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Second Term Test - 2022

Grade 12

Chemistry 1

Time : 2Hrs



- **Answer all the questions.**

| | |
|---|---|
| Avogadro constant | $N_A = 6.022 \times 10^{23}\ mol^{-1}$ |
| Planck constant | $h = 6.626 \times 10^{-34}\ mol^{-1}$ |
| Universal gas constant | $R = 8.314\ Nm\ K^{-1}\ mol^{-1}$ |
| Speed of light | $C = 3 \times 10^{8}\ ms^{-1}$ |

(1) Some concepts of atomic structure are mentioned below.

a) Matter consists positive charges.
b) Radioactive substances emit α, β, and γ radiation
c) The mass of the atom has been gathered at the Centre of it.

The scientists who have a close relation ship with the above ideas is given in,

1) Rutherford, Henry Becquerel, Niels Bohr.
2) Marsden, Henry Becquerel, Rutherford.
3) Thompson, Rutherford, Niels Bohr.
4) Goldstein, Rutherford, Rutherford .
5) Goldstein, Henry Becquerel Rutherford .

(2) Which out of following is true regarding isotopes and nuclide?

1) Different nuclides of same element are called isotopes.
2) Atoms and ions of the same element are different nuclides.
3) Different elements has same nuclides.
4) The isotopes and nuclides of same element have similar chemical properties.
5) The only difference between isotopes and nuclides is the number of nucleons.

(3) Which out of following is not true regarding cathode rays?

1) Occur due to the ionization of gaseous atoms.
2) Gaseous positive ions also can produce cathode rays.
3) The deviation of cathode rays in electric field doesn't depend on strength of electric fields.
4) Cathode rays give evidences for dual nature of electrons.
5) The charge of the cathode rays can be gained by the deviation in magnetic fields.

(4) Which out of following is true regarding the emission absorption spectrum of Hydrogen?

1) Balmer series spreads into visible region as well as UV region in electromagnetic spectrum.
2) Spectrum lines form for electronic transitions of adjacent energy levels, in same series
3) Electronic transition from third energy level to first energy level produces two spectral lines
4) Spectral lines are continuous.
5) The spectral lines apart from each other with increasing wavelength

(5) The increasing order of the radius in N, O, F, $O^{2-}$, and $F^-$

1) $F < O < F^- < O^{2-} < N$
2) $F < F^- < O < O^{2-} < N$
3) $F < O < N < F^- < O^{2-}$
4) $N < O < F < F^- < O^{2-}$
5) $F < O < N < O^{2-} < F^-$



(6) A rigid vessel with a stopcock has a volume V $cm^3$ contains a certain gas under 27 °C.It is heated up to 127 °C. A volume was 100 $cm^3$ of the gas was released out. The initial volume of the container is ,

1) 100 $cm^3$ 2) 200 $cm^3$ 3) 300 $cm^3$ 4)133.3$cm^3$ 5) 400 $cm^3$

(7) $H_2C_2O_4$ is oxidized by $KMnO_4$. in presence of $H_2SO_4$. Calculate the number of $H_2SO_4$ moles required for the complete oxidation of 4.5 g Oxalic acid ($H_2C_2O_4$).

1) 0.03 2) 0.04 3) 0.05 4) 0.08 5) 0.16

(8) Which out of following is correct when the below ions and molecules are arranged in the increasing order of the electro negativity of the central atom.

1) $CO_2 < NO_3^- < H_3O^+ < PO_4^{3-}$
2) $CO_2 < NO_3^- < PO_4^{3-} < H_3O^+$
3) $PO_4^{3-} < CO_2 < NO_3^- < H_3O^+$
4) $PO_4^{3-} < NO_3^- < CO_2 < H_3O^+$
5) $CO_2 < NO_3^- < PO_4^{3-} < H_3O^+$

(9) C- C bond energies in $CH_2=CH_2$ and HC ≡ CH are 600 $kJmol^{-1}$ and 840 $kJmol^{-1}$. The bond dissociation enthalpy of C-C and $CH_3$-$CH_3$ is.

1) 240 $kJmol^{-1}$ 2) 360 $kJmol^{-1}$ 3) 300 $kJmol^{-1}$ 4)280 $kJmol^{-1}$
5) Cannot calculate as C-H bond energy is not given.

(10) Which species has a shape and a geometry similar to that of NSF?

