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Second Term Test - 2022

Grade 12

Chemistry 1

Time : 2Hrs

- **Answer all the questions.**

Avogadro constant	$N_A = 6.022\times10^{23}\ mol^{-1}$
Planck constant	$h = 6.626\times10^{-34}\ mol^{-1}$
Universal gas constant	$R = 8.314\ Nm\ K^{-1}\ mol^{-1}$
Speed of light	$C = 3\times10^{8}\ ms^{-1}$

(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 ^0C.It is heated up to 127 ^0C. 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)133.3cm^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 $HC \equiv CH$ 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 x 10^{-3} $molkg^{-1}$
4) The mass volume composition is 120 gdm^{-3}
5) The ppm value of this is 1 x 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) $NO_4^{3-} < NO_2^- < NO_2 < NO_2^+$

134
100
115

(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

$\frac{50}{2} = \frac{1}{1}$

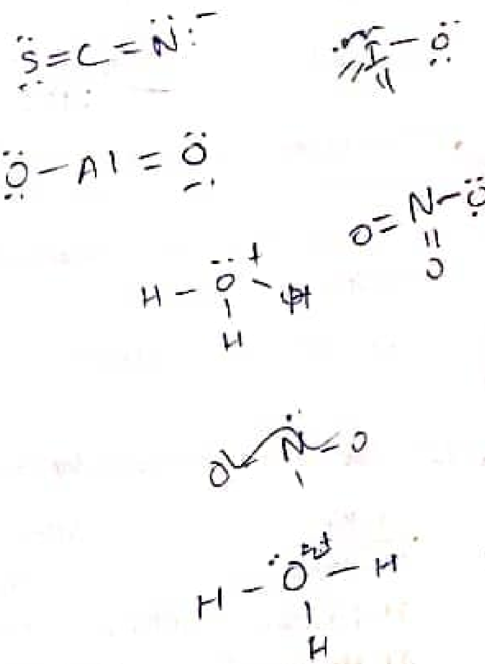
$PV = nRT$
$P = d$

(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 √2: √5
4) The velocities are equal as the gasses remain under the same temperature.
5) The ratio between mean kinetic energies is 25: 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.

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

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 cm³ from 0.05 mol dm⁻³ H_2SO_4 is used to nutralize 20 cm³ of NaOH in the titration flask in the presence of phenolphthalein. What is the burrette vreading when the titration is carried out using20 cm³ of the acid in the titration flask?

1) 10 cm³ 2) 20 cm³ 3) 40 cm³ 4) 45 cm³ 5) 50 cm³

$H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$

(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 cm³ volume of gaseous hydrocarbon was burnt more than O_2. Volume contraction is 20 cm³. The total gas emitted was passed through KOH solution and the volume reduction was 40 cm³.

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.

$8H^+ + 5e + MnO_4^{2-} \rightarrow Mn^{2+} + 4H_2O$

$2SCN^- \rightarrow 2CO_2 + 2S + N_2$

$SCN^- \rightarrow CO_2 + S + N_2$

(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 ⅓
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

$\ddot{O} = \ddot{N} - \ddot{N} = \ddot{O}$

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~~ 35   2) ~~540 g~~ 309   3) 9g   4) 54g   5) 18g

4

- 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

$(NH_4)_2Fe(SO_4)_2 \cdot 6H_2O$ 392

(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.

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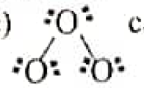
32) The most accurate statement/statements about the Ozone (O_3) molecule is/are,
(a) The atoms have different oxidation states   0
(b) O – O bond lengths are not equal ✓
(c)  can use this structure to illustrate the molecule. ✓
(d) The dipole moment of the molecule is not equal to zero.

5

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 (C2H5OH [$\Delta Hc\,\theta$ – 1400 kJmol-1]. The true statement/ s regarding relevant enthalpy change of this reaction is/are,

$C_2H_5OH \rightarrow 2CO_2 + 3H_2O$

4

(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,

1

(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 d. XeF_2

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

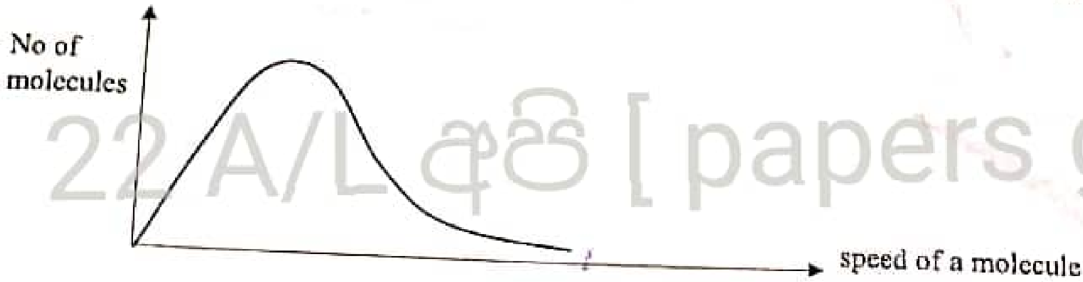
a. $CH_3 - CH_2 - CH(CH_3) - CH_3 < CH_3 - CH - CH_3$

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,



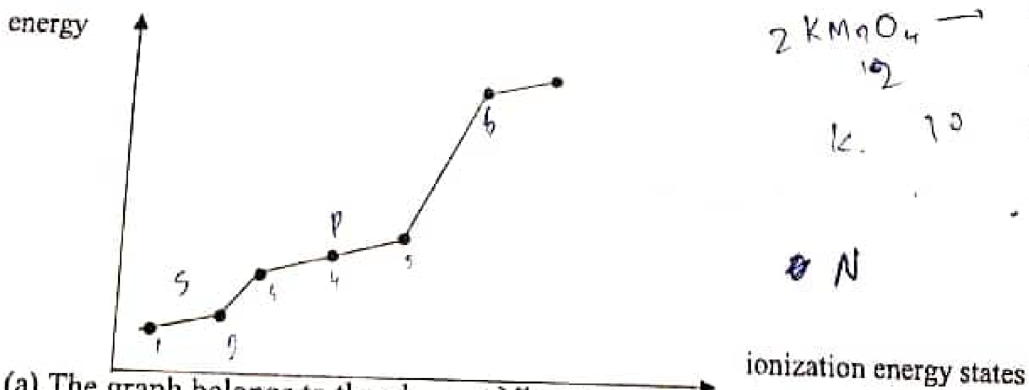
(a) There can be motionless particles in a gas.

(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 cm³ 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. concentration.
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 20m³ 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 mean 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.

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

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 $C_6H_{6(l)}$

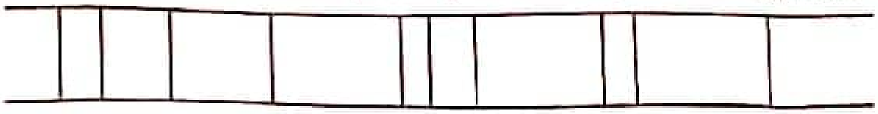
ii. Some thermo chemical data of on some given thermo chemical reactions are mentioned below.

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

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

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

$$FC = \begin{matrix} \text{the number of} \\ \text{valence shell} \\ \text{elecrton} \end{matrix} - \left[\left(\text{no of bonds} + \begin{matrix} \text{no of elecrons} \\ \text{in lone pair} \end{matrix}\right)\right]$$

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 σ bonds between X and Y?

ii. Illustrate the fractional charge distributed (using δ^+ and δ^-) 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

H																	He
Li	Be											B	C	N	O	F	Na
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Nh	Fl	Mc	Lv	Ts	Og

Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr