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G.C.E. Advanced Level Examination 2023
Sripalee College - Horana

First Term test - 2023 April

Chemistry

I

02 S I

Two hours

Name / Index No.:

Universal gas constant $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ Avogadro constant $N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$

Plank constant $h = 6.626 \times 10^{-34} \text{ J s}$ Speed of light $C = 3 \times 10^8 \text{ m s}^{-1}$

01. Select Correct combination from the below given list.

	1	2	3	4	5
Charge of election	Millicon	Millicon	Plank	de Broglie	de Broglie
quantun numbers	Plank	Plank	Millicon	Plank	Plank
Wave- partide duality of matter	de Broglie	de Broglie	de Broglie	Rutherford	Thomson
first nuelear model of atom	Thomson	Rutherford	Rutherford	Thomson	Rutherford
e/m ratio of cathode rays	Rutherford	Thomson	Thomson	Millicon	Millicon

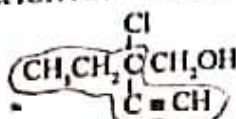
02. Which of the following election transmission has the highest energy. Within the visible range of line spectrum of atomic hydrogen ($n =$ principle quantum number)

- (1) $n = 4 \rightarrow n = 1$ (2) $n = 5 \rightarrow n = 1$
 (3) $n = 2 \rightarrow n = 1$ (4) $n = 5 \rightarrow n = 2$
 (5) $n = 4 \rightarrow n = 2$


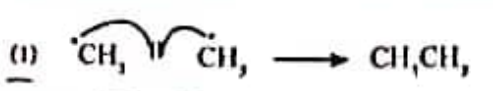
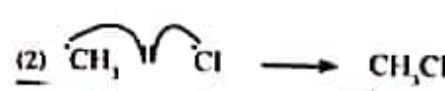
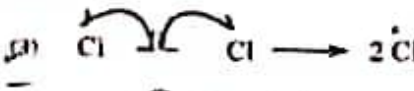
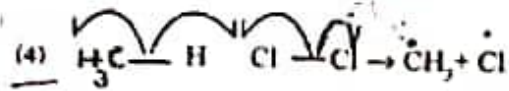
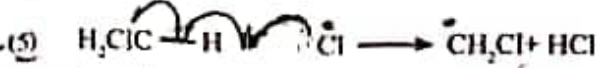
03. Correct combination representing basic electron pair geometry and - shape derived from it is,

- (1) Planar triangular - bent (2) Tetrahedral - bent
 (3) Tetrahedral - pyramidal (4) Trigonal bipyramidal - linear
 (5) Trigonal bipyramidal - pyramidal

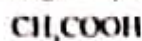
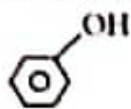
04. Correct IUPAC name of the below given compound is,



- (1) 2-ethyl-2-chlorobut-3-yne-1-ol (2) 2-chloro-2-ethylbut-3-yne-1-ol
 (3) 2-chloro-2-ethyl-3-ynol (4) 3-chloro-3-ethyl-4-hydroxy-1-butyne
 (5) 3-chloro-3-ethyl-4-hydroxybut-1-yne