1) $NO_2$ 2) $COCl_2$ 3) H2O 4) $N_2O$ 5) 5) $N_3^-$

(11) Density of a concentrated aqueous solution of HF is 1.2 $gcm^{-3}$ . Mole fraction of HF in it is1/11.The incorrect composition of the solution is,

1) Mass percentage is 10 %.
2) The concentration of the solution is 6 $moldm^{-3}$.
3) The molarity of the solution is $5 \times 10^{-3}$ $molkg^{-1}$
4) The mass volume composition is 120 $gdm^{-3}$
5) The ppm value of this is $1 \times 10^5$.

(12) The increasing order of the O-N bond angle of $NO_2$, $NO_2^-$, $NO_2^+$ and $NO_4^{3-}$ is

1) $NO_2 < NO_2^- < NO_2^+ < NO_4^{3-}$
2) $NO_2 = NO_2^- < NO_4^{3-} < NO_2^+$
3) $NO_2 = NO_2^- < NO_2^+ < NO_4^{3-}$
4) $NO_4^{3-} < NO_2^- < NO < NO_2^+$
5) $NO_4^{3-} < NO_2^- < NO_2 < NO_2^+$

(13) Four enthalpy changes relevant to the formation of $NO_2$ (g) is mentioned below.

$\frac{1}{2}N_{2(g)} + \frac{1}{2}O_{2(g)} \longrightarrow NO_{(g)}$ ——— (A)

$N_{(g)} + O_{(g)} \longrightarrow NO_{(g)}$ ——— (B)

$\frac{1}{2}N_{2(g)} + O_{(g)} \longrightarrow NO_{(g)}$ ——— (C)

$N_{(g)} + \frac{1}{2}O_{2(g)} \longrightarrow NO_{(g)}$ ——— (D)

The ascending order of the amount of enthalpy changes is,

1) A < B < C < D
2) B < C < D < A
3) A < C < D < B
4) A = B = C = D
5) C < D < B < A



(14) The density ratio between $A_2$ and $B_2$ is 2:1 when $A_2$ and $B_2$ gasses are stored under 27 °C with pressure ratio 50:1. The correct statement regarding these two gas samples is ,

1) The ratio between square mean velocities of A and B is 5:1.
2) The mean velocity cannot be calculated as the molar masses of gasses are not given.
3) The ratio between the mean speeds of A and B is $\sqrt{2}$: $\sqrt{5}$
4) The velocities are equal as the gasses remain under the same temperature.
5) The ratio between mean kinetic energies is 5: 1.

(15) Which out of following has not given the correct valency and oxidation number of the central atom?

| | Ion | Valency | Oxidation |
|---|---|---|---|
| 1 | $SCN^-$ | 4 | +4 |
| 2 | $AlO_2^-$ | 3 | +3 |
| 3 | $H_3O^+$ | 4 | -2 |
| 4 | $IO_3^-$ | 5 | +5 |
| 5 | $NO_3^-$ | 4 | +5 |

(16) Below equation shows the dimerization of $NO_2$ molecule.

$$2O = \overset{+}{N} - \ddot{O}:^- \longrightarrow :\ddot{O}^- = \underset{+}{N} - \underset{+}{N} - \ddot{O}:^-$$
(:O: :O: over the N=N)

Which out of following is the most accurate statement?

1) The forward reaction is endothermic.
2) The forward reaction is exothermic.
3) The forward reaction is exothermic.
4) In backward reaction chemical energy converts into thermal energy
5) In backward reaction thermal energy converts into chemical energy

(17) The correct statement for an enthalpy changes of a reaction is

1) The heat change under constant volume.
2) The heat change under constant pressure.
3) The heat change under the standard state.
4) The heat change of a chemical reaction which takes place according to the stoichiometric ratio.
5) The heat change of a chemical reaction which takes place under atmospheric pressure.

(18) A volime of 20 $cm^3$ from 0.05 mol $dm^{-3}$ $H_2SO_4$ is used to nutralize 20 $cm^3$ of NaOH in the titration flask in the presence of phenolphthalein. What is the burrette vreading when the titration is carried out using20 $cm^3$ of the acid in the titration flask?

1) 10 $cm^3$ 2) 20 $cm^3$ 3) 40 $cm^3$ 4) 45 $cm^3$ 5) 50 $cm^3$

(19) $I_2$ is a solid at room temperature and $H_2O$ is a liquid at room temperature. The false statement regarding the v intermolecular forces is,

1) Induced dipole- induced dipole interaction occur between water molecules.
2) $I_2$ has London forces only
3) Strength of the intermolecular interactions between $I_2$ molecules is higher than that in water.
4) There is no effect to the intermolecular forces even though the molecules are cooled.
5) The boiling point $I_2$ is lower than that of $H_2O$.

