[සියළුම හිමිකම් ඇවිරිණි | All Rights Reserved]

බස්නාහිර පළාත් අධ්‍යාපන දෙපාර්තමේන්තුව
மேல் மாகாணக் கல்வித் திணைக்களம்
Department of Education - Western Province

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය **2026** උපකාරක ප්‍රශ්න පත්‍රය
General Certificate of Education (Adv. Level) Exam

රසායන විද්‍යාව I Chemistry I	**2 E I**	**13** ශ්‍රේණිය **Grade 13**	පැය දෙකයි *Two hour*

Universal gas constant	$R = 8.314\ J\ K^{-1}\ mol^{-1}$	Planck's constant	$h = 6.626 \times 10^{-34}\ J\ s$
Avogadro constant	$N_A = 6.022 \times 10^{23}\ mol^{-1}$	Speed of light	$c = 3 \times 10^{8}\ m\ s^{-1}$

Instructions:

* This question paper has **10** pages.
* A periodic table is provided
* Answer all questions.
* **Use of calculators is not allowed.**
* Write your exam number in the given space on the answer sheet.
* Read the other instructions given at the back of the answer sheet carefully.
* For each question from 1 to 50, select the correct or most appropriate answer from the answers (1), (2), (3), (4), (5) and mark it with a cross (x) as per the instructions on the back of the answer sheet.

1. According to the history of the atom, the scientists who made the following discoveries are respectively?

   a) determination of e / m (charge / mass) ratio of the electron

   b) discovery of the neutron

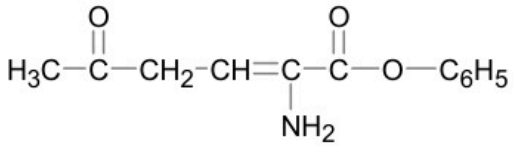
   c) discovery of the mass number

   1)Millikan, Chadwick, Aston
   2)Thomson , Chadwick, Aston
   3)Millikan, Bohr, Mosely
   4)Thomson, Chadwick, Mosely
   5)Thomson, Millikan, Rutherford

2. Which of the following is not a suitable set of quantum numbers for an electron belonging to the Cr^{3+} ion ? (in the order of { n, l, m_l, m_s})

   1) {3, 2, 0, +1/2}
   2) {3, 2, -1, +1/2}
   3) {3, 2, -2, +1/2}
   4) {4, 0, 0, +1/2}
   5) {3, 1, -1, +1/2}

3. What is the correct IUPAC name of the following molecule ?



   1) 2-amino-5-oxophenoate
   2) 2-amino-5-oxo-2-hexenphenoate
   3) hexyl 2-amino-5-oxo-2-hexenphenoate
   4) phenyl 2-amino-5-oxo-2-hexenoate
   5) phenyl 2-amino-5-oxo-2-hexanoate

4. The correct order of increasing radii of Cl^-, O^{2-}, Al^{3+}, Na^+ is?

   1) $Al^{3+} < O^{2-} < Cl^- < Na^+$
   2) $Na^+ < Al^{3+} < O^{2-} < Cl^-$
   3) $Al^{3+} < Na^+ < Cl^- < O^{2-}$
   4) $Al^{3+} < Na^+ < O^{2-} < Cl^-$
   5) $Na^+ < Al^{3+} < Cl^- < O^{2-}$

Past Papers Wiki

5. The correct order of increasing boiling points of the following series of compounds is?

$H_3CCH_2CH_2Cl$, $H_3CCH_2CH_2OH$, H_3CCH_2COOH, $H_3C-\overset{O}{\overset{\|}{C}}H$

1) $H_3C-\overset{O}{\overset{\|}{C}}H < H_3CCH_2CH_2OH < H_3CCH_2COOH < H_3CCH_2CH_2Cl$

2) $H_3CCH_2CH_2OH < H_3C-\overset{O}{\overset{\|}{C}}H < H_3CCH_2COOH < H_3CCH_2CH_2Cl$

3) $H_3CCH_2CH_2Cl < H_3C-\overset{O}{\overset{\|}{C}}H < H_3CCH_2CH_2OH < H_3CCH_2COOH$

4) $H_3C-\overset{O}{\overset{\|}{C}}H < H_3CCH_2CH_2OH < H_3CCH_2CH_2Cl < H_3CCH_2COOH$

5) $H_3CCH_2COOH < H_3CCH_2CH_2OH < H_3C-\overset{O}{\overset{\|}{C}}H < H_3CCH_2CH_2Cl$

6. Samples of AgCl(s) and $PbCl_2$(s) were dissolved by stirring in a solution of x mol dm^{-3} $MgCl_2$ (aq) until become saturated. The ratio $[Ag^+(aq)] : [Pb^{2+}(aq)]$ of this solution is?

$$AgCl_{(s)} \rightleftharpoons Ag^+_{(aq)} + Cl^-_{(aq)} : K_{sp_1}$$
$$PbCl_{2(s)} \rightleftharpoons Pb^{2+}_{(aq)} + 2Cl^-_{(aq)} : K_{sp_1}$$

1) $K_{sp1} : K_{sp2}$ 2) $K_{sp1} : K_{sp2} / 2$ 3) $2K_{sp1} : K_{sp2}$

4) $K_{sp1} : 4K_{sp2}$ 5) $4K_{sp1} : K_{sp2}$

7. The order of increasing electronegativity of N in the compounds NO_2, NO_2^- , NO_3^- and NH_4^+ is?

1) $NH_4^+ < NO_2^- < NO_2 < NO_3^-$

2) $NO_3^- < NO_2 < NO_2^- < NH_4^+$

3) $NO_2 < NH_4^+ < NO_2^- < NO_3^-$

4) $NO_3^- < NO_2^- < NH_4^+ < NO_2$

5) $NH_4^+ < NO_2 < NO_2^- < NO_3^-$

8. what is the volume required from 0.5 mol dm^{-3} XO_3^- (aq) solution in order to completely react with 20 cm^3 of 0.2 mol dm^{-3} FeC_2O_4 solution in acidic medium? (XO_3^- reduces to X^{2+} during the reaction)

1) 12 cm^3 2) 5.3 cm^3 3) 8 cm^3 4) 16 cm^3 5) 5.24 cm^3

9. which of the following group of species shows the octahedral geometry?

1) SO_3^{2-} , XeF_2, PO_4^{3-} 2) XeF_2^{2-}, ICl_5, SF_6 3) SO_4^{2-} , PO_4^{3-} , SF_6

4) XeF_2, SO_4^{2-}, PO_4^{3-} 5) PO_4^{3-} , SF_6, $BrCl_5$

10. what is the order of increasing pH of the following solutions?

A : - solution prepared by mixing 25 cm^3 of 0.2 mol dm^{-3} CH_3NH_2 and 25 cm^3 of distilled water

B : - solution prepared by mixing 25 cm^3 of 0.2 mol dm^{-3} CH_3NH_2 and 25 cm^3 of 0.2 mol dm^{-3} NH_4OH

C : - solution prepared by mixing 25 cm^3 of 0.2 mol dm^{-3} CH_3NH_2 and 25 cm^3 of 0.2 mol dm^{-3} NH_4Cl

D : - solution prepared by mixing 25 cm^3 of 0.2 mol dm^{-3} CH_3NH_2 and 25 cm^3 of 0.2 mol dm^{-3} HCl

1) A < B < C < D 2) B < A < C < D 3) D < C < B < A

4) D < C < A < B 5) A < D < C < B

11. When two liquids A and B are mixed in a mole ratio 3 : 1 to form an ideal binary solution and allowed the liquid - vapor phases to reach equilibrium in a closed vessel, which of the following statement is **true** ? ($P^0_A > P^0_B$)

X_A, X_B : mole fractions of A and B in liquid phase respectively.

