



**தொண்டைமானாறு வெளிக்கள நிலையம் நடாத்தும்
முதலாம் தவணைப் பரீட்சை - 2022
Conducted by Field Work Centre, Thondaimanaru.
1st Term Examination - 2022**

**இரசாயனவியல் I
Chemistry I**

One hour

02

E

I

Gr -12 (2023)

Part – I

❖ **Answer all questions.**

1) Which of the following combinations is correct.

- | | |
|---|-----------------|
| 1. Cathode ray experiment | - Pauli |
| 2. Gold foil experiment | - J. J. Thomson |
| 3. The number of positive charges on the nucleus increases in atom by single electron units | - Moseley |
| 4. Small particles under appropriate conditions show wave properties | - Max plank |
| 5. Positive ray experiment | - Dalton |

2) Maximum number of electrons possible to have for the quantum number $n = 3$ and $m_s = -\frac{1}{2}$ is,

- | | | | | |
|------|------|------|------|------|
| 1. 3 | 2. 4 | 3. 5 | 4. 7 | 5. 9 |
|------|------|------|------|------|

3) The correct increasing order of ionic radius is O^{2-} , N^{3-} , I^- , K^+ , Ca^{2+}

- | | |
|--|--|
| 1. $Ca^{2+} < K^+ < O^{2-} < N^{3-} < I^-$ | 2. $K^+ < Ca^{2+} < O^{2-} < N^{3-} < I^-$ |
| 3. $Ca^{2+} < K^+ < I^- < O^{2-} < N^{3-}$ | 4. $Ca^{2+} < K^+ < O^{2-} < I^- < N^{3-}$ |
| 5. $K^+ < Ca^{2+} < O^{2-} < I^- < N^{3-}$ | |

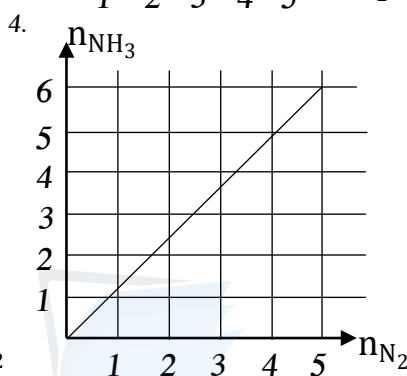
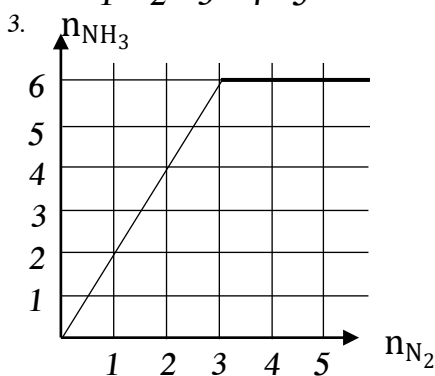
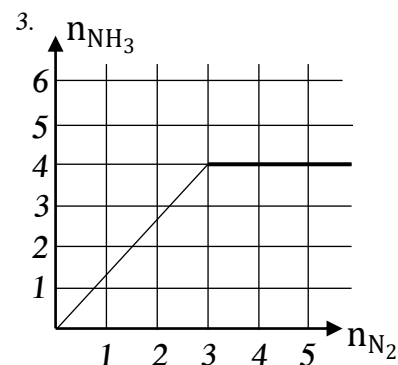
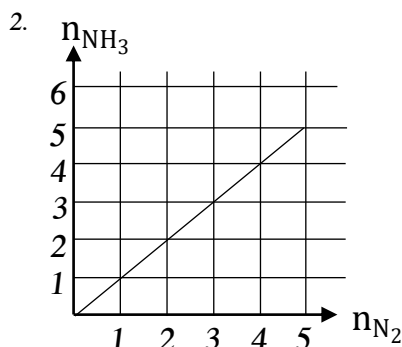
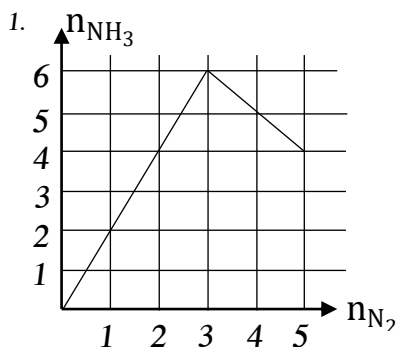
4) The density of an aqueous basic solution at $25^\circ C$ is 2 kgdm^{-3} . If the OH^- concentration is 0.05 moldm^{-3} its OH^- concentration in ppm would be, [H – 1, O – 16]

- | | | | | |
|--------|--------|--------|--------|-------|
| 1. 520 | 2. 340 | 3. 425 | 4. 850 | 5. 85 |
|--------|--------|--------|--------|-------|

5) Which is the correct decreasing order of electron negativity of nitrogen of the following NO_2Cl , $NOCl$, CF_3NC , NH_3 , NH_4^+ .

- | | |
|---|---|
| 1. $CF_3NC > NO_2Cl > NH_4^+ > NOCl > NH_3$ | 2. $CF_3NC > NO_2Cl > NOCl > NH_4^+ > NH_3$ |
| 3. $NH_4^+ > NO_2Cl > NOCl > NH_3 > CF_3NC$ | 4. $NH_3 > NH_4^+ > NOCl > NO_2Cl > CF_3NC$ |
| 5. $NH_4^+ > CF_3NC > NO_2Cl > NOCl > NH_3$ | |

6) 5 mol of N_2 gas and 9 mol of H_2 gas were mixed in a sealed container and allowed to react certain temperature. What is the diagram showing the changing mole of the NH_3 gas that forms with the reaction mole of N_2 gas?



7) Which of the following compounds has the lowest volatility?

1. CH_3Cl 2. $CHBr_3$ 3. CH_4 4. CH_2Cl_2 5. CBr_4

8) An organic compound containing C, H, and O only has 29.6 % oxygen by mass. Its relative molecular mass is 270. How many oxygen atoms are present in a molecule of this organic compound?

[H - 1, C - 12, O - 16]

1. 5 2. 4 3. 3 4. 2 5. 1

9) Most acceptable Lewis' structure of N_3^- ion

1. $\overset{+}{N} \equiv N = \overset{-}{N}:$ 2. $\overset{2-}{N} - \overset{+}{N} \equiv N:$ 3. $:\overset{+}{N} \equiv N - \overset{2-}{N}:$
4. $\overset{-}{N} \equiv N = \overset{+}{N}:$ 5. $\overset{-}{N} \equiv N \equiv N:$

10) In which one of the following atoms will the first ionization energy be the highest?

1. Mg 2. F 3. Ar 4. Li 5. Ca

11) A mixture of NaCl and KCl weighed $m_1 g$. The sample was dissolved in water and treated with excess of silver nitrate ($AgNO_3$). The resulting AgCl weighed M g. Mass of NaCl in mixture is [Molar mass of AgCl, NaCl and KCl respectively M_x, M_y, M_z]

1. $\left[\frac{M}{M_x} - \frac{m_1}{M_y} \right] M_x M_y$ 2. $\left[\frac{M}{M_x} - \frac{m_1}{M_y} \right] \frac{M_x M_y}{M_z}$ 3. $\left[\frac{M}{M_x} - \frac{m_1}{M_z} \right] \frac{M_y M_z}{(M_z - M_y)}$
4. $\left[\frac{m_1}{M_x} - \frac{M}{M_z} \right] \frac{M_y M_z}{(M_z - M_y)}$ 5. $\left[\frac{M}{M_x} - \frac{m_1}{M_y} \right] \frac{M_y M_z}{(M_z - M_y)}$

12) The correct answer when the molecules N_2 , NH_3 , NH_2OH , NO , NO_2 , and HNO_3 are arranged in the decreasing order of the oxidation state of nitrogen (N) is,