(20) The increasing order of the energy emitted in gaining electron is,

1) N < O < F < Cl 2) N < O < Cl < F 3) F < CL < O < N
4) N < Cl < O < F 5) N < O < F < Cl

(21) KSCN is oxidized by $KMNO_4$ in the presence of $H_2SO_4$ and forms $CO_2$, S, $N_2$. (The electronegativity of S is higher than that of C) The molar ratio of $CO_2$: $N_2$: S in a balanced equation is

1) 2:1:2 2) 1:1:2 3) 2:2:1 4) 5:2:5 5) 2:3:2

(22) A 10 $cm^3$ volume of gaseous hydrocarbon was burnt more than $O_2$. Volume contraction is 20 $cm^3$. The total gas emitted was passed through KOH solution and the volume reduction was 40 $cm^3$.

If all volumes were measured under room temperature and pressure, the molecular formula of the hydrocarbon is,

1) $C_2H_6$ 2) $C_4H_8$ 3) $C_4H_{10}$ 4) $C_4H_6$ 5) $C_8H_{14}$

(23) The most required factor for an ion or molecule to be polar is,

1) Presence of atoms of different elements.
2) Presence of lone pairs on the central atom.
3) Presence of different bonds on the central atom.
4) Having different shape and electron pair geometry around the central atom.
5) Presence of polar bonds.

(24) A method has been proposed to produce $CH_4$ gas from CO (g) emitted by an engine.

$$CO_{(g)} + 3H_{2(g)} \longrightarrow CH_{4(g)} + H_2O_{(g)}$$

Standard enthalpies of formation of CO (g), $CH_4$ (g) as and $H_2O$ (g) are -160, -75 and -245 $KJmol^{-1}$.

The false statement regarding this reaction is,

1) The enthalpy change of the reaction is - 160 $KJmol^{-1}$
2) The value of the enthalpy change will increase with the formation of water
3) Formation of $H_2$ (g) by reacting $CH_4$(g) and $H_2O$(l) is endothermic
4) Only the emission of heat is taken place in this reaction
5) The enthalpy change of $CH_{4(g)} + H_2O_{(aq)} \longrightarrow CO_{(g)} + 3H_2$ is +160 $KJmol^{-1}$

(25) The mass percentage of $CO_2$ is 44% in a mixture containing $CO_2$ (g) and CO (g) only. (C=12, O=16)

The false statement for the mixture is,

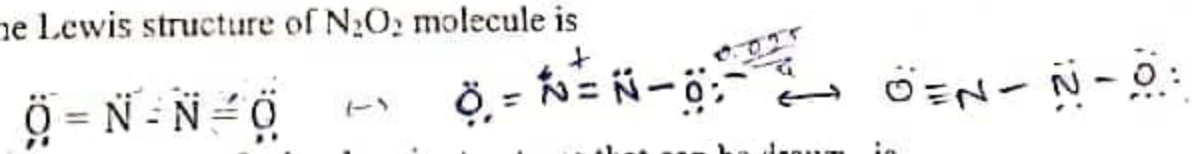
1) The mole fraction of $CO_2$ gas is $\frac{1}{3}$
2) The volume percentage of $CO_{2\,gas}$ is 33.3 %
3) The volume of the gas under the standard temperature and pressure is 67.2 $dm^3$
4) The mass percentage and volume percentage of $CO_2$ are different in this mixture
5) Mass percentage of C is 36 % in this mixture

(26) A mass of 50 $cm^3$ of $X_2$ gas is 1 g under standard pressure and temperature. Mass of 200 $cm^3$ of Ne gas under the same conditions of temperature and pressure is 0.5 g. (Ne = 20)

What is he relative atomic mass of X?

1) 20 2) 40 3) 80 4) 160 5) 100

(27) The Lewis structure of $N_2O_2$ molecule is



The number of other Lewis structures that can be drawn is,

1) 2 2) 3 3) 4 4) 5 5) 6

(28) True statement regarding the root mean square speed of a gas is,

1) Doubled when temperature of the gas is doubled.
2) Doubled when pressure of the gas is doubled.
3) Become half when density is doubled.
4) Become half when volume is doubled.
5) Mean square velocity becomes half when the temperature reduced to half.

