

Round 12

1. CHEMISTRY

Writer: Shihab Karim

Toss Up: Short Answer

What is the hybridization of CH₄?

Bonus Answer: sp³

Bonus: Short Answer

What intermolecular forces exist in HF?

Bonus Answer: Hydrogen Bonding

2. PHYSICS

Writer: William Xiang

Toss Up: Short Answer

A ball with a weight of 3.5 Newtons is thrown at an angle of 30 degrees above the horizontal with an initial speed of 16 meters per second. Give the magnitude and direction of the net force on the ball at its highest point.

Bonus Answer: 3.5 Newtons, downward

Bonus: Short Answer

A car is traveling at 15 meters per second on a horizontal road. The brakes are applied and the car skids to a stop in 4 seconds. Assuming gravitational acceleration is 10 meters per second squared, find the coefficient of kinetic friction between the tires and road. Round your answer to the nearest tenth.

Bonus Answer: 0.38

3. BIOLOGY

Writer: Shanjeed Ali

Toss Up: Multiple Choice

The phenomenon by which diploid cells cease to divide is known as

- W) parthenogenesis
- X) alternation of generations
- Y) cellular senescence
- Z) lysis

Toss Up Answer: Y

Bonus: Short Answer

What country has the highest human life expectancy?

Bonus Answer: Japan

4. CHEMISTRY

Writer: Shihab Karim

Toss Up: Multiple Choice

How many moles of nitrogen are in 35 grams of nitrogen?

- W) 3
- X) 3.5
- Y) 4
- Z) 2.5

Toss Up Answer: Z

Bonus: Short Answer

What group is Magnesium a part of?

Bonus Answer: Alkaline Earth Metals

=====

5. BIOLOGY

Writer: Shanjeed Ali

Toss Up: Short Answer

What term describes the number of times a normal human cell population can divide?

Bonus Answer: Hayflick limit

Bonus: Multiple Choice

What controls the Hayflick limit?

- W) apoptosis
- X) length of telomeres
- Y) genomic instability
- Z) genetic drift

Bonus Answer: X

=====

6. EARTH and SPACE

Writer: Shanjeed Ali

Toss Up: Multiple Choice

Where is the Great Rift Valley located?

- W) Western Africa
- X) Eastern Asia
- Y) Eastern Africa
- Z) Western Asia

Toss Up Answer: Y

Bonus: Multiple Choice

Which of these countries does the Great Rift Valley not run through?

- W) Tanzania
- X) Kenya
- Y) Burundi
- Z) Angola

Bonus Answer: Z

=====

7. PHYSICS

Writer: William Xiang

Toss Up: Multiple Choice

All electromagnetic waves have the same speed in:

- W) Water
- X) Air
- Y) Glass
- Z) Vacuum

Toss Up Answer: Z

Bonus: Short Answer

A man raises a massless string tied at the bottom to a 16N steel ball, with an upward acceleration of 2 meters per second squared. Find the tension in the string, to the nearest whole number of Newtons. Assume gravitational

acceleration is 10 meters per second squared.

Bonus Answer: 19 Newtons

=====

8. CHEMISTRY

Writer: Jan Wojcik

Toss Up: Multiple Choice

According to VSEPR theory, which of the following molecules DOES NOT have a trigonal pyramidal geometry?

W) NH₃ (read as: Ammonia)

X) BF₃ (read as: Barium trifluoride)

Y) XeF₃ (read as: Xenon trifluoride)

Z) PCl₃ (read as: Phosphorus trichloride)

Toss Up Answer: X

=====

Bonus: Short Answer

By name of number, which of the following molecules have a bent molecular structure? SO₂, CO₂, OF₂

Bonus Answer: SO₂ and OF₂ (accept 1 and 3)

=====

9. PHYSICS

Writer: William Xiang

Toss Up: Multiple Choice

A beam of white light hits the sharp end of a glass prism and is broken up into monochromatic components. Which of the following phenomenon is this a direct example of?

W) Refraction

X) Dispersion

Y) Rarefaction

Z) Diffraction

Toss Up Answer: X

=====

Bonus: Short Answer

A projectile whose mass is 9.4 kg is fired vertically upward. On its upward flight, an energy of 68 kJ is dissipated because of air resistance. How much higher would it have gone if the air resistance had been made negligible? Round to the nearest ten meters.

Bonus Answer: 740 m

=====

10. MATHEMATICS

Writer: Aaron Gee

Toss Up: Short Answer

Using an x-y coordinate axis, a parabola is represented by the equation $x^2 = 6y$. The vertex of this parabola is at what coordinate point?

Bonus Answer: (0,0)

=====

Bonus: Short Answer

For a right triangle, the $\sin(A)$ is $\frac{3}{5}$. To what value is the $\tan(A)$ equal?

Bonus Answer: $\frac{3}{4}$

=====

11. EARTH and SPACE

Writer: Shanjeed Ali

Toss Up: Short Answer

The Ring of Fire surrounds which ocean?

Bonus Answer: Pacific Ocean

Bonus: Multiple Choice

What kind of volcano is Mauna Loa?

- W) cone
- X) shield
- Y) subglacial
- Z) stratovolcano

Bonus Answer: X

12. BIOLOGY

Writer: Shanjeed Ali

Toss Up: Short Answer

Which two monosaccharides make up lactose?

Bonus Answer: Glucose and galactose

Bonus: Short Answer

Which two monosaccharides make up sucrose?

Bonus Answer: Glucose and fructose

13. EARTH and SPACE

Writer: George Papastefanou

Toss Up: Multiple Choice

How is the ISS powered?

- W) Solar Energy from photovoltaic cells
- X) Nuclear Power
- Y) A combination of solar energy and nuclear power
- Z) Rocket fuel

Toss Up Answer: W

Bonus: Short Answer

Who was the first American astronaut in space?