1. $HNO_3 > NO_2 > NO > N_2 > NH_3 > NH_2OH$
2. $NO_2 > HNO_3 > NO > N_2 > NH_3 > NH_2OH$
3. $NH_2OH > NH_3 > N_2 > NO > NO_2 > HNO_3$
4. $NH_3 > NH_2OH > N_2 > NO > NO_2 > HNO_3$
5. $HNO_3 > NO_2 > NO > N_2 > NH_2OH > NH_3$

13) Identify the correct statement from the following

1. Among the electronic transitions $n = 2 \rightarrow n = 1$, $n = \infty \rightarrow n = 2$ and $n = 6 \rightarrow n = 1$ in a hydrogen atom most energy is release in $n = \infty \rightarrow n = 2$.
2. The only type of inter molecular force present in CO_2 in the solid phase is dipole – dipole forces
3. The shape of the HNO_3 is trigonal bipyramidal
4. The O – N – O bond angle of NO_2 is greater than that of NO_2^- .
5. The addition of an electron to a gaseous berilium (Be) atom is an exothermic process whereas for a gaseous nitrogen atom it is endothermic

14) The number of moles of $KMnO_4$ that are required to react completely with one mole of FeI_2 in acidic medium is,

1. $\frac{2}{5}$
2. $\frac{3}{5}$
3. $\frac{1}{5}$
4. 1
5. $\frac{4}{5}$

15) Select the correct statement with regard to particles associated with positive rays observed in a cathode ray tube

1. The particles are uncharged.
2. They travel from cathode to anode along straight lines
3. Their charge to mass ratio e / m depends on the nature of gas inside the cathode ray tube.
4. Their direction of travel is not affected by magnetic and electric fields
5. They are not capable of ionizing the gas inside the cathode ray tube

❖ For each of the question 16 to 20 one or more response out of four responses (a), (b), (c) and (d) given is / are correct. Select the correct response / responses. In accordance with the instruction given on your answer sheet mark.

1	2	3	4	5
Only (a) (b) are correct	Only (b) (c) are correct	Only (c) (d) are correct	Only (a) (d) are correct	The other numbers correct

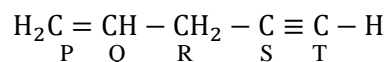
16) Which of the following statements is / are correct

- a) In a molecule if one atom is SP hybridized It will definitely have π bond.
- b) Concept of hybridization is applied to only one atom.
- c) The number of atomic orbitals that participate in the hybridization
- d) Hybrid orbitals have clear identify

17) Which of the following statements is / are **incorrect**?

- a) Hydrogen bond is formed only when there are H – F, H – O, H – N bonds in a molecule
- b) Oxidation number of oxygen in OF_2 is +2
- c) electromagnetic radiations are not affected by electric fields.
- d) When the momentum of a matter increases it's wave length also increases.

18) Which of the following statements is / are true regarding the molecule given below?



- Atoms labelled Q, R, S and T lie on a straight line.
- All carbon atoms lie in the same plane.
- Between C_S and C_T there is one σ bond and two π bonds.
- The angle between $C_P - C_Q$ and $C_Q - H$ bonds is approximately 120° .

19) 18 g $C_6H_{12}O_6$ was dissolved in 180 cm^3 of water which of the following statement / s is / are. correct regarding the above procedure. [water density is 1 gcm^{-3}] C – 12, H – 1, O – 16

- Molar concentration of $C_6H_{12}O_6$ in solution is 0.1 mol dm^{-3}
- Mass fraction of $C_6H_{12}O_6$ in solution is 0.091
- Mole fraction of $C_6H_{12}O_6$ in solution is $\frac{1}{101}$
- Percentage by mass of $C_6H_{12}O_6$ in solution is 91%

20) Which of the following statement / s is / are true?

- Electrons have particle as well as wave properties.
- A proton is heavier than a neutron
- All atoms have electrons, protons and neutrons
- All ions have at least one proton.

❖ Instructions for questions 21 – 25.