05. Molecular formula of the simplest unsaturated hydrocarbon which show enantiomerism and diastereomerism
 (1) C_7H_{16} (2) C_7H_{14} (3) C_7H_{12} (4) C_4H_{16} (5) C_8H_{14}
06. Ammonium salt which emit a gas upon thermal decomposition which is neither NH_3 nor N_2 is.
 (1) NH_4NO_3 (2) NH_4NO_2 (3) $(NH_4)_2Cr_2O_7$ (4) $(NH_4)_2SO_4$ (5) $(NH_4)_2CO_3$
07. Hydration enthalpy of X(s) and molar entropy of X(aq) respectively are $70 \text{ J K}^{-1} \text{ mol}^{-1}$ and $+170 \text{ J K}^{-1} \text{ mol}^{-1}$. Molar entropy of X(s) in $(\text{J K}^{-1} \text{ mol}^{-1})$ is.
 (1) +240 (2) -240 (3) 0 (4) +100 (5) -100
08. Volume of 1.0 mol dm^{-3} HCl in cm^3 needed to titrate with a mixture of equal volume of 1 mol dm^{-3} NaOH and 2 mol dm^{-3} KOH with a total volume of 25.0 cm^3 the presence of phenolphthalein as the indicator is,
 (1) 12.5 (2) 25 (3) 37.5 (4) 38 (5) 45
09. Solution of $(NH_4)_2SO_4 \cdot FeSO_4$ has 560 ppm value of Fe^{2+} . SO_4^{2-} (aq) concentration in this solution in mol dm^{-3} is, (N=14, H=1, S=32, O=16, Fe=56)
 (1) 0.002 (2) 0.001 (3) 0.003 (4) 0.004 (5) 0.005
10. Possible temperature and pressure values for H_2 gas, needed to display ideal behaviour.
 (1) 100 K, $1 \times 10^5 \text{ Pa}$ (2) 1000 K, $1 \times 10^2 \text{ Pa}$
 (3) 1000 K, 1 Pa (4) 15 K, $2 \times 10^5 \text{ Pa}$ (5) 25 K, $1 \times 10^5 \text{ Pa}$
11. Correct IUPAC name for, $K_4[Fe(CN)_6]$ is.
 (1) tetrapotassiumhexacyanidoferrate (II) (2) potassiumhexacyanidoferrate (III)
 (3) potassium hexacyanidoferrate (II) (4) tetrapotassiumhexacyanidoiron(III)
 (5) tetrapotassiumhexacyanidoiron(II)
12. Possible reaction via  group is
 (1) nucleophilic addition (2) electrophilic substitution
 (3) electrophilic addition (4) elimination (5) hydration
13. Incorrect statement regarding $CH_3CH=CHCH_2CHO$ is,
 (1) Decolorizes the purple colour of acidic $KMnO_4$
 (2) Decolorize Bromine water
 (3) Forms a dark yellow precipitate when heated with 2, 4, - DNP
 (4) Above molecule is formed by Bromination followed by dehydrobromination
 (5) Shows diastereomerism.
14. Incorrect step in chlorination of methane is,
 (1) 
 (2) 
 (3) 
 (4) 
 (5) 

15. Consider the following compounds



A

B

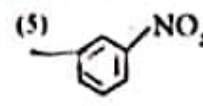
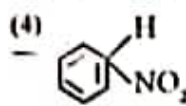
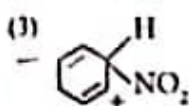
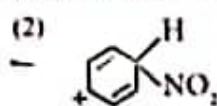
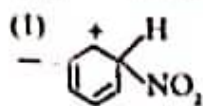
C

D

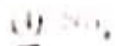
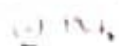
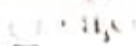
Correct order of increasing acidity of above given compounds is,



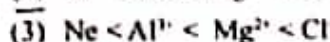
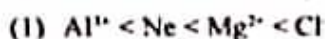
16. Which of the following is not a possible structure in nitration mechanism of Benzene



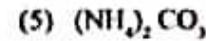
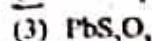
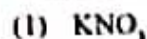
17. Molecule which has the shape similar to that of POCl_3 is,



18. Correct order of increasing radii of Ne , Mg^{2+} , Al^{3+} , Cl



19. Compound which release gaseous products only upon thermal decomposition is,



20. Which of the following statement is true regarding the compressibility factor (z) for real gases.

(1) Value equals to 1 all the time.

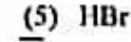
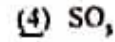
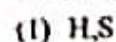
(2) value is not similar to 1 all the time.

(3) Value merely equals to 1 at low pressure and low temperature condition.

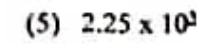
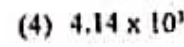
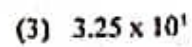
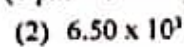
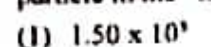
(4) Shows a positive deviation with pressure all the time.

(5) Value of Z merely equals to 1 at low pressure and high temperature condition.

