

Round 12

1. PHYSICS

Writer: Kerwin Chen

Toss Up: Short Answer

An octave is a music interval of what ratio of frequency?

Bonus Answer: 2:1

Bonus: Short Answer

From 440 Hertz to what Hertz would be one octave?

Bonus Answer: 880 Hertz

2. PHYSICS

Writer: Charles Zhang

Toss Up: Multiple Choice

A 5 kg ball is ejected from a spring and it rolls 8m up a frictionless incline at 30 degrees before coming to a stop.

Assuming that $g = 10 \text{ m/s}^2$ (READ AS 10 meters per second squared) and that the spring constant is 100N/m, how far does the spring has to be compressed initially?

W) 1m

X) 2m

Y) 4m

Z) 6m

Toss Up Answer: X

Bonus: Short Answer

The potential energy of a 1kg particle is represented by $U(x,y,z) = 2xy + 3z^2$ (READ AS: U of x, y, z equals 2xy plus 3 z squared). What is the magnitude of the force acting on the particle at position (0,4,1)?

Bonus Answer: 10 N

3. PHYSICS

Writer: Charles Zhang

Toss Up: Short Answer

An electron travels 45 degrees north of east in a magnetic field which points 45 degrees west of north. In what direction does the magnetic force acting on the electron points?

Bonus Answer: Down

Bonus: Short Answer

A 2C charge travels through a magnetic field $B = 6i + 15j + 9k$ with velocity $v = 2i + 5j + 3k$. What is the magnetic force acting on the charge?

Bonus Answer: 0

4. PHYSICS

Writer: Charles Zhang

Toss Up: Multiple Choice

An object oscillates with equation $x = 2\cos(5\pi t)$ (READ AS: x equals 2 times cosine of open parentheses 5 PI times t close parentheses). What is the frequency of the oscillation?

W) 0.5

X) 1

Y) 2.5

Z) 4

Toss Up Answer: Y

Bonus: Multiple Choice

An LC circuit consists of a 5 henry inductor and a 20 farad capacitor connected to a battery in a series circuit. What is the frequency of the oscillation of the current in the circuit?

W) $0.05/\pi$ ($0.05/\pi$)

X) $0.1/\pi$ ($0.1/\pi$)

Y) $2/\pi$ ($2/\pi$)

Z) $3/\pi$ ($3/\pi$)

Bonus Answer: W

5. MATHEMATICS

Writer: Ahmad Alnasser

Toss Up: Short Answer

Describe the expression $2 \log_3 x + \log_3 5$ as a single logarithmic expression

Bonus Answer: $\log_3 (5x^2)$

Bonus: Short Answer

Solve the equation $2|3x - 2| - 3 = 7$

Bonus Answer: $x = (7/3), -1$

6. MATHEMATICS

Writer: Siam Muquit

Toss Up: Multiple Choice

How many roots (real or complex) does $x^4 - x^3 - 9x^2 + 7x + 14 = 0$ have?

W) 1

X) 2

Y) 3

Z) 4

Toss Up Answer: Z

Bonus: Short Answer

Find all real roots of $x^4 - x^3 - 9x^2 + 7x + 14 = 0$

Bonus Answer: -1, 2, $\pm\sqrt{7}$

7. MATHEMATICS

Writer: Shihab Karim

Toss Up: Multiple Choice

If the diameter of a circle is 6 inches, what is the area of the circle?

W) 36π

X) 9π

Y) 12π

Z) 6π

Toss Up Answer: X

Bonus: Short Answer

Find the equation of the line that passes through the point (3,4) and is perpendicular to the line $y = 3x - 2$?

Bonus Answer: $y = -(1/3)x + 5$

8. MATHEMATICS

Writer: Shihab Karim

Toss Up: Short Answer

What is the imaginary unit "i" when raised to the power 30?

Bonus Answer: -1

Bonus: Short Answer

What is the sum of the first 50 positive integers?

Bonus Answer: 1275

9. BIOLOGY

Writer: Jason Weng

Toss Up: Short Answer

What is class of proteins "unzips" the DNA strands into two?

Bonus Answer: DNA helicase

Bonus: Short Answer

What is the probability that a cross between two parents with the same genotype of AaBbCcDd will result in an offspring of the same genotype as their parents?

Bonus Answer: 1/16

10. BIOLOGY

Writer: Siam Muquit

Toss Up: Multiple Choice

Which of these is not an abiotic factor that influences climate?

W) Sunlight

X) Precipitation

Y) Wind

Z) Bodies of water

Toss Up Answer: Z

Bonus: Short Answer

What type of population distribution characterizes human populations?

Bonus Answer: Clumped distribution (Accept clumped)

11. BIOLOGY

Writer: Jason Weng

Toss Up: Short Answer

What individual cell structure comprises polysomes?

Bonus Answer: Ribosome

Bonus: Short Answer

What is the complementary RNA for [read slowly] CAGGGTAC?

Bonus Answer: GUCCAUG

12. BIOLOGY

Writer: Jason Weng

Toss Up: Short Answer

What muscle of the respiratory system primarily regulates breathing?

Bonus Answer: Diaphragm

Bonus: Short Answer

What protein catalyzes the reaction of carbon dioxide with water to form bicarbonate ion and hydrogen ion?

Bonus Answer: Carbonic anhydrase

13. BIOLOGY

Writer: Jason Weng

Toss Up: Short Answer

What types of macromolecules to lipase break down?