Y_A, Y_B : mole fractions of A and B in gas phase respectively.

1) $X_A = 3/8$ and $X_B = 5/8$ ක්‍රි.
2) $X_B < Y_A$ and $X_A < Y_B$
3) $X_A < Y_A$ and $Y_B < X_B$
4) $X_A = Y_A$ and $X_B = Y_B$
5) $Y_A < X_A$ and $Y_B < X_B$

12. The K_D for compound X between two immiscible liquids P and Q is 25 at 25 °C . If 50 cm^3 of solution P containing 0.5 moles of X is placed to reach equilibrium with 50 cm^3 of Q, what is the percentage of X that entered into Q?

1) 0.4 %
2) 4 %
3) 40 %
4) 6 %
5) 60 %

13. A pair of cations, P and Q, show the following observations:

I.Gives a yellow solution with concentrated HCl. .

II.Gives a deep blue solution with concentrated NH_3.

P and Q could be, respectively:

1) Co^{2+} and Cu^{2+}
2) Co^{2+} and Ni^{2+}
3) Cr^{3+} and Cu^{2+}
4) Cr^{3+} and Ni^{2+}
5) Cu^{2+} and Ni^{2+}

14. 500 cm^3 of 0.5 mol dm^{-3} HA (aq) is mixed with 100 cm^3 of CCl_4 solution. When the system reaches equilibrium, a 25 cm^3 portion taken from the aqueous phase required 25 cm^3 of 0.1 mol dm^{-3} NaOH for titration. What is the distribution coefficient of HA between aqueous and CCl_4 phases?

1) 0.2
2) 2.0
3) 20
4) 40
5) 200

15. Which of the following reactions of the compound CH_3CH_2CHO yields a product with an asymmetric carbon atom?

1) $LiAlH_4$ / Dry ether
2) Reaction with $AgNO_3$ / NH_3
3) Reaction with $CH_3CH_2NH_2$
4) 1. CH_3CH_2MgBr / ether
   2. H_3O^+
5) Reaction with HCN

16. The mechanism for the reaction $2NO_{(g)} + 2H_{2(g)} \rightleftharpoons N_{2(g)} + 2H_2O_{(g)}$ is given below:

$2NO(g) \rightleftharpoons N_2O_2(g)$: *fast*

$N_2O_2(g) + H_2(g) \longrightarrow N_2O\,(g) + H_2O(g)$: *slow*

$N_2O\,(g) + H_2(g) \longrightarrow N_2(g) + H_2O\,(g)$: *fast*

The rate law for the above reaction is ?

1) $R = k[NO(g)]\,[H_2(g)]$
2) $R = k[NO(g)]^2$
3) $R = k[NO(g)]^2\,[H_2(g)]$
4) $R = k\,[H_2(g)]^2$
5) $R = k[NO(g)]^2\,[H_2(g)]^2$

17. When 10 ml of 0.1 mol dm^{-3} NaOH is added to a 100 ml volume of a 0.11 mol dm^{-3} solution of an indicator HIn, the final pH of the final solution was 5. What could be the pH range of the indicator?

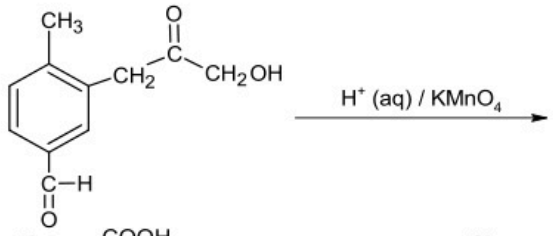
1) 4 - 6
2) 5 - 7
3) 3 - 5
4) 3 - 6
5) 4 - 7

18. For the reaction $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ ΔH^0 = -92 kJ mol^{-1} and ΔS^0 = -200 J mol^{-1} K^{-1}. Which statement regarding this reaction is **true**?

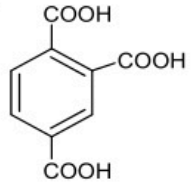
1) Entropy increases during the forward reaction.
2) It is not spontaneous at 27 °C
3) It is not spontaneous at 527 °C .
4) Spontaneity increases at high temperatures.
5) Spontaneity is determined by the activation energy.

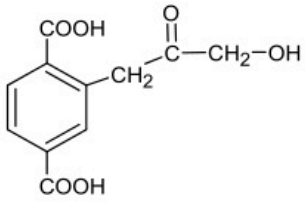
19. Which of the following statements regarding d-block is **incorrect**?

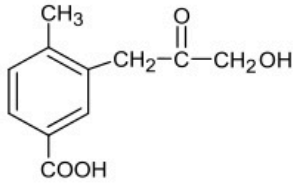
1) MnO_3 is an acidic oxide, while MnO_2 is a basic oxide.
2) Cr is the element with highest unpaired electrons in the 3d-block.
3) When NH_4OH is added to an aqueous solution containing Fe^{3+} and Fe^{2+} , both precipitate.
4) When either dilute NH_3 or dilute NaOH is added to $ZnCl_2$ (aq), a white precipitate is obtained.
5) Among 3d transition elements, V element has the highest melting point.

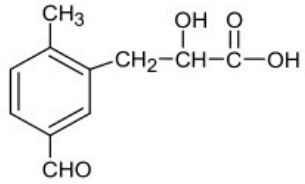
20. 

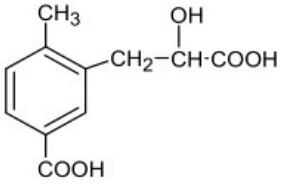
The major product of this reaction is?

1) 

2) 

3) 

4) 

5) 

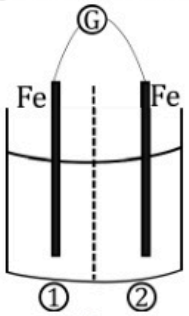
21. If $Hg(l) \longrightarrow Hg(s)$ ΔH = -2.4 kJ mol^{-1} , the change in enthalpy in kJ when 80 g of Hg (s) melts is? (Hg = 200)

1) -4.8 2) -9.6 3) 9.6 4) -0.96 5) 0.96

22. The following diagram shows two iron rods immersed in a $FeSO_4$ solution separated by an ion-permeable membrane, connected at the top through a galvanometer by a wire. The section containing the first electrode was diluted with water in a 1:5 ratio. Which of the following statements regarding this cell is **true**?

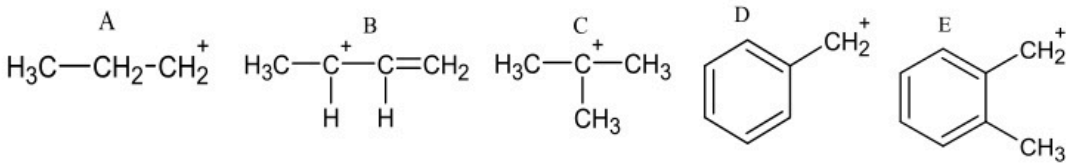
Fe^{2+} (aq) / Fe(s) = - 0.76 V

O_2 (g) / OH^- (aq) | Fe (s) = +0.26 V



1) Here, electrode (1) is the anode.
2) The electromotive force of this cell is 1.02 V.
3) The concentration of Fe^{2+} at electrode (2) increases.
4) The cell reaction for this cell is $2Fe^{2+}(aq) + 4OH^-(aq) \longrightarrow 2Fe(s) + O_2(g) + 2H_2O(l)$
5) The cathode reaction of this cell is $2H_2O(l) \longrightarrow O_2(g) + 4H^+(aq) + 4e$

23. The order of increasing stability of following carbocations is?



1)A < B < C < D < E
2)B < A < C < D < E
3)E < D < A < B < C
4)A < C < B < D < E
5)D < E < C < A < B

24. The saturated vapor pressures of A (l) and B(l) are respectively 4×10^4 Pa and 6×10^4 Pa . When an equimolar mixture of these two liquids is subjected to fractional distillation, what is the mole percentage of A in the resulting distillate?

