

## ***Science Bowl***

## **CHEMISTRY**

CHEM-91; Multiple Choice: Which of the following scientists was awarded the Nobel Prize in 1911 for the discovery of the radioactive elements, radium and polonium?

- w) John Dalton
- x) Dmitri Mendeleev
- y) Emil Fischer
- z) Marie Curie

ANSWER: Z -- MARIE CURIE

CHEM-91; Short Answer: Who was awarded a Nobel Prize in 1911 for the discovery of the radioactive elements, radium and polonium?

ANSWER: D -- MARIE CURIE

CHEM-91; Multiple Choice: Which of the following pairs of German scientists discovered the atomic fission of uranium and set the stage for the nuclear age?

- w) Hahn and Strassman
- x) Nernst and Planck
- y) Ostwald and Heisenberg
- z) Bohr and Rutherford

ANSWER: W -- HAHN AND STRASSMAN

CHEM-91; Multiple Choice: Name the person who developed a table of elements which revealed regularities in elemental properties in 1869?

- w) Theodore Richards
- x) Antoine Lavoisier
- y) Dmitri Mendeleev
- z) Svante Arrhenius

ANSWER: Y -- DMITRI MENDELEEV

CHEM-91; Short Answer: Name the person who developed a table of elements which revealed regularities in elemental properties?

ANSWER: DMITRI MENDELEEV

## *Science Bowl*

## CHEMISTRY

CHEM-91; Multiple Choice: Who was the first American chemist to receive a Nobel Prize? He was selected in 1914 for his precise determination of atomic weights.

- w) Edward Frankland
- x) Theodore Richards
- y) John Bardeen
- z) Paul Dirac

ANSWER: X -- THEODORE RICHARDS

CHEM-91; Multiple Choice: How many electrons can occupy an s orbital?

- w) one
- x) two
- y) three
- z) four

ANSWER: X -- TWO

CHEM-91; Short Answer: What is the maximum number of electrons that can occupy an s orbital?

ANSWER: TWO

CHEM-91; Multiple Choice: Which of the following is a necessary characteristic for electrons that share an s orbital?

- w) coplanar spins
- x) parallel spins
- y) opposite spins
- z) none of these

ANSWER: Y -- OPPOSITE SPINS

CHEM-91; Multiple Choice: Which of the following terms refers to the number of molecules or ions attached to a central metallic atom?

- w) coordination number
- x) connection number
- y) bonding number
- z) none of these

ANSWER: W -- COORDINATION NUMBER

## ***Science Bowl***

## **CHEMISTRY**

CHEM-91; Multiple Choice: Which of the following pairs do NOT show similar chemical properties?

- w) fluorine-argon
- x) beryllium-aluminum
- y) boron-silicon
- z) lithium-magnesium

ANSWER: W -- FLUORINE-ARGON

CHEM-91; Short Answer: What is the common name for calcium oxide, CaO?

ANSWER: QUICKLIME (LIME)

CHEM-91; Multiple Choice: Which of the following terms refers to a material which slows neutrons?

- w) retarder
- x) moderator
- y) buffer
- z) bottleneck

ANSWER: X -- MODERATOR

CHEM-91; Multiple Choice: Which of the following refers to the scattering of light by colloidal particles?

- w) Rutherford effect
- x) Tyndall effect (pron: tin-dahl)
- y) Thompson effect
- z) none of these

ANSWER: X -- TYNDALL EFFECT

CHEM-91; Short Answer: Who is accredited in the history of modern chemistry of proving that neutrons existed?

ANSWER: JAMES CHADWICK

## *Science Bowl*

## CHEMISTRY

CHEM-91; Multiple Choice: Which of the following refers to an easily melted product of the reaction between the flux and the impurities of an ore?

- w) slag
- x) slurry
- y) slug
- z) none of the above

ANSWER: W -- SLAG

CHEM-91; Short Answer: Name the thermodynamic state function that is a measure of randomness.

ANSWER: ENTROPY

CHEM-91; Short Answer: What term is used to describe silver which contains 7.5% copper?

ANSWER: STERLING

CHEM-91; Short Answer: Name the state function that represents the heat content of a system.

ANSWER: ENTHALPY

CHEM-91; Multiple Choice: Which of the following is NOT a physical property of crystalline boron?

- w) brown color
- x) diamond hardness
- y) brittleness
- z) high electrical resistance

ANSWER: W -- BROWN COLOR (Crystalline boron is transparent.)

CHEM-91; Multiple Choice: Which noble gas has the highest melting point ?

- w) argon
- x) krypton
- y) xenon
- z) radon

ANSWER: Z -- RADON

## Science Bowl

## CHEMISTRY

CHEM-91; Multiple Choice: The noble gases have low boiling points because:

- w) their ionization potentials are very low
- x) only weak Van der Waals forces hold the atoms together
- y) they are produced by the fractional distillation of liquid air
- z) they have eight electrons in the outer shell

ANSWER: X -- ONLY WEAK VAN DER WAALS FORCES HOLD THE ATOMS TOGETHER

CHEM-91; Multiple Choice: For which of the following classes of salts are all of its compounds soluble in water?

- w) sulfates
- x) nitrates
- y) hydroxides
- z) chlorides

ANSWER: X -- NITRATES

CHEM-91; Multiple Choice: Which of the following is NOT a general property of hydroxide bases in aqueous solution?

- w) High solubility
- x) Bitter taste
- y) Ability to neutralize aqueous acid solutions
- z) Ability to change phenolphthalein from colorless to red

ANSWER: W -- HIGH SOLUBILITY (The hydroxides of the alkali metals are soluble in water but all the other metal hydroxides are only moderately or sparingly soluble.)

CHEM-91; Multiple Choice: Aqua regia is:

- w) concentrated nitric acid
- x) a mixture of three parts of concentrated hydrochloric acid and one part concentrated nitric acid
- y) concentrated hydrochloric acid
- z) a mixture of sulfuric acid and hydrochloric acid

ANSWER: X -- A MIXTURE OF THREE PARTS OF CONCENTRATED HYDROCHLORIC ACID AND ONE PART CONCENTRATED NITRIC ACID

## *Science Bowl*

## CHEMISTRY

CHEM-91; Short Answer: What is the common name given to a mixture of three parts of concentrated hydrochloric acid and one part concentrated nitric acid?

ANSWER: AQUA REGIA

CHEM-91; Multiple Choice: A solution with a pH of 12 is:

- w) weakly acidic
- x) strongly acidic
- y) weakly basic
- z) strongly basic

ANSWER: Z -- STRONGLY BASIC

CHEM-91; Multiple Choice: The halogen with the largest atomic radius is:

- w) Cl
- x) I
- y) Br
- z) At

ANSWER: Z -- At

CHEM-91; Short Answer: Which halogen has the largest atomic radius:

ANSWER: ASTATINE

CHEM-91; Multiple Choice: Compounds of iodine are NOT used for which of the following?

- w) as a refrigerant
- x) in photographic film
- y) as an essential part of diet
- z) as an antiseptic

ANSWER: W -- AS A REFRIGERANT

## *Science Bowl*

## CHEMISTRY

CHEM-91; Multiple Choice: Allotropic modifications of phosphorus include each of the following EXCEPT:

- w) red phosphorus
- x) black phosphorus
- y) white phosphorus
- z) green phosphorus

ANSWER: Z -- GREEN PHOSPHORUS

CHEM-91; Short Answer: How many milligrams are in one metric carat?

ANSWER: 200 MILLIGRAMS

CHEM-91; Short Answer: What class of organic compounds is characterized by an -OH group bonded to an alkyl group?

ANSWER: ALCOHOL

CHEM-91; Multiple Choice: Which of the following contain sp<sup>2</sup> hybridized carbon atoms?

- w) alkanes
- x) alkenes
- y) alkynes
- z) cycloalkanes

ANSWER: X -- ALKENES

CHEM-91; Multiple Choice: Which of the following phrases is NOT appropriate for a description of benzene?

- w) characteristic reactivity of an alkene
- x) volatile liquid
- y) aromatic hydrocarbon
- z) resonance hybridization

ANSWER: W -- CHARACTERISTIC REACTIVITY OF AN ALKENE

## ***Science Bowl***

## **CHEMISTRY**

CHEM-91; Multiple Choice: Which of the following is NOT an aromatic hydrocarbon?

- w) naphthalene
- x) hexane
- y) styrene
- z) xylene

ANSWER: X -- HEXANE

CHEM-91; Multiple Choice: Which of the following is NOT an aliphatic hydrocarbon?

- w) n-octane
- x) propylene
- y) n-tridecane
- z) benzene

ANSWER: Z -- BENZENE

CHEM-91; Multiple Choice: Which of the following is NOT a means of preparing carbon dioxide?

- w) burning coke in the absence of air
- x) combustion of methane
- y) heating certain normal carbonates
- z) action of acids on carbonates

ANSWER: W -- BURNING COKE IN THE ABSENCE OF AIR

CHEM-91; Short Answer: After carbon, hydrogen, and oxygen, the next most abundant element in proteins is:

ANSWER: NITROGEN

CHEM-91; Multiple Choice: One of the following is NOT a lipid. Is it:

- w) fats and oils
- x) starches
- y) steroids
- z) waxes

ANSWER: X -- STARCHES

## ***Science Bowl***

## **CHEMISTRY**

CHEM-91; Multiple Choice: Which one of the following is NOT a vitamin?

- w) ascorbic acid
- x) niacin (pron: nI-eh-sen)
- y) trypsin (pron: trip-sen)
- z) riboflavin (pron: rye-bow-fla-vin)

ANSWER: Y -- TRYPSIN

CHEM-91; Multiple Choice: Of the following, which has units of "Pascal".

- w) force
- x) volume
- y) pressure
- z) viscosity

ANSWER: Y -- PRESSURE

CHEM-91; Multiple Choice: A Poise is the unit of measure of which of the following?

- w) pressure
- x) viscosity
- y) force
- z) mass

ANSWER: X -- VISCOSITY

CHEM-91; Multiple Choice: Which of the following is the element represented by the symbol B?

- w) Barium
- x) Bismuth
- y) Boron
- z) Beryllium

ANSWER: Y -- BORON

CHEM-91; Short Answer: Which element is represented by the symbol B?

ANSWER: BORON

CHEM-91; Short Answer: What is the element represented by the symbol Rb?

ANSWER: RUBIDIUM

## ***Science Bowl***

## **CHEMISTRY**

CHEM-91; Short Answer: What is the element represented by the symbol Sn?

ANSWER: TIN

CHEM-91; Short Answer: What is the element represented by the symbol Sr?

ANSWER: STRONTIUM

CHEM-91; Multiple Choice: In the periodic table, which of the following identifies a horizontal row?

- w) period
- x) group
- y) family
- z) series

ANSWER: W -- PERIOD

CHEM-91; Short Answer: In the periodic table, which term identifies a horizontal row?

ANSWER: PERIOD

CHEM-91; Multiple Choice: Which of the following describes the orientation of bonds in an  $sp^3$  hybridized atom?

- w)triagonal
- x)linear
- y)tetrahedral
- z)planar

ANSWER: Y -- TETRAHEDRAL

CHEM-91; Multiple Choice: Forces in ionic crystalline solids are primarily which of the following?

- w)covalent
- x)electrostatic
- y)Van der Waals
- z)magnetic

ANSWER: X -- ELECTROSTATIC

## Science Bowl

## CHEMISTRY

CHEM-91; Multiple Choice: In which of the following is the "octet rule" violated?

w) CO<sub>2</sub>

x) NH<sub>4</sub><sup>+</sup> (read: N - H - 4 - plus)

y) SO<sub>4</sub><sup>2-</sup> (read: S - O - 4 - 2 minus)

z) NO<sub>2</sub>

ANSWER: Z -- NO<sub>2</sub>

CHEM-91; Multiple Choice: Normality is defined as the number of:

- w) moles of solute per 1000 grams of solvent
- x) equivalent weights of solute per liter of solution
- y) kilograms of solute per liter of solution
- z) moles of solute per 1000 grams of solution

ANSWER: X -- EQUIVALENT WEIGHTS OF SOLUTE PER LITER OF SOLUTION

CHEM-91; Multiple Choice: The oxidation number of N in NaNO<sub>2</sub> is:

- w) +5
- x) +2
- y) +3
- z) -3

ANSWER: Y -- +3 (Accept 3)

CHEM-91; Short Answer: What is the oxidation number of nitrogen in NaNO<sub>2</sub>:

ANSWER: +3 (Accept 3)

## ***Science Bowl***

## **CHEMISTRY**

CHEM-91; Multiple Choice: Which one of the following atoms has two unpaired electrons in its ground state:

- w) Sodium
- x) Calcium
- y) Oxygen
- z) Aluminum

ANSWER: Y -- OXYGEN

CHEM-91; Multiple Choice: In which of the following compounds is the bonding most covalent?

- w) NaCl
- x) F<sub>2</sub>
- y) MgS
- z) Fe<sub>3</sub>C

ANSWER: X -- F<sub>2</sub>

CHEM-91; Multiple Choice: The elements in group 1A of the periodic table are called:

- w) halogens
- x) alkaline earths
- y) alkali metals
- z) rare earths

ANSWER: Y -- ALKALI METALS

CHEM-91; Short Answer: What is the family name given to the elements in group 1A of the periodic table?

ANSWER: ALKALI METALS

CHEM-91; Short Answer: What is the name of the organic compound whose chemical name is amygdalin (pron: a-MIG-da-lin) and is found in the pits of apricots and peaches?

ANSWER: LAETRILE

## ***Science Bowl***

## **CHEMISTRY**

CHEM-91; Multiple Choice: Name the element discovered upon its extraction from pitchblende?

- w) platinum
- x) uranium
- y) iridium
- z) plutonium

ANSWER: X -- URANIUM

CHEM-91; Short Answer: All proteins contain at least 5 specific elements. Four of them are carbon, oxygen, hydrogen, and nitrogen. What is the fifth element?

ANSWER: SULFUR

CHEM-91; Multiple Choice: Cinnabar, pyrite and galena are minerals which consist of one or more metals combined with the same element. Which one of the following is the element that is common to all three of these minerals? Is it:

- w) iron
- x) copper
- y) sulfur
- z) sodium

ANSWER: C-- SULFUR

CHEM-91; Multiple-choice: In a flame test, the presence of copper in a solution is evident by what color flame? Is the flame

- w) red
- x) orange
- y) indigo
- z) blue-green

ANSWER: Z -- BLUE-GREEN

## ***Science Bowl***

## **CHEMISTRY**

CHEM-91; Multiple Choice: Alpha rays are different from beta rays in one of the following ways. Are they different since:

- w) alpha rays are deflected in a magnetic field and beta rays are not
- x) alpha rays are identical to the electron in mass, and beta rays are not
- y) alpha rays have a positive charge and beta rays have a negative charge
- z) alpha rays are produced within the nucleus and beta rays are produced outside the nucleus

ANSWER: Y -- ALPHA RAYS HAVE A POSITIVE CHARGE AND BETA RAYS HAVE A NEGATIVE CHARGE

CHEM-91; Multiple Choice: Which one of the following statements is TRUE regarding the molar heat capacity for the noble gases?

- w) heat capacity decreases from Helium to Xenon
- x) heat capacity increases from helium to argon
- y) heat capacity increases from Helium to Argon, then decreases to Xenon
- z) heat capacity is the same for all noble gases

ANSWER: Z -- HEAT CAPACITY IS THE SAME FOR ALL NOBLE GASES

CHEM-91; Multiple Choice: Of the following types of material, which is the one that is heterogeneous? Is it:

- w) quartz
- x) feldspar
- y) granite
- z) mica

ANSWER: Y -- GRANITE

CHEM-91; Multiple Choice: Which of the following halogens does NOT replace the other halogens from their compounds?

- w) fluorine
- x) iodine
- y) bromine
- z) chlorine

ANSWER: X -- IODINE

## ***Science Bowl***

## **CHEMISTRY**

CHEM-91; Short Answer: Excluding Astatine, which halogen does NOT replace the other halogens from their compounds?

ANSWER: IODINE

CHEM-91; Multiple Choice: The bond in hydrogen chloride is which of the following types? Is it

- w) ionic
- x) nonpolar covalent
- y) polar covalent
- z) covalent network

ANSWER: Y -- POLAR COVALENT

CHEM-91; Multiple Choice: The bond in Fluorine is which of the following types? Is it

- w) ionic
- x) nonpolar covalent
- y) polar covalent
- z) covalent network

ANSWER: X -- NONPOLAR COVALENT

CHEM-91; Multiple Choice: Which of the following concentration expressions is defined as the number of moles of solute per kilogram of solvent:

- w) molarity
- x) molality
- y) normality
- z) equivalents

ANSWER: X -- MOLALITY

CHEM-91; Multiple Choice: Among the following, the substance that is considered to be the earliest stage in coal formation is:

- w) sub-bituminous
- x) bituminous
- y) anthracite
- z) lignite

ANSWER: Z -- LIGNITE

## *Science Bowl*

## CHEMISTRY

CHEM-91; Multiple Choice: When an aldehyde is heated with Fehling's solution, the aldehyde undergoes one of the following processes. Does it undergo:

- w) neutralization
- x) oxidation
- y) reduction
- z) esterification

ANSWER: X -- OXIDATION

CHEM-91; Multiple Choice: The hydrolysis of a fat using a solution of a strong hydroxide is called:

- w) neutralization
- x) esterification
- y) saponification
- z) condensation

ANSWER: Y -- SAPONIFICATION

CHEM-91; Multiple Choice: In the common dry cell, the zinc atoms are:

- w) reduced at the cathode
- x) oxidized at the cathode
- y) oxidized at the anode
- z) reduced at the anode

ANSWER: Y -- OXIDIZED AT THE ANODE

CHEM-91; Multiple Choice: As one goes across a period in the periodic table, the ionization energy generally increases for one of the following reasons. Is it because of the increasing

- w) atomic radius
- x) melting point
- y) nuclear charge
- z) density

ANSWER: Y -- NUCLEAR CHARGE

## ***Science Bowl***

## **CHEMISTRY**

CHEM-91; Multiple Choice: Which of the following reactions involve NEITHER oxidation nor reduction?

- w) burning antimony in chlorine
- x) decomposition of potassium chlorate
- y) reaction of sodium with water
- z) reaction of potassium hydroxide with nitric acid

ANSWER: Z -- REACTION OF POTASSIUM HYDROXIDE WITH NITRIC ACID

CHEM-91; Short Answer: In a flame test both lithium and strontium produce various shades of this color. What is this color?

ANSWER: RED

CHEM-91; Multiple Choice: Who hypothesized that it would be impossible to know the exact location and exact momentum of a particle at the same time? Was it:

- w) Heisenberg
- x) De Broglie
- y) Planck
- z) Schrodinger

ANSWER: A -- HEISENBERG

CHEM-91; Short Answer: Who hypothesized that it would be impossible to know the exact location and exact momentum of a particle at the same time?

ANSWER: HEISENBERG

CHEM-91; Multiple Choice: Ammonia can be considered a Lewis base because it can donate:

- w) electrons
- x) protons
- y) hydronium ions
- z) hydroxide ions

ANSWER: A -- ELECTRONS

## Science Bowl

## CHEMISTRY

CHEM-91; Multiple Choice: Acids react with bases to form which of the following? Do they form:

- w) salt and acidic anhydride
- x) water and basic anhydride
- y) basic anhydride and salt
- z) salt and water

ANSWER: D -- SALT AND WATER

CHEM-91; Multiple Choice: Which of the following is a metallic salt of a fatty acid? Is it:

- w) soap
- x) plastic
- y) rubber
- z) petroleum

ANSWER: A -- SOAP

CHEM-91; Multiple Choice: Which of the following choices are considered to be polymers of amino acids? Are they:

- w) nucleotides
- x) carbohydrates
- y) lipids
- z) proteins

ANSWER: Z -- PROTEINS

CHEM-91; Multiple Choice: Which of the following pairs of compounds could NOT be used to create a buffer solution? Would it be:

- w) HCL and NaCl (read: H - C - L and N - A - C - L)
- x) HCN and NaCN (read: H - C - N and N - A - C - N)
- y) NH3 and NH4Cl (read: N - H - 3 and N - H - 4 - C - L)
- z) HNO2 and NaNO2 (read: H - N - O - 2 and N - A - N - O - 2)

ANSWER: W -- HCL AND NaCl (read: H - C - L and N - A - C - L)

## *Science Bowl*

## CHEMISTRY

CHEM-91; Short Answer: In a body-centered structure for cesium chloride how many nearest neighbor chloride ions surround a cesium ion?

