

How many spectral lines are emitted from a hydrogen atom excited to the state designated by the principal quantum number,  $n=3$ ? A. 1 B. 2 C. 3 D. 4

How many moles are there in 159g of alanine,  $C_3H_7NO_2$ ? A. 0.560 B. 0.992 C. 1.78 D. 3.31

How many chloride ions are in 1.0 mole of  $CaCl_2$ ?  $3.01 \times 10^{23} Cl^{ions}$   $1.81 \times 10^{24} Cl^{ions}$   $6.02 \times 10^{23} Cl^{ions}$   $1.20 \times 10^{24} Cl^{ions}$

Which of the following is the right order of the steps of a scientific method?

A. Performing experiments formulating hypothesis Making observations

B. Formulating hypothesis Making observations performing experiments

C. Making observations formulating hypothesis performing experiments

D. Making observations performing experiments –Formulating hypothesis

The distance between two carbon atoms in a diamond is 154 pm. What is the distance between the carbon atoms in millimeters?  $7.7 \times 10^{-5}$   $7.7 \times 10^{-7}$   $1.54 \times 10^{-7}$   $1.54 \times 10^{-9}$

In which of the following numbers all of the zeros significant? 100.090090 0.143290 0.1000 0.030020

The first step of the scientific method involves

A. forming a hypothesis

B. making observations

C. performing an experiment

D. predicting the result of an experiment

Which of the following is correct when 34495 is rounded to three significant figures? 345 34500 344 3840

What is the first step of scientific method?

A. Making observations

B. Forming a hypothesis

C. Performing an experiment

D. Predicting the result of an experiment

Which of the following is correct?

A.  $1 \text{ Pa} = 10 \text{ Nm}^{-2}$

B.  $1 \text{ N} = 10^{-2}$

C.  $0.00072 = 7.2 \times 10^{-3}$

D.  $1 \text{ L} = 1 \text{ dm}^3$

Which of the following represents a tentative explanation of certain scientific law?.

A. Hypothesis

B. Observation

C. Experimentation

D. Theory

In order to advance to the level of theory, a hypothesis should

A. be obviously accepted by most people

B. be repeatedly confirmed by experimentation

C. be a fully functional experiment

D. report the past experience

What is the equivalent of 500 °C in °F ?

A. 100 °F

B. 180 °F

C. 820 F

D. 1229 F

A student determined the density of an acid to be 3.91, 3.90, and 3.93 g cm<sup>-3</sup>. If the actual density of the solid is 2.76 g cm<sup>-3</sup>, how should the student's result be described?

A. Low accuracy and low precision

B. Low accuracy and high precision

C. High accuracy and low precision

D. High accuracy and high precision

A pattern or relationship that has been established based on a large amount of experimental data is a

A. Theory

B. Hypothesis

C. Law

D. Scientific method

Which of the following numbers has 4 significant figures?

A. 0.0430

B. 0.04309

C. 0.0431

D. 0.43980

Which of the following correctly expresses the number 0.0000850 in scientific notation?

A.  $8.50 \times 10^{-5}$

B.  $8.50 \times 10^{-4}$

C.  $8.5 \times 10^{-5}$  D.  $8.50 \times 10^5$

What is the sum of  $3.71 \times 10^8$  and  $4.62 \times 10^7$  to the correct significant figure?

A.  $4.17 \times 10^8$

B.  $4.99 \times 10^7$

C.  $4.17 \times 10^8$

D.  $4.991 \times 10^7$

What is the closeness of the measurement to its true value?

A. Precision

B. Reproducibility

C. Accuracy

D. Usefulness

What skill is a scientist using when he/she listens to the sounds that animals make?

A. Drawing conclusion

B. Making a hypothesis

C. Making observation

D. Interpreting data

relationship between picometer(pm) and nanometer(nm)is:

- A. 1pm=10nm
- B. 1nm=1000pm
- C. 1pm=100nm

D. 1nm=10pm

To determine the volume of an irregularly shaped glass vessel, the vessel is weighed empty (121.3 g) and when filled with CCl<sub>4</sub>(283.2g). What is the volume capacity of the vessel, given that the density of CCl<sub>4</sub> is 1.59g/cm<sup>3</sup>?

- A. 76.29cm<sup>3</sup>
- B. 257.42cm<sup>3</sup>
- C. 178.11cm<sup>3</sup>

D. 101.82cm<sup>3</sup>

What is the bases for the scientific method?

- A. To formulate a research problem and disprove the hypothesis.
- B. To test hypotheses and if they are disproved, they should be abandoned completely.
- C. To test hypotheses in conditions that are favourable to their success.

D. To formulate a research problem, test the hypotheses under carefully controlled conditions that challenge the hypotheses

Which of the following has the same number of significant figures as the number 1.00310?

- A. 199.791
- B. 1X10<sup>6</sup>
- C. 100

D. 5.119

Precision refers to.....

- A. How close a measured number is to the true value
- B. How close a measured number is to the zero
- C. How close a measured number is to the calculated value

D. How close a measured number is to other measured numbers

What is the first step in scientific investigation?

- A. Ask questions
- B. Draw conclusions
- C. Do research

D. Make observation

Which of the following is the SI units of electric current?

- A. Watt

B. Volt

C. Ampere

D. Columb

11 Chapter- 2

Which one the following electronic transition in a hydrogen atom releases the largest energy?

A.  $n=2 \rightarrow n=1$

B.  $n=6 \rightarrow n=3$

C.  $n=4 \rightarrow n=2$

D.  $n=7 \rightarrow n=6$

Which set of quantum numbers ( $n, L, m, m_s$ ) is not possible?

A. 1,0,0,1/2

B. 1,1,0,1/2

C. 1,0,0,- 1/2

D. 2,1,- 1,1/2

Which of the following particles contains more electrons than neutrons? I. 1 II.  $^{35}\text{Cl}^-$  III.  $^{39}\text{K}^+$

A. I only

B. II only

C. I and II only

D. II and III only

In which region of the periodic table would the element with the electronic structure below be located?  $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^6 5s^2$

A. Group 6

B. Noble gases

C. s block

D. d block

What is the ionization energy of an iron atom if it requires a radiation of 276nm to completely remove its outer most electrons in the gaseous state? (planck's constant,  $h = 6.626 \times 10^{-34} \text{Js}$ , speed of light,  $c = 3 \times 10^8 \text{ms}^{-1}$ )

A.  $7.21 \times 10^{-19} \text{J}$

B.  $7.21 \times 10^{-19} \text{kJ}$

C.  $7.21 \times 10^{19} \text{J}$

D.  $7.21 \times 10^{19} \text{kJ}$

Which of the electron configurations describes the ground state electron configuration of  $\text{Ca}^{+2}$ ?

A.  $1s^2 2s^2 2p^6 3s^2 3p^6$

B.  $1s^2 2s^2 2p^6 3p^1$

C.  $1s^2 2s^2 2p^6 3s^1$

D.  $1s^2 2s^2 2p^6 3s^2 3p^4$

Which of the following statement is TRUE?

- A. Ultraviolet light has longer wavelength than visible light
- B. The energy of radiation decreases as the wave length decreases
- C. The frequency of radiation increase as the wavelength decrease

D. Wave number of an electromagnetic radiation increase as wavelength increase

An electron has a spin quantum number,  $s = +\frac{1}{2}$  and a magnetic quantum number,  $m_l = +1$ , In which of the following orbital will it NOT be present?

- A. S- orbital
- B. p- orbital
- C. d- orbital

D. f- orbital

Which of the following represents the general configuration of the transition elements?

- A.  $ns^2 np^6$
- B.  $ns(n-1)d$
- C.  $ns(n-2)f$

D.  $ns^2 np^6(n-1)d^{10}$

The quantum numbers listed below are meant for four different electrons in an atom: I.  $n = 4, l = 0, m_l = 0, m_s = +\frac{1}{2}$  II.  $n = 3, l = 1, m_l = 1, m_s = +\frac{1}{2}$  III.  $n = 4, l = 2, m_l = 0, m_s = +\frac{1}{2}$  IV.  $n = 4, l = 1, m_l = 0, m_s = -\frac{1}{2}$  When these set as of quantum numbers are arranged in order of increasing energy, one may get:

- A. I ; II ; III ; IV
- B. I ; III ; II ; IV
- C. II ; I ; III ; IV

D. IV ; III ; II ; I

The compound CuCl emits blue light having a wavelength of 450nm when heated at about 12000 C what is the increment in energy (quantum) that is emitted at 450nm?

- A.  $2.25 \times 10^{-19} \text{ J}$
- B.  $4.41 \times 10^{-19} \text{ J}$
- C.  $8.20 \times 10^{-19} \text{ J}$

D.  $16.20 \times 10^{-19} \text{ J}$

What is the total number of valence- shell electrons in  $\text{BrO}_3^-$

- A. 20
- B. 26
- C. 32

D. 36

What is the number of moles of atoms and the number of atoms in a 10.0- g sample of copper?

- A. 0.08 mol Cu atoms  $2.16 \times 10^{23}$  atoms
- B. 0.16 mol Cu atoms  $9.63 \times 10^{22}$  atoms
- C. 0.16 mol Cu atoms  $9.63 \times 10^{23}$  atoms
- D. 0.31 mol Cu atoms  $4.16 \times 10^{23}$  atoms

Which group of elements is characterized with  $ns^2 np^2$  outer- electron configuration?

- A. Group 2A
- B. Group 4A
- C. Group 4B
- D. Group 3B

Which of the following quantum number/s determine the energy of an electron in a hydrogen atom?

- A.  $n$
- B.  $n$  and  $l$
- C.  $n$ ,  $l$  and  $m$
- D.  $n$ ,  $l$  and  $s$

For elements in the left- most column of the periodic table. Properties that have increasing values as the atomic number increases include which of the following? I. Ionization energy II. Atomic radius III. Atomic mass

- A. III Only
- B. I, II, and III
- C. II and III only

What did Rutherford's particle experiment show?

- A. Electrons have a negative charge
  - B. A proton is a hydrogen atom without electron
  - C. Electrons circle the nucleus of an atom in orbits
  - D. Most of the mass and all of the positive charge of an atom is found in a tiny nucleus.
- Which of the following electron transitions requires the smallest energy to be absorbed by the hydrogen atom?
- A. From  $n = 1$  to  $n = 2$
  - B. from  $n = 3$  to  $n = 4$
  - C. from  $n = 2$  to  $n = 3$
  - D. from  $n = 4$  to  $n = 5$

For an electron that has quantum numbers  $n = 4$  and  $m_l = 0$ , which of the following is true?

- A. It must have the quantum number  $n =$
- B. It must have the quantum number  $l = 0$
- C. It must have the quantum number  $m_l = + 1/$

D. It may have the quantum number  $l = 0, 1, 2, 3$

For which of the following elements is Hund's rule used in writing the electron configuration?

A. C

B. B

C. Be

D. Li

Which set of quantum numbers ( $n, L, m, m_s$ ) is NOT permitted by the rules of quantum mechanics?

A.  $1, 0, 0, 1/2$  B.  $2, 1, -1, -1/2$  C.  $3, 3, 1, -1/2$  D.  $4, 3, 2, 1/2$

What can you conclude from the figure below? 1S 2s 2P

A. Hund's rule has been violated.

B. The Pauli Exclusion Principle has been violated.

C. The Pauli Exclusion Principle has been violated.

D. The Aufbau principle has been violated

This is a valid orbital diagram

A.

B.

C.

Which of the following is true about chlorofluorocarbons?

D. A. React directly with stratospheric ozone to destroy it.

B. Interact with UV energy and become free radicals which destroy ozone.

C. Become free radicals that react with oxygen to create ozone.

D. React with free radicals to remove carbon dioxide.

A monoatomic ion that has 20 protons and a +2 charge

A. Has 16 protons.

B. Has the symbol  $\text{Ar}^{2+}$

C. has 18 neutrons

D. is isoelectronic with Ar

According to valence bond theory, which orbital's on bromine atoms overlap in the formation of the bond in  $\text{Br}_2$

A. 3s

B. 3p

C. 4s

D. 2p

Which one of the following represents an acceptable possible set of quantum numbers ( in the order n, l, m<sub>l</sub>, m<sub>s</sub>) for an electron in an atom

A. 2, 1, 0, 0

B. 2, 0, 2, +1/2

C. 2, 1, -1, 1/2

D. 2, 0, 1, -1/2

Of the types of radioactivity characterized by Rutherford, which of the following are particles

A.  $\alpha$  rays

B.  $\beta$  rays

C.  $\alpha$  rays and  $\beta$  rays

D.  $\alpha$  rays,  $\beta$  rays, and  $\gamma$  rays

Consider the three electromagnetic waves shown below. Which of the electromagnetic waves has the highest frequency ?

A. 1

B. 2

C. 3

D. 4 Which of the following diagrams describes the electron density in the d<sub>xy</sub> orbital's

A.

B.

C.

The wave number of an electromagnetic radiation is  $1 \times 10^5 \text{ cm}^{-1}$ . The frequency of the radiation would be

D. A.  $3 \times 10^8 \text{ s}^{-1}$

B.  $3 \times 10^6 \text{ s}^{-1}$

C.  $3 \times 10^{10} \text{ s}^{-1}$

D.  $3 \times 10^{15} \text{ s}^{-1}$

The maximum number of electron in p-orbital with  $n = 6$ ,  $m_l = 0$  is

A. 2

B. 6

C. 16

D. 14

Which of the following transition will emit maximum energy in the hydrogen atom?

A.  $n = 4 \rightarrow n = 3$



B.  $n = 4$   $n = 2$

C.  $n = 2$   $n = 1$

D.  $n = 3$   $n = 2$

What is the ratio of the energy of a photon of 300nm wavelength radiation to that of 600nm radiation?

A. 1:2

B. 1:1

C. 2:1

D. 3:1

Which of the following quantum number(s) is (are) related to the size and energy of an electron in a hydrogen atom?

A.  $n$

B.  $n, l$

C.  $n, l, m$

D.  $n, l, m, s$

What is the difference between chlorine-35 and chlorine-37?

A. Chlorine-37 has two more protons than chlorine-35.

B. Chlorine-37 has two more neutrons than chlorine-35.

C. Chlorine-35 has two more electrons than chlorine-35.

D. Chlorine-37 has one more proton and one more neutron than chlorine-35.

Which one of the following electromagnetic radiations has the shortest wavelength?

A. X-rays

B. UV rays

C. gamma rays

D. microwaves

How many atoms are present in 22 g  $\text{CO}_2$ ?

A.  $3.10 \times 10^{23}$

B.  $6.02 \times 10^{23}$

C.  $2 \times 6.02 \times 10^{23}$

D.  $1.5 \times 6.02 \times 10^{23}$

The hybridization of the central atom in the  $\text{XeF}_4$  molecule is

A.  $sp^2$

B.  $sp^3$

C.  $sp^3d$

D. sp<sup>3</sup>d<sup>2</sup>

Which of the following are NOT electromagnetic waves?

A. Infrared waves

B. Gamma waves

C. Radio waves

D. Sound waves

What is the distance that a radio wave will travel in 0.250s? A  $1.2 \times 10^7$  m

E.  $12 \times 10^7$  m

F.  $7.5 \times 10^7$  m

G.  $12 \times 10^7$  m

Which of the following types of rays combine to form atoms of helium?

A. gamma rays ( $\gamma$ )

B. beta ( $\beta$ ) rays

C. alpha ( $\alpha$ ) rays

D. X- rays

What is the relationship between frequency ( $\nu$ ) , wavelength ( $\lambda$ ) and the speed of light ( $c$ )?

A.  $\nu = c$

B.  $\nu c = h$

C.  $hc = \nu$

D.  $c = \nu$

What is the magnitude of quantum energy and the frequency for an object whose wavelength is  $0.6 \times 10^{-6}$  m?

A.  $3.31 \times 10^{-19}$  J ,  $5 \times 10^{14}$  s<sup>-1</sup>

B.  $3.98 \times 10^{-40}$  J ,  $2 \times 10^{-15}$  s<sup>-1</sup>

C.  $1.99 \times 10^{-25}$  J ,  $3.98 \times 10^{-40}$  s<sup>-1</sup>

D.  $9.94 \times 10^{-12}$  J ,  $1.99 \times 10^{-25}$  s<sup>-1</sup>

What new concept did Bohr adapt and use to formulate his model of the atom? A Electromagnetic theory developed by Maxwell

E. The quantum concept developed by Planck

F. Photoelectric theory developed by Thompson

G. Neutron theory developed by Chadwick

What is the energy required to excite a hydrogen atom by causing an electronic transition from the energy level with  $n = 1$  to the level with  $n = 4$ ?  $E_n = 21.79 \times 10^{-19}$

A.  $665 \times 10^{26}$  J

B.  $1.824 \times 10^{-15}$  J

C.  $2.024 \times 10^{-18} \text{ J}$

D.  $3.649 \times 10^{-15} \text{ J}$

Which statement below is true with regard to Bohr's model of the atom?

A. The model was based on the wave properties of the electron

B. The model accounted for the absorption spectra of atoms but not for the emission spectra

C. The model accounted for the emission spectra of atoms, but not for the absorption spectra

D. The model could account for the emission spectrum of hydrogen and for the Rydberg equation

A radar unit is operating on frequency of 9.527 GHz. What is the wave length of the radiation?

A. 314.7nm

B. 314.7m

C. 3.147cm

D. 314.7cm

What important conclusion was reached through the study of cathode rays?

A. Cathode rays were shown to be neutral particles with mass

B. Cathode rays were proven to be light rays indicating that atoms were indeed indivisible

C. Cathode rays were shown to be positively charged particles indicating that atoms contained electric charge

D. The ratio of the charge to mass of particles making up cathode rays was constant, indicating they were fundamental particles found in all matter. If it takes 8.33min for light to travel from the sun to earth, how far away is the sun?

A.  $1.86 \times 10^5 \text{ miles}$

B.  $9.30 \times 10^7 \text{ miles}$

C.  $3.72 \times 10^7 \text{ miles}$

D.  $4.66 \times 10^7 \text{ miles}$

An element M with an atomic number of 25 has an electronic configuration of  $1s^2 2s^2 2p^6 3s^2 3p^4 4s^2 3d^5$ . What will be its period and group, respectively, in the periodic table?

A. 4, 7B

B. 4, 5B

C. 5, 5B

D. 6, 5B

What is the electron configuration of sulfur?

A.  $1s^2 2s^2 2p^6 3s^2 3p^4$

B.  $1s^2 2s^2 2p^4$

C.  $1s^2 2s^2 2p^6 3s^2 3p^2$

D.  $1s^2 2s^2 2p^6 3p^4$

What values of  $m_l$  are permitted for an electron with  $l = 3$ ?

