



தொண்டைமாளாறு வெளிக்கள நிலையம் நடாத்தும்
முன்றாம் தவணைப் பரீட்சை - 2022
Conducted by Field Work Centre, Thondaimanaru.
3rd Term Examination - 2022

இரசாயனவியல்
Chemistry

I
I

One Hour

Gr -12 (2022)

02

E

I

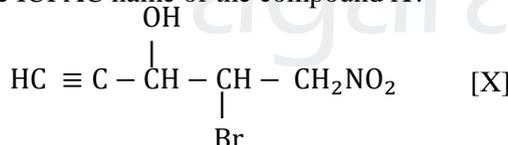
Part - I

$$N_A = 6.022 \times 10^{23} \text{ mol}^{-1} \quad h = 6.626 \times 10^{-34} \text{ Js} \quad C = 3 \times 10^8 \text{ ms}^{-1} \quad R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$$

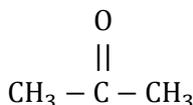
- 1) Identify the incorrect statement from the following
1. Wave nature of electrons has been shown by diffraction experiments.
 2. Atoms absorb or emit radiation in the form of definite small quantities and the smallest quantify is referred to as a photon
 3. The nuclear charge felt by the valence electron in a K atom is less than 19.
 4. Two electrons in an orbital must have opposite spins as deduced from Pauli exclusion principle
 5. The filling of electrons into orbitals of equal energy is governed by Aufbau principle.

- 2) Elements that, quantum number set (4, 0, 0, +1/2) and (3, 0, 0, +1/2) relevant to electron in the last sub energy level are respectively.
1. Na and Mg
 2. Al and Zn
 3. Cr and Na
 4. K and Li
 5. K and P

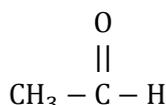
- 3) What is the IUPAC name of the compound X?



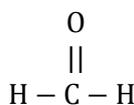
1. 1 - nitro - 2 - bromo - 1 - pentynol
 2. 1 - nitro - 2 - bromo - 4 - pentyn - 3 - ol
 3. 2 - bromo - 1 - nitro - 4 - pentyn - 3 - al
 4. 4 - bromo - 5 - nitro - 1 - pentyn - 3 - ol
 5. 4 - bromo - 5 - nitro - 1 - pentyn - 3 - al
- 4) When a 4 g mixture of sodium carbonate and sodium hydrogen carbonate was heated the mass lost was 0.62 g. The mass percentage of sodium carbonate in the mixture is (Na - 23, C - 12, H - 1, O - 16)
1. 79
 2. 42
 3. 58
 4. 84
 5. 21
- 5) What is correct decreasing order of tendency to under go nucleophilic addition reaction in the following compounds.



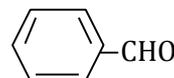
(a)



(b)



(c)



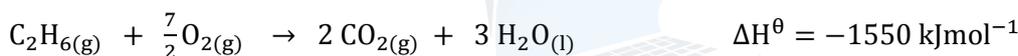
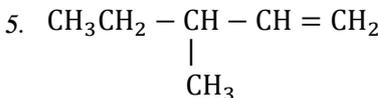
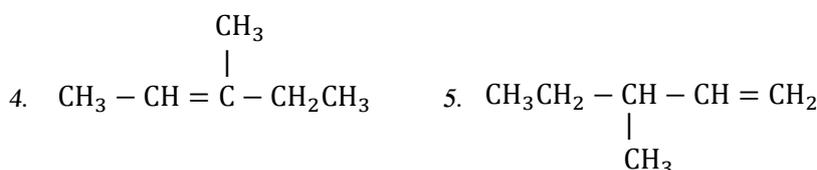
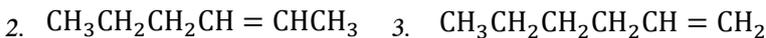
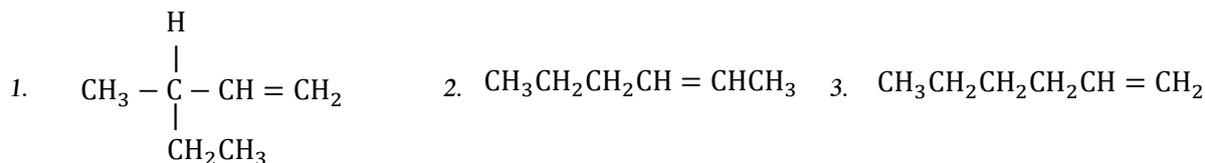
(d)

1. a > b > c > d
2. d > c > b > a
3. a > b > d > c
4. c > a > b > d
5. c > b > a > d

6) A salt containing one type of. Its anion gives a coloured gas when reacted with dil HCl. This gas undergoes disproportionation reaction with water. Which is the suitable anion.