Response	First statement	Second statement
1)	True	True and correctly explains the first statement.
2)	True	True, but not explain the first statement correctly
3)	True	False
4)	False	True
5)	False	False

	Statement I	Statement II
21)	SrCO_3 is more thermally stable than Li_2CO_3	Polarizing power of group two cations decreases down the group
22)	Although the electro negativities of $O > C$ according to pauling's scale, the electro negativity of C in CO_2 is greater than that of O in H_2O	In general, when S character of a hybrid orbital and the oxidation number of an atom increase, electro negativity will increase.
23)	Both methanol [CH_3OH] and KI readily dissolve in H_2O	H_2O forms strong hydrogen bonds with both methanol and KI.
24)	SCl_4 and CCl_4 are both tetrahedral	Molecules that have the same number of atoms generally have the same shape.
25)	$\text{SO}_2 + 2\text{H}_2\text{S} \rightarrow 3\text{S} + 2\text{H}_2\text{O}$ at this reaction is example for disproportionation.	A chemical species (element) undergoing oxidation and reduction at the same time is called disproportionation.



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இரசாயனவியல் II A

Chemistry II A

Two Hours ten minutes

Gr -12 (2023)

02

E

II A

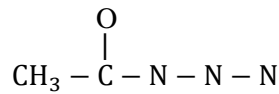
Structure essay Questions

Answer all questions

1) (a) To the following questions, write the answer in the given empty space

(i)	Among there elements F, Cl, Br, Which on has the highest electron gain enthalpy in ($kJmol^{-1}$)	.....
(ii)	Among the molecules XeF_2 , XeF_4 and XeO_3 which on has the highest bond angle.	.....
(iii)	Among O, Cl, and P Which one has the lowest first ionization energy	.....
(iv)	Among $MgCO_3$, $CaCO_3$ and $SrCO_3$ which one has the lowest polarization ability	.....
(v)	Among $HClO_4$, Cl_2O_3 and Cl_2O which one has the highest oxidation state in Cl atom	.....
(vi)	Among SF_6 , CCl_4 , BCl_3 which compound has the highest electron pair repulsion units in central atom	.....

(b)(i) Draw the most acceptable Lewis structure for the molecular skeleton given below .



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(ii) Write the possible three resonance structures for the above molecule and state the relative stability of that resonance structures (Except given in b(i))

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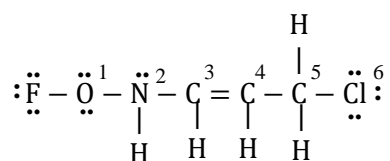
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(iii) Complete the given table based on the Lewis dot – dash structure and its labeled molecule given below.



		O ¹	N ²	C ³	C ⁵
I.	VSEPR Pairs				
II.	Electron pair geometry.				
III.	Molecular shape				
IV.	Hybridization				

(iv) Identify the atomic / hybrid orbitals involved in the formation of σ bond in the above Lewis dot dash structure

- I. O¹ – N² O¹ N²
- II. N² – C³ N² C³
- III. C³ – C⁵ C³ C⁵
- IV. C⁵ – Cl⁶ C⁵ Cl⁶

(v) Identify the atomic orbitals in the formation of the π bond in the Lewis dot – dash structure give in part (iii) above

- C³ – C⁴ C³ C⁴

(c)(i) Complete the following table.

	Species	Primary interaction	Secondary interaction
(1)	CH _{4(g)}	.....	.....
(2)	NaCl _(s)	.....	.....
(3)	Mg	.....	.....
(4)	C (Diamond)	.....	.....
(5)	CH ₃ OH _(aq)	.....	.....

(ii) Mention the approximate bond angle of the central atom in the following molecules.

1. XeF_4 :- 2. PCl_5 :- SO_2 :-

2) (a) An inorganic salt contains Cr, S, and O only. Cr 26.52%, S 24.53%, O 48.96% are the mass percentages of the elements Cr, S and O respectively.

(Cr = 52, S = 32, O = 16)

(i) Write the empirical formula of the salt X ?

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(ii) Write the chemical formula of the salt X.

.....

(iii) Write the IUPAC Names of the following compounds.

