

1. Biology

Toss Up: Multiple Choice

Which of these is not characteristic of an r-selecting species?

- W) Small physical size
- X) Short life span
- Y) Parental care
- Z) Variable and unpredictable mortality

Toss Up Answer: Y

Bonus: Short Answer

For each of the following, state whether it is an r-strategist or k-strategist: Oyster, Garden weeds, Desert flowers, Humans

Bonus Answer: Oyster: r-strategist; Garden weeds: r-strategist; Desert flowers: r-strategist; Humans: k-strategist

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2. Earth and Space Science

Toss Up: Short Answer

In which direction are winds and ocean currents deflected in the Southern Hemisphere?

Toss Up Answer: left

Bonus: Multiple Choice

Which of the following does not support the heliocentric model?

- W) Coriolis effect
- X) rotation of the Foucault pendulum
- Y) epicycles
- Z) direct motion

Bonus Answer: Y

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3. Physics

Toss Up: Multiple Choice

Which statement describes a situation when polarization could not occur?

- W) Light waves are reflected.
- X) Light waves are scattered.
- Y) Microwaves pass through a metal grid.
- Z) Sound waves pass through a metal grid.

Toss Up Answer: Z

Bonus: Multiple Choice

An electromagnetic wave has a wavelength that is numerically of the same order of magnitude as the diameter of a nucleus.

In which region of the electromagnetic spectrum does the wave occur?

- W) Gamma ray
- X) X-ray
- Y) Visible light

Z) Infra-red

Bonus Answer: W

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4. Earth and Space Science

Toss Up: Multiple Choice

In oceans, waves and surf current are generated by:

- W) El Nino
- X) salinity and temperature gradients
- Y) the intertropical convergence zone
- Z) wind

Toss Up Answer: Z

Bonus: Multiple Choice

During which of the following geological subdivisions was glaciation minimal on Earth?

- W) Quaternary Period
- X) Holocene Epoch
- Y) Cretaceous Period
- Z) Pleistocene Epoch

Bonus Answer: Y

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5. Chemistry

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?

- 1. SO₂
- 2. CO₂
- 3. OF₂

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

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6. Biology

Toss Up: Multiple Choice

Bottom-heavy age structure diagrams are characteristic of populations in:

- W) Developed countries
- X) Developing countries
- Y) Stable populations
- Z) Populations with high numbers of elderly

Toss Up Answer: X

Bonus: Short Answer

What is the expression for doubling time of a population given that it grows at constant annual rate of $r\%$?

Bonus Answer: $70/r$

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7. Earth and Space Science

Toss Up: Multiple Choice

Which of the following minerals has the highest number on the Mohs hardness scale?

W) Apatite

X) Fluorite

Y) Quartz

Z) Orthoclase

Toss Up Answer: Y

Bonus: Short Answer

What are the three most abundant elements in Earth's crust?

Bonus Answer: Oxygen, Silicon, Aluminum

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8. Chemistry

Toss Up: Short Answer

An ideal gas in a closed inflexible container has a pressure of 6 atmospheres and a temperature of 27°C . What will be the new pressure of the gas if the temperature is decreased to -73°C ?

Toss Up Answer: 4 atmospheres

Bonus: Multiple Choice

When CO_2 is bubbled through distilled water at 25°C , which of the following is most likely to occur?

W) Solid carbon will form

X) The pH of the solution will be reduced

Y) The water will boil

Z) Methane gas will be formed

Bonus Answer: X

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9. Mathematics

Toss Up: Short Answer

What is the slope of the tangent line to $e^{(2x)}$ at $x=3$

Toss Up Answer: $2e^6$

Bonus: Short Answer

What is the slope of the tangent line to $\ln(2x)$ at $x=3$

Bonus Answer: $1/3$

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10. 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

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11. 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)

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12. Chemistry

Toss Up: Short Answer

What is the molecular geometry of ammonia (NH₃)?

Toss Up Answer: Trigonal Pyramidal

Bonus: Multiple Choice

How many lone pairs are in Xenon tetrafluoride (XeF₄)?

- W) 0
- X) 1
- Y) 2
- Z) 3

Bonus Answer: Y

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13. Energy

Toss Up: Short Answer

Cadmium and boron are used in a nuclear reactor to absorb which subatomic particle?

