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#### TOSS-UP

Matinta Mar ph ' 18 PR Mailing # # 18 1) BIOLOGY Short Answer What is the common name for the 27-carbon lipid whose synthesis is in part regulated by HMG CoA (read as: H, M, G, koh, A) reductase and is the basic starting point Mythun 新春春等 % Militally 教教教学 for estrogen synthesis?

ANSWER: CHOLESTEROL

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### **BONUS**

- 1) BIOLOGY *Multiple Choice* Which of the following is NOT true regarding ribosomes:
- W) they are about 20 nanometers in diameter X) eukaryotic ribosomes are all 1 X) eukaryotic ribosomes are slightly larger than prokaryotic ribosomes
  - Y) mitochondrial ribosomes have 40S (read as: forty S) small subunits
  - Z) they are found in chloroplasts

柳紫紫紫紫 ANSWER: Y) MITOCHONDRIAL RIBOSOMES HAVE 40S SMALL SUBUNITS

#### **TOSS-UP**

- 2) CHEMISTRY Multiple Choice Which of the following has a melting point of 185°C and readily Mylithia Mark 18 18 Mylithe \*\* \*\* dissolves in water at room temperature, but is NOT an electrolyte:
- W) NaCl
- X) decane
- Y) methane
- Z) sucrose

ANSWER: Z) SUCROSE

### **BONUS**

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2) CHEMISTRY Short Answer Give the systematic chemical name for the following ionic Militate Market 18 182 Mulitute of the state of the st compound:  $Cr_2(SeO_4)_3$ 

ANSWER: CHROMIUM(III) SELENATE

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- TOSS-UP

  3) PHYSICS Multiple Choice Which of the following BEST describes the Balmer series:
  - W) a series of quantum numbers indicating certain energy levels
  - X) hydrogen atom spectral line emission
  - Y) a sequence of elements that are produced chronologically in supernovae
  - Z) the energy spectrum of the early universe

ANSWER: X) HYDROGEN ATOM SPECTRAL LINE EMISSION

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#### **BONUS**

force would the top quark decay? 3) PHYSICS Short Answer According to the Standard Model of Particle Physics, through what

ANSWER: WEAK FORCE (ACCEPT: WEAK or WEAK INTERACTION)

Imhiting 紫绿绿绿 4) MATH Short Answer Express 600° in radians as a reduced fraction in terms of  $\pi$ :

ANSWER:

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#### **BONUS**

Marithe Mar Nr 18 198 withthe 新林·涛 PR 4) MATH Short Answer Giving your answers in terms of  $\pi$  and in inches squared, find the total surface area of a closed right circular cone whose altitude is 8 inches and radius is 6 inches:

ANSWER: 96π

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(Solution:  $l^2 = 8^2$  $+6^2$ , l = 10 in; LSA =  $\pi r l = \pi(6)(10) = 60\pi$ ; SA = LA + B =  $60\pi + \pi(6)^2 = 96\pi$  in<sup>2</sup>)

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- 5) EARTH SCIENCE *Multiple Choice* Which of the following is the single most important factor that generally sets a northern limit to tree growth, such as in the areas of transition between taiga and tundra in Alaska:
- W) high-winter winds
- X) lack of summer warmth
- Y) lack of spring moisture
  - Z) lack of soil nutrients

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ANSWER: X) LACK OF SUMMER WARMTH

## BONUS 1/2 W

- 5) EARTH SCIENCE Multiple Choice Which of the following is NOT true of an El Nino:
- W) when an El Nino is present, fish are less abundant off the west coast of South America
- X) El Ninos typically come along every 4 to 5 years
- Y) during a peak El Nino, strong high pressure will be present in the eastern Pacific with lower pressure to the west
  Z) FI N:--
  - Z) El Nino affects global weather patterns

ANSWER: Y) DURING A PEAK EL NINO, STRONG HIGH PRESSURE WILL BE PRESENT IN THE EASTERN PACIFIC WITH LOWER PRESSURE TO THE WEST

(Solution: during peak strong high pressure is in the western Pacific with lower pressure to the east, setting up an easterly wind flow)

#### **TOSS-UP**

6) GENERAL SCIENCE *Short Answer* Pitchblende is one of the main ores of what element?