1) 40 % 2) 50 % 3) 60 % 4) 70 % 5) 80 %

25. 0.15 mol of N_2O_4 gas was placed in a 1 dm^3 closed rigid vessel and allowed to reach the equilibrium $N_2O_4(g) \rightleftharpoons 2NO_2(g)$ At equilibrium, the total pressure was found to be 9 x 10^5 Nm^{-2}. Which of the following statements regarding the equilibrium system is **incorrect**?

1) At equilibrium, the partial pressure of NO_2 gas is 8×10^5 Nm^{-2} ගේ.
2) For the equilibrium system, $K_P = 6.4 \times 10^6$ Nm^{-2} ගේ.
3) For the equilibrium system, $K_C = 1.9$ mol dm^{-3} ගේ.
4) The equilibrium system has shifted towards the right side.
5) The percentage of N_2O_4 that reacted is 20 % .

26. Which of the following is **false** about sulfuric acid industry?

1) The first step is the combustion of deposited S or S^{2-} in air.
2) Both the formation of SO_2(g) via $S(s) + O_2(g) \longrightarrow SO_2(g)$ and the formation of SO_3 (g) via $SO_2(g) + O_2(g) \longrightarrow SO_3(g)$ is exothermic.
3) To obtain SO_3(g) via $SO_2(g) + O_2(g) \longrightarrow SO_3(g)$, SO_2(g) is passed through a metal chamber consisting of four compartments.
4) This reaction is accelerated by the catalyst V_2O_5 .
5) Dissolving the formed SO_3(g) in oleum is more efficient. .

27. For the reaction $2A(g) \rightleftharpoons B(g) + C(g)$ occurring at 27 °C , the forward rate constant is 1×10^{-2} s^{-1} and the backward rate constant is 2×10^{-2} mol^{-1} dm^3 s^{-1} . When the initial concentrations of A, B, and C are 5 mol dm^{-3} each, which of the following is **true** regarding the reaction?

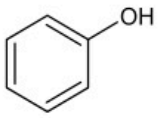
1) It is a single step reaction.
2) The order of the reaction with respect to A is 2
3) The initial rate of the forward reaction is 0.25 mol dm^{-3} s^{-1} .
4) The order of the reaction with respect to A could be 2.
5) The order of the reaction with respect to C is zero.

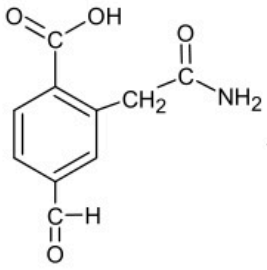
28. Which of the following statements regarding acid rain is **true**?

1) The dissolution of atmospheric CO_2, makes every rain an acid rain.
2) SO_2 and SO_3 gases contribute to acid rains as SO_x gases.
3) Only NO_2 is considered as NO_x .
4) NO is also a factor for acid rains to occur.
5) the CO_3^{2-} formed by the dissolution of CO_2 in rain water, makes the water basic.

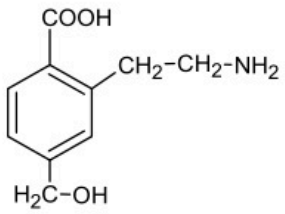
29. The tests and observations performed for organic compound X are shown in the table below. What could X be?

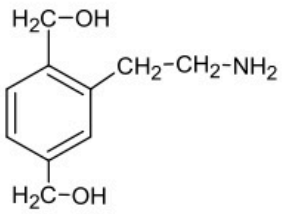
Reagent	**Observations**
1. Liquid Br_2	Brown color vanishes.
2. Metallic Na	A gas liberates
3. Adding NaOH (s)	System becomes hot.

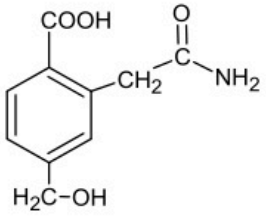
1) $H_3C-CH_2-C\equiv CH$
2) $H_3C-CH_2-CH_2-CHO$
3) H_3C-CH_2COOH
4) 
5) $H_3C-CH_2-CH_2-OH$

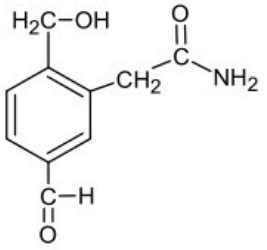
30. 

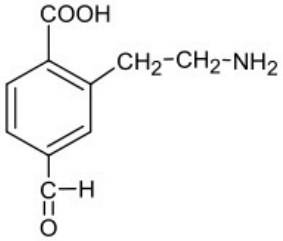
$\xrightarrow[\text{Butanol}]{\text{(i)}NaBH_4}$ The major product of this reaction is ?

1) 

2) 

3) 

4) 

5) 

- For each of the questions **31** to **40**, one or more responses out of the four responses *(a)*, *(b)*, *(c)* and *(d)* given is/are correct. Select the correct response/responses. In accordance with the instructions given on your answer sheet, mark

(1) if only *(a)* and *(b)* are correct.

(2) if only *(b)* and *(c)* are correct.

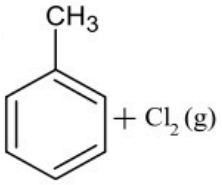
(3) if only *(c)* and *(d)* are correct.

(4) if only *(d)* and *(a)* are correct.

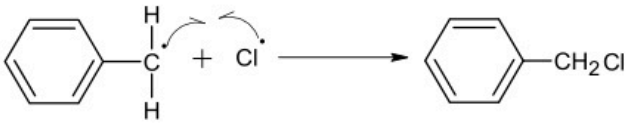
(5) if **any other** number or combination of responses is correct.

Summary of above Instructions

(1)	(2)	(3)	(4)	(5)
Only *(a)* and *(b)* are correct	Only *(b)* and *(c)* are correct	Only *(c)* and *(d)* are correct	Only *(d)* and *(a)* are correct	**Any other** number or combination of responses is correct

31. 

What is the correct statement(s) regarding the mechanism of the reaction that proceeds with reactants in 1 : 1 molar ratio.

a) 

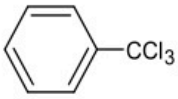
forms

b) 

forms

c) 

forms

d) 

Forms as the final product.

32. The true statement(s) regarding the s block is/are:

a) Electrolysis of molten salts is the most suitable method for the extraction of s-block metals.

b) $MgSO_4.\ 7H_2O$ is known as Epsom salt, a naturally occurring form of Mg.

c) A metal oxide is obtained as the product by the thermal decomposition of any oxide in s block.

d) The precipitation of the second group carbonates (CO_3^{2-}) as well as sulfates (SO_4^{2-}) increases down the group.