Toss Up Answer: Neutron

Bonus: Short Answer

The electrical resistance of a semiconducting wire is least likely to be reduced by a decrease in which of the following four wire characteristics? Radius, Melting Point, Length, or Temperature?

Bonus Answer: Melting Point

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14. 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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15. Physics

Toss Up: Short Answer

An infinitely long wire carries a current of three amps. How does the magnetic field outside the wire look like?

Toss Up Answer: Circles the wire

Bonus: Short Answer

Iron is what type of magnetic material?

Bonus Answer: ferromagnetic

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16. Chemistry

Toss Up: Multiple Choice

Which is the strongest type of intermolecular force?

W) Hydrogen bonding

X) Dipole-dipole

Y) Van der Waals

Z) Metallic bonding

Toss Up Answer: W

Bonus: Short Answer

By name or number, which of the following elements can form hydrogen bonds?

Oxygen, Chlorine, Fluorine, Nitrogen, Sulfur

Bonus Answer: Oxygen, Fluorine, Nitrogen or (1, 3, and 4)

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17. 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.

Toss Up 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: X

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18. Mathematics

Toss Up: Multiple Choice

Which of the following best characterizes every transcendental number?

W) Irrational

X) A linear combination of e or π in which the coefficients are non-zero

Y) A real number that is not a root of any non-zero polynomial with rational coefficients

Z) e or π

Toss Up Answer: W

Bonus: Short Answer

Which of the following numbers are transcendental numbers: 1) e ; 2) $\sqrt{2}$; 3) i^i ; 4) π ?

Bonus Answer: e , i^i , π [Accept any permutation of 1, 3, and 4]

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19. Biology

Toss Up: Short Answer

What is considered the most unifying concept in biology?

Toss Up Answer: Evolution

Bonus: Multiple Choice

You capture a Pikachu and make it hold a Light Ball. You breed this Pikachu and the resulting Pokemon inherits the move Volt Tackle. This phenomenon of inheriting traits due to the actions of individuals or acquired traits reflects what theory?

W) Darwinian Natural Selection

X) Lamarckian Inheritance

Y) Oak-azaki Fragments

Z) Parental Mimicry

Bonus Answer: X

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20. Chemistry

Toss Up: Short Answer

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

Toss Up 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, tellurium, (polonium)

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21. Earth and Space Science

Toss Up: Multiple Choice

Which of the following are sheet silicates?

- W) Micas and clay minerals
- X) pyroxenees and amphiboles
- Y) olivine and feldspar
- Z) staurolite and quartz

Toss Up Answer: W

Bonus: Multiple Choice

The most common intermediate volcanic rock is

- W) Andesite
- X) Basalt
- Y) Rhyolite
- Z) Diorite

Bonus Answer: W

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22. Chemistry

Toss Up: Multiple Choice

The shape of a PCl_3 molecule is described as

- W) bent
- X) trigonal pyramidal
- Y) linear
- Z) trigonal planar

Toss Up Answer: X

Bonus: Short Answer

Twenty-five percent of element X exists as ^{210}X and 75 percent of it exists as ^{214}X . What is the atomic weight of element X?

Bonus Answer: 211

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23. Physics

Toss Up: Multiple Choice

What German physicist developed the 2nd law of thermodynamics, showing that the universe's entropy always increases?

- W) Wilhelm Röntgen
- X) Rudolf Clausius
- Y) Wilhelm Weber
- Z) Hermann von Helmholtz

Toss Up Answer: X

Bonus: Multiple Choice

What German physicist, who died in 1855, formulated separate electrostatic and electrodynamical laws?

- W) James Clerk Maxwell
- X) Johann Gauss
- Y) Frederick Beck
- Z) Max von Laue

Bonus Answer: X

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24. Biology

Toss Up: Multiple Choice

Which of these does not result in recombinant bacteria?

W) Transformation

X) Insertion

Y) Transduction

Z) Conjugation

Toss Up Answer: X

Bonus: Short Answer

What serves as the vector for bacterial transduction?

Bonus Answer: Virus (accept viruses, phages, bacteriophages)

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25. 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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