(29) According to the standard nomenclature, name of H2O molecule is,

1) hydrogen oxide
2) hydrogen monoxide
3) dihydrogen oxide
4) water
5) dihydrogen monoxide

(30) The molar mass of Mohar salt $(NH_4)_2Fe(SO_4)_2.6H_2O$ is 392 gmol$_1$. The mass of $Fe(NO_3)_2$ which contains the same number of total ions in 7,84 g of above salt.,

1) ~~0.9 kg~~ 2) ~~540 g~~ 3) 9g 4) 54g 5) 18g

- For the questions 31 to 40, one or more responses out of the four responses (a), (b), (b) and (d) is/are correct. Select the correct response/responses. In accordance with the instruction given on your answer sheet, mark

1) If only (a) and (b) are correct
2) If only (b) and (c) are correct
3) If only (c) and (d) are correct
4) If only (a) and (d) are correct
5) If any other number or combination is correct

| (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|
| only (a) and (b) are correct | only (b) and (c) are correct | only (c) and (d) are correct | only (a) and (d) are correct | any other number or combination is correct |

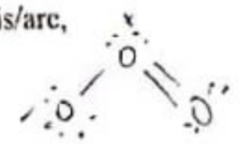


31) The true statement/statements regarding the atomic spectrum of hydrogen is/are,

(a) The departure of spectral lines with wavelength in Lyman series is corresponding with the departure of energy levels in an atom.
(b) When the energy difference of closer electronic transitions decreases in Balmer series, the frequency of spectral lines increases. ✓
(c) The electron transition from higher energy levels to lower energy levels has negative energy change, $\Delta H < 0$. ✓
(d) Departure of spectral lines in a spectrum can be described by using quantum theory only.

32) The most accurate statement/statements about the Ozone ($O_3$) molecule is/are,

(a) The atoms have different oxidation states
(b) O – O bond lengths are not equal ✓
(c) :O: can use this structure to illustrate the molecule. ✓
:O: :O:
(d) The dipole moment of the molecule is not equal to zero.



33) The correct statement regarding acid-base titration is/are,

(a) The equivalence point and the end point are the same ✗
(b) The unknown solution is always added to the flask ✓
(c) Strong acids should be used to titrate weak bases in the presence of an indicator
(d) A neutralization reaction takes place in between acetic acid and ammonia.

34) Complete combustion of liquid ethanol forms $CO_2$ (g) and $H_2O$(l) under 25°C and 1 atm pressure ($C_2H_5OH$ [$\Delta Hc\,\theta$ – 1400 kJmol-1 ). The true statement/ s regarding relevant enthalpy change of this reaction is/are,

$C_2H_5OH \longrightarrow 2CO_2 + 3H_2O$

(a) This related to the standard enthalpy of combustion of ethanol ✓
(b) When $H_2O$(g) forms, the enthalpy change becomes relatively higher. ✓
(c) During the combustion of ethanol, an amount of 1400KJ $mol^{-1}$ is emitted. ✓
(d) When $H_2O$(g) forms, the enthalphy change becomes relatively higher ✓

35) When ideal gas equation is used on a real gas, below corrections should be done.

$$\left(P + \frac{n^2a}{V^2}\right)(V - nb) = nRT$$

The correct statement/s regarding this equation is/are,

(a) "a" depends on intermolecular forces and "b" depends on volume of the molecule ✓
(b) The volume of an ideal gas is the volume of the container ✓
(c) The above equation cannot be used for an ideal gas ✗
(d) For the gasses $NH_3$ and $CH_4$, the value of "a" is $NH_3 > CH_4$ and value of "b" is $NH_3 < CH_4$

36) Which molecule is isoelectronic with $NO_3^-$ .

a. $ClO_2^-$ b. $SO_2$ c. $BF_3$

37) The correct order of the total intermolecular forces is,

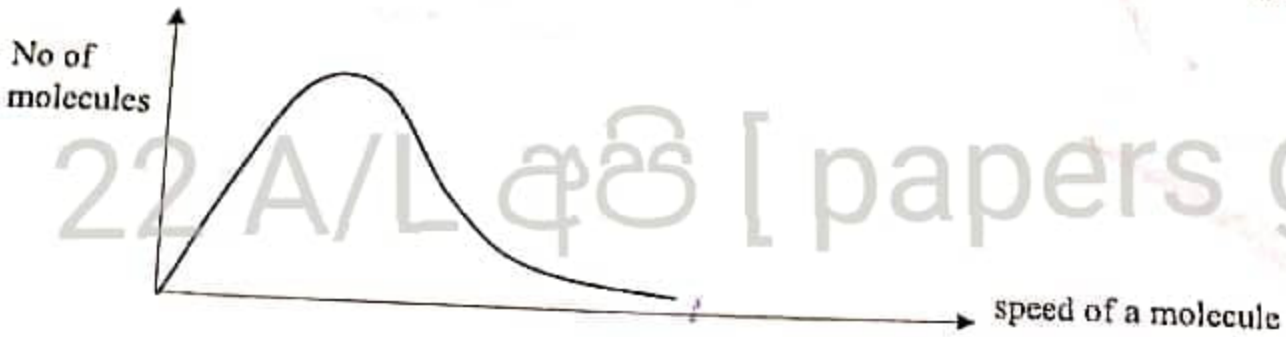
a. $CH_3 - CH_2 - \underset{CH_3}{CH_2} - CH_3 < CH_3 - CH - CH_3$