33. Which of the following statements is/are **correct** regarding equilibrium given below?

$$2H_2O(l) \rightleftharpoons H_3O^+(aq) + OH^-(aq)$$

a) It exists in any weakly basic solution.

b) Its entropy is zero

c) For any aqueous solution, $[\ H_3O^+\ (aq)\ ] = [\ OH^-\ (aq)\ ]$

d) At temperatures higher than 25 °C, $[\ H_3O^+\ (aq)\ ]\ [\ OH^-\ (aq)\ ] > 1 \times 10^{-14}\ mol^2\ dm^{-6}$

34. Which statement(s) is / are **true** about catalysts and their function?

a) When a catalyst is added, the average speed of the reactant molecules in the system increases.

b) When a catalyst is added, the equilibrium constants K_P and K_C of a reversible reaction increase.

c) When a catalyst is added, the rate constants of the reaction change.

d) A catalyst allows the reaction to proceed via an alternative pathway with a lower activation energy

35. Below equilibrium is reached at 100 °C

$$A(g) + B(g) \rightleftharpoons C(g) + D(s)\ ;\Delta H < 0$$

Which of the following is/are **correct** if the temperature of the equilibrium system is increased to 200°C ?

a) Initially, the rate of the forward reaction becomes greater than the rate of the backward reaction.

b) Initially, the rate of the backward reaction becomes greater than the rate of the forward reaction.

c) When a small amount of D is removed, the reaction rate remains unchanged.

d) When a small amount of D is removed, the forward reaction rate increases.

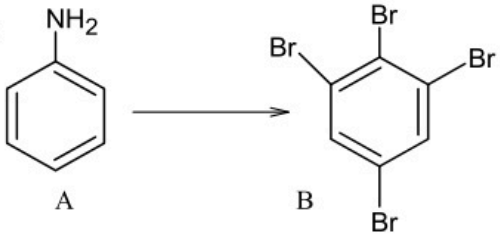
36. When the decomposition reaction $A(g) \longrightarrow B(g) + C(g)$ occurs in a closed system,

a) The temperature of the system increases.

b) The temperature of the surrounding decreases.

c) The entropy of the system increases.

d) The entropy of the surrounding decreases.

37. 

Which of the following expression(s) is/are **correct** regarding the required reagents and the process for the given synthesis?

a) $A \xrightarrow{NaNO_2/HCl} I_1 \xrightarrow{Br_2(l)} I_2 \xrightarrow{PBr_3} B$

b) $A \xrightarrow[(0-5)^oC]{NaNO_2/HCl} I_1 \xrightarrow{Br_2(l)} I_2 \xrightarrow{PBr_3} B$

c) $A \xrightarrow{Br_2(l)} I_1 \xrightarrow[(0-5)^oC]{NaNO_2/HCl} I_2 \xrightarrow{CuBr} B$

d) A white precipitate occurs during the synthesis.

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38. Which of the following is\are **true**?
    a) Under standard conditions, the heat released during the neutralization between 1 mol of HCl (aq) and NaOH (aq) is -57.3 kJ mol^{-1}
    b) Under standard conditions, the heat released during the neutralization between 1 mol of H_2SO_4 (aq) and NaOH (aq) is -114.6 kJ mol^{-1}
    c) the heat released during the neutralization between $Ca(OH)_2$ and 1 mol of H_2SO_4 is greater than -114.6 kJ mol^{-1}.
    d) the heat released during the neutralization between $Ba(OH)_2$ and 1 mol of H_2SO_4 is greater than -114.6 kJ mol^{-1}
39. Which statement(s) is/are **true** regarding Teflon?
    a) It contains double bonds.
    b) It is formed by the addition polymerization of CHF = CHF .
    c) It is a thermosetting polymer.
    d) It is a network polymer
40. Which of the following can be used as a definition for a mole?
    a) The number of electrons contained in one Faraday of charge is 1 mole.
    b) The number of $^{12}_{6}C$ atoms in 12.00 g of the isotope $^{12}_{6}C$ is 1 mole.
    c) The number of gas molecules in a volume of 22.4 dm^3 at 0 °C and under 1 atm is 1 mole.
    d) The number of C atoms in 180 g of $C_6H_{12}O_6$ is 1 mole.

- In question Nos. **41** to **50**, two statements are given in respect of each question. From the Table given below, select the response, out of the responses (1), (2), (3), (4) and (5), that best fits the two statements and mark appropriately on your answer sheet.

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)	False	True
(5)	False	False

	First statement	Second statement
41.	When the temperature of the equilibrium system $NO_2(g)$, $N_2O_4(g)$ at a certain temperature is increased, the red brown color of the system increases.	As the reaction $NO_2(g) \rightleftharpoons N_2O_4(g)$ is exothermic, the backward reaction speeds up at a higher temperature and increases the concentration of the $NO_2(g)$.
42.	C_2H_5OH can be obtained from $CH_3COOC_2H_5$ in a single step.	C_2H_5OH can be obtained by reacting the compound $CH_3COOC_2H_5$ with C_2H_5MgCl followed by hydrolysis.
43.	The ozone layer is protected by using HCFC s.	The compound HCFC is not harmful to the ozone layer.
44.	The bond angle of H_2O is higher than that of H_2S	The electronegativity of the central atom decreases down the group 16.

	First statement	Second statement
45.	The presence of NO_3^- can be assumed by the liberation of brown color gas when conc: H_2SO_4 is added to a solid ionic compound.	Only NO_3^- releases a brown color gas with H_2SO_4 (aq).
46.	When 0.5 mol of He is added to a system that contains $N_2(g)$ and $O_2(g)$ 0.5 moles each, the partial pressures of $N_2(g)$ and O_2 (g) decreases.	The mole fractions of N_2 and O_2 decreases when He is added to the system.
47.	The boiling point of propanoic acid is higher than the boiling point of propanal.	There are no hydrogen bonds in propanal.
48.	The pH of 0.1 mol dm^{-3} NH_4Cl solution at 25 °C is about 5.	NH_3 is a weak base and HCl is a strong acid.
49.	Bakelite is formed by the addition of phenol and formaldehyde in the presence of concentrated H_2SO_4	Bakelite is a network (cross-linked) polymer.
50.	When storing H_2O_2 in the laboratory, the solution is made slightly acidic.	The disproportionation of H_2O_2 is inhibited by acids and catalyzed by bases.

The periodic table

	1																2
1	H																He
	3	4											5	6	7	8	9	10
2	Li	Be											B	C	N	O	F	Ne
	11	12											13	14	15	16	17	18
3	Na	Mg											Al	Si	P	S	Cl	Ar
	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
	55	56	La-	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
6	Cs	Ba	Lu	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
	87	88	Ac-	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118
7	Fr	Ra	Lr	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Nh	Fl	Mc	Lv	Ts	Og

57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
89	90	91	92	93	94	95	96	97	98	99	100	101	102	103
Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

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[සියලුම හිමිකම් ඇවිරිණි | All Rights Reserved]

බස්නාහිර පළාත් අධ්‍යාපන දෙපාර්තමේන්තුව
மேல் மாகாணக் கல்வித் திணைக்களம்
Department of Education - Western Province

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය **2026** උපකාරක ප්‍රශ්න පත්‍රය
General Certificate of Education (Adv. Level) Exam

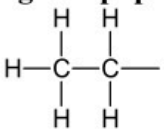
රසායන විද්‍යාව II Chemistry II	**02**	**E**	**II**	**13** ශ්‍රේණිය **Grade 13**	*පැය තුනයි* *Three hours*

Index no : .....

