

Round 25

1. 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

2. 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

3. PHYSICS

Writer: Kerwin Chen

Toss Up: Multiple Choice

Which of the following accurately describes the setup of Young's double slit experiment?

- W) single light source, monochromatic
- X) multiple light sources, monochromatic
- Y) single light source, polychromatic
- Z) multiple light sources, polychromatic

Toss Up Answer: W

Bonus: Short Answer

Which scientist is famous for their single slit diffraction experiment?

Bonus Answer: Fraunhofer, Joseph Fraunhofer, Joseph von Fraunhofer

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4. PHYSICS

Writer: Kerwin Chen

Toss Up: Short Answer

What type of surface does diffuse reflection occur on?

Bonus Answer: rough

Bonus: Short Answer

What type of scattering is responsible for the blue color of our sky?

Bonus Answer: Rayleigh scattering

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5. MATHEMATICS

Writer: Elias Milborn

Toss Up: Multiple Choice

Which of the following is an accurate representation of the inverse of $f(x) = x^3 - 5$?

W) $x^3 - 5$

X) $(x - 5)^3$

Y) $(x - 5)^{1/3}$

Z) $1/(x-5)^3$

Toss Up Answer: Y

Bonus: Short Answer

The three sides of a triangle are 5cm, 6cm, and 8cm. What is the cosine of the smallest angle in reduced fractional form?

Bonus Answer: 25/32

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6. MATHEMATICS

Writer: Elias Milborn

Toss Up: Short Answer

Giving your answer as up, down, left, or right, the graph of the equation $x = 5y - 8y^2 - 1$ opens in which direction

Bonus Answer: left

Bonus: Short Answer

If chord AB is 8 units from the center of a circle O with a radius of 17, what is the length of chord AB?

Bonus Answer: 30

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7. MATHEMATICS

Writer: Elias Milborn

Toss Up: Short Answer

On a blueprint, if $3/4$ of an inch represents 1 foot, then 2 inches will represent what distance, in feet, expressed as the most reduced simple fraction?

Bonus Answer: $8/3$

Bonus: Short Answer

Assuming that the probability of A is 0.3, the probability of B is 0.3, and the probability of A union B is 0.5, providing your answer as decimals to the nearest 10th, what are the probabilities respectively of A intersection B and the complement of the quantity A union B?

Bonus Answer: 0.1 and 0.5

8. MATHEMATICS

Writer: Larry Wong

Toss Up: Short Answer

What is the sum of the coefficients of $(x + 1)$ to the 6th power?

Bonus Answer: 64

Bonus: Short Answer

What is the height of a triangle with an area of 64 and a base of 5?

Bonus Answer: 25.6

9. BIOLOGY

Writer: Siam Muquit

Toss Up: Multiple Choice

Which of these is not an accepted domain of life?

W) Archea

X) Bacteria

Y) Eukarya

Z) Protista

Toss Up Answer: Z

Bonus: Short Answer

What is the causative agent of Scrapie?

Bonus Answer: prion

10. 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

11. 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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12. 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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13. 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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14. 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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15. 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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16. 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

17. 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)

18. CHEMISTRY

Writer: Andrew Chen

Toss Up: Multiple Choice

Which of the following is a weaker oxidizer than oxygen?

W) ozone

X) carbon dioxide

Y) hydrogen peroxide

Z) dioxygen difluoride

Toss Up Answer: X

Bonus: Short Answer

What is the coordination number of the hexagonal close packed crystal structure?

Bonus Answer: 12

19. CHEMISTRY

Writer: Andrew Chen

Toss Up: Short Answer

Rank the following by conductivity: copper, bronze, silver, gold

Bonus Answer: silver copper gold bronze, or 3 1 4 2

Bonus: Multiple Choice

A sophomore is doing a chemistry lab and mixes a sodium salt solution with a nitrate salt solution. A white precipitate forms. What could it be?

W) silver chloride

X) iron iodide

Y) iron nitrate

Z) potassium chlorate

Bonus Answer: W

20. CHEMISTRY

Writer: Andrew Chen

Toss Up: Multiple Choice

Which transition metal has the lowest electronegativity?

- W) gold
- X) scandium
- Y) actinium
- Z) zinc

Toss Up Answer: Y

Bonus: Short Answer

Which functional group is necessary for saponification?

Bonus Answer: ester

21. CHEMISTRY

Writer: Andrew Chen

Toss Up: Short Answer

In what hybridization is the carbon atom in an aldehyde?

Bonus Answer: sp²

Bonus: Short Answer

What is the most stable nucleus?

Bonus Answer: nickel 62

22. CHEMISTRY

Writer: Andrew Chen

Toss Up: Short Answer

What element is most commonly added in the vulcanization of rubber?

Bonus Answer: sulfur

Bonus: Multiple Choice

Which of the following elements wasn't first isolated through electrolysis?

- W) potassium
- X) antimony
- Y) fluorine
- Z) lithium

Bonus Answer: X

23. EARTH and SPACE

Writer: Mohammed Haque

Toss Up: Multiple Choice

How many moons does Neptune have?

- W) 22
- X) 34
- Y) 14
- Z) 12

Toss Up Answer: Y

Bonus: Multiple Choice

What is Saturn's atmosphere mostly composed of?

- W) Helium

- X) Amonia
- Y) Hydrogen
- Z) Carbon

Bonus Answer: Y

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24. EARTH and SPACE

Writer: Yevgeniy Gorbachev

Toss Up: Short Answer

What is the most geologically active object in the solar system and why?

Bonus Answer: Io, because of tidal forces from Jupiter, Europa, Ganymede, and Callisto.

Bonus: Short Answer

What is Io's surface primarily composed of?

Bonus Answer: Silicates and sulfur compounds.

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25. EARTH and SPACE

Writer: Yae June Lee

Toss Up: Multiple Choice

What happened to the melted rock after it goes through solidification to form basalt?

W) It occurred rapidly, with fine grained minerals

X) Slowly, coarse grained minerals

Y) Rapidly, coarse trained minerals

Z) Slowly, fine grained minerals

Toss Up Answer: W

Bonus: Short Answer

What are two surface traits that affect the rate of surface runoff?

Bonus Answer: Slope of land surface, soil type or composition, vegetation, porosity of soil, soil saturation.(any two of these answers are acceptable.)

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