**TOSS UP**

1. BIOLOGY *Multiple Choice* Which of the following is NOT an adaptation that prevents dehydration in land plants?  
   W) recessed stomates

X) presence of many epidermal hairs

Y) many guard cells in the flaccid condition

Z) many stomates on the top leaf surface  
ANSWER: Z) many stomates on the top leaf surface

**BONUS**

1. BIOLOGY *Multiple Choice* As plants evolved from simple to more complex forms, which of the following occurred?  
   W) the sporophyte generation became more dominant than the gametophyte generation

X) the haploid generation was lost

Y) the haploid generation became more dominante

Z) the gametophyte and sporophyte generations gained equal prominenceANSWER: W) the sporophyte generation became more dominant than the gametophyte generation

**TOSS UP**

1. PHYSICS *Multiple Choice* A weightlifter lowers a barbell from shoulder height to the ground. The work done on the barbell by the weightlifter isW) positive

X) negative

Y) zero

Z) changing sign through the process

ANSWER: X) negative

**BONUS**

1. PHYSICS *Short Answer* A 100 N box is at rest on top of a ramp inclined at an angle of 30 degrees. The coefficient of static friction between the box and ramp is 0.5. What is the force of static friction acting on the box? ANSWER: 25 N

**TOSS UP**

1. CHEMISTRY *Short Answer* Give the electron pair and molecular geometries respectively of the molecule that is produced in the largest quantity when rhombic sulfure reacts with fluorine gas  
     
   ANSWER: octahedral and octahedral

**BONUS**

1. CHEMISTRY *Short Answer* At a certain temperature, the value fo the equilibrium constant, K, for the reaction H2 gas plus Br 2 gas is in equil. with 2HBr gas is 2.0 x 10^5. What is K for the reverse reaction at the same temperature?

ANSWER: 5 x 10^-6

**TOSS UP**

1. EARTH AND SPACE SCIENCE *Multiple Choice* In which of the following situations would retrograde orbit not be found?W) stars orbiting the center of the milky way

X) a passing asteroid that has been captured by a planet as a moon

Y) asteroids in the asteroid belt orbiting the sun

Z) a moon formed from the protoplanetary disk of a planet in prograde motionANSWER: Z) a moon formed from the protoplanetary disk of a planet in prograde motion

**BONUS**

1. EARTH AND SPACE SCIENCE *Multiple Choice* The most significant source of energy that drives Io's geological activity comes from W) tidal heating due to its proximity to Jupiter

X) absorbed solar radiation

Y) decay of radioactive elements in its core

Z) interactions with Jupiter's strong magnetic fieldANSWER: W) tidal heating due to its proximity to Jupiter

**TOSS UP**

1. MATH *Multiple Choice* Find f(g(1)), given that f(x) = 2x + 2 and g(x) = -(x)/(2 + x ^2)  
   W) -8/9

X) 4/3

Y) 2

Z) 7/3  
ANSWER: X) 4/3

**BONUS**

1. MATH *Short Answer* FInd dy/dx of -4sec(x) + 2csc(x)ANSWER: -4tan(x)sec(x) - 2cot(x)csc(x)

**TOSS UP**

1. ENERGY *Multiple Choice* The sector than consumed the greatest amount of petroleum in the US in 2011 wasW) transportation

X) electric power

Y) industrial

Z) residential and commercialANSWER: W) transportation

**BONUS**

1. ENERGY *Short Answer* What country produced the greatest percentage of the world's coal in 2011?ANSWER: china

**TOSS UP**

1. BIOLOGY *Short Answer* What polymer consisting of sugars and amino acids is responsible for the retention of the stain crystal violet by gram positive bacteria?  
     
   ANSWER: peptidoglycan

**BONUS**

1. BIOLOGY *Short Answer* In a species that has five different alleles for a gene at a particular locus, how many different alleles may be present in the somatic cells of one diploid individual?ANSWER: two

**TOSS UP**

1. PHYSICS *Multiple Choice* Which of the following quantities is a cross product of two vectors?W) work

X) acceleration

Y) force

Z) torque

ANSWER: Z) torque

**BONUS**

1. PHYSICS *Short Answer* How many times greater is the constant volume heat capacity of 1 mol of diatomic hydrogen compared to 1 mol of monatomic hydrogen? Treat hydrogen as an ideal gas.  
   ANSWER: 5/3

**TOSS UP**

1. CHEMISTRY *Multiple Choice* Mixing which of the following two compound in water will result in the formation of a bright yellow precipitant?  
   W) Lead (II) hydroxide and sodium iodide

X) Copper (II) bromide and Lithium Carbonate

Y) Lead (II) acetate and Ammonium Iodide

Z) Silver nitrate and Lithium sulfate

ANSWER: Y) Lead (II) acetate and Ammonium Iodide

**BONUS**

1. CHEMISTRY *Multiple Choice* Which of the following bravais lattices is incorrectly paired with the number of atoms in each unit cell?W) face-centered cubic, 4

X) body centered cubic, 2

Y) primitive cubic, 1

Z) hexagonal, 3

ANSWER: Z) hexagonal, 3

**TOSS UP**

1. EARTH AND SPACE SCIENCE *Multiple Choice* Bladed, botryoidal, and banded all describeW) habit

X) cleavage

Y) tenacity

Z) hardnessANSWER: W) habit

**BONUS**

1. EARTH AND SPACE SCIENCE *Multiple Choice* Which of the following statements about mineral habit is false?W) botryoidal refers to groups of intergrown crystal resembling buches of grapes

X) the same mineral can develop different habits under different growth conditions such as space, heat, and impurities

Y) polygonal refers to elongated crystals with faces parallel to a common direction

Z) the banded habit can be seen in some samples of the mineral agate

ANSWER: Y) polygonal refers to elongated crystals with faces parallel to a common direction

**TOSS UP**

1. MATH *Short Answer* What is the cross product of the two vectors, vector one: [2, 3, -1] and vector 2: [-4, -6, 2]?  
     
   ANSWER: Zero

**BONUS**

1. MATH *Multiple Choice* Vectors A and B lie in the plane of your table. Vector A points to due right (your right), and vector B points down towards you. Vector C, the result of A cross B, will point W) due left

X) straight down into the plane of the table

Y) Straight up out of the plane of the table

Z) straight away from you

ANSWER: X) straight down into the plane of the table

**TOSS UP**

1. ENERGY *Short Answer* Hilt's law states that, for a small geologic area, the best rank of coal is generally foundW) in the shallowest area of the deposit

X) in the deepest area of the deposit

Y) in the area with the lowest geothermal gradient

Z) in areas with rocks high in oxygen content

ANSWER: X) in the deepest area of the deposit

**BONUS**

1. ENERGY *Multiple Choice* What brittle iron is high in carbon content and acts as the intermediate product of smelting iron ore with a high-carbon fuel such as coke, usually with limestone as a flux? This type of iron is typically intended for remelting and purification to make steel.W) cast iron

X) wrought iron

Y) pig iron

Z) grey iron

ANSWER: Y) pig iron