අමතර කියවීම් කාලය
මිනිත්තු **10**

Instructions :-

* *Periodic Table: A Periodic Table is provided on page 17.*
* ***Calculators: Use of calculators is not allowed.***
* *Universal gas constant , $R = 8.314\ J\ K^{-1}\ mol^{-1}$*
* *Avogadro constant, $N_A = 6.022 \times 10^{23}\ mol^{-1}$*
* **In answering this paper, you may represent alkyl groups in a condensed manner.**

Example:  group may be shown as $H_3C—CH_2—$

❑ **PART A — Structured Essay (pages 2 - 8)**

* *Answer **all** the questions on the question paper itself.*
* *Write your answer in the space provided for each question.*
* *Please note that the space provided is sufficient for the answer and that extensive answers are not expected.*

❑ **PART B and PART C — Essay (pages 9 - 17)**

* *Answer **four** questions selecting **two** questions from each part. Use the papers supplied for this purpose.*
* *At the end of the time allotted for this paper, tie the answers to the three Parts **A**, **B** and **C** together so that Part **A** is on top and hand them over to the Supervisor.*
* *You are permitted to remove only Parts **B** and **C** of the question paper from the Examination Hall.*

For examiner's use only

Part	Question No.	Marks.
A	1	
	2	
	3	
	4	
B	5	
	6	
	7	
C	8	
	9	
	10	
Total		

total

In Numbers	
In Letters	

Code numbers

Marking examiner 1	
Marking examiner 2	
Checked by :	
Supervised by :	

Do not write in this col-umn

Part A - structured essay

1. a) Answer the following questions based on the elements of the **third** period of the periodic table.

(i) The element that absorbs the **minimum** energy to form a gaseous unipositive ion from a gaseous isolated atom is .....

(ii) The element that emits the **highest** amount of heat during the first electron gain is .....

(iii) The element that forms the ion with the **largest** radius is, ...

(iv) The element possessing the **lowest** boiling point is, ...

(v) Among the metallic elements, the one that forms the cation with the **highest** polarizing power is .....

(vi) The element that naturally found existing as a covalent atomic lattice is, ...

(marks:24)

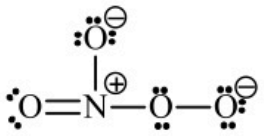
b) (i) Draw the most acceptable Lewis dot-dash structure for the SF_3ClO molecule. State the (I) shape around its central atom and (II) the oxidation number of the central atom.

I. Shape around the central atom: .....

II. Oxidation number of the central atom : .....

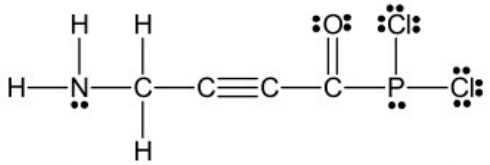
(marks :08)

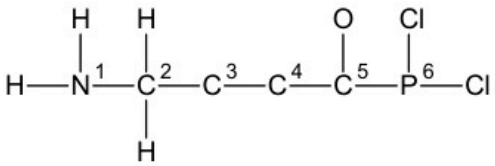
(ii) A stable Lewis structure for the NO_4^- ion is given below. Draw 3 Lewis dot-dash structures (resonance structures) for that ion and Write stable, unstable, or less stable below each structure to indicate its stability.



(marks :12)

(iii) Complete the table given below using the structure drawn for the $C_3H_4NOCl_2P$ molecule and its labeled skeleton.





		N^1	C^3	C^5	P^6
I.	Number of VSEPR pairs around the atom				
III.	Electron pair geometry around the atom				
III.	Shape around the atom				
IV.	Hybridization				

(marks :16)

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- **Answer questions (iv) to (vii) below based on the Lewis structure in (iii) above and its skeleton.**

(iv) Name the atomic/hybrid orbitals participating in the formation of each σ bond below.

I. N^1 — C^2 N^1 ..... C^2.....

II. C^2 — C^3 C^2 ..... C^3.....

III. C^3 — C^4 C^3 ..... C^4.....

IV. C^4 — C^5 C^4 ..... C^5.....

V. P^6 — Cl P^6 ..... Cl.....

(marks :10)

(v) Name the orbitals participating in the formation of each π bond below.

I. C^3—C^4 C^3 ..... C^4.....

C^3 ..... C^4.....

II. C^5—O C^5 ..... O.....

(marks :06)

(vi) Write the bond angles around the atoms N^1, C^2, C^3 and C^5 approximately.

N^1 ..... C^2 ..... C^3 ..... C^5 .....

(marks :04)

(vii) Arrange the atoms N^1, C^2, C^3 and C^5 in increasing order of their electronegativity.

..... < ..... < ..... < .....

(marks :02)

c) (i) A researcher exposed a gaseous Br_2 sample to a monochromatic radiation with a wavelength of 331 nm. If the Br—Br bond dissociation energy is 193 kJ mol^{-1}, show by calculation whether this radiation is capable of dissociating the Br_2 molecule. ($h = 6.62 \times 10^{-34}$ J s)

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(marks :08)

(ii) State whether the following statement is true or false and briefly explain.

I. The boiling point of ICl is higher than that of Br_2. (Br = 80, I = 127, Cl = 35.5)

.....

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.....

.....

(marks :10)

100

Do not write in this col-umn

2. a) 1. A, B, C, D and E are five inorganic compounds. All the compounds react with diluted HCl and form colorless, tri atomic, linear and odorless gas F.

(i) Among these compounds, only A forms a white precipitate, G, when dilute HCl is added. G dissolves in dilute NH_3 to give H. Identify A, G, and H.

A : ..... G : .....

H : .....

(ii) When solid B is heated, no decomposition occurs. When the solution formed by dissolving B in dilute HCl is subjected to a flame test, it gives a yellow color. Identify B.

.....

(iii) When C is heated, it decomposes leaving no solid residue. Identify C.

.....

(iv) When the white solid residue obtained from the thermal decomposition of D is dissolved in water and gas F is passed through it, a milky white precipitate is formed in the solution. When the gas is passed further, the solution becomes colorless. Identify D and F.

.....

(v) When E is reacted with dilute HCl, a pale green colored solution is obtained. When dimethyl-glyoxime (DMG) is added to that solution, a red precipitate is obtained. Identify E.

.....

2. Write the balanced chemical equations for the thermal decomposition of A, C, D, and E.

.....

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(marks : 70)

b) • P, Q, and R are three ionic compounds containing the sodium ion.

(i) P forms a white precipitate in the presence of dilute HCl while evolving a colorless, foul-smelling gas which changes the color of a filter paper soaked in acidic $KMnO_4$.

I. Identify P. .....

II. Write the balanced equation for the reaction of P with dilute HCl.

.....

(ii) Q does not yield a precipitate in the presence of dilute HCl. However, it gives off the exact same gas evolved by P in (i) above.

I. Identify Q. .....

II. Write the balanced equation for the reaction of Q with dilute HCl.

.....

(iii) R does not react with dilute HCl. But R, in the presence of Al powder and concentrated NaOH, evolves a colorless, alkaline gas with a strong odor.

I. Identify R. .....

II. Write the relevant balanced ionic equation for the above reaction.

.....

(marks : 30)

Do not write in this col-umn

100

3. a) A volume of 25.00 cm^3 of 0.1 mol dm^{-3} solution of a weak acid HA was mixed with 12.50 cm^3 of 0.1 mol dm^{-3} NaOH solution. The pH of the final solution was 5.

(i) Write the balanced ionic equation for the dissociation of the acid HA(aq) in water.

.....

(ii) Write the expression for the dissociation constant (K_a) of the acid.

.....

.....

.....

(iii) Write the balanced chemical equation for the reaction between HA(aq) and NaOH(aq).

.....

(iv) Show that the concentrations of the remaining acid and the salt in the final solution are equal.

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(v) Calculate the dissociation constant (K_a)of the weak acid.

