

Round 1

1. PHYSICS

Writer: Nicholas Adit

Toss Up: Multiple Choice

A light ray passes through a prism, causing a dispersion of light. Which color will have the greatest angle of deviation?

- W) Red
- X) Yellow
- Y) Green
- Z) Blue

Toss Up Answer: Z

Bonus: Short Answer

Put the following electromagnetic waves in order of increasing wavelength: Microwaves, Ultraviolet, Gamma Rays, Radio Waves, Visible Light, Infrared, X-rays.

Bonus Answer: Gamma Rays, X-rays, Ultraviolet, Visible Light, Infrared, Microwaves, Radio Waves

2. PHYSICS

Writer: Charles Zhang

Toss Up: Short Answer

What is the German term for the energy released when high voltage electrons decelerate at impact with a metal and is also known as "breaking radiation"?

Bonus Answer: Bremsstrahlung

Bonus: Short Answer

Given that Planck's constant is 4×10^{-15} eV*s (READ AS: 4 times 10 to the power of negative 15 electron volt second), what is the maximum kinetic energy, in electron volts, of an electron released from a metal with work function of 1 eV when a photon of frequency of 300 terahertz strikes the metal's surface?

Bonus Answer: 0.2 electron volts

3. PHYSICS

Writer: Charles Zhang

Toss Up: Multiple Choice

Two trucks are 50 kilometers apart and traveling toward each other. One automobile is moving at 60km/h and the other is moving at 40km/h mph. How long will it take for them meet?

- W) 15 minutes
- X) 20 minutes
- Y) 24 minutes
- Z) 30 minutes

Toss Up Answer: Z

Bonus: Short Answer

The position of a particle in meters is given by $x(t) = 25t - 3t^3$ (READ AS: 16 times t minus 3 times t cubed), where the time t is in seconds. The particle is momentarily at rest at what time t rounded to the nearest hundredth?

Bonus Answer: 1.67 seconds, accept 1.67

4. PHYSICS

Writer: Kerwin Chen

Toss Up: Multiple Choice

If an object is located at the focal point of a concave mirror, what type of image will form?

- W) real, inverted
- X) virtual, inverted
- Y) real, upright
- Z) Image will not exist

Toss Up Answer: Z

Bonus: Short Answer

Cone cells in the retina allow a human being to perceive color. What are the photoreceptor proteins found in cone cells called?

Bonus Answer: Photopsin

5. MATHEMATICS

Writer: Ivan Zhang

Toss Up: Short Answer

What number is a factor of $y^3 + 10y^2 + 123y + 5$?

Bonus Answer: 1, -1

Bonus: Short Answer

What is the area of a equilateral triangle inscribed in a circle with a radius of 6?

Bonus Answer: $(27(\sqrt{3}))$

6. MATHEMATICS

Writer: Zoe Orlin

Toss Up: Short Answer

What is the derivative of x^2 ?

Bonus Answer: $2x$

Bonus: Short Answer

What is the derivative of $42x^2$

Bonus Answer: $84x$

7. MATHEMATICS

Writer: Calvin Aw

Toss Up: Short Answer

For all positive integers n , what is the degree of the polynomial $(x^2 - 3)^{(2n)}$ in terms of n .

Bonus Answer: $4n$

Bonus: Short Answer

State the solutions, in increasing value, for the equation $(x+1)^3 - x^3 - x^2 = 0$

Bonus Answer: (Only accept the answers read in this order): $-1, -1/2$

8. MATHEMATICS

Writer: Calvin Aw

Toss Up: Short Answer

Compute $100^2 - 98 \cdot 102$

Bonus Answer: 4

Bonus: Multiple Choice

The absolute value of $n^2 - (n+x)(n-x)$, where n and x are positive integers, is always:

- W) $-(x^2)$

- X) n^2
- Y) $2 \cdot x \cdot n$
- Z) x^2

Bonus Answer: Z

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9. BIOLOGY

Writer: Ivan Zhang

Toss Up: Multiple Choice

Which of the following correctly states the composition of blood?

- W) 45 % RBC, 55% Plasma
- X) 65 % RBC, 25% Plasma
- Y) 85 % RBC, 15% Plasma
- Z) 35% RBC, 65% Plasma

Toss Up Answer: W

Bonus: Multiple Choice

What is the function of basophils?

- W) to engulf pathogens through phagocytosis
- X) to stimulate inflammation by releasing histamine
- Y) to kill RBCs
- Z) to remove pathogens from RBCs

Bonus Answer: X

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10. BIOLOGY

Writer: Ivan Zhang

Toss Up: Multiple Choice

Which gland releases the antidiuretic hormone?

- W) pituitary
- X) hypothalamus
- Y) pancreas
- Z) testes

Toss Up Answer: X

Bonus: Multiple Choice

Which part of the heart functions as a pacemaker?

- W) AV node
- X) S node
- Y) SA node
- Z) SA pacemaker

Bonus Answer: Y

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11. BIOLOGY

Writer: Ivan Zhang

Toss Up: Multiple Choice

Which of the following is the most common organic compound on Earth?

- W) chitin
- X) glucose
- Y) phospholipids
- Z) cellulose

Toss Up Answer: Z

Bonus: Multiple Choice

Which of the following syndrome occurs in women born with only 1 X chromosome?

- W) Marfan Syndrome
- X) Turner Syndrome
- Y) Prader-Willi syndrome
- Z) Porphyria

Bonus Answer: X

12. BIOLOGY

Writer: Ivan Zhang

Toss Up: Multiple Choice

Which of the following conditions causes an autoimmune response to eating glucose?