ANSWER: 8

CHEM-91; Short Answer: Metallic elements are often obtained from ores. Name the metallic element which is produced from the ore Bauxite.

ANSWER: ALUMINUM

CHEM-91; Short Answer: Name any five of the six noble gases.

ANSWER: HELIUM, NEON, ARGON, KRYPTON, XENON, OR RADON

CHEM-91; Short Answer: Name any four alkali metals.

ANSWER: LITHIUM, SODIUM, POTASSIUM, RUBIDIUM, CESIUM, AND FRANCIUM

CHEM-91; Short Answer: The element I am thinking about has several interesting characteristics. It occupies the same column in the periodic table as lead. Resistors which are commonly found in electronic circuits are often made out of this element. In addition, in one of its forms, this element is one of the hardest substances on earth. What element am I thinking about?

ANSWER: CARBON

CHEM-91; Short Answer: Give me the names, in order of increasing mass, of the four lightest members the halogen family.

ANSWER: FLUORINE, CHLORINE, BROMINE, AND IODINE

CHEM-91; Short Answer: Ketones are organic compounds. Name the functional group that all ketone molecules contain.

ANSWER: CARBONYL GROUP pr C DOUBLE BOND O

## *Science Bowl*

## CHEMISTRY

CHEM-91; Short Answer: Four of the lightest ten elements in the periodic table are solids at standard temperature and pressure. Name these four elements.

ANSWER: LITHIUM, BERYLLIUM, BORON, CARBON

CHEM-91; Multiple Choice: Which of the following scientists first stated the law of conservation of mass? Was it:

- w) Lavoisier
- x) Dalton
- y) Proust
- z) Boyle

ANSWER: W -- LAVOISIER

CHEM-91; Multiple Choice: Which of the following scientists explained the photoelectric effect? Was it:

- w) Einstein
- x) Planck
- y) Bohr
- z) Chadwick

ANSWER: W -- EINSTEIN

CHEM-91; Multiple Choice: Which of the following scientists hypothesized that it would be possible for particles to have wave-like properties? Was it:

- w) Planck
- x) Heisenberg
- y) Einstein
- z) de Broglie

ANSWER: Z -- DE BROGLIE

CHEM-91; Short Answer: Who developed the equation that is used to determine the PROBABILITY of finding the electron in any given place?

ANSWER: SCHRODINGER

## ***Science Bowl***

## **CHEMISTRY**

CHEM-91; Short Answer: How many hydrogen atoms are there in the organic compound 1,1,2,2-tetrabromoethane (read: tetra - bromo - ethane)?

ANSWER: 2

CHEM-91; Short Answer: Give the empirical formula for the organic compound naphthalene?

ANSWER: C<sub>10</sub>H<sub>8</sub>

CHEM-91; Multiple Choice: The triple bond between the carbon atoms causes acetylene, C<sub>2</sub>H<sub>2</sub>, to have which of the following shapes?

- w) trigonal planar (pron: try-gon-al)
- x) linear
- y) tetrahedral
- z) trigonal bipyramidal

ANSWER: X -- LINEAR

CHEM-91; Short Answer: What is the EMPIRICAL formula for glucose?

ANSWER: CH<sub>2</sub>O (read: C - H - 2 - O)

CHEM-91; Multiple Choice: Which of the following four elements has the largest atomic radius? Is it:

- w) strontium
- x) francium
- y) calcium
- z) bromine

ANSWER: X -- FRANCIUM

CHEM-91; Multiple Choice: Which of the following odors does the ester, methyl salicylate, produce? Is the odor that of:

- w) cinnamon
- x) avocado
- y) orange
- z) oil of wintergreen

ANSWER: D -- OIL OF WINTERGREEN

## *Science Bowl*

## CHEMISTRY

CHEM-91; Short Answer: What two chemical elements are found in sphalerite?

ANSWER: ZINC AND SULFUR (ZnS)

CHEM-91; Short Answer: Periclase is composed of what two elements?

ANSWER: MAGNESIUM AND OXYGEN (MgO)

CHEM-91; Short Answer: Who patented the common dry cell?

ANSWER: GEORGES LECLANCHÉ

CHEM-91; Multiple Choice:  $\text{Ca}(\text{BrO}_3)_2$  (read: C - a, left parenthesis, B - r - O - subscript 3, right parenthesis, subscript 2) is called:

- w) calcium bromate
- x) calcium bromite
- y) calcium dibromite
- z) calcium bromide

ANSWER: W -- CALCIUM BROMATE

CHEM-91; Short Answer: What is the common oxidation state of Radium?

ANSWER: +2 (read: Plus two)

CHEM-91; Short Answer: What is the pH of a solution that is 1000 times more acidic than pure water?

ANSWER: 4

CHEM-91; Multiple Choice: Which of the following are saturated aliphatic hydrocarbons?

- w) alkanes
- x) alkenes
- y) alkynes
- z) nixanes

ANSWER: W -- ALKANES

## ***Science Bowl***

## **CHEMISTRY**

CHEM-91; Multiple Choice: Sucrose, ordinary table sugar, may be classified as a:

- w) Monosaccharide
- x) Disaccharide
- y) Polysaccharide
- z) Oligosaccharide

ANSWER: X -- DISACCHARIDE

CHEM-91; Multiple Choice: Pure water is approximately what molar concentration:

- w) .55 Molar
- x) 5.5 Molar
- y) 55 Molar
- z) 550 Molar

ANSWER: Y -- 55 MOLAR

CHEM-91; Multiple Choice: The rate at which dissolution occurs is LEAST dependent upon which one of the following factors:

- w) temperature
- x) pressure
- y) solution concentration
- z) solute surface area

ANSWER: X -- PRESSURE

CHEM-91; Short Answer: Name the person who developed a table of elements which revealed regularities in elemental properties?

ANSWER: DMITRI MENDELEEV

CHEM-91; Multiple Choice: Who was the first American chemist to receive a Nobel Prize? He was selected in 1914 for his precise determination of atomic weights.

- w) Edward Frankland
- x) Theodore Richards
- y) John Bardeen
- z) Paul Dirac

ANSWER: X -- THEODORE RICHARDS

## *Science Bowl*

## CHEMISTRY

CHEM-91; Short Answer: What is the word that describes a substance that reacts with both strong acids and strong bases?

ANSWER: AMPHOTERIC

CHEM-91; Multiple Choice: Of the following, which has units of "Pascal".

- w) force
- x) volume
- y) pressure
- z) viscosity

ANSWER: Y -- PRESSURE

CHEM-91; Short Answer: What is the name of the point on a phase diagram which indicates the temperature above which a gas cannot be converted to a liquid?

ANSWER: THE CRITICAL TEMPERATURE

CHEM-91; Short Answer: List the following atoms in order of increasing electron affinity: oxygen, boron, and fluorine.

ANSWER: (1) BORON, (2) OXYGEN, (3) FLUORINE

CHEM-91; Short Answer: What name is given to the chemical elements with atom numbers 90 to 103, inclusively.

ANSWER: ACTINIDES or ACTINIDE SERIES

CHEM-91; Short Answer: The removal of two hydrogen atoms from an alcohol yields what type of chemical substance?

ANSWER: ALDEHYDE

CHEM-91; Short Answer: I will be describing a chemical element. Try to identify it with the fewest number of clues. This chemical element is a silver-white metal, with bluish tinge, capable of taking a high polish. The element occurs abundantly in all ordinary rocks, except limestone and sandstone; is third in abundance of the elements in the earth's crust and used to make drink cans. The atomic number of this element is 13. Name the element.

ANSWER: ALUMINUM

## ***Science Bowl***

## **CHEMISTRY**

CHEM-91; Multiple Choice: All alloys contain this element if they are amalgams. The element is:

- w) iron
- x) mercury
- y) gold
- z) platinum

ANSWER: X -- MERCURY

CHEM-91; Multiple Choice: Azo (pron: A-zo) Compounds characteristically are compounds containing the group:

- w) C2
- x) N2
- y) O2
- z) Cl2

ANSWER: X -- N2 (N = N)

CHEM-91; Short Answer: I will be describing a chemical element. Try to identify it with the fewest number of clues. This element is a halogen which is a liquid at standard conditions. The element volatilizes readily at room temperature to form a reddish vapor which is very irritating to the eyes and flesh. The atomic number of this element is 35 and its chemical symbol is Br. Name this element.

ANSWER: BROMINE

CHEM-91; Short Answer: Name the 5 elements of the periodic classification which comprise the Carbon Group.

ANSWER: CARBON, SILICON, GERMANIUM, TIN AND LEAD

CHEM-91; Multiple Choice: This noncombustible liquid in its dry form is noncorrosive to common metals except aluminum. About 90% of all of this material which is manufactured goes into the production of chlorofluorocarbons. Is this substance:

- w) carbon tetrachloride
- x) methylene chloride
- y) hydrogen chloride
- z) methyl fluoride

ANSWER: W -- CARBON TETRACHLORIDE

## Science Bowl

## CHEMISTRY

CHEM-91; Multiple Choice: A compound which contains two ring structures having one common carbon atom is known as a:

- w) spiro-compound
- x) nonpolar compound
- y) interstitial compound
- z) inner compound

ANSWER: W -- SPIRO-COMPOUND

CHEM-91; Multiple Choice: Which of the following elements would form an acid oxide with the formula  $XO_2$  and an acidic compound with hydrogen with the formula  $XH_2$ ?

- w) Sodium
- x) Magnesium
- y) Aluminum
- z) Sulfur

ANSWER: Z -- SULFUR

CHEM-91; Multiple Choice: Which of the following would have the largest THIRD ionization energy? Is it:

- w) Boron
- x) Carbon
- y) Nitrogen
- z) Magnesium

ANSWER: Z -- MAGNESIUM

CHEM-91; Multiple Choice: How many atoms of oxygen are in a glucose molecule

- w) 2
- x) 6
- y) 10
- z) 12

ANSWER: X -- 6

## Science Bowl

## CHEMISTRY

CHEM-91; Multiple Choice: Which of the following compounds contains a double bond?

- w) butene
- x) acetylene
- y) butane
- z) propane

ANSWER: W -- BUTENE

CHEM-91; Multiple Choice: An alcohol is related to an ester as a hydroxide compound is related to:

- w) an acid
- x) a ketone
- y) an ether
- z) a salt

ANSWER: Z -- A SALT

CHEM-91; Multiple Choice: In any chemical reaction, a quantity that decrease to a minimum is:

- w) free energy
- x) entropy
- y) temperature
- z) enthalpy

ANSWER: W -- FREE ENERGY

CHEM-91; Multiple Choice: It is believed that carbon-14 in nature is slowly generated by the action of:

- w) protons on carbon-12
- x) electrons on hydrogen
- y) cosmic rays on boron
- z) neutrons on nitrogen

ANSWER: Z -- NEUTRONS ON NITROGEN

CHEM-91; Multiple Choice: When water at 10 C is heated to 20 C, its internal energy:

- w) changes by 10 C
- x) is doubled
- y) is less than doubled
- z) is more than doubled

ANSWER: Y -- IS LESS THAN DOUBLED

## Science Bowl

## CHEMISTRY

CHEM-91; Multiple Choice: In the filling of electron orbitals for the element sulfur, which has 16 electrons, the number of electrons in the 3p orbitals is:

- w) 3
- x) 4
- y) 6
- z) 0

ANSWER: X -- 4

CHEM-91; Short Answer: You have a solution of 5 molar Sodium Phosphate and need to prepare a solution of 500 millimolar Sodium Phosphate. How much water would you add to 100 milliliter of the original 5 molar solution to produce the 500 millimolar solution?

ANSWER: 900 MILLILITERS (or 0.9 LITERS)

CHEM-91; Multiple Choice: Which of the following is the weakest acid?

- w) hydrochloric acid
- x) hydrofluoric acid
- y) sulfuric acid
- z) nitric acid

ANSWER: X -- HYDROFLUORIC ACID

CHEM-91; Short Answer: Marie Curie shared the 1911 Nobel Prize in chemistry with two fellow chemists. Name them.

ANSWER: PIERRE CURIE and (A. HENRI) BECQUEREL

CHEM-91; Multiple Choice: A mystical substance supposedly released during combustion was called:

- w) thermal flax
- x) ether
- y) caloric
- z) phlogiston (pron: flow-gis-ton)

ANSWER: Z -- PHLOGISTON

## ***Science Bowl***

## **CHEMISTRY**

CHEM-91; Multiple Choice: Of the following liquids, which is most dense?

- w) water
- x) gasoline
- y) acetone
- z) chloroform

ANSWER: Z -- CHLOROFORM

CHEM-91; Short Answer: What is the most abundant element in the human body, WEIGHT?

ANSWER: OXYGEN

CHEM-91; Multiple Choice: Solids may be considered to be either crystalline noncrystalline. The basic difference between them is that a crystal, in contrast to a noncrystal:

- w) has a sharp melting point
- x) has an irregular array of atoms
- y) exhibits double refraction
- z) has a completely regular atomic or molecular structure

ANSWER: Z -- HAS A COMPLETELY REGULAR ATOMIC OR MOLECULAR STRUCTURE

CHEM-91; Multiple Choice: The Rate Law expresses the rate of a reaction in terms of the concentrations of the:

- w) reactants
- x) products
- y) by-products
- z) catalysts

ANSWER: W -- REACTANTS

CHEM-91; Multiple Choice: Hydrocarbons that contain a triple bond between carbon atoms are known as:

- w) alkenes
- x) alkanes
- y) alkynes
- z) polymers

ANSWER: Y -- ALKYNES

## ***Science Bowl***

## **CHEMISTRY**

CHEM-91; Multiple Choice: Which of the following metals melts in your hand?

- w) gallium
- x) cesium
- y) sodium
- z) magnesium

ANSWER: W -- GALLIUM

CHEM-91; Multiple Choice: When vinegar and baking soda are mixed together, w gas is formed?

- w) oxygen
- x) nitrogen
- y) carbon dioxide
- z) hydrogen

ANSWER: Y -- CARBON DIOXIDE

CHEM-91; Short Answer: How many carbons are found in a propane molecule?

ANSWER: 3

CHEM-91; Multiple Choice: The atoms in sugar are bound by what type of bond?

- w) ionic
- x) hydrogen
- y) covalent
- z) van der Waals

ANSWER: Y -- COVALENT

CHEM-91; Multiple Choice: Which is an example of a polymer?

- w) salt
- x) oil
- y) plastic
- z) glucose

ANSWER: Y -- PLASTIC

## ***Science Bowl***

## **CHEMISTRY**

CHEM-91; Multiple Choice: Vegetable oil is made into margarine through:

- w) halogenation
- x) partial hydrogenation
- y) methylation
- z) oxidation

ANSWER: X -- PARTIAL HYDROGENATION

CHEM-91; Multiple Choice: What is the name given to the equation  $PV=nRT$ ?

- w) law of partial pressure
- x) ideal gas equation
- y) quadratic equation
- z) Raoult's equation

ANSWER: X -- IDEAL GAS EQUATION

CHEM-91; Short Answer: What term describes the process when a solid phase changes directly to the gas phase?

ANSWER: SUBLIMATION

CHEM-91; Multiple Choice: Which of the following elements can form the great number of covalent bonds?

- w) carbon
- x) nitrogen
- y) oxygen
- z) sulfur

ANSWER: Z -- SULFUR

CHEM-91; Multiple Choice: Which of the following elements forms a tetrahedra structure?

- w) carbon
- x) beryllium
- y) boron
- z) fluorine

ANSWER: W -- CARBON

## ***Science Bowl***

## **CHEMISTRY**

CHEM-91; Multiple Choice: Which of the following metals is a solid at room temperature, yet melts in your hand?

- w) gallium
- x) cesium
- y) sodium
- z) magnesium

ANSWER: W -- GALLIUM

CHEM-91; Short Answer: When water and an active metal react, what are the two products that result?

ANSWER: HYDROGEN AND A BASE (HYDROXIDE)

CHEM-91; Multiple Choice: 2.5 liters of a sodium chloride (NaCl) solution contain 5 moles of the solute. What is the molarity?

- w) 5 molar
- x) 2 molar
- y) 2.5 molar
- z) 12.5 molar

ANSWER: X -- 2 MOLAR

CHEM-91; Short Answer: What is the active ingredient in many common laxative that is also an acid-base indicator?

ANSWER: PHENOLPHTHALEIN (pron: fEn-el-thal-E-en)

CHEM-91; Multiple Choice: The structure of an ammonia molecule can best be described as:

- w) linear
- x) tetrahedral
- y) pyramidal
- z) triangular planar

ANSWER: Y -- PYRAMIDAL

## ***Science Bowl***

## **CHEMISTRY**

CHEM-91; Short Answer: What naturally occurring radioactive element is so common in homes that testing for its presence is often advisable?

ANSWER: RADON

CHEM-91; Multiple Choice: How many moles of carbon are in 48 grams of carbon

- w) 4
- x) 3
- y) 2
- z) 1

ANSWER: W -- 4

CHEM-91; Short Answer: What is the molality of a salt solution prepared by dissolving two moles of salt in 500 grams of water?

ANSWER: 4

CHEM-91; Short Answer: During electrolysis of water, what gas is evolved from the cathode?

ANSWER: HYDROGEN

CHEM-91; Multiple Choice: Crude oil is separated into its components by:

- w) chemical reaction
- x) simple distillation
- y) fractional distillation
- z) settling

ANSWER: Y -- FRACTIONAL DISTILLATION

CHEM-91; Short Answer: What compound occurs when ammonia and hydrogen chloride are mixed together?

ANSWER: AMMONIUM CHLORIDE FORMS

CHEM-91; Short Answer: The acid present in vinegar is:

ANSWER: ACETIC ACID

## *Science Bowl*

## CHEMISTRY

CHEM-91; Multiple Choice: What force between molecules tends to cause most common gases to behave as non-ideal gases?

- w) Van der Waals' force
- x) ionic bonding force
- y) gravitational force
- z) covalent bonding force

ANSWER: W -- VAN DER WAALS' FORCE

CHEM-91; Short Answer: What UNUSUAL type of bonding occurs in diborane, B<sub>2</sub>H<sub>6</sub>

ANSWER: THREE CENTER BONDING

CHEM-91; Multiple Choice: What is the name given to the non-superimposable mirror image forms of chiral compounds?

- w) cis-trans
- x) enantiomers
- y) functional isomers
- z) diastereomers

ANSWER: X -- ENANTIOMERS

CHEM-91; Multiple Choice: Which of the following is the EMPIRICAL formula of dodecane?

- w) C<sub>5</sub>H<sub>11</sub>
- x) C<sub>6</sub>H<sub>13</sub>
- y) C<sub>10</sub>H<sub>22</sub>
- z) C<sub>12</sub>H<sub>26</sub>

ANSWER: X -- C<sub>6</sub>H<sub>13</sub>

CHEM-91; Short Answer: What is the chemical formula for baking soda?

ANSWER: NaHCO<sub>3</sub>

## ***Science Bowl***

## **CHEMISTRY**

CHEM-91; Multiple Choice: Copper is refined commercially by a process of:

- w) smelting
- x) electrolysis
- y) sublimation
- z) roasting

ANSWER: X -- ELECTROLYSIS

CHEM-91; Multiple Choice: The action of concentrated sulfuric acid on sugar best described as:

- w) catalysis
- x) oxidation
- y) reduction
- z) dehydration

ANSWER: Z -- DEHYDRATION

CHEM-91; Multiple Choice: A metal that does NOT occur native in the earth is

- w) copper
- x) gold
- y) sodium
- z) silver

ANSWER: Y -- SODIUM

CHEM-91; Short Answer: What metal is used as a reducing agent to obtain iron from iron oxide in the Thermite process?

ANSWER: ALUMINUM

CHEM-91; Short Answer: What compound is formed when all the hydrogen of an a has been replaced by a metal?

ANSWER: A SALT

CHEM-91; Short Answer: Glycerine and what other substance are made by heatin animal fats or vegetable oils with sodium hydroxide?

ANSWER: SOAP

## *Science Bowl*

## CHEMISTRY

CHEM-91; Short Answer: What is the formula for the anhydride of sulfuric acid?