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(marks : 70)

b) 0.1 mol of Na_2CO_3 is added to 500.00 cm^3 of an aqueous solution where the concentrations of Ca^{2+} (aq) and Ba^{2+}(aq) are both 0.1 mol dm^{-3}. if K_{sp} ($CaCO_3$) = 1×10^{-10} $mol^2\ dm^{-6}$ and K_{sp} ($BaCO_3$) = 1×10^{-8} $mol^2\ dm^{-6}$, calculate the ratio [Ba^{2+} (aq)] : [Ca^{2+} (aq)] in the final solution .

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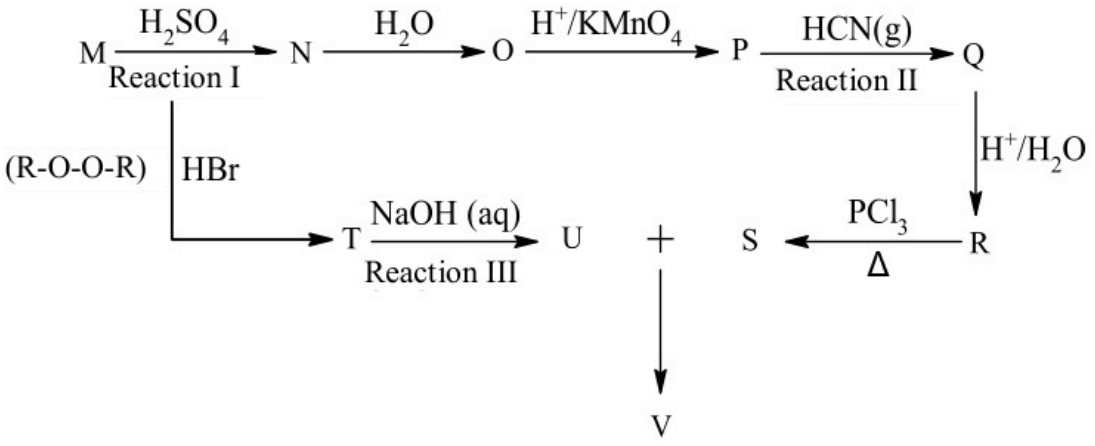
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(marks : 30)

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4. a) Compound M with the formula C_4H_8 decolorizes liquid Br_2 but does not exhibit geometric isomerism. Compound O and as well as Q and R are optically active.

Consider the following chain of reactions.



(i) Identify and write the structures of M, N, O, P, Q, R, S, T, U, V

M

N

O

P

Q

R

S

T

Do not write in this col-umn

U V

(ii) U was reacted with V $\xrightarrow[(2.)\ \text{dill: HCl}]{(1.)\ 2\times\ \text{C}_6\text{H}_4\text{MgCl}}$ Indicate the products in the boxes below.

Reaction IV

(marks :60)

(iii) Identify the reactions I to IV above. Identify their mechanism type and the initially attacking species.

(A_N - Nucleophlic addition, S_N - Nucleophlic substitution,
A_E - electrophilic addition, S_E - electrophilic substitution, E - elimination reaction
A \ B - acid / base reaction)

Reaction number	Type of the mechanism	Initially attacking species
I		
II		
III		
IV		

(iv) Consider the reaction between $H_3C-\overset{\overset{O}{\|}}{C}-Cl$ and H_2O, draw the mechanism indicating the major product.

(marks :40)

100

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மேல் மாகாணக் கல்வித் திணைக்களம்
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අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය **2026** උපකාරක ප්‍රශ්න පත්‍රය
General Certificate of Education (Adv. Level) Exam

රසායන විද්‍යාව II Chemistry II	**02**	**E**	**II**	**13** ශ්‍රේණිය **Grade 13**

Universal gas constant R = 8.314 J K^{-1} mol^{-1} Avogadro's constant N_A = 6.022 × 10^{23} mol^{-1}

PART B - ESSAY (*Answer **two** questions only*)

5. a) At 27 °C , N_2O_3 gas dissociates in a closed system to give NO_2 and NO gases.

	ΔH^0_f (kJ mol^{-1})	S^0(J mol^{-1} K^{-1})
NO (g)	90	210
NO_2 (g)	33	240
N_2O_3 (g)	82.8	316

(i) Write the balanced chemical equation for the above dissociation.

(ii) Calculate the standard enthalpy change for this reaction. State with reasons whether its sign (+ / -) is suitable or unsuitable for the reaction.

(iii) Calculate the standard entropy change for this reaction. State with reasons whether its sign (+ / -) is suitable or unsuitable for the reaction.

(iv) Show by an appropriate calculation that this reaction occurs spontaneously in both forward and backward directions at 27 °C . State an assumption you made in this calculation.

(v) Predict the effect of temperature on the reaction between NO_2(g) and NO (g) using the thermodynamic data of the reaction. ***(marks : 50)***

b) Pure N_2O gas of mass 6.6 g was allowed to dissociate and reach equilibrium in a closed vessel of volume 5 dm^3 at 328 °C as follows. At 328 °C , assume the RT product equals 5 × 10^3 J mol^{-1} .

$$2N_2O(g) \rightleftharpoons 2N_2(g) + O_2(g)$$

The pressure of this equilibrium system is 2 × 10^5 Pa .

(i) What are the concentrations of each gas in the equilibrium system? (N = 14, O = 16)

(ii) Obtain the K_C of the above equilibrium. Hence calculate its K_P

(iii) 1 g of He gas was introduced to the above system while keeping the temperature constant. State with reasons how the mole fractions and partial pressures of the above gases change during this process.

(iv) When 0.5 mol of each of the above gases is introduced at this temperature into the above equilibrium system and allowed to reach equilibrium, determine using an appropriate calculation whether the forward or backward reaction occurred faster for that.

(marks : 60)

c) Controlling the rate of reactions is an important aspect of a chemical industry. The rate of a given reaction can be presented in three main ways, and the average rate is one of them.

The following shows the reaction between peroxydisulfate ($S_2O_8^{2-}$) and iodide (I^-)

$$S_2O_8^{2-}(aq) + 2I^-(aq) \longrightarrow 2SO_4^{2-}(aq) + I_2(aq)$$

(i) Write an expression for the rate of the reaction in terms of the rate of consumption of I^- (aq)

(ii) If the concentration of I^-(aq) decreased from 0.4 mol dm^{-3} to 0.04 mol dm^{-3} within a time period of two minutes after mixing the reactants, express the rate of the reaction in mol dm^{-3} s^{-1}

(iii) The following shows the results of an experiment conducted to determine the order of the reaction with respect to I^- (aq) for the above reaction. In each experiment, the trials were carried out by keeping the concentration of $S_2O_8^{2-}$ (aq) at a relatively very high, constant value.

Exp. NO	Initial [$S_2O_8^{2-}$ (aq)] (mol dm^{-3})	Initial [I^- (aq)] (mol dm^{-3})	Rate (r) (mol $dm^{-3}s^{-1}$)
1	2.5	3.2×10^{-2}	1.0×10^{-4}
2	2.5	1.0×10^{-2}	1.0×10^{-5}
3	2.5	3.2×10^{-3}	1.0×10^{-6}

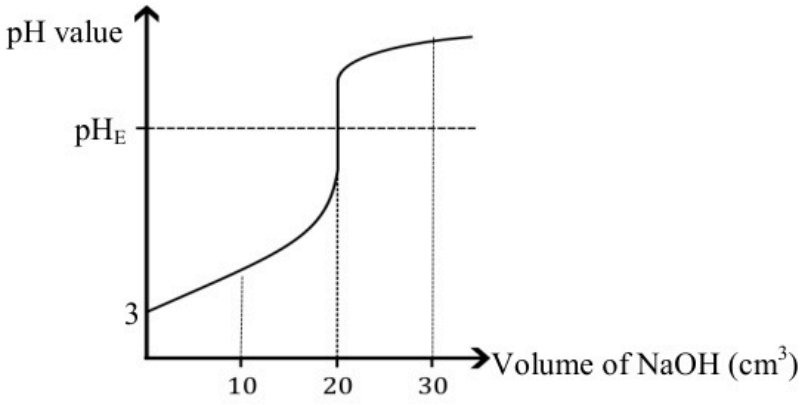
I. Using the data given in the above table, calculate the order of the reaction with respect to I^- (aq)

II. If the order of the reaction with respect to $S_2O_8^{2-}$(aq) is 1, write the rate equation for the reaction.

(marks : 40)

6. a) BH^+ is the conjugate acid of the base B. At 25 °C, a titration was carried out by placing 30 cm^3 of 0.05 mol dm^{-3} aqueous solution of BH^+ in a titration flask and adding an aqueous solution of NaOH from a burette and the corresponding pH curve is shown below.

