Name:……

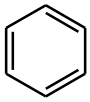
1. Complete the following equations and write the accepted mechanism for the reaction in each case.

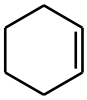
a. $CH_3\underset{Br}{C}H\underset{Br}{C}HCH_3 \xrightarrow[Heat]{CH_3CH_2O^-/CH_3CH_2OH}$

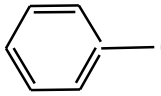
b. $(CH_3)_2\overset{Cl}{C}CH_2CH_3 \xrightarrow[Heat]{NaOH}$

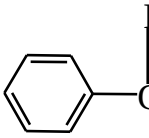
c. $CH_3HC{=}CH_2 \xrightarrow{H^+/H_2O}$

d. $CH_3CH_2CH_2OH \xrightarrow[180°C]{Conc.H_2SO_4}$

e.  + $CH_3\overset{CH_3}{C}{=}CH_2 \xrightarrow{H^+}$

f.  $\xrightarrow{HBr}$

g.  $\xrightarrow[Heat]{CH_3CH_2O^-Na^+/CH_3CH_2OH}$

h.  $\xrightarrow[Heat]{EtO^-/EtOH}$

i. $CH_3CH_2Cl + HC{\equiv}C^-Na^+ \xrightarrow{Lig.NH_3}$

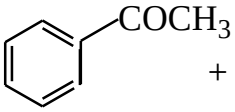
j. $H_2C{=}CH_2 + Cl_2 \xrightarrow[25°C]{CCl_4}$

k. $(CH_3)_3CBr \xrightarrow[Heat]{OH^-_{(aq)}}$

l. $CH_3HC{=}CHCH_3 \xrightarrow{H^+/H_2O}$

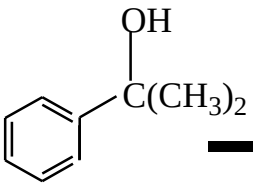
m. $(CH_3)_3CBr + CH_3O^-Na^+ \xrightarrow[Heat]{CH_3OH}$

n. $CH_3CH_2I \xrightarrow[\text{Heat}]{KOH_{(aq)}}$

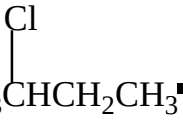
o.  $+ \; NaHSO_3 \longrightarrow$

p.  $+ \; CH_3COCl \xrightarrow{AlCl_3}$

q.  $+ \; CH_3CH_2Br \xrightarrow{AlBr_3}$

r.  $\xrightarrow[\text{Heat}]{Conc.H_3PO_4}$

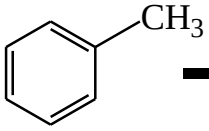
s. $CH_3CH_2OH \xrightarrow[140°C]{Conc.H_2SO_4}$

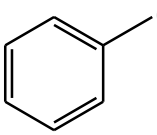
t.  $\xrightarrow[\text{Heat}]{EtO^-/EtOH}$

u. $(CH_3)_3CBr + CH_3CH_2O^-Na^+ \xrightarrow[\text{Heat}]{CH_3CH_2OH}$

v. $CH_3CH_2CHO + HSO_3^-Na^+ \longrightarrow$

x. $CH_3COCH_3 + H_2NNHCONH_2 \xrightarrow{H^+}$

w.  $\xrightarrow[\text{Light}]{Cl_2/U.V}$

y.  $\xrightarrow[\text{Heat}]{NaOH_{(aq)}}$

z.  $+ \; CH_3HC{=}CH_2 \xrightarrow{H^+}$

z.  $+ \; CH_3COBr \xrightarrow{FeCl_3}$

1. $CH_3\underset{\displaystyle OH}{\underset{|}{C}}HCH_3 \xrightarrow[\text{Heat}]{\text{Conc.}H_2SO_4}$

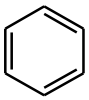
2. $(CH_3)_3COH \xrightarrow[\text{Heat}]{\text{Conc.}H_2SO_{4(l)}}$

