

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. 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

3. 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

4. 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

5. 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

6. 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)

7. 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

8. 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 $\frac{16}{3}$

9. 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: $\frac{5}{3}$

Bonus: Short Answer

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

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

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. 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-see-lum)?

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

Bonus Answer: Y

12. 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 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

13. 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

14. 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

15. 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

16. 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

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

17. 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)

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18. 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

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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

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19. CHEMISTRY

Writer: Hanna Yang

Toss Up: Short Answer

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

Bonus Answer: Copper

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Bonus: Short Answer

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

Bonus Answer: Silver and Copper

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20. 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) $\text{HI} + \text{Zn}(\text{NO}_3)_2 \rightarrow \text{ZnI}_2 + \text{H}(\text{NO}_3)_2$

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

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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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21. CHEMISTRY

Writer: Hanna Yang

Toss Up: Short Answer

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

Bonus Answer: Sulfate

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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) PO₄

Bonus Answer: X

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22. 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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23. 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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24. 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

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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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

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