**TOSS-UP**

CHEMISTRY ­*Short Answer* Determine which of the following ions are paramagnetic.

1. Mn2+ (Z=25)
2. Cr3+ (Z=24)
3. Hg2+ (Z=80)

ANSWER: 1 and 2

**TOSS-UP**

PHYSICS *Short Answer* Determine the period of a linear simple harmonic oscillator, composed of a block and spring moving along the positive x-axis, given that the mass of the block is 150 kg, and the spring constant is 1.5 Newtons per meters.

ANSWER: 20 pi

**TOSS-UP**

BIOLOGY *Multiple Choice* This cancer inhibiting gene can activate proteins that cause apoptosis, and can also turn on other genes that are directly involved with DNA repair in cancerous cells.

ANSWER: p53 gene

**TOSS-UP**

EARTH AND SPACE SCIENCE *Short Answer* A type of slip-strike fault, this type of fault is also a type of plate boundary, and primarily moves along a horizontal direction.

ANSWER: Transform fault

**TOSS-UP**

ENERGY *Multiple Choice* Which of the following descriptions is incorrect regarding solar power?

W) Photovoltaic and concentrated solar power are the only two ways to harvest solar energy

X) Molten salts are a highly efficient way of storing solar energy

Y) A major drawback to solar power is the limited regions of the world that can support solar power

Z) The United States has the world’s largest solar energy facility in the world under construction

ANSWER: Y) A major drawback to solar power is the limited regions of the world that can support solar power

**TOSS-UP**

CHEMISTRY *Short Answer* This definition of acids and bases establishes that metal cations, when dissolved in water, act as an acid.

ANSWER: Lewis definition

**TOSS-UP**

PHYSICS *Multiple Choice* After an earthquake, a nearby city experienced severe shaking that collapsed medium height buildings, but not taller and shorter buildings. What could best account for this phenomenon?

W) Only medium height buildings were shaken by the earthquake.

X) The medium height buildings were not built with the dampeners that the taller buildings had to prevent shaking.

Y) The earthquake’s vibrations were in resonance with the medium height buildings.

Z) The height of the buildings caused oscillations that were strongest at the medium height.

ANSWER: Y) The earthquake’s vibrations were in resonance with the medium height buildings.

**TOSS-UP**

BIOLOGY *Short Answer* When this class of genes is turned on, plants switch from growth to flowering. The proteins that are produced from these genes are essential for the development of determinate floral meristems.

ANSWER: Meristem Identity Genes

**TOSS-UP**

EARTH AND SPACE SCIENCE *Short Answer* Which of the following four choices are not elements produced in the fusion reactions of a star as it starts to enter into its red giant stage?

1. Oxygen
2. Calcium
3. Neon
4. Manganese

ANSWER: 2, 4

**TOSS-UP**

ENERGY *Short Answer* Due to the inability of any material to hold plasma at high temperatures to achieve nuclear fusion, scientists created this device to enclose the plasma within a magnetic field.

ANSWER: Tokamak

**TOSS-UP**

CHEMISTRY *Multiple Choice* Which of the following is an incorrect description of crystal lattice structures?

W) In a face centered cubic cell, there are 4 atoms packed into each unit cell.

X) All lattices consist of points with identical surroundings.

Y) The coordination number of a face-centered cubic crystal is 12.

Z) The greatest packing efficiency occurs in a body-centered cubic crystal.

ANSWER: Z) The greatest packing efficiency occurs in a body-centered cubic crystal.

**TOSS-UP**

PHYSICS *Short Answer* A beam of light is passed through a solution of methanol and water. How many times is the light diffracted in the medium formed by these two liquids?

ANSWER: 0

**TOSS-UP**

BIOLOGY *Short Answer* This element is a macronutrient essential to plant growth, as it is vital to the formation and stabilization of cell walls, and in the maintenance of cell membrane permeability.

ANSWER: Calcium

**TOSS-UP**

EARTH AND SPACE SCIENCE *Short Answer* In this type of fault, uncohesive fault rocks, such as fault gouge, fault breccia, and foliated gouge are formed. It is a structural discontinuity in the crust and upper mantle.

ANSWER: Shear zone

**TOSS-UP**

ENERGY *Short Answer* From Betz’s Law, we can derive the maximum energy derived from a wind turbine to be what value, rounded to two significant digits?

ANSWER: 59%

**TOSS-UP**

CHEMISTRY *Multiple Choice* Which of the following amino acids are aromatic?

W) Proline

X) Tyrosine

Y) Histidine

Z) Asparagine

ANSWER: X) Tyrosine

**TOSS-UP**

BIOLOGY *Short Answer* This type of cell participates in the humoral immune response, and is responsible for proliferating into memory b-cells, with the purpose of secreting antibodies.

ANSWER: Helper T-cell

**TOSS-UP**

PHYSICS *Short Answer* Which of the following is not a vector quantity?

1. Acceleration
2. Angular displacement
3. Average speed

ANSWER: 3 only

**TOSS-UP**

EARTH AND SPACE SCIENCE *Short Answer* Give the collective name for this binary star system that is the brightest object in the Centaurus constellation.

ANSWER: Alpha Centauri

**TOSS-UP**

ENERGY *Short Answer* This energy cycle is vital for the production of ATP during muscle activity. It also is vital in the prevention of lactic acidosis.

ANSWER: Cori’s Cycle