**TOSS UP**

1. BIOLOGY *Multiple Choice* You are walking outside when you spot a haleakala silversword, scientific name argyroxipium sandwicense. Which of the following locations could you be at?  
   W) the island of Maui

X) Grand Canyon

Y) Yellowstone National Park

Z) Yosemite National Park   
ANSWER: W) the island of Maui

**BONUS**

1. BIOLOGY *Short Answer* Commonly occurring after mass extinctions, what term describes periods of change in which groups of organisms form many new species whose adaptations allow them to fulfill many niches which have been vacated?ANSWER: adaptive radiations

**TOSS UP**

1. PHYSICS *Multiple Choice* A converging mirror with radius of curvature 50 cm has an object placed in front of it. At which of the following distances from the mirror could the object be placed such that the image produced is larger than the object itself and upright?W) 60 cm

X) 30 cm

Y) 25 cm

Z) 10 cmANSWER: Z) 10 cm

**BONUS**

1. PHYSICS *Short Answer* What is the lateral magnification of an object produced by a convex lens with a focal length of 10 cm if the object is placed 20 cm away?ANSWER: -1

**TOSS UP**

1. CHEMISTRY *Multiple Choice* A mixture of octane and air at room temperature is

W) thermodynamically and kinetically stable

X) thermodynamically unstable but kinetically stable

Y) thermodynamically stable but kinetically unstable

Z) thermodynamically and kinetically unstalbe  
ANSWER: Y) thermodynamically stable but kinetically unstable

**BONUS**

1. CHEMISTRY *Multiple Choice* In which of the following solutions would imine formation take place the fastestW) pure water

X) a 0.0001 M HCl solution

Y) a 0.0001 M NaOH solution

Z) pure benzeneANSWER: X) a 0.0001 M HCl solution

**TOSS UP**

1. EARTH AND SPACE SCIENCE *Multiple Choice* The Pleiades, also known as M45 or the seven sisters, is an example of aW) globular cluster

X) open cluster

Y) closed cluster

Z) OB associationANSWER: X) open cluster

**BONUS**

1. EARTH AND SPACE SCIENCE *Short Answer* Currently, the bright star Sirius marks the position of the North Celestial Pole. However, due to the precession of the earth's axis of rotation, it has not always been centered on the Earth's celestial pole. Also misleadingly known as Alpha Draconis, what star is historically significant as having been the pole star during ancient times. ANSWER: Thuban

**TOSS UP**

1. MATH *Short Answer* The area of a rhombus is 20 square inches. If the length of one diagonal is 5 inches, what is the length of the other diagonal?  
     
   ANSWER: 8 inches

**BONUS**

1. MATH *Short Answer* Given two real numbers, p and q which are both greater than one, if 1/p plus 1/q equals 1 and p times q equals 4, what is q? Give your answer as a radical in simplest form. ANSWER: 2 + sqrt (3)

**TOSS UP**

1. ENERGY *Multiple Choice* Click here to enter text.ANSWER: Click here to enter text.

**BONUS**

1. ENERGY *Short Answer* Click here to enter text.ANSWER: Click here to enter text.

**TOSS UP**

1. BIOLOGY *Short Answer* Identify the following muscle tissue described as follows: striated, involuntary, fibers which branch and interconnect via intercalated disks.  
     
   ANSWER: caridiac

**BONUS**

1. BIOLOGY *Short Answer* By name or number, identify all of the following three marine animals which possess a countercurrent exchange1. great white shark

2. largemouth bass

3. bluefin tunaANSWER: 1 and 3

**TOSS UP**

1. PHYSICS *Short Answer* What is the equivalent capacitance of 3 capacitors in parallel with capacitances of 1, 2, and 3 microfarads, in mircofareds? ANSWER: 6 microfareds

**BONUS**

1. PHYSICS *Short Answer* By name or number, identify all of the following 3 choices which will increase the final charge on the plates of a capacitor in a RC circuit delivering constant voltage.1. increasing the resistance of the resistor

2. increasing the voltage of the battery

3. increasing the capacitance of the capacitorANSWER: 2 and 3

**TOSS UP**

1. CHEMISTRY *Short Answer* The alkaline hydrolysis of esters into carboxylate salts is known as what process, which can be used to make glycerol and is utilized in wet chemical extinguishers used to put out cooking fats and oils?  
     