21. Which of the below given molecule has zero dipole moment.



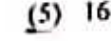
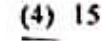
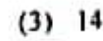
22. De Broglie wave length for a particle with a mass of 1.67×10^{-24} g is 122 pm. The travelling speed of the particle in ms^{-1} is, ($1 \text{ pm} = 10^{-12} \text{ m}$)



23. Successive ionization energy values of element A is given below in kJ mol^{-1}



The group of element A belongs is,

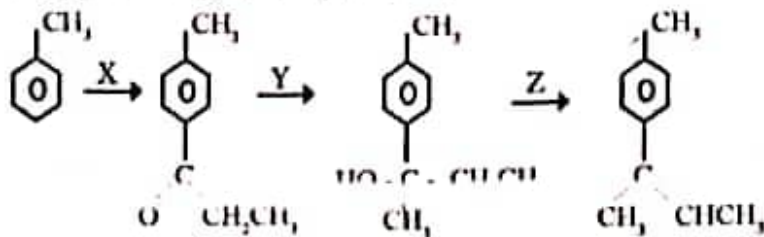


24. Composition of Cr in a water sample is 1.25 ppm Cr composition of the above sample in moldm⁻³ is,
 (1) 3.00×10^{-3} (2) 2.40×10^{-5} (3) 6.50×10^{-4} (4) 1.25×10^{-3} (5) 1.40×10^{-6}

25. Compound which forms a white precipitate with excess water is,
 (1) BiCl₃ (2) AlCl₃ (3) SCl₂ (4) PCl₃ (5) SiCl₄

26. Characteristic type of reaction in alkene is
 (1) Electrophilic addition (2) Electrophilic Substitution
 (3) Elimination (4) Nucleophile addition
 (5) Acid - Base reaction

27. Consider the following reaction sequence



Correct order of reagents used in X, Y, Z respectively are,

- | | | |
|--|---|---|
| (1) $\text{CH}_3\text{CH}_2\text{-}\overset{\text{O}}{\parallel}\text{C}-\text{Cl}$
— anhydrous AlCl ₃ , | i. CH ₃ MgBr
ii. dry ether | ,
anhydrous Al ₂ O ₃ ,
Δ |
| (2) $\text{CH}_3\text{CH}_2\text{-}\overset{\text{O}}{\parallel}\text{C}-\text{Cl}$
— anhydrous AlCl ₃ , | i. LiAlH ₄
ii. dry ether | ,
Concentrated H ₂ SO ₄ ,
Δ |
| (3) $\text{CH}_3\text{CH}_2\text{-}\overset{\text{O}}{\parallel}\text{C}-\text{Cl}$
— anhydrous AlCl ₃ , | i. CH ₃ MgBr
ii. H ⁺ /H ₂ O | ,
anhydrous Al ₂ O ₃ ,
Δ |
| (4) CH ₃ CH ₂ Cl
anhydrous AlCl ₃ , | i. CH ₃ CH ₂ Br
ii. Mg/dry ether | ,
anhydrous Al ₂ O ₃ ,
Δ |
| (5) i. CH ₃ CH ₂ -Br
ii. Mg/dry ether | i. LiAlH ₄
ii. H ⁺ /H ₂ O | ,
Concentrated H ₂ SO ₄ ,
Δ |

28. Which of the following couple forms a white precipitate upon mixing with each other

- (1) BaCl₂(aq) and KOH(aq) (2) MgNO₃(aq) and K₂SO₄(aq)
 (3) MgCl₂(aq) and NaOH(aq) (4) dilute H₂SO₄(aq) and Na₂CO₃(aq)
 (5) BaCl₂(aq) and K₂CrO₄(aq)

29. Species which does not show bleaching action is

- (1) H₂O₂ (2) SO₂ (3) NaClO (4) HOCl (5) Cl₂

30. Vessel A contains OH_2 gas at 27°C and vessel B contains O_2 gas at 327°C Ratio of root mean square speed of CH_4 and O_2 gas is $\sqrt{\frac{C^2 \text{CH}_4}{C^2 \text{O}_2}}$ (O=16, C=12, H=1)

- (1) 4:1 (2) 2:1 (3) 1:2 (4) 1:1 (5) 1:4

Summary of instructions from question number 31-40

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 num- ber of combina- tion of respons- es correct