- A. 0,1,2,3,
- B. - 3, - 2 , - 1 ,0 ,1, 2, 3
- C. - 2, - 1, 0, 1, 2
- D. 1, 2, 3

used the cathode Ray Tube to discover the electron and determine its charge to mass ratio?

- A. Robert.
- A. Millikan
- B. Ernest Rutherford
- C. James Chdwick
- D. J.J Thomson

The maximum kinetic energy of a photo electron emitted from a metal is  $1.03 \times 10^{-19} \text{J}$  when light that has a 656nm wavelength shines on the surface s the threshold frequency for this metal?

- A.  $4.57 \times 10^{-14} \text{ s}^{-1}$
- B.  $4.57 \times 10^{14} \text{ s}^{-1}$
- C.  $3.02 \times 10^{-14} \text{ s}^{-1}$  D.  $3.02 \times 10^{14} \text{ s}^{-1}$

What is the maximum number of electrons in an atom that can have the principal quantum number  $n=4$ ?

- A. 32
- B. 8
- C. 18
- D. 34

Which quantum number is used to determine sub shell?

- A. Principal quantum no
- B. Magnetic quantum number
- C. Azimuthal quantum no
- D. Spin quantum no

Which of the following is fundamentally different from others?

- A. Radio wave
- B. Sound wave
- C. Light wave
- D. Micro wave

Which of the following equations' expresses de Broglie hypothesis?

- A.  $\lambda = c / \nu$
- B.  $E = hc / \lambda$
- C.  $E = c / \lambda$

D.  $=h/(mv)$

What will be the wavelength of a radio wave having a frequency of 3MHz?

- A. 300nm
- B. 300m
- C. 100nm

D. 100m

Which of the following correctly lists electromagnetic waves in order from shortest to longest wavelength?

- A. Microwaves, ultraviolet, visible light, gamma rays
- B. Radio waves ,infrared gamma rays ,ultraviolet
- C. gamma rays ,ultraviolet ,infrared , microwaves

D. gamma rays ,infrared ,ultraviolet, microwaves

When an electron in a hydrogen atom makes the transition from the  $n=4$  state, to the  $n=2$  state, blue light with a wavelength of 434nm is emitted. Which of the following expressions gives the energy released by the transition?

- A.  $(6.63 \times 10^{-34})(4.34 \times 10^{-7})J$
- B.  $(6.63 \times 10^{-34}) (3.00 \times 10^8)J (3.00 \times 10^8) (4.34 \times 10^{-7})$
- C.  $(6.63 \times 10^{-34}) J$

D.  $(4.34 \times 10^{-7}) J (3.00 \times 10^8) (4.34 \times 10^{-7}) (6.63 \times 10^{-34}) (3.00 \times 10^8)$

Which of the following is Not true about the photoelectric effect?

- A. Most metals require ultraviolet light to emit electrons
- B. A bright light causes less electron to be emitted than a weak light.
- C. High frequency light emits electrons with high kinetic energy.

D. A bright light causes more electrons to be emitted than a weak light.

The sublevel that can be occupied by maximum of 10 electrons is identified by the letter.....?

- A. f
- B. d
- C. p

D. s

The energy of an electron in the first bohr orbit of hydrogen atom is - 13.6eV. The possible value of the excited state for an electron in Bohr orbit of hydrogen is.....

- A. - 4.21eV
- B. - 6.8eV
- C. - 1.51eV

D. +6.8ev

Consider the following two possibilities for electron transfer in hydrogen, given below: First: The electron drops from the Bohr orbit  $n=3$  to the orbit  $n=2$ , followed by the transition from  $n=2$  to  $n=1$ . Second: The electron drops from the Bohr orbit  $n=3$  directly to the orbit  $n=1$ . Which of the following is correct about the energy change of these transitions?

- A. The sum of the energies for the first transitions is less than the energy of transition of the second.
- B. The energies of transitions of the first and the energy of transition of the second can't be compared
- C. The sum of the energies for the first transitions is greater than the energy of transition of the second.

D. The sum of the energies for the first transitions is equal to the energy of transition of the second

Which of the following elements has the highest fifth ionization energy (IE<sub>5</sub>)?

- A. Si
- B. Al
- C. P

D. S

What aspects of the modern view of atomic structure was proved by Rutherford's gold foil experiment?

- A. The charge on an electron
- B. The charge on an alpha particle
- C. The existence of the nucleus

D. The existence of the electron

In the electromagnetic spectrum with wavelengths shown(in micrometers,m), w/c bracketed section of the spectrum represents visible light?

- A. O
- B. Y
- C. X

D. Z

Which of the orbitals in the figure below has (have) an angular momentum number of  $l=2$ ? I II III IV

- A. II
- B. I and III
- C. I

D. I and Iv

Chapter- 3

The unit cell in a certain lattice consists of a cube formed by an anion at each corner, an anion in the center, and a cation at the center of each face. How many cations and how many anions does the unit cell have?

A. 5 anions and 6 cations

B. 5 anions and 3 cations

C. 2 anions and 3 actions

D. 3 anions and 4 cations

Which one of the following atoms in its ground state has the greatest number of unpaired electrons?

A. 13Al

B. 14Si

C. 15P

D. 16S

Which compound contains both covalent and ionic bonds?

A. Sodium carbonate,  $\text{Na}_2\text{CO}_3$

B. Dichloromethane,  $\text{CH}_2\text{Cl}_2$

C. Magnesium bromide,  $\text{MgBr}_2$

D. Ethanoic acid,  $\text{CH}_3\text{COOH}$

Which molecule or ion does NOT have a tetrahedral shape?

A.  $\text{XeF}_4$

B.  $\text{SiCl}_4$

C.  $\text{BF}_3^-$

D.  $\text{NH}_4^+$

Why are metals soft and malleable?

A. Because they are very shiny

B. Because of the presence of mobile electrons

C. B/c they experience electrostatic repulsion

D. Because the metal cations can slip over each other fairly easily

How many bonds are present in  $\text{CO}_2$ ?

A. One

B. Two

C. Three

D. Four

What is the correct molecular electronic configuration for the molecular ion,  $\text{B}_2^+$ ?

A.  $1s^2 2s^2 2p^2$

B.  $1s^2 2s^2 2p^1$

C.  $1s^2 2s^2 2p^2$

D.  $1s^2 2s^2 2p^2$

Which of the following molecules or ions will exhibit delocalized bonding?  
 $\text{NO}_2^-$ ,  $\text{NH}_4^+$ ,  $\text{N}^-$

A.  $\text{NO}_2^-$  and  $\text{N}_3^-$

B.  $\text{NH}_4^+$  and  $\text{N}^-$

C.  $\text{NO}^-$

D.  $\text{NO}_2^-$  and  $\text{NH}_4^+$

Based on molecular orbital theory, the bond orders of  $\text{H}_2$ ,  $\text{H}_2^+$  and  $\text{H}_2^-$  are respectively.

A. 1, 0 and 0

B. 1,  $\frac{1}{2}$ , and 0

C. 1, 0, and  $\frac{1}{2}$

D. 1,  $\frac{1}{2}$ , and  $\frac{1}{2}$

How many 3d electrons are present in the ground state of chromium atom?

A. 4

B. 5

C. 6

D. 1

Which of the following ionic compounds is formed from the reaction between magnesium and nitrogen?

A.  $\text{Mg}_3\text{N}_2$

B.  $\text{Mg}_2\text{N}_3$

C.  $\text{Mg}_3\text{N}_2$

D.  $\text{Mg}_2\text{N}_3$

Which of the following molecules represents a non-polar covalent bond?

A. B-Cl

B. C-Cl

C. Cl-Cl

D. Mg-Cl

Which one of the following groups in the periodic table has paramagnetic atoms?

A. Group zero

B. Group IIA

C. Group IIB

D. Group IVA

How many types of cubic unit cells are known?

A. 2



B. 3

C. 4

D. 5

The total number of electrons participating in the bond formation of carbonate anion,  $\text{CO}_3^{2-}$ , in the molecule of carbonic acid are:

A. 16

B. 10

C. 8

D. 5

Which of the following crystals possess high electrical and thermal conductivities?

A. Ionic crystals

B. Metallic crystals

C. Molecular crystals

D. Covalent network crystals

Which of the following molecules has a trigonalbipyramidal structure?

A.  $\text{SF}_4$

B.  $\text{IF}_5$

C.  $\text{ICl}_4$

D.  $\text{BrF}_5$

Which of the following hybrid orbitals is favoring the formation of trigonal-bipyramidal?

A.  $\text{Sp}^3\text{d}$

B.  $\text{sp}^3$

C.  $\text{sp}^3\text{d}^2$

D.  $\text{sp}^3\text{d}^3$

Which one of the following molecules/molecular ions is paramagnetic according to the molecular orbital theory?

A.  $\text{O}^{2-}$

B.  $\text{O}_2$

C.  $\text{F}_2$

D.  $\text{O}_2^{2+}$

Which of the following molecules has a dipole moment?

A.  $\text{XeF}_4$

B.  $\text{H}_2\text{S}$

C.  $\text{SO}_3$

D. CH<sub>4</sub>

Which of the following element has the highest melting point?

- A. Iodine
- B. Tungsten
- C. mercury

D. Bromine

Which of the following is a chemical formula that represents an amino acid?

- A. CH<sub>4</sub>
- B. CH<sub>3</sub>NH<sub>2</sub>
- C. CH<sub>3</sub>COOH

D. NH<sub>2</sub>CH<sub>2</sub>COOH

Which term describes the units that make up compounds with covalent bonds?

- A. Ions
- B. Acids
- C. Salts

D. Molecules

There is a strong covalent bond between the N atoms in nitrogen gas, N<sub>2</sub>. Why, then, does nitrogen have such a low boiling point of - 196°C?

- A. The bond between the N- atoms is triple
- B. N is very electronegative, only next to F and O
- C. The strong bond, and intermolecular one, determines the boiling point of the substance

D. Boiling point is determined by intermolecular force, which in this case is weak as the molecule is non- polar

Which of the statements below best explains why atoms react chemically with each other?

- A. When atoms react, they gain protons and are more stable
- B. When atoms react, they lose all their electrons and become more stable
- C. When atoms react, they lose, gain, or share electrons and are then less stable

D. When atoms react, they lose, gain, or share electrons to attain a full outer energy level and are then more stable.

Which of the following species has the smallest H- X- H bond angle where X is the central atom?

- A. H<sub>2</sub>O
- B. NH<sub>3</sub>
- C. CH<sub>4</sub>

D. BH<sub>3</sub>

What is the hybridization of phosphorus atom in PCl<sub>5</sub>

A. Sp<sup>3</sup>d

B. sp<sup>3</sup>d<sup>2</sup>

C. sp<sup>3</sup>

D. sp<sup>2</sup>

Which molecule has a Lewis structure that does NOT obey the octet rule

A. NO

B. CS<sub>2</sub>

C. PF<sub>3</sub>

D. HCN

Which of the following explains why, at room temperature, I<sub>2</sub> is a solid, Br<sub>2</sub> is a liquid and Cl<sub>2</sub> is a gas?

A. Ionic bonding

B. Hybridization

C. Hydrogen bonding

D. London dispersion forces

Which molecule listed below has two sigma (σ) bonds?

A. N<sub>2</sub>

B. C<sub>2</sub>H<sub>4</sub>

C. N<sub>2</sub>F<sub>2</sub>

D. HCN

What is the hybridization of the carbon atom attached to nitrogen in acetonitrile shown?

A. Sp

B. sp<sup>2</sup>

C. sp<sup>3</sup>

D. sp<sup>4</sup>

Which one of the following is NOT true of metallic bonding?

A. It gives rise to excellent electrical conductivity

B. Electrons are free to move throughout the structure

C. The strength of metallic bonds increases down a group.

D. The strength of metallic bonding affects the boiling point of metals.

All of these are characteristics of most ionic compounds in the solid phases EXCEPT,

A. High melting point

- B. high electrical conductivity
- C. Solubility in water
- D. insolubility in organic solvents

Which one of the following does NOT form hydroxide ions when placed in water?

- A. Ionic hydrides
- B. Ionic metal oxide
- C. nonmetal oxides
- D. ionic nitrides

Which set contains only covalently bonded molecules?

- A.  $\text{BCl}_3$ ,  $\text{SiCl}_4$ ,  $\text{PCl}_5$
- B.  $\text{Br}_2$ ,  $\text{N}_2$ ,  $\text{HBr}$
- C.  $\text{I}_2$ ,  $\text{H}_2\text{S}$ ,  $\text{NaI}$
- D.  $\text{Al}$ ,  $\text{O}_3$ ,  $\text{As}_4$

Which of the following compounds would be expected to have the highest melting point?

- A.  $\text{BaF}_2$
- B.  $\text{BaCl}_2$
- C.  $\text{BaBr}_2$
- D.  $\text{BaI}_2$

Which one of the compounds below is most likely to be ionic?

- A.  $\text{CCl}_4$
- B.  $\text{NO}_2$
- C.  $\text{SCCl}_3$
- D.  $\text{ClO}_2$

When the following substances are arranged in order of increasing melting point (lowest melting point first), the correct order is:

- A.  $\text{CH}_3\text{CH}_2\text{CH}_3$ ,  $\text{CH}_3\text{COCH}_3$ ,  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
- B.  $\text{CH}_3\text{CH}_2\text{CH}_3$ ,  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ ,  $\text{CH}_3\text{COCH}_3$
- C.  $\text{CH}_3\text{COCH}_3$ ,  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ ,  $\text{CH}_3\text{CH}_2\text{CH}_3$
- D.  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$ ,  $\text{CH}_3\text{CH}_2\text{CH}_3$ ,  $\text{CH}_3\text{COCH}_3$

The type of compound that is MOST likely to contain a covalent bond is one that is

- A. a solid metal
- B. composed of only nonmetals
- C. composed of a metal from the far left and a non metal from far right of the periodic table

D. held together by the electrostatic forces between appositively charged ions

How many sigma and pi bonds are present in the following molecule ?  $\text{H}_3\text{C}-\text{CH}=\text{CH}-\text{CH}_3$

A. 8 bonds and 1 bond

B. 8 bonds and 2 bond

C. 10 bonds and 2 bond

D. 11 bonds and 1 bond

How many orbital's are there in an atom with  $n = 4$ ?

A. 2

B. 8

C. 16

D. 25

What hybridization change does the carbon atom undergo in the combustion of methane?  $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g})$

A.  $\text{sp} \rightarrow \text{sp}^2$

B.  $\text{sp}^2 \rightarrow \text{sp}^3$

C.  $\text{sp}^3 \rightarrow \text{sp}$

D.  $\text{sp}^2 \rightarrow \text{sp}$

Which of the following ionic compounds has the greatest lattice energy?

A. LiF

B. LiCl

C. LiBr

D. LiI

How many unpaired electrons are there in the Lewis structure of a  $\text{N}_3^-$  ion?

A. 0

B. 1

C. 2

D. 3

Which one following compound does NOT follow the octet rule?

A.  $\text{CS}_2$

B.  $\text{PBr}_3$

C. IBr

D.  $\text{BrF}_3$

The molecular geometry of the  $\text{H}_3\text{O}^+$  ion is

A. Linear

B. tetrahedral

C. bent

D. trigonal pyramidal

What is the hybridization of sulfur atom in SF<sub>6</sub>?

A. Sp<sup>2</sup>

B. Sp<sup>3</sup>

C. sp<sup>3</sup> d

D. sp<sup>3</sup>d<sup>2</sup>

Which of the following electron transition required the smallest energy to be absorbed by the hydrogen atom?

A. From n=4 to n=5

B. From n=3 to n=4

C. From n=2 to n=3

D. From n=1 to n=2

Which of the following molecules has a dipole moment?

A. XeF<sub>2</sub> B. IF<sub>3</sub>

B. BF<sub>3</sub>

C. SF<sub>5</sub> +

The dissolution of water in octane (C<sub>8</sub>H<sub>18</sub>) is prevented by

A. dipole- dipole attraction between octane molecules

B. hydrogen bonding between water molecules

C. London dispersion forces between octane molecules

D. repulsion between like charged water and octane molecules

Which one of the following is NOT a form of chemical bonding?

A. Covalent bonding

B. Metallic bonding

C. Ionic bonding

D. Hydrogen bonding

Which of the following statement is NOT true about covalent bonding?

A. Covalent bonds are least likely to be formed between atoms of the element.

B. Covalent bonds are least likely to be formed between atoms of different elements on the right side of periodic table

C. Covalent bonds are least likely to be formed between an element in Group 1 and an element in Group V11

D. Covalent bonds are least likely to be formed by head of the group elements with high ionization energies

What values of l are permitted for an electron with n = 4 ?

- A. 1, 2, 3
- B. 1, 2, 3, 4
- C. 0, 1, 2, 3, 4

D. 0, 1, 2, 3

Which of the following electron, identified only by their  $n$  and  $l$  quantum numbers have the highest energy?  $n = 3, l = 0$   $n = 4, l = 1$   $n = 3, l = 2$   $n = 4, l = 2$

- A.  $n = 3, l = 2$
- B.  $n = 4, l = 1$
- C.  $n = 4, l = 2$

D.  $n = 3, l = 0$

What is the maximum number of unpaired electrons in a  $d$  shell?

- A. 2
- B. 5
- C. 3

D. 4

The following energy level diagram represents the outermost shell of what ground state element?

- A. B
- B. He C, Al

C. Be

Formic acid, which is released by ants, has a molecular formula of  $\text{HCOOH}$ . What are the possible hybridizations that exist in the molecule?

- A.  $sp$  and  $sp^2$
- B.  $sp$  and  $sp^3$
- C.  $sp^2$ ,  $sp$  and  $sp^3$

D.  $sp$  and  $sp^3$

What would happen to the  $\text{O}_2$  molecule upon ionization to  $\text{O}_2^+$ ?

- A. The bond length will increase and the bond energy will increase
- B. The bond length will increase and the bond energy will decrease
- C. The bond length will decrease and the bond energy will increase

D. The bond length will decrease and the bond energy will decrease

How many bonding pairs and lone pairs, respectively does the ion  $\text{ICl}_4^-$  have?

- A. 3, 2
- B. 4, 2
- C. 5, 1

D. 4, 1

Which of the following molecules does NOT have a tetradral central atom?

A. SF<sub>4</sub>

B. AlH<sub>4</sub>

C. BF<sub>4</sub>

D. SiCl<sub>4</sub>

Acrylonitrile has the following Lewis structure with designation of x, y and z for each carbon atom:  $x \text{ } y \text{ } z \text{CH}_2 = \text{C} - \text{C} \text{ } \text{N} - \text{H}$  What will be the value of the bond angle and geometry of y z C - C N ? 0 — 0 0 0

A. 109 ,tetrahedral

B. 120 ,trigonal pyramidal

C. 180 ,linear

D. 90 , T- shaped

Antimony (Sb) is a group V element . What will be the molecular geometry and number of lone pair electrons, respectively that exist in the ion [SbCl<sub>5</sub>]<sup>2-</sup> ?