3. $(CH_3)_3CBr \xrightarrow[\text{Heat}]{C_2H_5O^-K^+/C_2H_5OH}$

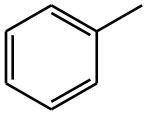
4. $CH_3HC{=}CHCH_3 \xrightarrow{\text{Conc.}H_2SO_4/H_2O}$

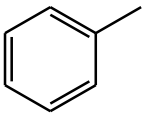
5. $CH_3CHO + NaHSO_3 \longrightarrow$

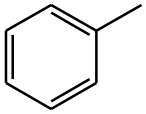
6. $CH_3CH_2CH_2Br + CH_3CH_2O^-Na^+ \xrightarrow[\text{Heat}]{CH_3CH_2OH}$

7.  $+ Br_2 \xrightarrow{Fe_{(s)}/\text{Heat}}$

8.  $+ CH_3HC{=}CH_2 \xrightarrow{H_2SO_4}$

9. $(CH_3)_3C{=}O +$  $\xrightarrow{H^+}$

10. $CH_3CH_2CHO +$  $\xrightarrow{H^+}$

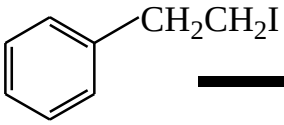
11.  $\xrightarrow[\text{Heat}]{OH^-_{(aq)}}$

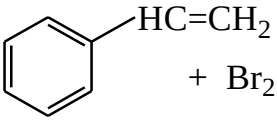
12. $CH_3CH_2CHO + NH_2NH_2 \xrightarrow{H^+}$

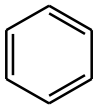
13. $CH_3\underset{\displaystyle OH}{\underset{|}{C}}HCH_3 \xrightarrow[\text{Heat}]{\text{Conc.}H_2SO_4}$

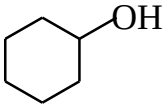
14. $CH_3HC{=}CHCH_3 \xrightarrow{Cl_2/H_2O}$

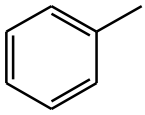
15. $(CH_3)_2C=CH_2 + I_2 \xrightarrow[25°C]{CCl_4}$

16.  $\xrightarrow{OH^-_{(aq)}}$

17.  $+ Br_2 \xrightarrow[25°C]{CCl_4}$

18.  $+ CH_3COCl \xrightarrow{AlCl_3}$

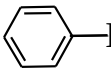
19.  $\xrightarrow[Heat]{Conc.H_3PO_4}$

20. $CH_3COCH_2CH_3 +$  $\xrightarrow{H^+}$

21.  $\xrightarrow{Cl_2/Fe}$

22.  $\xrightarrow{Br_2/FeBr_3}$

23. $CH_3\underset{\displaystyle CH_3}{\overset{|}{C}}=CHCH_3 + Conc.H_2SO_4 \xrightarrow[Warm]{H_2O}$

24.  $\xrightarrow{Br_2/H_2O}$

25. $CH_3BrCH_2Br \xrightarrow[Heat]{Excess\ KOH_{(aq)}/EtOH}$

26. $CH_3HC=CH_2 + Cl_2 \xrightarrow[25°C]{CCl_4}$

27. $CH_3HC=CH_2 + Br_2 \xrightarrow{H_2O}$

28.  $+ H_2C=CH_2 \xrightarrow{H^+}$

29. $(CH_3)_2\overset{I}{C}CH_2CH_3 \xrightarrow[Heat]{NaOH_{(aq)}}$

30. $(CH_3)_2C{=}CH_2 \xrightarrow{MnO_4^-/H_2O}$

31. $CH_3CH_2CH_2Cl \xrightarrow[Reflux]{NaOH_{(aq)}}$

32. $(CH_3)_3CBr + CH_3OH \xrightarrow[Heat]{KOH_{(aq)}}$

33. $CH_3CH_2CH_2Br + NaOH_{(aq)} \xrightarrow[Heat]{EtOH}$

34. $CH_3CHCH_2CH_3 \xrightarrow[Heat]{EtO^-/EtOH}$

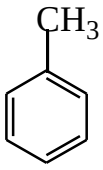
35. $CH_3COCH_3 + NH_2OH \xrightarrow{H^+}$

