

Round 29

1. BIOLOGY

Writer: Josh Tish

Toss Up: Multiple Choice

The chemical EDTA is routinely used in many experiments. For example, EDTA is used in electrophoresis buffer solutions. Which of the following statements is not true?

- W) EDTA has a strong binding affinity for divalent and some trivalent cations.
- X) EDTA is a catalyst for polymer formation and essential for protein and nucleic acid polymerization.
- Y) EDTA is a chelator.
- Z) EDTA is used to help denature proteins and weaken cell membranes.

Toss Up Answer: X

Bonus: Multiple Choice

Which of the following statements is not true?

- W) Insects, birds, and many reptiles excrete nitrogenous waste in the form of urea.
- X) Neurons have evolved to speed the communication between distant cells in multi-cellular organisms.
- Y) Synapses are specialized connections between neurons to facilitate the formation of complex neuronal networks.
- Z) The regulatory proteins tropomyosin and troponin control the contraction of contractile filaments, actin and myosin.

Bonus Answer: W

2. EARTH and SPACE

Writer: Mohammed Jamil

Toss Up: Multiple Choice

Which of the following renewable energy sources do not involve water

- W) Geothermal energy
- X) Hydroelectric power
- Y) Tidal power
- Z) Biomass

Toss Up Answer: Z

Bonus: Multiple Choice

Which gas is attributed to be the cause of ozone depletion

- W) Carbon di Oxide
- X) Chlorofluorocarbons
- Y) Nitrogen
- Z) Methane

Bonus Answer: X

3. CHEMISTRY

Writer: Olivia Gallager

Toss Up: Short Answer

Mass spectrometers shoot which subatomic particle at a sample to ionize it?

Bonus Answer: electrons

Bonus: Multiple Choice

Radium-226 is most likely to undergo which type of nuclear decay?

- W) electron capture
- X) alpha
- Y) beta
- Z) positron

Bonus Answer: X

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4. EARTH and SPACE

Writer: Benjamin Avrahami

Toss Up: Multiple Choice

Fog forms when the difference between temperature and dew point is:

- W) More than 7.5 degrees Celsius
- X) Between 5 and 7.5 degrees Celsius
- Y) Between 2.5 and 5 degrees Celsius
- Z) Less than 2.5 degrees Celsius

Toss Up Answer: Z

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Bonus: Multiple Choice

Name how the environmental lapse rate changes going from the troposphere into the stratosphere:

- W) In the troposphere, it is positive; in the tropopause, it is negative; in the stratosphere, it is positive
- X) In the troposphere, it is negative; in the tropopause, it is positive; in the stratosphere, it is negative
- Y) In the troposphere, it is positive; in the tropopause, it is zero; in the stratosphere, it is negative
- Z) In the troposphere, it is negative; in the tropopause, it is zero; in the stratosphere, it is positive

Bonus Answer: Y

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5. PHYSICS

Writer: Charles Zhang

Toss Up: Multiple Choice

What is the thrust of a rocket ejecting fuel at 200 kg/s and with an exhaust velocity of 1500 m/s?

- W) 30000 newton meters
- X) 60000 newton meters
- Y) 90000 newton meters
- Z) 300000 newton meters

Toss Up Answer: W

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Bonus: Multiple Choice

A solid disk with a rotational inertia of $5 \text{ kg}\cdot\text{m}^2$ (READ AS: kilogram meters squared) and a radius of 0.25 m rotates on a fixed axis perpendicular to the disk and through its center. If a force of 2 N is applied tangentially to the disk, what is the work done by the force after half of a revolution to the nearest tenth?

- W) 0.4 J
- X) 0.8 J
- Y) 1.6 J
- Z) 3.1 J

Bonus Answer: Y

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6. CHEMISTRY

Writer: Nicholas Parker Ng

Toss Up: Multiple Choice

Permalloy steel is an alloy which is 21.2% Fe by mass. How many grams of Fe are present in 1 kg of steel?

W) 212 g

X) 21.2 g

Y) 4.7 g

Z) .212 g

Toss Up Answer: W

Bonus: Short Answer

Astatine, having atomic number 85 on the periodic table, is a radioactive member of the halogens. Give the full electron configuration of At. Arrange the orbitals in order of increasing energy. (Do not use noble gas abbreviations, such as [Xe], for this problem.)

Bonus Answer: 1s22s22p63s23p64s23d104p65s24d105p66s24f145d106p5

7. BIOLOGY

Writer: Josh Tish

Toss Up: Multiple Choice

When the temperature increases, which of the following statements is not true?

W) Dissolved oxygen decreases at higher temperatures and higher salinity.