ANSWER: URANIUM

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#### **BONUS**

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6) GENERAL SCIENCE Short Answer Order the following 3 temperature values from the COOLEST to the WARMEST: 32°C; 85°F; 310 K

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ANSWER: 85°F; 32°C; 310 K

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- 7) ASTRONOMY Multiple Choice The BEST explanation of why population I (read as: one) stars have a higher proportion of elements beginning the start of the start have a higher proportion of elements heavier than helium than population II (read as: two) stars, is because Population I stars are:
  - W) younger than population II stars
  - X) older than population II stars
- Y) usually closer to planetary nebula than population II stars

  7) often found poor II I
  - Z) often found near H-I (read as: H, one) regions

ANSWER: W) YOUNGER THAN POPULATION II STARS

7) ASTRONOMY Short Answer How many sidereal minutes are in 7.5 sidereal hours?

ANSWER: 450

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#### **TOSS-UP**

- 8) BIOLOGY Multiple Choice Which of the following is NOT true of globular proteins in mammals:
- W) most are soluble in water
- X) some serve as transport molecules in the plasma
- Y) plasma enzymes typically have an optimal operating pH of about 6.8 to 7.0

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Z) most protein hormones are globular

ANSWER: Y) PLASMA ENZYMES TYPICALLY HAVE AN OPTIMAL OPERATING PH OF ABOUT 6.8 TO 7.0

#### **BONUS**

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8) BIOLOGY Short Answer During photorespiration, the plant enzyme RuBisCO (read as: rue-BIS-ko) will bind what molecular substance rather than carbon dioxide? Mylitate the 14 18 Unitate the the light of the li 

ANSWER: OXYGEN (ACCEPT: O<sub>2</sub>)

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- 9) CHEMISTRY Multiple Choice Which of the following is a substance whose molecular and empirical formulas are NOT the same:
- W) benzene
- X) water

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- Y) ammonia
- Z) sulfur dioxide

ANSWER: W) BENZENE

#### **BONUS**

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- 9) CHEMISTRY *Multiple Choice* Which of the following is a molecule with a square pyramidal molecular geometry around its central atom:
  - W) PCl<sub>5</sub>
  - X) ClF<sub>5</sub>
  - Y) XeF<sub>4</sub>
- Z) SF<sub>6</sub>

ANSWER: X) CIF<sub>5</sub>

(Solution:  $PCl_5$  = trigonal bipyramidal;  $XeF_4$  = square planar;  $SF_6$  = octahedral)

#### **TOSS-UP**

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- 10) PHYSICS Multiple Choice Which of the following has the lowest refractive index at STP:
- W) diamond
- X) water
- Y) dry air
- Z) a perfect vacuum

ANSWER: Z) A PERFECT VACUUM

## **BONUS**

10) PHYSICS Short Answer Rounded to the nearest hundred joules, how much work is done in pulling a sled across a pond for 3 meters with 100 newtons of force, with a rope that makes a 45° angle with the pond? slithte 横林 · 漢 「死

ANSWER: 200

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(Solution:  $w = F \times d \times \cos \text{ angle} = 100N \times 3 \text{ m} \times 0.7071 = 212.13$ )

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11) MATH Short Answer Find the center of the circle given by the following equation:  $x^2 + y^2 + 4x + 16y + 3 = 0$ 

ANSWER: (-2, -8)

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## **BONUS**

11) MATH Short Answer What are the coordinates of the vertex in the graph of the following equation:  $y = 4x^2 + 8x - 5$ 

ANSWER: (-1, -9)

#### **TOSS-UP**

- sedimentary rock that is made primarily of microcrystalline quartz: 12) EARTH SCIENCE Multiple Choice Which of the following is a fine-grained silica-rich
  - W) shale
  - X) potash
  - Y) dolostone
  - Z) chert

ANSWER: Z) CHERT

#### **BONUS**

- 12) EARTH SCIENCE Multiple Choice Which of the following is a foliated metamorphic rock composed of very fine-grained mica:
- W) marble
- X) phyllite
- Y) quartzite
- Z) schist

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ANSWER: X) PHYLLITE

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(Solution: marble = non-foliated; quartzite = non-foliated; schist = well-developed foliation)