1. $S_2O_3^{2-}$ 2. S^{2-} 3. SO_3^{2-} 4. NO_3^- 5. NO_2^-

7) Molecular formula of compound A is C_6H_{12} . It reacts with Cl_2 / CCl_4 to form compound B with molecular formula $C_6H_{12}Cl_2$. When B is heated with an alcoholic KOH, compound with molecular formula C_6H_{10} is formed, which does not show optical isomerism and reacts with $NH_3 / AgNO_3$ to give a white precipitate. The compound A can be



Using the above data, the calculated standard formation enthalpy change of $H_2O(l)$

1. -286 kJmol^{-1} 2. -267 kJmol^{-1} 3. 286 kJmol^{-1}
4. -176 kJmol^{-1} 5. -394 kJmol^{-1}

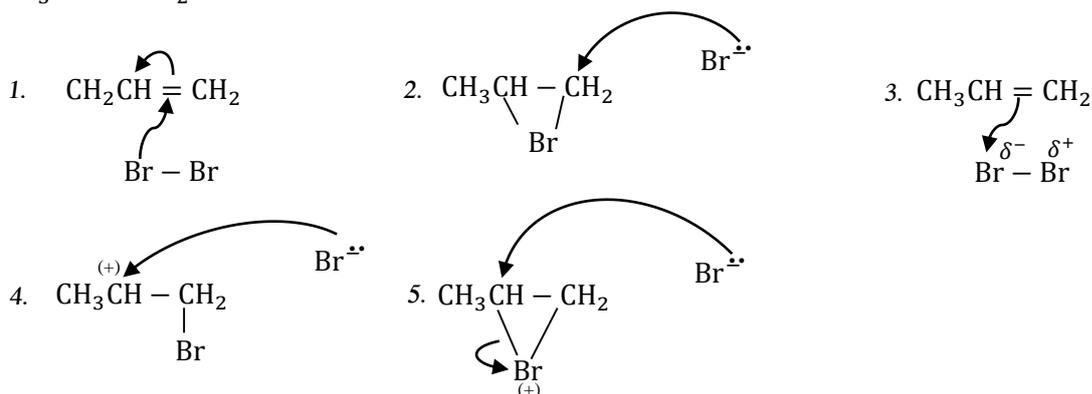
9) O_2 gas formed by the thermal decomposition of $NaNO_3$ is collected by downward displacement of water. The volume of O_2 gas collected in such an experiment at $27^\circ C$ and $1.44 \times 10^5 \text{ Pa}$ pressure was 300 cm^3 . Given that the saturated vapour pressure of water is $0.04 \times 10^5 \text{ Pa}$ at 300 K . The decomposition mass of $NaNO_3$ is [Na - 23, N - 14, O - 16]

1. 2.85 g 2. 1.95 g 3. 2.74 g 4. 2.52 g 5. 2.68 g

10) Identify the incorrect statement from the following

- Aluminium chloride satisfies the octet rule in the gaseous state.
- All elements in group 2 react with $N_2(g)$.
- The density of diamond is higher than the density of graphite.
- $HOCl, HClO_2, HClO_3, HClO_4$ oxo acids contain at least one double bond.
- Dilution of $SbCl_3(aq)$ solution with water gives a white precipitate.

11) Which of the following best represents the step in the mechanism of addition of Br_2 to an $\text{CH}_3\text{CH}=\text{CH}_2$?



12) The reaction between CH_4 and Br_2 is directed effected in the presence of sunlight Br_2 molecule is dissociated to Br atom by the sunlight

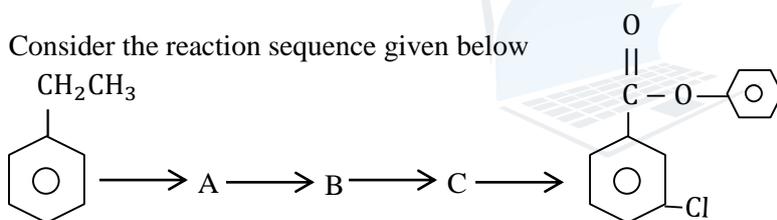


The wave length of the sunlight used in the above dissociation (in nm)