31. Which of the following statement/s is / are true.
- (a) strongest acid is HClO_4 (b) HClO_4 acid can not act as a reducing agent
 (c) Out of all weakest acid is HOCl (c) Oxidation number of Cl in HClO_4 is +6
32. Which of the following statement / s is/ are true regarding chemical reactions
- (a) $\Delta S > 0$ for all spontaneous reactions
 (b) $\Delta H > 0$ for all spontaneous reactions
 (c) $\Delta G = 0$ for all a reaction at equilibrium
 (d) Both ΔH and ΔS for forward and back ward reactions either positive or negative for a reaction at equilibrium.
33. Which of the following statement/s is / are incorrect,
- (a) Alkyl halides can undergo nucleophile substitution as well as elimination reactions.
 (b) Characteristic reaction of alkenes and alkynes is electrophilic addition.
 (c) Characteristic reaction of benzene is electrophile addition.
 (d) Benzene can undergo electrophile substitution reactions under harsh conditions
34. Which of the following reaction/s generate sulphure as a product
- (a) Adding dilute HCl into aqueous sodium sulphide
 (b) Adding dilute H_2SO_4 acid into aqueous sodium thiosulphate
 (c) Bubbling H_2S gas through aqueous iron(III) solution
 (d) Reacting H_2S and SO_2 gases together.
35. Which of the following statement/s is / are correct,
- (a) Titanium can form compounds with + IV oxidation state.
 (b) Oxidation state of Mn can be changed from +7 to +6 and +4.
 (c) All titanium compounds are colourless
 (d) Dichromate ions react in alkaline medium to form chromate ions.
36. Which of the following set/s. Has/ have a molecule with an unpaired electron.
- (a) NO , CCl_4 , CO_2 (b) NO_2 , H_2S , O_3 (c) SO_2 , H_2SO_4 , HNO_3 (d) HCl , HCN , SO_2

37. Correct response which include acidic and basic oxides only
 (a) $\text{CO}_2, \text{K}_2\text{O}, \text{SO}_2$ (b) $\text{ZnO}, \text{NO}_2, \text{NO}$
 (c) $\text{MnO}_2, \text{Al}_2\text{O}_3, \text{BeO}$ (d) $\text{SO}_3, \text{Na}_2\text{O}, \text{MgO}$
38. Which of the following statement/s is always correct regarding $(\text{CH}_3)_3\text{C}-\text{OH}$
 (a) It gives an instant turbidity upon addition of anhydrous ZnCl_2 and concentratal HCl
 (b) It doesn't react with aqueous KCN
 (c) It doesn't react with aqueous NaOH
 (d) It doesn't react with aqueous $\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-\text{H}$
39. Correct response/s including non- polar molecules only.
 (a) $\text{CO}_2, \text{CCl}_4, \text{SO}_2$ (b) $\text{BeCl}_2, \text{BF}_3, \text{BCl}_3$
 (c) $\text{NO}_2, \text{HCl}, \text{PCl}_3$ (d) $\text{HNO}_3, \text{NH}_3, \text{SO}_2$
40. Which of the following is a decomposition reaction?
 (a) Decomposition of H_2O_2 (b) Hydolysis of NCl_3
 (c) Reaction of H_2S with SO_2 (d) Reaction of Cl_2 gas with NaOH

• Summary of instruction from question number 41 -50

Response	first statement	Second statement
1	True	True and correctly explains the first statement
2	True	True but does not explain the first statement correctly
3	True	False
4	True	True
5	True	False

First Statement	Second Statement
41. Vinyl halides as well as aryl halides do not show nucleophile substitution reactions	C-X bond in Vinyl halides and Aryl halides carry partial double bond nature
42. Highest melting point is recorded in Mn among elements From Sc - Zn	Sc is a transition element
43. Equal volumes of CO_2 and N_2 gases at 350 K and 10 atm carry equal number of molecules.	Equal volumes of different gases at constant temperature and constant pressure carry equal number of molecules
44. Filter paper soaked with $\text{H}^+/\text{K}_2\text{Cr}_2\text{O}_7$ can be used to distinguish SO_2 and H_2S gases.	H_2S as well as SO_2 convert colour of $\text{H}^+/\text{K}_2\text{Cr}_2\text{O}_7$ from Orange to green.