ANSWER: SO<sub>3</sub>

CHEM-91; Multiple Choice: Under similar conditions, which of the following is the best reducing agent under similar conditions?

- w) fluoride ion
- x) chloride ion
- y) bromide ion
- z) iodide ion

ANSWER: Z -- IODIDE ION

CHEM-91; Multiple Choice: How many carbon atoms are there in one naphthalene molecule?

- w) 6
- x) 8
- y) 10
- z) 15

ANSWER: Y -- 10

CHEM-91; Multiple Choice: A process in which substances are separated through differences in the rates at which the components migrate is called:

- w) filtration
- x) chromatography
- y) elution
- z) titration

ANSWER: X -- CHROMATOGRAPHY

CHEM-91; Short Answer: What is the name of the bond that joins amino acids together in a protein?

ANSWER: PEPTIDE BOND or AMIDE

## ***Science Bowl***

## **CHEMISTRY**

CHEM-91; Multiple Choice: Which bond has the LEAST ionic character?

- w) H - F
- x) Li - F
- y) Li - Br
- z) F - F

ANSWER: Z -- F - F

CHEM-91; Multiple Choice: The lanthanide series elements are also known as:

- w) rare earth elements
- x) non-metals
- y) fifth period elements
- z) sixth period elements

ANSWER: W -- RARE EARTH ELEMENTS

CHEM-91; Multiple Choice: If the first ionization energy of magnesium is 176 kilocalories per mole, one would expect the second ionization energy to be approximately:

- w) 350 kilocalories per mole
- x) 1,760 kilocalories per mole
- y) 200 kilocalories per mole
- z) 20 kilocalories per mole

ANSWER: W -- 350 KILOCALORIES PER MOLE

CHEM-91; Short Answer: When considering electron orbitals, which orbital is generally considered spherical?

ANSWER: S ORBITAL

CHEM-91; Short Answer: The angle between any two carbon-hydrogen bonds in a methane molecule is how many degrees?

ANSWER: 109.5 DEGREES

CHEM-91; Short Answer: Jaroslav Heyrovsky (Czechoslovakian) received the 1959 Nobel Prize in chemistry for developing what technique used in chemical analysis?

ANSWER: POLAROGRAPHY

## *Science Bowl*

## CHEMISTRY

CHEM-91; Multiple Choice: Ferrous is an equivalent name for which of the following?

- w) Iron (IV) (pron: iron-4)
- x) Iron (III) (pron: iron-3)
- y) Iron (II) (pron: iron-2)
- z) Iron (I) (pron: iron-1)

ANSWER: Y -- IRON (II)

CHEM-91; Multiple Choice: Mass percentage of carbon in CO<sub>2</sub> is approximately:

- w) 37.5%
- x) 27.3%
- y) 75%
- z) 45%

ANSWER: X -- 27.3%

CHEM-91; Multiple Choice: Harold Clayton Urey, an American, received the 193 Nobel Prize in chemistry for his discovery of:

- w) Francium
- x) Americium
- y) deuterium
- z) protium

ANSWER: Y -- DEUTERIUM

CHEM-91; Multiple Choice: The most abundant element in the universe is thought to be:

- w) carbon
- x) oxygen
- y) hydrogen
- z) nitrogen

ANSWER: Y -- HYDROGEN

## *Science Bowl*

## CHEMISTRY

CHEM-91; Multiple Choice: The 1936 Nobel Prize in chemistry was awarded to Peter J.W. Debye for his studies of:

- w) kinetic energy of colliding particles
- x) electron configuration
- y) dipole moments
- z) conformations of cyclohexane

ANSWER: Y -- DIPOLE MOMENTS

CHEM-91; Multiple Choice: The inventor of the Kelvin temperature scale was:

- w) K. Cavendish II
- x) Lord William H. Harrison
- y) Sir William Thomson
- z) none of the above

ANSWER: Y -- SIR WILLIAM THOMSON (Lord Kelvin)

CHEM-91; Multiple Choice: "Under the same conditions of temperature and pressure, the volumes of reacting gases and of their gaseous products are expressed in ratios of small whole numbers." This law is attributed to:

- w) Dalton
- x) Gay-Lussac
- y) Ramsay
- z) Avogadro

ANSWER: X -- GAY-LUSSAC

CHEM-91; Multiple Choice: The type of crystal lattice exemplified in a diamond is:

- w) ionic crystal
- x) covalent network crystal
- y) metallic crystal
- z) covalent molecular crystal

ANSWER: X -- COVALENT NETWORK CRYSTAL

## *Science Bowl*

## CHEMISTRY

CHEM-91; Multiple Choice: A crystallized substance containing water of crystallization is most appropriately termed:

- w) a hydrate
- x) an oxide
- y) a hydroxide
- z) a condensation crystal

ANSWER: W -- A HYDRATE

CHEM-91; Multiple Choice: The loss of water of crystallization from a hydrate when exposed to air is termed:

- w) efflorescence (pron: eh-floor-es-ence)
- x) deliquescence (pron: del-i-kwes-ence)
- y) quiescence (pron: kwi-es-ence)
- z) anhydrogenation

ANSWER: W -- EFFLORESCENCE

CHEM-91; Multiple Choice: Mayonnaise is:

- w) a coalescent solution
- x) a hydrogenated oil
- y) a covalent solution
- z) an emulsion

ANSWER: Z -- AN EMULSION

CHEM-91; Multiple Choice: "The solubility of a gas in a liquid is directly proportional to the pressure of the gas above the liquid" is a fair statement of:

- w) Dalton's secondary law
- x) Le Chatelier's solubility principle
- y) Henry's law
- z) none of the above

ANSWER: Y -- HENRY'S LAW

## *Science Bowl*

## CHEMISTRY

CHEM-91; Multiple Choice: Solubility of a gas in a liquid exhibits what type proportionality to the liquid temperature?

- w) direct
- x) inverse
- y) logarithmic
- z) exponential

ANSWER: X -- INVERSE

CHEM-91; Multiple Choice: A negative heat of solution indicates that:

- w) an endothermic dissolving process occurs
- x) solute solubility increases with rising solution temperature
- y) solute solubility decreases with rising solution temperature
- z) super-saturation conditions exist

ANSWER: Y -- SOLUTE SOLUBILITY DECREASES WITH RISING SOLUTION TEMPERATURE

CHEM-91; Multiple Choice: A colligative property depends on:

- w) chemical properties of particles in system
- x) physical properties of particles in system
- y) number of particles present in system
- z) all of the above

ANSWER: Y -- NUMBER OF PARTICLES PRESENT IN SYSTEM

CHEM-91; Multiple Choice: My theory of electrolytic dissociation earned me t 1903 Nobel Prize in chemistry. My name is:

- w) Niels Bohr
- x) Svante Arrhenius
- y) Michael Faraday
- z) John Cavendish

ANSWER: X -- SVANTE ARRHENIUS

## Science Bowl

## CHEMISTRY

CHEM-91; Multiple Choice: A net ionic equation does NOT show:

- w) electronic charges
- x) solid products (precipitates)
- y) spectator ions
- z) reacting species

ANSWER: Y -- SPECTATOR IONS

CHEM-91; Multiple Choice: The theory of interionic attraction attributed to Debye and Hückel:

- w) was disproved by Arrhenius
- x) accounts quantitatively for the attraction between ions in dilute aqueous solutions
- y) does not account for kindered "ion-activity"
- z) accounts for intra-molecular polar bonds

ANSWER: X -- ACCOUNTS QUANTITATIVELY FOR THE ATTRACTION BETWEEN IONS IN DILUTE AQUEOUS SOLUTIONS

CHEM-91; Multiple Choice: HCl is dissolved in solvent A; the solution is non-conducting towards an electric current. Solvent A must be:

- w) polar
- x) non-polar
- y) organic
- z) more acidic than HCl

ANSWER: X -- NON-POLAR

CHEM-91; Multiple Choice: HClO<sub>3</sub> is commonly named:

- w) hydrochloric acid
- x) chloric acid
- y) perchloric acid
- z) chlorous acid

ANSWER: X -- CHLORIC ACID

CHEM-91; Multiple Choice: Any species that acts as an electron-pair acceptor a:

- w) Lewis base
- x) Bronsted base
- y) Lewis acid
- z) Bronsted acid

ANSWER: Y -- LEWIS ACID

## ***Science Bowl***

## **CHEMISTRY**

CHEM-91; Multiple Choice: Amphoteric substances:

- w) act as either bases or acids
- x) precipitate from aqueous solutions
- y) salt out of basic solutions
- z) form emulsions in oils

ANSWER: W -- ACT AS EITHER BASES OR ACIDS

CHEM-91; Multiple Choice: One equivalent of a triprotic acid is the same as:

- w) one mole of the acid
- x) one-third mole of the acid
- y) three moles of the acid
- z) three equivalents of a diprotic acid

ANSWER: X -- ONE-THIRD MOLE OF THE ACID

CHEM-91; Multiple Choice: The pH range over which an indicator color change occurs is referred to as its:

- w) titration range
- x) titration constant
- y) transition interval
- z) none of the above

ANSWER: Y -- TRANSITION INTERVAL

CHEM-91; Multiple Choice: In a photosynthesis reaction, chlorophyll is:

- w) a reactant
- w) a product
- y) a catalyst
- z) an intermediate

ANSWER: Y -- A CATALYST

CHEM-91; Multiple Choice: All systems of measurement use the same units for which of the following?

- w) mass
- x) time
- y) force
- z) volume

ANSWER: X -- TIME

## *Science Bowl*

## CHEMISTRY

CHEM-91; Multiple Choice: If the temperature of the atmosphere rose 50 degrees on a Fahrenheit thermometer, the rise on a Celsius thermometer would have been:

- w) 90 degrees
- x) 82.3 degrees
- y) 50.3 degrees
- z) 27.8 degrees

ANSWER: Z -- 27.8 DEGREES

CHEM-91; Multiple Choice: In which of the branches of chemistry would the development of a theory about how a reaction takes place best be carried out?

- w) analytical
- x) inorganic
- y) organic
- z) physical

ANSWER: Z -- PHYSICAL

CHEM-91; Short Answer: What is the name of the alkane that is composed of a chain of five carbon atoms?

ANSWER: PENTANE

CHEM-91; Short Answer: How many hydrogens are there in the straight chain alkane that has three carbon atoms?

ANSWER: EIGHT

CHEM-91; Short Answer: What substance is produced at the cathode in the electrolysis of molten sodium chloride?

ANSWER: SODIUM

## ***Science Bowl***

## **CHEMISTRY**

CHEM-91; Multiple Choice: Which class of solids could have London Forces the attractive forces between particles in crystal lattice positions?

- w) ionic
- x) covalent
- y) metallic
- z) molecular

ANSWER: Z -- MOLECULAR

CHEM-91; Multiple Choice: Surface tension of liquids is the result of which the following:

- w) interaction of a liquid with its container
- x) unbalanced forces on the liquid's surface molecules
- y) adhesive forces of the liquid
- z) interaction of the liquid's surface molecules and the applied pressure

ANSWER: X -- UNBALANCED FORCES ON THE LIQUID'S SURFACE MOLECULES

CHEM-91; Multiple Choice: Which of the following liquid types would have the highest viscosity?

- w) low molecular mass-polar liquid
- x) high molecular mass-polar liquid
- y) low molecular mass-nonpolar liquid
- d) high molecular mass-nonpolar liquid

ANSWER: X -- HIGH MOLECULAR MASS-POLAR LIQUID

CHEM-91; Multiple Choice: What two primary factors determine whether or no molecular collision leads to a chemical reaction?

- w) energy and volume of molecules
- x) energy and mass of molecules
- y) energy and orientation of molecules
- z) orientation and volume of molecules

ANSWER: Y -- ENERGY AND ORIENTATION OF MOLECULES

## *Science Bowl*

## CHEMISTRY

CHEM-91; Multiple Choice: An Arrhenius acid is a substance that:

- w) donates protons
- x) accepts protons
- y) donates hydrogen ions to water
- z) donates hydroxide ions to water

ANSWER: Y -- DONATES HYDROGEN IONS TO WATER

CHEM-91; Short Answer: Name the conjugate acid of bicarbonate ion.

ANSWER: CARBONIC ACID

CHEM-91; Short Answer: What is the name of H<sub>2</sub>SO<sub>3</sub>?

ANSWER: SULFUROUS ACID

CHEM-91; Short Answer: What is the formula for Magnesium Nitride?

ANSWER: Mg<sub>3</sub>N<sub>2</sub>

CHEM-91; Short Answer: What is the I-U-P-A-C (pron: eye-you pack) name for a cyclic alkane containing four carbons?

ANSWER: CYCLOBUTANE

CHEM-91; Multiple Choice: Dacron is a:

- w) polyamide
- x) polyester
- y) polyether
- z) polyolefin

ANSWER: X -- POLYESTER

## ***Science Bowl***

## **CHEMISTRY**

CHEM-91; Multiple Choice: Which of the following is produced when polyvinyl chloride is burned?

- w) Hydrogen Cyanide
- x) Hydrogen Chloride
- y) Nitrogen Oxide
- z) Oxygen

ANSWER: X -- HYDROGEN CHLORIDE

CHEM-91; Multiple Choice: Which of the following best describes Nylon?

- w) polyamide
- x) polyester
- y) polyolefin
- z) acrylic

ANSWER: W -- POLYAMIDE

CHEM-91; Short Answer: How many valence electrons does an atom of an element with an atomic number of twelve have?

ANSWER: TWO

CHEM-91; Multiple Choice: Which of the following compounds contains both ionic and covalent bonds?

- w) Calcium Chloride
- x) Carbon Dioxide
- y) Calcium Fluoride
- z) Calcium Sulfate

ANSWER: Z -- CALCIUM SULFATE

CHEM-91; Short Answer: Name the two major ingredients in vinegar.

ANSWER: ACETIC ACID AND WATER

CHEM-91; Short Answer: Solution A has a pH of 2 while solution B has a pH of 7. How many times more acidic is solution A than Solution B?

ANSWER: ONE HUNDRED THOUSAND or TEN TO THE FIFTH POWER

## Science Bowl

## CHEMISTRY

CHEM-91; Short Answer: What is the oxidation number of sulfur in HS<sup>-</sup>? (read HS minus one)

ANSWER: -2

CHEM-91; Multiple Choice: Which of the following compounds is the strongest acid?

- w) NH<sub>3</sub>
- x) PH<sub>3</sub>
- y) H<sub>2</sub>O
- z) H<sub>2</sub>S

ANSWER: Z -- H<sub>2</sub>S

CHEM-91; Multiple Choice: Which of the following compounds is the strongest base?

- w) NH<sub>3</sub>
- x) PH<sub>3</sub>
- y) H<sub>2</sub>O
- z) H<sub>2</sub>S

ANSWER: W -- NH<sub>3</sub>

CHEM-91; Multiple Choice: Which of the following molecules does NOT have a dipole moment of zero?

- w) BeCl<sub>2</sub>
- x) BF<sub>3</sub>
- y) CO<sub>2</sub>
- z) NH<sub>3</sub>

ANSWER: Z -- NH<sub>3</sub>

CHEM-91; Multiple Choice: Which of the following minerals is a source of iron?

- w) Bauxite (pron: box-ite)
- x) Hematite (pron: he-ma-tite)
- y) Malachite (pron: mal-ah-kite)
- z) Galena (pron: ga-lee-nah)

ANSWER: X -- HEMATITE

## ***Science Bowl***

## **CHEMISTRY**

CHEM-91; Multiple Choice: Which of the following metals is LEAST reactive toward atmospheric oxygen?

- w) Lead
- x) Copper
- y) Iron
- z) Aluminum

ANSWER: X -- COPPER

CHEM-91; Short Answer: Brass is an alloy of what two elements?

ANSWER: COPPER AND ZINC

CHEM-91; Multiple Choice: Which of the following are alloying materials used the manufacture of stainless steel?

- w) Limestone and carbon
- x) Calcium oxide and oxygen
- y) Oxygen and sulfur dioxide
- z) Chromium and nickel

ANSWER: Z -- CHROMIUM AND NICKEL

CHEM-91; Multiple Choice: Which of the following materials are used in the manufacture of pig iron from iron ore?

- w) Limestone and carbon
- x) Calcium oxide and oxygen
- y) Chromium and nickel
- z) Oxygen and sulfur dioxide

ANSWER: W -- LIMESTONE AND CARBON

CHEM-91; Multiple Choice: How many neighboring atoms are in contact with eac atom in a monatomic body-centered cubic structure.

- w) 4
- x) 6
- y) 8
- z) 12

ANSWER: Y -- 8

## ***Science Bowl***

## **CHEMISTRY**

CHEM-91; Short Answer: How many neighboring atoms are in contact with each a in a hexagonal close-packed structure?

ANSWER: 12

CHEM-91; Multiple Choice: Members of which of the following classes of compounds generally produce acidic solutions when dissolved in water?

- w) metal oxides
- x) nonmetal oxides
- y) alcohols
- z) aldehydes

ANSWER: X -- NONMETAL OXIDES

CHEM-91; Multiple Choice: Which of the following substances is a molecular solid?

- w) Glass
- x) Ice
- y) Silver
- z) Table Salt

ANSWER: X -- ICE

CHEM-91; Multiple Choice: Which of the following substances is an ionic netw solid?

- w) Diamond
- x) Table Salt
- y) Brass
- z) Dry ice

ANSWER: X -- TABLE SALT

CHEM-91; Multiple Choice: Which of the following compounds has the highest boiling point?

- w) CH<sub>4</sub>
- x) CCL<sub>4</sub>
- y) HI
- z) IF<sub>5</sub>

ANSWER: Z -- IF<sub>5</sub>

## ***Science Bowl***

## **CHEMISTRY**

CHEM-91; Multiple Choice: Which of the following compounds has the lowest boiling points?

- w) CH<sub>4</sub>
- x) CCl<sub>4</sub>
- y) PH<sub>3</sub>
- z) PCl<sub>3</sub>

ANSWER: W -- CH<sub>4</sub>

CHEM-91; Multiple Choice: What is the primary constituent of marble?

- w) Calcium carbonate
- x) Calcium sulfate
- y) Hydroxyapatite
- z) Chloroapatite

ANSWER: W -- CALCIUM CARBONATE

CHEM-91; Multiple Choice: An aqueous solution whose concentration effectively matches the concentration of blood is said to be:

- w) isotopic
- x) isobaric
- y) isotonic
- z) isoelectronic

ANSWER: Y -- ISOTONIC

CHEM-91; Multiple Choice: A family of organic compounds whose molecules will add water under an acid catalysis and change into alcohols are the:

- w) alkenes
- x) alkanes
- y) aromatic hydrocarbons
- z) cycloalkanes

ANSWER: W -- ALKENES

## Science Bowl

## CHEMISTRY

CHEM-91; Multiple Choice: The substance whose chemical formula is CH<sub>3</sub>OH is known as

- w) carbonated water
- x) grain alcohol
- y) potable alcohol
- z) methanol

ANSWER: Z -- METHANOL

CHEM-91; Multiple Choice: The azimuthal quantum number determines the:

- w) spin of an electron
- x) shape of an orbital
- y) size of an orbital
- z) energy of an orbital

ANSWER: X -- SHAPE OF AN ORBITAL

CHEM-91; Multiple Choice: An orbital for which  $n=3$  and  $l = 1$  (read: ell equa 1) is called a:

- w) 2d orbital
- x) 3d orbital
- y) 3s orbital
- z) 3p orbital

ANSWER: Z -- 3p ORBITAL

CHEM-91; Multiple Choice: The elements that have an outer electron configuration  $ns^2$  (read: n - s - 2) are called:

- w) halogens
- x) transition metals
- y) alkaline earths
- z) noble gases

ANSWER: Y -- ALKALINE EARTHES

CHEM-91; Multiple Choice: Unpaired electrons are present in ground-state ato of:

- w) Helium
- x) Calcium
- y) Oxygen
- z) Magnesium

ANSWER: Y -- OXYGEN

## Science Bowl

## CHEMISTRY

CHEM-91; Multiple Choice: How many unpaired electrons are there in the ground state of  $Al^{3+}$ ?

- w) 0
- x) 1
- y) 2
- z) 3

ANSWER: W -- 0

CHEM-91; Multiple Choice: Of the following elements which has the largest atomic radius?

- w) Ba
- x) F
- y) C
- z) Be

ANSWER: W -- Ba

CHEM-91; Multiple Choice: Which of the following species has the smallest equilibrium separation for its ion-pair?

