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TOSS-UP

- Matitude Mar At 12 198 1) CHEMISTRY Multiple Choice Which of the following is NOT true:
 - W) any foreign substance added to water will cause a freezing point drop
 - X) a nonvolatile solute raises the boiling point of a solvent
- Y) methane has a higher boiling point than ethane Z) freezing point depression. Z) freezing point depression is a colligative property

ANSWER: Y) METHANE HAS A HIGHER BOILING POINT THAN ETHANE

BONUS %

Mylithte start 1) CHEMISTRY Short Answer According to standard chemical nomenclature, what is the formula for aluminum bicarbonate?

ANSWER: $Al(HCO_3)_3$

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TOSS-UP

- 2) BIOLOGY Multiple Choice Which of the following types of biological molecules is digested by trypsin: Ministate 新春·養原 Molitule # # 18 18 Marithus 教育教·養 一樣 Militale Market 18 18
- W) proteins
- X) nucleic acids
- Y) carbohydrates
- Z) lipids

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ANSWER: W) PROTEINS Marithus Mark 18

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BONUS

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Marithus Mark 18 182 2) BIOLOGY Short Answer Name all of the following 4 choices that are typically considered human autoimmune dysfunctions: Rheumatoid arthritis; Lupus; shingles; Down's syndrome ANSWER: RHEUMATOID ARTHRITIS; LUPUS Militate At 18 18 即即相談樂珠·漢條

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- 3) PHYSICS Multiple Choice Which of the following is closest to the radius of a hydrogen nucleus:
- W) 1 micrometer
- X) 1 angstrom
- Z) 1 femtometer

ANSWER: Z) 1 FEMTOMETER

BONUS

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3) PHYSICS *Short Answer* Consider a planet where g equals 5.0 meters per second squared. Ignoring friction, if an object started from rest, how far would it fall and it fall Ignoring friction, if an object started from rest, how far would it fall vertically off a cliff in 4.0 seconds, giving your answer in standard SI units?

ANSWER: 40 METERS (must give units)

(Solution: $d = \frac{1}{2} \times at^2 = \frac{1}{2} \times 5 \times 4^2 = 40$ meters)

TOSS-UP

- 4) MATH Multiple Choice The graph of the relation y = -W) circle

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- X) semi-circle
- Y) parabola
- Z) straight line

ANSWER: X) SEMI-CIRCLE

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BONUS

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4) MATH Short Answer If y varies directly as x and z, and y = 12 when x = 4 and z = 5, find y when x = 10 and z = 20:

ANSWER: 120

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(Solution: y = kxz; 12 = k(4)(5); k = 3/5; y = 3/5(10)(20) = 120)

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5) EARTH SCIENCE Short Answer What is the third most common gas naturally found in the Earth's clean, dry atmosphere?

ANSWER: ARGON

BONUS

- 5) EARTH SCIENCE *Multiple Choice* The Earth's greenhouse effect is primarily caused by which of the following:
- W) incoming solar ultraviolet light is absorbed by the ozone layer
- X) outgoing infrared solar radiation is trapped by the lower atmosphere Y) incoming infrared solar radiation is trapped by the magnetic field

 Z) outgoing X-rays are absorbed to the magnetic field

 - Z) outgoing X-rays are absorbed by the troposphere and reflected to the Earth's surface

ANSWER: X) OUTGOING INFRARED SOLAR RADIATION IS TRAPPED BY THE LOWER **ATMOSPHERE**

TOSS-UP

- 6) GENERAL SCIENCE Multiple Choice Ed the entomologist is setting up mosquito traps in a farmer's field in Nebraska. Which of the following would be the BEST mosquito attractant to Mulitute ## # 18 ensure he traps the greatest number and variety of mosquitoes:
- W) oxygen

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- X) nitrogen
- Y) dry ice
- Z) methane

ANSWER: Y) DRY ICE

(Solution: mosquitoes attracted to CO₂)

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BONUS

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6) GENERAL SCIENCE Short Answer Rounded to the nearest whole number, convert 3,000 meters per second into kilometers per hour:

