

Round 10

1. PHYSICS

Toss Up: Multiple Choice

A Newton is equal to which of the following?

- W) w) kilogram-meter per second
- X) x) meter per second squared
- Y) y) kilogram-meter per second squared
- Z) z) kilogram per meter-second

Toss Up Answer: Y

Bonus: Short Answer

Work is what type of quantity?

Bonus Answer: Scalar quantity.

2. PHYSICS

Toss Up: Short Answer

In a totally inelastic collision, what happens to the two colliding objects?

Bonus Answer: They STICK together!

Bonus: Short Answer

r For a uniformly rotating object, what do we call the rate of change in the angle through which the object turns in one second?

Bonus Answer: ANGULAR VELOCITY

3. PHYSICS

Toss Up: Multiple Choice

Aaron, whose mass is 45 kilograms, is riding his 5.0 kilogram skateboard down the sidewalk with a constant speed of 6.0 meters per second when he rolls across a 10.0 meter long patch of sand on the pavement. The sand provides force of friction of 6.0 newtons. What is Aaron's speed in meters per second as he emerges from the sand?

- W) 0
- X) 1.8
- Y) 3.8
- Z) 5.8

Toss Up Answer: Z

Bonus: Short Answer

Which of the following does NOT contain a scalar quantity? Force, energy, or acceleration?

Bonus Answer: Acceleration

4. PHYSICS

Toss Up: Short Answer

An electric vehicle has two stages. If the first stage, the battery, has an efficiency of 90% and the second stage, the inverter, has an efficiency of 80%, calculate the approximate overall efficiency of the vehicle.

Bonus Answer: 72%

Bonus: Multiple Choice

Which of the following is congruent to $(n + 1)$ modulus n ?

- W) 0
- X) 1
- Y) $n-1$
- Z) $n-2$

Bonus Answer: W

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5. PHYSICS

Toss Up: Short Answer

In the SI system of measure, what is the unit of capacitance?

Bonus Answer: FARAD

Bonus: Short Answer

How much work in joules is done by friction on a sled weighing 100 newtons during a 10 meter displacement? The coefficient of sliding friction is 0.1.

Bonus Answer: 100

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6. MATHEMATICS

Toss Up: Short Answer

If Robert can paint a fence in 12 hours and George can paint a fence in 6 hours how long will they take to paint the fence together?

Bonus Answer: 4 hours

Bonus: Multiple Choice

What is the coefficient of the 3rd term in the expansion of $(x+y)^7$

- W) 1
- X) 7
- Y) 21
- Z) 35

Bonus Answer: Y

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7. MATHEMATICS

Toss Up: Short Answer

What is $64x^3 + 27y^3$ factored in simplest form?

Bonus Answer: $(4x+3y)(16x^2-12xy+9y^2)$

Bonus: Short Answer

If i is the square root of -1 , what is the value of i^{97} ?

Bonus Answer: i

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8. MATHEMATICS

Toss Up: Multiple Choice

A set is countable:

- W) If and only if it is finite.
- X) If and only if a surjection can be made between the set and the natural numbers.
- Y) If it has the same cardinality as some subset of the natural numbers.
- Z) If it has the same cardinality as some subset of the real numbers.

Toss Up Answer: Y

Bonus: Short Answer

Who was the famous German mathematician that invented Set Theory and effectively proved the uncountableness of the reals?

Bonus Answer: Georg Cantor (accept Cantor)

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9. MATHEMATICS

Toss Up: Short Answer

In what type of triangle is the angle bisector, the altitude and the median the same line?

Bonus Answer: Isosceles or equilateral triangle

Bonus: Short Answer

Find the other roots of $x^3 + 6x^2 - 13x - 42$ if one of them is -2

Bonus Answer: -7, 3

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10. BIOLOGY

Toss Up: Short Answer

Which three amino acids can most often be phosphorylated in eukaryotes?

Bonus Answer: Serine, Threonine, Tyrosine

Bonus: Short Answer

After transforming the *Ku11* gene into XL10 Gold *E. coli* and growing the bacteria for a day in selective media in the 25°C incubator, you notice that the colonies are much smaller than they should be. Why did this happen?

Bonus Answer: 37°C is the optimal temperature for growing *E. coli*. The colonies were smaller because they grew more slowly.

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11. BIOLOGY

Toss Up: Short Answer

The phenomenon where bacteria monitor the presence of secreted signaling molecules to determine the local density of cells is called?

Bonus Answer: Quorum sensing

Bonus: Short Answer

Quorum sensing allows bacteria to coordinate their behaviors in synchrony. One example of said behavior is illustrated when you find them on your teeth when you wake up. What has formed on your teeth?

Bonus Answer: biofilm

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12. BIOLOGY

Toss Up: Short Answer

In 1999, scientists discovered a fossil in China of what appeared to be an early chordate. This chordate had eyes and a brain but no skull, a derived feature of craniates. What was this fossil called?