b. $NaH < NaCl$

c. $I_2$ , $H_2O < I_2$ , KI

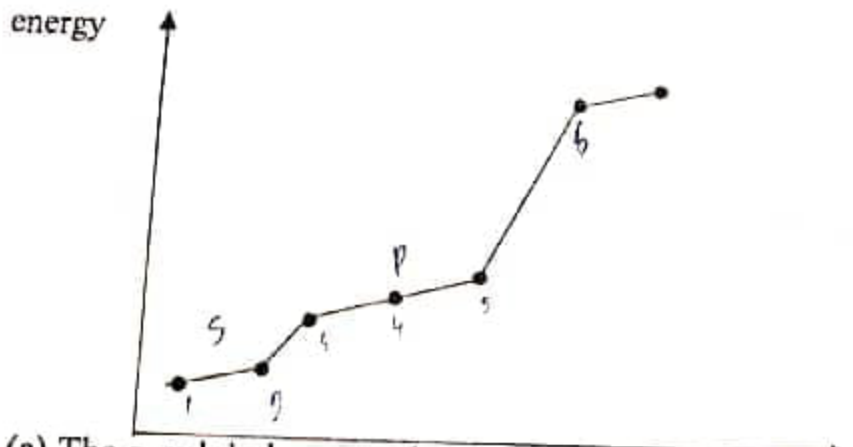
d. $H_2S < H_2O$

38) The Boltzmann's distribution of molecular speed is given below. The conclusion regarding the gas sample is,




(a) There can be motionless particles in a gas.
(b) Gas molecules moves in infinite speeds.
(c) The gas molecules have a trend to move in high speeds.
(d) The shape of the graph changes in moment to moment.

39) The successive ionization energy graph for the first seven ionization energies is given below. The correct conclusion/conclusions on this graph is/are,




(a) The graph belongs to the element Nitrogen
(b) This belongs to group 15
(c) It has two energy levels.
(d) Total number of electrons in the last energy level is 2.

40) $K_2MnO_4$, $MnO_2$ and $O_2$ are formed in thermal decomposition of $KMnO_4$. The volume of gas emitted is 224 $cm^3$ under the S.T.P. When 5.13g of a mixture of $KMnO_4$ and $K_2MnO_4$ sample undergoes thermal decomposition the volume of gas emitted is 224 $cm^3$ under the S.T.P. (The molar volume of $O_2$ under the STP is 22.4 $dm^3$ ). The mole fraction of $K_2MnO_4$ in the initial mixture is,

a. $1/3$ b. $2/3$ c. $1/5$ d. $1/2$

# Second Term Test- 2023 A/L Grade 12

## Chemistry II

### Essay

- **Answer 2 questions from part B and 2 questions from part C.**



### Part B

(05) a) i. a) An amount of $5.97\ g$ of a mixture of solid sample of $BaCO_3$ and $CaCO_3$ was heated in extremely high temperature and $3.77\ g$ of solid residue was remained. Calculate the molar fraction of $CaCO_3$.

$$BaCO_{3\,(s)} \xrightarrow{\Delta} BaO_{(s)} + CO_{2\,(g)}$$

$$CaCO_{3\,(s)} \xrightarrow{\Delta} CaO_{(s)} + CO_{2\,(g)}$$

$(Ba = 137,\quad Ca = 40,\quad C = 12,\quad O = 16)$

b) Certain organic compounds with 198 of relative of molecular mass has 36.36% C, 28.28% of N and 32.32% of O in the percentage of mass. State the molecular formula. (C = 12, H = 1, N = 14, O = 16)

c) A solid mixture of $Al$ and $Fe$ with $H_2S$ in high temperature.

$$Al \longrightarrow Al_2S_3$$

$$Fe \longrightarrow FeS$$

(Reaction should be balanced. When 1.1 g of solid sample was heated with $H_2S_{(g)}$ and 2.38 g of constant mass was obtained.) [Al = 27, S = 32, Fe = 56]

i. Calculate the mole fraction of $Al$ at the initial solid mixture.

ii. Calculate the mole fraction of FeS in final solid mixture.

iii. Calculate the $H_{2\,(g)}$ volume generated in standard pressure and temperature.