   ANSWER: saponification

**BONUS**

1. CHEMISTRY *Short Answer* What product results from the reaction of an ester with a Gringard reagant or organolithium?ANSWER: TERTIARY ALCOHOL

**TOSS UP**

1. EARTH AND SPACE SCIENCE *Short Answer* Identify the mineral with chemical structure CaCO3, which is one of the most abundant minerals in the earth's crust and forms the major constituent of limestonesANSWER: calcite

**BONUS**

1. EARTH AND SPACE SCIENCE *Short Answer* What mineral of the discontinuous portion of Bowens reaction series has a structure consisting of double chains of silicon tetradedra, with two cleavage planes at 60 degrees and 120 degrees to each other?ANSWER: amphibole

**TOSS UP**

1. MATH *Short Answer* What number can be subtracted from both the numerator and denominator of 19/24 such that the resulting fraction is equivalent to 3/4?  
     
   ANSWER: 4

**BONUS**

1. MATH *Short Answer* Give the domain of the function f(x) equals 1/(x^2 + 3x + 3)ANSWER: all reals

**TOSS UP**

1. ENERGY *Short Answer* Two lightbulbs are wired in parallel. By name or number, identify all of the following 3 actions which will increase the brightness of both of the two bulbs.1. wiring another bulb in parallel

2. wiring another bulb in series

3. adding a section of wire in parallel such as to cause a short circuitANSWER: 1 only

**BONUS**

1. ENERGY *Short Answer* What is the maximum load a 40g mouse can lift if it stands on a platform with an area of 20 square centimeters, given that the load rests on a platform with an area of 1 square meter? Give your answer in kilograms ANSWER: 20 kilograms

**TOSS UP**

1. BIOLOGY *Multiple Choice* Which of the following anibodies are found only in mammals, confer immunity to parasites such as parasitic worms, and play a role in allergic responses?  
   W) IgA

X) IgD

Y) IgE

Z) IgG  
ANSWER: Y) IgE

**BONUS**

1. BIOLOGY *Short Answer* Match the following three leukocytes with their correct description. A. neutrophil B. lymphocyte C. basophil1. make up the majority of white blood cells in adults, mainly target bacteria and fungi

2. release histamine for inflammatory responses, susceptible to staining by alkaline dyes

3. includes B, T, and natural killer cells, identifiable by their large nucleus

ANSWER: 1. a (neutrophil) 2. C (basophil) 3. B (lymphocyte)

**TOSS UP**

1. PHYSICS *Multiple Choice* By name or number, identify all of the following three quantities which increase for a clock moving at relativistic velocities if its movement is perpendicular to the clock face1. time between ticks as seen by a stationary observer

2. thickness of the clock's frame

3. radius of the clockANSWER: 1 only

**BONUS**

1. PHYSICS *Short Answer* A spaceship traveling at 0.8c has a large analog clock mounted on the side. To a stationary observer who times the ticks, how many seconds does it take for the clock's second hand to move? Give your answer to two significant figures.ANSWER: 1.7

**TOSS UP**

1. CHEMISTRY *Short Answer* In the reaction between boron trifluoride and trimethylamine, what element acts as the electrophile?  
     
   ANSWER: boron

**BONUS**

1. CHEMISTRY *Short Answer* What is the most common decomposition reaction in which a sigma bond can break in an organic reaction, with the leaving group taking both electrons from the original sigma bond.

ANSWER: heterolytic fission

**TOSS UP**

1. EARTH AND SPACE SCIENCE *Short Answer* During the early Triassic period, Pangaea was mostly assembled. What large ocean, ancestor to the Pacific surrounded Pangaea on all sides, whose name is Greek for "all seas"?  
   ANSWER: panthalassa

**BONUS**

1. EARTH AND SPACE SCIENCE *Multiple Choice* In which of the following locations could you find rocks with columnar jointing due to the contraction of cooling basalt?W) Giant's Causeway

X) Ural Mountains

Y) Grand Canyon

Z) Channeled ScablandsANSWER: W) Giant's Causeway, North Ireland

**TOSS UP**

1. MATH *Short Answer* What is the ratio of the measure of the supplement of a 30 degree angle to the measure of the complement of a 30 degree angle? Give your answer as an improper fraction in simplest form.   
     
