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1. Physics

Toss Up: Multiple Choice

As an object falls to the earth with air resistance present, what happens to the acceleration of the object?

- W) It remains a constant 9.8 m/s^2
- X) It increases from 0 to 9.8 m/s^2
- Y) It remains at a constant 0 m/s^2
- Z) It decreases from 9.8 to 0 m/s^2

Toss Up Answer: Z

Bonus: Multiple Choice

Mary and Joe are on a merry-go-round. Mary is seated near the center of rotation and Joe is on the outer edge. Which of the following BEST describes their motion?

- W) Mary has a greater acceleration than Joe
- X) Joe has a greater acceleration than Mary
- Y) neither Joe nor Mary are accelerating
- Z) both Mary and Joe have the same acceleration

Bonus Answer: X

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2. Chemistry

Toss Up: Multiple Choice

Which of the following species is amphoteric?

- W) Na_3PO_4
- X) HSO_4^-
- Y) KOH
- Z) HNO_3

Toss Up Answer: X

Bonus: Short Answer

A 600-milliliter container holds 2 moles of $\text{O}_2(\text{g})$, 3 moles of $\text{H}_2(\text{g})$, and 1 mole of $\text{He}(\text{g})$. Total pressure within the container is 760 torr. What is the partial pressure of O_2 ?

Bonus Answer: 253 torr

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3. Earth and Space Science

Toss Up: Short Answer

What is the US state with the most glaciers?

Toss Up Answer: Alaska

Bonus: Short Answer

How many glaciers are there in Hawaii rounded to the nearest 1000?

Bonus Answer: 0

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4. 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) nonexistent

Bonus Answer: W

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5. Chemistry

Toss Up: Short Answer

In 12.4 hours, a 100 gram sample of an element decays so that its mass is 25 grams. What is the approximate half-life of this radioactive substance?

Toss Up Answer: 6.2 hours

Bonus: Multiple Choice

Which of the following will raise the boiling point of a sample of water?

- W) Heat the water
- X) Mix gasoline into the water
- Y) Bring the water to a higher altitude
- Z) Dissolve table sugar in the water

Bonus Answer: Z

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6. Physics

Toss Up: Short Answer

A baseball is thrown straight upward. What is the velocity at the highest point?

Toss Up Answer: 0

Bonus: Multiple Choice

A rock is dropped off a cliff and strikes the ground with an impact velocity of 30 m/s. How high was the cliff?

- W) 15 m
- X) 30 m
- Y) 45 m
- Z) 60 m

Bonus Answer: Y

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7. Earth and Space Science

Toss Up: Multiple Choice

What is the driving force present in a supernova explosion?

- W) electromagnetic force
- X) strong nuclear force
- Y) gravitational force
- Z) weak nuclear force

Toss Up Answer: Y

Bonus: Short Answer

What gas is the Mars atmosphere primarily made up of?

Bonus Answer: Carbon dioxide

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8. Physics

Toss Up: Short Answer

What is the name of the first American physicist to win two Nobel prizes? (very random lol)

Toss Up Answer: John Bardeen (can accept just last name?)

Bonus: Multiple Choice

If the resultant force acting on a body of constant mass is zero, the body's momentum is:

- W) constant
- X) 0
- Y) increasing
- Z) decreasing

Bonus Answer: W

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9. Mathematics

Toss Up: Short Answer

Subtract the following complex numbers, giving your answer in standard

form: $(11 - 4i) - (-3 + 3i)$

Toss Up Answer: 12 - 7i

Bonus: Short Answer

Solve the following inequality for x, giving your answer in fractional

form, $\frac{1}{3}x + \frac{2}{3}$ is less than $\frac{5}{6}x - 2$.

Bonus Answer: x is greater than $\frac{16}{3}$

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10. Physics

Toss Up: Multiple Choice

The force acting between two point charges can be computed using which of the following laws?

- W) Ohm's Law
- X) Ampere's Law
- Y) Coulomb's Law
- Z) Newton's Second Law

Toss Up Answer: Y

Bonus: Short Answer

Five volts are applied across the plates of a parallel plate capacitor. The distance of separation of the plates is .02 meters. What is the magnitude of the electric field inside the capacitor?

Bonus Answer: 250 volts per meter

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11. Earth and Space Science

Toss Up: Multiple Choice

The metamorphic rock formed from limestone is:

- W) quartzite
- X) slate
- Y) greenstone
- Z) marble

Toss Up Answer: Z

Bonus: Multiple Choice

The direct impact of running water is called

- W) bed load
- X) meander cutoff
- Y) base level
- Z) hydraulic action

Bonus Answer: Z

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12. Mathematics

Toss Up: Multiple Choice

What is the square root of 2 (to the nearest tenths)?

