

8

1. Chemistry

Toss Up: Multiple Choice

Which of the following is the most electronegative element?

W) Carbon

X) Vanadium

Y) Selenium

Z) Fluorine

Toss Up Answer: Z

Bonus: Short Answer

What is the name given to the hybrid orbital created with a steric number of 3?

Bonus Answer: $2sp^2$

=====

2. Biology

Toss Up: Short Answer

Why is oxygen required for cellular respiration?

Toss Up Answer: Oxygen is the final electron acceptor for cellular respiration.

Bonus: Short Answer

The chemical structures of saturated and unsaturated fats differ in what respect?

Bonus Answer: Number of bonds (single, double, etc) between carbons.

=====

3. Physics

Toss Up: Short Answer

The speed at which a wave propagates down a string is 300 meters per second. If the frequency of this wave is 150 Hertz, what is the wavelength of this wave?

Toss Up Answer: 2 meters

Bonus: Multiple Choice

When a physical property such as charge exists in discrete "packets" rather than in continuous amounts, the property is said to be:

W) quantized

X) random

Y) discontinuous

Z) nonexistant

Bonus Answer: W

=====

4. Mathematics

Toss Up: Short Answer

What type of number is defined as a number that is not a root of a polynomial with rational coefficients?

Toss Up Answer: Transcendental numbers

Bonus: Short Answer

Of the following, which of these numbers is transcendental? π , e , i , ϕ , $e \cdot i$, $2^{\sqrt{2}}$

Bonus Answer: π , e , $e \cdot i$, $2^{\sqrt{2}}$

=====

5. Chemistry

Toss Up: Multiple Choice

Which of the following is a polar molecule?

W) SO_2

X) CH_4

Y) SF_6

Z) BF_4

Toss Up Answer: W

Bonus: Short Answer

Fill in the blanks in the following statement to make it true. Ionic compounds are ____ conductors in their solid state, but ____ conductors when dissolved in water.

Bonus Answer: poor; good (accept equivalent answers)

=====

6. Physics

Toss Up: Short Answer

If a 5000 kg truck is traveling at 30 m/s, how high must a ramp be to bring the truck to a complete stop?

Toss Up Answer: 45 m

Bonus: Short Answer

A 1 kg radio controlled car is traveling at 10 m/s. When the car is 5 m from a cliff, the operator hits the brakes. How much force is required to stop the car?

Bonus Answer: 10 N

=====

7. Earth and Space Science

Toss Up: Multiple Choice

Since Pumice and Rhyolite are both extrusive felsic rocks, they both have:

W) Vesicles and low density

X) No vesicles and silicon

Y) Magnesium and high density

Z) Low density and aluminum

Toss Up Answer: Z

Bonus: Short Answer

By name or number, order these materials from lowest specific heat to highest specific heat: Ice, (liquid) water, water vapor, iron

Bonus Answer: Iron, water vapor, ice, liquid water (4, 3, 1, 2)

=====

8. Physics

Toss Up: Short Answer

What's the stopping potential, in eV/C (READ AS: electron volts per coulomb) of a photoelectron ejected from a metal with work function of 1eV when the incident photon's energy is 3.5 eV?

Toss Up Answer: 2.5 eV/C

Bonus: Multiple Choice

Two students conduct separate Compton scattering experiments with visible light and x-rays. The scattered radiation is observed at the same scattering angle. Which of the following statements about the observed results is true?

- W) the x rays have the greater shift in wavelength and the greater change in photon energy
- X) the two radiations have the same shift in wavelength and the visible light has the greater change in photon energy
- Y) the two radiations have the same shift in wavelength and the same change in photon energy
- Z) the two radiations have the same shift in wavelength and the x rays have the greater change in photon energy

Bonus Answer: Z

=====

9. Earth and Space Science

Toss Up: Multiple Choice

Which of these factors has the least influence on the velocity of a stream?

- W) discharge
- X) channel shape
- Y) roughness of stream bottom
- Z) gradient

Toss Up Answer: Y

Bonus: Multiple Choice

Where does water flow fastest in the meanders of a stream?

- W) near the inside of the stream bend
- X) near the outside of the stream bend
- Y) near the center of the stream
- Z) the velocity is equal everywhere

Bonus Answer: X

=====

10. Physics

Toss Up: Short Answer

A horse moves a sleigh 10 meters by applying a horizontal 60-newton force on its harness for 2 minutes. What is the power of the horse?

Toss Up Answer: 5 Watts

Bonus: Short Answer

A force of 100 newtons is used to move an object a distance of 15 meters. Find the time the force is applied to achieve a power of 25 Watts.

Bonus Answer: 60 seconds

=====

11. Chemistry

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-Lusacc's Law

Toss Up Answer: Y

Bonus: Short Answer

What are bond angles to the nearest tenth of a molecule with a tetrahedral molecular geometry?

Bonus Answer: 109.5 degrees

=====

12. Physics

Toss Up: Multiple Choice

Which of the following is true about a light wave?

- W) Its energy is directly proportional to its wavelength.
- X) Its energy is directly proportional to its frequency.
- Y) Its energy is directly proportional to its amplitude.
- Z) Its energy is not related to any other of its properties.