1. H_2S
2. HClO_4
3. KH_2PO_4
4. Fe_2S_3

(b) (i) Write oxidation and reduction half ionic reaction and then write complete ionic – equation for the reaction $\text{Fe}_{(aq)}^{2+} + \text{NO}_{3(aq)}^- + \text{H}_2\text{O} \rightarrow \text{Fe}_{(aq)}^{3+} + \text{NO}_{(g)} + \text{OH}^-$ in basic medium.

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(ii) $\text{S}_{(s)} + \text{HNO}_{3(aq)} \rightarrow \text{H}_2\text{SO}_{4(aq)} + \text{NO}_{2(g)} + \text{H}_2\text{O}_{(l)}$ Balance this reaction by oxidation number method.

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(iii) $C_3H_8(g) + O_2(g) \rightarrow CO_2(g) + H_2O(l)$ Balance this equation using inspection method.

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(c) A solution contain acidic $KMnO_4$ Volume of that is 100 cm^3 . 0.1 mol dm^{-3} 50 cm^3 H_2O_2 solution was added to it and shaken well. After that 0.1 mol dm^{-3} 50 cm^3 Na_2SO_3 solution was needed to completely react with remaining $KMnO_4$ solution

(i) Write balance chemical reactions for the above reactions.

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(ii) What is the concentration of $KMnO_4$ in the solution?

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3) (a) A,B and C are three successive elements belongs to periodic table, Which atomic numbers are less than 20. Ascending order of the boiling point of this elements as follows $A < B < C$. Common variation of first and second ionization energies are given in the following table. Consider this to answer the following questions.

Element	A	B	C
1 st Ionization energy kJ mol^{-1}	494	736	577
2 nd Ionization energy kJ mol^{-1}	4560	1450	1820

(i) Identify and write the common names of the elements A, B, and C.

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(ii) Briefly explain the common trend of the first ionization energies of A, B and C.

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(iii) Write the electronic configuration of the element B

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(iv) Draw the graph of successive ionization energies VS number of removing electrons of element A

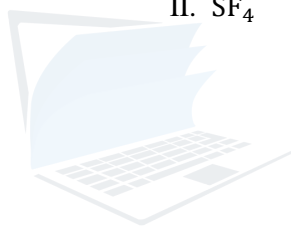
(v) Give two uses of element C

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(b) Derive the molecular shape of the following molecules

I. ClF_3

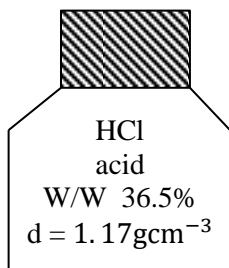
II. SF_4



(c) The following table give the information of melting point and electric conductance of the species Mg, Al_2O_3 , CO_2 , NaCl, SiO_2 . Fill in the blank in the given table based on this details.

	Species	Melting point $^{\circ}\text{C}$	Electric conductance	
			Solid state	Aqueous solution molten stage
I.	1610	Nil	Nil
II.	649	Very good	Very good
III.	801	Very poor	good
IV.	- 78	Nil	Nil
V.	2027	Very good	good

4) (a)



Answer the following based on the given acid bottle

(i) What is the concentration of HCl acid in mol dm^{-3} (H = 1, Cl = 35.5)

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(ii) What is the IUPAC name of the above acid.

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(iii) How can you prepare 5 mol dm^{-3} 250 cm^3 HCl acid solution from the above acid.

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(iv) 2 mol dm^{-3} 100 cm^3 HCl solution is prepared from the stock solution of 5 mol dm^{-3} HCl. The prepared solution of 2 mol dm^{-3} , 100 cm^3 HCL is allowed to completely react with 1 mol dm^{-3} , 100 cm^3 NaOH solution based on the stoichiometric ratio of the reaction

I. Resulting solution shows acidic / basic property (delete wrong statement)

II. Calculate the concentration of $\text{H}_{(\text{aq})}^+$, or $\text{OH}_{(\text{aq})}^-$ ions in the resulting solution in mol dm^{-3}

(v) Write the balanced chemical equation of the reaction between concentrated HCl solution and KMnO_4

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(B) The mole of acidify KMnO_4 is which is change $2.68 \times 10^{-3} \text{ mol A}^{n+}$ to AO_3^- is $1.61 \times 10^{-3} \text{ mol}$

(i) Give oxidation and reduction half ionic reaction to the above reaction

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(ii) Write the balanced complete ionic equation.