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ANSWER: 10,800

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- 7) ASTRONOMY Multiple Choice Which of the following is LEAST accurate:
- W) most stars visible to the unaided eye are part of the Milky Way galaxy
- X) there are 88 constellations officially recognized by the IAU
- Y) a red supergiant has a hotter surface than our Sun
- Z) the constellation Leo is located within 9° of the ecliptic

ANSWER: Y) A RED SUPERGIANT HAS A HOTTER SURFACE THAN OUR SUN

BONUS

- 7) ASTRONOMY Multiple Choice Which of the following is NOT true:
- W) the core of a red supergiant is hotter than the core of a main sequence K-type star
- X) helium flash is something that occurs in red giant stars
- Y) the Pleiades is an open star cluster
- Z) there is more lithium than carbon in the universe

ANSWER: Z) THERE IS MORE LITHIUM THAN CARBON IN THE UNIVERSE

TOSS-UP

- 8) CHEMISTRY *Multiple Choice* Carbon monoxide, or CO, will be adsorbed (read as: ADD-sorbed) onto the surface of which of the following metals the MOST strongly:
- W) iron

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- X) nickel
- Y) cobalt
- Z) gold

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ANSWER: W) IRON

BONUS

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8) CHEMISTRY Short Answer Arrange the following 3 choices in order of increasing bond energies: O_2 ; N_2 ; F_2

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ANSWER: F_2 ; O_2 ; N_2

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Mistitute And	9) BIOLOGY active:	Multiple Choice	At which o	of the following pl	H levels will human	pepsin be most

W) 2

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X) 4₂

Y) 6

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ANSWER: W) 2

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BONUS

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9) BIOLOGY *Short Answer* What is the most plentiful class of immunoglobulins in human plasma?

ANSWER: IgG (ACCEPT: G or IMMUNOGLOBULIN G)

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TOSS-UP

10) PHYSICS Short Answer What constant is given as the amount of electric charge per mole of electrons?

ANSWER: FARADAY CONSTANT (ACCEPT: FARADAY)

BONUS

10) PHYSICS Multiple Choice Which of the following best describes the direction of the force on an electron moving through a magnetic field: Maritule Mark 18 182 面的加州

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- W) opposite to the direction of the velocity
- X) the same direction as the velocity
- Y) the same direction as the magnetic field
- Z) perpendicular to the magnetic field

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Maritale Mark 18 18 ANSWER: Z) PERPENDICULAR TO THE MAGNETIC FIELD Milliante Am Ax 38

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- 11) MATH *Multiple Choice* Which of the following is a second quadrant angle in standard position:
- W) 500°
- $X) -180^{\circ}$
- Y) -680°
- Z) 930°

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ANSWER: W) 500°

BONUS

11) MATH *Short Answer* Giving your answer in simplest radical form, rationalize the denominator of the following expression: $\frac{-3\sqrt{2}}{(\sqrt{3}-\sqrt{5})}$

ANSWER: $\frac{3\sqrt{6} + 3\sqrt{10}}{2}$ (ACCEPT: $\frac{3}{2}(\sqrt{6} + \sqrt{10})$)

TOSS-UP

- 12) EARTH SCIENCE *Multiple Choice* Which of the following minerals occurs in small amounts in many igneous rocks, is black and shiny, often occurs in small hexagonal blocks, and is soft with good cleavage:
 - W) biotite
 - X) olivine
 - Y) plagioclase
 - Z) quartz

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ANSWER: W) BIOTITE

BONUS

- 12) EARTH SCIENCE Multiple Choice Which of the following is NOT true of basalt and gabbro:
- W) they formed from magma at the same temperature
- X) they are derived from basaltic magma
- Y) they formed from magma with the same silica content
- Z) they are both intrusive igneous rocks

ANSWER: Z) THEY ARE BOTH INTRUSIVE IGNEOUS ROCKS

(Solution: basalt = extrusive; gabbro = intrusive)