- w) KF
- x) LiF
- y) BaBr
- z) NaCl

ANSWER: B -- LiF

CHEM-91; Short Answer: How many resonance forms are possible for the Lewis structure of  $SO_3$ ?

ANSWER: 3

CHEM-91; Multiple Choice: Which of the following molecules exhibit resonance

- w)  $OF_3$
- x)  $HNO_3$
- y)  $C_2H_4$
- z)  $PCl_3$

ANSWER: X --  $HNO_3$

## *Science Bowl*

## CHEMISTRY

CHEM-91; Multiple Choice: The molecular shape of formaldehyde, H<sub>2</sub>CO, is:

- w) linear
- x) trigonal planar
- y) bent
- z) tetrahedral

ANSWER: X -- TRIGONAL PLANAR

CHEM-91; Multiple Choice: Which of the following molecules is linear?

- w) SO<sub>2</sub>
- x) O<sub>3</sub>
- y) XeF<sub>2</sub>
- z) H<sub>2</sub>S

ANSWER: Y -- XeF<sub>2</sub>

CHEM-91; Short Answer: What bond angle is associated with sp hybrid orbitals

ANSWER: 180 DEGREES

CHEM-91; Short Answer: What bond angle is associated with sp<sup>2</sup> hybrid orbital

ANSWER: 120 DEGREES

CHEM-91; Multiple Choice: Which of the following molecules would have the smallest molar enthalpy of vaporization?

- w) Water
- x) Formaldehyde
- y) Methane
- z) Ammonia

ANSWER: Y -- METHANE

CHEM-91; Short Answer: The pH of a 0.005 molar solution of calcium hydroxide is:

ANSWER: 12

## ***Science Bowl***

## **CHEMISTRY**

CHEM-91; Multiple Choice: Which of the following compounds is ONLY WEAKLY soluble in cold water?

- w) Silver Nitrate
- x) Sodium Carbonate
- y) Sodium Chloride
- z) Lead Chloride

ANSWER: Z -- LEAD CHLORIDE

CHEM-91; Multiple Choice: Radioactive decay is a:

- w) zero-order process
- x) temperature-dependent process
- y) first-order process
- z) second-order process

ANSWER: Y -- FIRST-ORDER PROCESS

CHEM-91; Multiple Choice: The first organic compound synthesized in 1828 by Frederich Wohler was:

- w) benzene
- x) urea
- y) estrogen
- z) methane

ANSWER: X -- UREA

CHEM-91; Multiple Choice: Moth balls contain:

- w) formalin
- x) chitin (pron: kite-en)
- y) formaldehyde
- z) naphthalene

ANSWER: Z -- NAPHTHALENE

## *Science Bowl*

## CHEMISTRY

CHEM-91; Multiple Choice: In commercial vulcanization, crosslinking is introduced by the addition of:

- w) sulfur
- x) toluene
- y) silicon
- z) phosphorus

ANSWER: W -- SULFUR

CHEM-91; Multiple Choice: The alcohol with lowest molecular weight is:

- w) isopropanol
- x) propanol
- y) ethanol
- z) methanol

ANSWER: Z -- METHANOL

CHEM-91; Multiple Choice: The chemical symbol for antimony is:

- w) An
- x) Sn
- y) Sb
- z) At

ANSWER: Y -- Sb

CHEM-91; Multiple Choice: Which of the following inert gas atoms is the heaviest?

- w) xenon
- x) neon
- y) radon
- z) krypton

ANSWER: Y -- RADON

CHEM-91; Multiple Choice: The major constituent of marsh gas is:

- w) methane
- x) propane
- y) benzene
- z) ethanol

ANSWER: W -- METHANE

## Science Bowl

## CHEMISTRY

CHEM-91; Multiple Choice: The element used in treating manic depression is:

- w) sulfur
- x) nitrogen
- y) calcium
- z) lithium

ANSWER: Z -- LITHIUM

CHEM-91; Multiple Choice: Teflon is produced by polymerizing ethylene which hydrogen substituted with one of the following elements:

- w) teffinium
- x) tin
- y) fluorine
- z) carbon

ANSWER: Y -- FLUORINE

CHEM-91; Multiple Choice: Cyclohexanone is an example of:

- w) an aldehyde
- x) a carboxylic acid
- y) an alkyne
- z) a ketone

ANSWER: Z -- A KETONE

CHEM-91; Multiple Choice: One source of Acid Rain is:

- w) sulfur in fossil fuels
- x) carbon in coal
- y) hydrogen in hydrocarbons
- z) chloroflorocarbons in aerosols

ANSWER: W -- SULFUR IN FOSSIL FUELS

CHEM-91; Short Answer: Name the PRINCIPAL cancer-causing agent in Agent Orange

ANSWER: DIOXIN  
or TCDD  
or DIMETHOXANE  
or 2,3,7,8 - TETRACHLORODIBENZO-P-DIOXIN  
or 2,6-DIMETHYL-DIOXAN-Y-YL ACETATE

## ***Science Bowl***

## **CHEMISTRY**

CHEM-91; Short Answer: What was the principal use of Agent Orange?

ANSWER: AS A DEFOLIANT (or herbicide)

CHEM-91; Short Answer: What chemical functionality do unsaturated fatty acid contain that saturated fatty acids do not?

ANSWER: DOUBLE BONDS or CARBON-CARBON DOUBLE BONDS

CHEM-91; Short Answer: Priestley called the gas he prepared "perfect air", but it was later named "oxygen" by whom?

ANSWER: LAVOISIER

CHEM-91; Short Answer: What compound accounts for the unpleasant odor in decayed eggs?

ANSWER: HYDROGEN SULFIDE

CHEM-91; Short Answer: Name any two of the four elements that are ferromagnetic at 0°C.

ANSWER: IRON (Fe), COBALT (Co), NICKEL (Ni) AND GADOLINIUM (Gd)

CHEM-91; Short Answer: The chemical element present in greatest abundance in the earth's crust is:

ANSWER: OXYGEN

CHEM-91; Multiple Choice: Chlorine is used in swimming pools as a disinfectant. In its natural, standard state it is a:

- w) blue liquid
- x) colorless crystals
- y) yellow-green gas
- z) reddish-brown gas

ANSWER: Y -- YELLOW-GREEN GAS

## Science Bowl

## CHEMISTRY

CHEM-91; Short Answer: What is responsible for the reddish, brown color of photochemical smog?

ANSWER: NITROGEN DIOXIDE or NO<sub>2</sub>

CHEM-91; Multiple Choice: What is the pH of an aqueous solution of 0.1 molar HCl?

- w) 7
- x) 13
- y) 1
- z) 3

ANSWER: Y -- 1

CHEM-91; Short Answer: What is the ground-state configuration for Na<sup>+</sup>? The atomic number for sodium is eleven.

ANSWER: 1S<sup>2</sup>2S<sup>2</sup>2p<sup>6</sup>

CHEM-91; Multiple Choice: Which of the following four compounds would have the most ionic bond?

- w) CH<sub>4</sub>
- x) LiF
- y) CsF
- z) N<sub>2</sub>

ANSWER: Y -- CsF

CHEM-91; Multiple Choice: Charcoal is 'activated' by:

- w) heating it in the absence of air
- x) heating it in steam
- y) destructive distillation
- z) absorption

ANSWER: X -- HEATING IT IN STEAM

## ***Science Bowl***

## **CHEMISTRY**

CHEM-91; Multiple Choice: Which of the following atoms or ions would be the smallest?

- w) sodium atom
- x) magnesium atom
- y) singly charged sodium ion
- z) doubly charged magnesium ion

ANSWER: Z -- DOUBLY CHARGED MAGNESIUM ION

CHEM-92; Multiple Choice: Which of the following chemists was the first to use letters as symbols for elements?

- w) Ernest Oliver Lawrence
- x) Louis Andrew Proust
- y) Jons Jacob Berzelius
- z) none of these

ANSWER: Y -- JONS JACOB BERZELIUS

CHEM-92; Multiple Choice: Which of the following indicates the shape of the orbital in which the electron moves?

- w) principal quantum number
- x) spin quantum number
- y) angular momentum quantum number
- z) none of these

ANSWER: Y -- ANGULAR MOMENTUM QUANTUM NUMBER

CHEM-92; Short Answer: Which quantum number indicates the shape of the orbital in which the electron moves?

ANSWER: B -- SPIN QUANTUM NUMBER

CHEM-92; Multiple Choice: Which of the following terms refers to the energy released when an electron is added to a neutral atom?

- w) electrovalence
- x) electron affinity
- y) electroconductance
- z) none of these

ANSWER: X -- ELECTRON AFFINITY

## *Science Bowl*

## CHEMISTRY

CHEM-92; Short Answer: What is the EMPIRICAL FORMULA for Benzene?

ANSWER: CH

CHEM-92; Short Answer: How many electrons are there in the valence shell of a calcium atom?

ANSWER: 2

CHEM-92; Short Answer: Who is credited, in the history of modern chemistry, with discovering X-rays?

ANSWER: WILLIAM ROENTGEN

CHEM-92; Short Answer: Which of the following would be most acidic?

- w) phenol
- x) methanol
- y) acetic acid
- z) methyl amine

ANSWER: C -- ACETIC ACID

CHEM-92; Multiple Choice: Which of the following elements has the highest electronegativity?

- w) Lithium
- x) Iodine
- y) Cesium
- z) Oxygen

ANSWER: D -- OXYGEN

CHEM-92; Multiple Choice: For which molecule can the bonding be described in terms of  $sp^3$  hybrid orbitals of the central atom?

- w) CH<sub>4</sub>
- x) SF<sub>6</sub>
- y) BF<sub>3</sub>
- z) PCl<sub>5</sub>

ANSWER: B -- CH<sub>4</sub>

## Science Bowl

## CHEMISTRY

CHEM-92; Multiple Choice: Which of the following molecules has a dipole moment?

- w) BF<sub>3</sub>
- x) NH<sub>3</sub>
- y) CCL<sub>4</sub>
- z) CH<sub>4</sub>

ANSWER: B -- NH<sub>3</sub>

CHEM-92; Multiple Choice: Which of the following chemical reactions does not lead to formation of a salt?

- w) Reaction of salts with acids.
- x) The reaction of base anhydrides with acid anhydrides.
- y) Action of water on oxides of nonmetals.
- z) Reaction of acid with base.

ANSWER: Y -- ACTION OF WATER ON OXIDES OF NONMETALS. (If water reacts with oxides of nonmetals, an acid is formed.)

CHEM-92; Multiple Choice: Which of the following elements gains electrons most readily?

- w) Sodium
- x) Magnesium
- y) Aluminum
- z) Fluorine

ANSWER: D -- FLUORINE

CHEM-92; Multiple Choice: The pH of water will be decreased to below pH 7 by the hydrolysis of which of the following?

- w) sodium carbonate
- x) sodium chloride
- y) ammonium chloride
- z) potassium bromide

ANSWER: C -- AMMONIUM CHLORIDE

CHEM-92; Short Answer: What does the acronym NMR stand for:

ANSWER: NUCLEAR MAGNETIC RESONANCE

## ***Science Bowl***

## **CHEMISTRY**

CHEM-92; Short Answer: During the electrolysis of a dilute aqueous solution of sulfuric acid, what happens to the sulfuric acid concentration?

ANSWER: IT REMAINS THE SAME

CHEM-92; Short Answer: What is the name for the element whose symbol is Tl (pron: T - L)?

ANSWER: THALLIUM

CHEM-92; Short Answer: Name the process used to obtain Aluminum by electrolysis of aluminum oxide dissolved in molten cryolite?

ANSWER: HALL PROCESS

CHEM-92; Short Answer: what is the name given to a semisolid suspension of a material of high molecular mass in a liquid solvent?

ANSWER: GEL

CHEM-92; Short Answer: Name the thermodynamic term that is a quantitative measure of disorder of a system?

ANSWER: ENTROPY

CHEM-92; Short Answer: At temperatures above 96 degrees Celsius, which crystalline form of sulfur is the most stable?

ANSWER: MONOCLINIC

CHEM-92; Multiple Choice: Pi bonds are formed by the overlap of:

- w) unhybridized p orbitals
- x) sp<sup>2</sup> hybridized orbitals
- y) sp hybridized orbitals
- z) unhybridized s orbitals

ANSWER: W -- UNHYBRIDIZED P ORBITALS

CHEM-92; Short Answer: Pi bonds are formed by the overlap of what specific type of orbitals:

ANSWER: UNHYBRIDIZED P ORBITALS

## ***Science Bowl***

## **CHEMISTRY**

CHEM-92; Multiple Choice: A triple bond consists of:

- w) three sigma bonds
- x) three pi bonds
- y) two sigma bonds and one pi bond
- z) one sigma bond and two pi bonds

ANSWER: Z -- ONE SIGMA BOND AND TWO PI BONDS

CHEM-92; Multiple Choice: A triple bond consists of how many pi bonds and how many sigma bonds?

ANSWER: ONE SIGMA BOND AND TWO PI BONDS

CHEM-92; Short Answer: Glucose is one of the simple sugars in sucrose. Name the other.

ANSWER: FRUCTOSE

CHEM-92; Short Answer: What metal ion is found in chlorophyll?

ANSWER: MAGNESIUM ION

CHEM-92; Short Answer: What does EDTA stand for?

ANSWER: ETHYLENE DIAMINE TETRAACETIC ACID

CHEM-92; Multiple Choice: Cubic crystals containing lattice points only at the corners are called:

- w) body centered
- x) face centered
- y) simple
- z) hexagonal

ANSWER: C-SIMPLE

CHEM-92; Short Answer: Cobalamins are found in what group of vitamins?

ANSWER: THE B GROUP

## *Science Bowl*

## CHEMISTRY

CHEM-92; Multiple Choice: Which of the following is not a covalent network solid?

- w) silicon dioxide
- x) silicon oxide
- y) boron nitrate
- z) sodium oxide

ANSWER: D -- SODIUM OXIDE

CHEM-92; Short Answer: What gas law states "Pressure times Volume = Constant":

ANSWER: BOYLE'S LAW

CHEM-92; Multiple Choice: The conjugate acid of water is:

- w) OH-
- x) H<sub>2</sub>
- y) O<sub>2</sub>
- z) H<sub>3</sub>O<sup>+</sup>

ANSWER: Z -- H<sub>3</sub>O<sup>+</sup>

CHEM-92; Short Answer: What is the systematic name for LiClO<sub>4</sub>?

ANSWER: LITHIUM PERCHLORATE

CHEM-92; Short Answer: What is the formula for phosphorus acid?

ANSWER: H<sub>3</sub>PO<sub>3</sub>

CHEM-92; Short Answer: What is the formula for ethyne?

ANSWER: C<sub>2</sub>H<sub>2</sub>

CHEM-92; Short Answer: What is the general formula for the alkene series?

ANSWER: C<sub>n</sub>H<sub>2n</sub>

## *Science Bowl*

## CHEMISTRY

CHEM-92; Multiple Choice: The modern atomic theory was conceived by :

- w) Victor Grignard
- x) Daniel Rutherford
- y) Svante Arrhenius
- z) John Dalton

ANSWER: Z -- JOHN DALTON

CHEM-92; Short Answer: Who discovered Nitrogen

ANSWER: DANIEL RUTHERFORD

CHEM-92; Multiple Choice: The percent composition by mass of copper in anhydrous cupric sulfate is about:

- w) 10%
- x) 25%
- y) 40%
- z) 75%

ANSWER: C -- 40%

CHEM-92; Short Answer: What is the gaseous product formed from the reaction of calcium carbide and water?

ANSWER: ACETYLENE (or ETHYNE OR C<sub>2</sub>H<sub>2</sub>)

CHEM-92; Short Answer: What is the number of atomic radii along the face diagonal of a face-centered unit cell?

ANSWER: 4

CHEM-92; Short Answer: What is the empirical formula for fructose?

ANSWER: CH<sub>2</sub>O

## ***Science Bowl***

## **CHEMISTRY**

CHEM-92; Multiple Choice: Which of the following terms best fits the statement: "Process by which polysaccharides are degraded to monosaccharides."

- w) hydrolysis
- x) glycolosis
- y) lipogenesis
- z) none of the above

ANSWER: W -- HYDROLYSIS

CHEM-92; Short Answer: Starch is the polymer of what monosaccharide?

ANSWER: GLUCOSE

CHEM-92; Multiple Choice: Which of the following is NOT a base in DNA?

- w) uracil
- x) guanine
- y) adenine
- z) cytosine

ANSWER: W -- URACIL

CHEM-92; Multiple Choice: A bond in which there is an unequal attraction for the shared electrons and a resultant unbalanced distribution of charge is which one of the following types of bonds?

- w) ionic
- x) pure covalent
- y) nonpolar covalent
- z) polar covalent

ANSWER: Z -- POLAR COVALENT

CHEM-92; Short Answer: Name the type of bond in which there is an unequal attraction for the shared electrons and a resultant unbalanced distribution of charge:

ANSWER: POLAR COVALENT BOND

## *Science Bowl*

## CHEMISTRY

CHEM-92; Multiple Choice: In protolytic reactions in which the reactants are much stronger as an acid and a base than the products, the proton transfer reaction:

- w) does not occur
- x) approaches completeness
- y) produces a much stronger acid and a much weaker base
- z) produces a much weaker acid and a much stronger base

ANSWER: X -- APPROACHES COMPLETENESS

CHEM-92; Multiple Choice: Chemically, fats are esters of long carbon-chain acids and which of the following:

- w) ethanol
- x) glycerol
- y) ethylene glycol
- z) sodium hydroxide

ANSWER: X -- GLYCEROL

CHEM-92; Short Answer: The most common complex ions have octahedral geometry. What is the coordination number of the central ion in an octahedral complex?

ANSWER: SIX

CHEM-92; Short Answer: In a flame test the presence of calcium would cause what color flame?

ANSWER: RED (accept yellow-red)

CHEM-92; Short Answer: What will be formed when a metal oxide dissolves in water?

ANSWER: A BASE

CHEM-92; Short Answer: What is the term used to describe the resistance of a liquid to flow?

ANSWER: VISCOSITY

CHEM-92; Short Answer: What is the term used to describe a compound that contains no water of hydration?

ANSWER: ANHYDROUS

## ***Science Bowl***

## **CHEMISTRY**

CHEM-92; Short Answer: What is the oxidation number of Cl in HClO (read: H - C - L - O)?

ANSWER: 1+ (accept 1)

CHEM-92; Short Answer: What is another name for 1,2, Dimethyl Benzene?

ANSWER: ORTHO XYLENE

CHEM-92; Short Answer: What is another name for 1,3, Dimethyl Benzene?

ANSWER: META XYLENE

CHEM-92; Short Answer: What is another name for 1,4, Dimethyl Benzene?

ANSWER: PARA XYLENE

CHEM-92; Multiple Choice: Which of the following pairs of numbers best represents the diameter, in nanometers, of most atoms?

- w) between 0.1 and 0.5
- x) between 1 and 10
- y) between 10 and 100
- z) between 10,000 and 1,000,000

ANSWER: A -- BETWEEN 0.1 AND 0.5

CHEM-92; Multiple Choice: Which of the following Greek philosophers proposed the first atomic theory around 400 B.C.? Was it

- w) Plato
- x) Archimedes
- y) Aristotle
- z) Democritus

ANSWER: D -- DEMOCRITUS

CHEM-92; Short Answer: What is the simplest unit of repetition in a crystalline structure?

ANSWER: A UNIT CELL

## ***Science Bowl***

## **CHEMISTRY**

CHEM-92; Multiple Choice: How many water molecules are contained in Cobalt (II) sulfate heptahydrate?

- w) 3
- x) 6
- y) 8
- z) 7

ANSWER: D -- 7

CHEM-92; Multiple Choice: Which of the following is NOT oxidized by chlorine?

- w) F- (read: F minus)
- x) Br- (read: B - R minus)
- y) F<sub>2</sub> (read: F - 2)
- z) I- (read: I minus)

ANSWER: A -- F-

CHEM-92; Multiple Choice: Gels and Foams are classified as:

- w) solutions
- x) emulsions
- y) colloids
- z) suspensions

ANSWER: C -- COLLOIDS

CHEM-92; Short Answer: What substance, which is a variety of carbon, is also called Plumbago?

ANSWER: GRAPHITE

CHEM-92; Short Answer: What element has a lower boiling point than hydrogen?

