

1. Earth and Space Science

Toss Up: Short Answer

What determines a mineral's properties?

Toss Up Answer: The internal arrangement of its atoms.

Bonus: Short Answer

What type of currents cause plates to move in the mantle?

Bonus Answer: Convection currents

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2. Physics

Toss Up: Short Answer

The mean distance from Saturn to the sun is 9 times greater than the mean distance from Earth to the sun. How long is a Saturn year?

Toss Up Answer: 27 Earth years

Bonus: Short Answer

An object moves at constant speed in a circular path. True statements about the motion include which of the following?

- I. The velocity is constant.
- II. The acceleration is constant.
- III. The net force on the object is zero since its speed is constant.

Bonus Answer: None of them (The vectors are changing)

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3. Biology

Toss Up: Multiple Choice

How is oxygen transported in blood?

- W) It is dissolved in the blood
- X) It is carried by hemoglobin on white blood cells
- Y) It is carried by hemoglobin on red blood cells
- Z) It is carried by hemoglobin on platelets

Toss Up Answer: Y

Bonus: Short Answer

By name or by number, identify which of the following ways can carbon dioxide be transported in blood?

- 1. It can be dissolved in the blood
- 2. It can be carried by hemoglobin on white blood cells
- 3. It can be carried by hemoglobin on red blood cells
- 4. It can be carried by hemoglobin on platelets

Bonus Answer: 1 & 3

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4. Physics

Toss Up: Short Answer

A car with a mass of one ton collides with a truck with a mass of ten tons. Which applies the greatest force on the other, in Newtons?

Toss Up Answer: They both apply an equal force.

Bonus: Short Answer

Which experiences greater acceleration in the collision from a car with a mass of one ton colliding with a truck with a mass of ten tons, and by how many times greater.

Bonus Answer: The car, it will accelerate ten times as much.

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5. Biology

Toss Up: Multiple Choice

Which of the following processes in cellular respiration produce the most ATP

W) Glycolysis

X) Link Reaction

Y) Krebs Cycle

Z) Oxidative Phosphorylation

Toss Up Answer: Z

Bonus: Multiple Choice

Which of the following is not used in cellular respiration

W) Glucose

X) NADH

Y) FADH₂

Z) NADPH

Bonus Answer: Z

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6. Earth and Space Science

Toss Up: Multiple Choice

Where in the H-R Diagram would Betelgeuse be found?

W) Upper Left Corner

X) Lower Left Corner

Y) Upper Right Corner

Z) Lower Right Corner

Toss Up Answer: Y

Bonus: Multiple Choice

At what distance is absolute magnitude the same as apparent magnitude?

W) 1 AU

X) 100 AU

Y) 1 parsec

Z) 10 parsecs

Bonus Answer: Z

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7. 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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8. Physics

Toss Up: Short Answer

A quarter of a wavelength is equal to how many degrees of phase?

Toss Up Answer: 90 degrees

Bonus: Short Answer

Davisson and Germer scattered electrons from a crystal of nickel. The scattered electrons formed a strong diffraction pattern. What important conclusion was drawn from this experiment?

Bonus Answer: Electrons act like waves
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9. Earth and Space Science

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
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10. Mathematics

Toss Up: Short Answer

What is the amplitude of $y=4\sin(5x+3)$

Toss Up Answer: 4

Bonus: Short Answer

What is the period of $y=4\sin(5x+3)$ rounded to the nearest 100th

Bonus Answer: 1.26
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11. Chemistry

Toss Up: Short Answer

What is the largest ion with an equal amount of protons and neutrons?

Toss Up Answer: Ca²⁺

Bonus: Short Answer

Who is regarded as the father of the modern periodic table? (1st and last name)

Bonus Answer: Dmitri Mendeleev

12. Biology

Toss Up: Multiple Choice

Which of the following is not true about genetically modified food?

W) genetically modified organisms are generally safe for human consumption

X) over 80 % of corn grown in the US is genetically modified

Y) genetically modified crops require larger amounts of pesticides

Z) genetically modified crops can yield greater harvests for less cost

Toss Up Answer: Y

Bonus: Short Answer

Bt corn is genetically modified to produce a certain protein that is poisonous to certain insects. What is the genus of the source of the genetic material that produces this corn?

Bonus Answer: Bacillus

13. Chemistry

Toss Up: Multiple Choice

What is the correct term(s) used to determine if a system has come to equilibrium?

W) K_a and Q

X) K_{sp}

Y) Q

Z) K_c

Toss Up Answer: Y

Bonus: Multiple Choice

Chemical equilibrium may be used to describe

W) gas phase chemical reactions

X) acid and based ionization

Y) Solubility

Z) All of the Above

Bonus Answer: Z

14. Mathematics

Toss Up: Short Answer

What is the name for the rule that states that when you have a limit of indeterminate form as a fraction, it is equal to the limit of the derivative of the numerator over the derivative of the denominator?