The ionic product of water (K_w) at 25 °C = 1×10^{-14} mol^2 dm^{-6}



(i) Calculate the initial concentration of the NaOH in the burette.

(ii) Calculate the K_b value of base B.

(iii) Obtain the pH value of the solution in the flask at the equivalence point.

(iv) Qualitatively explain the changes occur in the pH of the solution in the flask at 10 cm^3 of the burette reading , when adding a small volume of a strong acid, strong base and distilled water separately into the solution at this point.

(marks : 60)

b) In order to prepare a ideal binary solution, at 47 °C , 60 g of pure propanol (CH_3-CH_2-CH_2-OH) and 90 g of acetic acid (CH_3COOH) respectively were mixed in a closed vessel and allowed to equilibrate with their vapor phase. The volume and the pressure of its vapor phase were 415.7 dm^3 and 3.2 $\times 10^3$ Pa respectively and it contained CH_3-CH_2-CH_2-OH and CH_3COOH in a 3 : 2 molar ratio.

(i) Obtain the total number of gaseous moles in the vapor phase.

(ii) What are the mole fractions of propanol and acetic acid in the liquid phase?

(iii) Calculate the saturated vapor pressure of acetic acid at this temperature.

(marks : 50)

c) At 25 °C, a mixture containing 50.00 cm^3 of a 0.1 mol dm^{-3} NH_3 solution and 50.00 cm^3 of a CCl_4 solution was shaken well and allowed to stand. The system reached equilibrium as a mole percentage of 20 % of the NH_3 that was in the aqueous solution diffused into the organic layer.

(i) Obtain the distribution coefficient (K_D) corresponding to the distribution of NH_3 between the aqueous and organic phases in the mixture At 25 °C.

(ii) When 50.00 cm^3 of 0.02 mol dm^{-3} aqueous $AgNO_3$ is mixed with 50.00 cm^3 of 0.04 mol dm^{-3} aqueous NH_3 , following equilibrium is established in the solution mixture (A).

$$Ag^+(aq) + 2NH_3(aq) \rightleftharpoons [Ag(NH_3)_2]^+(aq)$$

Above solution is then shaken vigorously with 50.00 cm^3 of CCl_4 and allowed to stand to reach the equilibrium. The organic layer of the equilibrium system required 5.0 cm^3 of 0.01 mol dm^{-3} HCl solution for the titration.

I. What are the initial concentrations of $AgNO_3$ (aq) and NH_3 (aq) in the aqueous solution A?

II. What is the concentration of NH_3 in the organic layer in equilibrium with solution A?

III. Calculate the equilibrium constant for the above equilibrium. ***(marks : 60)***

7. a) During rusting of iron, the formation of $Fe(OH)_2$ occurs first as the oxygen and water in contact with Fe react with each other. Later, it is converted to hydrous ferric oxide due to the further oxidation.

In order to construct an electro chemical cell required for the study of the electro chemical process of the above first step, you are provided with an Fe (s) electrode immersed in a 1 mol dm^{-3} $Fe(NO_3)_2$ (aq) and a standard Oxygen electrode in which O_2 gas at 1 atm interacting with 1 mol dm^{-3} KOH in the presence of Pt.

To connect these components together, facilities such as connecting wires, a voltmeter, and a salt bridge containing $NaNO_3$ (aq) are also provided. (O = 16, Fe = 56, H = 1)

At 25 °C $E^0_{(O_2(g)|OH^-(aq))} = +0.40\ V$ and $E^0_{(Fe^{2+}(aq)|Fe(s))} = -0.44\ V$

(i) Draw a rough diagram of this electrochemical cell, indicating the standard conditions.

(ii) For this cell, write down :

I. Anode and cathode

II. Positive and negative terminals

III. Half-ionic reactions occurring at the electrodes

IV. Overall cell reaction

(iii) Calculate the electromotive force of the cell (E^0_{cell}) at 25 °C .

(iv) Write down the IUPAC notation of this cell.

(v) Describe how the charge equilibrium in the half-cells is maintained by the salt bridge here.

(vi) The change in mass that occurred at the anode over a period of 5 hours was 112 mg. What is the volume of gas that should be supplied to / removed from the system during that time under standard temperature and pressure conditions (1 atm \ 0 °C)

(marks : 70)

b) A, B, C, D, and E are complex compounds formed by stable cations of the element iron (Fe).

Each of these compounds contains two common types of ligands, which are neutral and anionic ligands. The composition of the ligands consists only of C, H, O, and N. The coordination number of all the above central metal cations is 6, and there are K^+ or halide ions outside the coordination

Specifications for each compound are given below

	Charge of the cation	**Charge of the coordination sphere**	**Number of ions given to water by a formula unit**	**Observation with aqueous $AgNO_3$**
A	**+3**	**0**	**-**	**-**
B	**+2**	**-3**	**4**	**-**
C	**+2**	**-2**	**3**	**-**
D	**+3**	**+1**	**2**	**A precipitate soluble in diluted NH_3**
E	**+3**	**+2**	**3**	**A precipitate soluble only in concentrated NH_3**

(i) Identify the ligands found in these compounds and write their corresponding formulas.

(ii) Draw the structural formulas of compounds A, B, C, D, and E.

(iii) Write the IUPAC names of compounds A, D, and E.

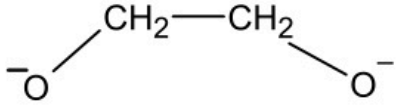
(iv) Identify the compounds from A to E that react with the following reagents. Also, state the observations obtained.

(a) $KMnO_4 / H^+$

(b) $K_3[Fe(CN)_6]$

(c) CCl_4 / Cl_2

(v) The diol given by C_2H_4 with $KMnO_4$ in alkaline medium forms the following bidentate ligand with K.