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(iii) calculate the value for n.

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இரசாயனவியல் II B
 Chemistry II B

Gr -12 (2023)

02

E

II B

Part – II B

❖ Answer any two questions from this section.

01) (A) Give the Lewis structure and approximated bond angle of the following molecules.

(i) POCl_3 (ii) H_2SO_3 (iii) $\text{H}_2\text{S}_2\text{O}_3$

(B) Draw the molecular structure of C_2H_4 using the knowledge of hybridization

(C) Draw the Lewis structure of N_2O , draw the resonance structures of N_2O and mention their relative stability.

(D) Arrange the ascending order of electronegativity of H_2S , SO_3^{2-} and SO_4^{2-} . Explain your Answer.

(E) Draw the formation of hydrogen bond of the following molecules.

(i) $\text{HF}_{(l)}$ (ii) $\text{CH}_3\text{COOH}_{(l)}$

(iii) Between acetone (CH_3COCH_3) and $\text{H}_2\text{O}_{(l)}$ molecule.

02) (A) A mixture only contain CaCO_3 , MgCO_3 and SiO_2 mole ratio of $\text{CaCO}_3 : \text{MgCO}_3$ is 1 : 1. When 2.00g of this mixture is heated until the constant mass obtained and the mass of residue is 1.12 g. Calculate the mass percentage of each species (Ca = 40, Mg = 24, Si = 28, O = 16)
 $(\text{MCO}_{3(s)} \rightarrow \text{MO}_{(s)} + \text{CO}_{2(g)})$

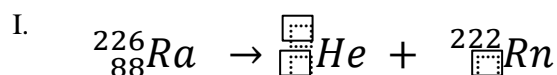
(B) When heated 80.0g of hydrated salt $\text{MSO}_4 \cdot x\text{H}_2\text{O}$ give anhydrous sulfate and 3.75 g H_2O as products. Calculate the value for x. (M = 24)

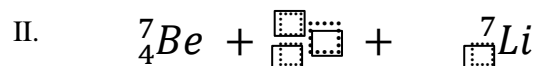
(C) Mass percentage of isotopes of carbon sample is given below.

$^{12}_6\text{C} = 98.89\%$, $^{13}_6\text{C} = 1.11\%$ and mass percentage of $^{14}_6\text{C}$ is neglected. What is the relative atomic mass of natural carbon

(D) How can you prepare 2 mol dm⁻³, 250 cm³ Na_2CO_3 solution.

(E) Fill in the blank of the following nuclear reaction.





03) (A) Derive the Lewis structure for the following molecules.

- (i) SO_3 (ii) H_2S (iii) PH_3

(B) i) Write the most acceptable Lewis structure for NO_3^- ion.

ii) Draw the possible resonance structure for the above ion.

(C) calculate one mole photon energy of yellow light which has 589 nm wave length.

$$(C = 3 \times 10^8 \text{ms}^{-1}, h = 6.626 \times 10^{-34} \text{Js}, N_A = 6.022 \times 10^{23} \text{mol}^{-1})$$

(D) An organic compound Y contain C, H and O only when Y was burn CO_2 and H_2O were obtained in 2 : 1 mole ratio. Accurate relative molar mass of Y is 152. The mass percentage of oxygen in Y is less then 40 %. Find out the molecular formula of Y.

$$(C = 12, H = 1, O = 16)$$

(E) Give the oxidation and, reduction reactions and write complete ionic equation for the following reaction.

i. Reaction between acidify $\text{K}_2\text{Cr}_2\text{O}_7$ and H_2S

ii. Reaction between acidify KMnO_4 and FeC_2O_4

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