X) Many corals die when the temperature exceeds 86°F.

Y) Metabolic reactions are less likely to achieve their activation energy.

Z) The amount of carbon dioxide that can be absorbed by the ocean decreases.

Toss Up Answer: Y

Bonus: Multiple Choice

Which of the following carbohydrates contain α -1, 4-linkages?

W) amylose

X) Cellulose

Y) Deoxyarabinose

Z) Glucose

Bonus Answer: W

8. CHEMISTRY

Writer: Nicholas Parker Ng

Toss Up: Multiple Choice

Identify the INCORRECT statement below:

W) In the most fundamental sense, the properties of the elements are periodic functions of their atomic weight.

X) The vertical columns of the periodic chart are called groups, sharing similar properties.

Y) Elements with atomic numbers of 9, 17, 35, and 53 are members of the halogen family, meaning "salt formers."

Z) Elements Li, B, N and F are all in the same period.

Toss Up Answer: W

Bonus: Multiple Choice

All of the following statements are true EXCEPT:

W) the enthalpy change of an endothermic reaction is positive.

X) at constant pressure the heat flow for a reaction equals the change in enthalpy.

Y) ΔH for a reaction is equal in magnitude but opposite in sign to ΔH for the reverse reaction.

Z) enthalpy change is dependent upon the number of steps in a reaction.

Bonus Answer: Z

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9. PHYSICS

Writer: Charles Zhang

Toss Up: Short Answer

A heated 8 kg ring with a radius of 4m cools as it rotates, causing it to shrink to a radius of 2m. If it was initially rotating at 6 rad/s, what is it's final angular velocity?

Bonus Answer: 24 rad/s

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Bonus: Short Answer

A 120-N child sits on a light swing and is pulled back and held with a horizontal force of 90 N. What is the magnitude of the tension force in each of the two supporting ropes?

Bonus Answer: 75 N

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10. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Multiple Choice

Which one of these is NOT true?

W) All planets revolve in the same direction.

X) All planets rotate in the same direction.

Y) The orbits of the planets are all ellipses.

Z) The orbits of the planets are nearly in the same plane.

Toss Up Answer: X

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Bonus: Multiple Choice

Coal is believed to have been principally formed in which of the following types of environment?

W) river beds

X) swamps

Y) volcanic regions

Z) deserts

Bonus Answer: X

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11. PHYSICS

Writer: Aaron Gee

Toss Up: Multiple Choice

A block of metal which weighs 60 newtons in air and 40 newtons under water has a density, in kilograms per meter cubed of

W) 2400

X) 1000

Y) 3000

Z) 5000

Toss Up Answer: Y

Bonus: Multiple Choice

A ball leaves a girl's hand with an upward velocity of 6 meters per second. What is the maximum height of the ball above the girl's hand?

W) 10

X) 6

Y) 1.8

Z) 2.8

Bonus Answer: Y

12. BIOLOGY

Writer: Hanna Yang

Toss Up: Multiple Choice

What is the name of the first livestock virus eradicated by a vaccine?

W) Smallpox

X) Polio

Y) Rinderpest

Z) Mumps

Toss Up Answer: Y

Bonus: Short Answer

By mass, what element makes up most of the human body?

Bonus Answer: Oxygen

13. EARTH and SPACE

Writer: Shamaul Dilmohamed

Toss Up: Multiple Choice

The principal mineral in most sand beaches is

W) quartz

X) orthoclase

Y) magnetite

Z) muscovite

Toss Up Answer: W

Bonus: Short Answer

What geological event will allow you to see Bishop's ring?

Bonus Answer: a volcanic eruption

14. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

Two forces have magnitudes of 11 newtons and 5 newtons. What's the highest value of their magnitude?

Bonus Answer: 16 N

Bonus: Short Answer

A toy train moves in a circle of 8 meters radius with a speed of 4 meters per second. What is the magnitude of the acceleration of the train?

Bonus Answer: 2 m/s^2

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15. ENERGY

Writer: Aaron Gee

Toss Up: Short Answer

Used normally, a 150-watt, 120 volt light bulb requires how many amps of current?

Bonus Answer: 1.25 Amps

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Bonus: Short Answer

If 10 joules of energy are required to move 5 coulombs of charge between two points, the potential difference between the two points is equal to how many volts?

Bonus Answer: 2 volts

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16. BIOLOGY

Writer: Hanna Yang

Toss Up: Multiple Choice

Some birds, such as pigeons and doves secrete "milk" that they feed to their children. From which of the following organs does it come from?

W) Crop

X) Gizzard

Y) Mammary Gland

Z) Stomach

Toss Up Answer: W

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Bonus: Short Answer

What is the common name for *Columba livia*?

