards a goalie. If the goalie slides the puck back in the direction in which it came with a speed of 30 m/s, what is the impulse experienced by the puck?

W) 1 kgm/s

X) 7 kgm/s

Y) 3 kgm/s

Z) 120 kgm/s

Toss Up Answer: X

Bonus: Multiple Choice

A block sliding on a frictionless surface at 10 m/s hits a spring which returns the block at the same speed. If the block's mass is 5 kg, what is the impulse the block experiences?

W) 0.5 kgm/s

X) 50 kgm/s

Y) 2 kgm/s

Z) 100 kgm/s

Bonus Answer: Z

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21. 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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22. BIOLOGY

Writer: Josh Tish

Toss Up: Multiple Choice

Which of the following is a way in which the cell increases gene expression in the nucleus?

W) Acetylation of histone tails
X) DNA methylation
Y) Locating a gene within heterochromatin
Z) Dephosphorylating DNA

Toss Up Answer: W

Bonus: Multiple Choice
Which of the following chemicals or groups of chemicals is not a major determinant of flower color?
W) Flavonols
X) Carotenoids
Y) Cyanidin
Z) Phytoalexins

Bonus Answer: Z

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23. BIOLOGY

Writer: Josh Tish

Toss Up: Multiple Choice
You have a multicellular organism that reproduces asexually by fission. When you excise a ~10,000 cell portion of its body, both the original organism and the excised portion grow into fully formed, healthy organisms. You take one of the offspring and repeat the procedure for one hundred and twenty-three generations. Each time, the resulting organisms are healthy. What must be true of the nuclei of this species?
W) The cells contain plasmids
X) The cells have multiple forms of DNA polymerase.
Y) The cells have the majority of their genome stored in circular DNA
Z) The cells contain active telomerase.

Toss Up Answer: Z

Bonus: Multiple Choice
Which of the following oligonucleotides would have the highest melting point when paired with the proper complementary strand?
W) 5’-AAAAAAAA-3’
X) 5’-ATGCATGC-3’
Y) 5’-CGCGCGCG-3’
Z) 5’-TTTTGGGG-3’

Bonus Answer: Y

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24. 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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25. 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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