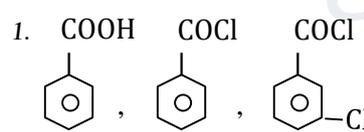
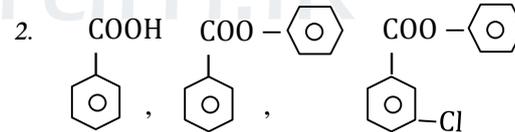
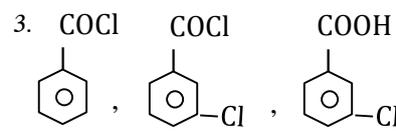
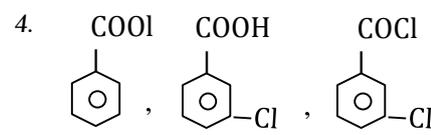
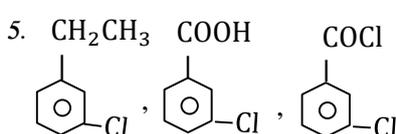
$$[h - 6 \times 10^{-34} \text{Js} \quad c - 3 \times 10^8 \text{ms}^{-1} \quad N_A - 6 \times 10^{23} \text{mol}^{-1}]$$

1. 568 2. 550 3. 600 4. 580 5. 450

13) Consider the reaction sequence given below



Which answer in the following shows the most appropriate structures for A, B, C respectively?

1. 
2. 
3. 
4. 
5. 

14) When sample of yellow solid G is dissolved in water, a coloured solution is formed. When few drops of con HCl are added to this aqueous solution, a yellow colour solution is formed. Blue colour precipitate is formed when $\text{NH}_3(\text{aq})$ solution is added to the solution G. This precipitate dissolves in excess $\text{NH}_3(\text{aq})$ to form deep blue colour solution K. The compound K can be

1. $[\text{Cu}(\text{NH}_3)_6]^{2+}$ 2. $[\text{Ni}(\text{NH}_3)_6]^{2+}$ 3. $[\text{Co}(\text{NH}_3)_6]^{2+}$
4. $[\text{Cu}(\text{NH}_3)_4]^{2+}$ 5. $[\text{FeCl}_4]^-$

15) What is the molar ratio between ethanol and KMnO_4 when ethanol is oxidized to acetic acid by KMnO_4 in acidic medium?

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

❖ 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) In which of the following change / changes the sign of ΔH , ΔS and ΔG is correctly designated?

	Reaction	ΔH	ΔS	ΔG
a.	$\text{H}_2\text{O}_{(s)} \rightarrow \text{H}_2\text{O}_{(l)}$	(+) V_e	(+) V_e	(-) V_e
b.	$\text{Li}_2\text{CO}_3(s) \rightarrow \text{Li}_2\text{O}(s) + \text{CO}_2(g)$	(+) V_e	(+) V_e	(+) V_e
c.	$\text{KBr}(s) \rightarrow \text{K}^+_{(aq)} + \text{Br}^-_{(aq)}$	(+) V_e	(-) V_e	(-) V_e
d.	$2\text{N}_2(g) + 3\text{H}_2(g) \rightarrow 2\text{NH}_3(g)$	(-) V_e	(-) V_e	(+) V_e

17) Which of the following statements is / are true for a sample of an ideal gas?

- The average value of the kinetic energies of molecules depends only on temperature.
- Molecules move randomly in straight lines at the same speed.
- The volume of the sample is constant as long as the temperature is kept constant.
- Size of gas molecules is negligibly small compared to the distance between them.

18) Which of the following statement / statements is / are correct with regard to simple covalent molecules containing oxygen and sulphur atoms?

- Both H_2O_2 and H_2S have the capacity to act as reducing agents.
- SO_2 can act as an oxidizing and a reducing agent.
- The boiling point of H_2O is higher than the boiling point of H_2O_2 .
- H_2O shows only acidic properties.

19) Which of the following statements regarding benzaldehyde is / are incorrect?



- All carbon atoms lie in the same plane.
- All atoms are Sp^2 hybridized.
- Lengths of all carbon carbon bonds are equal to each other
- Any $\text{C} - \text{C} - \text{C}$ bond angle is approximately 120° .

20) Consider the following reaction $3 P_{(g)} \rightarrow 2 Q_{(g)}$

P and Q behave as ideal gases. Root mean square speeds and average kinetic energy of P and Q are C_p , C_Q and $\overline{E_p}$, $\overline{E_Q}$ respectively at the particular temperature. Which of the relationship / s is / are correct?

