**TOSS UP**

1. BIOLOGY *Short Answer* Match the following 3 enzymes with the given reaction it describes: Phosphofructokinase, Aldolase, Enolase  
   1. Fructose 1-6 Bisposphate to DHAP or G3P  
   2. 2-Phosphoglycerate to PEP  
   3. Fructose 6 Phosphate, to Fructose 1-6 Bisphosphate  
     
   ANSWER: Aldolase, enolase, phosphofructokinase

**BONUS**

1. BIOLOGY *Short Answer* How many molecules of CO2 are needed to release 15 molecules of G3P from the Calvin Cycle?ANSWER: 45

**TOSS UP**

1. PHYSICS *Short Answer* A battery of 30 V is attached to two resistors in parallel. The resistors have resistances x and y. If the current through the resistor with resistance x is 15 A, what is the voltage across the resistor with resistance y?ANSWER: 30 V

**BONUS**

1. PHYSICS *Short Answer* Denote by name or number all of the following 3 statements which is or are true of equipotential surfaces.  
   1. Field lines and equipotential surfaces are always mutually perpendicular.  
   2. When all charges are at rest, the surface of a conductor is always an equipotential surface.   
   3. When all charges are at rest, the electric field just outside a conductor must be parallel to the surface at every point.ANSWER: 1 and 2

**TOSS UP**

1. CHEMISTRY *Multiple Choice* Which of the following methyl halogens has the most acidic proton?  
   W) CH3I  
   X) CH3Br  
   Y) CH3Cl  
   Z) CH3F  
     
   ANSWER: Z

**BONUS**

1. CHEMISTRY *Short Answer* Magnesium and Copper (I) Sulfate are reacted to form Magnesium Sulfate and Copper. If 48 g of Magnesium are present initially and 32 g of Copper are formed, how many grams of Copper (I) Sulfate have reacted?  
   W) 40 g  
   X) 56 g  
   Y) 115 g  
   Z) 160 gANSWER: X

**TOSS UP**

1. EARTH AND SPACE SCIENCE *Short Answer* The process of layering progressing from coarse grains at the base to fine grains at the top is what type of bedding?ANSWER: graded bedding

**BONUS**

1. EARTH AND SPACE SCIENCE *Short Answer* Denote which type of biochemically precipitated sediment is produced by each of the following 4 animals.  
   1. Diatoms  
   2. Coccolithophores  
   3. Foraminiferans  
   4. RadiolariansANSWER: S, C, C, S

**TOSS UP**

1. MATH *Short Answer* Order the left hand, right hand, and midpoint Riemann sum for the following integral in order from the smallest to largest approximated area: the integral from 0 to 2 of x^3 dx.   
     
   ANSWER: left, midpoint, right

**BONUS**

1. MATH *Short Answer* A solid has as its base the circle x^2 + y^2=9, and all cross sections parallel to the y-axis are squares. Find the volume of the solid. ANSWER: 144

**TOSS UP**

1. ENERGY *Short Answer* Diamonds exist chiefly in what ultramafic igneous rock, which were forcefully intruded to the surface from deep in the crust and upper mantle in the form of long narrow pipes?ANSWER: kimberlite

**BONUS**

1. ENERGY *Short Answer* Denote what elements the following 4 sulfide ores are primarily used for the production of.   
   1. Galena  
   2. Cinnabar  
   3. Pyrite  
   4. SphaleriteANSWER: lead, mercury, iron, zinc

**TOSS UP**

1. BIOLOGY *Short Answer* Match the following 4 hormones with the class they follow into, using the following classes: Amino Acid, Peptide, Steroid or Glycoprotein.  
   1. Calcitonin  
   2. LH  
   3. Epinephrine  
   4. Aldosterone  
     
   ANSWER: peptide, glycoprotein, amino acid, steroid

**BONUS**

1. BIOLOGY *Short Answer* What is the hormone produced by a pair of endocrine glands near the Ecdysozoan brain called the corpora allata, which in high levels prevents the transformation to the adult stage and results in a larval to larval molt. If the level of this hormone is low, however, the molt will result in metamorphosis.ANSWER: juvenile hormone

**TOSS UP**

1. PHYSICS *Multiple Choice* In a graph of stopping potential versus frequency, what is the slope of the straight line obtained?  
   W) work function over planck’s constant  
   X) planck’s constant over work function  
   Y) elementary charge over planck’s constant  
   Z) planck’s constant over elementary chargeANSWER: Z

**BONUS**

1. PHYSICS *Short Answer* During beta minus decay, which gauge boson decays into the electron and electron antineutrino?ANSWER: W- boson

**TOSS UP**

1. CHEMISTRY *Short Answer* Denote by name or number all of the following 4 statements which does or do hold true for a glass of pure water at 60 C?  
   1. pH is 7  
   2. The solution will contain a nonzero concentration of dissociated hydroxide ions  
   3. The expression for the equilibrium constant for the dissociation of water does not include the term for liquid water.  
     
   ANSWER: 2 and 3

**BONUS**

1. CHEMISTRY *Multiple Choice* 400 mL of 0.01M HCl is mixed with 100 mL of 0.1M MgCl2. What is the final molarity of Cl- in the solution?  
   W) 0.24 mol/L  
   X) 0.024 mol/L  
   Y) 0.048 mol/L  
   Z) 0.36 mol/LANSWER: Y

**TOSS UP**

1. EARTH AND SPACE SCIENCE *Short Answer* What is the space observatory of the European Space Agency which has recently been launched to observe the anisotropies of the cosmic microwave background over the entire sky, at a high sensitivity and angular resolution, in order to improve upon WMAP observations?ANSWER: planck

**BONUS**

1. EARTH AND SPACE SCIENCE *Short Answer* Denote what type of active galactic nucleus an observer on Earth would see based on the angle of the jet in the following 3 examples:   
   1. At a 30 degree angle to the jet  
   2. Straight down the jet  
   3. At a 90 degree angle to the jet

ANSWER: Type 1 Seyfert, blazar, type 2 seyfert

**TOSS UP**

1. MATH *Short Answer* Without evaluating the natural log, how long does it take for an investment to triple if is it compounded continuously as a yearly rate of 5%?  
     
   ANSWER: (ln3)/0.05 years

**BONUS**

1. MATH *Short Answer* Denote by name or number, all of the following 3 series which converge.  
   1. E (n/(n^2 + 1))  
   2. E (n/e^n)  
   3. E ((n^n)/n!)ANSWER: 2 only

**TOSS UP**

1. ENERGY *Short Answer* Denote by name or number all of the following statements which is or are true of ethanol.  
   1. The E10 blend results in 12 to 25 percent less carbon monoxide emissions than conventional gasoline.  
   2. Switching to corn ethanol from gasoline would provide little or no climate change benefit in the next 50 years.  
   3. The production and use of cellulosic ethanol will not reduce CO2 emissions when compared to gasoline, even when the impacts from clearing land for crops are considered.  
   4. With one of the highest octane ratings of any transportation fuel, ethanol increases the energy efficiency of an engine.ANSWER: 1,2 and 4

**BONUS**

1. ENERGY *Short Answer* What almost pure carbon residue of coal is used as a fuel in smelting metals?ANSWER: coke