Bonus Answer: Feral/City/Street pigeon

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17. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

A 10 farad capacitor is used in a circuit. The voltage difference between the plates of the capacitor is 20 volts. What is the magnitude of the charge on each of the capacitor's plates?

Bonus Answer: 200 Coloumbs

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Bonus: Multiple Choice

A circuit which employs a DIRECT CURRENT source has a branch which contains a capacitor. After the circuit has reached a steady state, what is the magnitude of the current in the circuit branch which contains the capacitor?

W) 0

X) Infinity

Y) Nonexistant

Z) 1

Bonus Answer: W

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18. BIOLOGY

Writer: Ivan Zhang

Toss Up: Multiple Choice

What makes the fur of polar bears white?

- W) White pigment
- X) No pigment and transparency of fur
- Y) White pigment and transparency of fur
- Z) Transparency of fur

Toss Up Answer: X

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Bonus: Short Answer

The term superbugs is usually used to refer to what?

Bonus Answer: Antibiotic-resistant bacteria

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19. PHYSICS

Writer: Aaron Gee

Toss Up: Short Answer

An infinitely long wire carries a current of three amps. How does the magnetic field outside the wire look like?

Bonus Answer: Circles the wire

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Bonus: Short Answer

Iron is what type of magnetic material?

Bonus Answer: ferromagnetic

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20. CHEMISTRY

Writer: Nicholas Parker Ng

Toss Up: Multiple Choice

In which of the lists below are the atoms arranged in order of increasing size (increasing atomic radius)?

- W) Si In Ge N
- X) N In Ge Si
- Y) In Ge N Si
- Z) N Si Ge In

Toss Up Answer: Z

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Bonus: Multiple Choice

Which of the following matched pairs of name and formula has an error?

- W) H₃PO₄, phosphoric acid
- X) H₂SO₃, sulfurous acid
- Y) HNO₃, nitrous acid
- Z) HClO₄, perchloric acid

Bonus Answer: Y

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21. BIOLOGY

Writer: Shamaul Dilmohamed

Toss Up: Short Answer

The chromosomes responsible for characteristics other than sex are known by what name?

Bonus Answer: Autosomes

Bonus: Short Answer

What is the term given to enzymes whose action is modulated by binding of a molecule to a site other than the active site?

Bonus Answer: allosteric enzymes

22. CHEMISTRY

Writer: Nicholas Parker Ng

Toss Up: Multiple Choice

The longest wavelength absorption in the UV visible spectrum of acetone, CH_3COCH_3 , occurs at 335 nm. Predict the energy required to excite an electron from a lone pair orbital on the oxygen atom to an antibonding orbital centred on the carbonyl group.

- W) 3.7 eV
- X) .27 eV
- Y) 2.99 eV
- Z) 1.67 eV

Toss Up Answer: W

Bonus: Multiple Choice

The Pauling electronegativities of fluorine and chlorine are 4.0 and 3.0 respectively. Estimate the dipole moment of chlorine monofluoride, ClF.

- W) 4 D
- X) 3 D
- Y) 1.6 D
- Z) 1 D

Bonus Answer: Z

23. BIOLOGY

Writer: Shamaul Dilmohamed

Toss Up: Short Answer

What is the name given to the jellylike substance filling the chamber behind the lens of the human eye?

Bonus Answer: vitreous humor

Bonus: Short Answer

Name the clear watery liquid that surrounds the brain and spinal cord and fills the four cavities or ventricles of the brain.

Bonus Answer: Cerebrospinal Fluid

24. BIOLOGY

Writer: Mohammed Jamil

Toss Up: Multiple Choice

Where does the electrical signal in the heart start

- W) sinoatrial node
- X) atrioventricular node

- Y) atrioventricular bundle
- Z) purkinje fibers

Toss Up Answer: W

Bonus: Multiple Choice

Which valve separates the right atrium from the right ventricle

- W) Mitral Valve
- X) Tricuspid valve
- Y) Bicuspid Valve
- Z) Semi-lunar valves

Bonus Answer: X

25. BIOLOGY

Writer: Mohammed Jamil

Toss Up: Multiple Choice

Which of the following is not one of the basic tastes

- W) sweetness
- X) saltiness
- Y) umami
- Z) spiciness

Toss Up Answer: Z

Bonus: Multiple Choice

In classical conditioning, an unlearned, inborn reaction to an unconditioned stimulus is a(n)

- W) unconditioned stimulus
- X) conditioned stimulus
- Y) conditioned response
- Z) unconditioned response

Bonus Answer: Z