- W) Anaplasmosis
- X) Anisakiasis
- Y) celiac disease
- Z) Candidiasis

Toss Up Answer: Y

Bonus: Multiple Choice

What is colony collapse disorder characterized by?

- W) The disappearance of many male worker bees
- X) The death of the queen bee
- Y) The destruction of the honey produced by bees
- Z) The destruction of the structure of a bee hive

Bonus Answer: W

13. BIOLOGY

Writer: Ivan Zhang

Toss Up: Multiple Choice

Which of the following is not an anabolic steroid?

- W) Fenestrane
- X) Stanozolol
- Y) Fortesta
- Z) Deca-Durabolin

Toss Up Answer: W

Bonus: Short Answer

Which scientist became known as the founder of molecular biology due to their discovery of the spiral structure of proteins?

Bonus Answer: Linus Pauling

14. BIOLOGY

Writer: Ivan Zhang

Toss Up: Short Answer

What family are fruit flies apart of?

Bonus Answer: Drosophilidae

Bonus: Short Answer

Which species of animals are the most abundant on Earth?

Bonus Answer: nematodes

15. BIOLOGY

Writer: Ivan Zhang

Toss Up: Short Answer

What is the most abundant element in the human body?

Bonus Answer: Oxygen

Bonus: Short Answer

What is the function of the alveoli?

Bonus Answer: to allow oxygen and carbon dioxide to move between the lungs and bloodstream

16. BIOLOGY

Writer: Josh Tish

Toss Up: Short Answer

Which three amino acids can most often be phosphorylated in eukaryotes?

Bonus Answer: Serine, Threonine, Tyrosine

Bonus: Short Answer

After transforming the Ku11 gene into XL10 Gold E. coli and growing the bacteria for a day in selective media in the 25°C incubator, you notice that the colonies are much smaller than they should be. Why did this happen?

Bonus Answer: 37°C is the optimal temperature for growing E. coli. The colonies were smaller because they grew more slowly.

17. BIOLOGY

Writer: Josh Tish

Toss Up: Multiple Choice

Natural selection is effective in the evolutionary process because it:

W) causes evolution

X) changes allele frequencies

Y) increases the mean fitness of a population

Z) leads to fixation or loss of particular alleles

Toss Up Answer: Y

Bonus: Short Answer

You tie a ribbon to a tree trunk. The height measured from the ribbon to the ground is five feet. The tree grows at a rate of three feet per year. After 10 years, how far up from the ground will the ribbon be?

Bonus Answer: Five feet. The elongation of a tree trunk occurs from the apical meristem up.

18. CHEMISTRY

Writer: Nicholas Adit

Toss Up: Multiple Choice

Which of these compounds is not a saturated compound?

- W) ethane
- X) propanol
- Y) butanal
- Z) acetylene

Toss Up Answer: Z

Bonus: Short Answer

What are the two compounds formed when ethanoic acid and ethanol react?

Bonus Answer: Ethyl ethanoate and water

19. CHEMISTRY

Writer: Nicholas Adit

Toss Up: Multiple Choice

What is the fourth most abundant element on Earth?

- W) Oxygen
- X) Carbon
- Y) Sulfur
- Z) Argon

Toss Up Answer: X

Bonus: Short Answer

What metal forms compounds that give a grayish-white color?

Bonus Answer: Lead

20. CHEMISTRY

Writer: Ivan Zhang

Toss Up: Multiple Choice

What does Pauli's Exclusion Principle state?

- W) Electrons of an atom must have the same spin
- X) No two electrons of an atom travel in the same orbital
- Y) no two electrons in an atom can be at the same time in the same state or configuration
- Z) Electrons can switch spin automatically

Toss Up Answer: Y

Bonus: Short Answer

What law states that electrons in the same orbitals reorganize themselves to maximize spin?

Bonus Answer: Hund's law

21. CHEMISTRY

Writer: Ivan Zhang

Toss Up: Short Answer

What is the largest ion with an equal amount of protons and neutrons?

Bonus Answer: Ca²⁰⁺

Bonus: Short Answer

Who is regarded as the father of the modern periodic table? (1st and last name)

Bonus Answer: Dmitri Mendeleev

22. CHEMISTRY

Writer: Zoe Orlin

Toss Up: Short Answer

What element has the largest atomic radius?

Bonus Answer: Francium

Bonus: Multiple Choice

What is the most electronegative element?

W) Francium

X) Beryllium

Y) Fluorine

Z) Lithium

Bonus Answer: Y

23. EARTH and SPACE

Writer: Zoe Orlin

Toss Up: Short Answer

what is a front?

Bonus Answer: boundary between two air masses

Bonus: Short Answer

How does a cold front form?

Bonus Answer: w. drop in temperature

x. cold air moves in and replaces warm air

y.warm air moves in and replaces cold air

z. cold and warm air mix :)

24. EARTH and SPACE

Writer: Janine Goh

Toss Up: Short Answer

What is the closest star to the solar system, 4.25 light years away from the sun?

Bonus Answer: Proxima Centauri

Bonus: Short Answer

On approximately which two days of the Gregorian calendar do full moons appear?

Bonus Answer: 15th and 16th of each month

25. EARTH and SPACE

Writer: Janine Goh

Toss Up: Short Answer

What is the speed of light in km/hr, in scientific notation, to 2 decimal places?

Bonus Answer: 1.08×10^9

Bonus: Multiple Choice

How many sub levels does Cesium have?

W) 9

X) 10

Y) 11

Z) 12

Bonus Answer: Z

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