<p>45. Methanolic NaBH₄ converts</p> $\begin{array}{c} \text{O} \\ \parallel \\ \text{C}_2\text{H}_5\text{OH} \end{array} \rightarrow \text{C}_2\text{H}_5\text{CH}_2\text{OH}$	<p>$\begin{array}{c} \text{O} \\ \parallel \\ -\text{C}-\text{H} \end{array}$ group is reduced to $-\text{CH}_2\text{OH}$ by NaBH₄ since it is a reducing agent</p>
<p>46. During thermal decomposition of NH₄NO₃, N₂O gas and H₂O vapor are formed</p>	<p>Ammonium salts are ionic in nature and thermally decompose easily</p>
<p>47. BaC₂O₄ do not dissolve in water but dissolve in dilute acids</p>	<p>C₂O₄²⁻ ions are removed as H₂C₂O₄ in acidic medium</p>
<p>48. Correct order of increasing acidity of hydrogen halide is HF < HCl < HBr < HI</p>	<p>Correct order of increasing bond length of hydrogen halide is HF < HCl < HI < HBr</p>
<p>49. H₂S has the minimum boiling point out of H₂O, H₂S, H₂Se and H₂Te</p>	<p>Secondary interactions among H₂S molecules are weaker compared to that in water</p>
<p>50. Silver mirror is formed when C₆H₅-C≡C-H react with ammoniacal AgNO₃</p>	<p>Silver mirror is formed as a result of reduction of Ag⁺ ion.</p>

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G.C.E. Advanced Level Examination 2023
Sripalee College - Horana

First Term test - 2023 April

Chemistry

II

02

S

II

Three hours

- Answer all questions.

Part B - Essay

05. (a) Using below given data draw a Born - Haber cycle to calculate standard Lattice formation enthalpy

$\Delta H_f^\circ(\text{Ca}_{(s)})$	= 178 kJ mol ⁻¹
$\Delta H_f^\circ(\text{Ca}_{(aq)})$	= 59.1 kJ mol ⁻¹
$\Delta H_f^\circ(\text{Ca}^{2+}_{(aq)})$	= 1145 kJ mol ⁻¹
$\Delta H_f^\circ(\text{Cl}_{2(g)})$	= 242 kJ mol ⁻¹
$\Delta H_{\text{EG}}^\circ(\text{Cl}_{(aq)})$	= -349 kJ mol ⁻¹
$\Delta H_f^\circ(\text{CaCl}_{2(aq)})$	= -795 kJ mol ⁻¹

(b) Write balanced equations to show following enthalpy changes.

- i. Standard enthalpy change of hydration of sodium ion.
- ii. Standard lattice formation enthalpy change of Lithium Fluoride.

iii. Standard enthalpy change of combustion of $\text{CH}_3\overset{\text{O}}{\parallel}{\text{C}}\text{CH}_3(l)$

iv. Standard enthalpy change of bond dissociation of fluorine

v. Standard enthalpy change of atomization of chlorine

vi. Standard enthalpy change of vaporization of water

vii. Standard enthalpy change of Sublimation of Iodine

viii. Standard enthalpy change of formation of $(\text{NH}_4)_2\text{SO}_4(s)$.

(c) How would you identify the following two solutions

$\text{Cl}^-(aq)$ solution and $\text{CO}_3^{2-}(aq)$ solution

06. (a) i. NH_3 and $\text{O}_2(g)$ react with each other forming $\text{NO}(g)$ and $\text{H}_2\text{O}(l)$ under standard conditions write balanced chemical equation for this reaction

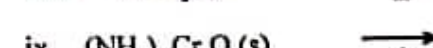
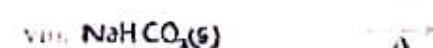
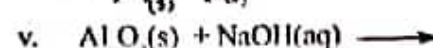
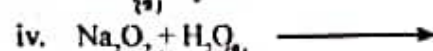
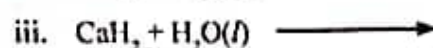
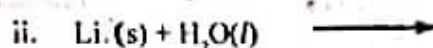
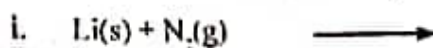
ii. Calculate ΔH_r° for the above reaction

