

Round 11

1. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

The speed at which a wave propagates down a string is 300 meters per second. If the frequency of this wave is 150 Hertz, what is the wavelength of this wave?

Bonus Answer: 2 meters

Bonus: Multiple Choice

When a physical property such as charge exists in discrete "packets" rather than in continuous amounts, the property is said to be:

- W) quantized
- X) random
- Y) discontinuous
- Z) nonexistent

Bonus Answer: W

2. MATHEMATICS

Writer: Aaron Gee

Toss Up: Short Answer

What function is the inverse of $y = 3x + 4$?

Bonus Answer: $y = x - 4/3$

Bonus: Short Answer

Giving your answer as an ordered pair, find the solution of the system of the following 2 equations: $2x + 3y = 8$, and $3x - 2y = -1$

Bonus Answer: (1,2)

3. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

The focal length of a concave mirror is 2 meters. An object is positioned 8 meters in front of the mirror. Where is the image of this object formed?

Bonus Answer: 8/3 or 2.66 meters in front of the mirror

Bonus: Multiple Choice

A standing wave is formed on a tightly stretched string. The distance between a node and an antinode is how many wavelengths?

- W) 1/2
- X) 1/4
- Y) 1/8
- Z) 1

Bonus Answer: X

4. MATHEMATICS

Writer: Aaron Gee

Toss Up: Short Answer

If you roll 2 fair dice simultaneously, what is the probability, given as a fraction, that you will roll the number 6 on AT LEAST one die?

Bonus Answer: 11/36

Bonus: Short Answer

Find the sum of all interior angles, in degrees, in a regular polygon having 14 sides

Bonus Answer: 2160 degrees

5. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

A quarter of a wavelength is equal to how many degrees of phase?

Bonus Answer: 90 degrees

Bonus: Short Answer

Davisson and Germer scattered electrons from a crystal of nickel. The scattered electrons formed a strong diffraction pattern. What important conclusion was drawn from this experiment?

Bonus Answer: Electrons act like waves

6. MATHEMATICS

Writer: Aaron Gee

Toss Up: Short Answer

Subtract the following complex numbers, giving your answer in standard form: $(11 - 4i) - (-3 + 3i)$

Bonus Answer: 12 - 7i

Bonus: Short Answer

Solve the following inequality for x, giving your answer in fractional form, $\frac{1}{3}x + \frac{2}{3}$ is less than $\frac{5}{6}x - 2$.

Bonus Answer: x is greater than 16/3

7. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

The frequency of a wave is 50 Hertz and its wavelength is 25 meters. What is the velocity of this wave?

Bonus Answer: 1250 meters/second

Bonus: Short Answer

The focal length of a concave spherical mirror is equal to 1 meter. What is the radius of curvature of this mirror?

Bonus Answer: 2 meters

8. MATHEMATICS

Writer: Aryan Bhatt

Toss Up: Short Answer

What is the sum of the roots of the polynomial $f(x) = 3x^2 - 5x + 5$?

Bonus Answer: 5/3

Bonus: Short Answer

completely factor $2x^4 - 16x^2 + 32$

Bonus Answer: $2(x+2)(x+2)(x-2)(x-2)$

9. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

Besides solid, liquid, and gas, what is the fourth form of matter?

Bonus Answer: Plasma

Bonus: Short Answer

In Einstein's universe, what is the fourth dimension?

Bonus Answer: Time

10. BIOLOGY

Writer: Henry Zheng

Toss Up: Short Answer

What type of organisms convert nitrogen-containing organic molecules into nitrates?

Bonus Answer: Decomposers

Bonus: Short Answer

What type of organisms comprise the greatest biomass in a terrestrial food chain?

Bonus Answer: Producers

11. CHEMISTRY

Writer: Nten Nylam

Toss Up: Multiple Choice

Which of these is not an amorphous solid?

W) sodium chloride

X) polystyrene

Y) potassium nitrate

Z) benzoic acid

Toss Up Answer: X

Bonus: Short Answer

What is the amount of heat (in joules) needed to raise 5 grams of aluminum by 20 degrees, considering the specific heat of aluminum is 0.900 J/ g x Celsius?

Bonus Answer: 90 joules

12. BIOLOGY

Writer: Benjamin Avrahami

Toss Up: Short Answer

What type of immune disease is SCID?

Bonus Answer: Immune deficiency disease

Bonus: Multiple Choice

Which one of the following classes of organisms has a pseudocoelom (pronounce soo-do-cee-lum)?

W) Calcarea

- X) Ceriantharia
- Y) Chromadorea
- Z) Clitellata

Bonus Answer: Y

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13. CHEMISTRY

Writer: Hanna Yang

Toss Up: Short Answer

What element is mixed with gold to make rose gold / pink gold?

Bonus Answer: Copper

Bonus: Short Answer

What two elements are mixed with gold to make white gold?

Bonus Answer: Silver and Copper

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14. BIOLOGY

Writer: Mohammed Jamil

Toss Up: Multiple Choice

Which statement about carbohydrate biosynthesis during the dark reactions of photosynthesis (i.e. the Calvin cycle reactions) is NOT TRUE?

- W) RUBISCO is a an enzyme required for carbon dioxide fixation.
- X) NADPH is the source of electrons for glucose synthesis.
- Y) ATP is the energy source for glucose synthesis.
- Z) The reactions occur in the photosynthetic membranes of chloroplasts.

Toss Up Answer: Z

Bonus: Short Answer

In the basic equation of photosynthesis for the synthesis of one molecule of a sugar such as glucose, how many molecules of carbon dioxide are required and how many molecules of oxygen are produced?

Bonus Answer: 6,6

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15. CHEMISTRY

Writer: Hanna Yang

Toss Up: Multiple Choice

Which of the following reactions is expected to produce a precipitate?

