

Round 20

1. BIOLOGY

Writer: Olivia Gallager

Toss Up: Short Answer

Which scientist, born in 1920, is known for the discovery of DNA's double helical structure using X-ray crystallography?

Bonus Answer: Rosalind Franklin

Bonus: Short Answer

True or false?: Viruses can have DNA.

Bonus Answer: true.

2. CHEMISTRY

Writer: Ahmad Alnasser

Toss Up: Short Answer

What is the word that describes a substance that reacts with both strong acids and strong bases?

Bonus Answer: Amphoteric

Bonus: Multiple Choice

The triple bond between the carbon atoms causes acetylene, C_2H_2 , to have which of the following shapes?

W) Trigonal planar (pron: try-gon-al)

X) Linear

Y) Tetrahedral

Z) Trigonal bipyramidal

Bonus Answer: X

3. MATHEMATICS

Writer: Elias Milborn

Toss Up: Multiple Choice

Which of the following is an accurate representation of the inverse of $f(x) = x^3 - 5$?

W) $x^3 - 5$

X) $(x - 5)^3$

Y) $(x - 5)^{1/3}$

Z) $1/(x-5)^3$

Toss Up Answer: Y

Bonus: Short Answer

The three sides of a triangle are 5cm, 6cm, and 8cm. What is the cosine of the smallest angle in reduced fractional form?

Bonus Answer: 25/32

4. CHEMISTRY

Writer: Ahmad Alnasser

Toss Up: Short Answer

What is the name of a cyclic molecule with 6 carbons?

Bonus Answer: cyclohexane

Bonus: Multiple Choice

Which of the following compounds contains a double bond?

- W) butene
- X) acetylene
- Y) butane
- Z) butyne

Bonus Answer: W

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5. BIOLOGY

Writer: Benjamin Avrahami

Toss Up: Short Answer

Which animal phylum was the first to develop true coelems?

Bonus Answer: Annelids (or earthworms)

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Bonus: Multiple Choice

Which one of these molecules helps break down some of your food?

- W) Hydrochloric Acid
- X) Pepsinogen
- Y) Trypsin
- Z) Mucus

Bonus Answer: Y

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6. MATHEMATICS

Writer: Elias Milborn

Toss Up: Short Answer

Giving your answer as up, down, left, or right, the graph of the equation $x = 5y - 8y^2 - 1$ opens in which direction

Bonus Answer: left

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Bonus: Short Answer

If chord AB is 8 units from the center of a circle O with a radius of 17, what is the length of chord AB?

Bonus Answer: 30

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7. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Multiple Choice

Where in the H-R Diagram would Betelgeuse be found?

- W) Upper Left Corner
- X) Lower Left Corner
- Y) Upper Right Corner
- Z) Lower Right Corner

Toss Up Answer: Y

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Bonus: Multiple Choice

At what distance is absolute magnitude the same as apparent magnitude?

- W) 1 AU
- X) 100 AU
- Y) 1 parsec
- Z) 10 parsecs

Bonus Answer: Z

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8. CHEMISTRY

Writer: Ahmad Alnasser

Toss Up: Multiple Choice

What is the name given to the non-superimposable mirror image forms of chiral compounds?

- W) Diastereomers
- X) Stereoisomers
- Y) Enantiomers
- Z) Cis-trans isomers

Toss Up Answer: Y

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Bonus: Short Answer

What metal is used as a reducing agent to obtain iron from iron oxide in the Thermite process?

Bonus Answer: Aluminum

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9. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Short Answer

What comet was the first one recognized by astronomers to be periodic, with a period of roughly 76 years?

Bonus Answer: Halley's Comet

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Bonus: Short Answer

Located between the A and B rings of Saturn, what famous region stretches 4800 km and is characterized by a lack of material?

Bonus Answer: Cassini Division

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10. CHEMISTRY

Writer: Elias Milborn

Toss Up: Multiple Choice

Which of the following elements, in gaseous state, has the highest electron affinity?

