

Round 11

1. BIOLOGY

Writer: Jason Mohabir

Toss Up: Multiple Choice

Proteonomics is the study of

- W) sets of proteins
- X) sets of proteins in a specific organelle
- Y) entire set of expressed proteins in a cell
- Z) none of these

Toss Up Answer: Y

Bonus: Multiple Choice

The computational methodology that tries to find the best matching between two molecules, a receptor and ligand called:

- W) molecular matching
- X) molecular docking
- Y) molecular fitting
- Z) molecule affinity checking

Bonus Answer: X

2. MATHEMATICS

Writer: George Zhou

Toss Up: Multiple Choice

$3^{12}=27^x$. What is the value of x?

- W) $x=12$
- X) $x=4$
- Y) $x=6$
- Z) $x=3$

Toss Up Answer: X

Bonus: Short Answer

$3^{12}+3^{11}+3^{10}=b \cdot 3^a$ What is the positive difference between the product and the sum of a and b?

Bonus Answer: 107

3. PHYSICS

Writer: William Xiang

Toss Up: Multiple Choice

Which of the following quantities are vector?

- W) Work
- X) Speed
- Y) Torque
- Z) Power

Toss Up Answer: Y

Bonus: Multiple Choice

Which of the following terms is NOT commonly used to represent a higher-order derivative of displacement?

- W) Acceleration

- X) Jounce
- Y) Lock
- Z) Spin

Bonus Answer: Z

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4. CHEMISTRY

Writer: Siam Muquit

Toss Up: Multiple Choice

What is the principal quantum number of Sodium?

- W) 0
- X) 1
- Y) 2
- Z) 3

Toss Up Answer: Z

Bonus: Short Answer

What are the possible angular momentum quantum numbers for sodium?

Bonus Answer: 0, 1, 2

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5. PHYSICS

Writer: William Xiang

Toss Up: Short Answer

A ball is thrown with an initial velocity of 10 meters per second off the top of a 30 foot building, at an angle 30 degrees above the horizontal. Assuming there is no air friction and the scenario occurs on Jupiter where objects have a gravitational acceleration of 25 meters per second squared, find the time it takes, in seconds, for the ball to reach ground level. Round to the nearest tenth.

Bonus Answer: 0.4

Bonus: Multiple Choice

A boy in freefall swings a ball tied to a string around in horizontal circles. Assuming no air friction, which of the following forces are NOT acting ball?

- W) Centripetal Force
- X) Centrifugal Force
- Y) Gravitational Force
- Z) Normal Force

Bonus Answer: Z

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6. MATHEMATICS

Writer: George Zhou

Toss Up: Multiple Choice

Donald Trump has $10x+5$ apples where $x=3$. How many apples does he have if he eats two of them?

- W) 35
- X) 39
- Y) 30
- Z) 33

Toss Up Answer: Z

Bonus: Short Answer

Donald Trump has a tower consisting of 0.00405×10^{45} grams of gold. How many kilograms of gold is in his tower?
Express in scientific notation.

Bonus Answer: 4.05×10^{39} (kilograms of gold)

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7. PHYSICS

Writer: Shihab Karim

Toss Up: Multiple Choice

As defined in physics, speed is:

- W) a vector quantity
- X) always negative
- Y) always zero
- Z) always positive

Toss Up Answer: Z

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Bonus: Multiple Choice

Electric current may be expressed in which one of the following units?

- W) joules/coulomb
- X) coulombs/second
- Y) coulombs/volt
- Z) ohms/second

Bonus Answer: X

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8. EARTH and SPACE

Writer: Jan Wojcik

Toss Up: Short Answer

By name or number, which of the following is not a mineral: diamond, gold, coal, silt

Bonus Answer: Coal and silt (accept 3 and 4)

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Bonus: Short Answer

The Mohs scale is used to measure mineral hardness. By name or number order the following minerals in increasing order: Fluorite, Gypsum, Quartz, Talc

Bonus Answer: Talc, Gypsum, Fluorite, Quartz (accept 1 2 3 4, in that order)

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9. PHYSICS

Writer: William Xiang

Toss Up: Multiple Choice

Vectors A and B each have magnitude L. What is the cross product of these vectors if the angle between them when drawn with their tails at the same point is 60 degrees.