(06) a) (a) A commercial $H_2SO_4$ sample with unknown concentration has being labeled as 'Specific gravity' 1.47 (density $1.47\ gcm^{-3}$). $10\ cm^3$ volume of a the initial sample was placed in to $100cm^3$ volumetric flask and diluted with $H_2O_{(l)}$ up to the mark. When $75\ cm^3$ volume of $1\ moldm^{-3}\ NaOH$ solution was added to $25cm^3$ of above diluted solution. When phenolphthalein is added to final solution, the solution was converted in to red. This solution was titrated with $1\ moldm^{-3}\ HCl$ and the volume of $HCl$ required to reach the end point was $37.5\ cm^3$.

i. Calculate the concentration of commercial $H_2SO_4$ sample.

ii. Calculate the percentage of purity in $H_2SO_4$ sample.

b) Two samples of same solution were separately checked to 'calculate the concentration of $Fe^{2+}$ and $Fe^{3+}$ ion by using two separate 25.00 $cm^3$ of the sample..

Test 1 :- 10 $cm^3$ of 0.01 $moldm^{-3}$ $KMnO_4$ solution was spent, until purple colour (dark colour) solution was obtained

Test 2 :-Excess KI solution was added to second sample and then 20 $cm^3$ of 0.01 $moldm^{-3}$ of $Na_2S_2O_3$ solution was spent with starch indicator

i. Write the balanced ionic equation for the $MnO_4^-$ , $Fe^{2+}$ reaction.
ii. Write the balanced ionic equation for the $I^-$ , $Fe^{3+}$ reaction.
iii. Calculate the initial $Fe^{2+}$ and $Fe^{3+}$ ion solution.
iv. Identify the colour change of second titration.
v. At the end of the second experiment the final solution was titrated with $KMnO_4$. Calculate the burette reading.

(07) a) Two large closed, glass, gas containers with 10 $m^3$ and 20 $m^3$ have been separated by a thin tube with a stopcock of which the volume nelegible.

→ First container contains $N_{2(g)}$ with $1 \times 10^5\ Nm^{-2}$ pressure in $27^0c$.

→ Second container $H_2$ with $1 \times 10^5\ Nm^{-3}$ Pressure in $127^0c$.

The system was kept with initial temperature, although gases were mixed by opening the tap.

i. Calculate the number of $N_{2(g)}$ moles. (RT = 2500 Nmmol$^{-1}$ at 27°C)
ii. Calculate the number of $H_{2(g)}$ moles. (RT = 10000/3 Nmmol$^{-1}$ at 127°C)
iii. The total number of gas moles and number of moles of each gas after mixing in 20m$^3$ bulb when tap opened.
iv. Total pressure of final system
v. The temperature of the final system was increased by 600 K by adding catalyst $X$. $N_{2(g)}$ and $H_{2(g)}$ reaction was completely occurred and converted to $NH_{3(g)}$. Calculate the partial pressure of each gas in the system.

b) i. By using ideal gas law and kinetic molecular equation, Derive an equation for the relationship between mean velocity and absolute temperature of the atoms of the gas.
ii. If A sample of $H_{2(g)}$ is in $127^0C$ temperature and $10dm^3$ volume calculate the mean velocity of $H_{2(g)}$ atom.
iii. Logically calculate the velocity of $Ne_{(g)}$ atom at same temperature. (Ne =20)
iv. Draw a graph on the mean velocity of $H_{2(g)}$ and $Ne_{(g)}$ sample using the Maxwell-boltz-mann distribution of speeds.

c) The pressure of He is double respective to the pressure of $O_2$, in a same system where only $O_{2(g)}$ and $He_{(g)}$ remain. The volume of the system is $8.314dm^3$ and the total pressure is $4.5 \times 10^5\ Nm^{-2}$ with $27^0C$ temperature.