ANSWER: HELIUM

CHEM-92; Short Answer: What is the formula for quartz?

ANSWER: SiO<sub>2</sub>

## *Science Bowl*

## CHEMISTRY

CHEM-92; Short Answer: What American first proposed the free energy function G, which interrelates entropy and enthalpy?

ANSWER: J. WILLARD GIBBS

CHEM-92; Short Answer: What is the volume occupied by one mole of a gas under standard conditions called?

ANSWER: A MOLAR VOLUME

CHEM-92; Short Answer: What compound is the main component of Epson salts?

ANSWER: MAGNESIUM SULFATE HEPTAHYDRATE(MgSO<sub>4</sub>·7H<sub>2</sub>O)

CHEM-92; Short Answer: Which element was named for Satan or the devil?

ANSWER: NICKEL (from the german word nickel, meaning satan or "old nick")

CHEM-92; Short Answer: Aromatic compounds are generally derived from what substance?

ANSWER: BENZENE

CHEM-92; Short Answer: What is the name of the element whose symbol is Ga?

ANSWER: GALLIUM

CHEM-92; Short Answer: What is the thermodynamic STATE function that is directly associated with a constant pressure process in which heat is exchanged between system and surroundings?

ANSWER: DELTA H

CHEM-92; Short Answer: In 1962, at Argonne National Laboratory, Neil Bartlett first synthesized what type of compound?

ANSWER: A XENON COMPOUND WAS FORMED or A NOBLE GAS COMPOUND WAS FORMED

CHEM-92; Short Answer: What is the Latin name for Silver?

ANSWER: ARGENTUM

## *Science Bowl*

## CHEMISTRY

CHEM-92; Short Answer: What is the Latin name for Tungsten?

ANSWER: WOLFRAM

CHEM-92; Short Answer: A gaseous organic compound that is best known for its use in preservative solutions has the chemical formula HCHO (read: H - C - H CHEM-92; Short Answer: Give me the name and atomic number of the element I am thinking about. It occupies the same column in the periodic table as selenium. Under standard conditions of temperature and pressure this element is a clear, odorless gas. This element is one of the essential ingredients in the burning process.

ANSWER: OXYGEN ATOMIC NUMBER = 8

CHEM-92; Short Answer: Organic acids have a common functional group. Give me the formula of that functional group.

ANSWER: COOH

CHEM-92; Short Answer: Give the IUPAC (pron: I - U - PAY) name for the straight chain, saturated organic acid containing 10 carbons in an unbranched structure.

ANSWER: DECANOIC ACID

CHEM-92; Multiple Choice: Which of the following chemical compounds is an important aromatic hydrocarbon. Is it:

- w) methane
- x) ethane
- y) benzene
- z) propyne

ANSWER: Y -- BENZENE

CHEM-92; Multiple Choice: In 2-butene, which of the following bonds prevents the atoms at each end of the bond from rotating with respect to each other. Is it an:

- w) ionic bond
- x) sigma bond
- y) strong bond
- z) double bond

ANSWER: Z -- DOUBLE BOND

## ***Science Bowl***

## **CHEMISTRY**

CHEM-92; Short Answer: What is the acid anhydride of sulfurous acid ?

ANSWER: SULFUR DIOXIDE or SO<sub>2</sub>

CHEM-92; Multiple Choice: Which of the following scientists first determined the atomic number of an atom by use of X-rays? Is it:

- w) Millikan
- x) Planck
- y) Thompson
- z) Moseley

ANSWER: Z -- MOSELEY

CHEM-92; Short Answer: What is formed by heating an organic acid with an alcohol.

ANSWER: AN ESTER

CHEM-92; Short Answer: What is the radius of an imaginary shell around an atom which determines how close two nonbonded atoms may approach each other called?

ANSWER: VAN DER WAALS RADIUS

CHEM-92; Short Answer: List the following atoms in order of increasing electron affinity: oxygen, boron, and fluorine.

ANSWER: (1) BORON, (2) OXYGEN, (3) FLUORINE

CHEM-92; Short Answer: Give me the formula for the organic compound cyclobutene.

ANSWER: C<sub>4</sub>H<sub>6</sub>

CHEM-92; Short Answer: Give the EMPIRICAL formula for the organic compound cyclopentene.

ANSWER: C<sub>5</sub>H<sub>8</sub>

CHEM-92; Short Answer: What is the Vitamin name for Ascorbic acid?

ANSWER: VITAMIN C

## ***Science Bowl***

## **CHEMISTRY**

CHEM-92; Short Answer: Retinol is the common name for what vitamin?

ANSWER: VITAMIN A

CHEM-92; Short Answer: How many joules are required to cause the temperature of one gram of water to be raised from 24 degrees Celsius to 25 degrees Celsius.

ANSWER: 4.18 JOULES

CHEM-92; Short Answer: What is the oxidation number of sulfur in sulfurous acid?

ANSWER: 4+ or +4 (read: 4 - plus or plus - 4) (accept 4)

CHEM-92; Multiple Choice: Which of the following is the primary reason for adding calcium carbonate to the reduction process of iron oxide ores ? The calcium carbonate:

- w) acts as an oxidizing agent
- x) removes silicate waste products
- y) acts as a reducing agent
- z) removes sulfur waste products

ANSWER: X -- REMOVES SILICATE WASTE PRODUCTS

CHEM-92; Short Answer: What molten substance is used in the Hall process to reduce aluminum?

ANSWER: CRYOLITE

CHEM-92; Multiple Choice: Which of the following odors does the ester isoamyl isovalerate produce? Is it an odor of:

- w) bananas
- x) apples
- y) cherries
- z) strawberries

ANSWER: B -- APPLES

CHEM-92; Short Answer: When one heats concentrated sulfuric acid, one molecule of water is eliminated for every two molecules of sulfuric acid. What substance will result from this reaction?

ANSWER: PYROSULFURIC ACID or DISULFURIC ACID

## *Science Bowl*

## CHEMISTRY

CHEM-92; Short Answer: How many oxygen atoms are there in one formula unit of magnetite?

ANSWER: FOUR

CHEM-92; Short Answer: What is the name given to the bond that links an amino group of one molecule of an amino acid to a carboxyl group of another amino acid?

ANSWER: PEPTIDE LINK or AMIDE LINK or PEPTIDE BOND

CHEM-92; Multiple Choice: Which of the following substances would be the best choice to neutralize aqueous Sodium Hydroxide?

- w) sodium carbonate
- x) silicon dioxide
- y) aluminum oxide
- z) phosphorus pentoxide

ANSWER: Z -- PHOSPHORUS PENTOXIDE

CHEM-92; Short Answer: Give the IUPAC (pron: I - U - PAY) name of the shortest of the alcohols.

ANSWER: METHANOL

CHEM-92; Short Answer: What is the element represented by the symbol Rh?

ANSWER: RHODIUM

CHEM-92; Short Answer: Leaf and Garbage disposal "plastic bags" are usually made from what polymer?

ANSWER: POLYETHYLENE

CHEM-92; Short Answer: What is the chemical name of the nonstick coating on cookware?

ANSWER: POLYTETRAFLUROETHYLENE

## ***Science Bowl***

## **CHEMISTRY**

CHEM-92; Multiple Choice: Which of the following group of compounds is most soluble in water?

- w) alkanes (pron: ak-KANES)
- x) alcohols
- y) aldehydes (pron: al-deh-HIDES)
- z) alkenes (pron: al-KEENS)

ANSWER: X -- ALCOHOLS

CHEM-92; Short Answer: Tocopherol is the name of what vitamin?

ANSWER: VITAMIN E

CHEM-92; Short Answer: Calciferol (pron: kal-sif-eh-rol) is the common name of what vitamin?

ANSWER: VITAMIN D

CHEM-92; Short Answer: Name the compound formed when an hydroxyl group is attached to a phenyl group.

ANSWER: PHENOL

CHEM-92; Multiple Choice: In which of the following class of substances would WAX be found?

- w) carbohydrates
- x) lipids
- y) proteins
- z) nucleic acids

ANSWER: LIPIDS

CHEM-92; Short Answer: In what vitamin would retinoic acid be found?

ANSWER: VITAMIN A

CHEM-92; Short Answer: What is the element whose symbol is Ho?

ANSWER: HOLMIUM

## ***Science Bowl***

## **CHEMISTRY**

CHEM-92; Short Answer: Fifty micrograms of an isotope have decayed to 12.5 micrograms after 12 hours. What is the half life of the radioisotope?

ANSWER: SIX HOURS

CHEM-92; Short Answer: In what U.S. state were most of the transuranic elements first created?

ANSWER: CALIFORNIA

CHEM-92; Short Answer: What is the PRIMARY carbohydrate in milk?

ANSWER: LACTOSE

CHEM-92; Multiple Choice: Which of the following yields a substance other than glucose on degradation by water?

- w) Cellulose
- x) Glycogen
- y) Sucrose
- z) Maltose

ANSWER: Y -- SUCROSE

CHEM-92; Multiple Choice: In what category may LIPASE (pron: lie-pase) be placed

- w) carbohydrates
- x) lipids
- y) enzymes
- z) nucleic acids

ANSWER: C--ENZYMES

CHEM-92; Multiple Choice: The hydrocarbon end of a detergent molecule is:

- w) hydrophilic
- x) hydrophobic
- y) possible ionic
- z) contains oxygen or sulfur

ANSWER: HYDROPHOBIC

## ***Science Bowl***

## **CHEMISTRY**

CHEM-92; Multiple Choice: An amine contains which one of the following functional groups?

- w) NO<sub>2</sub>
- x) NOH
- y) NH<sub>2</sub>
- z) N<sub>2</sub>

ANSWER: Y -- NH<sub>2</sub>

CHEM-92; Multiple Choice: The molar volume of which two elements is the same at standard temperature and pressure?

- w) fluorine and bromine
- x) fluorine and iodine
- y) fluorine and chlorine
- z) bromine and iodine

ANSWER: Y -- FLUORINE AND CHLORINE

CHEM-92; Multiple Choice: Which one of the following elements is not found in nature?

- w) Technetium
- x) Iridium
- y) Osmium
- z) Molybdenum

ANSWER: W -- TECHNETIUM

CHEM-92; Multiple Choice: The class of compounds implicated in the Antarctic ozone destruction is:

- w) RBC's
- x) DDT's
- y) CFC's
- z) PCB's

ANSWER: Y -- CFC'S

CHEM-92; Multiple Choice: Which one of the following compounds is amphoteric in water?

- w) sodium chloride
- x) sodium sulfate
- y) sodium hydride
- z) sodium hydrogen carbonate

ANSWER: Z -- SODIUM HYDROGEN CARBONATE

## *Science Bowl*

## CHEMISTRY

CHEM-92; Short Answer: Minus 18 degrees centigrade corresponds to what Fahrenheit temperature?

ANSWER: 0 DEGREES FAHRENHEIT

CHEM-92; Short Answer: What is the common name given to a mixture of three parts of concentrated hydrochloric acid and one part concentrated nitric acid?

ANSWER: AQUA REGIA

CHEM-92; Short Answer: What is the name for the element whose symbol is Tl (pron: T - L)?

ANSWER: THALLIUM

CHEM-92; Short Answer: What is the name for the element whose symbol is Lr?

ANSWER: LAWRENCIUM

CHEM-92; Short Answer: What is the oxidation number of nitrogen in  $\text{NaNO}_2$ ?

ANSWER: +3 (Accept 3)

CHEM-92; Short Answer: What halogen is a liquid at room temperature?

ANSWER: BROMINE

CHEM-92; Short Answer: What is another name for 1,4, Dimethyl Benzene?

ANSWER: PARA XYLENE

CHEM-92; Multiple Choice: In a liquid crystal, what is the name given to the simplest ordering of molecules?

- w) Nematic
- x) Smectic
- y) Cholesteric
- z) Lipidic

ANSWER: W -- NEMATIC

## ***Science Bowl***

## **CHEMISTRY**

CHEM-92; Short Answer: What is the name given to a polar molecule or negative ion that is clustered about a central positive ion?

ANSWER: LIGAND

CHEM-92; Short Answer: What substance, which is a variety of carbon, is also called Plumbago?

ANSWER: GRAPHITE

CHEM-92; Short Answer: What element has a lower boiling point than hydrogen?

ANSWER: HELIUM

CHEM-92; Short Answer: I will be describing a chemical element. Try to identify it with the fewest number of clues. This chemical element is the most abundant of the rare-earth group. The element is a silver-gray metal which oxidizes readily at room temperature and is an important factor in color television tubes. The atomic number of this element is 58. What is this element?

ANSWER: CERIUM (Ce)

CHEM-92; Multiple Choice: Which of the following molecules or ions is NOT formed when K metal reacts with liquid CH<sub>3</sub>OH? Is it:

- w) potassium ion
- x) hydrogen ion
- y) methoxy ion
- z) hydrogen molecule

ANSWER: X -- HYDROGEN ION

CHEM-92; Multiple Choice: "Mirror-image" molecules are called:

- w) stereoisomers
- x) structural isomers
- y) diastereomers
- z) constitutional isomers

ANSWER: W -- STEREOISOMERS

## *Science Bowl*

## CHEMISTRY

CHEM-92; Multiple Choice: What is the only nonmetal element that is a liquid room temperature?

- w) phosphorus
- x) bromine
- y) iodine
- z) arsenic

ANSWER: X -- BROMINE

CHEM-92; Multiple Choice: Which of the following compounds will be a nonelectrolyte when dissolved in water?

- w) sodium chloride
- x) potassium nitrate
- y) ethanol
- z) hydrogen chloride

ANSWER: Y -- ETHANOL

CHEM-92; Short Answer: What is the chemical formula of buckminsterfullerene?

ANSWER: C<sub>60</sub>

CHEM-92; Multiple Choice: What is the molarity of a salt solution prepared by dissolving three moles of salt in 500 milliliters of water?

- w) 1
- x) 2
- y) 4
- z) 6

ANSWER: Z -- 6

CHEM-92; Multiple Choice: Dry ice is the solid form of what gas?

- w) nitrogen
- x) oxygen
- y) helium
- z) carbon dioxide

ANSWER: Z -- CARBON DIOXIDE

## Science Bowl

## CHEMISTRY

CHEM-92; Multiple Choice: Thermite is a mixture of aluminum and:

- w) hematite
- x) sodium oxide
- y) iron
- z) magnesium

ANSWER: W -- HEMATITE

CHEM-92; Multiple Choice: Nitric acid is made from air and water by the:

- w) Haber process
- x) Contact process
- y) Castner process
- z) Arc process

ANSWER: Z -- ARC PROCESS

CHEM-92; Multiple Choice: Impurities in metal ores are called:

- w) flux
- x) gangue (pron: gang)
- y) slag
- z) sediments

ANSWER: X -- GANGUE

CHEM-92; Multiple Choice: The existence of an element in two or more forms in the same physical phase is known as:

- w) allotropy
- x) diphasisty
- y) polyformation
- z) diatomic existence

ANSWER: W -- ALLOTROPY

CHEM-92; Multiple Choice: The complete combustion of one mole of hydrogen produces:

- w) 1/2 mole H<sub>2</sub>O
- x) 1/2 mole H<sub>2</sub>O + 1/2 mole O<sub>3</sub>
- y) 1 mole water
- z) 1 mole hydroxide ions

ANSWER: Y -- 1 MOLE WATER

## Science Bowl

## CHEMISTRY

CHEM-92; Short Answer: Who named the element hydrogen?

ANSWER: LAVOISIER

CHEM-92; Multiple Choice: Moles of solute divided by kilograms of solvent is expression for:

- w) molarity
- x) solute-to-solution ratio
- y) mole percentage
- z) molality

ANSWER: Z -- MOLALITY

CHEM-92; Multiple Choice: 0.51 °C/molal is the molal:

- w) freezing-point constant for water
- x) boiling-point constant for water
- y) vapor-temperature constant for water
- z) heat of solution for water

ANSWER: X -- BOILING-POINT CONSTANT FOR WATER

CHEM-92; Short Answer: Name the conjugate base of the bicarbonate ion.

ANSWER: CARBONATE ION

CHEM-92; Short Answer: What is the formula for Hypochlorous Acid?

ANSWER: HClO

CHEM-92; Multiple Choice: The bond most likely to be formed when two atoms differ SOMEWHAT in their tendency to attract electrons is:

- w) nonpolar ionic
- x) polar ionic
- y) polar covalent
- z) nonpolar covalent

ANSWER: Y -- POLAR COVALENT

## Science Bowl

## CHEMISTRY

CHEM-92; Multiple Choice: What is the expected bond angle in H<sub>2</sub>S when the bonding is described using hydrogen-like atomic orbitals?

- w) 180°
- x) 120°
- y) 109.5°
- z) 90°

ANSWER: Z -- 90°

CHEM-92; Multiple Choice: Zinc is most soluble in which of the following liquids?

- w) Water
- x) Alcohol
- y) Mercury
- z) Oil

ANSWER: Y -- MERCURY

CHEM-92; Multiple Choice: What is the primary CONSTITUENT of human bones?

- w) Calcium sulfate
- x) Calcium carbonate
- y) Hydroxyapatite (pron: high-drox-ee-ap-eh-tite)
- z) Chloroapatite (pron: klor-o-ap-eh-tite)

ANSWER: Y -- HYDROXYAPATITE

CHEM-92; Multiple Choice: One property a colloidal dispersion has that a solution does not is:

- w) homogeneity
- x) filterability
- y) the Tyndall effect
- z) osmotic pressure

ANSWER: Y -- THE TYNDALL EFFECT

CHEM-92; Multiple Choice: A family of organic compounds containing only carb and hydrogen and having only single bonds are the:

- w) alkenes and alkanes
- x) alkanes and cycloalkanes
- y) alkynes (pron: AL-kines) and alkenes
- z) cycloalkanes and alkenes

ANSWER: B -- ALKANES AND CYCLOALKANES

## Science Bowl

## CHEMISTRY

CHEM-92; Multiple Choice: In quantum chemistry, a nodal surface:

- w) gives 99 percent contour surface for an orbital
- x) exists for a 1s orbital
- y) has quantum number  $l = 1$
- z) is an orbital surface on which the probability density is zero

ANSWER: Z -- IS AN ORBITAL SURFACE ON WHICH THE PROBABILITY DENSITY IS ZERO

CHEM-92; Multiple Choice: Which of the following elements has the largest crystallographic radius?

- w) Mg
- x) N
- y) K
- z) F

ANSWER: Y -- K

CHEM-92; Short Answer: What bond angle is associated with  $sp^3$  (read: S - P - hybrid orbitals)?

ANSWER: 109.5 DEGREES

CHEM-92; Multiple Choice: Which of the following substances would be expected to have the highest melting point?

- w) Potassium Bromide
- x) Iodine
- y) Methane
- z) Hydrogen Chloride

ANSWER: W -- POTASSIUM BROMIDE

CHEM-92; Multiple Choice: Which of the following aqueous solutions would have the lowest boiling point? Would it be a 1.0 molal solution of:

- w) Hydrochloric acid
- x) Sodium Hydroxide
- y) Acetic Acid,
- z) Magnesium Chloride

ANSWER: Y -- ACETIC ACID

## Science Bowl

## CHEMISTRY

CHEM-92; Multiple Choice: The three isotopes of hydrogen are protium, tritium and:

- w) heprin
- x) helium
- y) duodenum
- z) deuterium

ANSWER: Z -- DEUTERIUM

CHEM-92; Short Answer: What is the atomic number of uranium?

ANSWER: 92

CHEM-92; Short Answer: To which class of organic chemical compounds does rhamnose (pronounced ram-nose) belong?

ANSWER: SUGARS or CARBOHYDRATE

CHEM-92; Multiple Choice: Which of these molecules is bound by ionic bonds?

- w) H<sub>2</sub>O
- x) CH<sub>4</sub>
- y) NaCl
- z) C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>

ANSWER: Y -- NaCl

CHEM-92; Multiple Choice: The equilibrium constant for the gas phase reaction  $A + B = C + D$  is  $10^{-3}$ . The rate of the forward reaction is  $10^{-11}$  cubic centimeters per molecule per second. What is the rate constant of the reverse reaction?