- a) $C_p = C_Q$ b) $\overline{E_p} > \overline{E_Q}$ c) $\overline{E_p} = \overline{E_Q}$ d) $C_p > C_Q$

❖ 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

	First Statement	Second statement
21)	At a given pressure the spontaneity of the reaction between SO_2 and O_2 to give SO_3 dropdown with increasing temperature.	Entropy change of the reaction between SO_2 and O_2 to give SO_3 is negative.
22)	Reactivity of alkali metals with water increases with going down the group	alkali metals are reducing agents
23)	Boiling point $CaF_2 > CaCl_2$	Polarizability of group 17 anions increases down the group
24)	Aryl chloride undergoes nucleophilic substitution reactions more easily than ethyl chloride.	Aryl chloride is an aromatic compound whereas ethyl chloride is not
25)	2 – methylbut – 2 – ene shows diastereoisomerism.	There are two possible structures for 2 – methyl but – 2 – ene which are not mirror image of each other.



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இரசாயனவியல் II A
Chemistry II A

Two Hours and
ten minutes

02

E

II A

Gr -12 (2022)

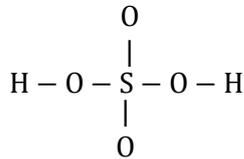
Part – II A

1) A) State whether the following statements are true / false.

- (i) Polarizing ability of group I cations decrease along the group
(ii) O – N – O bond angle of NO₂ is nearly 134°.
(iii) Secondary interaction in aqueous NaCl solution is only ion – dipole interaction
(iv) Electron pair geometry of SF₄ molecule is an irregular tetrahedral.
(v) dipole moment of NH₃ is higher than dipole moment of NF₃.
(vi) Electron affinity energy of N is positive while that of P is negative.

B)

- i) Draw the most acceptable Lewie dot – cross structure of H₂S₂O₃ molecule. Basic skeletal structure is as given below.



.....
.....
.....
.....
.....

2) A) P and Q are elements belonging to same group and in belongs to p – block of the periodic table. P and Q forms the hydrides X and Y respectively by reacting with hydrogen gas. Hydride of P is found in all 3 physical states solid, liquid and gas mean while it has strong hydrogen bond as well.

i) Identify the elements P, Q

P :-

Q :-

ii) Write the chemical formula of compounds X, Y.

X :-

Y :-

iii) Write balanced chemical equations for the following situations to show the function of Y in each

Oxidizing agent :-

Reducing agent :-

iv) Write a balanced chemical equation for laboratory preparation of Y.

.....

v) Give a test to identify gas Y. (Note :- none of the other gases should answer to this test)

.....

.....

.....

vi) Give the major product obtained in reaction of element P with K.

.....

vii) Write the balanced chemical equation for the reaction of compound Z with hot water.

.....

B) The following tests were done to salt A. Salt A has 3 anions. Considering the following observations answer the following questions.

	Test	Obervation
(1)	I. diluted HCl was added.	When the gases evolved a brown coloured gas also evolved. This gaseous mixture the gas had odour.
	II. evolved gas is passed through acidified $K_2Cr_2O_7$	orange solution turned green.
	II. evolved gas is passed over a moist coloured substance.	the substance decolourised.
(2)	I. The salt was dissolved in water and brown ring was done.	brown ring formed
	II. NaOH solution and Al powder were added to the salt and heated	Gas evolved that turns Nessler's reagent to brown colour.
(3)	I. lead acetate was added to the salt.	Yellow coloured precipitate was obtained.
	II. Precipitate was heated and allowed to cool.	the yellow precipitate dissolved and precipitated when cooled.
	II. Cl_2/CCl_4 added.	Organic layer turned violet.

i) Give the gases you would predict to evolve only in experiment (1).

.....

ii) What gases would you predict to be evolved only in experiment (1) I and II.

.....

iii) Predict the gas evolved only in experiment (1) I, II and III what is the anion?

.....

.....

iv) From experiment (2) I, II only, predict the anions in the solution.

.....

v) Predict the anion from experiment (1) – I, (2) I, II (3)

.....

vi) Identify an oxidizing agent that has the ability to oxidize the anion you predicted above.

.....

vii) The formulae of the yellow precipitate obtained in (3) I.

.....

viii) Write the ionic equation for the reaction taking place in (3) II.

.....

ix) From experiment (3) I, II, III, Predict the anion?

.....

x) Give reasons why CCl_4 is being used in experiment (3) III.

.....

.....

.....

3) A) When a student likes to find the neutralization enthalpy in laboratory. The experimental details are given below.

