

Round 26

1. PHYSICS

Writer: Kerwin Chen

Toss Up: Short Answer

What are substances that deforms continuously when subjected to shearing called?

Bonus Answer: fluids

Bonus: Short Answer

Which class of lasers is the most dangerous?

Bonus Answer: Class 4

2. PHYSICS

Writer: Larry Wong

Toss Up: Short Answer

The acceleration due to gravity on the Earth's surface is

Bonus Answer: 9.8 m/s²

Bonus: Multiple Choice

Which of the following quantities is a scalar?

W) acceleration

X) force

Y) speed

Z) velocity

Bonus Answer: Y

3. PHYSICS

Writer: Ivan Zhang

Toss Up: Short Answer

What is the speed of light in km per second?

Bonus Answer: about 1.079 10⁹ km per second

Bonus: Short Answer

What equation relates and connects the the concepts of mass and energy?

Bonus Answer: $E = mc^2$

4. PHYSICS

Writer: Banpreet Singh

Toss Up: Multiple Choice

Work is a

W) vector

X) scaler

Y) cross product

Z) an imaginary number

Toss Up Answer: X

Bonus: Short Answer

What is the greek letter for angular velocity

Bonus Answer: Omega

5. MATHEMATICS

Writer: Larry Wong

Toss Up: Short Answer

If $3x - y = 12$, what is the value of $8^x/2^y$?

Bonus Answer: 2^{12} or 4096

Bonus: Short Answer

What is the argument of $2 + 2i$?

Bonus Answer: 45

6. MATHEMATICS

Writer: Larry Wong

Toss Up: Short Answer

How many x intercepts in $y = X^2 + 1$?

Bonus Answer: 0

Bonus: Short Answer

How many degrees are in $\pi/3$ radians?

Bonus Answer: 60

7. MATHEMATICS

Writer: Larry Wong

Toss Up: Short Answer

What is the volume of a sphere?

Bonus Answer: $\frac{4}{3} \pi r^3$

Bonus: Short Answer

what is the sum of the 7th row of Pascal's triangle?

Bonus Answer: 128

8. MATHEMATICS

Writer: Larry Wong

Toss Up: Short Answer

What is the center of a circle with the equation $X^2 + Y^2 = 69$?

Bonus Answer: (0,0)

Bonus: Short Answer

What is the area of an ellipse with axis lengths of 5 and 3, in terms of π ?

Bonus Answer: 15π

9. 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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10. 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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11. 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

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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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12. 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

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

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

15. 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

16. 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

17. BIOLOGY

Writer: Henry Zheng

Toss Up: Short Answer

What is the powerhouse of the cell?

Bonus Answer: Mitochondria

Bonus: Short Answer

Where does photosynthesis take place?

Bonus Answer: Chloroplast

18. CHEMISTRY

Writer: Andrew Chen

Toss Up: Short Answer

Rank the following by increasing polarizability: hexane, benzene, methane

Bonus Answer: methane benzene hexane

Bonus: Multiple Choice

What is the main ingredient of cement?

W) silica

X) alumina

Y) calcium oxide

Z) aluminum sulfate

Bonus Answer: Y

19. 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

20. 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

21. 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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22. 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

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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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23. EARTH and SPACE

Writer: Yae June Lee

Toss Up: Multiple Choice

What is the relationship between size of a particle and the capillarity of soil?

- W) As soil particle increases, capillarity increases.
- X) As soil size increases, capillarity decreases.
- Y) As soil size increases, capillarity stays the same.
- Z) As soil size increases, the capillarity curves in a parabola.

Toss Up Answer: X

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Bonus: Short Answer

Why do polar jet streams vary throughout the seasons?

Bonus Answer: The rays of the sun shift north of the equator during the summer.

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24. EARTH and SPACE

Writer: Elias Milborn

Toss Up: Multiple Choice

Which of the following is a term specifically given to water that replenishes an aquifer?

- W) Recharge
- X) Discharge
- Y) Hydraulic
- Z) Permeable

Toss Up Answer: W

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Bonus: Multiple Choice

When a strong south wind occurs along the west coast of North America, Ekman transport causes water to move to which of the following?

- W) onshore
- X) offshore
- Y) alongshore to the south
- Z) alongshore to the north

Bonus Answer: W

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25. EARTH and SPACE

Writer: Elias Milborn

Toss Up: Multiple Choice

In which of the following locations is it possible to find an esker formed during the Pleistocene [PLY-stuh-seen] epoch?

- W) Maryland
- X) West Virginia
- Y) Tennessee
- Z) Iowa

Toss Up Answer: Z

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Bonus: Short Answer

Calculate the percent relative humidity for air at 70°F containing 10 millibars of water vapor if the saturation vapor pressure is 25 millibars at that temperature:

Bonus Answer: 40%

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