1. When the system was heated by inserting a $Mg$ strip, $O_2$ gas was totally removed form the system by forming $MgO$.

i. Calculate the MgO mass formed.
ii. What is the total pressure of the system. (The final temperature of the system is in 27°C)

## Part C

(08) a)I. State the relationship between heat change and enthalpy change of a reaction.

ii. 11.5g mass of liqud ethanol($C_5H_5OH$) has completly burned with execess $O_2$ in closed rigid system. The temperature of the system has been increased by 25°C . (the heat capacity of the system is $15kJK^{-1}$)
(C = 12, O =16, H =1)

i. Write the balanced equation for the combustion of liquid ethanol.
ii. Calculate the enthalpy change of above reaction by using given datas.
iii. Calculate the standard enthalpy of combustion for Ethanol with a Thermo-chemical cycle by
I. using below datas.

$\Delta HF_f^{\theta}[CO_{2(g)}] = -395\ kJmol^{-1}$
$\Delta HF_f^{\theta}[H_2O_{(l)}] = -286\ kJmol^{-1}$
$\Delta HF_f^{\theta}[C_2H_5OH_{(l)}] = -148\ kJmol^{-1}$

II. State whether the amount of enthalpy change of experimental value and calculated value is equal or not? Discuss the theoretical and practical reason that.



c)

i. Write the equation for the below statements.
(a) The standard enthalpy of combustion of $C_2H_{2(g)}$.
(b) The standard enthalpy of formation of $C_6H_{6(l)}$

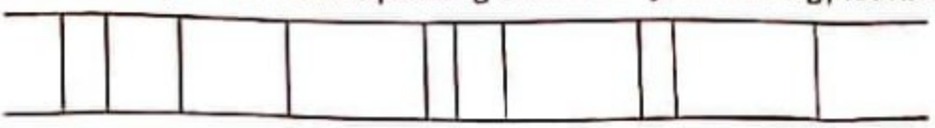
ii. Some thermo chemical data of on some given thermo chemical reactions are mentioned below.

$\Delta H_{f\,(CO_2\,(g))}^{\theta} \longrightarrow -393\ KJmol^{-1}$ ,
$\Delta H_{f\,(H_2O_{(l)})}^{\theta} \longrightarrow -286\ KJmol^{-1}$
$\Delta H_{c\,(C_2H_{2(g)})}^{\theta} \longrightarrow -1300\ KJmol^{-1}$ ,
$\Delta H_{C\,(C_6H_{6(g)})}^{\theta} \longrightarrow -3265\ KJmol^{-1}$

By using above data, calculate the enthalpy changes by only using enthalpy level diagramme.

(a) $3C_2H_{2(g)} \longrightarrow C_6H6_{(l)}$ $\Delta H_1^{\theta}$
(b) $2C_{(s,gr)} + \frac{1}{2}H_{2\,(g)} \longrightarrow C_2H_{2(g)}$ $\Delta H_2^{\theta}$
(c) $2C_{(s,gr)} + 3H_{2(g)} \longrightarrow C_6H_{6(l)}\,\Delta H_3^{\theta}$

(09) (a) The ten lines of H spectrum corresponding to first 5 adjacent energy levels are given below.



i. Consider the lines of Lymann series as $X_1, X_2, \ldots\ldots$ diagramme in order, lines of Bahmer series as $Y_1, Y_2, \ldots\ldots$ and lines of Paschen as $Z_1, Z_2, \ldots\ldots$ Order and lines of Bracket as $M_1, M_2, \ldots\ldots$ In order and pfund as $N_1, N_2, \ldots\ldots$ mark only the lines corresponding to first 5 energy levels in your diagram. (show the energy increasing direction by using →)

ii. Draw the electronic transitions relevant to $x_1$, $x_2$ $y_2$, $z_1$ lines in a energy level diagramme.

iii. If four adjacent lines of the Bahmer series have 656 nm, 456 nm, 434 nm and 410 nm, Calculate the energy of a photon in $y_2$($h = 6.63\times10^{-34}$Js , $c = 3\times108\ ms^{-1}$)

iv. Calculate energy of 1mol relevent to y2.($L = 6.022\times10^{23}\ mol^{-1}$)

v. The energies of adjecement energy levels of H atom are E1, E2, E. The energy of an energy level can be calculated by $E_n = \frac{2.17\times10^{19}}{n^2}$ (n = main quantum number) Calculate the energy for $x_1$ radiation in Lyman series.

