Round 8

1. PHYSICS

Writer: William Xiang

Toss Up: Multiple Choice

All electromagnetic waves have the same speed in:

W) Water

X) Air

Y) Glass

Z) Vacuum

Toss Up Answer: Z

Bonus: Short Answer

A man raises a massless string tied at the bottom to a 16N steel ball, with an upward acceleration of 2 meters per second squared. Find the tension in the string, to the nearest whole number of Newtons. Assume gravitational acceleration is 10 meters per second squared.

Bonus Answer: 19 Newtons

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2. PHYSICS

Writer: William Xiang

Toss Up: Multiple Choice

A beam of white light hits the sharp end of a glass prism and is broken up into monochromatic components. Which of the following phenomenon is this a direct example of?

W) Refraction

X) Dispersion

Y) Rarefaction

Z) Diffraction

Toss Up Answer: X

Bonus: Short Answer

A projectile whose mass is 9.4 kg is fired vertically upward. On its upward flight,
an energy of 68 kJ is dissipated because of air resistance. How much higher
would it have gone if the air resistance had been made negligible? Round to the nearest ten meters.

Bonus Answer: 740 m

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3. PHYSICS

Writer: Henry Zheng

Toss Up: Short Answer

What is the term for change in velocity per unit time?

Bonus Answer: acceleration

Bonus: Short Answer

What is the common term in physics for the product of mass times acceleration?

Bonus Answer: force

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4. PHYSICS

Writer: Seiji Yawata

Toss Up: Multiple Choice

The driver of a car moving at a speed of 10 m/s sees a child and immediately applies brakes to bring the car to rest in 150 meters. If the combined mass of the car and the driver is 1200 kg, the magnitude of the retarding force on the vehicle is:

W) 300 N
X) 350 N
Y) 400 N
Z) 450 N

Toss Up Answer: Y

Bonus: Short Answer

A body is projected upwards with twice the escape velocity on Earth, 11.2 km/s. Ignoring the presence of other heavenly bodies, what is the speed of the body at infinity? Give your answer in km/s rounded to one decimal point.

Bonus Answer: 19.4 km/s

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5. MATHEMATICS

Writer: Jason Weng

Toss Up: Multiple Choice

What is the area of an equilateral triangle with side lengths 2?

W) 1
X) √3
Y) √6
Z) 2

Toss Up Answer: X

Bonus: Multiple Choice

If the roots of P(x) = 64x^2 - 24x + 2 are A and B, what is the harmonic mean of A and B in simplest fractional form?

W) 1/3
X) 1/6
Y) 1/12
Z) 1/24

Bonus Answer: X

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6. MATHEMATICS

Writer: Jason Weng

Toss Up: Multiple Choice

Given P(x) = x^2 + ax + b and P(1) = 9, what is a + b?

W) 8
X) 10
Y) 9
Z) 1

Toss Up Answer: W

Bonus: Multiple Choice

Factor the following completely: (4x^4) - (20x^2) + 16

W) (x+1)(x-1)(x+2)(x-2)
X) (x+1)(x+1)(x-2)(x-2)
Y) 4(x+1)(x-1)(x+2)(x-2)
Z) 4(x+1)(x+1)(x-2)(x-2)

Bonus Answer: Y

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7. MATHEMATICS

Writer: Hanna Yang

Toss Up: Multiple Choice

Simplify: (24*63)/(72*21)

W) 1

X) 3

Y) 7

Z) 1/3

Toss Up Answer: W

Bonus: Short Answer

Simplify (333(x^4 - x^2))/(9(x^2+2x+1)(x^2))

Bonus Answer: (x-1)/((37)(x+1))

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8. MATHEMATICS

Writer: Hanna Yang

Toss Up: Short Answer

Compute: sqrt((3*4*5-60)^2)

Bonus Answer: 0

Bonus: Short Answer

Compute (34/17 - 2 + 5) * (96 + -144) * (1/ (46 - 130/5))

Bonus Answer: -12

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9. BIOLOGY

Writer: Olivia Gallager

Toss Up: Multiple Choice

Which of the following enzymes makes C4 and CAM species more efficient in hotter, dryer climates?

W) phosphofructokinase

X) Rubisco

Y) DNA polymerase

Z) PEP Carboxylase

Toss Up Answer: Z

Bonus: Short Answer

During the light dependent reactions, on what membrane does ATP synthesis take place via ATP Synthase?

Bonus Answer: thylakoid, thylakoid membrane

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10. BIOLOGY

Writer: Olivia Gallager

Toss Up: Short Answer

What part of the brain controls the interaction between the two hemispheres?

Bonus Answer: corpus callosum

Bonus: Short Answer

Which lobe of the brain is known for spatial reasoning and navigation?

Bonus Answer: parietal lobes

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11. 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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12. BIOLOGY

Writer: Ahmad Alnasser

Toss Up: Multiple Choice

Animals and fungi are both characterized as heterotrophic. The distinguishing factor of animal heterotrophy from fungal heterotrophy is that only animals derive their nutrition by

W) consuming living, rather than dead, prey.

X) preying on animals

Y) ingesting it

Z) using enzymes for digestion

Toss Up Answer: Y

Bonus: Multiple Choice

At which developmental stage should one be able to first distinguish a diploblastic embryo from a triploblastic embryo?

W) fertilization

X) gastrulation

Y) coelom formation

Z) cleavage

Bonus Answer: X

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13. BIOLOGY

Writer: Siam Muquit

Toss Up: Multiple Choice

Which biome is characterized by population oscillations?