$$H_f^\circ(\text{NH}_3(\text{g})) = 46 \text{ kJ mol}^{-1}$$

$$H_f^\circ(\text{NO}(\text{g})) = 90 \text{ kJ mol}^{-1}$$

$$H_f^\circ(\text{H}_2\text{O}(\text{l})) = -242 \text{ kJ mol}^{-1}$$

(b) Write balanced chemical reactions by identifying the correct products

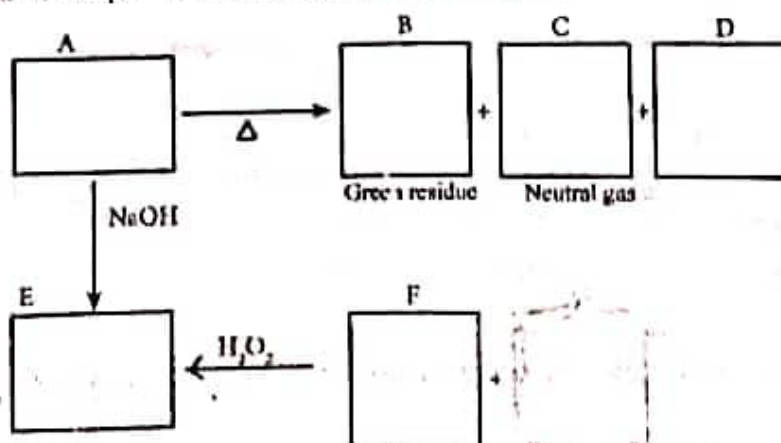


(c) i. Write molecular kinetic equation and identify the terms.

ii. Using ideal gas equation and above equation derive a relationship to calculate r.m.s. speed of a gas.

iii. Using the equation derived in (ii) above calculate $\bar{C}^2_{\text{CO}_2} : \bar{C}^2_{\text{H}_2}$ ($\bar{C}^2_{\text{CO}_2} / \bar{C}^2_{\text{H}_2}$)

07. Reactions of compounds of a 3d element are given below.



i. Identify species from A - F

ii. Write balanced reaction for heating A

iii. Write balanced reaction for F reacting with H_2O_2

iv. Write balanced reaction for A converting to E by adding NaOH

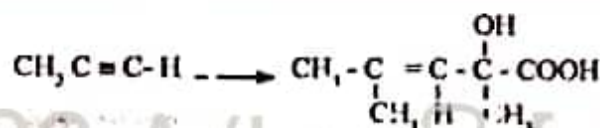
(b) Write Formula of oxides of the third period elements with their highest oxidation states. Classify them considering acidic, basic or amphoteric nature.

(c) Rusted iron nail was treated with excess dilute H_2SO_4 acid and the final volume was brought upto 250 cm^3 by adding water. 25 cm^3 from this solution was taken and reacted with 0.02 mol dm^{-3} $KMnO_4$ solution used volume of $KMnO_4$ was 20 cm^3

Another 25 cm^3 portion from the above solution was taken and SO_2 gas was bubbled initially and excess SO_2 was removed by heating the solution. This solution was ageing titrated with the above $KMnO_4$ solution and its volume was 60 cm^3 .

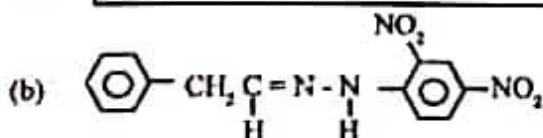
- Write balanced ionic reaction for the reaction between $KMnO_4$ and Fe^{2+} .
- Calculate mass of Iron which did not undergo rusting.
- Calculate mass of Iron which undergo rusting.
- Calculate total mass of iron nail.

08. (a) Carry out the following conversion using the below given reagents by not exceeding 5 steps.



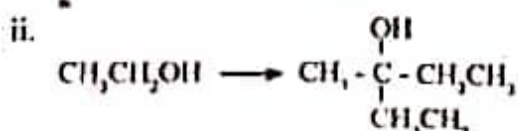
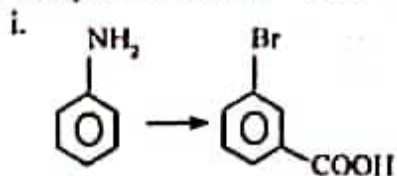
List of reagents

HCN , dilute H_2SO_4 , $NaOH$, H_2O , HCN , H_2SO_4



- Identify the reactants needed to synthesize the above compound.
- What is the colour of the above compound
- The product obtained in above part (i) is used to identify an important group of compound in inorganic chemistry. What is that important type of compound.
- What is the name of the reagent used to identify the above important group of compound.

(c) Complete the below conversions by not exceeding 4 steps.



iii. Acidity of phenol is higher than that of alcohols Explain this