A. Seesaw, 1

B. Square planar, 2

C. Seesaw, 2

D. Linear, 3

Which of the following molecule does NOT have a trigonal bipyramidal electron-pair geometry?

A. SF<sub>4</sub>

B. ClF<sub>3</sub>

C. XeF<sub>2</sub>

How many atomic orbitals are required for an sp<sup>3</sup>

A. 2

B. 6 C.4

C. 8

D. BrF<sub>5</sub> hybridization?

A neutral molecule having the general formula AB<sub>3</sub> , has two unshared pair of electrons on A . What is the hybridization of A ?

A. sp

B. sp<sup>2</sup>

C. sp<sup>3</sup>

D. sp<sup>3</sup>

Which of following contains an sp<sup>2</sup> hybridized atom?



A.  $\text{CH}_2\text{Cl}$

B.  $\text{H}_2\text{O}$

C.  $\text{N}_2$

D.  $\text{H}_2\text{CCH}_2$

What is the electron set and molecular geometry of  $\text{BrO}_2$  ?

A. Trigonal planner, trigonal planar

B. Tetrahedral ,trigonal planner

C. Trigonal pyramidal , linear

D. Tetrahedral, bent

According to VSEPR theory , what is the geometry of  $\text{PCl}_3$  molecule?

A. Linear

B. Trigonal planner

C. Trigonal pyramidal

D. Tetrahedral

What is the geometry of the molecular compound formed by the reaction of sulfur with hydrogen?

A. Linear

B. Trigonal planner

C. Trigonal pyramidal

D. Tetrahedral

Which combination of atoms is more likely to produce an ionic compound?

A. Al and F

B. P and H

C. SI and O

D. S and Br

What are the ions present in  $\text{KHCO}_3$  ?

A.  $\text{KH}^+$  and  $\text{CO}_3$

B.  $\text{K}^+$  ,  $\text{H}^+$  ,  $\text{C}_4^+$  and  $\text{O}^+$

C.  $\text{K}^+$  ,  $\text{HCO}^+$

D.  $\text{KH}_2^+$  ,  $\text{CO}_3^{2-}$

Which of the following substances contains an atom that obeys the octet rule?

A.  $\text{PCl}_3$

B.  $\text{AlF}_3$

C. SF<sub>4</sub>

D. NO<sub>2</sub>

Which of the following has formed coordinate covalent bond?

A. H<sub>2</sub>O

B. NH<sub>4</sub>

C. CO<sup>2-</sup>

D. Na<sub>2</sub>O

Which of the following elements will form an ionic bond with chlorine?

A. Magnesium

B. Oxygen

C. Phosphorous

D. Silicon

The perchloric acid molecule contains

A. 8 lone pairs, no bonds ,and 5 bonds

B. 9 lone pairs ,2 bonds , and 5 bonds

C. 8 lone pairs , 3 bonds, and 5 bonds

D. 2 lone pairs , 3 bonds , and 4 bonds

When a student draws a plausible Lewis structure for hydrazine molecule (N<sub>2</sub>H<sub>4</sub>), how many lone pairs of electrons are available?

A. 2

B. 1 C.3

C. 4

The number of resonance structures for CO<sup>2-</sup> are:

A. 3

B. 2

C. 6

D. 9

In the following equation, what type of hybridization change, if any, occurs at the Xe atom?  $\text{XeF}_2(\text{s}) + \text{F}_2(\text{g}) \rightarrow \text{XeF}_4(\text{s})$

A. Sp<sup>3</sup>d to sp<sup>3</sup>

B. dsp<sup>2</sup> to sp<sup>3</sup>

C. sp<sup>3</sup>d to sp<sup>3</sup>d<sup>2</sup>

D. sp<sup>3</sup> to sp<sup>3</sup>d

What is (are)the bond angle(s) in SF<sub>6</sub>?

A. 180°

B. 109.5o

C. 90o and 109.5o

D. 90o

Which of the following statements about oxygen and fluorine is NOT correct?

A. O and F have the same number of core electrons.

B. O has a smaller atomic radius than F. C.O has a smaller electron affinity than F.

C. O<sup>2-</sup> has a larger ionic radius than F<sup>-</sup>

What will be the charges on the ions formed when silicon reacts with nitrogen?

A. Si<sup>2+</sup>, N<sup>2-</sup>

B. Si<sup>4+</sup>, N<sup>3-</sup>

C. Si<sup>3+</sup>, N<sup>3+</sup>

D. Si<sup>4+</sup>, N<sup>2-</sup>

Which of the following compounds does NOT contain an ionic bond?

A. K<sub>2</sub>S

B. NaOH

C. HCl

D. LiH

Which of the following molecular orbital diagram is correct for the carbide ion (C<sup>2-</sup>)?

A.  $1s^2 * 1s^2 2s^2 * 2s^2 2p^4$

B.  $1s^2 * 1s^2 2s^2 * 2s^2 2p^4 2p^2 * 2p^4$

C.  $1s^2 * 1s^2 2s^2 * 2s^2 2p^4 2p^2 * 2p^2$

D.  $1s^2 * 1s^2 2s^2 * 2s^2 2p^4 2p^2$

Which of the following is not the decomposition product of HNO<sub>3</sub>?

A. N<sub>2</sub>O<sub>4</sub>

B. NO<sub>2</sub>

C. O<sub>2</sub>

D. H<sub>2</sub>O

From CO<sub>2</sub>, H<sub>2</sub>O, BeCl<sub>2</sub> and N<sub>2</sub>O which have the same molecular geometry?

A. CO<sub>2</sub>, BeCl<sub>2</sub> and N<sub>2</sub>O

B. CO<sub>2</sub>, H<sub>2</sub>O and N<sub>2</sub>O

C. CO<sub>2</sub> and BeCl<sub>2</sub> only

D.  $\text{H}_2\text{O}$  and  $\text{N}_2\text{O}$  only

How many electrons are present in the 2p molecular orbital of  $\text{N}^+$ ?

- A. 1
- B. 4
- C. 3

D. 2

Give the following  $\text{AF}_n$  species,  $\text{BF}_3$ ,  $\text{BeF}_2$ ,  $\text{CF}_4$ ,  $\text{NF}_3$ ,  $\text{OF}_2$ , what is the correct order of F-A-F bond angles?

- A.  $\text{OF}_2$ ;  $\text{BeF}_2$ ;  $\text{NF}_3$ ;  $\text{BF}_3$ ;  $\text{CF}_4$
- B.  $\text{OF}_2$ ;  $\text{NF}_3$ ;  $\text{CF}_4$ ;  $\text{BF}_3$ ;  $\text{BeF}_2$
- C.  $\text{CF}_4$ ;  $\text{BF}_3$ ;  $\text{NF}_3$ ;  $\text{BeF}_2$ ;  $\text{OF}_2$

D.  $\text{BeF}_2$ ;  $\text{OF}_2$ ;  $\text{NF}_3$ ;  $\text{BF}_3$ ;  $\text{CF}_4$

Which of the following molecules has the largest dipole moment?

- A.  $\text{HF}$
- B.  $\text{HCN}$
- C.  $\text{HCl}$

D.  $\text{CO}$

Arrange the following molecules in the order of increasing stability.

- A.  $\text{N}^+$ ;  $\text{N}_2$ ;  $\text{N}^-$ ;  $\text{N}_2^{2-}$
- B.  $\text{N}_2^{2-}$ ;  $\text{N}^-$ ;  $\text{N}_2$ ;  $\text{N}^+$
- C.  $\text{N}_2$ ;  $\text{N}^+$ ;  $=\text{N}_2^-$ ;  $\text{N}_2^{2-}$

D.  $\text{N}_2^{2-}$ ;  $\text{N}^-$ ;  $=\text{N}_2^+$ ;  $\text{N}_2$

Which of the following statements is correct about nitrosyl chloride ( $\text{NOCl}$ )?

- A. It has a trigonal planar geometry with O a central atom
- B. It has a bent or angular geometry with O a central atom
- C. It has a trigonal planar geometry with N a central atom

D. It has a bent or angular geometry with N a central atom

What hybridization change, if any occurs at the underlined atom in the following reaction?  $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{CO}_3$

- A.  $\text{sp}^2$  to  $\text{sp}^3$
- B.  $\text{sp}$  to  $\text{sp}^2$
- C.  $\text{sp}^3$  to  $\text{sp}^3\text{d}$

D. No hybridization change observed

What is the molecular shape of  $\text{ICl}_4^-$ ?

- A. Octahedral

- B. T- shaped
  - C. Trigonal bipyramidal
  - D. Square planar
- Which one of the following types of bonding exists between atoms with very different electronegativities?
- A. Ionic bonding
  - B. Hydrogen bonding
  - C. Network covalent bonding
  - D. Metallic bonding
- Considering only resonance structures that are major contributors to the overall bonding in PF<sub>5</sub>, which of the following statements is correct?
- A. There are no resonance structures that involve ionic contributions.
  - B. Only three resonance structures can be drawn for PF<sub>5</sub>
  - C. One resonance structure contains five P- F bonds.
  - D. In each resonance structure, the P atom carries a positive charge.
- Which groups in the periodic table form ionic bonds?
- A. Groups IA and VIIB, Groups IIA – VIB
  - B. Groups IA and 17(VIIA), Group IIA – 16(VIA)
  - C. Group IA – 18(VIIA), Groups IVB – 14 (IVA)
  - D. Groups IIIB – VB, Group IVB – 14 (IVA)
- There is a progressive decrease in the bond angle in the series of molecules CCl<sub>4</sub>, PCl<sub>3</sub> and H<sub>2</sub>O. According to the VSEPR model, this is best explained by:
- A. Increasing electronegativity of the central atom
  - B. increasing number of lone pairs electrons
  - C. Decreases the size of the central atom
  - D. decreasing bond strength
- Which of the following compounds does not contain both ionic and covalent bond?
- A. NH<sub>4</sub>NO<sub>3</sub>
  - B. Na<sub>2</sub>CO<sub>3</sub>
  - C. NH<sub>4</sub>Cl
  - D. CH<sub>3</sub>CO<sub>2</sub>H

#### 11 Chapter- 4

In a reaction,  $A + B \rightarrow \text{product}$ , the rate is doubled when the concentration of B is 'doubled, and the rate increases by a factor of 8 when concentrations of both the reactants (A and B) are doubled, the rate law for the reaction can be written as:

A.  $\text{Rate} = k[\text{A}][\text{B}]$

B.  $\text{Rate} = k[\text{A}][\text{B}]^2$

C.  $\text{Rate} = k[\text{A}]^2[\text{B}]$

D.  $\text{Rate} = k[\text{A}]^2[\text{B}]^2$

Which factor will influence the rate of the reaction shown below?  
 $\text{NO}_2(\text{g}) + \text{CO}(\text{g}) \rightarrow \text{NO}(\text{g}) + \text{CO}_2(\text{g})$   
 I. The number of collisions per second  
 II. The energy of the collisions  
 III. The geometry with which the molecules collide

A. I only

B. II only

C. I and II only

D. I, II and III

The mechanism of a reaction is shown below.  
 $\text{HOOH} + \text{I}^- \rightarrow \text{HOI} + \text{OH}^-$  (slow)  
 $\text{HOI} + \text{I}^- \rightarrow \text{I}_2 + \text{OH}^-$  (fast)  
 $2\text{OH}^- + 2\text{H}_3\text{O}^+ \rightarrow 4\text{H}_2\text{O}$  (fast)  
 What is the rate law based on this mechanism?

A.  $\text{Rate} = k[\text{HOOH}][\text{I}^-]$

B.  $\text{Rate} = k[\text{HOOH}][\text{I}^-]^2$

C.  $\text{Rate} = k[\text{HOOH}]^2[\text{I}^-]$

D.  $\text{Rate} = k[\text{HOOH}]$

The half life for the first order decomposition of nitro methane,  $\text{CH}_3\text{NO}_2$ , at 500K is 650 seconds. If the initial concentration of  $\text{CH}_3\text{NO}_2$  is 0.500M, what will its concentration be (M) after 1300 seconds have elapsed?

A. 0.125

B. 0.140

C. 0.250

D. 0.425

In a zero-order reaction for every 100 rise of temperature, the rate is doubled. If the temperature is increased from 100°C to 1000°C, the rate of the reaction will become

A. 64 times

B. 128 times

C. 256 times

D. 512 times

The kinetic data below are for the reaction:  $\text{A} + \text{B} \rightarrow \text{C}$   

Initial Rate (mol dm <sup>-3</sup> sec <sup>-1</sup> )	[A]	[B]
0.1	0.1	$1 \times 10^{-5}$
0.1	0.2	$4 \times 10^{-5}$
0.1	0.1	$1 \times 10^{-5}$

A. order of A = 1 order of B = 0

B. order of A = 0 order of B = 4

C. order of A = 0 order of B = 2

D. order of A = 1 order of B = 2

Which of the following molecules represents a non-polar covalent bond?

A. B-Cl

B. C-Cl

C. Cl-Cl

D. Mg-Cl

What is a valid rate expression for the following reaction?  $2\text{NO} + 2\text{H}_2 \rightarrow \text{N}_2 + 2\text{H}_2\text{O}$

A.  $1/[\text{NO}]$

B.  $-1/[\text{H}_2\text{O}]$

C.  $-1/[\text{NO}]$  D.  $-1/[\text{N}_2]$

For the reaction:  $2\text{A} + \text{B} \rightarrow \text{C}$  The following experimental results were obtained: Experiment, What is the value of the rate constant?

A.  $0.6\text{mol L}^{-1}\text{s}^{-1}$

B.  $0.6\text{Lmol}^{-1}\text{s}^{-1}$

C.  $1.2\text{Lmol}^{-1}\text{s}^{-1}$

D.  $2.4\text{molL}^{-1}\text{s}^{-1}$

Increase in temperature of a reaction also increase the rate of a given reaction is due to the increase in the:

A. Extent of molecular dissociation

B. Frequency of collision of the reacting species

C. Activation energy of the reaction Numerical value of the rate constant of the reaction

The reaction for the formation of nitrosyl chloride  $2\text{NO(g)} + \text{Cl}_2\text{(g)} \rightarrow 2\text{NOCl(g)}$  Was studied at 250

D. The value of  $K_p$  for this reaction at 250C is  $1.9 \times 10^3 \text{ atm}^{-1}$  What is the value of  $K_c$  at 250C?

A.  $1.9 \times 10^{-3} \text{ L/mol}$

B.  $3.8 \times 10^{-3} \text{ L/mol}$

C.  $4.6 \times 10^4 \text{ L/mol}$

D.  $4.6 \times 10^5 \text{ L/mol}$

What is the half-life,  $t_{1/2}$  for a zero order reaction  $\text{A} \rightarrow \text{B}$ , (K is rate constant)?

A.  $\ln 2/K$

B.  $[A] / 2K$

C.  $\ln k[A]$

D.  $\ln 2[A] / K$

Consider the following reaction:  $2\text{S}_2\text{O}_3^{2-}(\text{aq}) + \text{I}_2(\text{aq}) \rightarrow \text{S}_4\text{O}_6^{2-}(\text{aq}) + 2\text{I}^-(\text{aq})$  If, in an experiment, 0.05 mol  $\text{S}_2\text{O}_3^{2-}$  is consumed in 1.0 L of solution each second, at what rates are  $\text{S}_4\text{O}_6^{2-}$  and  $\text{I}^-$  produced in this solution?

A.  $\text{S}_4\text{O}_6^{2-} = 0.025; \text{I}^- = 0.025$

B.  $\text{S}_4\text{O}_6^{2-} = 0.025; \text{I}^- = 0.05$

C.  $\text{S}_4\text{O}_6^{2-} = 0.05; \text{I}^- = 0.05$

D.  $\text{S}_4\text{O}_6^{2-} = 0.05; \text{I}^- = 0.025$

The reaction  $2\text{X} + \text{Y} \rightarrow \text{Z}$  was studied and the following data were obtained

Expt	[X]	[Y]	Rate (mole L <sup>-1</sup> s <sup>-1</sup> )
1	3.0	1.8	2.0
2	3.0	1.5	0.45
3	1.5	1.5	0.45

What is the proper rate expression?

A.  $\text{Rate} = k[X]$

B.  $\text{Rate} = k[X][Y]$

C.  $\text{Rate} = k[Y]^2$  D.  $\text{Rate} = k[X]^2[Y]$

The reaction between NO and I<sub>2</sub> is second order in NO and first-order in I<sub>2</sub>. What change occurs in the rate of the reaction if the concentration of NO is doubled and I<sub>2</sub> left unchanged?

A. Double

B. Quadruple

C. Eight times

D. Three times

A reaction is 50

A. 0

B. 1

C. 2

D. 3

Which are the number of moles and the mass of a copper sample containing  $5.00 \times 10^{20}$  atoms?

A.  $3.8 \times 10^{-4}$  mol Cu and  $5.2 \times 10^{-2}$  g Cu

B.  $5.2 \times 10^{-2}$  mol Cu and  $8.3 \times 10^{-4}$  g Cu

C.  $8.3 \times 10^{-4}$  mol Cu and  $5.2 \times 10^{-2}$  g Cu



- D.  $5.2 \times 10^{-2}$  mol Cu and  $3.8 \times 10^{-4}$  g Cu

Given the following reaction, what mass of gaseous carbon dioxide can be absorbed by 1 kg of lithium hydroxide?  $2\text{LiOH(s)} + \text{CO}_2\text{(g)} \rightarrow \text{Li}_2\text{CO}_3\text{(s)} + \text{H}_2\text{O(l)}$

- A. 920g
- B. 1840g
- C. 2760g

- D. 3680g

If a sample containing 36g  $\text{NH}_3$  is reacted with 180g of CuO, according to the following reaction, then what is the limiting reactant and how many grams of  $\text{N}_2$  will be formed?  $2\text{NH}_3\text{(g)} + 3\text{CuO(s)} \rightarrow \text{N}_2\text{(g)} + 3\text{Cu(s)} + 3\text{H}_2\text{O(g)}$

- A.  $\text{NH}_3$ ; 10.6g  $\text{N}_2$
- B.  $\text{NH}_3$ ; 22.3g  $\text{N}_2$
- C. CuO; 22.3g  $\text{N}_2$

- D. CuO; 10.6g  $\text{N}_2$

If the fermentation of sugar in an enzymatic solution, which is initially 0.2M, the concentration of the sugar is reduced to 0.1M in 10 hours and to 0.05M in 20 hours. What is the order of the reaction and the rate constant?