- W) $\text{CdSO}_4 + \text{K}_2\text{S} \rightarrow \text{CdS} + \text{K}_2\text{SO}_4$
- X) $\text{CoCl}_2 + \text{Na}_2\text{SO}_4 \rightarrow \text{CoSO}_4 + \text{NaCl}$
- Y) $\text{HI} + \text{Zn}(\text{NO}_3)_2 \rightarrow \text{ZnI} + \text{H}(\text{NO}_3)_2$
- Z) $\text{Pb}(\text{NO}_3)_2 + \text{K}_2\text{SO}_4 \rightarrow 2\text{KNO}_3 + \text{PbSO}_4$

Toss Up Answer: W

Bonus: Short Answer

Name the precipitate for the following reaction: $3\text{CaCl}_2 + 2\text{Na}_3\text{PO}_4 \rightarrow ? + ?$

Bonus Answer: $\text{Ca}_3(\text{PO}_4)_2$ (Calcium Phosphate)

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16. BIOLOGY

Writer: Mohammed Jamil

Toss Up: Multiple Choice

Which buffer system prevent large changes in pH in the blood during gas exchange

- W) Hemoglobin
- X) Phosphate
- Y) Protein
- Z) Bicarbonate

Toss Up Answer: Z

Bonus: Multiple Choice

How many ml of a 0.4 M HCl solution are required to bring the pH of 10 ml of a 0.4 M NaOH solution to 7.0 (neutral pH)?

- W) 4
- X) 40
- Y) 10
- Z) 20

Bonus Answer: Y

17. CHEMISTRY

Writer: Hanna Yang

Toss Up: Short Answer

Name the polyatomic ion with formula SO_4^{2-}

Bonus Answer: Sulfate

Bonus: Multiple Choice

Which of the following is a base?

- W) $\text{C}_6\text{H}_{12}\text{O}_6$
- X) NaOH
- Y) HCl
- Z) PO_4

Bonus Answer: X

18. BIOLOGY

Writer: Mohammed Jamil

Toss Up: Multiple Choice

What is a fluid analogous to blood in most vertebrates

- W) Interstitial fluid
- X) Hemolymphs
- Y) Hemocyanin
- Z) Plasma

Toss Up Answer: X

Bonus: Multiple Choice

Which of the following do not have a double circulatory system

- W) Lizard
- X) Human
- Y) A bird
- Z) A fish

Bonus Answer: Z

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19. CHEMISTRY

Writer: Hanna Yang

Toss Up: Short Answer

What characteristic of water causes its temperature to change slowly in response to the environment?

Bonus Answer: High Specific Heat

Bonus: Short Answer

What is the most abundant molecule in the human body?

Bonus Answer: Water

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20. BIOLOGY

Writer: Mohammed Jamil

Toss Up: Multiple Choice

The fundamental cause of sickle-cell anemia is a change in the structure of

W) blood

X) capillaries

Y) red blood cells

Z) hemoglobin

Toss Up Answer: Z

Bonus: Multiple Choice

Which regulatory chemical stimulates gastric gland activity and motility?

W) Secretin

X) Gastrin

Y) Leptin

Z) Histamine

Bonus Answer: X

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21. EARTH and SPACE

Writer: Mohammed Haque

Toss Up: Multiple Choice

Which of the following moons do not belong to Saturn?

W) Titan

X) Dione

Y) Europa

Z) Mimas

Toss Up Answer: Y

Bonus: Multiple Choice

What is Saturn's orbital period (Earth years)?

W) 15 years

X) 24 years

Y) 29 years

Z) 17 years

Bonus Answer: Y

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22. BIOLOGY

Writer: Mohammed Jamil

Toss Up: Multiple Choice

Birds are able to sustain long flights at high altitudes because they

W) can extract oxygen during both inhalation and exhalation

X) use anaerobic metabolism during flight

Y) are able to lower their body temperature during flight

Z) decrease their heart rate during flight

Toss Up Answer: W

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Bonus: Multiple Choice

Carbon monoxide (CO) is toxic to humans because

W) it binds to myoglobin and causes it to denature.

X) it is rapidly converted to toxic CO₂.

Y) it binds to the globin portion of hemoglobin and prevents the binding of O₂.

Z) it binds to the Fe in hemoglobin and prevents the binding of O₂.

Bonus Answer: Z

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23. EARTH and SPACE

Writer: Mohammed Haque

Toss Up: Multiple Choice

Which of the following is the best description of Jupiter's red spot ?

W) A Giant Tornado

X) A Hurricane

Y) A Weather Phenomenon.

Z) Non of the above

Toss Up Answer: X

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Bonus: Multiple Choice

What are the light and dark strips that band around Jupiter?

W) Bands and belts

X) Belts and zones

Y) Bands and Zones

Z) Non of the above

Bonus Answer: X

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24. BIOLOGY

Writer: Benjamin Avrahami

Toss Up: Multiple Choice

Which of the following is not an amino acid?

W) Threonine

X) Serine

Y) Diamine

Z) Lysine

Toss Up Answer: Y

Bonus: Short Answer

Giving your answer in millions of years ago, name one year that was in Romer's gap.

Bonus Answer: Between 345 and 360 (inclusive)

25. EARTH and SPACE

Writer: Mohammed Haque

Toss Up: Multiple Choice

Which of the following moon's do not belong to Jupiter?

W) Europa

X) Thebe

Y) Titan

Z) Lo

Toss Up Answer: Y

Bonus: Multiple Choice

What element is Jupiter mainly composed of?

W) Hydrogen

X) Fluorine

Y) Xenon

Z) Arsenic

Bonus Answer: W