Bonus Answer: Lipids

Bonus: Short Answer

What lobe of the brain is associated with vision?

Bonus Answer: Occipital Lobe

14. BIOLOGY

Writer: Jason Weng

Toss Up: Short Answer

What type of tissue are the urinary bladder comprised of?

Bonus Answer: Transitional epithelium

Bonus: Short Answer

The walls of the heart consist of three layers. What is the middle layer called, which is also the main layer that allows the heart's muscular contractions?

Bonus Answer: Myocardium

15. BIOLOGY

Writer: Jason Weng

Toss Up: Short Answer

The flow of what ion allows ATP synthase to synthesize ATP?

Bonus Answer: H⁺, hydrogen ion, proton

Bonus: Short Answer

Which cellular structures oxygen to oxidize complex molecules to produce a by-product of hydrogen peroxide?

Bonus Answer: Peroxisome

16. BIOLOGY

Writer: Hanna Yang

Toss Up: Multiple Choice

How is oxygen transported in blood?

- W) It is dissolved in the blood
- X) It is carried by hemoglobin on white blood cells
- Y) It is carried by hemoglobin on red blood cells
- Z) It is carried by hemoglobin on platelets

Toss Up Answer: Y

Bonus: Short Answer

By name or by number, identify which of the following can carbon dioxide be transported in blood?

1. It can be dissolved in the blood
2. It can be carried by hemoglobin on white blood cells

3. It can be carried by hemoglobin on red blood cells

4. It can be carried by hemoglobin on platelets

Bonus Answer: 1 & 3

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17. BIOLOGY

Writer: Justin Lam

Toss Up: Multiple Choice

Which of the following polysaccharides is commonly found in the exoskeleton of insects?

W) Cellulose

X) Chitin

Y) Starch

Z) Glycogen

Toss Up Answer: X

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Bonus: Multiple Choice

In which stage of cellular respiration is glucose broken down into two pyruvate molecules?

W) Krebs Cycle

X) Electron Transport Chain

Y) Glycolysis

Z) Oxidative Phosphorylation

Bonus Answer: Y

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18. CHEMISTRY

Writer: Shihab Karim

Toss Up: Short Answer

What term describes the process when a solid phase changes directly to the gas phase?

Bonus Answer: Sublimation

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Bonus: Short Answer

The angle between any two boron-hydrogen bonds in a boron trihydride molecule is how many degrees?

Bonus Answer: 120 degrees

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19. CHEMISTRY

Writer: Henry Zheng

Toss Up: Short Answer

A stable suspension of fine particles in a liquid is called a:

Bonus Answer: colloid

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Bonus: Multiple Choice

Which of the following compounds is used as a fuel additive in what is commonly known as "dry gas" by solubilizing water to reduce its contamination in gasoline?

W) isooctane

X) glycerol

Y) MTBE

Z) isopropyl alcohol

Bonus Answer: Z

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20. CHEMISTRY

Writer: George Papastefanou

Toss Up: Short Answer

Using noble gas abbreviation, what is the electron configuration of a silver atom?

Bonus Answer: [Kr] 4d¹⁰ 5s¹

Bonus: Short Answer

What is the most electropositive element in group 1A?

Bonus Answer: Francium

21. CHEMISTRY

Writer: George Papastefanou

Toss Up: Short Answer

What is the last element of the periodic table to occur naturally on Earth?

Bonus Answer: Plutonium, element 94

Bonus: Short Answer

Which element is most abundant in the entire Earth?

Bonus Answer: Iron (do not accept Oxygen, that's just the crust)

22. CHEMISTRY

Writer: Siam Muquit

Toss Up: Multiple Choice

A precipitation reaction is an example of which of the following reactions?

W) Combustion

X) Substitution

Y) Single Displacement

Z) Double Displacement

Toss Up Answer: Z

Bonus: Short Answer

By name or number, which of the following would be a precipitate in aqueous solution? Silver sulfide, Potassium nitrate, Strontium hydroxide, Lead(II) fluoride

Bonus Answer: Silver sulfide, Lead(II) fluoride OR (1, 4 only)

23. EARTH and SPACE

Writer: Elias Milborn

Toss Up: Short Answer

Pandora is a moon of which planet?

Bonus Answer: Saturn

Bonus: Multiple Choice

Sea water is approximately what percent salt by mass?

W) 1%

X) 2%

Y) 4%

Z) 8%

Bonus Answer: Y

24. EARTH and SPACE

Writer: Seiji Yawata

Toss Up: Multiple Choice

The Cascadia Subduction Zone separates the North American Plate and the

W) Caribbean Plate

X) Juan de Fuca Plate

Y) Okhotsk Plate

Z) Cocos Plate

Toss Up Answer: X

Bonus: Short Answer

During which geologic period did Pangaea start breaking up?

Bonus Answer: Jurassic

25. EARTH and SPACE

Writer: Seiji Yawata

Toss Up: Multiple Choice

New York City is primarily composed of sediments that were metamorphosed during the Taconic and Acadian orogenies roughly:

W) 450 million years ago

X) 550 million years ago

Y) 650 million years ago

Z) 750 million years ago

Toss Up Answer: W

Bonus: Short Answer

When the earth is closest to the sun, what season is it in the Southern Hemisphere?

Bonus Answer: Summer
