Round 12

1. PHYSICS

Writer: Aaron Gee

Toss Up: Multiple Choice

The collision between a photon and a free electron was first explained by which of the following scientists?

W) Compton

X) Hertz

Y) Einstein

Z) Newton

Toss Up Answer: W

Bonus: Multiple Choice

The Tesla and the Gauss are units of measure of

W) magnetic fieild strength

X) conductance

Y) light

Z) electrical current

Bonus Answer: W

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2. MATHEMATICS

Writer: Aaron Gee

Toss Up: Multiple Choice

Solve the following equation for x:

$x^2 – 20x + 19 = 0$

W) 9, 10

X) 10 and 9

Y) 21 and 19

Z) 19 and 1

Toss Up Answer: Z

Bonus: Short Answer

Convert log base 4 of 53 into a base 10 expression:

Bonus Answer: log 53/ log4

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3. PHYSICS

Writer: Aaron Gee

Toss Up: Multiple Choice

Whose principle or law states that each point on a wavefront may be considered a new wave source?

W) Snell's Law

X) Huygen's principle

Y) Young's Law

Z) Hertz's Law

Toss Up Answer: X

Bonus: Multiple Choice

The wave nature of light is demonstrated by which of the following?

W) Diffraction
X) Color
Y) Length
Z) Speed of light

Bonus Answer: W

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4. MATHEMATICS

Writer: William Xiang

Toss Up: Short Answer

Find the integral of 2x^3 + 2 with respect to x in simplest terms.

Bonus Answer: (x^4)/2 + 2x

Bonus: Multiple Choice

Which of the following is a conic section?
W) Cylinder
X) Triangle
Y) Hyperbola
Z) Asymptote

Bonus Answer: Y

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5. PHYSICS

Writer: Mohammed Jamil

Toss Up: Short Answer

Given that the specific heat capacity of water is 11 times that of copper, calculate the mass of copper at a temperature of 100 °C required to raise the temperature of 200 g of water from 20.0 °C to 24.0 °C, assuming no energy is lost to the surroundings.

Bonus Answer: 0.116 kg

Bonus: Short Answer

1 kg of water at a temperature of 45 °C is mixed with 1.5 kg of alcohol at 20 °C. Find the final temperature of the mixture.

Take the specific heat capacity of water to be 4200 J kg –1 K –1 and the specific heat capacity of alcohol to be 2400 J kg –1 K –1 . Assume no other exchange of heat occurs.

Bonus Answer: 33°C

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6. MATHEMATICS

Writer: William Xiang

Toss Up: Short Answer

Find the first derivative of 10x^3 + 3x^2 + 3 in the simplest form.

Bonus Answer: 30x^2 + 6x

Bonus: Short Answer

How many points of inflection does the graph x^3 + 5 have?

Bonus Answer: 1

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7. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

What is the resulting electrical potential, in volts, when a charge of 12 coulombs is applied to a 1 farad capacitor?

Bonus Answer: 12 volts

Bonus: Short Answer

If 1000 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: 1,000

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8. MATHEMATICS

Writer: Larry Wong

Toss Up: Short Answer

What is the value of 125 to the ⅔ power?

Bonus Answer: 25

Bonus: Short Answer

What is the argument of 1 + sqrt 3 i?

Bonus Answer: 60

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9. PHYSICS

Writer: Mohammed Jamil

Toss Up: Multiple Choice

Which statement describes a situation when polarization could not occur?

W) Light waves are reflected.

X) Light waves are scattered.

Y) Microwaves pass through a metal grid.

Z) Sound waves pass through a metal grid.

Toss Up Answer: Z

Bonus: Multiple Choice

An electromagnetic wave has a wavelength that is numerically of the same order of magnitude as the diameter of a nucleus.

In which region of the electromagnetic spectrum does the wave occur?

W) Gamma ray

X) X-ray

Y) Visible light

Z) Infra-red

Bonus Answer: W

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10. BIOLOGY

Writer: Henry Zheng

Toss Up: Short Answer

What is another name for the voice box?

Bonus Answer: Larynx

Bonus: Short Answer

Which part of the larynx is responsible for sound production?

Bonus Answer: Intrinsic laryngeal muscles (accept intrinsic, intrinsic muscles)

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11. CHEMISTRY

Writer: Jason Weng

Toss Up: Multiple Choice

How much heat, in kJ, is needed to heat 1 kg of water 1 Kelvin if the specific heat of water is 4.18?

W) 4.18 kJ

X) 41.8 kJ

Y) 418 kJ

Z) 4180 kJ

Toss Up Answer: Z

Bonus: Multiple Choice

What is the molecular geometry of phosphorous triflouride according to the VSEPR theory?

W) Bent

X) Seesaw

Y) Trigonal pyramid

Z) T-shape

Bonus Answer: Y

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12. BIOLOGY

Writer: Henry Zheng

Toss Up: Short Answer

What state was the first to use DNA to exonerate an accused serial rapist/murderer?

Bonus Answer: Virginia

Bonus: Short Answer

Who was the first person to be exonerated based on contradictory DNA evidence?

Bonus Answer: David Vasquez

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13. CHEMISTRY

Writer: Jason Weng

Toss Up: Multiple Choice

According to the VSEPR theory, what shape does methane assume?

W) Trigonal pyramid

X) Linear

Y) Tetrahedron

Z) Octahedron

Toss Up Answer: Y

Bonus: Multiple Choice

How many pi and sigma bond are present in hexene, respectively?