36. $CH_3COCH_3 + NaHSO_3 \longrightarrow$

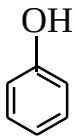
37. $2CH_3CHO + NaOH_{(aq)} \longrightarrow$

38. $CH_3C{\equiv}CH + \text{Excess HCl} \longrightarrow$

39. $C_6H_5NH_2 + CH_3COCl \xrightarrow{FeBr_3}$

40.  $+ \quad CH_3COCl \xrightarrow{AlCl_3}$

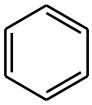
41. $CH_3CH_2OH \xrightarrow[O°C]{Conc.H_2SO_4}$

42.  $\xrightarrow{CH_3COCl/NaOH_{(aq)}}$

43. $CH_3CH_2COOH + CH_3COCl \longrightarrow$

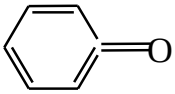
44. $CH_3CH_2COOH + CH_3OH \xrightarrow{H^+}$

45. $2CH_3COCH_3 \xrightarrow[Warm]{Dil.\ NaOH}$

46.  + Conc.HNO_3 $\xrightarrow[55°C]{Conc.H_2SO_4}$

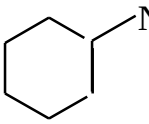
47. $CH_3CH_2CH_2OH$ $\xrightarrow[Heat]{Conc.H_3PO_4}$

48. $CH_3COOCH_3 + H_2O$ $\xrightarrow{OH^-_{(aq)}}$

49.  $\xrightarrow{KCN/CH_3COOH}$

50. $CH_3COCH_3 + HCN_{(aq)}$ $\longrightarrow$

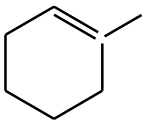
51. $(CH_3)_3COH + Conc.HCl$ $\xrightarrow{Anhyd.ZnCl_2}$

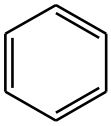
52.  + CH_3COCl $\longrightarrow$

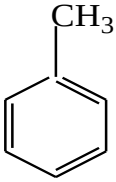
53. $(CH_3)_3COH + HCl$ $\longrightarrow$

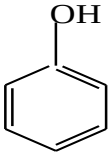
54. $(CH_3)_3CHCH_3$ (OH) $\xrightarrow[Heat]{Conc.H_3PO_4}$

55. $CH_3CH_2HC{=}CH_2$ $\xrightarrow[Heat\ or\ Light]{HBr/ROOR}$

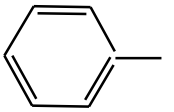
56.  (CH_3) $\xrightarrow{Cl_2/H_2O}$

57.  + CH_3CH_2COCl $\xrightarrow[40°C]{AlCl_3/CS_2}$

58.  (CH_3) + Conc.HNO_3 $\xrightarrow[Heat]{Conc.H_2SO_4}$

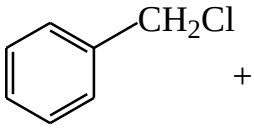
59.  (OH) + Conc.HNO_3 $\xrightarrow{Conc.H_2SO_4}$

60. $CH_3COCH_3 \xrightarrow[Dil.H_2SO_4]{NaCN/H_2O}$

61.  $+ \; KCN \longrightarrow$

62. $CH_3COCl \; +$  $\xrightarrow[50°C]{FeCl_3}$

63. $CH_3HC{=}CH_2 \xrightarrow[Cold]{MnO^-_{(aq)}/OH_{(aq)}}$

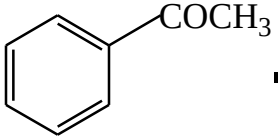
64.  $+ \; CH_3C{\equiv}CH \xrightarrow{Na_{(s)}/Liq.NH_3}$

65. $CH_3CHO \xrightarrow[H^+/H_2O]{CH_3CH_2MgCl/Ether}$

66. $CH_3COCH_3 \xrightarrow[H^+/H_2O]{CH_3CH_2MgCl/Ether}$

67. $CH_3\underset{\displaystyle OH}{\underset{|}{C}}HCH_3 \xrightarrow[Heat]{I_2/NaOH}$