   ANSWER: 5/3

**BONUS**

1. MATH *Short Answer* Rectangle ABCD is bisected into two parts by line segment ED, where E lies on side AB and D lies on side CD. Quadrilateral AEFD is a square, whose enclosed area is 1/4 that of the original rectangle. What is the ratio of the perimeter of rectangle ABCD to the perimeter of square AEFD? Express your answer as an improper fraction in lowest terms. ANSWER: 5/2

**TOSS UP**

1. ENERGY *Multiple Choice* The majority of the US's energy in 2007 was used forW) residential and commercial consumption

X) the generation of electricity

Y) transportation

Z) industrial productionANSWER: X) the generation of electricity

**BONUS**

1. ENERGY *Multiple Choice* In 2007, the US consumed roughly how many BTUs of energy?W) 94.9 million

X) 94.9 billion

Y) 94.9 trillion

Z) 94.9 quadrillionANSWER: Z) 94.9 quadrillion

**TOSS UP**

1. BIOLOGY *Multiple Choice* Which of the following organisms contains a nervous system consisting of a brain, ventral nerve cord, and segmental ganglia?  
   W) hydra

X) leech

Y) salamander

Z) sea star  
ANSWER: X) leech

**BONUS**

1. BIOLOGY *Short Answer* What cells are the principal glia of the peripheral nervous system, functioning to support neurons and keep peripheral nerve fibers alive, and are further subdivided into myelinating and non myelinatingANSWER: schwann cells or neurolemmocytes

**TOSS UP**

1. PHYSICS *Multiple Choice* A metal cube with a mass of 1kg and side length of 5 cm is suspended by a rope in a tank of water. What is the force of tension in the rope if the cube is at equilibrium? Approximate the acceleration due to gravity as 10 m/s squared and give your answer in newtons.ANSWER: 8.75 newtons

**BONUS**

1. PHYSICS *Multiple Choice* Which of the following substances will have a constant pressure specific heat capacity that is the closest to its constant volume specific heat capacityW) water vapor

X) gaseous nitrogen

Y) liquid ethanol

Z) fused quartzANSWER: Z) fused quartz

**TOSS UP**

1. CHEMISTRY *Multiple Choice* In crystal field theory, d orbitals of the central atom which have lobes which point directly towards the ligands are designated  
   W) t sub g

X) t sub 2g

Y) e sub g

Z) e sub 2g  
ANSWER: Y) e sub g

**BONUS**

1. CHEMISTRY *Short Answer* By name or number, denote all of the following three d orbitals for a central atom in an octahedral complex which are considered to be e sub g orbitals1. z squared

2. xy

3. x squared minus y squaredANSWER: 1 and 3

**TOSS UP**

1. EARTH AND SPACE SCIENCE *Multiple Choice* The crystal habit of chrysotile, a type of asbestos, is best described asW) platy

X) foliated

Y) fibrous

Z) bladedANSWER: Y) fibrous

**BONUS**

1. EARTH AND SPACE SCIENCE *Short Answer* By name or number, identify all of the following four minerals which could scratch window glass1. calcite

2. apatite

3. topaz

4. diamondANSWER: 3 and 4

**TOSS UP**

1. MATH *Short Answer* Five distinct points are identified on the perimeter of a circle. How many distinct lines are determined by these points?  
     
   ANSWER: 10

**BONUS**

1. MATH *Short Answer* What non-zero integer must be substituted for y in the expression (3x + 2)(12x - y) such that the simplified product of the two binomials is also a binomial?ANSWER: 8

**TOSS UP**

1. ENERGY *Short Answer* Click here to enter text.ANSWER: Click here to enter text.

**BONUS**

1. ENERGY *Short Answer* Click here to enter text.ANSWER: Click here to enter text.

**TOSS UP**

1. EARTH AND SPACE SCIENCE *Short Answer* Reflection nebula commonly appear to be what color?  
     
   ANSWER: blue

**BONUS**

1. EARTH AND SPACE SCIENCE *Short Answer* The distance modulus of a star is 10. What is its distance in parsecs from earth?ANSWER: 1,000 parsecs