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- 13) GENERAL SCIENCE Multiple Choice A standard rain gauge consists of a metal canister open at the top in which a funnel drains rainwater into a narrow cylinder. Each time they are deployed to the field, a small amount of light oil is added to the cylinder. This is done to:
- W) deter birds from drinking the water
- X) stop the canister from oxidizing
- Y) prevent the growth of blue-green algae
 - Z) prevent water evaporation

ANSWER: Z) PREVENT WATER EVAPORATION

BONUS 1/2

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13) GENERAL SCIENCE Multiple Choice Which of the following is a widely-used analgesic and antipyretic medication which is not considered an NSAID (read as: en-say'd):

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- W) acetylcysteine
- X) acetaminophen
- Y) acetylsalicylic acid
 Z) ihupropl

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ANSWER: X) ACETAMINOPHEN

TOSS-UP

- Maritha An 14 13 18 14) ASTRONOMY Multiple Choice Which of the following is LEAST likely to occur for a stargazer observing from mid-northern latitudes during summer months:
 - 加加斯林安學 W) the planet Venus passing within a few degrees of the Moon a few hours after sunset
 - X) the Moon at perigee
 - Y) the planet Saturn passing with 5 degrees of the Moon
 - Z) the planet Mercury within 10 degrees of the zenith

ANSWER: Z) THE PLANET MERCURY WITHIN 10 DEGREES OF THE ZENITH

BONUS

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面的抽物物料接触 14) ASTRONOMY *Short Answer* Through how many degrees does the Earth rotate in 8 hours?

ANSWER: 120

(Solution: 15° per hour $= 8 \times 15^{\circ} = 120^{\circ}$)

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- 15) CHEMISTRY Multiple Choice The molal (read as: moe-lahl) is a concentration unit that is most appropriately used in experimental designs that determine:
- W) freezing point depression
- X) osmotic pressure
- Y) density
- Z) vapor pressure lowering

ANSWER: W) FREEZING POINT DEPRESSION

BONUS

15) CHEMISTRY Short Answer A 4.0 gram sample of calcium chloride contains 6.0×10^{22} cations. Giving your answer in scientific notation. cations. Giving your answer in scientific notation to the nearest whole number, determine the number of anions in 2 grams of CaCl₂. Assume the atomic mass of calcium is 40 and chloride is 35.

ANSWER: 6×10^{22}

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(Solution: $(2g \, CaCl_2)(6.0 \times 10^{22} \, Ca^{2+}/4g \, CaCl_2)(2 \, Cl^{-}/1 \, Ca^{2+}) = 6.0 \times 10^{22}$

TOSS-UP

- antibiotic penicillin: 16) BIOLOGY *Multiple Choice* Which of the following is the main target of bacteria by the
 - W) energy production
 - X) DNA synthesis
 - Y) cell wall synthesis
 - Z) translation

ANSWER: Y) CELL WALL SYNTHESIS

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BONUS

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16) BIOLOGY Short Answer What is the most common term for the form of protection when a non-poisonous frog has the same appearance as a poisonous frog?

ANSWER: BATESIAN MIMICRY (ACCEPT: MIMICRY or WARNING MIMICRY) (DO NOT ACCEPT: MULLERIAN MIMICRY)

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- 17) PHYSICS Multiple Choice During positron emission, which of the following most likely occurs:
- W) a proton changes to an electron
- X) a proton changes to a neutron

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- Y) a neutron changes to an electron
- Z) a neutron changes to a proton

ANSWER: X) A PROTON CHANGES TO A NEUTRON

BONUS

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17) PHYSICS *Short Answer* Name all of the following 4 isotopes that release energy if they undergo fission: helium-4; hydrogen-2: uranium-235: iron 56

ANSWER: URANIUM-235

TOSS-UP

18) MATH Short Answer Identify the type of conic section represented by the equation, $x^2 + y^2 + 10y + 16 = 0$:

(Solution: $x^2 + (y+5)^2 = 9$)

BONUS

18) MATH Short Answer Find the area, in centimeters squared and in simplest radical form, of a regular or equilateral triangle whose circumcircle has a radius of 8 centimeters:

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ANSWER: $48\sqrt{3}$

(Solution: apothem = 4; perimeter = $(8\sqrt{3})(3)$; $A = \frac{1}{2}(4)(24\sqrt{3}) = 48\sqrt{3}$ cm²) Auti Militalia 新来考察 Maitata Star 14 13 192

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Milling 新菜菜家 19) EARTH SCIENCE Short Answer What type of fog frequently forms in valleys when the wind is light and the ground cools until the dew point is reached?