68. $CH_3CH_2MgBr + CO_{2(s)} \xrightarrow{H^+/H_2O}$

69.  $\xrightarrow[Heat]{NH_2OH/H^+}$

70. $H_2C{=}CH_2 + H_2O \xrightarrow[60°C]{H_2SO_4/HgSO_4}$

71. $CH_3\underset{\displaystyle Br}{\underset{|}{C}}H\underset{\displaystyle Br}{\underset{|}{C}}HCH_3 \xrightarrow[Heat]{NH_2OH/H^+}$

72. $CH_3COCl + CH_3NH_2 \longrightarrow$

73. $CH_3CH_2COCl + NH_3 \longrightarrow$

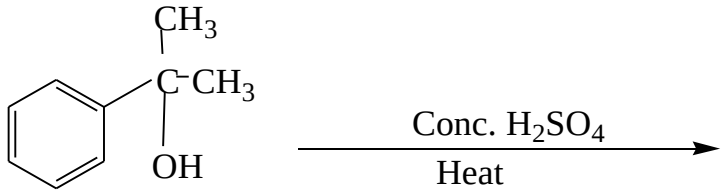
74. $CH_3CH_2COCl + CH_3COO^-Ag^+ \longrightarrow$

75. $(CH_3CH_2)_2CO \xrightarrow{NH_2OH}$

76. 

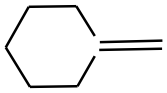
76. $CH_3COBr \xrightarrow[\text{Reflux}]{CH_3CH_2NH_2}$

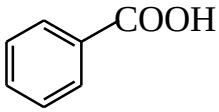
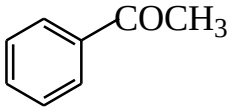
77. $CH_3COCCH_3 + CH_3CH_2OH \longrightarrow$

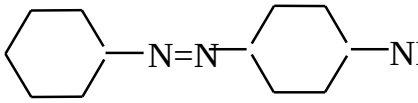
78. 

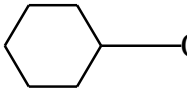
2. Show how the following conversion can be effected and in each case, indicate the reagents and conditions for the reactions.

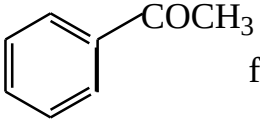
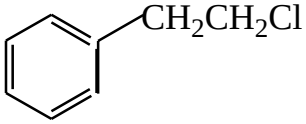
1. $(CH_3)_3CHOH$ from ethene
2. $(CH_3)_3CHOH$ from CH_3CH_2Br
3. $CH_3CH_2CH_2NH_2$ from pentene
4. Phenol from 2-phenylpropane
5. Benzene from phenylmethanol
6. $CH_3CH_2CH_2COOH$ from propan-1-ol
7. Ethanoylchloride from ethane
8. Phenylbenzoate from phenylamine
9. Phenol from nitrobenzene
10. $CH_3CH_2NH_2$ from $CH_3CH_2CH_2Cl$
11. CH_3CH_2OH from CH_3CH_2COCl
12. CH_3CH_2COOH from CH_3CH_2OH
13. CH_3COCH_3 from $CH_3CH_2CH_2OH$
14. But-2-yne from propene
15. Ethene from propan-2-ol
16. $CH_3CH_2OCH_2CH_3$ from ethane
17. Propene from acetic acid
18. $CH_3CONHCH_2CH_3$ from CH_3Br
19. Cyclohexene from aminobenzene
20. $CH_3CH_2NH_2$ from CH_3CH_2COOH
21. Phenylamine from benzoic acid
22. Phenylmethanol from benzene
23. $(CH_3)_2C=NOH$ from ethanol

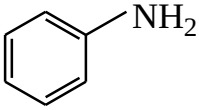
25.  from Cyclohexene

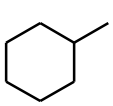
26.  from 

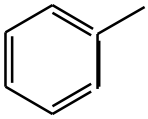
27.  from Benzene

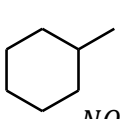
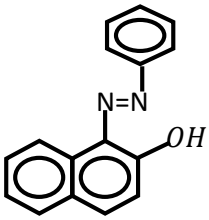
28.  from Benzene