W) 17 pi, 1 sigma

X) 1 pi, 17 sigma

Y) 2 pi, 16 sigma

Z) 16 pi, 2 sigma

Bonus Answer: X

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14. BIOLOGY

Writer: Henry Zheng

Toss Up: Short Answer

What state was the first to use DNA to capture a serial rapist/murderer?

Bonus Answer: Virginia

Bonus: Short Answer

Who was the first murderer to be convicted on the basis of DNA evidence?

Bonus Answer: Timothy Wilson Spencer (accept Spencer, Timothy Spencer, Southside Strangler"

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15. CHEMISTRY

Writer: Mohammed Jamil

Toss Up: Short Answer

What is the chemical equation(s) for the reversible reaction(s) in the contact process

Bonus Answer: $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

Bonus: Multiple Choice

Which set of conditions would promote the fastest rate for the converter reaction in the contact process?

W) No catalyst, high pressure, low temperature. Catalyst, high pressure, high temperature. Catalyst, low pressure, low temperature. Catalyst, low pressure, high temperature.

X) Catalyst, high pressure, high temperature.

Y) Catalyst, low pressure, low temperature

Z) No catalyst, high pressure, low temperature. Catalyst, high pressure, high temperature. Catalyst, low pressure, low temperature. Catalyst, low pressure, high temperature.

Bonus Answer: X

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16. BIOLOGY

Writer: Henry Zheng

Toss Up: Multiple Choice

What light-sensitive cells in the eye detect colors?

W) Rods

X) Cones

Y) Retina

Z) Lens

Toss Up Answer: X

Bonus: Short Answer

What are the three types of cones?

Bonus Answer: blue, green, red (accept in any order)

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17. CHEMISTRY

Writer: Mohammed Jamil

Toss Up: Multiple Choice

What suggests that metal, M, is not in Group I of the Periodic Table?

W) M has a bright, silvery appearance and is a good conductor of electricity.

X) M is hard and difficult to cut

Y) M produces an alkaline solution when it reacts with water.

Z) M produces hydrogen gas when it reacts with water.

Toss Up Answer: X

Bonus: Multiple Choice

Lactic acid, $CH_3CH(OH)CO_2H$, causes pain when it builds up in muscles.
Which reagent reacts with both of the –OH groups in lactic acid?
W) acidified potassium dichromate(VI)
X) ethanol
Y) sodium
Z) sodium hydroxide

Bonus Answer: Y

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18. BIOLOGY

Writer: Jason Weng

Toss Up: Short Answer

What is it called when a protein loses its 3-dimensional shape?

Bonus Answer: Denatured

Bonus: Short Answer

Of the 4, name all the following that are not common amino acids: histidine, isoleucine, glutamine, isovaline

Bonus Answer: Isovaline

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19. CHEMISTRY

Writer: Andrew Chen

Toss Up: Short Answer

What is the common name of the simplest molecule with a carbonyl group?

Bonus Answer: formaldehyde

Bonus: Multiple Choice

What would be the best indicator for the titration of a weak base with a strong acid?
W) phenolphthalein
X) bromothymol blue
Y) methyl yellow
Z) methyl violet

Bonus Answer: Y

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20. BIOLOGY

Writer: Jason Weng

Toss Up: Short Answer

Which human organ, comprised mostly of lymphoid, is essential for the growth of T cells?

Bonus Answer: Thymus

Bonus: Short Answer

What cells are responsible for forming blood platelets?

Bonus Answer: Megakaryocytes

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21. EARTH and SPACE

Writer: Mohammed Haque

Toss Up: Multiple Choice

What metal is Mercury mainly comprised of ?

W) Lithium

X) Magnesium

Y) Iron

Z) Lead

Toss Up Answer: Y

Bonus: Multiple Choice

How long is Mercury's orbital period (Earth days)?

W) 88 days

X) 165 days

Y) 49 days

Z) 57 days

Bonus Answer: W

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22. BIOLOGY

Writer: Jason Weng

Toss Up: Multiple Choice

Which of the following blood types has blood cells that possess antibodies for type A antigens?

W) A

X) AB

Y) B

Z) O

Toss Up Answer: Y

Bonus: Short Answer

Which molecule produced by alveolar cells cause the decrease in surface tension within alveoli?

Bonus Answer: Pulmonary surfactant

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23. EARTH and SPACE

Writer: Mohammed Haque

Toss Up: Multiple Choice

Which of the 3 following components needed for the formation of a star?

W) Helium, lithium, and pressure.

X) Helium, pressure, and time.

Y) Hydrogen, pressure, and time.

Z) Magnesium, pressure, and time.

Toss Up Answer: Y

Bonus: Multiple Choice

What gas is Venus's atmosphere mainly composed of?

W) Carbon Monoxide

X) Hydrogen Gas

Y) Carbon Dioxide

Z) Carbon is a gaseous form

Bonus Answer: Y

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24. BIOLOGY

Writer: Mohammed Jamil

Toss Up: Multiple Choice

Which type of cell has a large number of glycoproteins on the cell surface membrane?

W) Ciliated cell

X) Goblet cell

Y) Lymphocyte

Z) Red blood cell

Toss Up Answer: Y

Bonus: Short Answer

Name the bond that forms between glucose molecules in polysaccharides, such as amylose.

Bonus Answer: Glycosidic bond

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25. EARTH and SPACE

Writer: Henry Zheng

Toss Up: Short Answer

What is the most abundant gas in the atmosphere?

Bonus Answer: Nitrogen

Bonus: Multiple Choice

An example of a density-dependent factor is

W) weather

X) climate

Y) air

Z) food

Bonus Answer: Z

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