- W) Zero
- X) $L/2$
- Y) L^2
- Z) $(L^2)/2$

Toss Up Answer: Z

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Bonus: Multiple Choice

Which of the following is true when a system is at equilibrium?

- W) The object is at rest.
X) The object is not accelerating.
Y) The object is at constant velocity.
Z) Internal forces sum to zero.

Bonus Answer: X

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10. CHEMISTRY

Writer: George Papastefanou

Toss Up: Short Answer

What is the common name of the chemical with formula $C_{9}H_{8}O_{4}$

Bonus Answer: Aspirin

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Bonus: Short Answer

What is the molar mass, to the nearest whole number, of three molecules of the above chemical?

Bonus Answer: 540 g/mol

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11. EARTH and SPACE

Writer: Jan Wojcik

Toss Up: Multiple Choice

Which of the following pairs of minerals share the same cleavage?

- W) Fluorite and Calcite
X) Mica and Galena
Y) Cryolite and Fluorite
Z) Halite and Sylvite

Toss Up Answer: Z

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Bonus: Short Answer

In how many directions does muscovite break (cleave)?

Bonus Answer: 1 (one)

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12. CHEMISTRY

Writer: Shihab Karim

Toss Up: Multiple Choice

Which of the one of the following salts is insoluble?

- W) NH_4Cl
X) $Ca(NO_3)_2$
Y) $BaCO_3$
Z) Na_2S

Toss Up Answer: Y

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Bonus: Short Answer

What is the empirical formula for glucose?

Bonus Answer: CH_2O

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13. EARTH and SPACE

Writer: Sean Vaysburd

Toss Up: Multiple Choice

Which is not a type of rock?

- W) sedimentary

X) metamorphic

Y) igneous

Z) elementary

Toss Up Answer: Z

Bonus: Short Answer

Which type of rock is formed from magma?

Bonus Answer: igneous rock

14. PHYSICS

Writer: William Xiang

Toss Up: Multiple Choice

A ball is thrown vertically up from the ground. Which of the following explains the ball's motion on its way up?

W) The ball is decelerating.

X) The ball's velocity is decreasing exponentially.

Y) The change in the ball's displacement is decreasing exponentially.

Z) The ball's velocity is constant.

Toss Up Answer: Y

Bonus: Multiple Choice

A ball is thrown horizontally at the same speed from the same height, one on the Earth and one on the Moon. Which of the following statements is/are true?

I. The horizontal distance traveled by the bullet is greater on the Moon.

II. The flight time is less for the bullet on the Earth.

III. The velocities of the bullets at impact are the same.

W) III only

X) I and II only

Y) II and III only

Z) I, II, and III

Bonus Answer: X

15. CHEMISTRY

Writer: Shihab Karim

Toss Up: Short Answer

What is the common oxidation state of Oxygen?

Bonus Answer: -2

Bonus: Multiple Choice

Which of the following elements is a halogen?

W) Lithium

X) Potassium

Y) Neon

Z) Chlorine

Bonus Answer: Z

16. PHYSICS

Writer: William Xiang

Toss Up: Multiple Choice

A vector extends 6 meters in the x direction and $2\sqrt{3}$ meters in the y direction. The angle this vector makes with the positive x axis is:

- W) 30 degrees
- X) 60 degrees
- Y) 90 degrees
- Z) 180 degrees

Toss Up Answer: W

Bonus: Multiple Choice

A brick slides on a horizontal surface. Which of the following will increase the frictional force on it?

- W) Increasing the surface of contact
- X) Decreasing the surface of contact
- Y) Increasing the mass of the brick
- Z) Decreasing the mass of the brick

Bonus Answer: Y

17. CHEMISTRY

Writer: Shihab Karim

Toss Up: Multiple Choice

What is the name given to the equation $P_1V_1=P_2V_2$?