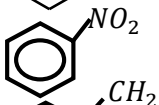
29.  from 

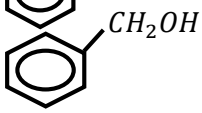
30.  from 

31.  from 

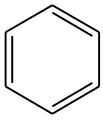
32.  from Benzaldehyde

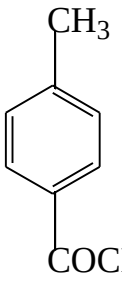
33.  from Cyclohexene 

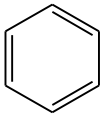
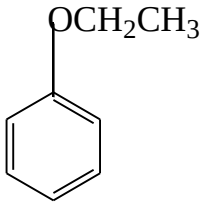
34.  to

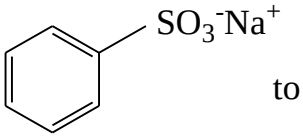
35.  to 

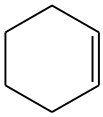
36. $(CH_3)_2CHBr$ to $(CH_3)_2C = N - OH$

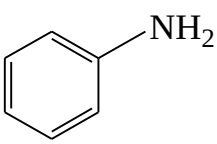
37.  from $CaCO_3$

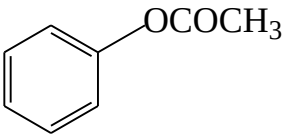
38. CaO to 

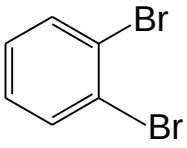
39.  to 

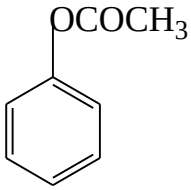
40. 

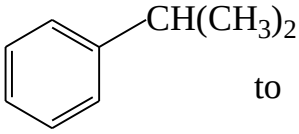
to 

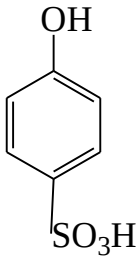
41. 

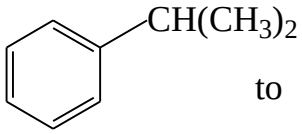
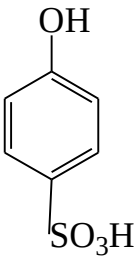
to 

42. BrCH$_2$CH$_2$Br to 

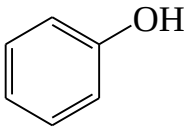
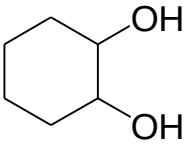
43. CH$_3$HC=CH$_2$ to 

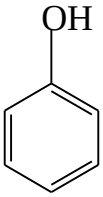
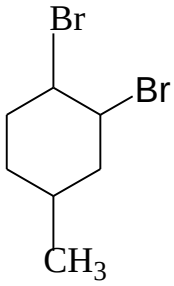
44. 

to 

44.  to 

45. CH_3CHCH_3 (OH) to CH_3CCOOH (OH, CH_3)

46.  to 

47.  to 

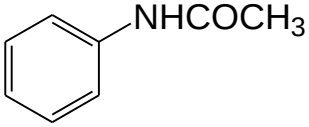
48. CaC_2 to CH_3CCH_3 (Cl, Cl)

49. $CH_3HC{=}CH_2$ to $CHCl_3$

50. Fuming sulphuric acid to cyclohexanol

51. $CH_3HC{=}CH_2$ to CH_3CH_2COOH

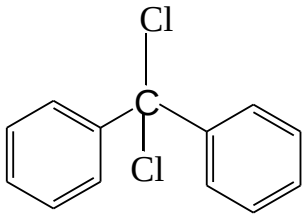
52. Propan-1-ol to Tri-iodomethane

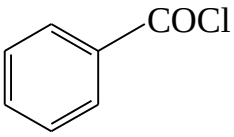
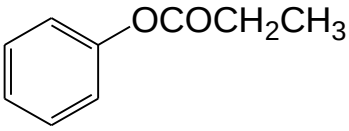
53. CH_3CH_2Br to 