ANSWER: RADIATION FOG (ACCEPT: RADIATION or RADIATIONAL)

(Solution: brought about by radiational cooling)

BONUS

19) EARTH SCIENCE Short Answer Giving your answer as morning, afternoon, evening, or night, when does most radiational cooling occur for any location in the U.S.?

ANSWER: NIGHT

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TOSS-UP

20) GENERAL SCIENCE Short Answer What is the sling psychrometer used to measure?

ANSWER: HUMIDITY (ACCEPT: RELATIVE HUMIDITY; AMBIENT HUMIDITY)

BONUS

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- 20) GENERAL SCIENCE *Multiple Choice* From which of the following is camphor derived:
- W) petroleum distillate
- X) the wood of an evergreen tree of the laurel family
- Y) the bark of a fir tree from the Mediterranean
- Z) the seed pod of the camphor herb

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ANSWER: X) THE WOOD OF AN EVERGREEN TREE OF THE LAUREL FAMILY

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21) ASTRONOMY Short Answer As seen from the Earth, what planet has the smallest maximum eastern elongation?

ANSWER: MERCURY

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BONUS 18

21) ASTRONOMY Short Answer Choosing from noon, sunset, midnight or sunrise, at what time of the day does a new Moon rise for an observer at mid-northern latitudes in September?

ANSWER: SUNRISE

TOSS-UP

22) CHEMISTRY Short Answer What is the electron capacity in each of the 4 sublevels s, p, d, and f, respectively? Marithus 教育教士等序系

ANSWER: s = 2; p = 6; d = 10; f = 14

BONUS

22) CHEMISTRY Short Answer A sample of oxygen gas is collected over water at 14°C. Knowing that the vapor pressure of water at 14°C is 1.6 kilopascals, and that the pressure of the resultant mixture is 120 kilopascals, find the pressure, to the first decimal place, exerted by the dry oxygen alone:

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ANSWER: 118.4

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(Solution: $P_{dry} = P_t - P_{wv} = 120 \text{ kPa} - 1.6 \text{ kPa} = 118.4 \text{ kPa}$) Mylithite Mark Ar &

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23) BIOLOGY Short Answer What cell in the peripheral blood is the immediate precursor of the macrophage?

ANSWER: MONOCYTE

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BONUS 3

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ANSWER: NEUTROPHIL; BASOPHIL

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TOSS-UP

24) PHYSICS Short Answer As opposed to spontaneous emission, what is the type of emission, first theorized by Albert Einstein, where a photon interacts with an atom's electron which, when it returns to a ground state, emits a coherent photon?

ANSWER: STIMULATED EMISSION (ACCEPT: STIMULATED)

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temperature to the one with the HIGHEST temperature: copper freezes; water boils: solar correct. 24) PHYSICS Short Answer Order the following 4 choices from the one with the LOWEST

ANSWER: WATER BOILS; LEAD MELTS; COPPER FREEZES; SOLAR CORONA

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TOSS-UP 25) MATH Short Answer Simplify i^{17} (read as: i to the 17^{th} power):

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(Solution: $i^{17} = i^1 = i$) Joseph Marine

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BONUS25) MATH *Short Answer* Solve the following equation for x: $2^7 \times 2^{(x^2-2)} = 2^{21}$ ANSWER: $4 \text{ OR } -4 \text{ (ACCEPT: } x = \pm 4 \text{)}$

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(Solution: $7 + x^2 - 2 = 21$; x = 4 and -4)

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