- W) Fluorine
- X) bromine
- Y) sulfur
- Z) chlorine

Toss Up Answer: W

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Bonus: Multiple Choice

In order to calculate the heat of fusion for a piece of ice placed in warm water, you must know:

- W) The energy released by the warm water and the mass of the water
- X) The energy released by the warm water and the mass of the ice
- Y) the energy released by the ice and the mass of the warm water
- Z) the energy released by the ice and the mass of the ice

Bonus Answer: X

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11. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Multiple Choice

Which famous astronomer created the “dirty snowball” hypothesis for comets, saying that comets were icy objects containing some dust and rock?

- W) Fred Whipple
- X) Fred Hoyle
- Y) Carl Sagan
- Z) Clyde Tombaugh

Toss Up Answer: W

Bonus: Short Answer

Which comet was dubbed the comet of the 20th century, reaching an absolute magnitude value of -0.8 at perihelion?

Bonus Answer: Comet Hale-Bopp

12. MATHEMATICS

Writer: Elias Milborn

Toss Up: Short Answer

On a blueprint, if $\frac{3}{4}$ of an inch represents 1 foot, then 2 inches will represent what distance, in feet, expressed as the most reduced simple fraction?

Bonus Answer: $\frac{8}{3}$

Bonus: Short Answer

Assuming that the probability of A is 0.3, the probability of B is 0.3, and the probability of A union B is 0.5, providing your answer as decimals to the nearest 10th, what are the probabilities respectively of A intersection B and the complement of the quantity A union B?

Bonus Answer: 0.1 and 0.5

13. BIOLOGY

Writer: Benjamin Avrahami

Toss Up: Multiple Choice

Which one of these is an enzyme?

- W) Inositol
- X) Lyase
- Y) Alanine
- Z) Butyric Acid

Toss Up Answer: X

Bonus: Multiple Choice

Which molecule is not involved in the Calvin cycle?

- W) OAA
- X) RuBP
- Y) G3P
- Z) PGA

Bonus Answer: W

14. PHYSICS

Writer: William Xiang

Toss Up: Short Answer

A woman pushes a 25-kg shopping cart 10 meters along a frictionless horizontal surface. What is the total work

exerted by the woman on the cart?

Bonus Answer: 0 Joules

Bonus: Multiple Choice

A 0.50kg block attached to an ideal spring with a spring constant of 80 N/m oscillates on a horizontal frictionless surface. The total mechanical energy is 0.12J. The greatest extensions from this equilibrium length is:

- W) 1.5×10^{-3} m
- X) 3.0×10^{-3} m
- Y) 0.039 m
- Z) 0.054 m

Bonus Answer: Z

15. BIOLOGY

Writer: Ahmad Alnasser

Toss Up: Multiple Choice

When electrons move closer to a more electronegative atom, what happens?

- W) The more electronegative atom is reduced, and energy is consumed.
- X) The more electronegative atom is reduced, and energy is released.
- Y) The more electronegative atom is oxidized, and energy is released.
- Z) The more electronegative atom is oxidized, and energy is consumed.

Toss Up Answer: X

Bonus: Short Answer

Where does glycolysis take place in eukaryotic cells?

Bonus Answer: Cytosol

16. CHEMISTRY

Writer: Elias Milborn

Toss Up: Multiple Choice

What is the mass of an electron relative to a proton?

- W) 9.1×10^{-31}
- X) 8.2×10^{-14}
- Y) 1/1836
- Z) 0.51

Toss Up Answer: Y

Bonus: Multiple Choice

Which of the following is not a component of a phospholipid?

- W) water
- X) glycerol
- Y) fatty acid
- Z) phosphate group

Bonus Answer: W

17. PHYSICS

Writer: William Xiang

Toss Up: Multiple Choice

Two particles interact by conservative forces. In addition, an external force acts on each particle. They complete round trips, ending at the points where they started. Which of the following must have the same values at the beginning and end of this trip?

- W) the total kinetic energy of the two-particle system
- X) the potential energy of the two-particle system
- Y) the total linear momentum of the two-particle system
- Z) the mechanical energy of the two-particle system

Toss Up Answer: X

Bonus: Multiple Choice

A force of 10 N holds an ideal spring with a 20 N/m spring constant in compression. The potential energy stored in the spring is:

- W) 0.5J
- X) 2.5J
- Y) 5J
- Z) 10J

Bonus Answer: X

18. BIOLOGY

Writer: Ahmad Alnasser

Toss Up: Multiple Choice

How many carbon atoms are fed into the citric acid cycle as a result of the oxidation of one molecule of pyruvate?