- W) 1.7
- X) 1.5
- Y) 1.3
- Z) 1.4

Toss Up Answer: Z

Bonus: Short Answer

What is the equation of a circle with circumference 6π that is positioned 3 points above the x axis and 4 points before the y axis?

Bonus Answer: $(x-4)^2 + (y+3)^2 = 9$

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13. Physics

Toss Up: Short Answer

A Tesla is an SI derived unit that can be expressed as $\text{kg}^a \cdot \text{C}^b \cdot \text{s}^c$. What are the values of a, b and c?

Toss Up Answer: 1, -1, -1

Bonus: Short Answer

A positron moves through a region in which the electric field is uniform in the x-direction and the magnetic field is uniform in the y-direction. What is the direction of the terminal velocity of the positron?

Bonus Answer: Positive z direction

14. 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

15. Biology

Toss Up: Multiple Choice

Kuru is a disease caused by what type of microbe?

- W) Bacteria
- X) Virus
- Y) Prion
- Z) Viroid

Toss Up Answer: Y

Bonus: Short Answer

Give the genus and species name of the microbe that causes peptic ulcer disease.

Bonus Answer: *Helicobacter pylori*

16. Mathematics

Toss Up: Short Answer

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

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

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

17. Earth and Space Science

Toss Up: Short Answer

As it pertains to, say, a recent rain storm, what zone would lie right above the impermeable bedrock?

Toss Up Answer: zone of saturation

Bonus: Short Answer

In the zone of aeration, groundwater is present between spaces and cracks in soil and rock grains. What is this groundwater known as?

Bonus Answer: capillary water

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18. Mathematics

Toss Up: Short Answer

Find the first derivative of $10x^3 + 3x^2 + 3$ in the simplest form.

Toss Up Answer: $30x^2 + 6x$

Bonus: Short Answer

How many points of inflection does the graph $x^3 + 5$ have?

Bonus Answer: 1

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19. Biology

Toss Up: Multiple Choice

What structure in plant cells is similar to gap junctions in animal cells?

- W) Cell wall
- X) Central Vacuole
- Y) Plasmodesmata
- Z) Thylakoid

Toss Up Answer: Y

Bonus: Multiple Choice

If, on average, 46% of the loci in a species' gene pool are heterozygous, then the average homozygosity of the species should be

- W) 23%
- X) 46%
- Y) 54%
- Z) There is not enough information to say.

Bonus Answer: Y

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20. Earth and Space Science

Toss Up: Short Answer

What is the angle of insolation?

Toss Up Answer: The angle at which light hits the earth.

Bonus: Multiple Choice

Which of the following locations can have an angle of insolation of 90 degrees?

- W) 20 degrees N

- X) 40 degrees N
- Y) 60 degrees N
- Z) 30 degrees S

Bonus Answer: W

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21. Mathematics

Toss Up: Multiple Choice

If $f(x) = x^4 + 5x^8 + 7x^6 + 5$, which of the following is true about $f(x)$?

- W) $f(x)$ is odd, only
- X) $f(x)$ is even, only
- Y) $f(x)$ is neither odd nor even
- Z) $f(x)$ is both even and odd

Toss Up Answer: X

Bonus: Short Answer

Simplify: $\cos(\sin^{-1}(3/5))$

Bonus Answer: 4/5

Solution:

Draw a 3-4-5 right triangle and find the angle that $\sin^{-1}(3/5)$ is equal to. Then, take its cosine.

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22. 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

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23. Physics

Toss Up: Short Answer

An electron travels 45 degrees north of east in a magnetic field which points 45 degrees west of north. In what direction does the magnetic force acting on the electron points?

Toss Up Answer: Down

Bonus: Short Answer

A 2C charge travels through a magnetic field $B = 6i + 15j + 9k$ with velocity $v = 2i + 5j + 3k$. What is the magnetic force acting on the charge?

Bonus Answer: 0

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24. Earth and Space Science

Toss Up: Multiple Choice

A hill of unsorted sediments of mixed grain sizes was probably deposited by

- W) ice
- X) wind
- Y) water
- Z) frost action

Toss Up Answer: W

Bonus: Multiple Choice

Which of the following minerals has a pretty strong set of silicon-oxygen bonds but cleaves easily into thin sheets?

- W) olivine
- X) hornblende
- Y) mica
- Z) quartz

Bonus Answer: Y

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