- A. First order  $K = 1.92 \times 10^{-5} \text{ s}^{-1}$
- B. Second order  $K = 1.38 \times 10^{-4} \text{ M}^{-1} \text{ s}^{-1}$
- C. First order  $K = 3.85 \times 10^{-5} \text{ s}^{-1}$

- D. Second order  $K = 2.72 \times 10^{-4} \text{ M}^{-1} \text{ s}^{-1}$

The reaction,  $2\text{O}_3 \rightarrow 3\text{O}_2$ , proceeds through the mechanism given below:  $\text{O}_3 \rightarrow \text{O}_2 + \text{O}$ , fast  $\text{O} + \text{O}_3 \rightarrow 2\text{O}_2$  slow. What would be the rate law expression for the reaction?

- A.  $\text{Rate} = k[\text{O}_3]^2$
- B.  $\text{Rate} = k[\text{O}_3]$
- C.  $\text{Rate} = k[\text{O}_3]^2$

- D.  $\text{rate} = k[\text{O}_3]^2$

Consider the following:  $2\text{NO(g)} + \text{Cl}_2\text{(g)} \rightarrow 2\text{NOCl(g)}$ ,  $\Delta H = -78.38 \text{ kJ}$  Which of the following does NOT affect the rate of a chemical reaction?

- A. Enthalpy of the reaction
- B. Surface area
- C. Concentration of reactants

D. Temperature

Which of the following is NOT a valid expression for the rate of the reaction given below?  
 $4\text{NH}_3 + 7\text{O}_2 \rightarrow 4\text{NO}_2 + 6\text{H}_2\text{O}$

- A.  $[\text{NO}_2]$
- B.  $1A[\text{NO}_2]$
- C.  $1A[\text{H}_2\text{O}]$

D.  $1A[\text{NH}_3]$

Each of the choices below gives a reaction and the corresponding rate law. Of these choices, which one could be an elementary process or individual step in a chemical reaction?

- A.  $2A \rightarrow P$ , rate =  $k[A]$
- B.  $A + B \rightarrow P$ , rate =  $k[A][B]$
- C.  $A + 2B \rightarrow P$ , rate =  $k[A]$

D.  $A + B + C \rightarrow P$ , rate =  $k[A][C]$

Consider the reaction in which nitric oxide is oxidized to nitrogen dioxide:  $2\text{NO}(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{NO}_2(\text{g})$ . For which the rate law is rate =  $k[\text{NO}]^2[\text{O}_2]$ . If this reaction takes place in a sealed vessel and the partial pressure of nitric oxide is doubled, what effect would this have on the rate of reaction?

- A. The reaction rate would increase by a factor of four.
- B. The reaction rate would increase by a factor of three.
- C. The reaction rate would increase by a factor eight.

D. The reaction rate would increase by a factor of two.

The equilibrium constant for reaction (1) is  $K$ . What is the equilibrium constant for reaction (2)?  
 $\text{SO}_2(\text{g}) + \text{O}_2 \rightleftharpoons 2\text{SO}_3(\text{g})$  (1)  
 $2\text{SO}_3(\text{g}) \rightleftharpoons 2\text{SO}_2(\text{g}) + \text{O}_2(\text{g})$  (2)

- A.  $K^2$  B.  $2K$
- B.  $1/K$  D.  $1/K^2$

A homogeneous liquid reaction mixture is often heated to increase the rate of reaction. This is best explained by the fact that raising the temperature:

- A. Increases the heat of reaction.
- B. Increases the vapor pressure of the liquid.

C. Decrease the energy of activation.

D. Increases the average kinetic energy of the reactants.

Considering the reaction below, in which of the following will the effect of concentration and temperature simultaneously cause an increase in the rate at which products are formed?

$$\text{CaCO}_3(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{CO}_2(\text{g}) + \text{CaCl}_2(\text{aq}) + \text{H}_2\text{O}(\text{l}) + \text{heat}$$

A. Decrease  $[\text{HCl}]$  and decrease temperature

B. Increase  $[\text{HCl}]$  and decrease temperature

C. Increase  $[\text{HCl}]$  and increase temperature

D. Grind up the  $\text{CaCO}_3$  and decrease temperature

For the gas phase reaction  $\text{N}_2 + \text{O}_2 \rightarrow 2\text{NO}$   $\Delta H = +180 \text{ kJ mol}^{-1}$  the value of  $K$  changes with the

A. change in pressure

B. introduction of  $\text{NO}$

C. change in concentration of  $\text{N}_2$

D. change in temperature

In the reaction  $2\text{SO}_2 + \text{O}_2 \rightleftharpoons 2\text{SO}_3$ ,  $K_{\text{eq}} = 100$  what will be the concentration of  $\text{O}_2$ , the concentration of  $\text{SO}_2$  is the same as that of  $\text{SO}_3$

A.  $[\text{O}_2] = [\text{SO}_2]$

B.  $[\text{O}_2] = 0.01 \text{ M}$

C.  $[\text{O}_2] = 100 \text{ M}$

D.  $[\text{O}_2] = 0.1 \text{ M}$

The decomposition of nitrosyl chloride was studied as  $2\text{NOCl}(\text{g}) \rightarrow 2\text{NO}(\text{g}) + \text{Cl}_2(\text{g})$ . The following data were obtained where  $\text{Rate} = -\frac{[\text{NOCl}]}{t} - \frac{[\text{NOCl}]_0}{t_0}$

(molecules/cm<sup>3</sup>) (molecules/cm<sup>3</sup> .s)

$3.0 \times 10^{16}$	$5.98 \times 10^4$	$2.0 \times 10^{16}$	$2.66 \times 10^4$
$1.0 \times 10^{16}$	$6.64 \times 10^3$	$4.0 \times 10^{16}$	$1.06 \times 10^5$

What is the rate law in the above decomposition?

A.  $r = k[\text{NOCl}]^2$

B.  $r = k[\text{NOCl}]$

C.  $r = k[\text{NOCl}] [\text{NO}]$

D.  $r = k[\text{NOCl}] [\text{Cl}]$

Considering the mechanism for a reaction below, which of the following statement is correct? Step 1:  $\text{HBr} + \text{O}_2 \rightarrow \text{HOBr}$  Step 2:  $\text{HBr} + \text{HOBr} \rightarrow 2\text{HOBr}$  Step 3:  $2\text{HOBr} + 2\text{HBr} \rightarrow 2\text{Br}_2 + 2\text{H}_2\text{O}$

A.  $\text{Br}_2$  is reactant

B.  $\text{HBr}$  is a product

C.  $\text{HOBr}$  is a catalyst

D.  $\text{HOBr}$  is a reaction intermediate

The reaction  $\text{A} + 3\text{B} \rightarrow 2\text{C} + \text{D}$  is first order with respect to reactant A and second order with respect to reactant B. If the conc of A is doubled and the concentration of B is halved, the rate of the reaction would...by a factor of...

A. increase, 2

B. decrease, 2

C. increase, 4

D. decrease, 4

What conditions of temperature and pressure will produce the highest yield of  $\text{NOCl}$  at equilibrium?

A. High temperature High pressure.

B. Low temperature high pressure.

C. High temperature low pressure.

D. Low temperature low pressure.

At 4450C, Ke for the following reaction is 0.020.  $2\text{HI}(\text{g}) \rightleftharpoons \text{H}_2(\text{g}) + \text{I}_2(\text{g})$  A mixture of  $\text{H}_2$ ,  $\text{I}_2$ , and  $\text{HI}$  in a vessel at 4450C has the following concentrations:  $[\text{HI}] = 2.0 \text{ M}$ ,  $[\text{H}_2] = 0.50\text{M}$  and  $[\text{I}_2] = 0.10\text{M}$ . which one of the following statements concerning the reaction quotient, Qc, is true for the above system?

- A.  $Q_c$  is less than  $K_c$ ; more HI will be produced
- B.  $Q_c$  is greater than  $K_c$  ; more than HI will be produced.
- C.  $Q_c$  is less than  $K_c$ ; more  $H_2$  and  $I_2$  will be produced.
- D.  $Q_c$  is greater than  $K_c$  ; more  $H_2$  and  $I_2$  will be produced.

The conventional equilibrium constant expression ( $K_c$ ) for the system  $2\text{ICl(s)} + \text{I}_2\text{(s)} + \text{Cl}_2\text{(g)}$  is

- A.  $[\text{I}_2] [\text{Cl}_2] / [\text{ICl}]^2$
- B.  $[\text{I}_2] [\text{Cl}_2] / 2[\text{ICl}]$
- C.  $[\text{Cl}_2]$
- D.  $[\text{I}_2] + [\text{Cl}_2] / 2 [\text{ICl}]$

How many electrons will appear when the following half- reaction is balanced?  
 $\text{S O}_2^- \rightarrow \text{S O}_4^{2-}$

- A. 3
- B. 2
- C. 4
- D. 1

The decomposition of carbon disulfide,  $\text{CS}_2$  to carbon monosulfide,  $\text{CS}$ , and sulfur is first order with  $K=2.8 \times 10^{-7} \text{ s}^{-1}$  at 10000

- E. What is the half- life of the reaction below at 10000C?  $\text{CS}_2 \rightarrow \text{CS} + \text{S}$
- A.  $5.0 \times 10^{-7} \text{ s}$
- B.  $4.7 \times 10^{-6} \text{ s}$
- C.  $3.8 \times 10^5 \text{ s}$
- D.  $2.5 \times 10^6 \text{ s}$

If we increase the concentration of a reactant , what happens to the collisions beteen particles?

- A. There are more collisions
- B. There are fewer collisions
- C. There are the same number of collisions

- D. There are same number of collisions , but they have more energy - 1

A drug decomposes by zero- 1order kinetics with a rate constant of  $2\text{mg mL}^{-1}\text{month}^{-1}$ . If the initial concentration is  $100\text{ mg mL}^{-1}$  , how long will it take for the drug to decompose by 10

A. 2 month

B. 3 month

C. 5month

- D. 4 month

For a first - order reaction , a plot of - - - - - versus is linear.

A. 1 ,t

B.  $\ln 1$  ,t

C.  $[A]$  t ,t

- D.  $\ln[A]$  t ,t $[A]$ t  $[A]$ t

The rate law of the overall reaction  $A + B \rightarrow C$  is:  $\text{rate} = K[A]^2$  Which of the following will NOT increase the rate of the reaction?

A. Increasing the concentration of reactant A

B. Increasing the temperature of the reaction

C. Increasing the concentration of reactant B

- D. Adding a catalyst for the reaction

Which of the following statement(s) is (are) applicable to a balanced chemical equation of an elementary reaction? i. Order is the same as molecularity ii. Order is less than the molecularity iii. Order is greater than the molecularity iv. Molecularity can never be zero

A. i

B. i , ii

C. i , iv

- D. i , iii

At high pressure, the following reaction is zero order  $11.30\text{ K, Pt } 2\text{NH}_3(\text{g}) \rightarrow \text{N}_2(\text{g}) + 3\text{H}_2(\text{g})$  i. Rate of reaction =

rate constant ii. Rate of reaction depends on the concentration of ammonia iii. Rate of decomposition of ammonia remains constant until ammonia decomposes completely iv. Further increase in pressure will change the rate of reaction

A. i

B. i , iii, iv

C. i, ii

D. i ,ii iv

Which of the following expressions is correct for the rate of the reaction given below?  $5\text{Br}^- (\text{aq}) + \text{BrO}_3^- (\text{aq}) + 6\text{H}^+ (\text{aq}) \rightarrow 3\text{Br}_2 (\text{aq}) + 3\text{H}_2\text{O} (\text{l})$

A.  $[\text{Br}^-]_t = 5[\text{H}^+]_t$

B.  $[\text{Br}^-]_t = 5/6 [\text{H}^+]_t$

C.  $[\text{Br}^-]_t = 6/5[\text{H}^+]_t$

D.  $[\text{Br}^-]_t = 6[\text{H}^+]_t$

Rate for the reaction  $\text{A} + 2\text{B} \rightarrow \text{C}$  is found to be  $\text{Rate} = k [\text{A}][\text{B}]$  If the concentration of reactant B is doubled , keeping the concentration A constant , what will be the value of the rate constant?

A. the same

B. doubled

C. halved

D. quadrupled

The oxidation of chloride by dichromate ( $\text{Cr}_2\text{O}_7^{2-}$ ) in acidic solution can be written as follows:  $6\text{Cl}^- (\text{aq}) + \text{Cr}_2\text{O}_7^{2-} (\text{aq}) + 14\text{H}^+ (\text{aq}) \rightarrow 3\text{Cl}_2 (\text{g}) + 2\text{Cr}^{3+} (\text{aq}) + 7\text{H}_2\text{O} (\text{l})$  The reaction is first order in  $\text{Cl}^-$ , first order in  $\text{Cr}_2\text{O}_7^{2-}$  and second order in  $\text{H}^+$ . What is the change in initial rate if the concentration of  $\text{Cl}^-$  and  $\text{Cr}_2\text{O}_7^{2-}$  are halved ? The new rate will be /have

A. rate = 1 (initial rate)

B. rate = 1/8 (initial rate)

C. rate = 1/14 (initial rate)

D. no change

Consider the following gaseous reaction and its rate law given below  $2A(g) + B(g) \rightarrow C(g)$  Rate =  $K[A]^2[B]$  In this reaction  $[A] = 2.0 \text{ M}$  and the rate was recorded to be  $0.048 \text{ mole l}^{-1}\text{s}^{-1}$ . What will be the numerical value of the rate constant,  $K$  ?

A. 8.0

B.  $6.0 \times 10^{-3}$

C.  $3.0 \times 10^{-3}$

D.  $1.5 \times 10^{-3}$

Given :  $A + 3B \rightarrow 2C + D$  This reaction is first order with respect to reaction A and second order with respect to reactant B . If the concentration of A is doubled and the concentration of B is halved , the rate of the reaction would be by a factor of- - - - -

A. increase, 2

B. decrease , 2

C. increase , 4

D. decrease , 4

The graph shown below shows the variation of concentration of a reactant with time as a reaction proceed. What is the average reaction rate , in  $\text{mol l}^{-1}\text{s}^{-1}$  , during the first 20s

A. 0.0025

B. 0.0036

C. 0.75

D. 0.0090

For zero order reactions ,which one of the following is true ?

A. The units of the rate constant ( $k$ ) are  $\text{time}^{-1}$

B. The half- life may be represented by the expression  $t_{1/2} = 0.693/k$

C. The rate of degradation is independent of the concentration of the reactant(s)



- D. A plot of the concentration remaining against time is a straight line with a gradient of  $1/k$

If the reaction is zero order in A, tripling the concentration of A will cause the reaction rate to:

- A. Increase by a factor of 27
- B. Remain constant
- C. Increase by a factor of 3
- D. Increase by a factor of 9.

Which one of the following factor does NOT affect the rate of a chemical reaction?

- A. Humidity
- B. Concentration
- C. Temperature
- D. Nature of reactants

Consider the following equilibrium:  $2\text{CO(g)} + \text{O}_2\text{(g)} \rightleftharpoons 2\text{CO}_2\text{(g)}$   $K_{eq} = 4.0 \times 10^{-10}$   
What is the value of  $K_{eq}$  for  $\text{CO(g)} + \frac{1}{2}\text{O}_2\text{(g)} \rightleftharpoons \text{CO}_2\text{(g)}$

- A.  $4.0 \times 10^{-10}$
- B.  $2.5 \times 10^9$
- C.  $5.0 \times 10^4$
- D.  $2.0 \times 10^{-5}$

What species of ions are present in a 0.1M solution of HCl and what will be their equilibrium concentration?

- A.  $[\text{H}_3\text{O}^+] = 0.1\text{M}$ ;  $[\text{OH}^-] = 0.1\text{M}$ ,  $[\text{Cl}^-] = 0.1\text{M}$
- B.  $[\text{H}_3\text{O}^+] = 0.1\text{M}$ ;  $[\text{OH}^-] = 10^{-13}\text{M}$ ,  $[\text{Cl}^-] = 0.1\text{M}$
- C.  $[\text{H}_3\text{O}^+] = 0.1\text{M}$ ;  $[\text{OH}^-] = 0.01\text{M}$ ,  $[\text{Cl}^-] = 0.1\text{M}$
- D.  $[\text{H}_3\text{O}^+] = 10^{-13}$ ;  $[\text{OH}^-] = 0.1\text{M}$ ,  $[\text{Cl}^-] = 0.1\text{M}$

The decomposition of a compound at 400°C is first order with the half life of 1570 seconds. What fraction of an initial amount of the compound remains after 4710 seconds?

- A.  $1/12$

B.  $1/6$

C.  $1/8$

D.  $1/3$

The diagram below shows the range of energies of collision of a collection of reactants at two temperatures, T1 and T2. Fraction of molecules T1 T2

A.  $1/12$

B.  $1/6$

C.  $1/8$

D.  $1/3$

Which of the following is true regarding T1 and T2?

A. T1=T2, fraction of molecules at both temperatures are equal.

B. T1<T2, fraction of molecules at T1 is smaller.

C. T2<T1, fraction of molecules at T2 is smaller.

D. T1>T2, fraction of molecules at T1 is larger.

In three different experiments the following results were obtained for the reaction A products: [ A] 0=1.00M,  $t_{1/2}$  = 50min; [ A] 0= 2.00M,  $t_{1/2}$ =25min; [ A] 0=0.50M,  $t_{1/2}$ = 100min. what is the value of the rate constant for this reaction?

A.  $0.010\text{Lmol}^{-1}\text{min}^{-1}$

B.  $0.030\text{Lmol}^{-1}\text{min}^{-1}$

C.  $0.020\text{Lmol}^{-1}\text{min}^{-1}$

D.  $0.040\text{Lmol}^{-1}\text{min}^{-1}$

The reaction below takes place with all of the reactants and products in the gaseous phase. Which of the following is true of the relative rates of disappearance the reactants and appearance of the products?  $2\text{NOCl} \rightarrow 2\text{NO} + \text{Cl}_2$

A. NO appears at twice the rate that NOCl disappears.

B. NO appears at half the rate that NOCl disappears. C.NO appears at the same rate that NOCl disappears

- C.  $\text{Cl}_2$  appears at the same rate that  $\text{NOCl}$  disappears

The proposed reaction mechanism between nitrogen monoxide and bromine is given below.  $\text{NO} + \text{Br}_2 \rightarrow \text{NOBr}_2$  (fast)  
 $\text{NOBr}_2 + \text{NO} \rightarrow 2\text{NOBr}$  (slow) Which of the following rate equations is consistent with the proposed mechanism?

- A.  $\text{Rate} = k[\text{NO}]^2$   
 B.  $\text{Rate} = k[\text{NO}][\text{Br}_2]^2$   
 C.  $\text{Rate} = k[\text{NO}]^2[\text{Br}_2]$   
 D.  $\text{Rate} = k[\text{NO}][\text{Br}_2]$

The minimum energy required for an effective collision is called.....?