Student Mixes 50 ml of 1.0 M HCl and 50 ml of 1 M NaOH in a calorimeter, the temperature of the resultant solution increases from 21.0 to 27.5°C.

The density of solution is 1gml^{-1} and its specific heat is $4.18\text{Jg}^{-1}\text{K}^{-1}$.

1. Indicate two measurements takes place in this experiment.

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2. Give two apparatus used in this experiment.

.....

3. Calculate the amount of heat released in the process?

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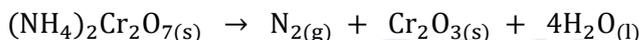
4. Calculate the neutralization enthalpy change for the reaction.

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5. State two assumptions made here?

.....

B) Consider the following chemical reaction. Thermo chemical data at 25⁰C is given below.



Chemical species.	(NH ₄) ₂ Cr ₂ O ₇ (s)	Cr ₂ O ₃ (s)	N ₂ (g)	H ₂ O(l)
Standard enthalpy of formation ΔH_f^θ (kJmol ⁻¹)	-1806	-1140	0	-286
Standard enthalpy ΔH_S^θ (Jmol ⁻¹ K ⁻¹)	336	81	192	70

1. Calculate ΔH^θ for the above reaction at 25⁰C.

.....

2. Calculate ΔS^θ for the above reaction at 25⁰C.

.....

3.

(i) Write down an expression that relates with ΔG , ΔH and ΔS .

.....

(ii) Calculate the ΔG^θ for the above reaction at 25°C .

.....

(iii) State the spontaneity of the reaction with mention the reason.

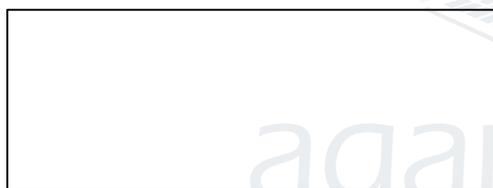
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4. Give the observation when $(\text{NH}_4)_2\text{Cr}_2\text{O}_7(\text{s})$ decomposed?

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4) A) A, B, C and D are four structural isomers with the molecular formula $\text{C}_4\text{H}_{10}\text{Br}$. Only A exhibited optical isomerism (Enantiomers). All four isomers reacted with Alcoholic KOH on hot condition give E, F and G as products respectively. B and C give same product F, when E, F and G were treated with diluted H_2SO_4 , E and G give same product H and F give product I. when B treated with KCN aqueous give stable carbonium ion J as an intermediated.

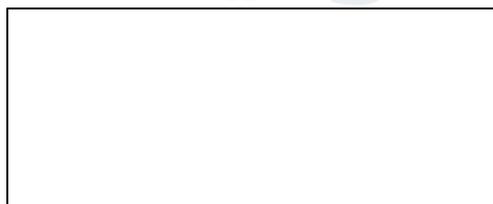
1) Give the structures of A, B, C, D, E, F, G and H.



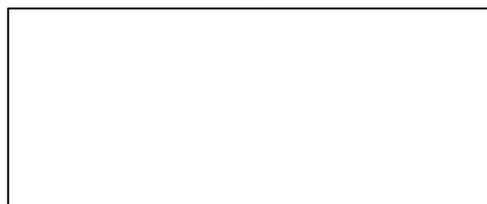
A



B



C



D



E



F

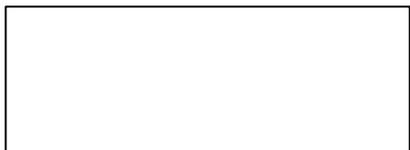


G



H

2) Give the structure of J.



B) Give the structure of the major organic products P, Q, R, S, T, U, V, W, X and Y of the following reactions given below.