- w)  $10$  cubic centimeters per molecule per second
- x)  $10^{-8}$  cubic centimeters per molecule per second
- y)  $10^{-10}$  cubic centimeters per molecule per second
- z)  $10^{-14}$  cubic centimeters per molecule per second

ANSWER: Z --  $10^{-14}$  CUBIC CENTIMETERS PER MOLECULE PER SECOND

## ***Science Bowl***

## **CHEMISTRY**

CHEM-92; Multiple Choice: The chemical symbol for Plutonium is:

- w) Pl (read: P - L)
- x) Pu
- y) Pt
- z) Pm

ANSWER: X -- Pu

CHEM-92; Multiple Choice: A nonpolar molecule is usually:

- w) hydrophilic
- x) soluble in water
- y) hydrophytic
- z) soluble in organic solvents

ANSWER: Z -- SOLUBLE IN ORGANIC SOLVENTS

CHEM-92; Multiple Choice: Which compound is a monosaccharide?

- w) maltose
- x) sucrose
- y) glucose
- z) glycogen

ANSWER: Y -- GLUCOSE

CHEM-92; Multiple Choice: What acid is prevalent in the human stomach?

- w) sulfuric acid
- x) nitric acid
- y) muriatic acid
- z) amino acids

ANSWER: Y -- MURIATIC ACID

CHEM-92; Multiple Choice: Another name for milk sugar is:

- w) glucose
- x) maltose
- y) lactose
- z) fructose

ANSWER: Y -- LACTOSE

## Science Bowl

## CHEMISTRY

CHEM-92; Multiple Choice: Molecular oxygen is said to be paramagnetic. This indicates that molecular oxygen:

- w) is a gas at room temperature
- x) forms molecules containing two oxygen atoms
- y) has an approximate molecular weight of 32
- z) has unpaired electrons

ANSWER: Z -- HAS UNPAIRED ELECTRONS

CHEM-92; Short Answer: What is the oxidation number of Bismuth in the compound Bismuth Phosphide?

ANSWER: + 3 (accept 3)

CHEM-92; Multiple Choice: What is the molecular geometry of XeO<sub>2</sub> (Xenon Dioxide)?

- w) linear
- x) angular
- y) tetrahedral
- z) trigonal planar

ANSWER: X -- ANGULAR

CHEM-92; Multiple Choice: What is the molecular geometry of the Bromine Tetrafluoride ion (BrF<sub>4</sub><sup>-</sup>)?

- w) linear
- x) angular
- y) tetrahedral
- z) pyramidal

ANSWER: Y -- TETRAHEDRAL

CHEM-92; Multiple Choice: What is the molecular geometry of thiocyanate (pronounced thie-owe-SIE-a-nate) ion (SCN<sup>-</sup>)?

- w) linear
- x) angular
- y) tetrahedral
- z) pyramidal

ANSWER: W -- LINEAR

## ***Science Bowl***

## **CHEMISTRY**

CHEM-92; Multiple Choice: Which one of the following molecules exhibits resonance?

- w) Carbon Tetrachloride
- x) Carbonate ion
- y) Sulfur Dichloride
- z) Phosphorus Tribromide

ANSWER: X -- CARBONATE ION

CHEM-92; Short Answer: How many electron lone pairs are on the central atom in Hydrogen Sulfide?

ANSWER: TWO

CHEM-92; Multiple Choice: Which of the following has a multiple covalent bond?

- w) Bromine
- x) Hydrogen
- y) Oxygen
- z) Chlorine Monofluoride

ANSWER: Y -- OXYGEN

CHEM-92; Multiple Choice: Which of the following molecules is polar?

- w) Iodine
- x) Carbon Dioxide
- y) Carbon Monoxide
- z) Chlorine

ANSWER: Y -- CARBON MONOXIDE

CHEM-92; Multiple Choice: Which of the following elements would form a covalent bond with Bromine?

- w) Calcium
- x) Aluminum
- y) Oxygen
- z) Tin

ANSWER: Y -- OXYGEN

## ***Science Bowl***

## **CHEMISTRY**

CHEM-92; Short Answer: What is the formula for Calcium Nitride?

ANSWER: Ca<sub>3</sub>N<sub>2</sub>

CHEM-92; Multiple Choice: In which form is Silicon most frequently found in nature?

- w) The free element Silicon
- x) Silicon-Oxygen compounds
- y) Silicon-Carbon compounds
- z) Silicon-Metal compounds

ANSWER: X -- SILICON-OXYGEN COMPOUNDS

CHEM-92; Multiple Choice: Compared to Chlorine, Bromine has:

- w) smaller atomic size
- x) higher density
- y) lower boiling point
- z) greater number of outer electrons

ANSWER: X -- HIGHER DENSITY

CHEM-92; Multiple Choice: Which of the following best describes Chlorine?

- w) colorless liquid
- x) reddish-brown liquid
- y) colorless gas
- z) greenish-yellow gas

ANSWER: D -- GREENISH-YELLOW GAS

CHEM-92; Short Answer: Which of the STABLE Group IA elements will have the lowest melting point?

ANSWER: CESIUM

CHEM-92; Multiple Choice: Which of the following elements has the highest first ionization energy?

- w) Helium
- x) Neon
- y) Fluorine
- z) Argon

ANSWER: W -- HELIUM

## *Science Bowl*

## CHEMISTRY

CHEM-92; Short Answer: Which member of the GROUP SIX A elements is the least metallic?

ANSWER: OXYGEN

CHEM-92; Multiple Choice: Which of the following elements would most likely be a silvery solid at room temperature?

- w) Sodium
- x) Silicon
- y) Selenium
- z) Astatine

ANSWER: W -- SODIUM

CHEM-92; Short Answer: What is the oxidation number of Manganese in Potassium Permanganate?

ANSWER: PLUS SEVEN

CHEM-92; Short Answer: Proceeding across a period in the Periodic Table, what atomic size trend is observed?

ANSWER: ATOMIC SIZE DECREASES

CHEM-92; Multiple Choice: Which of the following groups of elements have an OUTER ELECTRONIC configuration of S-2-P-2?

- w) halogens
- x) Nitrogen-Phosphorus Group
- y) Carbon-Silicon Group
- z) Boron-Aluminum Group

ANSWER: Y -- CARBON-SILICON GROUP

CHEM-92; Short Answer: Which group of elements have an outer electronic configuration of S-2-P-6?

ANSWER: NOBLE GASES

## *Science Bowl*

## CHEMISTRY

CHEM-92; Short Answer: At what temperature are the Fahrenheit and Celsius scales equal to each other?

ANSWER: MINUS FORTY DEGREES

CHEM-92; Short Answer: Name the Greek philosopher who first proposed the idea that matter was composed of small indivisible particles.

ANSWER: DEMOCRITUS

CHEM-92; Short Answer: Who is considered the father of modern Chemistry?

ANSWER: LAVOISIER

CHEM-92; Short Answer: What is the common name for Potassium Aluminum Sulfate dodecahydrate?

ANSWER: ALUM

CHEM-92; Multiple Choice: AS A GROUP, the halogens have the largest:

- w) atomic radii
- x) Boiling points
- y) electronegativities
- z) ionization energies

ANSWER: Y -- ELECTRONEGATIVITIES

CHEM-92; Short Answer: What is the formula for Lithium Peroxide?

ANSWER:  $\text{Li}_2\text{O}_2$

CHEM-92; Multiple Choice: What is the chemical formula for soda ash?

ANSWER:  $\text{Na}_2\text{CO}_3$

CHEM-92; Short Answer: What is the formula for Hydrosulfuric acid?

ANSWER:  $\text{H}_2\text{S}$

## ***Science Bowl***

## **CHEMISTRY**

CHEM-92; Short Answer: What is the formula for Periodic acid?

ANSWER: H<sub>5</sub>IO<sub>6</sub>

CHEM-92; Short Answer: What is the formula for the compound that is formed from Sodium and Fluorine?

ANSWER: NaF

CHEM-92; Short Answer: What is the name for the ClO<sup>-1</sup> (read: C-L-O-Minus-One) ion?

ANSWER: HYPOCHLORITE

CHEM-92; Short Answer: Name this chemical element. The principal use of this element has been in solid-state electronic devices, notably transistors. Its position in the periodic table is in group "4A". The element's atomic number is 32 and its chemical symbol is Ge.

ANSWER: GERMANIUM

CHEM-92; Short Answer: This colorless liquid has a mild characteristic odor. Its chemical formula is C<sub>2</sub>H<sub>5</sub>OH. Name this liquid.

ANSWER: ETHYL ALCOHOL or ETHANOL

CHEM-92; Short Answer: A beaker of ethyl alcohol is marked 188 proof. What percentage of the liquid is ethyl alcohol?

ANSWER: 94%

CHEM-92; Short Answer: What is the simplest gem in chemical composition?

ANSWER: DIAMOND

CHEM-92; Short Answer: Name the chemical element that is eleventh in the Lanthanide Series in the periodic table. Because of the metal's high thermal-neutron-absorption cross section, it has been of much interest in terms of use in nuclear reactor hardware. The chemical symbol for this element is Er.

ANSWER: ERBIUM

## Science Bowl

## CHEMISTRY

CHEM-92; Multiple Choice: Relative to a solution with a pH of 4, a solution of pH = 6 is:

- w) higher in H<sup>+</sup> concentration
- x) lower in OH<sup>-</sup>
- y) less basic
- z) less acidic

ANSWER: Z -- LESS ACIDIC

CHEM-92; Short Answer: What is the chemical solvent DMF called?

ANSWER: -- DIMETHYLFORMAMIDE (pron: die-meth-il-FOR-ma-mide)

CHEM-92; Short Answer: What is an amalgam?

ANSWER: AN ALLOY OF A METAL AND MERCURY

CHEM-92; Short Answer: What is the oxidation state of nitrogen in nitrous acid?

ANSWER: +3

CHEM-92; Short Answer: If one begins with a 12 Normal solution of HCl and wishes to make a 2 Molar solution, what will be the ratio of 12N HCl to the final solution volume?

ANSWER: 1:6

CHEM-92; Multiple Choice: A cobalt chloride solution soaked into a piece of cotton can be used as an indicator for changes in humidity levels. Pink indicates a high-humidity environment and blue a low-humidity environment. What are these color changes caused by:

- w) The ionization and reduction of the cobalt plus two slash cobalt plus three couple.
- x) The vaporization and redeposition of cobalt chloride.
- y) The loss and readsorption of the cobalt's waters of hydration.
- z) This is an illustration of the Schrodinger principle.

ANSWER: Y -- THE LOSS AND READSORPTION OF THE COBALT'S WATERS OF HYDRATION.

## Science Bowl

## CHEMISTRY

CHEM-92; Multiple Choice: pH is defined as the negative logarithm of the hydrogen ion concentration. Comparing a pH 5 and a pH 8 solution, which of the following is true?

- w) There are 1,000 times more hydrogen ions in the pH 8 solution.
- x) There are 1,000 times more hydrogen ions in the pH 5 solution.
- y) There are 3 times more hydrogen ions in the pH 8 solution.
- z) Cannot tell the difference between these two solutions by pH, since the numbers are so close.

ANSWER: X -- THERE ARE 1,000 TIMES MORE HYDROGEN IONS IN THE PH 5 SOLUTION

CHEM-92; Short Answer: Joseph Priestly was working in England when he discovered oxygen. He actually did more research in another country where he died and is buried. What is the second country where he worked?

ANSWER: UNITED STATES

CHEM-92; Multiple Choice: Ethylene diamine tetraacetoacetate (pron: te-tra-a-see-tow-AS-e-tate) (EDTW) is often used for which of the following:

- w) Determine hardness of water
- x) Measure the amount of zinc in a solution.
- y) A preservative in foods
- z) All of the above

ANSWER: Z -- ALL OF THE ABOVE

CHEM-92; Multiple Choice: The common alloy, babbitt metal, which is composed of tin, antimony, and copper, is best known for its use in:

- w) magnets
- x) bearings
- y) dental fillings
- z) drinking vessels

ANSWER: X -- BEARINGS

## Science Bowl

## CHEMISTRY

CHEM-92; Short Answer: The boiling point of normal paraffinic (pron: pair-ah-FIN-ik) hydrocarbons increases with the number of carbon atoms per molecule. What is the smallest number of carbon atoms a normal paraffinic hydrocarbon can have and still be a liquid at room temperature (70-75 degrees Fahrenheit) and 1 atmosphere pressure.

ANSWER: FIVE

CHEM-92; Multiple Choice: The boiling points of the halogens increase going from F<sub>2</sub> to I<sub>2</sub>. What type of intermolecular forces are responsible for this trend?

- w) permanent dipole
- x) hydrogen bonding
- y) ion-ion attraction
- z) London dispersion forces

ANSWER: Z -- LONDON DISPERSION FORCES

CHEM-92; Multiple Choice: A sample of grapefruit juice at 25 degrees Celsius has a hydronium concentration of  $1.78 \times 10^{-3}$  molar. What is the pH of the solution?

- w) 2.22
- x) 2.75
- y) 3.25
- z) 6.33

ANSWER: X -- 2.75

CHEM-92; Short Answer: What is the name given to an element that exists in two or more physical forms?

ANSWER: ALLOTROPIC

CHEM-92; Short Answer: Graphite carbon atoms form planar layers in what regular geometric arrangement?

ANSWER: HEXAGONAL

CHEM-92; Short Answer: Planar Platinum compounds are being investigated in the treatment of cancer. Name the isomers of dichlorodiamineplatinum(II) (pron: die-klor-o-di-a-MIN-e-plat-i-num two)?

ANSWER: CIS AND TRANS (DICHLORODIAMINEPLATINUM (II))

## ***Science Bowl***

## **CHEMISTRY**

CHEM-92; Short Answer: The block of elements in the periodic table which are filling the 4-f electron shell are known as:

ANSWER: LANTHANIDES

CHEM-92; Short Answer: What is the oxidation state of chromium in potassium dichromate?

ANSWER: +6 (or 6)

CHEM-92; Multiple Choice: Which of the following has the smallest atomic radius?

- w) iodine
- x) chlorine
- y) fluorine
- z) bromine

ANSWER: Y -- FLUORINE

CHEM-92; Short Answer: What is the literal meaning of the word "chromatography"?

ANSWER: COLOR-WRITING (or equivalent terminology)

CHEM-92; Multiple Choice: Which of the following is an example of a "cation":

- w) ammonium
- x) chloride
- y) sulfate
- z) oxalate

ANSWER: W -- AMMONIUM

CHEM-92; Multiple Choice: Which of the following is NOT an organic acid?

- w) butyric (pron: byu-TEER-ik)
- x) sulfuric
- y) acetic
- z) citric

ANSWER: X -- SULFURIC

## *Science Bowl*

## CHEMISTRY

CHEM-92; Short Answer: Identify any FIVE elements named after astronomical bodies:

ANSWER: PALLADIUM; URANIUM; PLUTONIUM; NEPTUNIUM;  
SELENIUM; TELLURIUM; HELIUM; CERIUM

CHEM-92; Short Answer: Isomers which are chemically identical but cannot be superimposed on each other are called what?

ANSWER: STEREOISOMERS or ENANTIOMERS

CHEM-92; Multiple Choice: In Celsius, the freezing point of a one-molal water solution of sodium phosphate, chemical formula  $\text{Na}_3\text{PO}_4$ , is expected to be:

- w) - 0.93 degrees Celsius
- x) - 1.86 degrees Celsius
- y) - 7.44 degrees Celsius
- z) - 3.72 degrees Celsius

ANSWER: C -- (- 7.44 DEGREES CELSIUS)

CHEM-92; Short Answer: What is the name given to the temperature and pressure at which solid, liquid, and gas coexist for a pure material?

ANSWER: TRIPLE POINT

CHEM-92; Multiple Choice: Which of the following metals is obtained from its most common ore using an electrolytic process?

- w) nickel
- x) tin
- y) aluminum
- z) manganese

ANSWER: Y -- ALUMINUM

CHEM-92; Short Answer: What would be the volume, in liters, of 11 grams of  $\text{CO}_2$  at standard temperature and pressure?

ANSWER: 5.6 LITERS

## Science Bowl

## CHEMISTRY

CHEM-92; Multiple Choice: When a radioisotope undergoes beta minus decay, does its atomic number:

- w) increase
- x) decrease
- y) remain the same
- z) vary depending on the element involved

ANSWER: W -- INCREASE

CHEM-92; Multiple Choice: Which of the following forms the weakest acid in aqueous solution?

- w) hydrogen fluoride
- x) hydrogen chloride
- y) hydrogen bromide
- z) hydrogen iodide

ANSWER: W -- HYDROGEN FLUORIDE

CHEM-92; Short Answer: How many molecules of an ideal gas are there in 22.414 liters at 10 atmospheres pressure and 0 degrees C?

ANSWER:  $6.02 \times 10^{24}$  (or accept  $10 \times$  AVAGADRO'S NUMBER)

CHEM-92; Short Answer: Name this chemical element. It is a member of the Lanthanide Series and can be found in the minerals apatite (pron: AP-a-tite), gadolinite (pron: gad-O-lin-ite), and xenotime (pron: ZEN-o- time). This element was first identified by Boisbaudran in 1886. Its chemical symbol is Dy.

ANSWER: DYSPROSIUM (pron: dis-PRO-zee-um)

CHEM-92; Multiple Choice: Oxygen has a valence number of -1 in:

- w) Sodium Peroxide
- x) Potassium Chlorate
- y) Water
- z) Sodium Hydroxide

ANSWER: W -- SODIUM PEROXIDE

## Science Bowl

## CHEMISTRY

CHEM-92; Short Answer: The molecular weight of H<sub>2</sub>SO<sub>4</sub> is 98. How many grams of H<sub>2</sub>SO<sub>4</sub> are contained in 1 liter of a 1 Normal solution?

ANSWER: 49 grams of H<sub>2</sub>SO<sub>4</sub>

CHEM-92; Multiple Choice: The oxidation number of chlorine in KClO<sub>4</sub> is:

- w) -1
- x) +3
- y) +7
- z) +1

ANSWER: C -- +7

CHEM-92; Multiple Choice: What is a typical spacing between atoms in a crystal, e.g., copper or rock salt?

- w) 0.1 Angstroms
- x) 2 Angstroms
- y) 20 Angstroms
- z) 100 Angstroms

ANSWER: B -- 2 ANGSTROMS

CHEM-92; Multiple Choice: Mendeleev proposed the existence of an unknown element that he called eka-aluminum. The element is now called:

- w) magnesium
- x) silicon
- y) gallium
- z) germanium

ANSWER: C -- GALLIUM

CHEM-92; Multiple Choice: Which one of the following is classified as a covalent network solid crystal?

- w) CaO
- x) SiO<sub>2</sub>
- y) CO<sub>2</sub>
- z) Pb

ANSWER: B -- SiO<sub>2</sub>

## ***Science Bowl***

## **CHEMISTRY**

CHEM-92; Multiple Choice: Foods cooked in salt water compared to unsalted water will:

- w) cook faster
- x) boil at a lower temperature
- y) not be affected in any way
- z) will cook slower because of the action of the salt

ANSWER: W -- COOK FASTER

CHEM-92; Short Answer: Name the two elements that are liquids at 25 degrees Celsius.

ANSWER: BROMINE (Br) AND MERCURY (Hg)

CHEM-92; Multiple Choice: Crystals of ice are:

- w) isometric
- x) tetragonal
- y) hexagonal
- z) orthorombic

ANSWER: Y -- HEXAGONAL

CHEM-92; Short Answer: Name the atom that has one proton and no neutrons?

ANSWER: HYDROGEN

CHEM-92; Short Answer: What are the only two metallic elements that end with the letter "d"?

ANSWER: GOLD AND LEAD

CHEM-92; Multiple Choice: What device is used to remove sulfur dioxide from power plant stack gases?

- w) scrubber
- x) precipitator
- y) digester
- z) clarifier

ANSWER: W -- SCRUBBER

## ***Science Bowl***

## **CHEMISTRY**

CHEM-92; Multiple Choice: The lunar soil consists primarily of:

- w) FeTiO<sub>2</sub>
- x) Al<sub>2</sub>O<sub>3</sub>
- y) SiO<sub>2</sub>
- z) H<sub>2</sub>O

ANSWER: W -- FeTiO<sub>2</sub>

CHEM-92; Multiple Choice: The metallic element with the highest melting point is:

- w) Ta
- x) W
- y) Rh
- z) Mo

ANSWER: X -- W

CHEM-92; Multiple Choice: The greatest reservoir of carbon dioxide is:

- w) the atmosphere
- x) plants
- y) the soil
- z) the oceans

ANSWER: Z -- THE OCEANS

CHEM-92; Multiple Choice: What are the major constituents of typical fly ash particles generated from the combustion of coal?