- A. activation energy  
 B. Potential energy  
 C. Free energy  
 D. Kinetic energy
- For the reaction,  $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$ , the rate of disappearance of  $\text{H}_2$  is  $0.01 \text{ mol L}^{-1} \text{ min}^{-1}$ . What is the rate of appearance of  $\text{NH}_3$ ?

- A.  $0.007 \text{ mol L}^{-1} \text{ min}^{-1}$   
 B.  $0.02 \text{ mol L}^{-1} \text{ min}^{-1}$   
 C.  $0.01 \text{ mol L}^{-1} \text{ min}^{-1}$   
 D.  $0.002 \text{ mol L}^{-1} \text{ min}^{-1}$

The appropriate unit for a first order rate constant is?

- A.  $1/\text{s}$   
 B.  $1/\text{M s}$   
 C.  $\text{M/s}$   
 D.  $1/\text{M}^2 \text{s}$

11 Chapter- 5

Answer the following question using the phase diagram below. At which point can only the solid and liquid phases co-exist?

- A. 1  
 B. 2  
 C. 3

D. 4

Which statement is true about chemical reactions at equilibrium?

- A. The forward and backward reactions proceed at equal rates
- B. The forward and backward reactions have stopped
- C. The concentrations of the reactants and products are equal

D. The forward reaction is exothermic

Which changes will increase the amount of  $\text{SO}_3(\text{g})$  at equilibrium?  $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$   $\Delta H = -197\text{kJ}$  I. Increasing the temperature II. Decreasing the volume III. Adding a catalyst

- A. I only
- B. II only
- C. I and II only

D. I, II and III

What is the equilibrium constant expression for the following reaction?  $2\text{Hg}(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{HgO}(\text{s})$

- A.  $k = 1/([\text{Hg}]^2 [\text{O}_2])$
- B.  $k = [\text{HgO}]^2 / ([\text{Hg}]^2 [\text{O}_2])$
- C.  $k = [\text{Hg}]^2 [\text{O}_2]$

D.  $k = [2\text{HgO}] / ([2\text{Hg}] [\text{O}_2])$

Which of the following mathematical relationships between  $K$ ,  $K_1$  and  $K_2$  correct?  $\text{CO}_2(\text{g}) + \text{H}_2(\text{g}) \rightleftharpoons \text{CO}(\text{g}) + \text{H}_2\text{O}(\text{g})$   $K$   $\text{Fe}(\text{s}) + \text{CO}_2(\text{g}) \rightleftharpoons \text{FeO}(\text{s}) + \text{CO}(\text{g})$   $K_1$   $\text{Fe}(\text{s}) + \text{H}_2\text{O}(\text{g}) \rightleftharpoons \text{FeO}(\text{s}) + \text{H}_2(\text{g})$   $K_2$

- A.  $K = K_1 + K_2$
- B.  $K = K_1 / K_2$
- C.  $K = K_1 \times K_2$

D.  $K = K_2 / K_1$

The value of  $K_{\text{eq}}$  for the following equilibrium reaction is 4.0 at a temperature of 373K.  $\text{CH}_3\text{COOH} + \text{C}_2\text{H}_5\text{OH} \rightleftharpoons \text{CH}_3\text{COOC}_2\text{H}_5 + \text{H}_2\text{O}$  What mass of ethyl ester ( $\text{CH}_3\text{COOC}_2\text{H}_5$ ) would be

present in the equilibrium mixture if 15g of acetic acid and 11.5g of ethanol were mixed and equilibrium was established at this temperature?

- A. 5.2
- B. 10.1
- C. 12.6

D. 14.1

Which of the following statements is TRUE about equilibrium reaction?

- A. No more reactants are transformed into products
- B. There are equal amounts of reactants and products
- C. The rate constant for forward reactions equals that of the reverse reaction

D. The rate for the forward reactions equals that of the reverse reactions

Three gases are in equilibrium in a closed chamber sealed with a piston. The following equilibrium is established :  $2\text{NH}_3(\text{g}) \rightleftharpoons \text{N}_2(\text{g}) + 3\text{H}_2(\text{g})$  What will happen if the piston is pushed into the chamber?

- A. The mole fraction of  $\text{N}_2$  increases
- B. The mole fraction of  $\text{N}_2$  remains the same
- C. The mole of  $\text{N}_2$  decreases

D. The mole fraction of  $\text{N}_2$  increases and then decreases

Consider the following phase Diagram for  $\text{CO}_2$  What happens when in a  $\text{CO}_2$  sample initially at 1 atm and  $-70^\circ\text{C}$  the temperature increases from  $-70^\circ\text{C}$  to  $-100^\circ\text{C}$  at a constant pressure of 60 atm?

- A.  $\text{CO}_2(\text{g}) \rightarrow \text{CO}_2(\text{s})$
- B.  $\text{CO}_2(\text{g}) \rightarrow \text{CO}_2(\text{g})$
- C.  $\text{CO}_2(\text{s}) \rightarrow \text{CO}_2(\text{l})$

D.  $\text{CO}_2(\text{g}) \rightarrow \text{CO}_2(\text{l})$  What will happen if  $\text{NaOCl}$  is added to this reaction at equilibrium  $\text{HOCl} + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{OCl}^-$  ?

- A. The concentrations of both HOCl and  $\text{H}_3\text{O}^+$  would increase.
- B. The concentrations of both HOCl and  $\text{H}_3\text{O}^+$  would decrease.
- C. The concentration of HOCl would increase and the concentration of  $\text{H}_3\text{O}^+$  would decrease.
- D. The concentration of HOCl would decrease and the concentration  $\text{H}_3\text{O}^+$  would increase.

Consider the following equilibrium  $\text{CaCO}_3(\text{S}) \rightleftharpoons \text{CaO}(\text{S}) + \text{CO}_2(\text{g})$  Which of the following mixtures, each placed in a closed container and allowed to stand is not capable of reaching the equilibrium given above?

- A. Pure  $\text{CaCO}_3$
- B. Some CaO and a pressure of  $\text{CO}_2$  greater than the value of  $K_p$
- C.  $\text{CaCO}_3$  and CaO
- D. Some  $\text{CaCO}_3$  and a pressure of  $\text{CO}_2$  greater than the value of  $K_p$

Which of the following statement correctly describes a chemical reaction at equilibrium?

- A. The concentrations of the products and reactants are equal
- B. The change in the concentrations of the products and reactants is constant
- C. The rate of the forward reaction is less than the rate of the reverse reaction
- D. The rate of the forward reaction is greater than the rate of the reverse reaction

If the following reaction is at equilibrium, which one of the following changes will shift the equilibrium to the left?

$$\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3 + \text{heat}$$

- A. Increasing pressure
- B. Adding more  $\text{N}_2$  and  $\text{H}_2$
- C. Decreasing temperature

- D. Increasing the volume of the reaction container.

Suppose reactions  $A \rightleftharpoons B$  and  $B \rightleftharpoons A$  are both elementary processes with rate constants of  $8 \times 10^2 \text{ s}^{-1}$  and  $4 \times 10^4 \text{ s}^{-1}$ , respectively. What is the value of the equilibrium constant for the equilibrium?  $A \rightleftharpoons B$

- A.  $2 \times 10^2$
- B.  $0.5 \times 10^2$
- C.  $4 \times 10^2$

- D.  $4 \times 10^2$

Which one of the following will change the value of an equilibrium constant?

- A. Changing the temperature.
- B. Adding other substances that do not react with any of the species involved in the equilibrium.
- C. Varying the initial concentration of reactants.

- D. Varying the initial concentration of products

The conventional equilibrium constant expression ( $K_c$ ) for the system as described by the equation:  $2\text{ICl(s)} \rightleftharpoons \text{I}_2\text{(s)} + \text{Cl}_2\text{(g)}$  is:

- A.  $[\text{Cl}]$
- B.  $[\text{Cl}_2] / [\text{ICl}]^2$
- C.  $[\text{I}_2] [\text{Cl}_2] / [\text{ICl}]$

- D.  $[\text{I}_2] [\text{Cl}_2] / [\text{ICl}]$

The value of  $K_{eq}$  for the following reaction is 0.5  $\text{SO}_2\text{(g)} + \text{NO}_2\text{(g)} \rightleftharpoons \text{SO}_3\text{(g)} + \text{NO(g)}$  What is the value of  $K_{eq}$  at the same temperature for the reaction below?  $2 \text{SO}_2\text{(g)} + 2\text{NO}_2\text{(g)} \rightleftharpoons 2 \text{SO}_3\text{(g)} + 2\text{NO(g)}$

- A. 0.25
- B. 0.026
- C. 0.50

- D. 16

The following equilibrium constants were determined at  $3000^\circ\text{C}$   $2\text{N}_2\text{O(g)} \rightleftharpoons 2\text{N}_2\text{(g)}$

$\text{N}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{NO}(\text{g})$   $K_c = 4.0 \times 10^{-31}$  at 3000 K  
 What will be the equilibrium constant at 3000 K for the gaseous reaction of  $\text{N}_2\text{O}(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{NO}(\text{g})$  ?

A.  $3.2 \times 10^{-12}$

B.  $2 \times 10^{-13}$

C.  $5.0 \times 10^{50}$

D.  $1.6 \times 10^{-49}$

When 0.50 mol of  $\text{N}_2\text{O}_4$  is placed in a 4.0 liter reaction vessel and heated to 400K, 80% decomposes to  $\text{NO}_2$  gas as follows:  
 $\text{N}_2\text{O}_4(\text{g}) \rightleftharpoons 2\text{NO}_2(\text{g})$  What will be the value of  $K_p$ , in units of pressure, at 400K for this reaction?

A. 2.62

B. 13.12

C. 50.48

D. 16.20

Consider the following graph, which relates to the equilibrium system:  
 $\text{CH}_3\text{COOH}(\text{aq}) + \text{H}_2\text{O} \rightleftharpoons \text{CH}_3\text{COO}^-(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$   
 Which of the following actions caused the change in the concentration of  $[\text{H}_3\text{O}^+(\text{aq})]$  at time t ?

A. 2.62

B. 13.12

C. 50.48

D. 16.20

Which of the following actions caused the change in the concentration of  $[\text{H}_3\text{O}^+(\text{aq})]$  at time t ?

A. Addition of  $\text{CH}_3\text{COO}^-(\text{aq})$

B. Addition of HCl

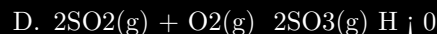
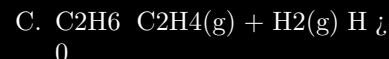
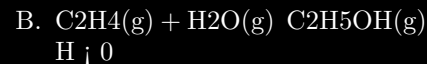
C. Decreasing of temperature

D. Increasing the volume of the container

In which of the following systems will the position of equilibrium shift to the left upon an increase in pressure, but to the right upon an increase in temperature ?

$\text{CO}_2(\text{g}) + \text{H}_2(\text{g}) \rightleftharpoons \text{CO}(\text{g}) + \text{H}_2\text{O}(\text{g})$   $\Delta H < 0$





The hydrogen used in the Haber process is made by the following reaction:  $\text{CH}_4(\text{g}) + \text{H}_2\text{O}(\text{g}) \rightleftharpoons \text{CO}(\text{g}) + 3\text{H}_2(\text{g})$   $\Delta H = +206 \text{ kJ}$  Which of the following sets of conditions will favor the formation of  $\text{H}_2$ ?

- A. Low pressure and high temperature
- B. Low pressure and low temperature
- C. High pressure and low temperature

- D. High pressure and high temperature

Why does the rate of the reaction increase when powdered calcium carbonate is used instead of marble chips?

- A. The powdered calcium carbonate acts as a catalyst
- B. There is an increase of the concentration of the calcium carbonate
- C. There is an increase of the particles size of the calcium carbonate

- D. There is an increase of the surface area of the calcium carbonate

In the Haber process for the synthesis of ammonia, the expected reaction is  $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g}) + 92.4 \text{ kJ mol}^{-1}$  Which of the following is true about this process at equilibrium?

- A. Concentration of reactant and product are equal
- B. The forward and backward reaction rate are equal
- C. The formation of ammonia is more dominant at equilibrium

- D. Formation and dissociation of ammonia at equilibrium is static.

In the coal - gasification process, carbon monoxide is converted to carbon dioxide via the following reaction:  $\text{CO(g)} + \text{H}_2\text{O (g)} \rightleftharpoons \text{CO}_2\text{(g)} + \text{H}_2\text{(g)}$  In an experiment , 0.35 mol of CO and 0.40 mol of H<sub>2</sub>O were placed in a 1.00- L reaction vessel. At equilibrium , there were 0.19 mol of CO remaining . What is K<sub>eq</sub> at the temperature of the experiment?

- A. 0.25
- B. 0.36
- C. 0.56

- D. 0.78

A pure substance is heated as indicated in the diagram below . Which section of the graph indicates the boiling point?

- A. A
- B. B
- C. C

- D. D

The value of K<sub>eq</sub> for the equilibrium  $\text{H}_2\text{(g)} + \frac{1}{2} \text{I}_2\text{(g)} \rightleftharpoons \text{2HI(g)}$  is 794 at 25 °C . At this temperature, what is the value of K<sub>eq</sub> for the equilibrium below?  $\text{HI(g)} \rightleftharpoons \frac{1}{2} \text{H}_2\text{(g)} + \frac{1}{2} \text{I}_2\text{(g)}$

- A. 0.0013
- B. 0.035
- C. 28

- D. 397

Which one of the following will change the value of equilibrium constant?

- A. Adding other substances that do not react with any of the species involved in the equilibrium.
- B. Varying the initial concentration of reactants
- C. Varying the initial concentration of products

D. Changing temperature Which of the following statements is true about equilibrium involving a chemical reaction?

- A. The rate constants of the forward and reverse reactions are equal
- B. The rate of the forward and reverse reactions are equal
- C. The value of the equilibrium constant is 1

D. All chemical reactions have ceased

The rate equation for the decomposition of nitramide,  $\text{H}_2\text{NNO}_2 \rightarrow \text{N}_2\text{O} + \text{H}_2\text{O}$ , is  $\text{Rate} = k[\text{H}_2\text{NNO}_2][\text{H}^+]^{-1}$ . Which of the following mechanisms is consistent with this rate equation?

- A.  $\text{H}_2\text{NNO}_2 \rightarrow \text{N}_2\text{O} + \text{H}_2\text{O}$  slow
- B.  $\text{H}_2\text{NNO}_2 + \text{H}^+ \rightleftharpoons \text{H}_3\text{NNO}_2^+$  fast equilibrium  
 $\text{H}_3\text{NNO}_2^+ \rightarrow \text{H}_3\text{NNO} + \text{N}_2\text{O}$  fast equilibrium  
 $\text{H}_3\text{NNO} + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{NH}_2^-$  fast equilibrium  
 $\text{NH}_2^- + \text{H}^+ \rightarrow \text{NH}_3$  fast equilibrium
- C.  $\text{H}_2\text{NNO}_2 + \text{OH}^- \rightleftharpoons \text{NH}_2^- + \text{NH}_3 + \text{H}_2\text{O}$  fast equilibrium  
 $\text{NH}_2^- + \text{H}^+ \rightarrow \text{NH}_3$  fast equilibrium  
 $\text{H}_2\text{O} \rightleftharpoons \text{H}^+ + \text{OH}^-$  fast equilibrium

D.  $\text{H}_2\text{NNO}_2 + \text{H}^+ \rightleftharpoons \text{H}_3\text{NNO}_2^+$  fast equilibrium  
 $\text{H}_3\text{NNO}_2^+ \rightarrow \text{N}_2\text{O} + \text{H}_3\text{O}^+$  slow  
 $\text{H}_3\text{O}^+ + \text{OH}^- \rightleftharpoons \text{H}_2\text{O} + \text{H}_2\text{O}$  fast

Given the equilibrium constant values:  
 $\text{N}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g}) \rightleftharpoons \text{N}_2\text{O}(\text{g})$   $K_c = 3.4 \times 10^{-18}$   
 $\text{N}_2\text{O}_4(\text{g}) \rightleftharpoons 2\text{NO}_2(\text{g})$   $K_c = 4.6 \times 10^{-3}$   
 $\frac{1}{2}\text{N}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons \text{NO}_2(\text{g})$   $K_c = 4.1 \times 10^{-9}$   
 What is the value of  $K_c$  for the following reaction?  $2\text{NO}_2 + 3\text{O}_2(\text{g}) \rightleftharpoons 2\text{N}_2\text{O}_4(\text{g})$

- A.  $2.4 \times 10^{-6}$
- B.  $1.2 \times 10^6$
- C.  $1.2 \times 10^{-6}$

D.  $4.8 \times 10^6$

The equilibrium constant for the ionization of HCN is  $4.9 \times 10^{-10}$ .  $\text{HCN} \rightleftharpoons \text{H}^+ + \text{CN}^-$   $K = 4.9 \times 10^{-10}$ . Which of the following statements is true regarding this equilibrium? I. The reaction is product favored III. Equilibrium lies far to

the right II. The reaction is reactant favored VI. Equilibrium lies far to the left

A. II and III

B. I and III

C. II and IV

D. I and IV

For the certain gas phase reaction  $2A(g) + B(g) + C(g) \rightleftharpoons D(g)$   $\Delta H = +45 \text{ kJ/mol}$ ,  $K = 4.5 \times 10^{-2}$  Which of the following would be true if the temperature was increased from  $25^\circ\text{C}$  to  $200^\circ\text{C}$ ? I. The value of  $K$  would be smaller II. The concentration of  $A(g)$  would be increased. III. The concentration of  $B(g)$  would increase.

A. III

B. II

C. I

D. I and III

For the reaction  $C_6H_{14}(g) \rightleftharpoons C_6H_6(g) + 4H_2(g)$ ,  $P(H_2)/t$  was found to be  $2.5 \times 10^{-2} \text{ atm/s}$ , where  $P(H_2)$  is change in the pressure of hydrogen. Determine  $P(H_2)/t$  (in units of atm/s) for this reaction at the same time.

A.  $-6.2 \times 10^{-3}$

B.  $1.6 \times 10^{-3}$

C.  $2.5 \times 10^{-2}$

D.  $6.2 \times 10^{-3}$

Consider the following equilibrium:  $Cl_2(g) + 2NO(g) \rightleftharpoons 2NOCl(g)$   $K_{eq} = 5.0$  At equilibrium,  $[Cl_2] = 1.0 \text{ M}$  and  $[NO] = 2.0 \text{ M}$ . What is the  $[NOCl]$  at equilibrium?

A.  $4.5 \text{ M}$

B.  $0.89 \text{ M}$

C.  $0.80 \text{ M}$

D.  $10 \text{ M}$

Which of the following statement is NOT true in relation to the triple point on a single component phase diagram?

