

Round 12

1. 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)

2. 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 trifluoride according to the VSEPR theory?

W) Bent

X) Seesaw

Y) Trigonal pyramid

Z) T-shape

Bonus Answer: Y

3. 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

4. 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 field strength
- X) conductance
- Y) light
- Z) electrical current

Bonus Answer: W

5. 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

6. 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

7. 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

8. 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

9. 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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10. 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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11. 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: $\log 53 / \log 4$

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12. 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: $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$

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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13. 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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14. 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, $\text{CH}_3\text{CH}(\text{OH})\text{CO}_2\text{H}$, causes pain when it builds up in muscles.

Which reagent reacts with both of the $-\text{OH}$ groups in lactic acid?

- W) acidified potassium dichromate(VI)
- X) ethanol
- Y) sodium
- Z) sodium hydroxide

Bonus Answer: Y

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15. 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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16. 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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17. 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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18. 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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19. 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

20. 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

21. 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

22. 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

23. MATHEMATICS

Writer: Larry Wong

Toss Up: Short Answer

What is the value of 125 to the $\frac{2}{3}$ power?

Bonus Answer: 25

Bonus: Short Answer

What is the argument of $1 + \sqrt{3}i$?

Bonus Answer: 60

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24. 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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25. 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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