(i)	$\text{CH}_3\text{CHO} \xrightarrow{\text{dil NaOH}}$	P :-
(ii)	$\text{CH}_3\text{CH}_2\text{C} \equiv \text{H} \xrightarrow{\text{NaNH}_2}$	Q:-
(iii)	$\text{CH}_3\text{COCH}_3 \xrightarrow[\text{(2) dehydration}]{\text{(1) 2,4 DNP}}$	R:-
(iv)	$\text{CH}_3\text{CH}_2\text{COCl} \xrightarrow[\text{(2) H}_3\text{O}^+]{\text{(1) CH}_3\text{MgBr}}$	S :-
(v)	 $\text{C}_6\text{H}_5\text{OH} \xrightarrow{\text{Br}_2(\text{l})}$	T :-
(vi)	 $\text{C}_6\text{H}_5\text{CHO} \xrightarrow{\text{CH}_3\text{Cl, anhydrous AlCl}_3}$	U :-
(vii)	$\text{CH}_3\text{CH}_2\text{C} \equiv \text{H} \xrightarrow[\text{Quinoline}]{\text{H}_2/\text{Pd, BaSO}_4}$	V :-
(viii)	 $\text{1-Naphthol} \xrightarrow[\text{NaOH(aq)}]{\text{C}_6\text{H}_5\text{N}_2^+\text{Cl}^-}$	W:-
(ix)	$\text{CH}_3\text{CH}_2\text{COOH} \xrightarrow[\text{(2) H}^+ / \text{H}_2\text{O}]{\text{(1) LiAlH}_4}$	X:-
(x)	 $\text{C}_6\text{H}_5\text{N}_2^+\text{Cl}^- \xrightarrow{\text{H}_3\text{PO}_2 / \text{H}_2\text{O}}$	Y:-



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இரசாயனவியல் II B
Chemistry II B

Gr -12 (2022)

02

E

II B

Part – II B

❖ Answer any two questions from this section.

5) A)

1. State Daltons partial pressure law.
2. At 400 K, 2 dm³ rigid container contains H_{2(g)} with pressure 4 x 10⁵Nm⁻² and 500 K, 3 dm³ rigid container contains He gas with pressure 1 x 10⁶Nm⁻². Those containers are connected and allowed to mix completely. Assume both gases behave as ideally. Calculate the followings. (H – 1, He – 4)
 - (i) Initial moles of each gases.
 - (ii) Mole fraction of H_{2(g)}.
 - (iii) Common pressure when containers are connected.
 - (iv) Find the pressure when the temperature of the system raised as 600 K,

B) Using the following data, Arrange them in ascending order of their efficiency of fuel per gram.

	Standard enthalpy of formation ΔH_f^\ominus KJ/mol
CH _{4(g)}	- 75
C ₂ H _{6(g)}	- 84
C ₄ H _{10(g)}	- 126
CO _{2(g)}	- 394
H ₂ O(l)	- 286

- C) 1. Define the standard lattice enthalpy.
 2. Several thermochemical data are given below.

Standard enthalpy of formation of Ba _(g)	=	130 kJmol ⁻¹
Standard enthalpy of atomization I _{2(s)}	=	106 kJmol ⁻¹
Sum of 1 st and 2 nd Ionization enthalpy of Ba _(g)	=	1145 kJmol ⁻¹
Standard enthalpy of hydration of Ba _(g) ²⁺	=	- 1309 kJmol ⁻¹
Standard enthalpy of hydration of I _(g) ⁻	=	- 308 kJmol ⁻¹
Standard enthalpy of first electron gain of I _(g)	=	- 295 kJmol ⁻¹
Standard enthalpy of dissolution of BaI _{2(s)}	=	+ 252 kJmol ⁻¹

- (i) Write suitable equations for each of the above information.
- (ii) Using the above data to calculate the standard enthalpy of formation of BaI_{2(s)}.