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- 13) GENERAL SCIENCE Multiple Choice The largest deposits of diatomite, or diatomaceous earth, are typically found in which of the following regions of the U.S.:
- W) western
- X) eastern

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- Z) southern

ANSWER: W) WESTERN

(Solution: most formed in shallow lakes and marine environments)

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#### **BONUS**

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13) GENERAL SCIENCE Multiple Choice Diatomite, or diatomaceous earth, is readily available in the U.S. and is used primarily for which of the following functions:

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- X) crushed stone
  Y) filter W) soil improvement

  - Z) lubricant

ANSWER: Y) FILTERING AGENT

### **TOSS-UP**

- Maritule And At 13 18 14) ASTRONOMY Multiple Choice Which of the following is closest to the range for the Balmer series: Militate Mr. # 18 180 Militate ## # 18 18
- W) microwave
- X) infrared through UV
- Y) UV to soft x-ray
- Z) visible light to UV

ANSWER: Z) VISIBLE LIGHT TO UV

### **BONUS**

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Millite Mit H. is fin 14) ASTRONOMY Short Answer Choosing from upper right, lower right, lower left, and upper left, in what area of the Hertzsprung Russell diagram will the Sun end its life? ANSWER: LOWER LEFT Willing the 14 th 18 th Astitute to the is the

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- 15) BIOLOGY *Multiple Choice* Which of the following is most directly responsible for the colloid osmotic pressure in humans that acts to retain fluid in the vascular system:
- W) albumin
- X) sodium ions
- Y) calcium ions
- Z) potassium ions

ANSWER: W) ALBUMIN

#### **BONUS**

- 15) BIOLOGY *Multiple Choice* Which of the following is NOT true of the most common form of DNA:
  - W) it is a right-handed helix
  - X) it has 3.4 nanometers between each successive nucleotide base of the same strand
  - Y) the strands are considered anti-parallel
  - Z) each strand has a 3-prime phosphate and a 5-prime hydroxyl at opposite ends

ANSWER: Z) EACH STRAND HAS A 3-PRIME PHOSPHATE AND A 5-PRIME HYDROXYL AT OPPOSITE ENDS

#### **TOSS-UP**

- 16) CHEMISTRY Multiple Choice An organic compound with the formula  $C_6H_{14}$  is an:
  - W) alkane

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- X) alkene
- Y) alkyne
- Z) arene

ANSWER: W) ALKANE (Solution: alkanes =  $C_nH_{2n+2}$ )

#### **BONUS**

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- 16) CHEMISTRY *Multiple Choice* Which of the following gases has the highest effusion rate through a pinhole opening from one compartment to another and at room temperature:
- W) argon
- X)  $CO_2$
- Y) SO<sub>2</sub>
- Z) helium

ANSWER: Z) HELIUM

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- 17) PHYSICS Multiple Choice Which of the following did J. J. Thompson use that primarily led him to conclude that electrons were basic particles of atoms and carried electric charge:
- W) a compass and batteries
- X) a solenoid
- Y) cathode ray tubes
- Z) electromagnets

ANSWER: Y) CATHODE RAY TUBES

#### **BONUS**

17) PHYSICS Short Answer Consider a satellite that is a uniform sphere rotating about its axis. What is its moment of inertial giving your answer is acients. squared, if it has a mass of 10,000 kilograms and a diameter of 200 meters?

ANSWER:  $4 \times 10^7$ 

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Y.

(Solution:  $I = (2/5)(10,000 \text{ Kg})(100\text{m})^2 = 40,000,000 \text{ kg.m}^2$ )

#### **TOSS-UP**

18) MATH Short Answer For the function  $f(x) = \frac{1}{x}$ , what is f'(5) (read as: f prime of 5)?

(Solution:  $f'(5) = \frac{-1}{5^2} = \frac{-1}{25}$ )

#### **BONUS**

18) MATH Short Answer An object is launched straight up from the ground with an initial velocity of 176 feet per second. What is the height of the object above the ground, in feet, 2 seconds into the flight?

ANSWER: 288

(Solution:  $P(t) = -16t^2 + 176t$ ; P(2) = -16(4) + 352 = 288 ft) Tati

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- 19) EARTH SCIENCE *Multiple Choice* Meteorologists think of wind as circulation patterns which are divided into 4 "scales of motion". A land-breeze circulation is grouped into which of the following categories:
- W) mesoscale

Y.