54. CH_3CH_2OH to Cyclohexanone

55. Cyclohexene to Cyclohexanone

56. CH_3CHO to C_2H_2

57.  from Calcium benzoate

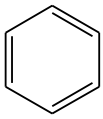
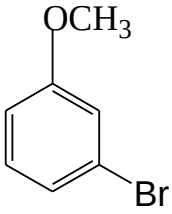
58.  to 

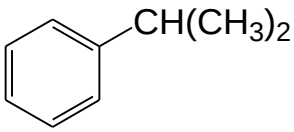
59. 2-methylpropene from 1, 2-dibromopropane

60. Cyclohexene from 2-phenylpropane

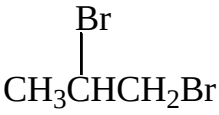
61. Ethyne to Benzaldehyde

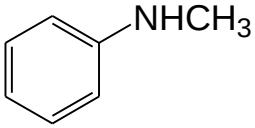
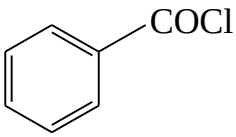
62. Bromobenzene to Benzoic acid

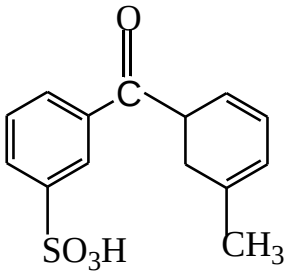
63.  to 

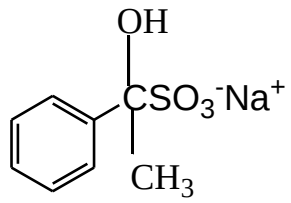
64. CH_3COCH_3 from 

65. Nylon 6, 6 from phenol

66. 2-methylpropene from 

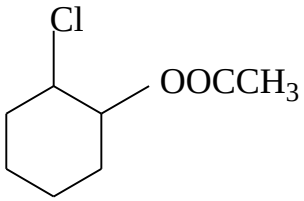
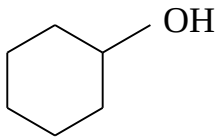
67.  from 

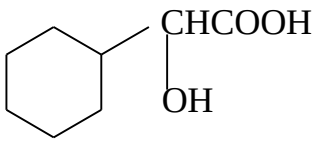
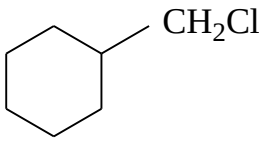
68.  from Ethene

69.  from Ethanol

70. $CH_3CH_2OCH_2CH_3$ from $Ca(CH_3COO)_2$

71. Nitrobenzene to Iodobenzene

72.  from 

73.  from 

3. Name the reagents used to distinguish between each of the followings and in each case, state what would be observed and write equations of reactions where possible.

Part A Inorganic branch of chemistry:

1) Br^- and I^-

Reagent: Lead (II) nitrate solution

Observation:

- ✓ Pale yellow precipitate is formed with bromide, Br^- ion.
- ✓ Bright yellow precipitate is formed with iodide, I^- ion.

2) Zn^{2+} and Al^{3+}

Reagent: Aqueous Ammonia solution

Observation:

- ✓ White precipitate soluble in excess aqueous ammonia solution forming a colourless solution with zinc, Zn^{2+} ion.
- ✓ White precipitate insoluble in excess aqueous ammonia solution is formed with Aluminium, Al^{3+} ion.

3) Fe^{3+} and Cr^{3+}

Reagent: Aqueous sodium hydroxide solution.

Observation:

- ✓ A brown precipitate insoluble in excess aqueous sodium hydroxide solution is formed with iron, Fe^{3+} ion.
- ✓ A green precipitate is soluble in excess aqueous sodium hydroxide solution is formed with chromium, Cr^{3+} ion.

4) Mg^{2+} and Ba^{2+}

Reagent: Dilute sulphuric acid.

Observation:

- ✓ No observable change occurs with magnesium, Mg^{2+} ion.
- ✓ A white precipitate is formed with barium, Ba^{2+} ion.

5) Fe^{3+} and Fe^{2+}

Reagent: Potassium hexacyanoferrate (II) solution.