- w) acidic and basic oxides
- x) trace elements
- y) unburned carbon
- z) sulfates and phosphates

ANSWER: W -- ACIDIC AND BASIC OXIDES

CHEM-92; Multiple Choice: Which of the following molecules has a permanent electric dipole moment?

- w) H<sub>2</sub>O
- x) Cl<sub>2</sub>
- y) CH<sub>4</sub>
- z) N<sub>2</sub>

ANSWER: W -- H<sub>2</sub>O

## ***Science Bowl***

## **CHEMISTRY**

CHEM-92; Multiple Choice: Within a given period of the periodic table, the element with the lowest ionization energy is:

- w) transition metal
- x) alkali metal
- y) halogen
- z) noble gas

ANSWER: X -- ALKALI METAL

CHEM-92; Short Answer: A sample of gas has a volume of 210 cubic centimeters at a temperature of 250 degrees Kelvin. The temperature is raised to 500 degrees Kelvin while the pressure remains unchanged. What is the new volume of the gas.

ANSWER: 420 CUBIC CENTIMETERS

CHEM-92; Multiple Choice: A substance that accepts an electron pair is classified as a:

- w) bronsted-lowry acid
- x) bronsted-lowry base
- y) lewis acid
- z) lewis base

ANSWER: Y -- LEWIS ACID

CHEM-92; Multiple Choice: In general, as you move down a family the ionization energy:

- w) increases
- x) decreases
- y) remains the same
- z) increases or decreases

ANSWER: X -- DECREASES

CHEM-92; Multiple Choice: In general, as you move across a period (left to right) electronegativity:

- w) increases
- x) decreases
- y) remains the same
- z) increases or decreases

ANSWER: W -- INCREASES

## ***Science Bowl***

## **CHEMISTRY**

CHEM-92; Multiple Choice: Absorption into the nucleus of an electron from the K shell is called, "electron capture". When this happens to  $^{37}_{18}\text{Ar}$  (read: A - R, 37, atomic number 18), the product is:

- w)  $^{17}_{17}\text{Cl}$  (read: C - L, 37, atomic number 17)
- x)  $^{17}_{18}\text{Cl}$  (read: C - L, 38, atomic number 17)
- y)  $^{19}_{17}\text{K}$  (read: K, 37, atomic number 19)
- z)  $^{19}_{18}\text{K}$  (read: K, 38, atomic number 19)

ANSWER: W --  $^{17}_{17}\text{Cl}$

CHEM-92; Short Answer: Name either of the elements which, in the form of oxides, contributes to the formation of acid rain.

ANSWER: NITROGEN OR SULFUR

CHEM-92; Multiple Choice: An aldehyde can be oxidized to form:

- w) a ketone
- x) an acid
- y) an alcohol
- z) an ester

ANSWER: X -- AN ACID

CHEM-92; Short Answer: This drug, used for treatment of cardiac diseases, is obtained from the purple foxglove.

ANSWER: DIGITALIS

CHEM-92; Short Answer: The first plastic was a mixture of cellulose nitrate and camphor invented in the 1860's by John Hyatt. What was the trademark given to this material?

ANSWER: CELLULOID

## ***Science Bowl***

## **CHEMISTRY**

CHEM-92; Short Answer: This natural fiber obtained from the stems of a plant of the nettle family has found popularity in modern fibers with a high wet strength, absorbent but dries quickly, it can be spun or woven, has a high rot and mildew resistance and elasticity 50 percent greater than that of CHEM-92; Multiple Choice: What transuranic element is often used in satellites as a source of heat or power?

- w) Plutonium-238
- x) Strontium-90
- y) Cesium-137
- z) Uranium-235

ANSWER: W -- PLUTONIUM-238

CHEM-92; Short Answer: What gas is given off when an acid reacts with chalk?

ANSWER: CARBON DIOXIDE

CHEM-92; Short Answer: What is the chemical composition of quartz?

ANSWER: SiO<sub>2</sub> or SILICON DIOXIDE

CHEM-92; Short Answer: What metal is often obtained from deposits of Hematite?

ANSWER: IRON

CHEM-92; Short Answer: What is the hybridization assumed for phosphorus in PCl<sub>5</sub>?

ANSWER: d sp<sup>3</sup>

CHEM-92; Short Answer: What are alkenes having two double bonds separated by one single bond known as?

ANSWER: CONJUGATED DIENES

CHEM-92; Short Answer: The six carbon cyclic alkane is called what?

ANSWER: CYCLOHEXANE

## ***Science Bowl***

## **CHEMISTRY**

CHEM-92; Short Answer: Compounds of the same atomic content and molecular formula but with differing structures are called what?

ANSWER: ISOMERS

CHEM-92; Short Answer: What is the oxidation number of Bismuth in the compound Bismuth Phosphide?

ANSWER: PLUS 3 (or 3)

CHEM-93; Multiple Choice: Elements that exist in two or more distinctly different solid forms are known as:

- w) azeotropes
- x) allotropes
- y) isotopes
- z) isochores

ANSWER: X -- ALLOTROPEs

CHEM-93; Multiple Choice: Which of the following statements is not one of the three basic assumptions of the kinetic theory?

- w) Matter is composed of very tiny particles.
- x) The particles of matter are in constant motion.
- y) The particles of matter lose energy in collisions.

ANSWER: Y -- THE PARTICLES OF MATTER LOSE ENERGY IN COLLISIONS

CHEM-93; Multiple Choice: Which of the 3rd period elements loses electrons most readily?

- w) Sodium
- x) Magnesium
- y) Aluminum
- z) Silicon

ANSWER: A-SODIUM

## *Science Bowl*

## CHEMISTRY

CHEM-93; Multiple Choice: Of the nonmetallic elements the one least likely to be found in organic compounds is:

- w) nitrogen
- x) phosphorus
- y) chlorine
- z) selenium

ANSWER: Z -- SELENIUM

CHEM-93; Multiple Choice: A waste product in the metabolism of glucose in cells is:

- w) oxygen
- x) methane
- y) carbon dioxide
- z) urea

ANSWER: C -- CARBON DIOXIDE

CHEM-93; Short Answer: At what Kelvin temperature does entropy have the minimum value?

ANSWER: ZERO

CHEM-93; Multiple Choice: Diamond has each of the following properties except:

- w) extreme hardness
- x) ability to conduct electricity
- y) high melting point
- z) tendency to burn in air

ANSWER: X -- ABILITY TO CONDUCT ELECTRICITY

CHEM-93; Short Answer: What is the collective term used to describe substances such as Orlon, Nylon, polyethylene, and polyurethane foam?

ANSWER: POLYMER

## ***Science Bowl***

## **CHEMISTRY**

CHEM-93; Multiple Choice: Which of the following is not a polymer?

- w) rayon
- x) Teflon
- y) rubber
- z) penicillin

ANSWER: Z -- PENICILLIN

CHEM-93; Short Answer: What term defines the amount of heat needed to raise the temperature of one gram of matter by one degree C.

ANSWER: SPECIFIC HEAT (OR HEAT CAPACITY)

CHEM-93; Short Answer: What thermodynamic function is a quantitative measure of disorder?

ANSWER: ENTROPY

CHEM-93; Short Answer: How many millimeters of mercury are equal to one atmosphere at sea level?

ANSWER: 760 MILLIMETERS

CHEM-93; Multiple Choice: What is the process by which an atom gains electrons?

- w) Reduction
- x) Neutralization
- y) Electrolysis
- z) Oxidation

ANSWER: W -- REDUCTION

CHEM-93; Short Answer: Give the names of four alkali metals:

ANSWER: LITHIUM, SODIUM, POTASSIUM, RUBIDIUM, CESIUM, AND FRANCIUM

CHEM-93; Short Answer: What is the term commonly used for mass per unit volume?

ANSWER: DENSITY

## ***Science Bowl***

## **CHEMISTRY**

CHEM-93; Multiple Choice: Which of the following is TRUE of a sample of gas at a constant temperature when the pressure is doubled?

- w) the volume doubles
- x) the volume halves
- y) the volume remains the same

ANSWER: X -- THE VOLUME HALVES

CHEM-93; Multiple Choice: Immiscible liquids:

- w) are not mutually soluble
- x) dissolve in each other
- y) dissolve in more than one liquid
- z) are unstable and chemically react
- e) do not exist

ANSWER: W -- ARE NOT MUTUALLY SOLUBLE

CHEM-93; Multiple Choice: Which of the following would be least soluble in water?

- w) Carbon Tetrachloride
- x) Sodium Oxide
- y) Magnesium Bromide
- z) Potassium Phosphate

ANSWER: W -- CARBON TETRACHLORIDE

CHEM-93; Multiple Choice: Which of the following is the term used for the resistance of a liquid system to flow?

- w) surface tension
- x) diffusion
- y) viscosity

ANSWER: Y -- VISCOSITY

CHEM-93; Short Answer: What is the standard unit of measure for viscosity?

ANSWER: POISE (ACCEPT PASCAL-SECONDS)

## Science Bowl

## CHEMISTRY

CHEM-93; Multiple Choice: The critical temperature is the temperature:

- w) above which a substance cannot be vaporized
- x) at which the density is a minimum
- y) at which solid, liquid, and vapor are in equilibrium
- z) above which the substance cannot be liquified.

ANSWER: Z -- ABOVE WHICH THE SUBSTANCE CANNOT BE LIQUIFIED.

CHEM-93; Multiple Choice: Which of the following substances would be the best choice to neutralize sulfuric acid?

- w) sodium hydroxide
- x) silicon dioxide
- y) copper metal
- z) phosphorus pentoxide

ANSWER: W -- SODIUM HYDROXIDE

CHEM-93; Multiple Choice: A compound which is an electron pair donor is generally classified as a:

- w) Lewis acid
- x) Bronsted base
- y) Bronsted acid
- z) Lewis base

ANSWER: Z -- LEWIS BASE

CHEM-93; Multiple Choice: Buffer solutions show which one of the following traits:

- w) absorb acid and base with only small changes in pH
- x) indefinite stability
- y) high elasticity
- z) abnormal density

ANSWER: W -- ABSORB ACID AND BASE WITH ONLY SMALL CHANGES IN pH

CHEM-93; Short Answer: Who constructed the first cyclotron?

ANSWER: (ERNEST O.) LAWRENCE

CHEM-93; Short Answer: What is the maximum number of electrons that can occupy an s atomic orbital?

ANSWER: 2

## *Science Bowl*

## CHEMISTRY

CHEM-93; Short Answer: By what name is dinitrogen oxide commonly known?

ANSWER: LAUGHING GAS (ACCEPT NITROUS OR NITROUS OXIDE)

CHEM-93; Multiple Choice: Relative to the pure solvent, the boiling point of a solution is:

- w) higher
- x) lower
- y) at the same temperature

ANSWER: W -- HIGHER

CHEM-93; Multiple Choice: Which of the following is the element which makes up about 8 percent of the earth's crust and occurs in all rocks except limestone and sandstone?

- w) sulfur
- x) aluminum
- y) sodium
- z) magnesium

ANSWER: X -- ALUMINUM

CHEM-93; Multiple Choice: Which one of the following metals is immune to corrosion by air, water, hydrochloric acid and nitric acid; but is soluble in aqua regia?

- w) gold
- x) silver
- y) magnesium
- z) nickel

ANSWER: W -- GOLD

CHEM-93; Multiple Choice: Which one of the following metals is essential to the structure and functioning of hemoglobin?

- w) copper
- x) magnesium
- y) tin
- z) iron

ANSWER: Z -- IRON

## *Science Bowl*

## CHEMISTRY

CHEM-93; Multiple Choice: Which of the following would you measure using a calorimeter?

- w) specific heat
- x) weight
- y) specific gravity
- z) density

ANSWER: W -- SPECIFIC HEAT

CHEM-93; Short Answer: Who first postulated the statement "equal volumes of gases, at the same temperature and pressure, contain equal numbers of molecules."

ANSWER: (AMADEO) AVOGADRO

CHEM-93; Multiple Choice: The energy required to melt one mole of a solid at its melting point is called one of the following.

- w) the molar heat of fusion
- x) the molar heat of vaporization
- y) the molar heat of capacity
- z) the melting point

ANSWER: W -- THE MOLAR HEAT OF FUSION

CHEM-93; Multiple Choice: Gamma rays are similar to X rays in which of the following ways?

- w) they have neither rest mass nor charge
- x) they can be bent in an electric field
- y) they originate within the nucleus
- z) they are of low energy

ANSWER: W -- HAVE NEITHER REST MASS NOR CHARGE

CHEM-93; Short Answer: How many isotopes of hydrogen are known?

ANSWER: 3

CHEM-93; Short Answer: At what Celsius temperature should all molecular motion cease?

ANSWER: -273.16 DEGREES CELSIUS (ACCEPT -273)

## ***Science Bowl***

## **CHEMISTRY**

CHEM-93; Multiple Choice: Which element is associated with the term "galvanized"?

- w) gallium
- x) zinc
- y) mercury
- z) nickel

ANSWER: X -- ZINC

CHEM-93; Multiple Choice: Which of the properties listed below would you expect a solution to have if it is an acid?

- w) It feels slippery to the touch.
- x) It tastes bitter.
- y) It turns red litmus blue.
- z) It is a conductor of electricity.

ANSWER: Z -- IT IS A CONDUCTOR OF ELECTRICITY.

CHEM-93; Multiple Choice: Which of the following compounds has the highest energy content?

- w) protein
- x) fats
- y) carbohydrate

ANSWER: X -- FATS

CHEM-93; Multiple Choice: The orbital angular momentum quantum number indicates which one of the following?

- w) the average distance of the electrons from the nucleus
- x) the direction of spin of the electron
- y) the shape of the orbital
- z) the position about the three axes in space of the orbital

ANSWER: Y -- THE SHAPE OF THE ORBITAL

## ***Science Bowl***

## **CHEMISTRY**

CHEM-93; Multiple Choice: The characteristic bonds in nonmetal oxides are which of the following types?

- w) network
- x) covalent
- y) ionic
- z) coordinate covalent

ANSWER: X -- COVALENT

CHEM-93; Multiple Choice: Lead-206 is the final product of the radioactive decay series named the:

- w) thorium series
- x) actinium series
- y) uranium series
- z) neptunium series

ANSWER: Y -- URANIUM SERIES

CHEM-93; Multiple Choice: As water solidifies it does one of the following:

- w) gives off heat and contracts
- x) gives off heat and expands
- y) takes in heat and contracts
- z) takes in heat and expands

ANSWER: X -- GIVES OFF HEAT AND EXPANDS

CHEM-93; Multiple Choice: Carbon atoms link together with other carbon atoms in all of the following ways EXCEPT

- w) networks
- x) chains
- y) ionic bonds
- z) rings

ANSWER: Y -- IONIC BONDS

## Science Bowl

## CHEMISTRY

CHEM-93; Multiple Choice: Carbon monoxide is a poisonous gas for one of the following reasons.

- w) it is a powerful acid anhydride
- x) it combines with the hemoglobin of the blood
- y) it depletes the dissolved oxygen in the blood by forming carbon dioxide
- z) it is a strong oxidizing agent

ANSWER: X -- IT COMBINES WITH THE HEMOGLOBIN OF THE BLOOD

CHEM-93; Multiple Choice: To increase the solubility of a gas in a liquid as much as possible, we would use:

- w) low temperature and high pressure.
- x) high temperature and high pressure.
- y) high temperature and low pressure.
- z) low temperature and low pressure.

ANSWER: W -- LOW TEMPERATURE AND HIGH PRESSURE.

CHEM-93; Multiple Choice: The silver luster of the metals can be attributed to one of the following. It is attributed to their free

- w) protons
- x) ions
- y) neutrons
- z) electrons

ANSWER: Z -- ELECTRONS

CHEM-93; Multiple Choice: Radon differs from other naturally radioactive elements in which one of the following ways. Is it because radon

- w) is extremely radioactive
- x) decays into the element radium
- y) is a noble gas
- z) is as chemically active as fluorine

ANSWER: Y -- IS A NOBLE GAS

## ***Science Bowl***

## **CHEMISTRY**

CHEM-93; Multiple Choice: If the volume of a gas changes by a factor of 3, with pressure remaining constant, the temperature in Kelvin will change by a factor of:

- w) 1/9
- x) 1/3
- y) 3
- z) 9

ANSWER: Y -- 3

CHEM-93; Multiple Choice: Which of the following substances is classified as amorphous?

- w) glass
- x) Zinc
- y) diamond
- z) sodium chloride

ANSWER: W -- GLASS

CHEM-93; Short Answer: What occurs when the vapor pressure of a liquid equals atmospheric pressure?

ANSWER: IT BEGINS TO BOIL

CHEM-93; Multiple Choice: Nature tends to move toward states of:

- w) high energy and disorder
- x) high energy and order
- y) low energy and disorder
- z) low energy and order

ANSWER: Y -- LOW ENERGY AND DISORDER

CHEM-93; Multiple Choice: The bubbling off of carbon dioxide when a bottle of carbonated beverage is opened is a good example of:

- w) deliquescence
- x) effervescence
- y) condensation
- z) sublimation

ANSWER: EFFERVESCENCE

## *Science Bowl*

## CHEMISTRY

CHEM-93; Multiple Choice: The process of a solid converting directly into a gas is called:

- w) fusion
- x) sublimation
- y) condensation
- z) distillation

ANSWER: X -- SUBLIMATION

CHEM-93; Multiple Choice: Which is the HEAVIEST of the following molecules:

- w) butane
- x) ethane
- y) methane
- z) propane

ANSWER: W -- BUTANE

CHEM-93; Short Answer: In electrolysis, what process always occurs at the anode?

ANSWER: OXIDATION

CHEM-93; Short Answer: What is the common name for 2,4,6, Trinitrotoluene (read: tri-nitro-toluene)?

ANSWER: TNT

CHEM-93; Multiple Choice: Which oxide of the following metals is often used as a pigment in white paint?

- w) titanium
- x) cobalt
- y) nickel
- z) vanadium

ANSWER: W -- TITANIUM

## *Science Bowl*

## CHEMISTRY

CHEM-93; Multiple Choice: Which of the following terms means that a crystal has the ability to capture and hold water molecules?

- w) hydroponic
- x) hygroscopic
- y) hydrophobic
- z) hydropholectic

ANSWER: X -- HYGROSCOPIC

CHEM-93; Multiple Choice: Which of the following terms has as its definition: a mixture having continuous and dispersed phases?

- w) colloid
- x) solute
- y) suspension
- z) solvent

ANSWER: W -- COLLOID

CHEM-93; Multiple Choice: Which of the following properties is greater for a solution than for the pure solvent?

- w) freezing point
- x) vapor pressure
- y) temperature
- z) boiling point

ANSWER: D -- BOILING POINT

CHEM-93; Short Answer: The main constituent of antifreeze is what organic compound?

ANSWER: ETHYLENE GLYCOL

CHEM-93; Multiple Choice: Which of the following terms denotes the polar molecules or negative ions clustered about a central positive ion?

- w) ligands
- x) isomers
- y) complex ions
- z) dipoles

ANSWER: W -- LIGAND

## *Science Bowl*

## CHEMISTRY

CHEM-93; Short Answer: What is the most common solvent?

ANSWER: WATER

CHEM-93; Multiple Choice: If the pressure of a gas is increased by a factor of 4, and the temperature is kept constant, the volume of the gas will change by which of the following factors?

- w) 4
- x) 2
- y) 1/2
- z) 1/4

ANSWER: Z -- 1/4

CHEM-93; Short Answer: What form of carbon is useful as a lubricant?

ANSWER: GRAPHITE

CHEM-93; Multiple Choice: The atomic number of a nucleus will increase by 1 if which of the following is emitted by the nucleus?

- w) an alpha particle
- x) a positron
- y) a beta particle
- z) a gamma ray

ANSWER: Y -- BETA PARTICLE

CHEM-93; Short Answer: What is the chemical name for wood alcohol?

ANSWER: METHANOL or METHYL ALCOHOL

CHEM-93; Short Answer: What is the main constituent of nail polish remover?

ANSWER: ACETONE

## Science Bowl

## CHEMISTRY

CHEM-93; Multiple Choice: As one moves down a group of the periodic table, the tendency to lose electrons does which of the following?