- W) 3
- X) 1
- Y) 2
- Z) 6

Toss Up Answer: Y

Bonus: Multiple Choice

In the absence of oxygen, yeast cells can obtain energy by fermentation, resulting in the production of

- W) reduction of acetaldehyde to ethanol (ethyl alcohol).
- X) oxidation of pyruvate to acetyl CoA.
- Y) oxidation of ethanol to acetyl CoA
- Z) reduction of ethanol to pyruvate.

Bonus Answer: W

19. PHYSICS

Writer: William Xiang

Toss Up: Short Answer

Suppose that the fundamental dimensions are taken to be: force (F), velocity (V), and time (T). Find the dimensions of potential energy in simplest form.

Bonus Answer: FVT

Bonus: Multiple Choice

A projectile of mass 0.50kg is fired with an initial speed of 10 m/s at an angle of 60 degrees above the horizontal. The potential energy of the projectile-Earth system (relative potential energy when the projectile is at ground level) is:

- W) 25 J
- X) 18.75 J
- Y) 12.5 J
- Z) 6.25 J

Bonus Answer: X

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20. BIOLOGY

Writer: Ahmad Alnasser

Toss Up: Short Answer

In marine sponges, intracellular digestion of peptides is usually immediately preceded by

Bonus Answer: Endocytosis

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Bonus: Short Answer

The large surface area in the gut directly facilitates

Bonus Answer: Absorption

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21. PHYSICS

Writer: William Xiang

Toss Up: Short Answer

Name all of the following that are NOT correct units for work: Joule, Newton*meter, Watt, ft*lb, Volt

Bonus Answer: Watt, Volt

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Bonus: Multiple Choice

An 80-N crate slides with constant speed a distance of 5.0 m downward along a rough slope that makes an angle of 30 degrees with the horizontal. The work done by the force of gravity is:

- W) -400 J
- X) -200 J
- Y) 200 J
- Z) 400 J

Bonus Answer: Y

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22. BIOLOGY

Writer: Ahmad Alnasser

Toss Up: Multiple Choice

Which of the following choices would most likely promote random distribution?

- W) flocking and schooling behaviors
- X) homogeneous chemical and physical factors in the environment
- Y) spacing during the breeding season
- Z) territorial species

Toss Up Answer: X

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Bonus: Multiple Choice

The Allee effect is used to describe a population that

- W) has become so large that it will have difficulty surviving and reproducing.
- X) has exceeded its carrying capacity.
- Y) has become so small that it will have difficulty surviving and reproducing.
- Z) is in crash decline

Bonus Answer: Y

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23. PHYSICS

Writer: William Xiang

Toss Up: Short Answer

Name all of the following that are vector quantities: Weight, Distance, Velocity, Energy, Watt

Bonus Answer: Weight, Velocity

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Bonus: Multiple Choice

A man wishes to pull a crate 15 m across a rough floor by exerting a force of 100 N. The coefficient of kinetic friction is 0.25. For the man to do the least work, the angle between the force and the horizontal should be

- W) 0 degrees
- X) 14 degrees
- Y) 43 degrees
- Z) 66 degrees

Bonus Answer: W

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24. BIOLOGY

Writer: Siam Muquit

Toss Up: Multiple Choice

HIV is an example of which type of shape of virus?

- W) Spiral
- X) Polyhedral
- Y) Spherical
- Z) Complex

Toss Up Answer: Z

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Bonus: Short Answer

Which of the following types of virus is HIV associated with? Type IV, Type V, Type VI

Bonus Answer: Type VI only (3 only)

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25. PHYSICS

Writer: William Xiang

Toss Up: Multiple Choice

Which of the following bodies has the largest kinetic energy?

- W) Mass 3M and speed V
- X) Mass 3M and speed 2V
- Y) Mass 2M and speed 3V
- Z) Mass M and speed 4V

Toss Up Answer: Y

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Bonus: Multiple Choice

AN object is constrained by a cord to move in a circular path of radius 0.5m on a horizontal frictionless surface. The cord will break if its tension exceeds 16N. The maximum kinetic energy the object can have is:

- W) 4J
- X) 8J
- Y) 17J

Z) 32J

Bonus Answer: W

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