Observation:

- ✓ Deep blue precipitate is formed with iron, Fe^{3+} ion.
- ✓ No observable change occurs with iron, Fe^{2+} ion.

6) Pb^{2+} and Zn^{2+}

Reagent: Potassium iodide solution.

Observation:

- ✓ Yellow precipitate is formed with lead (II), Pb^{2+} ion.
- ✓ Yellow solution is formed with zinc (II), Zn^{2+} ion.

7) FeO and NiO

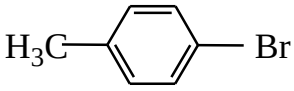
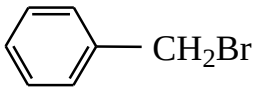
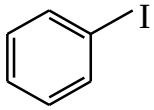
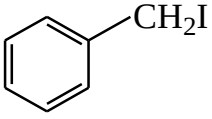
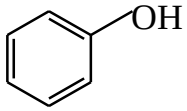
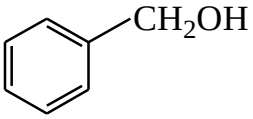
Reagent: Dilute nitric acid followed by potassium hexacyanoferrate (III) solution

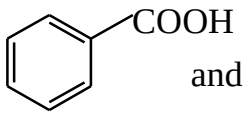
Observation:

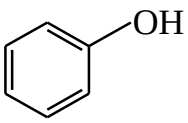
- ✓ Dark blue precipitate is formed with iron (II) oxide.
- ✓ No observable change occurs with nickel (II) oxide.

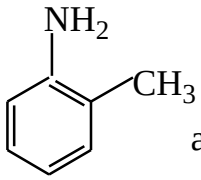
1. Ni^{2+} and Cr^{3+}
2. Ca^{2+} and Ba^{2+}
3. Ca^{2+} and Mg^{2+}
4. Al^{3+} and Pb^{2+}
5. Sn^{4+} and Sn^{2+}
6. Pb^{2+} and Ag^{+}
7. Mn^{2+} and Pb^{2+}
8. SO_4^{2-} and SO_3^{2-}
9. CO_3^{2-} and Cl^-
10. HCO_3^- and CO_3^{2-}
11. Cl^- and F^-
12. NO_3^- and NO_2^-
13. SO_3^{2-} and $S_2O_3^{2-}$
14. $C_2O_4^{2-}$ and HCO_3^-
15. Br^- and Cl^-

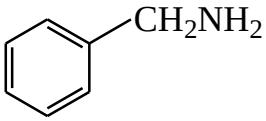
Part B Organic branch of chemistry:

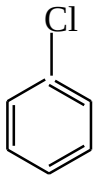
16. $HCOO^-$ and CH_3COO^-
17. $CH_3CH_2COCH_2CH_3$ and $CH_3CH_2CH_2COCH_3$
18. CH_3CHO and CH_3CH_2CHO
19. $CH_3CH_2NH_2$ and $CH_3CH_2NHCH_3$
20. $CH_3(CH_2)_3OH$ and $(CH_3)_3COH$
21. $CH_3CH_2CH_2OH$ and $CH_3CH(OH)CH_3$
22. $CH_3CH_2CH_2I$ and $CH_3CH_2CH_2Cl$
23. C_6H_5CHO and $C_6H_5CH_2CHO$
24. CH_3CH_2COOH and CH_3COOCH_3
25. $CH_3CH_2COCH_2CH_3$ and $CH_3COCH_2CH_3$
26. C_6H_5CHO and $C_6H_5CH_2COCH_3$
27. CH_3OH and CH_3CH_2OH
28. HCOOH and CH_3COOH
29. CH_3CHO and CH_3CH_2CHO
30. Ethene and Ethyne
31. Propan-1-ol and 2-Methylpropan-2-ol
32.  and 
33.  and 
34.  and 

35. 

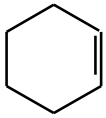
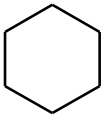
and 

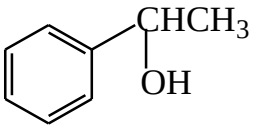
36. 