- w) increase
- x) decrease
- y) stay the same

ANSWER: W -- INCREASE

CHEM-93; Short Answer: The Earth's stratosphere contains ozone. Give the chemical formula for ozone?

ANSWER: O<sub>3</sub> (pron: Oh - three)

CHEM-93; Multiple Choice: An organic liquid will generally have a specific gravity?

- w) equal to that of water
- x) less than that of water
- y) greater than that of water

ANSWER: X -- LESS THAN THAT OF WATER

CHEM-93; Short Answer: Acetylene is commonly used in a gas welding torch. Give the molecular formula for acetylene.

ANSWER: C<sub>2</sub>H<sub>2</sub> or HC<sub>2</sub>H or H<sub>2</sub>C<sub>2</sub>

CHEM-93; Short Answer: What is the name of the least massive carboxylic (read: car-box-ILL-iy) acid.

ANSWER: FORMIC ACID

CHEM-93; Multiple Choice: Peroxides such as hydrogen peroxide and benzoyl peroxide are commonly used in small quantities in over-the-counter preparations such as antiseptics and acne creams. What hazard do peroxides present in higher concentrations?

- w) explosive
- x) strongly acidic
- y) strongly basic
- z) there is no hazard

ANSWER: W -- EXPLOSIVE

## *Science Bowl*

## CHEMISTRY

CHEM-93; Short Answer: Give me the name of two elements that are liquid at room temperature.

ANSWER: BROMINE AND MERCURY

CHEM-93; Multiple Choice: Sodium chloride is an example of what kind of compound?

- w) ionic
- x) covalent
- y) polyatomic
- z) monatomic

ANSWER: W -- IONIC

CHEM-93; Multiple Choice: A COPPER strip is placed in one compartment of a voltaic cell and a wire connects this strip to a piece of metal in the other compartment through a voltmeter. If the voltmeter reads zero, the other piece of metal is:

- w) zinc
- x) mercury
- y) silver
- z) copper

ANSWER: Z -- COPPER

CHEM-93; Multiple Choice: Isobaric processes take place at constant:

- w) temperature
- x) volume
- y) pressure
- z) energy

ANSWER: Y -- PRESSURE

CHEM-93; Multiple Choice: Which of the following nitrogen-containing compounds is most readily used by plants?

- w) nitrogen dioxide
- x) ammonia
- y) nitrous oxide
- z) nitrate

ANSWER: Z -- NITRATE

## ***Science Bowl***

## **CHEMISTRY**

CHEM-93; Multiple Choice: Which of the following organic compounds is known as a saturated chain hydrocarbon ?

- w) an aromatic compound
- x) an alkene
- y) an alkyne
- z) an alkane

ANSWER: Z -- AN ALKANE

CHEM-93; Multiple Choice: In terms of quality, what is the highest ranked coal?

- w) peat
- x) bituminous
- y) anthracite
- z) lignite

ANSWER: Y -- ANTHRACITE

CHEM-93; Multiple Choice: The force responsible for drops of liquid assuming a spherical shape is known as:

- w) strong nuclear force
- x) Van der Waals attraction
- y) surface tension
- z) osmotic pressure

ANSWER: Y -- SURFACE TENSION

CHEM-93; Multiple Choice: If a piece of metal at -20 degrees Celsius is added to an ice and water mixture in equilibrium at 0 degrees Celsius, the amount of ice will:

- w) Increase
- x) Remain the same
- y) Decrease

ANSWER: W -- INCREASE

## ***Science Bowl***

## **CHEMISTRY**

CHEM-93; Multiple Choice: Which of the following materials is the chief source of natural organic compounds?

- w) petroleum
- x) coal
- y) natural gas
- z) carbon dioxide

ANSWER: W -- PETROLEUM

CHEM-93; Short Answer: What two products are formed when a hydrocarbon is oxidized to completion?

ANSWER: CO<sub>2</sub> AND H<sub>2</sub>O (CARBON DIOXIDE AND WATER)

CHEM-93; Multiple Choice: Which of the following elements does not normally occur as a diatomic molecule?

- w) hydrogen
- x) chlorine
- y) argon
- z) oxygen

ANSWER: Y -- ARGON

CHEM-93; Multiple Choice: Which of the following metals can be obtained from its ore only by electrolysis of a molten salt ?

- w) cobalt
- x) chromium
- y) copper
- z) sodium

ANSWER: Z -- SODIUM

## *Science Bowl*

## CHEMISTRY

CHEM-93; Multiple Choice: Which of the following elements does not occur in nature as a native ore?

- w) silver
- x) gold
- y) platinum
- z) aluminum

ANSWER: Z -- ALUMINUM

CHEM-93; Short Answer: If a potassium iodide solution is electrolyzed, at what electrode would the potassium appear?

ANSWER: CATHODE

CHEM-93; Short Answer: When combining acid and water, which should go in first?

ANSWER: THE WATER

CHEM-93; Short Answer: What is the name given to compounds having the same chemical composition but different structural arrangement?

ANSWER: ISOMERS

CHEM-93; Multiple Choice: Which of the following gases cannot be collected by water displacement?

- w) Nitrogen
- x) Oxygen
- y) Hydrogen
- z) Hydrogen Chloride

ANSWER: Z -- HYDROGEN CHLORIDE

CHEM-93; Multiple Choice: Which of the following metals is least subject to oxidation?

- w) silver
- x) gold
- y) magnesium
- z) nickel

ANSWER: X -- GOLD

## Science Bowl

## CHEMISTRY

CHEM-93; Short Answer: What is the common name of the homogeneous mixture which is a 70% isopropanol solution and sometimes used to reduce body temperature by spreading over the body?

ANSWER: RUBBING ALCOHOL

CHEM-93; Multiple Choice: Endothermic refers to a process that

- w) does work
- x) gives off heat
- y) loses mass
- z) absorbs heat

ANSWER: Z -- ABSORBS HEAT

CHEM-93; Multiple Choice: Which of the following is an aromatic hydrocarbon?

- w) methane
- x) ethanol
- y) benzene
- z) glycine

ANSWER: Y -- BENZENE

CHEM-93; Multiple Choice: In the United States, Grain alcohol is made:

- w) from coal
- x) by fermenting starches
- y) from methanol
- z) from vinegar
- e) by fermenting acetic acid

ANSWER: X -- BY FERMENTING STARCHES

CHEM-93; Multiple Choice: When a solute is dissolved in a pure solvent, the resulting freezing point is:

- w) higher than pure solvent
- x) lower than pure solvent
- y) does not change
- z) cannot tell from this information

ANSWER: X -- LOWER THAN PURE SOLVENT

## ***Science Bowl***

## **CHEMISTRY**

CHEM-93; Multiple Choice: High grade coal is mainly which of the following?

- w) methane
- x) propane
- y) a mixture of hydrocarbons
- z) anthracene

ANSWER: Y -- A MIXTURE OF HYDROCARBONS

CHEM-93; Multiple Choice: Which of the following properties is lower for a solution than for the pure solvent?

- w) osmotic pressure
- x) vapor pressure
- y) temperature
- z) boiling point

ANSWER: X -- VAPOR PRESSURE

CHEM-93; Short Answer: Name three elements that make up sucrose.

ANSWER: CARBON, HYDROGEN, OXYGEN

CHEM-93; Multiple Choice: Which of the following is the same for both radioactive iodine and stable iodine?

- w) number of neutrons
- x) mass number
- y) half-life
- z) chemical properties

ANSWER: Z -- CHEMICAL PROPERTIES

CHEM-93; Short Answer: Bauxite is a mineral that primarily contains which metal?

ANSWER: ALUMINUM

## ***Science Bowl***

## **CHEMISTRY**

CHEM-93; Multiple Choice: Which of the following is a strong electrolyte in aqueous solution.

- w) ammonia
- x) coffee
- y) Gatorade
- z) corn syrup

ANSWER: Y -- GATORADE

CHEM-93; Short Answer: Give the name of the acid found in stomach fluid.

ANSWER: HCl (HYDROCHLORIC ACID)

CHEM-93; Multiple Choice: Nutrasweet, the artificial sweetener, contains molecules in which of the following groups?

- w) carbohydrates
- x) lipids
- y) amino acids
- z) nucleic acids

ANSWER: C--AMINO ACIDS

CHEM-93; Short Answer: Who is given credit for first arranging the elements in the Periodic Table?

ANSWER: MENDELEEV

CHEM-93; Multiple Choice: Most of the transuranic elements were first created:

- w) in Germany
- x) at Argonne National Laboratory
- y) in California
- z) in Russia

ANSWER: Y -- IN CALIFORNIA

CHEM-93; Multiple Choice: The nuclei of heavy atoms generally contain:

- w) more electrons than neutrons
- x) more protons than electrons
- y) more neutrons than electrons
- z) more orbitals than electrons

ANSWER: Y -- MORE NEUTRONS THAN ELECTRONS

## Science Bowl

## CHEMISTRY

CHEM-93; Multiple Choice: Which one of the following is largest?

- w) the number of molecules in 2 grams of hydrogen gas
- x) the number of molecules in 60 grams of lead sulfate
- y) the number of molecules in 20 liters of oxygen gas at standard temperature and pressure
- z) the population of the United States

ANSWER: A - THE NUMBER OF MOLECULES IN 2 GRAMS OF HYDROGEN GAS

CHEM-93; Multiple Choice: One mole of electrons is known as:

- w) a Faraday
- x) a Henry
- y) a Coulomb
- z) an Ampere

ANSWER: W -- A FARADAY

CHEM-93; Multiple Choice: A standardized base solution should be protected from which of the following gases?

- w) hydrogen
- x) carbon dioxide
- y) nitrogen
- z) argon

ANSWER: X -- CARBON DIOXIDE

CHEM-93; Multiple Choice: For a substance, density, solubility and melting point are examples of:

- w) physical properties
- x) amorphous properties
- y) chemical properties
- z) potential properties

ANSWER: W -- PHYSICAL PROPERTIES

CHEM-93; Short Answer: -40 degrees Fahrenheit is equivalent to what Celcius temperature?

ANSWER: -40 DEGREES CELCIUS

## ***Science Bowl***

## **CHEMISTRY**

CHEM-93; Multiple Choice: Which of the following acids is in vinegar?

- w) benzoic
- x) formic
- y) malanoic
- z) acetic

ANSWER: Z -- ACETIC

CHEM-93; Multiple Choice: Which of the following would you expect to have the highest boiling point?

- w) methane
- x) carbon tetrachloride
- y) chloroform
- z) chloromethane

ANSWER: X -- CARBON TETRACHLORIDE

CHEM-93; Multiple Choice: An aqueous solution is always a solution in which the:

- w) solute is water
- x) solute is a salt
- y) solvent is a salt
- z) solvent is water

ANSWER: Z -- SOLVENT IS WATER

CHEM-93; Multiple Choice: The rate of a chemical reaction can be affected by:

- w) temperature
- x) concentration of products
- y) concentration of reactants
- z) all of the above

ANSWER: Z -- ALL OF THE ABOVE

CHEM-93; Short Answer: If 16 grams of oxygen are produced by the electrolysis of water, how many grams of hydrogen are produced at the same time?

ANSWER: 2 GRAMS

## *Science Bowl*

## CHEMISTRY

CHEM-93; Multiple Choice: When you push down on the piston of a bicycle pump, the air is compressed into a smaller volume, which causes its temperature to:

- w) decrease
- x) increase
- y) stay the same

ANSWER: X -- INCREASE

CHEM-93; Short Answer: What is the name for a substance that alters the rate of chemical reactions, without being permanently altered itself?

ANSWER: CATALYST

CHEM-93; Multiple Choice: The word atom is from a Greek word meaning:

- w) small
- x) indivisible
- y) unseen
- z) visible

ANSWER: X -- INDIVISIBLE

CHEM-93; Multiple Choice: Standard temperature is defined to be:

- w) 0 DEGREES C
- x) 0 DEGREES K
- y) 25 DEGREES C
- z) 32 DEGREES C

ANSWER: W -- 0 DEGREES C

CHEM-93; Multiple Choice: The man credited with the law relating the temperature and volume of a gas is:

- w) Thomson
- x) Boyle
- y) Charles
- z) Dalton

ANSWER: Y -- CHARLES

## ***Science Bowl***

## **CHEMISTRY**

CHEM-93; Multiple Choice: Ionic substances dissolve in water to form:

- w) highly acid solutions
- x) electrolytic solutions
- y) colloids
- z) emulsions

ANSWER: X -- ELECTROLYTIC SOLUTIONS

CHEM-93; Multiple Choice: Mineral acids are also classified as:

- w) carboxyl acids
- x) inorganic acids
- y) non-electrolytic acids
- z) oxidation acids

ANSWER: X -- INORGANIC ACIDS

CHEM-93; Multiple Choice: How many calories are required to raise the temperature of 20 grams of water from 40 degrees to 60 degrees?

- w) 40 cal
- x) 400 cal
- y) 20 cal
- z) 200 cal

ANSWER: X -- 400 cal

CHEM-93; Multiple Choice: Which of the following energy technologies is not utilized for power generation today?

- w) Nuclear Fission
- x) Solar Ponds
- y) Geothermal Power
- z) Nuclear Fusion

ANSWER: Z -- NUCLEAR FUSION

## *Science Bowl*

## CHEMISTRY

CHEM-93; Multiple Choice: If your room has a natural tendency to become messy and disordered, it is an excellent example of:

- w) enthalpy
- x) entropy
- y) the Bernoulli effect
- z) the Haase effect

ANSWER: X -- ENTROPY

CHEM-93; Multiple Choice: Which compound is responsible for the rotten egg smell?

- w) sulfuric acid
- x) putrescine
- y) hydrogen sulfide
- z) sulfur dioxide

ANSWER: Y -- HYDROGEN SULFIDE (NOTE: putrescine is a real compounz)

CHEM-93; Short Answer: Many elements are Greek or Latin names for a particular color, examples are Chlorine from chloros (greenish-yellow) and Cesium from caesius (sky blue). What is the element that was named from the Greek word meaning color?

ANSWER: CHROMIUM

CHEM-93; Short Answer: Which compound is briefly exposed to light when taking a photograph?

ANSWER: SILVER CHLORIDE

CHEM-93; Short Answer: In 1789, Martin Heinrick Klaproth named this element for a newly-discovered planet. Identify this element.

ANSWER: URANIUM

CHEM-93; Multiple Choice: If a material has the capacity to behave either as an acid or a base it is said to be:

- w) amorphous
- x) amphoteric
- y) anhydrous
- z) aklaline

ANSWER: X -- AMPHOTERIC

## ***Science Bowl***

## **CHEMISTRY**

CHEM-93; Multiple Choice: All gases form what type of mixture?

- w) dispersion
- x) colloidal
- y) homogeneous
- z) heterogeneous

ANSWER: Y -- HOMOGENEOUS

CHEM-93; Short Answer: What is the main product of the HALL process?

ANSWER: ALUMINUM METAL (accept ALUMINUM)

CHEM-93; Multiple Choice: Which of the following elements is not an alkaline earth metal?

- w) beryllium
- x) barium
- y) calcium
- z) rubidium

ANSWER: Z -- RUBIDIUM

CHEM-93; Short Answer: Which element is named after the Greek word for "sun"?

ANSWER: HELIUM

CHEM-93; Short Answer: How many carbon atoms are found in the benzene ring?

ANSWER: 6

CHEM-93; Short Answer: What is the name given to a substance with one or more unpaired electrons?

ANSWER: FREE RADICAL

CHEM-93; Short Answer: A triple bond consists of how many pi bonds and how many sigma bonds?

ANSWER: ONE SIGMA BOND AND TWO PI BONDS

## Science Bowl

## CHEMISTRY

CHEM-93; Multiple Choice: Carbon dioxide has each of the following uses except:

- w) refrigerant
- x) manufacture of baking soda
- y) fire extinguisher
- z) valuable reducing agent

ANSWER: Z -- VALUABLE REDUCING AGENT

CHEM-93; Short Answer: Name the term that defines the temperature above which the liquid phase cannot exist:

ANSWER: CRITICAL TEMPERATURE

CHEM-93; Multiple Choice: In 1953, Sir Edmund Hillary and Tenzing Norgay were the first people to reach the summit of Mount Everest from their last previously established camp at an altitude of 27,900 feet (barometric pressure about 220 mm). At that camp, water would have:

- w) boiled at 100 degrees Celsius
- x) boiled at 68 degrees Celsius
- y) not boiled at any temperature
- z) sublimed

ANSWER: X -- BOILED AT 68 DEGREES CELSIUS

CHEM-93; Short Answer: What is the term given to a solid that has the ability of a solid to be hammered into a thin sheet.

ANSWER: MALLEABILITY

CHEM-93; Short Answer: What is the common name of the substance which is inert to nearly all chemicals and is a polymer of tetrafluoroethylene?

ANSWER: TEFLON

CHEM-93; Multiple Choice: Consider the following gaseous equilibrium:  $\text{PCl}_3 + \text{Cl}_2 = \text{PCl}_5 + \text{heat}$ . Which of the following changes will shift it to the right:

- w) lower the temperature
- x) remove some  $\text{Cl}_2$
- y) increase the volume
- z) add a catalyst

ANSWER: W -- LOWER THE TEMPERATURE

## Science Bowl

## CHEMISTRY

CHEM-93; Multiple Choice: Whose name is given to alkylmagnesium halides:

- w) Victor Grignard
- x) Daniel Rutherford
- y) Dmitri Mendeleev

ANSWER: W -- VICTOR GRIGNARD

CHEM-93; Multiple Choice: During osmosis

- w) Pure solvent diffuses through a membrane but solutes do not.
- x) Pure solutes diffuse through a membrane but solvent does not.
- y) Pure solvent and a solution both diffuse at the same time through a membrane.
- z) Gases diffuse through a membrane into a solution and build up pressure.

ANSWER: W -- PURE SOLVENT DIFFUSES THROUGH A MEMBRANE BUT SOLUTES DO NOT.

CHEM-93; Multiple Choice: What is the purpose of the salt bridge in an electrochemical cell?

- w) It allows ion migration.
- x) It allows electron flow.
- y) It prevents ion migration.
- z) It prevents electron flow.

ANSWER: W -- IT ALLOWS ION MIGRATION

CHEM-93; Multiple Choice: Calcium carbonate is most soluble in:

- w) 0.2 Molar Sodium carbonate
- x) 0.1 Molar Calcium chloride
- y) 0.1 Molar Sodium hydroxide
- z) 0.1 Molar Hydrochloric acid

ANSWER: Z -- 0.1 MOLAR HYDROCHLORIC ACID

## Science Bowl

## CHEMISTRY

CHEM-93; Multiple Choice: Based on the intermolecular forces involved, which of the following molecules will have the lowest boiling point?

- w) ethane
- x) methyl alcohol
- y) methyl amine
- z) methyl fluoride

ANSWER: W -- ethane

CHEM-93; Multiple choice: The compound which would have the greatest molar effect on the colligative properties of a dilute solution would be:

- w)  $\text{CaCl}_2$
- x)  $\text{NaCl}$
- y)  $\text{C}_6\text{H}_{12}\text{O}_6$
- z) Benzene

ANSWER: W --  $\text{CaCl}_2$

CHEM-93; Multiple Choice: Which of the following gases is more soluble in water as the water temperature increases?

- w) Helium
- x) Air
- y) Carbon dioxide
- z) Hydrogen

ANSWER: W -- HELIUM

CHEM-93; Multiple Choice: How many carbon atoms are there in one naphthalene molecule?

- w) 6
- x) 8
- y) 10
- z) 15

ANSWER: Y -- 10

## ***Science Bowl***

## **CHEMISTRY**

CHEM-93; Multiple Choice: Mayonnaise is:

- w) an emulsion
- x) a hydrogenated oil
- y) a covalent solution
- z) a coalescent solution

ANSWER: W -- AN EMULSION

CHEM-93; Multiple Choice: The difference in the osmotic pressures of one molar solutions of different compounds in a given solvent at a given temperature results from?

- w) Different values for R
- x) Different values for Avogadro's number
- y) Ionization or dissociation
- z) None of the above

ANSWER: Y -- IONIZATION OR DISSOCIATION

CHEM-93; Multiple Choice: Which of the following substances is a molecular solid?

- w) Glass
- x) Ice
- y) Silver
- z) Table Salt

ANSWER: X -- ICE