Toss Up Answer: L'hospital's rule

Bonus: Short Answer

What famous function, named after a mathematician, takes the infinite sum of the reciprocals of the natural numbers raised to an argument?

Bonus Answer: Riemann zeta function

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*

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16. Chemistry

Toss Up: Multiple Choice

What is the oxidation state of Manganese in the permanganate ion?

- W) +5
- X) +7
- Y) +2
- Z) -2

Toss Up Answer: X

Bonus: Short Answer

What is the oxidation state of molecular oxygen?

Bonus Answer: 0

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17. Earth and Space Science

Toss Up: Multiple Choice

Which planet's tilt of the axis is closest to that of Mars?

- W) Mercury
- X) Venus
- Y) Earth
- Z) Jupiter

Toss Up Answer: Y

Bonus: Multiple Choice

Which planet rotates the fastest in our solar system?

- W) Earth
- X) Jupiter
- Y) Pluto
- Z) Uranus

Bonus Answer: X

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18. Physics

Toss Up: Multiple Choice

An object of mass 2 kg has a linear momentum of magnitude 6 kg · m/s. What is this object's kinetic

energy?

W) 3 J

X) 6 J

Y) 9 J

Z) 12 J

Toss Up Answer: Y

Bonus: Short Answer

Two objects, one of mass 3 kg and moving with a speed of 2 m/s and the other of mass 5 kg and speed 2 m/s, move toward each other and collide head-on. If the collision is perfectly inelastic, find the speed of the objects after the collision.

Bonus Answer: 0.5 m/s

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19. Mathematics

Toss Up: Multiple Choice

Donald Trump has $10x+5$ apples where $x=3$. How many apples does he have if he eats two of them?

W) 35

X) 39

Y) 30

Z) 33

Toss Up Answer: Z

Bonus: Short Answer

Donald Trump has a tower consisting of 0.00405×10^{45} grams of gold. How many kilograms of gold is in his tower? Express in scientific notation.

Bonus Answer: 4.05×10^{39} (kilograms of gold)

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20. Earth and Space Science

Toss Up: Multiple Choice

Which of these units is defined as "3.26 light-years"?

W) Astronomical Unit

X) Parsec

Y) Gigasphere

Z) Kilometer

Toss Up Answer: X

Bonus: Multiple Choice

What are the two neighboring galaxies of the Milky Way known as?

W) The Keplers

X) Magellanic Clouds

Y) Twin Cities

Z) Petronas Galaxies

Bonus Answer: X

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21. Mathematics

Toss Up: Short Answer

If you roll 2 fair dice simultaneously, what is the probability, given as a fraction, that you will roll the number 6 on AT LEAST one die?

Toss Up Answer: 11/36

Bonus: Short Answer

Find the sum of all interior angles, in degrees, in a regular polygon having 14 sides

Bonus Answer: 2160 degrees

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22. Physics

Toss Up: Multiple Choice

What is the magnitude of a vector 4 meters in the x direction, 1 meter in the y direction, and 8 meters in the z direction?

- W) 7 meters
- X) 9 meters
- Y) 11 meters
- Z) 13 meters

Toss Up Answer: X

Bonus: Short Answer

Unit X equals " $\sqrt{A / B}$ " and is in units " $(\text{Mass} \cdot \text{Time}) / \text{Length}^2$ ". If A has units "Length / Time", what are the units of B?

Bonus Answer: $\text{Length}^5 / (\text{Mass}^2 \cdot \text{Time}^3)$

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23. Biology

Toss Up: Short Answer

At which stage of mitosis are chromosomes usually photographed in order to produce a karyotype?

Toss Up Answer: metaphase

Bonus: Short Answer

Name all of the following that a homologous pairs of chromosomes share in common.

- I. length
- II. loci of genes
- III. characteristics encoded by their genes
- IV. DNA sequence

Bonus Answer: I, II, III only

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24. Chemistry

Toss Up: Short Answer

What is the name for a molecule with tetrahedral electron geometry but only three substituent groups?

Toss Up Answer: trigonal pyramidal

Bonus: Multiple Choice

Which of the following is not an ionic compound?

- W) NaCl

- X) HF
- Y) FeCl₃
- Z) H₂SO₄

Bonus Answer: X

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25. Chemistry

Toss Up: Multiple Choice

A solution of H₂SO₃ is found to have a hydrogen ion concentration of 1×10^{-3} molar at 25°C. What is the hydroxide ion concentration in the solution?

- W) 1×10^{-1}
- X) 1×10^{-3}
- Y) 1×10^{-11}
- Z) 1×10^{-13}

Toss Up Answer: Y

Bonus: Short Answer

If the pH of a solution is changed from 1 to 3 with the addition of an antacid, what percentage of [H⁺] was neutralized?

Bonus Answer: 99%

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