Bonus Answer: Alan Shepard

14. MATHEMATICS

Writer: Ahmad Alnasser

Toss Up: Short Answer

Describe the expression $2 \log_3 x + \log_3 5$ as a single logarithmic expression

Bonus Answer: $\log_3 (5x^2)$

Bonus: Short Answer

Solve the equation $2|3x - 2| - 3 = 7$

Bonus Answer: $x = (7/3), -1$

15. CHEMISTRY

Writer: Shihab Karim

Toss Up: Short Answer

List the following atoms in order of increasing electronegativity: fluorine, chlorine, and bromine

Bonus Answer: Fluorine

Bonus: Short Answer

Which element has the highest electronegativity?

Bonus Answer: Flourine

16. PHYSICS

Writer: Shantanu Jha

Toss Up: Multiple Choice

What is stated by Kirchhoff's First Law?

W) The description of the force interacting between static electrically charged particles.

X) The algebraic sum of currents in a network of conductors meeting at a point is zero.

Y) The algebraic sum of the products of the resistances of the conductors and the currents in them in a closed loop is equal to the total emf available in that loop.

Z) The net electric flux through any closed surface is equal to $\frac{1}{\epsilon_0}$ times the net electric charge within that closed surface.

Toss Up Answer: X

Bonus: Multiple Choice

If two 4-Farad capacitors and one 6-Farad are connected in parallel, what is the equivalent capacitance three capacitors?

W) 14 Farads

X) 4.66 Farads

Y) 1.5 Farads

Z) 1 Farad

Bonus Answer: W

17. CHEMISTRY

Writer: Shihab Karim

Toss Up: Short Answer

What term describes the process when a solid phase changes directly to the gas phase?

Bonus Answer: Sublimation

Bonus: Short Answer

The angle between any two boron-hydrogen bonds in a boron trihydride molecule is how many degrees?

Bonus Answer: 120 degrees

18. BIOLOGY

Writer: Shanjeed Ali

Toss Up: Short Answer

What are the purine bases in DNA?

Bonus Answer: Adenine and guanine

Bonus: Short Answer

What are the pyrimidine bases in RNA?

Bonus Answer: Cytosine and uracil

19. PHYSICS

Writer: Seiji Yawata

Toss Up: Multiple Choice

The driver of a car moving at a speed of 10 m/s sees a child and immediately applies brakes to bring the car to rest in 150 meters. If the combined mass of the car and the driver is 1200 kg, the magnitude of the retarding force on the vehicle is:

- W) 300 N
- X) 350 N
- Y) 400 N
- Z) 450 N

Toss Up Answer: Y

Bonus: Short Answer

A body is projected upwards with twice the escape velocity on Earth, 11.2 km/s. Ignoring the presence of other heavenly bodies, what is the speed of the body at infinity? Give your answer in km/s rounded to one decimal point.

Bonus Answer: 19.4 km/s

20. MATHEMATICS

Writer: Siam Muquit

Toss Up: Multiple Choice

How many roots (real or complex) does $x^4 - x^3 - 9x^2 + 7x + 14 = 0$ have?

- W) 1
- X) 2
- Y) 3
- Z) 4

Toss Up Answer: Z

Bonus: Short Answer

Find all real roots of $x^4 - x^3 - 9x^2 + 7x + 14 = 0$

Bonus Answer: -1, 2, +/- (sqrt 7)

21. BIOLOGY

Writer: Shanjeed Ali

Toss Up: Multiple Choice

The purpose of Glial cells is to

- W) insulate and protect neurons
- X) insulate and protect endothelial cells
- Y) protect the body from viral diseases
- Z) reinforce smooth muscle

Toss Up Answer: W

Bonus: Short Answer

Blood is to the circulatory system as hemolymph is to the

Bonus Answer: hemocoel

22. PHYSICS

Writer: Seiji Yawata

Toss Up: Multiple Choice

Suppose all the resistors in the world were only 10,000 Ohm resistors. What is the minimum number of resistors needed to make an equivalent resistance of 600 Ohms.

- W) 8
- X) 6

Y) 4

Z) 3

Toss Up Answer: Y

Bonus: Short Answer

Two wires of the same material and equal length are joined in parallel. If one of them has half the thickness of the other, and the thinner wire has a resistance of 8 Ohms, what is the resistance of the parallel combination?

Bonus Answer: 1.6 Ohms

23. BIOLOGY

Writer: Shanjeed Ali

Toss Up: Short Answer

Platelets are pieces of what type of cell?

Bonus Answer: Megakaryocytes

Bonus: Multiple Choice

Where do erythrocytes develop?

W) spleen

X) trabecular bone

Y) cortical bone

Z) bone marrow

Bonus Answer: Z

24. BIOLOGY

Writer: George Papastefanou

Toss Up: Multiple Choice

What kind of typing is used to identify tissue-specific gene expression?

W) Southern Blot

X) Northern Blot

Y) Western Blot

Z) Radioactive Tracer

Toss Up Answer: X

Bonus: Multiple Choice

Which genetic disorder is mainly characterized by an onset in middle age?

W) Huntington's Disease

X) Schizophrenia

Y) Prader-Willi syndrome

Z) Tay-Sachs Syndrome

Bonus Answer: W

25. BIOLOGY

Writer: George Papastefanou

Toss Up: Multiple Choice

Rett syndrome displays which of the following inheritance patterns?

W) Autosomal Dominant

X) Autosomal Recessive

Y) X-Linked Dominant

Z) X-Linked Recessive

Toss Up Answer: Y

Bonus: Short Answer

In the genetic disorder known as cri-du-chat, what chromosome is affected?

Bonus Answer: Chromosome 5