A. The point at which the solid, liquid and gaseous phases for a substance coexist.

- B. The system must be enclosed so that no vapour can escape.
- C. The triple point exists for a substance occurs at a specific temperature and pressure.
- D. The triple point exists at a single temperature and is independent of pressure.

In the figure shown below, what does O denote?

- A. Melting point
  - B. vaporization
  - C. Boiling point
  - D. Triple point
- Which one of the following statements regarding a dynamic equilibrium is false?
- A. At equilibrium, the forward and reverse reaction ceases to occur.
  - B. At equilibrium, there is no net change in the system
  - C. At equilibrium, the rate of the forward and backward reactions is identical.
  - D. At equilibrium, the concentration of reactants and products stay the same.

A sample of solid ammonium carbamate is heated in a closed container at 298K and allowed to reach equilibrium.  $\text{NH}_4\text{CO}_2\text{NH}_2(\text{s}) \rightleftharpoons 2\text{NH}_3(\text{g}) + \text{CO}_2(\text{g})$  If the total pressure of the system is 0.114atm, what is the value of equilibrium constant,  $K_p$ ?

- A.  $1.29 \times 10^{-3}$
- B.  $3.80 \times 10^{-4}$
- C.  $2.19 \times 10^{-4}$
- D.  $7.60 \times 10^{-3}$

Which one of the following reaction at equilibrium would be unaffected by an increase in pressure? I.  $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$  II.  $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{H}_2\text{O}(\text{g})$  III.  $\text{N}_2(\text{g}) + \text{N}_2(\text{g}) \rightleftharpoons 2\text{NO}(\text{g})$  IV.  $2\text{CO}(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{CO}_2(\text{g})$

A. I

B. II

C. III

D. IV

A sealed isothermal container initially contained 2mole of CO gas and 3moles of H<sub>2</sub> gas. The following reversible reaction occurred:  $\text{CO(g)} + 2\text{H}_2\text{(g)} \rightleftharpoons \text{CH}_3\text{OH(g)}$  at equilibrium, there was one mole of CH<sub>3</sub>OH in the container at equilibrium?  $2\text{X(g)} \rightleftharpoons 3\text{Y(g)} + \text{Z(g)}$  (forward rxn)  $K_c = 0$

A. 1

B. 3

C. 2

D. 4

The molar equilibrium concentrations for the reaction mixture represented above at 298K are  $[\text{X}] = 4.0\text{M}$ ,  $[\text{Y}] = 5.0\text{M}$ , and  $[\text{Z}] = 2.0\text{M}$ . What is the value of the equilibrium constant,  $K_{eq}$ , for the reaction at 298K?

A. 16.0

B. 2.50

C. 0.06

D. 62.5

Chemistry grade- 11 Entrance Chapter- 6

Commercially, liquid vegetable oils are converted to solid fats such as margarine by:

A. Hydrogenation

B. Hydration

C. Saponification

D. Oxidation

What is the chemical name for Aspirin?

A. Acetyl salicylic acid

B. Salicylic acid

C. Methyl salicylate

D. Sodium salicylate

Which compound is a carboxylic acid?

A.  $\text{CH}_3\text{COOH}$

B.  $(\text{CH}_3\text{CO})_2\text{O}$

C.  $(\text{CH}_3)_2\text{CHOOCH}_3$

D.  $(\text{CH}_3)_2\text{O}$

A triacylglycerol that is solid at room temperature is called :

A. Lecithin

B. Fat

C. Wax

D. Oil

Which compound is an ester?

A.  $\text{CH}_3\text{COOH}$

B.  $\text{CH}_3\text{OC}_2\text{H}_5$

C.  $\text{C}_2\text{H}_5\text{CHO}$

D.  $\text{HCOOCH}_3$

Which of the following gives the correct order of decreasing acidity of carboxylic acids?

A.  $\text{Cl}_3\text{CCOOH}$ ,  $\text{Cl}_2\text{CHCOOH}$ ,  $\text{FCH}_2\text{COOH}$ ,  $\text{CH}_3\text{COOH}$

B.  $\text{FCH}_2\text{COOH}$ ,  $\text{CH}_3\text{COOH}$ ,  $\text{Cl}_2\text{CHCOOH}$ ,  $\text{Cl}_3\text{CCOOH}$

C.  $\text{CH}_3\text{COOH}$ ,  $\text{FCH}_2\text{COOH}$ ,  $\text{Cl}_2\text{CHCOOH}$ ,  $\text{Cl}_3\text{CCOOH}$

D.  $\text{Cl}_2\text{CHCOOH}$ ,  $\text{CH}_3\text{COOH}$ ,  $\text{FCH}_2\text{COOH}$ ,  $\text{Cl}_3\text{CCOOH}$

Which of these compounds is the ester formed from the reaction of acetic acid and 1-propanol?

A.  $\text{—CH}_3\text{COH—OCH}_2\text{CH}_2\text{CH}_2\text{OH—}$

B.  $\text{CH}_3\text{CH}_2\text{COHOCH}_2\text{CH}_3\text{—}$

C.  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OCH}_2\text{COH—}$

D.  $\text{CH}_3\text{COCH}_2\text{CH}_2\text{CH}_3$

What is the name of a base-promoted ester hydrolysis reaction?

A. Acylation

B. Esterification

C. Condensation

D. Saponification

What is the name of the following compound?

A. Benzoate ester

B. Ethyl benzoate

C. Phenyl butyrate

D. Ethyl benzyl ketone Which of the following statements is true about esters?

A. Esters can form intermolecular hydrogen bonds

B. Ester molecules can form intermolecular hydrogen bonds

C. Ester molecules cannot form intermolecular hydrogen bonds

D. Esters have higher boiling points than alcohols of comparable molecular weight

The organic compound  $\text{CH}_3\text{C}(\text{O})\text{CH}_3$  is

A. Aldehyde

B. Ester

C. Carbonyl

D. Ketone

Consider the following reaction  $\text{CH}_3\text{CH}_2\text{C}(\text{O})\text{CH}_3 + \text{NaOH}$  What are the products of this reaction?

A. Sodium acetate and ethanol

B. Sodium propionate and methanol

C. Sodium acetate and methanol

D. Methyl propionic acid and methanol

Which catalyst is used in the hydrogenation of vegetables?

A. Iron

B. Nickel

C. Platinum

D. Molybdenum

What is the name of a base-promoted ester hydrolysis reaction?



- A. Acylation
- B. Esterification
- C. Condensation

D. Saponification

Which organic functional group does the following molecular representation, i.e.,  $R_1R_2CHCOH$  belong? ( $R_1$  and  $R_2$  represent different alkyl chains)

- A. Amides
- B. Aldehyde
- C. Ethers

D. Organic acids

What is the IUPAC name for the compound  $(CH_3)_2CHCH_2CHCOH$

- A. 2,4- dimethylpentanoic acid
- B. 1- hydroxy- 2,4- dimethylpentanone
- C. 1,1,3- trimethylbutanoic acid

D. 2- carboxyisohexane

Given the following reaction What is the major product of the reaction

- A. 2,4- dimethylpentanoic acid
- B. 1- hydroxy- 2,4- dimethylpentanone
- C. 1,1,3- trimethylbutanoic acid

D. 2- carboxyisohexane

What is the process that converts liquid vegetable oils to solid fats?

- A. Hydration
- B. Hydrogenation
- C. Hydrolysis

D. Saponification

What would be the solubility of  $HOCH_2(CH_2)_6CH_2OH$  compared to  $CH_3(CH_2)_6CH_2OH$ ?

- A. Less soluble in water
- B. The same solubility in water
- C. More soluble in water

- D. more soluble in a non- polar solvent such as dichloroethane

Which of the following reactions will produce an alkyl carboxylic acid?

- A. Heating a methyl ketone with acid and iodine
- B. Reacting an alkyl halide with hydrogen gas and platinum
- C. Reacting an alcohol with ozone

- D. Oxidation of a primary alcohol with hot permanganate or chromate

Which of the following statements is NOT TRUE?

- A. Naturally derived soaps consist of a soluble salt of a long chain fatty acid
- B. Triacylglycerols are esters of glycerol and long chain carboxylic acids
- C. Long chain carboxylic acids are also known as fatty acids

- D. The major acidic components of vinegar is formic acid

What is the product of the hydrolysis of esters in the presence of a mineral acid catalyst?

- A. alcohol
- B. carbon dioxide
- C. ether

- D. ketones

To which organic functional group does the following molecular representation, i.e.,  $R_1R_2CHCOH$  belong? (  $R_1$  and  $R_2$  represent different alkyl chains)

- A. Amides
- B. Aldehyde
- C. Ethers

- D. Ketones

Chemically , fats and oils are

- A. acids
- B. alcohols

C. esters

D. alkene

Which of the following would react to form pentylethanoate?

A. 1 - propanol and pentanoic acid

B. Ethanol and pentanoic acid

C. 1 - pentanol and ethanoic acid

D. Ethanol and ethanoic acid

The difference between fats and oils is that

A. oils are liquid at room temperature.

B. oils have more calories

C. oils are solid at room temperature

D. fats are liquid at room temperature

Which of the following is NOT true about carbonyl compounds?

A. Carbonyl compounds contain 3  $\sigma$  - bond and 1  $\pi$  - bond

B. The carbon oxygen bond is both longer and weaker

C. The bond angle in carbonyl is about 120

D. Carbonyl compounds may be hydrolyzed

Consider the following reaction; Which of the following types of compounds are expected products from saponification of a fat? A Glycerol and fatty acid salts

E. Glycerol and fatty acids

F. Fatty acid salts and fatty acids

G. Glycerol, fatty acid salts and fatty acids

Which of the following statements concerning the carbonyl group in aldehydes and ketones is NOT true?

A. The bond is polar, with a slight negative charge on the oxygen atom

B. The bond angles about the central carbon atom are 120

- C. The bond is polar . Therefore , carbonyl groups readily form hydrogen bonds with each other
- D. In condensed form, the carbonyl group can be written as CHO Which of the following statements concerning fats and oils is INCORRECT?
- They are also called triacylglycerols
  - They are also called triglycerides
  - They are fatty acids salts
  - They are glycerol triesters
- Which of the following statements concerning petroleum is INCORRECT?
- It is a renewable energy source
  - It is a fossil fuel
  - It is a mixture consisting mainly of hydrocarbons
  - It was formed from marine organisms, which died millions of years ago
- Triglycerides ( fats and oils ) are made up of
- sugars and water
  - glycerol and amino acids
  - fatty acids and glycerol
  - water , glycerol and salt
- The compound shown below is derived from- - -  
 - - - - and - - - - - It is called- - - - -  
 - -
- propanol, benzoic , propyl benzoate
  - ethanol, benzoic acid , ethylbenzoate
  - ethanol, benzol, phenyl butyrate
  - ethanol, benzol, ethylbenzoate
- What is the correct name of the following compound?
- 2- aminopropanoic acid
  - 3- aminobutanoic acid
  - 2- aminobutanoic acid
  - 3- aminopropanoic acid
- When reacts with NaOH, the product is sodium benzoate.
- Benzoic acid

- B. Benzaldehyde
- C. Benzene
- D. Benzoic hydroxide
 

The reaction between alcohol and acyl chlorides produce.....

  - A. Ether
  - B. Carboxylic acids
  - C. Aromatic salts
- D. Ester
 

Fats and oils are:

  - A. Esters
  - B. Alcohols
  - C. Acids
- D. Alkanes
 

Compounds that contain the carboxyl and hydroxyl group are said to be:

  - A. Ester
  - B. Ketones
  - C. Organic acids
- D. Aldehydes
 

An ester has the structural formula  $\text{OCH}_3\text{CH}_2\text{CH}_2\text{COCH}_2\text{CH}_3$ . On hydrolysis, the ester would produce:

  - A. Propanoic acid and propan-1-ol
  - B. Butanoic acid and ethanol
  - C. Ethanoic acid and butan-1-ol
- D. Propanoic acid and ethanol
 

Which of the following compounds would be the most stable in  $\text{H}_2\text{O}$ ?

  - A. Ethane
  - B. Pentane
  - C. Octanoic acid
- D. Ethanoic acid
 

Which acid is produced when toluene is subjected to  $\text{KMnO}_4$  oxidation?

  - A. Toluic acid
  - B. Benzoic acid

C. Phenyl acetic acid

D. Phthalic acid

Which of the following is an organic acid?

A.  $\text{CH}_3\text{CO}_2\text{H}$

B.  $\text{CH}_3\text{CH}_2\text{OH}$

C.  $\text{CH}_2=\text{CH}_2$

D.  $\text{CH}_3\text{CH}_3$

During esterification of carboxylic acid with alcohol which bond of carboxylic acid undergoes cleavage?

A. C- C

B. C= O

C. O- H

D. C- O

Hydrolysis of ester leads to the formation of which of the following products in basic medium?

A. Alcohol and sodium carbonate

B. Ether and alcohol

C. Aldehyde and alcohol

D. Sodium carboxylate

Fats and oils can be classified as - - .

A. carbohydrates

B. Acids

C. alcohols

D. esters

What is the IUPAC name for the following carboxylic acid?  $\text{CH}_3\text{-C(CH}_3)_2\text{-CH}_2\text{-C(CH}_3)_2\text{-OH}$

A. 2- dimethylbutanoic acid

B. 3,3- Dimethylbutanoic acid

C. 2- methylpentanoic acid

D. 3- methylpentanoic acid

Acetylsalicylic acid (aspirin) has the structural formula: Which functional group (groups) is (are) present in aspirin?

A. Carboxyl and ester

B. hydroxyl and carbonyl

C. carboxyl and acetyl

D. Hydroxyl

Which of these compounds is propanoic acid ?

A.  $\text{CH}_3\text{CH}_2\text{COOCH}_3$

B.  $\text{CH}_3\text{CH}_2\text{COH}$

C.  $\text{CH}_3\text{CH}_2\text{COOH}$

D.  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$

Chemistry grade- 12 Entrance exam Chapter- 1

Which of the following statement(s) is (are) true of an ideal liquid- liquid solution? I. It obeys  $pV=nRT$  II. It obeys Raoult's law III. Solute- solvent, solvent- solvent, and solute -solvent interactions are very similar IV. Solute- solute, solvent- solvent, and solute- solvent interactions are quite different

A. I, II and III

B. I, II and IV

C. II and III

D. II and IV

Butane burns in oxygen according to the equation below.  $2\text{C}_4\text{H}_{10}(\text{g}) + 13\text{O}_2(\text{g}) \rightarrow 8\text{CO}_2(\text{g}) + 10\text{H}_2\text{O}(\text{l})$  If 11.6g of butane is burned in 11.6g of oxygen, which is the limiting reagent?

A. Butane

B. Oxygen

C. Neither

D. Both oxygen and butane

A beaker filled to the 100mL mark with salt ( the salt has a mass of 100g) and another beaker to the 100mL mark with water ( the water has a mass of 100g) are mixed together in a bigger beaker until the salt is completely dissolved. What will be the mass of the solution?

A. It will be much more than 200g

B. It will be much smaller than 200g

C. It will be exactly 200g

D. It will be slightly more than 200g

A solution is made by dissolving 250.0g of potassium chromate crystals ( $\text{K}_2\text{CrO}_4$ , molar mass, 194.2g) in 1.00kg of water. What will be the freezing point of the solution? ( $k_f$  for water is  $1.860^\circ\text{C/molal}$ ).

A. - 8.87 °C

B. - 7.180°C

C. - 5.730°C

D. - 1.860°C

How many moles of sodium hydroxide are present in 2.5L of 0.5 M aqueous solution?

A. 0.2

B. 0.5

C. 1.25

D. 12.5

If the solute- solvent interactions are greater than the solute- solute and solvent- solvent interactions, what will be the total vapor pressure of the solution?

A. Greater than that calculated from Raoult's law

B. Less than that calculated from Raoult's law

C. The same as calculated from Raoult's law

D. Raoult's law cannot be applied for such interactions

What volume of 0.5000M NaOH is required to neutralize 25.0mL of 1.2 M H<sub>2</sub>SO<sub>4</sub>? ( assume complete ionization of the acid).

A. 60mL

B. 90mL

C. 100mL

D. 120mL

An aqueous solution is 70.0

A. 0.559m

B. 8.62m

C. 11.1m

D. 37.0m

A lab instructor is preparing 5.0 liters of a 0.10 M Pb(NO<sub>3</sub>)<sub>2</sub> ( Molecular mass 331) solution. What is the mass required?



- A. 165.5g of  $\text{Pb}(\text{NO}_3)_2$  and add 5.0kg of  $\text{H}_2\text{O}$
- B. 165.5g of  $\text{Pb}(\text{NO}_3)_2$  and add  $\text{H}_2\text{O}$  until the solution has a volume of 5.0liters
- C. 33.1g of  $\text{Pb}(\text{NO}_3)_2$  and add  $\text{H}_2\text{O}$  until the solution has a volume of 5.0 liters

D. 33.1g of  $\text{Pb}(\text{NO}_3)_2$  and add 5.0 liters of  $\text{H}_2\text{O}$  What would be the solubility of  $\text{HOCH}_2(\text{CH}_2)_6\text{CH}_2\text{OH}$  compared to  $\text{CH}_3(\text{CH}_2)_6\text{CH}_2\text{OH}$ ?

- A. Less soluble in water
- B. The same solubility in water
- C. More soluble in water

D. More soluble in a non- polar solvent such as dichloromethane

What is the mass of one molecule of water?

- A.  $3.0 \times 10^{-23}\text{g}$
- B. 0.0003g
- C.  $1.8 \times 10^{-22}\text{g}$

D. 18.0g

Which of the following is the most important type of solute- solvent interaction in a solution of n- butanol in water?

- A. Dispersion
- B. Ion – dipole
- C. Dipole – dipole

D. Hydrogen bonding

Which of the following statements is TRUE about colligative properties?

- A. Both vapor pressure freezing point increase when a non-volatile solute is added to a solvent
- B. Both freezing point and boiling point increase when a non-volatile solute is added to a solvent

- C. Both vapor pressure and boiling point decrease when a non-volatile solute is added to a solvent
- D. Colligative properties depend only upon the number of solute particles in a solution and not upon their identity

What is the equivalent weight of  $\text{HNO}_3$ , as an oxidizing agent, in the following balanced reaction?  $3\text{Fe}^{2+} + 4\text{H}^+ + \text{NO}_3^- \rightarrow 3\text{Fe}^{3+} + \text{NO} + 2\text{H}_2\text{O}$

- A. 10.50
- B. 15.75
- C. 21.00
- D. 31.50
- What is the number of chloride ions ( $\text{Cl}^-$ ) present in  $1.0 \times 10^{-5}$  mol of  $\text{AlCl}_3$ ?
- A.  $1.80 \times 10^{19}$
- B.  $6.02 \times 10^{18}$
- C.  $6.02 \times 10^{23}$
- D.  $6.02 \times 10^{28}$
- A solution was prepared by adding 48g of methanol ( $\text{CH}_3\text{OH}$ ) into 81g of water ( $\text{H}_2\text{O}$ ). What is the mole fraction of methanol in this solution?
- A. 0.25
- B. 0.75
- C. 1.5
- D. 4.