Bonus Answer: Haikouella

Bonus: Short Answer

What is the class of the most basal group of craniates?

Bonus Answer: Myxini (accept: Hagfishes)

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13. BIOLOGY

Toss Up: Short Answer

HIV can be treated with a drug cocktail known as HAART. What does HAART stand for?

Bonus Answer: Highly Active Anti-Retroviral Treatment

Bonus: Short Answer

AIDS patients may become afflicted with an extremely rare cancer caused by a certain herpesvirus. What is this cancer called?

Bonus Answer: Kaposi's Sarcoma

14. BIOLOGY

Toss Up: Multiple Choice

Which of the following types of antibodies is typically used to fight parasitic infections?

W) E

X) M

Y) G

Z) A

Toss Up Answer: W

Bonus: Short Answer

The immune response can include complement protein cascades, which form pores in the membrane of the target cell. The cell then swells and lyses do to water and ions rushing in. The type of complex that forms the pore in the membrane is called?

Bonus Answer: membrane attack (accept: membrane attack complex)

15. BIOLOGY

Toss Up: Short Answer

Certain proteins are released by virus-infected cells which induce neighboring cells to produce substances that will inhibit viral replication. What are these proteins called?

Bonus Answer: Interferons

Bonus: Short Answer

What is the process by which antibodies cover a pathogen such that it is marked for destruction and forms a precipitate to be flushed out?

Bonus Answer: Opsonization

16. BIOLOGY

Toss Up: Multiple Choice

Chitons, a type of mollusk, have oval-shaped bodies and a shell composed of how many dorsal plates?

W) 6

X) 7

Y) 8

Z) 9

Toss Up Answer: Y

Bonus: Short Answer

Gastropods undergo a distinct developmental process, which causes their visceral mass to rotate 180 degrees, and as a consequence its anus ends up above its head. What is this process called?

Bonus Answer: torsion

17. CHEMISTRY

Toss Up: Multiple Choice

Which of the following elements are Lanthanides?

W) Lawrencium

- X) Meltnerium
- Y) Seaborgium
- Z) Terbium

Toss Up Answer: Z

Bonus: Short Answer

What unit does electronegativity use?

Bonus Answer: No unit

18. CHEMISTRY

Toss Up: Short Answer

Which group of elements has the lowest ionization energy?

Bonus Answer: Alkali metals

Bonus: Short Answer

What are the elements in group 5 called?

Bonus Answer: Pnictogens

19. CHEMISTRY

Toss Up: Short Answer

Which group of the periodic table has a fully filled d orbital?

Bonus Answer: Group 12

Bonus: Short Answer

Name 2 elements that behave both as a metal and non-metal

Bonus Answer: Any 2: Boron, silicon, germanium, arsenic, antimony, tellerium, (polonium)

20. CHEMISTRY

Toss Up: Short Answer

How many orientation of f orbitals are there?

Bonus Answer: 7

Bonus: Short Answer

The Pauli Exclusion Principle states that at most how many electrons can occupy a single atomic orbital?

Bonus Answer: 2

21. CHEMISTRY

Toss Up: Multiple Choice

Which of the following is false about metals?

- W) Metals are malleable and ductile
- X) Metals tend to lose electrons to become cations
- Y) Metallic reactivity increases as you go down a group.
- Z) All metals are solid at room temperature

Toss Up Answer: Z

Bonus: Multiple Choice

Which of the following metals isn't solid at room temperature?

- W) Mercury
- X) Tantalum

- Y) Barium
- Z) Chromium

Bonus Answer: W

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22. CHEMISTRY

Toss Up: Multiple Choice

Which of the following isoelectronic ions has the largest ionic radius?

- W) Sulfur: 2-
- X) Chlorine: 1-
- Y) Potassium: 1+
- Z) Calcium: 2+

Toss Up Answer: W

Bonus: Short Answer

Complete the sentence with one word: As the nuclear charge of an ion increases, the ionic radius _____.

Bonus Answer: decreases (Do not accept decrease)

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23. EARTH and SPACE

Toss Up: Multiple Choice

The San Andreas fault is what specific type of fault line?

- W) Transform plate boundary
- X) Normal fault
- Y) Reverse fault
- Z) Strike slip fault

Toss Up Answer: Z

Bonus: Short Answer

There are different types of seismic waves, body waves and surface waves. Name the two different types of body waves.

Bonus Answer: P waves and S waves

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24. EARTH and SPACE

Toss Up: Multiple Choice

Which type of weather front is represented by alternating purple spikes and semicircles?

- W) Cold front
- X) Warm front
- Y) Occluded front
- Z) Stationary front

Toss Up Answer: Y

Bonus: Short Answer

What weather front is formed as a cold air mass pushes under a warm air mass?

Bonus Answer: Cold front

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25. EARTH and SPACE

Toss Up: Short Answer

What is the term for the reflection of radiation off Earth's surface?

Bonus Answer: Albedo

Bonus: Short Answer

Which planet is most similar to Earth in size?

Bonus Answer: Venus

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