**TOSS UP**

1. PHYSICS: *Short Answer:* What law, derived from Faraday's law, is an alternative method of determining the direction of an induced current or electromotive force?  
  
ANSWER: Lenz's Law

**BONUS**

1. PHYSICS: *Multiple Choice:* Which of the following statements best describes the behavior of a homogenous sphere made of superconducting material in a uniform magnetic field?

W) as the material is heated above the critical temperature, the magnetic field inside the material increases and the material becomes superconducting

X) as the material is heated above the critical temperature, the magnetic field inside the material decreases to zero and the material becomes superconducting

Y) as the material is cooled below the critical temperature, the magnetic field inside the material increases and the material becomes superconducting

Z) as the material is cooled below the critical temperature, the magnetic field inside the material decreases to zero and the material becomes superconducting

ANSWER: Z) as the material is cooled below the critical temperature, the magnetic field inside the material decreases to zero and the material becomes superconducting

**TOSS UP**

2. CHEMISTRY: *Short Answer:* What is the name given to the aromatic compound that consists of a benzene ring in which one of the C - H groups has been substituted for a nitrogen atom?  
  
ANSWER: pyridine

**BONUS**

2. CHEMISTRY: *Short Answer:* What aromatic compound, which can be derived from the distillation of coal was used by Lister as an antiseptic during surgery and consists of a hydroxyl group bonded to phenyl?

ANSWER: phenol

**TOSS UP**

3. BIOLOGY: *Multiple Choice:* What is the term given to animals which cannot tolerate substantial changes in external osmolarity?  
  
W) osmoregulators  
X) osmoconformers

Y) stenohalines

Z) euryhalines  
  
ANSWER: Y) stenohalines

**BONUS**

3. BIOLOGY: *Short Answer:* What is the adaptation of certain animals to enter a dormant state when their habitats dry up to prevent dessication? Examples of organisms with this adaptation include water bears, which can dehydrate to less than 2% water and survive in an inactive state?

ANSWER: anhydrobiosis

**TOSS UP**

4. EARTH AND SPACE SCIENCE: *Multiple Choice:* According to Bowen's reaction series, which of the following minerals will crystallize at the highest temperature?

W) pyroxene

X) quartz

Y) muscovite mica  
Z) olivine

ANSWER: Z) olivine

**BONUS**

4. EARTH AND SPACE SCIENCE: *Short Answer:* What sequence of mineral weathering, which follows the same pattern as Bowen's reaction series, occurs due to minerals being most stable in the conditions closest to those under which they form?  
  
ANSWER: Goldich dissolution series

**TOSS UP**

5. PHYSICS: *Short Answer:* If the temperature of an ideal gas is doubled, by what factor will the average translational kinetic energy of an individual particle change?  
  
ANSWER: 3

**BONUS**

5. PHYSICS: *Short Answer:* What is the name of the effect in which atomic energy levels, and thereby associated spectrum lines, are split when atoms are placed in a magnetic field?  
  
ANSWER: Zeeman effect

**TOSS UP**

6. CHEMISTRY: *Multiple Choice:* What is the term given to the attractive interaction between two permanent dipoles in molecules?  
  
W) Keesom force

X) Debye foce

Y) London dispersion force

Z) electrostatic interaction  
  
ANSWER: W) Keesom force

**BONUS**

6. CHEMISTRY: *Short Answer:* Rank the following four compounds from strongest London dispersion force to weakest London dispersion force.

F2, I2, Cl2, Br2  
  
ANSWER: I2, Br2, Cl2, F2 (2, 4, 3, 1)

**TOSS UP**

7. BIOLOGY: *Multiple Choice:* Which of the following was not one of Darwin's four observations of nature?

W) members of a population often vary greatly in their traits  
X) individuals with favorable inherited traits have no impact on the future generations of the population

Y) traits in population are inherited from parents to offspring

Z) all species are capable of producing more offspring than their environment can support

ANSWER: X) individuals with favorable inherited traits have no impact on the future generations of the population

**BONUS**

7. BIOLOGY: *Short Answer:* What is the name of the period of time, approximately 530 million years ago, in which most major phyla rapidly appeared on the earth, accompanied by major diversification of other organisms

ANSWER: Cambrian explosion or Cambrian radiation

**TOSS UP**

8. EARTH AND SPACE SCIENCE: *Multiple Choice:* What type of meteorites are characterized by having both chondrules and volatile compounds?  
  
W) iron meteorites

X) achondrites

Y) chondrites  
Z) carbonaceous chondrites  
  
ANSWER: Z) carbonaceous chondrites

**BONUS**

8. EARTH AND SPACE SCIENCE: *Short Answer:* When iron meteorites are sliced open, polished, and etched with nitric acid, they reveal regular bands that are the result of large crystals of nickel-iron alloys. Name these bands.  
  
ANSWER: Widmanstätten patterns

**TOSS UP**

9. PHYSICS: *Multiple Choice:* Which of the following lenses would be most beneficial to a person with nearsightedness?

W)biconcave

X) biconvex

Y) cylindrical

Z) cannot be determined from the information provided  
  
ANSWER: W)biconcave

**BONUS**

9. PHYSICS: *Multiple Choice:* What is the power, in diopters, of a lens with focal length of 50 centimeters?  
  
ANSWER: 2 diopters

**TOSS UP**

10. CHEMISTRY: *Short Answer:* Give the molecular structure for the following 3 compounds based on VESPR theory

CO2, CCl4, NH3

ANSWER: Linear, tetrahedral, trigonal pyramidal

**BONUS**

10. CHEMISTRY: *Short Answer:* Classify the following 5 compounds as either a strong or weak electrolyte

H2SO4, H2SO3, HCl, HF, HC2H3O2

ANSWER: strong, weak, strong, weak, weak

**TOSS UP**

11. BIOLOGY: *Short Answer:* Classify the following five organisms as either archaea, bacteria, or eukarya

Thermophiles, Cyanobacteria, Methanobacterium, Euglena

ANSWER: archaea, bacteria, archaea, eukarya

**TOSS UP**

12. ENERGY: *Multiple Choice:* A nuclear weapon which consists of high-explosives being used to compress a mass of fissile material, such as plutonium or uranium to create a supercritical mass would be classified as a   
  
W) gun-type assembly

X) implosion assembly

Y) Teller-Ulam design

Z) primary/secondary assembly

ANSWER: X) implosion assembly

**BONUS**

12. ENERGY: *Short Answer:* What was the codename given to the first test of a thermonuclear weapon by the United States in which a major part of the explosive yield was provided by nuclear fusion?

ANSWER: Ivy mike