A solution was prepared by dissolving 3.75g of pure hydrocarbon in 95.0g of cyclohexane. The boiling point of pure cyclohexane was observed to be  $80.700^\circ\text{C}$  and that of the solution was  $81.450^\circ\text{C}$ . What is the approximate molecular weight of the hydrocarbon? ( $K_b$  for cyclohexane =  $2.790^\circ\text{C}/m$ )

- A.  $71.0\text{g/mol}$
- B.  $105\text{g/mol}$
- C.  $147\text{g/mol}$

D. 312 g/mol

How many mL conc.  $\text{HNO}_3$  and how many mL of water are required to prepare 500mL of 0.1 M  $\text{HNO}_3$  from a conc. 13M  $\text{HNO}_3$ ?

A. 1mL  $\text{HNO}_3$  and 496.15mL  $\text{H}_2\text{O}$

B. 3.85mL  $\text{HNO}_3$  and 500mL  $\text{H}_2\text{O}$

C. 3mL  $\text{HNO}_3$  and 500mL  $\text{H}_2\text{O}$

D. 3.85mL  $\text{HNO}_3$  and 496.15mL  $\text{H}_2\text{O}$

Which one of the following organic molecules has the highest water solubility?

A.  $\text{HOCH}_2\text{CH}_2\text{CH}_2\text{OH}$

B.  $\text{HOCH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$

C.  $\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$

D.  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$

Which one of the following substances is a non-conductor of electricity?

A. Graphite

B.  $\text{MgCl}_2(\text{s})$

C. Silver (s)

D.  $\text{H}_2\text{SO}_4(\text{aq})$

Which of the following is Not a solution?

A. Milk

B. Brass

C. Whisky

D. Coca cola drink

How much water has to be evaporated from 250 ml of 1 M  $\text{Ca}(\text{OH})_2$  to make it 3M

A. 100 ml

B. 150 ml

C. 167 ml

D. 200 ml

How many ml of water is required to dilute 50 ml of 3.5 M  $\text{H}_2\text{SO}_4$  to 2.00 M  $\text{H}_2\text{SO}_4$ ?

A. 37.5

B. 45

C. 75

D. 87.5

The solubility of sodium selenite,  $\text{Na}_2\text{SeO}_4$ , is 84g/100g of water at 350

E. If a solution is obtained by dissolving 92 g of  $\text{Na}_2\text{SeO}_4$  in 200g of water at 350C, what do you call this solution?

A. Diluted

B. Saturated

C. Unsaturated

D. Supersaturated

Which law relates the concentration of a dissolved gas,  $C_g$ , to its partial pressure?

A. Henry's law

B. Raoult's

C. Boyle's law

D. Ideal gas law

Which of the following compounds would give the lowest freezing point depression when 100 g of each are dissolved in 1 kg of water ( $K_f$  for water = 1.860C/m)? Assume complete dissociation.

A. NaCl

B.  $\text{NH}_4\text{NO}_3$

C.  $(\text{NH}_4)_2\text{SO}_4$

D. glucose,  $\text{C}_6\text{H}_{12}\text{O}_6$

Which of the following is most likely to deviate from ideal gas behavior?

A. He

B. Ar

C.  $\text{Cl}_2$

D.  $\text{CCL}_2\text{F}_2$

What is the molarity of a solution containing 10g of sulfuric acid in 500ml of solution?

A. 0.02

B. 0.03

C. 0.12 D.0.2

Which of the following types of solutions are possible? I. Solid dissolved in a liquid III. Gas dissolved in a liquid II. Gas dissolved in a gas IV. Solid dissolved in a gas

A. I and II

B. I, II, III and IV

C. I, II and IV D. I What is the normality of 1.0M solution of  $\text{Na}_2\text{CO}_3$ ?

A. 1N

B. 0.5N C. 2N D. 3N

What type of solute-solvent interaction should be the most important in a solution of iodine in carbon tetrachloride?

A. London forces

B. Ionic bond

C. Ion-dipole forces

D. Dipole - dipole forces

A liquid is any substance of biochemical origin that is

A. soluble  
in  
both  
wa-  
ter  
and  
non  
po-  
lar  
sol-  
vents

B. insoluble  
in  
both  
wa-  
ter  
and  
non-  
  
po-  
lar  
sol-  
vents

C. soluble  
in  
wa-  
ter  
but  
in-  
sol-  
u-  
ble  
in  
non-  
  
po-  
lar  
sol-  
vents

D. soluble in  
non- polar  
solvents and  
insoluble in  
water

What is the  
molarity of  
a 5 g hy-  
drogen per-

oxide (  $\text{H}_2\text{O}_2$  )  
in 100 ml.  
solution that  
is used for  
their bleach-  
ing?

A.  
0.015M

B.  
15M

C.  
1.5M

D. 3M

If a stu-  
dent wishes  
to prepare  
approximately  
100 milliliters  
of an aque-  
ous solu-  
tion of 6M  
HCl using  
12 M HCl,  
which pro-  
cedure is cor-  
rect?

A.  
Adding  
50  
ml.  
of  
12  
HCl  
to  
50  
ml.  
of  
wa-  
ter  
while  
stir-  
ring  
the  
mix-  
ture  
steadily.

B.  
Adding  
25

ml  
.of  
12M  
HCl  
to  
50  
ml.  
wa-  
ter  
while  
stir-  
ring  
the  
mix-  
ture  
steadily

C.  
Adding  
50ml.  
of  
wa-  
ter  
to  
50ml.  
of  
12  
M  
HCl  
while  
stir-  
ring  
the  
mix-  
ture  
steadily

D. Adding 25  
ml. of wa-  
ter to 50ml.  
of 12 M HCl  
while stir-  
ring the mix-  
ture steadily

What kind  
of solution  
forms when  
gasoline evap-  
orates in  
air?

A.  
Gas



in  
gas  
so/n

B.  
Gas  
in  
liq-  
uid  
so/n

C.  
Liquid  
in  
liq-  
uid  
so/n

D. Liquid in  
gas so/n

What is the  
solvent in  
70

A.  
Water

B.  
Alcohol

C.  
Sugar

D. Kerosene

How many  
moles of  $\text{H}_2\text{SO}_4$   
are needed  
to prepare  
5.0 liters  
of a 2.0 M  
of  $\text{H}_2\text{SO}_4$

A.  
2.5

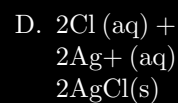
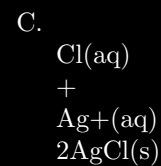
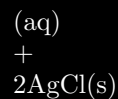
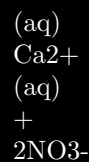
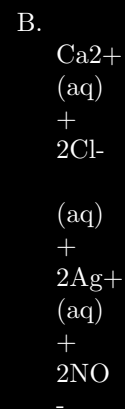
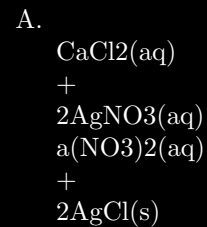
B.  
5.0

C.  
20

D. 10

What is the  
balanced NET

IONIC EQUATION for the reaction of  $\text{CaCl}_2(\text{aq})$  and  $\text{AgNO}_3$ ?



When a small amount of crystal solute is added to the supernatural

solution ,  
the solute  
crystal will

- A.  
grow  
big-  
ger
- B.  
slightly  
dis-  
solve
- C.  
remain  
un-  
changed

D. dissolve com-  
pletely

What is the  
molality of  
a solution  
that con-  
tains 51.2  
g of naph-  
thalene,  $C_{10}H_8$   
, in 500 mL  
of carbon  
tetrachlo-  
ride ? The  
density of  
 $CCl_4$  is 1.60  
g/mL.

- A.  
0.750m
- B.  
0.500m
- C.  
0.840m

D. 1.69 m

Which of  
the follow-  
ing does NOT  
affect the  
solubility  
of a gas dis-  
solved in  
a liquid?

A.  
Nature  
of  
so-  
lute  
and  
sol-  
vent

B.  
Pressure

C.  
Temperature

D. Rate at which  
the gas dis-  
solves

Equal masses  
of He and  
Ne are placed  
in a sealed  
container  
. What is  
the partial  
pressure of  
Ne, if the  
total pres-  
sure is 6  
atm?

A.  
2

B.  
3

C.  
1

D. 5

What is the  
molarity of  
a solution  
made by  
dissolving  
10 g of glu-  
cose ( $C_6H_{12}O_6$ )  
in sufficient  
water to form  
300 mL so-  
lution?

A.  
0.18

B.  
0.251

C.  
0.362

D. 0.278

What is the molar solubility of  $\text{Fe}(\text{OH})_3$  in a solution that is buffered at  $\text{pH} = 3.50$  at  $25^\circ\text{C}$ ? ( $K_{\text{sp}}(\text{Fe}(\text{OH})_3) = 4 \times 10^{-38}$ )

A.  
 $1 \times 10^{-5}$

B.  
 $1.1 \times 10^{-6}$

C.  
 $2.0 \times 10^{-6}$

D.  $1.26 \times 10^{-6}$

Dissolve each of  $\text{NaI}$ ,  $\text{CuSO}_4$ ,  $\text{KMnO}_4$ ,  $\text{KNO}_3$  in different 200 mL measuring cylinders. Which one of the following forms more concentrated molar solution?

A.  
KNO<sub>3</sub>

B.  
NaI

C.  
KMnO<sub>4</sub>

D. CuSO<sub>4</sub>

Consider the following compounds having lattice energy of  
Compound  
NaOH Mg(OH)<sub>2</sub>  
MgO Al(OH)<sub>3</sub>  
Lattice energy (KJ/mol)  
900 3006  
3791 5627  
Which one is insoluble in water?

A.  
Al(OH)<sub>3</sub>

B.  
MgO

C.  
Mg(OH)<sub>2</sub>

D. NaOH

At 70 °C, the vapour pressure of pure water is 39 kPa. Which one of the following is the most likely vapour pressure for a 1.5 M solution of sucrose (aq) at the temperature?

A.  
37kPa

B.  
39kPa

C.  
41  
kPa

D. 45 kPa

What is the concentration of nitrate ion ( $\text{NO}_3^-$ ) in a solution that contains 0.5 M  $\text{Al}(\text{NO}_3)_3$ ?

A.  
0.5  
M

B.  
1  
M

C.  
1.5  
M

D. 2.5 M

A 500 mL of 0.1 M nitric acid solution ( $\text{HNO}_3$ ) is to be prepared from a 13 M concentrated nitric acid ( $\text{HNO}_3$ ). How many mL of concentrated  $\text{HNO}_3$  and how many mL of water are needed?

A.  
3.85

mL  
conc.  
HNO<sub>3</sub>  
and  
496.15  
mL  
HNO<sub>3</sub>

B.  
15  
mL  
conc.  
HNO<sub>3</sub>  
and  
485  
mL  
H<sub>2</sub>O

C.  
30  
mL  
conc.  
HNO<sub>3</sub>  
and  
470  
mL  
H<sub>2</sub>O

D. 13 mL conc.  
HNO<sub>3</sub> and  
487mL H<sub>2</sub>O

The figure  
below shows  
the solu-  
bilities of  
several ionic  
solids as a  
function of  
temperature.

A.  
3.85  
mL  
conc.  
HNO<sub>3</sub>  
and  
496.15  
mL  
HNO<sub>3</sub>

B.  
15  
mL



conc.  
HNO<sub>3</sub>  
and  
485  
mL  
H<sub>2</sub>O

C.  
30  
mL  
conc.  
HNO<sub>3</sub>  
and  
470  
mL  
H<sub>2</sub>O

D. 13 mL conc.  
HNO<sub>3</sub> and  
487mL H<sub>2</sub>O

A sample  
of potas-  
sium nitrate  
(49.0g) is  
dissolved in  
100 g of wa-  
ter at 100  
0C with pre-  
cautions taken  
to avoid evap-  
oration of  
any water.  
The solu-  
tion is cooled  
to 30.0 0C  
and no pre-  
cipitate is  
observed .  
This solu-  
tion is - -  
- -

A.  
Supersaturated

B.  
Saturated

C.  
Unsaturated

D. Hydrated

What is the molarity of sodium chloride in solution that is 13.0

A. 1.43  
x  
10  
-

2

B. 2.23

C. 1.22

D. 2.45

Which opposing processes occur in a saturated solution?

A. Vaporization and condensation

B. Dissociation and crystallization

C. Dissociation and reduction

D. Oxidation and reduction

Compounds

A and B

are com-

bined in a

mole ratio

of 0.30 to

0.70 respec-

tively . At

a given tem-

perature,

the pure va-

por pres-

sure of com-

pound A

is given to

be 100 torr

and the pure

vapor pres-

sure of B

is 50 torr.

What will

be the to-

tal pressure

above the

solution?

A.

85

torr

B.

70

torr

C.

65

torr

D. 55 torr

Ammonium

sulphate (

$\text{NH}_4$ ) $_2$ SO $_4$

is manu-

factured by

reacting sul-

phuric acid

with am-

monia as

follows  $\text{H}_2\text{SO}_4(\text{aq})$

+  $2\text{NH}_3(\text{aq})$

$(\text{NH}_4)_2\text{SO}_4(\text{aq})$

What vol-

ume of 0.80

M H<sub>2</sub>SO<sub>4</sub>  
 is needed  
 to react with  
 200 mL of  
 1.2 M am-  
 monia so-  
 lution to  
 prepare the  
 required salt,  
 (NH<sub>4</sub>)<sub>2</sub> SO<sub>4</sub>  
 ?

- A. 0.40 L
- B. 0.30 L
- C. 0.150 L

D. 0.0244 L

Which of  
 the follow-  
 ing aque-  
 ous solu-  
 tions will  
 have the Low-  
 est freez-  
 ing point?

- A. Pur H<sub>2</sub>O
- B. aq.0.50m KF
- C. aq.0.24m FeI<sub>3</sub>

D. aq. 0.60m  
 glucose

A.....H  
 corresponds  
 to an pro-  
 cess.

- A. Positive,

en-  
dother-  
mic

B. Negative,  
en-  
dother-  
mic

C. Positive  
exother-  
mic

D. Zero, exother-  
mic

You are given  
a bottle of  
solid X three  
aqueous so-  
lutions of  
Y , the first  
saturated, the  
second un-  
saturated  
and the third  
supersat-  
urated. Which  
of the fol-  
lowing is  
correct, if  
you add the  
small amount  
of the solid  
solute to  
each solu-  
tion?

A. The  
so-  
lu-  
tion  
in  
which  
the  
added  
solid  
so-  
lute  
dis-  
solves  
is

the  
sat-  
u-  
rated  
so-  
lu-  
tion.

B.

The  
su-  
per-  
sat-  
u-  
rated  
so-  
lu-  
tion  
is  
un-  
sta-  
ble  
and  
ad-  
di-  
tion  
of  
ad-  
di-  
tional  
so-  
lute  
causes  
the  
ex-  
cess  
so-  
lute  
to  
crys-  
tal-  
lize.

C.

The  
so-  
lu-  
tion  
in  
which  
the  
added  
solid  
so-

lute  
re-  
mains  
undis-  
solved  
is  
the  
un-  
sat-  
u-  
rated  
so-  
lu-  
tion.

D. In all the  
three so-  
lutions ; sat-  
urated,unsaturated  
and super-  
saturated  
the added  
solidsolute  
will dissolve.

The phrase  
like dissolve  
like refers  
to the fact  
that:

A.  
Polar  
sol-  
vents  
dis-  
solve  
po-  
lar  
so-  
lutes  
and  
non  
po-  
lar  
sol-  
vents  
dis-  
solve  
non  
po-  
lar  
so-  
lutes

B. Polar solvents dissolve non-polar solutes and vice versa

C. Solvents can only dissolve solutes of similar molar mass

D. Gases can only dissolve other gases. 2.3g of ethanol( $\text{CH}_3\text{CH}_2\text{OH}$ ) is added to 500 g of water. What is the molarity of the resulting solution?

A. 0.01m

B. 1.0m

C. 0.1m

D. 10.0m



A 0.5L and 0.1M  $\text{HNO}_3$  solution is to be prepared by dilution process from a 13M nitric acid. How many ml con.  $\text{HNO}_3$  and how many mL of water are required to prepare the dilute solution?

A. 3.85mL  $\text{HNO}_3$  and 496.15mL-water

B. 10ml  $\text{HNO}_3$  and 490mL-water

C. 2mL  $\text{HNO}_3$  and 498mL-water

D. 20ml  $\text{HNO}_3$  and 490ml water  
Commercial concentration sulphuric acid (density=1.831g/cm<sup>3</sup>) is 94.0

A. 16.8M

- B.  
28.2
- C.  
40.4  
M

D. 35.0N

What is the final temperature when 150.0ml of water at 90.0oc is added to 100.0ml of water at 30.0oc?

- A.  
33.0oc
- B.  
45.0oc
- C.  
66.0oc

D. 60.0oc

What is the PH of a mixture of 15.0ml of 0.26M NaOH and 21.0M H<sub>2</sub>SO<sub>4</sub>?

- A.  
1.70
- B.  
13.60
- C.  
11.81

D. 2.15

Which of the following is true regarding the solution formation process?

A. Intermolecular force between the solute particles must weaken in which the enthalpy change is exothermic ( $H_1^0$ ).

B. Intermolecular forces between the solvent molecules must weaken in which the enthalpy change is exothermic ( $H_1^0$ ).

C. Covalent bonds within the solute and

sol-  
vent  
molecules  
must  
be  
bro-  
ken.

D. New columbic  
attractions  
between the  
solute and  
the solvents  
from in which  
the enthalpy  
change is  
exothermic  
( $H_f^0$ )

What vol-  
ume of 1.40M  $H_2SO_4$   
solution is  
needed to  
react ex-  
actly with  
10.0 g of  
aluminum  
according  
to the fol-  
lowing re-  
action?  $2Al(s)$   
 $+ 2H_2SO_4(aq)$   
 $Al_2(SO_4)_3(aq)$   
 $+ 3H_2(g)$

A.  
2.643ml

B.  
26.43ml

C.  
2643ml

D. 264.3ml  
A solution  
of  $NH_4Cl$   
made by  
dissolving  
3.16g  $NH_4Cl$   
in 30.14 g  
 $H_2O$  has  
a density  
of 1.0272g/cm

What is the mole fraction of  $\text{NH}_4\text{Cl}$ ?