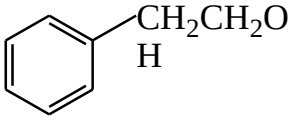
and 

37. 

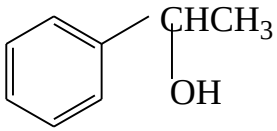
and $CH_3CH_2CH_2Cl$

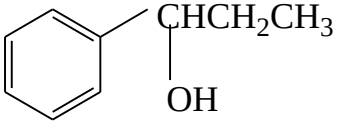
38. 
and 

39. 

and 

40. $HCOOH$ and $(HCOOC)_2$

41. 

and 

42.

4. Write the half-cell equations for the followings conversions from 01 to 06 while 07 to 15 complete the half-cell equations.

1. $S_2O_8^{2-}$ to SO_4^{2-}
2. SO_3^{2-} to SO_4^{2-}
3. NO_2^- to NO_3^-
4. Mn^{2+} to MnO_2^-
5. MnO_2^- to MnO_4^{2-}
6. Mn^{2+} to MnO^{2-}
7. $S_2O_8^{2-}$ + I^-
8. Mn^{2+} + $S_2O_8^{2-}$
9. Sn^{2+} + $S_2O_8^{2-}$
10. Fe^{2+} + $S_2O_8^{2-}$
11. Cl^- + SO_3^{2-}
12. Fe^{3+} + SO_3^{2-}
13. $Cr_2O_7^{2-}$ + SO_3^{2-}
14. MnO_4^- + SO_3^{2-}
15. $Cr_2O_7^{2-}$ + NO_2^-

5. Write the names of the following compounds and state their oxidation states and coordination numbers.

Structres	Names	O.S	C.N
$[Co(H_2O)_6]^{3+}$			
$[Fe(CN)_6]^{3-}$			
$Na_2[Fe(CN)_5NO]2H_2O$			
$[Fe(CO)_5$			

Structures	Names	O.S	C.N
$[Cu(NH_3)_4]^{2+}$			
$[Cr(H_2O)_4(NH_3)_2]^{3+}$			
$[Pt(NH_3)_2NO_2Cl]^{2+}$			
$[Co(NH_3)_5SO_4]Br$			
$[Cu(NH_3)_4(H_2O)]SO_4$			
$[Cr(H_2O)_6]Cl$			
$[Co(NH_2CH_2CH_2NH_2)_3]Cl_3$			
$[Cu(CN)_4]^{3-}$			
$[Cu(NH_3)_2(H_2O)_2]^{2+}$			
$[Co(NH_3)_6]^{3+}$			
$[SiF_6]^{2-}$			
$[SnCl_6]^{2-}$			
H_2SiF_6			
$[Fe(CN)_5NO]^{-}$			
$[Pt(NH_3)(NO_2)Cl]^{2+}$			
$[CrCl_2(H_2O)]^{+}$			
$[Co(NH_3)_5Br]^{2+}SO_4^{2-}$			
$[Co(NH_3)_5SO_4]^{+}Br^{-}$			
$[Ni(NH_3)_6]^{2+}$			
$[Ag(NH_3)_2]^{+}$			
$[Cu(H_2O)_4]^{2+}$			
Al_4^{-}			
$[Fe(CN)_6]^{2+}$			
$[Fe(CN)_6]^{4-}$			
$[Zn(NH_3)_4]^{2+}$			
$[Zn(OH)_4]^{2-}$			
$[Zn(CN)_4]^{2-}$			
$[Zn(H_2O)_6]^{2+}$			
$[Cu(H_2O)_6]^{2+}$			
$[Cu(NH_3)_2]^{+}$			
$[CuCl_4]^{2-}$			
$[NiCl_4]^{2-}$			
$[Ni(H_2O)_6]^{2+}$			
$[Co(H_2O)_6]^{2+}$			
$[Co(CN)_6]^{3-}$			
$Na_3[Co(NO_2)_6]$			
$K_3[Co(NO_2)_6]$			
$[CoCl_4]^{2-}$			
$[Co(CN)_6]^{3-}$			
$[Co(NH_3)_6]^{2+}$			

END SUCCESS