- W) Ideal Gas Law
- X) Charles's Law
- Y) Boyle's Law
- Z) Gay-Lussac's Law

Toss Up Answer: Y

Bonus: Short Answer

What are bond angles of a tetrahedral?

Bonus Answer: 109.5 degrees

18. MATHEMATICS

Writer: Aaron Gee

Toss Up: Short Answer

What is the volume of a sphere of radius "R"?

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

Bonus: Short Answer

Using an x-y coordinate axis, a parabola is given by the equation $y = x^2$. Give the x-y coordinates of the focal point for this parabola.

Bonus Answer: (0, 1/4)

19. BIOLOGY

Writer: Jason Mohabir

Toss Up: Multiple Choice

The field of biostatistics is also called

- W) statistics in biology
- X) bionemerology
- Y) biometry
- Z) Both W and X

Toss Up Answer: Y

Bonus: Multiple Choice

The word [must be said in a German accent] "statistik" in German means:

- W) calculation
- X) government
- Y) maths
- Z) classification

Bonus Answer: X

20. BIOLOGY

Writer: Shanjeed Ali

Toss Up: Short Answer

How many ATP molecules are produced by the Calvin cycle?

Bonus Answer: 0

Bonus: Short Answer

How many ATP are used in the Calvin cycle to make one glucose molecule?

Bonus Answer: 18

21. BIOLOGY

Writer: Siam Muquit

Toss Up: Multiple Choice

Which pair of organisms is correctly matched with the interspecific interaction?

- W) Commensalism: Clownfish and sea anemone
- X) Parasitism: Whales and barnacles
- Y) Mutualism: Oxpecker and rhino
- Z) Predation: Apes and bees

Toss Up Answer: Y

Bonus: Short Answer

List the 5 types of interspecific interaction.

Bonus Answer: Predation, Commensalism, Parasitism, Mutualism, Neutral

22. BIOLOGY

Writer: Siam Muquit

Toss Up: Multiple Choice

Which disease was famously eradicated in 1977?

- W) Polio
- X) Smallpox
- Y) Mumps
- Z) AIDS

Toss Up Answer: X

Bonus: Short Answer

Which human body system is attacked by AIDS?

Bonus Answer: Immune system

23. BIOLOGY

Writer: Siam Muquit

Toss Up: Multiple Choice

Which biome is characterized by population oscillations?

W) Temperate Deciduous

X) Tropical Rainforest

Y) Tundra

Z) Taiga

Toss Up Answer: Y

Bonus: Short Answer

Large-scale population oscillations in the tundra are caused by what abiotic factor?

Bonus Answer: Thawing and freezing of the ice (Also accept: population migrations)

24. BIOLOGY

Writer: Ahmad Alnasser

Toss Up: Multiple Choice

Animals and fungi are both characterized as heterotrophic. The distinguishing factor of animal heterotrophy from fungal heterotrophy is that only animals derive their nutrition by

W) consuming living, rather than dead, prey.

X) preying on animals

Y) ingesting it

Z) using enzymes for digestion

Toss Up Answer: Y

Bonus: Multiple Choice

At which developmental stage should one be able to first distinguish a diploblastic embryo from a triploblastic embryo?

W) fertilization

X) gastrulation

Y) coelom formation

Z) cleavage

Bonus Answer: X

25. BIOLOGY

Writer: Jason Mohabir

Toss Up: Multiple Choice

Which of the following phospholipids is released by phagocytic cells and leads to superoxide radical production in alveoli macrophages?

W) Plasmalogens

X) Phosphatidylinositol

Y) Cardiolipin

Z) Platelet activating factor

Toss Up Answer: Z

Bonus: Short Answer

Which of the following forms of movement do the phospholipids of plasma membranes have routinely exhibit? Answer with the number.

1. Diffusion in the plane of the bilayer
2. Translocation from one side of the bilayer to the other side
3. Rotation of fatty-acid residues around saturated carbon atoms

Bonus Answer: 1 and 3