A. 0.0341

B. 0.9659

C. 0.6500

D. 0.2100

Is the standard cell potential for the oxidation of ammonia, given below?  
 $4\text{NH}_3 + 3\text{O}_2 \rightarrow 2\text{N}_2 + 6\text{H}_2\text{O}$ ,  
 $\Delta G^\circ = -1356\text{KJ}$

A. 3.51V

B. 1.17V

C. 7.02V

D. 14.04V

. What is the freezing point of the solution of 250g of  $\text{CaCl}_2$  in 1.0kg of water? ( $K_f$  for  $\text{H}_2\text{O} = 1.860^\circ\text{C}/\text{m}$ )

A. -

1.30c

A.

-

130c

B.

-

9.00c

C.

-

6.50c  
Which  
of  
the  
fol-  
low-  
ing  
com-  
pounds  
is  
least  
sol-  
u-  
ble  
in  
wa-  
ter?

A.

(NH<sub>4</sub>)

B.

(Na<sub>3</sub>(

C.

(Fe(N

D.

BaCO<sub>3</sub>

Given  
the  
fol-  
low-  
ing  
un-  
bal-  
anced  
equa-  
tion  
KMnO<sub>4</sub>  
+  
KI  
+  
H<sub>2</sub>SO<sub>4</sub>  
K<sub>2</sub>SO<sub>4</sub>

+  
 $\text{MnSO}_4$

+  
 $\text{I}_2$

+  
 $\text{H}_2\text{O}$

How  
many  
grams  
of  
 $\text{KMnO}_4$   
are  
needed  
to  
make  
250ml  
of  
0.20N  
so-  
lu-  
tion?

A.  
3.95g

B.  
1.58g

C.  
2.98g

D.  
3.16g

If  
a  
so-  
lu-  
tion  
of  
acetic  
acid  
( $\text{CH}_3\text{COOH}$ )  
has  
a  
PH  
of  
3.00,  
what  
is  
its  
con-  
cen-

tra-  
tion?  
K<sub>a</sub>  
of  
acetic  
acid=1.74x10-

5

A.  
0.0057

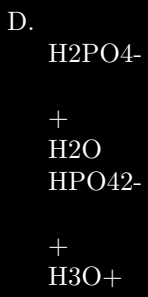
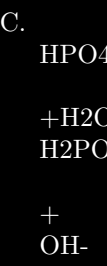
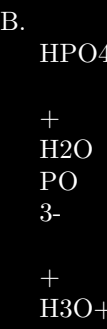
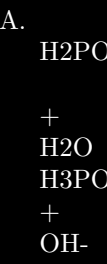
B.  
0.57M

C.  
0.057M

D.  
5.70M

The  
in-  
di-  
ca-  
tor  
methyl  
red  
in  
a  
so-  
lu-  
tion  
of  
NaH<sub>2</sub>PO<sub>4</sub>  
Which  
of  
the  
fol-  
low-  
ing  
equation  
is  
con-  
sis-  
tent  
with  
this  
ob-  
ser-  
va-  
tion?





A  
chemist  
cre-  
ates  
a  
buffer  
so-  
lu-  
tion  
by  
mix-  
ing  
equal

volume  
of  
a  
0.2  
M  
 $\text{HOCl}$   
so-  
lu-  
tion  
and  
a  
0.2M  
 $\text{KOCl}$   
so-  
lu-  
tion.  
Which  
of  
the  
fol-  
low-  
ing  
will  
oc-  
cur  
when  
a  
small  
amount  
of  
 $\text{KOH}$   
is  
added  
to  
the  
so-  
lu-  
tion  
?  
I.  
The  
con-  
cen-  
tra-  
tion  
of  
undis-  
so-  
ci-  
ated  
 $\text{HOCl}$   
will

in-crease  
II.  
The con-  
cen-  
tra-  
tion  
of  
OCl-

ions  
will  
in-  
creases  
III.  
The con-  
cen-  
tra-  
tion  
of  
H+  
ions  
will  
in-  
crease.

A.  
I  
only

B.  
I  
and  
II  
only

C.  
III  
only

D.  
II  
only

In  
which  
of  
the  
fol-  
low-  
ing

cases  
will  
the  
dis-  
so-  
lu-  
tion  
of  
sugar  
be  
the  
most  
rapid?

A.

Powdered  
sugar  
in  
hot  
wa-  
ter

B.

Sugar  
crys-  
tals  
in  
cold  
wa-  
ter

C.

Sugar  
crys-  
tals  
in  
hot  
wa-  
ter

D.

Powdered  
Sugar  
in  
cold  
wa-  
ter

How  
many  
grams  
of  
io-  
dine,

I<sub>2</sub>,  
must  
be  
dis-  
solved  
in  
225.0ml  
of  
car-  
bon  
disul-  
fide,  
CS<sub>2</sub>  
(den-  
sity=  
1.261g/cm<sup>3</sup>),  
to  
pro-  
duce  
a  
0.116m  
so-  
lu-  
tion?

A.  
4.84g

B.  
6.32g

C.  
11.71g

D.  
4.17g

4  
L  
of  
0.02M  
of  
aque-  
ous  
so-  
lu-  
tion  
of  
NaCl  
is  
di-  
luted  
with

1L  
of  
wa-  
ter.  
What  
is  
the  
mo-  
lar-  
ity  
of  
the  
so-  
lu-  
tion?

A.  
0.004M

B.  
0.016M

C.  
0.012M  
D.0.00

How  
much  
wa-  
ter,  
in  
liters,  
must  
be  
added  
to  
0.50lit  
of  
6.0M  
to  
make  
the  
so-  
lu-  
tion  
2.0M?

D.

2.0

Which  
of  
the  
four  
col-  
liga-  
tive  
prop-  
er-  
ties  
arises  
in  
sys-  
tems  
where  
there  
is  
equi-  
lib-  
rium  
be-  
tween  
a  
liq-  
uid  
so-  
lu-  
tion  
phase  
and  
a  
sec-  
ond  
liq-  
uid  
phase

D. Freezing point depression

Chemistry grade 12 Entrance Chapter

2 Which of the following is NOT a conjugate acid-

base pair?



D.

$\text{H}_3\text{O}^+$

During  
the  
titra-  
tion  
of  
a  
know  
vol-  
ume  
of  
a  
strong  
acid  
with  
a  
strong  
base,  
there  
is

D.

A

sharp  
de-  
crease  
in  
pH  
around  
the  
end  
point

A  
so-  
lu-  
tion  
with  
pH  
of  
7.5  
would  
be  
de-  
scribe  
as:

D.  
Very  
acidic

Which  
specie  
CAN-  
NOT  
act  
as  
a  
Lewis  
acid?

D.

$\text{AlCl}_3$

Which  
of  
the  
fol-  
low-  
ing  
state-  
ments  
is  
true?



in  
a  
weak  
acid

Three  
acids,  
HA,  
HB,  
HC  
have  
the  
fol-  
low-  
ing  
ka  
val-  
ues.  
ka  
(HA)  
=  
1x10<sup>5</sup>  
ka(HB)  
=  
2x10-

5  
ka  
(HC)  
=  
1x10-

6  
What  
is  
the  
cor-  
rect  
or-  
der  
of  
in-  
creas-  
ing  
acid  
streng  
(weak  
est  
first)?

D.

HB,  
HA,  
HC

Which  
of  
the  
fol-  
low-  
ing  
pro-  
ce-  
dures  
will  
pro-  
duce  
a  
buffer  
so-  
lu-  
tion?

I.  
Equal  
vol-  
umes  
of  
0.5M  
NaOH  
and  
1  
M  
HCl  
so-  
lu-  
tions  
are  
mixed  
II.  
Equal

vol-  
 umes  
 of  
 0.5  
 M  
 NaOH  
 ,  
 1.0M  
 CH<sub>3</sub>  
 COOH  
 so-  
 lu-  
 tions  
 III.  
 Equal  
 vol-  
 umes  
 of  
 1  
 M  
 NaCH<sub>3</sub>  
 CO<sub>2</sub>  
 and  
 1  
 M  
 CH<sub>3</sub>  
 COOH  
 IV.  
 Equal  
 vol-  
 umes  
 of  
 1.0  
 M  
 NaOH  
 and  
 1,0M  
 HCl  
 so-  
 lu-  
 tions  
 are  
 mixed

D.

II  
and  
III

Which  
of  
the  
fol-  
low-  
ing  
state-  
ments  
is  
true  
about  
the  
per-  
cent  
ion-  
iza-  
tion  
of  
a  
weak  
acid?



D.

It  
de-  
crease  
with  
de-  
creas-  
ing  
con-  
cen-  
tra-  
tion

Which  
one  
of  
the  
mix-  
ture  
of  
the  
fol-  
low-  
ing  
pairs  
will  
NOT  
give  
a  
buffer  
so-  
lu-  
tion?

D.

$\text{HNO}_3$   
and  
 $\text{NaNO}_2$

Which  
one  
of  
the  
fol-  
low-  
ing  
is  
TRUE  
for  
salts  
formed  
from  
strong  
acids  
and  
strong  
bases?

D.

Dependence of the  $pK_a$  and  $pK_b$  of the parent acids and bases

What is the quantity of water, in mL, required to prepare 0.5M of HCl from a concentrated solution of 3.5 M

in  
50mL  
is?

D.  
350ml

What  
is  
the  
pH  
of  
0.005  
M  
so-  
lu-  
tion  
of  
Ca(OH)

D.  
14

Given  
the  
fol-  
low-  
ing  
equi-  
lib-  
ria  
and  
equi-  
lib-  
rium

con-

stant:

I.

HC2H

+

H2O

H3O+

+

C2H3

;

Ka

=

1.80x1

5

II.

H2CO

+

H2O

H3O+

+

HCO3

;

Ka

=

4.20x1

7

III.

NH

+

+

H2O

H3O+

+

NH3;

Ka

=

5.6x10

10

IV.

HCOO

+

H2O

H3O+

H3O+

+

HCOO

Ka

=

1.80x1

4  
 What  
 is  
 the  
 streng  
 of  
 the  
 acids  
 in  
 DE-  
 CREA  
 ING  
 or-  
 der?

D.  
 IV,  
 I,  
 II  
 and  
 III

Given  
 the  
 re-  
 ac-  
 tion:  
 $\text{H}_2\text{PO}_4^-$   
 $\rightleftharpoons$   
 $\text{HPO}_4^{2-}$   
 $+$

H<sub>2</sub>O  
H<sub>3</sub>O<sup>+</sup>  
+  
HPO<sub>4</sub><sup>2-</sup>

Which  
of  
the  
fol-  
low-  
ing  
rep-  
re-  
sents  
a  
con-  
ju-  
gate  
acid-

base  
pair?

D.  
H<sub>2</sub>O  
and  
HPO<sub>4</sub><sup>2-</sup>

The  
in-  
di-

ca-  
 tor  
 Brom  
 mol  
 Blue  
 (HBb)  
 is  
 is  
 a  
 weak  
 acid  
 with  
 Ka  
 =  
 1.0  
 x10-  
  
 7  
 ion-  
 izes  
 as  
 follow  
  
 HBb(a  
 yel-  
 low)  
 H+(ac  
 colour  
 less)  
 +  
 In  
 -(aq,  
 blue)  
 Which  
 way  
 will  
 the  
 equi-  
 lib-  
 rium  
 shift  
 when  
 NaOH  
 is  
 added  
 and  
 what  
 will  
 the  
 colour  
 of  
 the  
 NaOH  
 so-





D.

Equilibrium  
will  
shift  
to  
the  
left  
and  
the  
color  
of  
NaOH  
so-  
lu-  
tion  
will  
turn  
blue

A  
50  
mL  
so-  
lu-  
tion  
of  
H<sub>2</sub>SO<sub>4</sub>  
of  
0.205  
M  
is  
titrated  
with  
NaOH  
so-  
lu-

tion  
of  
un-  
known  
con-  
cen-  
tra-  
tion.  
The  
end-  
point  
against  
phe-  
nolph-  
thalei-  
in-  
di-  
ca-  
tor  
was  
signed  
when  
41.0m  
of  
NaOH  
was  
added  
What  
is  
the  
con-  
cen-  
tra-  
tion  
of  
NaOH  
so-  
lu-  
tion?

D.  
0.50M  
  
To  
0.2M

so-  
lu-  
tion  
of  
a  
weak  
mono-  
pro-  
tic  
acid,  
HA,  
enough  
quan-  
tity  
of  
its  
sodium  
salt,  
NaA,  
was  
dis-  
solved  
to  
give  
a  
con-  
cen-  
tra-  
tion  
of  
0.2M  
of  
the  
salt.  
What  
will  
be  
the  
acid  
con-  
cen-  
tra-  
tion,  
[  
H<sub>3</sub>O<sup>+</sup>  
,  
in  
the  
fi-  
nal  
so-  
lu-  
tion?

(  
 $K_a$   
of  
HA  
 $=1.80$   
 $\times$   
 $10^{-5}$ )

D.  
 $1.90$   
 $\times$   
 $10^{-3}$   
M

What  
is  
the  
pH  
of  
an  
aque-  
ous  
so-  
lu-  
tion  
pre-  
pared  
to

con-  
tain  
1.3  
 $\times 10^{-}$

3  
M  
sodium  
ni-  
trite  
( $\text{NaNO}_2$ )  
if  
the  
acid  
dis-  
so-  
ci-  
a-  
tion  
equi-  
lib-  
rium  
con-  
stant,  
 $K_a$ ,  
for  
ni-  
trous  
acid  
( $\text{HNO}_2$ )  
is  
5.1  
 $\times$   
 $10^{-}$

$4?K_w$   
=  
1.0  
 $\times$   
 $10^{-}$

14

D.  
7.3

A  
so-  
lu-  
tion  
is  
la-  
beled  
0.500  
M  
HCl.  
What  
is  
PH?

D.  
1.69

Which  
of  
the  
fol-  
low-  
ing  
com-  
pound  
would  
be  
the  
most  
ba-  
sic?

D.

0.1  
M  
am-  
mo-  
nium  
chlo-  
ride

How  
is  
a  
buffer  
so-  
lu-  
tion  
pre-  
pared



D.

By  
mix-  
ing  
a  
strong  
base  
and  
its  
con-  
ju-  
gate  
acid.

The  
dye  
bro-  
moth-  
y-  
mol  
blue  
(HbB)  
is  
a  
weak  
acid  
whose  
ion-  
iza-  
tion  
can  
be  
rep-  
re-  
sented  
as  
fol-  
lows,  
HbB(

H+  
(aq)  
+Bb-  
  
(aq)  
Which  
way  
will  
the  
equi-  
lib-  
rium  
shift  
when  
NaOH  
is  
added

D.  
Initial  
to  
the  
right  
and  
af-  
ter  
a  
while  
to  
the

left

Which  
one  
of  
the  
fol-  
low-  
ing  
state-  
ments  
is  
NOT  
true  
about  
acids

D.  
An  
acid  
is  
a

sub-  
stance  
that  
is  
ion-  
ized  
in  
wa-  
ter  
to  
pro-  
duce  
 $H^+(aq)$

Consi-  
der  
the  
fol-  
low-  
ing  
acids:  
I.  
 $CH_3COOH$   
 $K_a=1.8 \times 10^{-5}$

5  
III.  
 $HCO_2H$   
 $K_a=1.8 \times 10^{-4}$

4  
II.  
 $HOBr$   
 $K_a=2.5 \times 10^{-9}$

9  
V.  
 $C_6H_5COOH$   
 $K_a=1.3 \times 10^{-4}$

10  
Which  
of  
the  
fol-  
low-  
ing  
aque-  
ous  
so-  
lu-  
tions  
will

have  
the  
high-  
est  
pH?

D.  
0.10  
M  
CH<sub>3</sub>CO<sub>2</sub>H

What  
is  
the  
hy-  
drox-  
ide  
ion  
con-  
cen-  
tra-  
tion  
for  
a  
so-  
lu-  
tion  
with  
a  
pH  
of  
10  
at  
25°C?

D.

10-

4M

Which  
of  
the  
fol-  
low-  
ing  
titra-  
tions  
will  
have  
an  
equiv-  
a-  
lence  
point  
at  
a  
pH  
7

D.

Weak  
acid  
with  
strong  
base

All  
of  
the  
fol-  
low-  
ing  
can  
act  
as  
Brons

Lowry  
bases  
EX-  
CEPT

D.

H<sub>2</sub>CO<sub>3</sub>

Which  
of  
the  
fol-  
low-  
ing  
is  
a  
con-  
ju-  
gate

acid/l  
pair?

D.  
 $\text{H}_2\text{SO}_4$

The  
pH  
at  
room  
tem-  
per-  
a-  
ture  
of  
a  
0.1  
M  
so-  
lu-  
tion  
of  
formic  
acid  
(HCH  
was  
mea-  
sured  
to  
be  
4. What  
is  
the  
hy-  
dro-  
gen  
ion  
con-  
cen-  
tra-  
tion?



D.

6.32x1

4M

In  
which  
of  
the  
fol-  
low-  
ing  
pe-  
riod  
of  
the  
pe-  
ri-  
odic  
Ta-  
ble  
is  
an  
el-  
e-  
ment  
with  
atomic  
num-  
ber  
20  
placed

D.

4

Which  
of  
the  
fol-  
low-  
ing  
sub-  
stance  
un-  
der-  
goes  
hy-  
drol-  
y-  
sis  
in  
aque-  
ous  
so-  
lu-  
tion?

D.

$\text{NH}_4\text{Cl}$

The  
pH  
of  
0.1M  
so-  
lu-  
tion  
of  
a  
weak  
acid  
is

3. What

is  
the  
value  
of  
the  
ion-  
iza-  
tion  
con-  
stant  
for  
the  
acid?

D.  
0.1

An  
am-  
phipro-  
tic  
species  
is  
a  
molec-  
or  
ion  
that  
can?

D.

be  
formed  
into  
a  
dou-  
ble  
ion.

Which  
one  
is  
true  
for  
a  
tripro-  
tic  
acid,  
such  
as  
phos-  
pho-  
ric  
acid,  
 $\text{H}_3\text{PO}_4$

D.

$K_a$ ,  
=

Ka2  
=  
Ka3

Which  
of  
the  
fol-  
low-  
ing  
is  
true  
for  
a  
0.10M  
so-  
lu-  
tion  
of  
a  
weak  
base  
HB?

D.  
pH=  
1.0

What  
is  
the  
mo-  
lar-  
ity

of  
a  
so-  
lu-  
tion  
ob-  
tained  
by  
dis-  
solv-  
ing  
0.01m  
of  
NaCl  
is  
500ml  
of  
so-  
lu-  
tion?













































































































































































































































































































































































































































































































































