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Y.

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- Y) medium scale
  7)

ANSWER: X) MICROSCALE

## BONUS 1/4

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19) EARTH SCIENCE Multiple Choice If the air temperature is 0°F and the wind speed is 10 miles per hour, which of the following is closest to the wind chill, in degrees Fahrenheit:

W) 10

X) 0

Y) -10

ANSWER: Z) -20

### **TOSS-UP**

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Marithta Mar # 13 198 20) GENERAL SCIENCE Multiple Choice Which of the following anthropogenic air pollutants is the major contributor to reduced visibility in most regions of the U.S., excluding fires and dust:

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- W) elemental carbon «
- X) hydrogen sulfide
- Y) sulfate particles
- Z) lead

ANSWER: Y) SULFATE PARTICLES

## **BONUS**

Myjitute 精 株 溪 溪 20) GENERAL SCIENCE Short Answer What is the most common name for the edible vegetable oil that is derived from cultivars of rapeseed plants and is low in erucic acid?

Unitate the 14 th 18 th ANSWER: CANOLA OIL (ACCEPT: CANOLA) Militate At H

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21) ASTRONOMY Short Answer Giving your answer in decimal form, what would the "Z" value be if a distant celestial object were shifted towards longer wavelengths by 40% of the original wavelength?

ANSWER: 0.4

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#### **BONUS**

21) ASTRONOMY *Short Answer* If a planet had an orbital period of 11.2 years, what is the length of its orbital semi-major axis, in astronomical units rounded to the nearest whole number?

ANSWER: 5

(Solution:  $d^3 = p^2$ ;  $d^3 = (11.2)^2$ ;  $d^3 = 125.4$ ; d = 5)

#### TOSS-UP

22) BIOLOGY *Short Answer* Name all of the following 3 choices that are chemoautotrophs: *Nitrosomonas* (read as: nitro-so-MOAN-us) *Paramecium*: Volume

ANSWER: NITROSOMONAS

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22) BIOLOGY Short Answer From what vitamin is the electron carrier FAD (read as: F, A, D) derived?

ANSWER: RIBOFLAVIN (ACCEPT: VITAMIN B2) Military Market & PR Militate At 18 18 Inditute 紫 林 溪 W

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23) CHEMISTRY *Short Answer* Name all of the following 3 concentration units that are temperature-dependent: molal (read as: moe-LAHL); molarity; normality

ANSWER: MOLARITY; NORMALITY

# BONUS

23) CHEMISTRY *Short Answer* Calculate the enthalpy of vaporization, in kilojoules, of water at 25°C and 1 atmosphere. Assume the standard enthalpy of formation of liquid water is –286 kilojoules and the standard enthalpy of formation of water gas is –242 kilojoules:

ANSWER: 44

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(Solution:  $\Delta H^{\circ}_{reaction} = \Sigma n_p \Delta H_f^{\circ}(products) - \Sigma n_r \Delta H_f^{\circ}(reactants) = [-242 - (-286) = +44.0 \text{ kJ})$ 

#### **TOSS-UP**

24) PHYSICS *Short Answer* What was the most sensitive device Coulomb used to measure the electric forces between pith balls?

ANSWER: TORSION BALANCE

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#### BONUS

24) PHYSICS *Short Answer* Order the following 3 choices from the MOST penetrating through a thin sheet of cardboard to the LEAST: beta rays; alpha rays; x-rays

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ANSWER: X-RAYS; BETA RAYS; ALPHA RAYS

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25) BIOLOGY Short Answer What is the most common name for the histone octamer used in the coiling and packing of DNA and regulation of gene expression?

ANSWER: NUCLEOSOMES

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# BONUS 1/3

Marithe Mar H 13 198 25) BIOLOGY *Short Answer* Name all of the following 4 organelles that are bounded by a double membrane: nucleus; mitochondrion; lysosome; chloroplast

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motitud # \*\* \*\* ANSWER: NUCLEUS; MITOCHONDRION; CHLOROPLAST

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(ACCEPT: ALL BUT LYSOSOME) lingitude of the

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