(c) i. Below equation is used to calculate the formal charge on an atom in a molecule or poly atomic ion.

$$FC = \text{the number of valence shell electron} - \left[\left(\text{no of bonds} + \frac{\text{no of electrons}}{\text{in lone pair}}\right)\right]$$

pm = $10^{-12}$



Calculate the formal charge on s atom in below molecules

a. $H_2S$ b. $SO_3^{2-}$ c. $SO_4^{2-}$

ii. Oxidation number is used to determine the number of electrons Transfered among the atoms. Determine the oxidation number of below molecules

a. $H_2S$ b. $SO_3^{2-}$ c. $SO_4^{2-}$

iii. Although according to payling scale, the electro + negativity of an element is a constant, it can be vary with the environment. What are the factors affecting to the electro negativity of an atom.

iv. Deduce the deviation of the electro negativity of $S$ atoms in $H_2S, SO_3^{2-}$ and $SO_4^{2-}$.

(c) $XY$ is diatomic molecule and the electro negativity of X is less than electro negativity of Y. ( $X_X < X_Y$ ) XY atom can be written as X-Y and below equation denote the inter nuclear distance ( $d_{xy}$ ) of X and Y atoms.

$$d_{x-y} = r_x + r_y - c(x_y - x_x)$$

r = atomic radius c = 9 pm

I. Answer below questions based on above information.

i. What is the name used to identify the $\sigma$ bonds between X and Y?

ii. Illustrate the fractional charge distributed (using $\delta^+$ and $\delta^-$) of the XY molecule.

iii. Write the equation used calculate the dipole moment (a) and mark the direction.

iv. Calculate the percentage of ionic nature of K – Cl bond in KCl molecule using data given below..

Atomic radius of K($r_K$) = 280.0 pm

Atomic radius of Cl($r_{Cl}$) = 175.0 pm

Electro negativity of $X_K$ = 0.8

Electro negativity of $X_{Cl}$ = 3.0

Dipole momentum of KCl = $3.34 \times 10^{-29} cm$

Charge of the electron = $1.6 \times 10^{-19} C$

(10) a) Below data are based on an experiment to determine the percentage of $Na_2SO_4$ and $NaCl$ salts in a medicinal drug.



A solution is prepared by dissolving 4g of the medicine in $25cm^3$ of water and treated with $BaCl_{2(aq)}$ solution and all $SO_4^{2-}$ ion were precipitated as $BaSO_4$. The dry mass received was 4.66 g.

Another 4 g sample of the medicine was dissolved in $25cm^3$ of water and treated with Dilute $Pb(NO_3)_2$ and all $Cl^-$ and $SO_4^{2-}$ ions were precipitated as $PbCl_2$ and $PbSO_4$. The dry mass received was 7.44 g (Ba - 137, S -32, O -16, Na -23)

i. Write the balanced equation for the above processes.
ii. Calculate the $Na_2SO_4$ mass in 4.00 g of the medicine.
iii. Calculate the $NaCl$ mass in 4.00 g of medicine.

b) An experiment was designed to calculate the $CaCO_3$ mass percentage of a sea shell sample. A mass of 3 g was totally dissolved in $25cm^3$ of HCl sample. Then it was diluted until 100 $cm^3$ and $25cm^3$ of that was titrated with $0.5\ moldm^{-3}$ NaOH solution with phenolphthalein indicator. The mean burette reading is 12.7 $cm^3$( Ca -40, C -12, O-16, Pb -207, Cl -35.5)

i. Write the balanced chemical equation for the reactions between $CaCO_3$ and HCl
ii. Number of HCl mols reacted with NaOH in titration.
iii. Number of $CaCO_3$ reacted with HCl acid.
iv. State colour change obtain in the end point of the titration.
v. $CaCO_3$ mass percentage in sea shell sample.

c) The volume composition of commercial $H_2O_2$ bottle label has mentioned as 1:X . It means in S.T.P. $xcm^3$ of $O_{2(g)}$ is liberated by dissociating $1cm^3$
Of relevant solution.

An amount of $5cm^3$of $H_2O_2$ was mixed with excess KI . The liberated $I_2$ was titrated with $Na_2S_2O_3$ solution is 1 $moldm^3$ and the burette reading at the end point was $18cm^3$

I. State the balanced chemical equation for below reactions.
i. Reaction between $H_2O_2$ and KI

ii. Reaction between $Na_2S_2O_3$ and KI

iii. Dissociation of $H_2O_2$

II. Calculate the number of moles liberated as $I_2$.

III. Molar concentration of $H_2O_2$ solution.

IV. Calculate volume composition of $H_2O_2$ solution. (consider the molar volume of $O_2$ in S.T.P. is 22.4 $dm^3$ )

V. The $Na_2S_2O_3$ titration should be done as soon as possible when $H_2O_2$ and KI solutions are mixed together " Do you agree with this " Discuss the reason.



## PERIODIC TABLE OF ELEMENTS