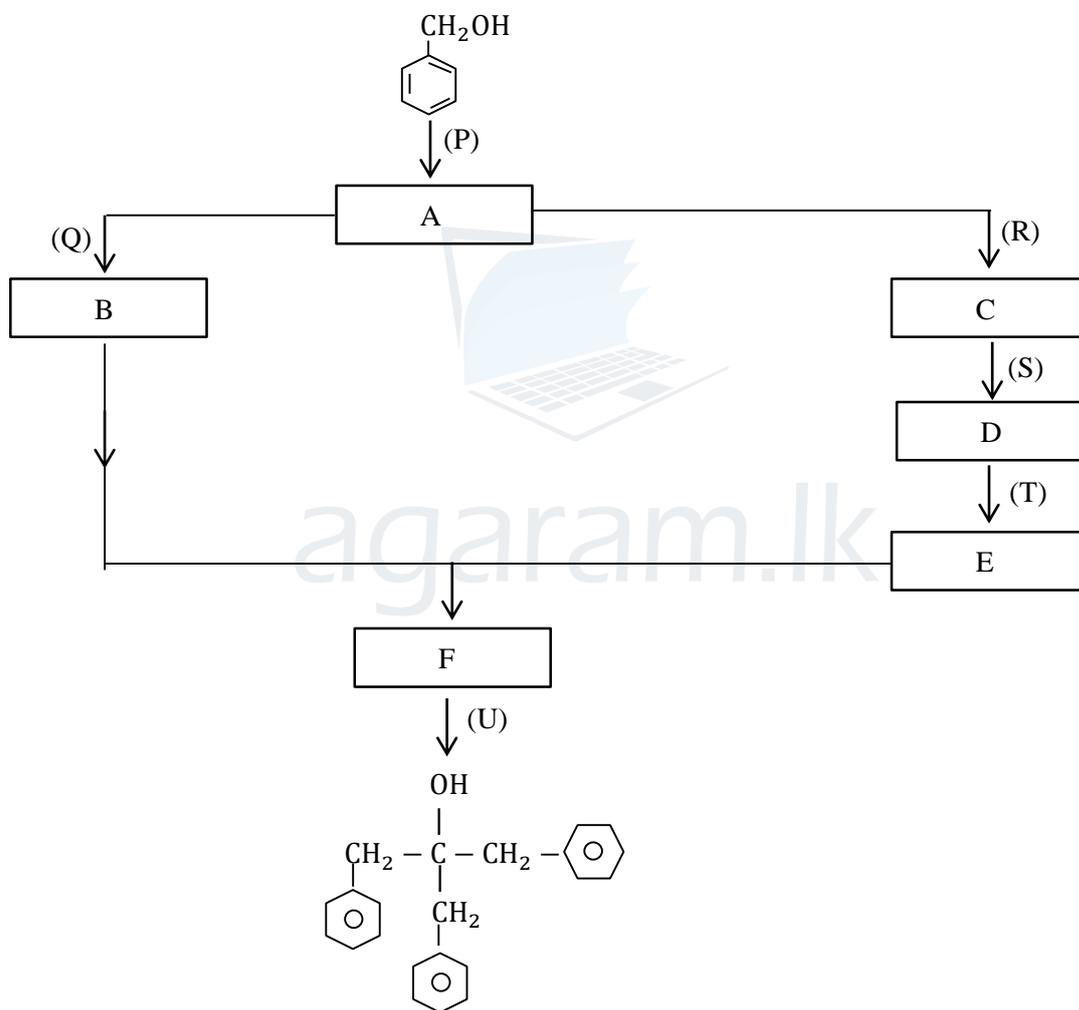
- 6) A) Using C_2H_2 as the only organic starting materials and as reagents only those given in the list, show how you would synthesize the following compound in not more than eight (8) steps.



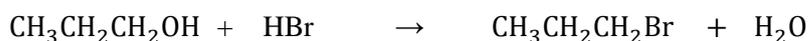
List of reagents.

Conc. H_2SO_4 , H_2O , H_2 , $BaSO_4$, Pd , PCC , quinoline, PCl_5 ,
 $Zn(Hg)$, Conc. HCl , dil $NaOH$, KOH , Alcohols

- B) Identify A, B, C, D, E, F, P, Q, R, S, T and U in order to complete the following reaction scheme.