Toss Up Answer: X

Bonus: Short Answer

Find the electrostatic force between two perfect spheres, both with charge 1 and are 1 meter apart from each other. Give your answer in scientific notation.

Bonus Answer: $8.99 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2$

=====

13. Earth and Space Science

Toss Up: Multiple Choice

What is the closest star to earth

- W) Sirius
- X) Betelgeuse
- Y) Alpha proxima
- Z) The sun

Toss Up Answer: Z

Bonus: Short Answer

What is the closest star to the sun

Bonus Answer: Proxima centauri

=====

14. Mathematics

Toss Up: Short Answer

Write an equation for a sine function with an amplitude of $5/3$, a period of $\pi/2$, and a vertical shift of 4 units up.

Toss Up Answer: $y = (5/3)\sin(4x) + 4$

Bonus: Short Answer

Two large and 1 small pumps can fill a swimming pool in 4 hours. One large and 3 small pumps can also fill the same swimming pool in 4 hours. How many hours will it take 4 large and 4 small pumps to fill the swimming pool?

Bonus Answer: 1 hour and 40 minutes

15. Biology

Toss Up: Multiple Choice

Which of the following conditions causes an autoimmune response to eating gluten?

- W) Anaplasmosis
- X) Anisakiasis
- Y) celiac disease
- Z) Candidiasis

Toss Up Answer: Y

Bonus: Multiple Choice

What is colony collapse disorder characterized by?

- W) The disappearance of many male worker bees
- X) The death of the queen bee
- Y) The destruction of the honey produced by bees
- Z) The destruction of the structure of a bee hive

Bonus Answer: W

16. Mathematics

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?

Toss Up 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: $\frac{3}{4}$

17. Earth and Space Science

Toss Up: Multiple Choice

What happened to the melted rock after it goes through solidification to form basalt?

- W) It occurred rapidly, with fine grained minerals
- X) Slowly, coarse grained minerals
- Y) Rapidly, coarse trained minerals
- Z) Slowly, fine grained minerals

Toss Up Answer: W

Bonus: Short Answer

What are two surface traits that affect the rate of surface runoff?

Bonus Answer: Slope of land surface, soil type or composition, vegetation, porosity of soil, soil saturation.(any two of these answers are acceptable.)

18. Mathematics

Toss Up: Short Answer

What is $\tan(\arcsin(9/41))$

Toss Up Answer: 9/40

Bonus: Short Answer

What is $\sin(\operatorname{arccot}(\tan(\arccos(3/5))))$

Bonus Answer: 3/5

=====

19. Chemistry

Toss Up: Multiple Choice

What happens in a hydrogen atom when an electron jumps from an excited energy state to a more stable energy state?

- W) electromagnetic radiation is emitted by the atom
- X) electromagnetic radiation is absorbed by the atom
- Y) the atom becomes a positively charged ion
- Z) the atom becomes a negatively charged ion

Toss Up Answer: W

Bonus: Short Answer

A closed 5-liter vessel contains a sample of neon gas. The temperature inside the container is 25°C, and the pressure is 1.5 atmospheres. (The gas constant, R, is equal to 0.08 L·atm/mol·K.) If the neon gas in the vessel is replaced with an equal molar quantity of helium gas, which of the following properties of the gas in the container will be changed?

- I. Pressure
- II. Temperature
- III. Density

Bonus Answer: III only

=====

20. Biology

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

=====

21. Earth and Space Science

Toss Up: Multiple Choice

Which type of air mass is dominant in Central Canada?

- W) continental arctic
- X) continental polar
- Y) maritime polar
- Z) maritime tropical

Toss Up Answer: X

Bonus: Multiple Choice

A stationary front is symbolized by which of the following:

- W) triangles only
- X) semicircles only
- Y) triangles and semicircles on opposite sides of a line
- Z) triangles and semicircles on same side of a line

Bonus Answer: Y

=====

22. Chemistry

Toss Up: Multiple Choice

The evaporation of any liquid is expected to have

- W) a positive delta H and a negative delta S
- X) a negative delta H and a negative delta S
- Y) a positive delta H and a positive delta S
- Z) a positive delta H and a negative delta S

Toss Up Answer: Y

Bonus: Multiple Choice

The rate of reaction will be large if

- W) delta G is a large negative number
- X) delta S is a large negative number
- Y) delta H is a large negative number
- Z) None of the above

Bonus Answer: Z

=====

23. Biology

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

Bonus: Short Answer

The term superbugs is usually used to refer to what?

Bonus Answer: Antibiotic-resistant bacteria

=====

24. Mathematics

Toss Up: Short Answer

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

Toss Up Answer: $\log_3 (5x^2)$

Bonus: Short Answer

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

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

=====

25. Biology

Toss Up: Multiple Choice

A trend toward the decrease in the size of plants on the slopes of mountains as altitudes increase is an example of

W) a cline

X) a bottleneck

Y) relative fitness

Z) geographic variation

Toss Up Answer: W

Bonus: Short Answer

If thermoregulation is considered to be a secondary function of the large ears of jackrabbits, then the primary function of the ears is

Bonus Answer: to detect predators

=====