W) Temperate Deciduous

X) Tropical Rainforest

Y) Tundra

Z) Taiga

Toss Up Answer: Y

Bonus: Short Answer

Large-scale population oscillations in the tundra are caused by what abiotic factor?

Bonus Answer: Thawing and freezing of the ice (Also accept: population migrations)

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14. BIOLOGY

Writer: Siam Muquit

Toss Up: Multiple Choice

Which disease was famously eradicated in 1977?

W) Polio

X) Smallpox

Y) Mumbs
Z) AIDS
Toss Up Answer: X

Bonus: Short Answer
Which human body system is attacked by AIDS?
Bonus Answer: Immune system

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15. BIOLOGY

Writer: Siam Muquit
Toss Up: Multiple Choice
Which pair of organisms is correctly matched with the interspecific interaction?
W) Commensalism: Clownfish and sea anemone
X) Parasitism: Whales and barnacles
Y) Mutualism: Oxpecker and rhino
Z) Predation: Apes and bees
Toss Up Answer: Y

Bonus: Short Answer
List the 5 types of interspecific interaction.
Bonus Answer: Predation, Commensalism, Parasitism, Mutualism, Neutral

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16. BIOLOGY

Writer: Shanjeed Ali
Toss Up: Short Answer
How many ATP molecules are produced by the Calvin cycle?
Bonus Answer: 0

Bonus: Short Answer
How many ATP are used in the Calvin cycle to make one glucose molecule?
Bonus Answer: 18

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17. BIOLOGY

Writer: Shanjeed Ali
Toss Up: Multiple Choice
The phenomenon by which diploid cells cease to divide is known as
W) parthenogenesis
X) alternation of generations
Y) cellular senescence
Z) lysis
Toss Up Answer: Y

Bonus: Short Answer
What country has the highest human life expectancy?
Bonus Answer: Japan

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18. CHEMISTRY

Writer: Nicholas Adit
Toss Up: Multiple Choice
What happens in a hydrogen atom when an electron jumps from an excited energy state to a more stable energy

state?
W) electromagnetic radiation is emitted by the atom
X) electromagnetic radiation is absorbed by the atom
Y) the atom becomes a positively charged ion
Z) the atom becomes a negatively charged ion
Toss Up Answer: W

Bonus: Short Answer
A closed 5-liter vessel contains a sample of neon gas. The temperature inside the container is 25°C, and the pressure is 1.5 atmospheres. (The gas constant, R, is equal to 0.08 L?atm/mol?K.) If the neon gas in the vessel is replaced with an equal molar quantity of helium gas, which of the following properties of the gas in the container will be changed?
I. Pressure
II. Temperature
III. Density
Bonus Answer: III only

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19. CHEMISTRY

Writer: Nicholas Adit
Toss Up: Multiple Choice
A solution of H2SO3 is found to have a hydrogen ion concentration of 1 × 10–3 molar at 25°C. What is the hydroxide ion concentration in the solution?
W) 1 x 10^-1
X) 1 x 10^-3
Y) 1 x 10^-11
Z) 1 x 10^-13
Toss Up Answer: Y

Bonus: Short Answer
If the pH of a solution is changed from 1 to 3 with the addition of an antacid, what percentage of [H+] was neutralized?
Bonus Answer: 99%

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20. CHEMISTRY

Writer: Siam Muquit
Toss Up: Short Answer
What is the molecular geometry of ammonia (NH3)?
Bonus Answer: Trigonal Pyramidal

Bonus: Multiple Choice
How many lone pairs are in Xenon tetrafluoride (XeF4)?
W) 0
X) 1
Y) 2
Z) 3

Bonus Answer: Y

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21. CHEMISTRY

Writer: Siam Muquit
Toss Up: Multiple Choice
Which of the following does not exhibit resonance stabilization?

W) Ozone
X) SO_2
Y) NO_3
Z) H_2O
Toss Up Answer: Z

Bonus: Short Answer
What is the bond order of H_2O?
Bonus Answer: 2

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22. CHEMISTRY

Writer: Ahmad Alnasser
Toss Up: Short Answer
At room temperature, what is the only metal that is in liquid form?
Bonus Answer: Mercury (Hg)

Bonus: Multiple Choice
What is the third most common gas found in the air in the atmosphere?
W) Argon
X) Hydrogen
Y) Oxygen
Z) Helium

Bonus Answer: W

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23. EARTH and SPACE

Writer: Zoe Orlin
Toss Up: Multiple Choice
In the Northern Hemisphere, the Coriolis force deflects in which direction?
W) Up
X) Down
Y) Right
Z) Left
Toss Up Answer: Y

Bonus: Short Answer
The altitude of Polaris is equal to...
Bonus Answer: Your latitude

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24. EARTH and SPACE

Writer: Shamaul Dilmohamed
Toss Up: Short Answer
In terms of mass, what are the four biggest planets in our solar system?
Bonus Answer: Jupiter, Saturn, Neptune, Uranus

Bonus: Multiple Choice
Dark energy makes up about how much of the energy in the universe?
W) 20%
X) 40%
Y) 70%

Z) 80%

Bonus Answer: Y

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25. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Short Answer

If we could observe all forms of radiation, what would the brightest star be?

Bonus Answer: Betelgeuse

Bonus: Multiple Choice

In 12000 years, which star will take the place of our North Star?

W) Aldebaran

X) Vega

Y) Sirius

Z) Rigel

Bonus Answer: X

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