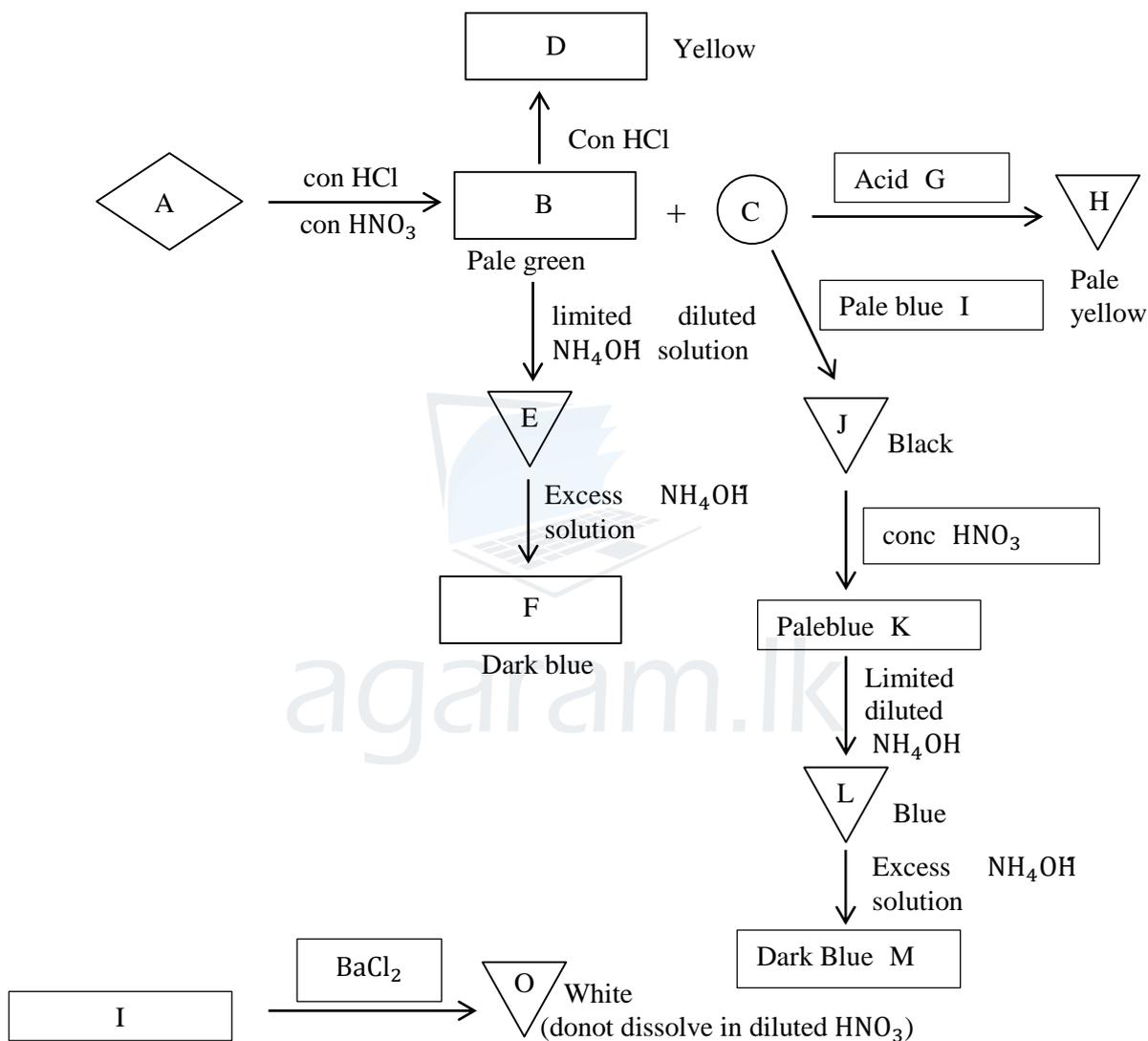
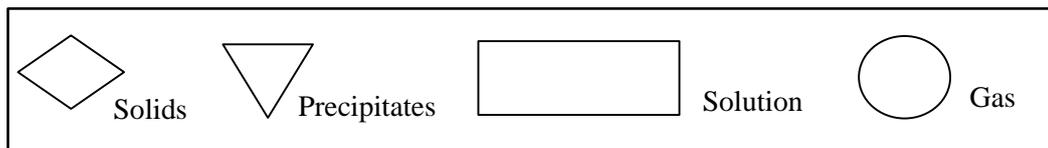


- C) Give the mechanism of the following reaction.



7) A) (1) Write the chemical formulae of substances given in the flow diagram named A – O.

The following shapes are used to denote solid, precipitates, solutions and gases. .



- Write the electronic configuration of the transition element found in I.
- Write the whole ionic equation for the reaction between cation in I and I⁻. Write the observation.
- State whether the action of the cation in the above reaction is oxidation / reduction.

B) An aqueous solution contain Cu^{2+} and H^+ ions only. The following process 1 and 2 are used to calculate the concentration of the above ions.

1. H_2S gas was passed through the 25 cm^3 of Cu^{2+} solution to precipitate. Cu^{2+} ions as CuS . Formed precipitate was filtered and washed with water then filtrate is used in Process 2. This precipitate was added to 0.2 mol dm^{-3} KMnO_4 solution to form Mn^{2+} and SO_4^{2-} ions (assume that all S^{2-} ions in CuS is converted to SO_4^{2-}). 25 cm^3 0.2 mol dm^{-3} Fe^{2+} aqueous solution is needed to titrate excess KMnO_4 in this solution. Calculate the amount of $\text{Cu}_{(aq)}^{2+}$ ions present in the above solution
2. The filtrate which was obtained in process (1) was transferred to the titration flask and it was boiled until H_2S gas was removed from this solution and this solution was allowed to cool. Excess KI and KIO_3 were added to this solution. 30 cm^3 , 0.2 mol dm^{-3} $\text{Na}_2\text{S}_2\text{O}_3$ solution was required to titrate the liberated I_2 . Calculate the concentration of H^+ ions in the above solution.



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