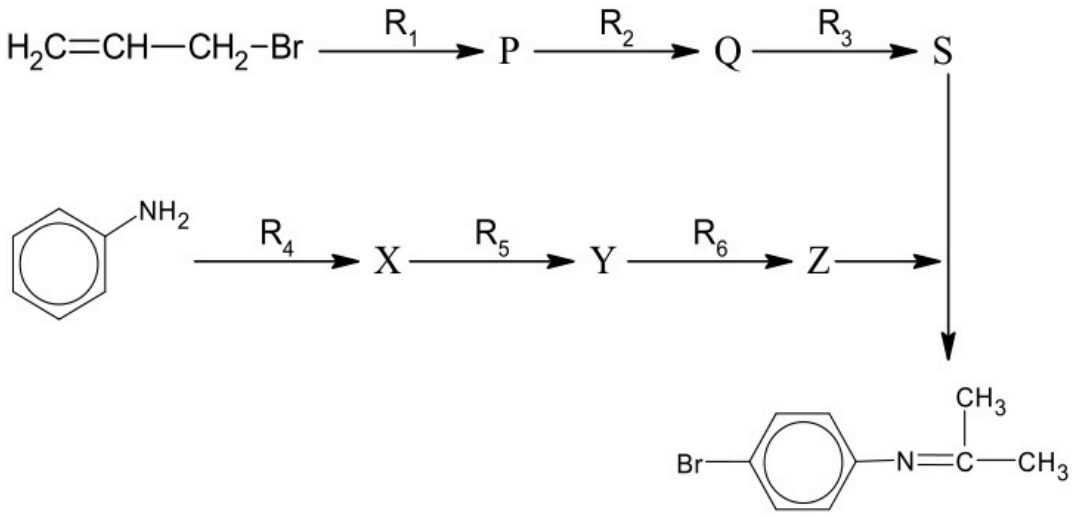


State the formula or structure of the octahedral complex ion formed by this with the ion having the highest oxidation state among the above central metal cations. Above ligand can be indicated as 'do' in the formula or structure.

(marks : 80)

PART C - ESSAY (*Answer **two** questions only*)

8. a) Answer using the reaction scheme and reagent list given below.



List of reagents :

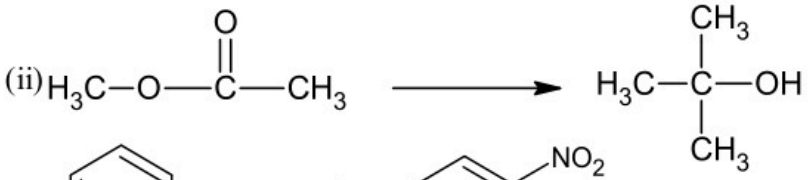
Br_2 , NaOH, $HgSO_4$, dill: H_2SO_4, HBr, $FeBr_3$, CH_3-COCl, H_2O, KOH / C_2H_5OH

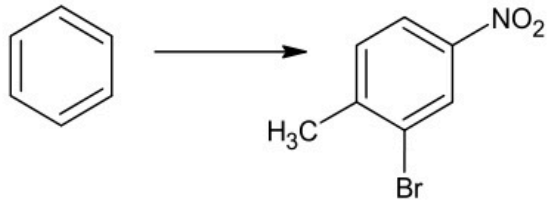
(i) Identify the compounds P, Q, S, X, Y and Z

(ii) Write down the reagents from R_1 to R_6. ***(marks : 60)***

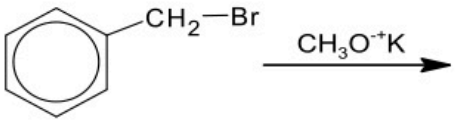
b) Carry out the following conversions using a reaction sequence not exceeding 4 steps.

(i) $H_3C—CH_2—OH \longrightarrow H_3C—CH=CH—CH_3$

(ii) 

(iii) 

(marks : 45)

c) (i) Consider the following reaction 

I. State the major product of this reaction

II. Identify the type of this reaction which the mechanism belong to and the number of steps stating reasons.

(ii) Write down the mechanism of the above reaction.

(iii) Show by presenting appropriate structures that this organic mechanism occurs under the number of steps you mentioned.

(iv) State another pair of reactants that can be used to produce the above organic product via this same mechanism. ***(marks : 45)***

9. a) The following steps are proposed to separate and identify 4 metal/non-metal cations in an aqueous solution A.

Step	Observation
1.Acidifying a portion of solution **A** and passing H_2S gas.	No change occurs in the solution.
2.Heating the solution from **1**. above and boiling with conc. HNO_3 and adding a mixture of NH_4Cl / NH_4OH.	A mixture of precipitates $\mathbf{P_1}$ and $\mathbf{P_2}$.
3.Filtering the mixture of precipitate from **2** above and bubbling H_2S gas through the filtrate.	Light colored precipitate $\mathbf{P_3}$
4.Adding conc. NaOH to an initial portion of solution **A**.	Gas $\mathbf{G_1}$ evolved.

The products obtained above were further tested under the following steps.

Step	Observation
1. Adding an aqueous solution of NaOH to the mixture of $\mathbf{P_1}$ and $\mathbf{P_2}$.	Precipitate $\mathbf{P_1}$ dissolves to give colorless solution $\mathbf{S_1}$.
2. I.Filtering and separating precipitate $\mathbf{P_2}$ and adding dil. HCl to it. II.Adding NH_4SCN to the solution $\mathbf{S_2}$.	A colored solution $\mathbf{S_2}$ is obtained. A deeply colored solution $\mathbf{S_3}$ is obtained.
3. I.Adding dill: H_2SO_4 to precipitate $\mathbf{P_3}$. II.Add NaOH to solution $\mathbf{S_4}$.	Gas $\mathbf{G_2}$ and solution $\mathbf{S_4}$ are obtained. A pale colored precipitate $\mathbf{P_4}$ is initially obtained and later turns into a deep colored precipitate $\mathbf{P_5}$.
4. Inserting moist litmus paper into gas $\mathbf{G_1}$	Changes the color of litmus.

(i) Identify the gases $\mathbf{G_1}$ and $\mathbf{G_2}$. State a suitable chemical reaction to identify each, along with observations.

(ii) Identify precipitates $\mathbf{P_1}$ to $\mathbf{P_5}$.

Write the formulas of the chemical compounds contained in the solutions S_1 to S_2.

(iii) Write down the types of metal/non-metal cations identified during the above procedures.

(iv) Represent the following reactions by balanced equations.

I.Dissolution of precipitate P_1 in NaOH.

II.Conversion of precipitate P_4 into P_5. ***(marks : 100)***

b) A chemical mixture (A) used for fireworks is prepared by mixing $NaNO_3$, $Cu(NO_3)_2$ and another inert ingredient

The results of an experimental procedure carried out by a group of students to determine its composition are given below .

step I :

•Accurately measuring 10.00 g of the solid mixture A, dissolving it in distilled water, and diluting it to 250 cm^3 to prepare solution B.

Step II

- Accurately weighing 4.28 g of solid KIO_3, dissolving it in distilled water, and preparing 250 cm^3 of aqueous solution C.
- Adding excess KI and only the required amount of dil. H_2SO_4 to a 25 cm^3 of solution C and allowing the necessary time to react. .
- The volume of aqueous $Na_2S_2O_3$ consumed during the titration of that reaction mixture for the standardization was 30.00 cm^3.

step III :

- The gas X evolved upon heating 25.00 cm^3 of the above mixture B with Devarda's alloy (an alloy containing Al) and excess NaOH crystals was absorbed into 100 cm^3 of an HCl acid solution of concentration 0.1 mol dm^{-3}. Subsequently when that solution was titrated against a 0.1 mol dm^{-3} NaOH solution, the endpoint was 10.00 cm^3.

step IV :

- Upon mixing 25.00 cm^3 of solution B with excess KI and heating, a precipitate and a colored solution were obtained .
- When that precipitate was filtered and the filtrate was titrated with the $Na_2S_2O_3$ standardized under step II above, the burette reading consumed was 7.50 cm^3.

(Na = 23, N = 14, O = 16, Cu = 63.5, K = 39)

(i) State a suitable indicator for the titrations carried out in steps II and III, along with the color change at the endpoint

(ii) Represent the reactions that occurred under step II by balanced equations and determine the concentration of $Na_2S_2O_3$.

(iii) Present balanced equations for the reactions that occurred under step IV and obtain the mass percentage of $Cu(NO_3)_2$

(iv) Give the balanced equations for the reactions that occurred under step III and calculate the mass percentage of $NaNO_3$.

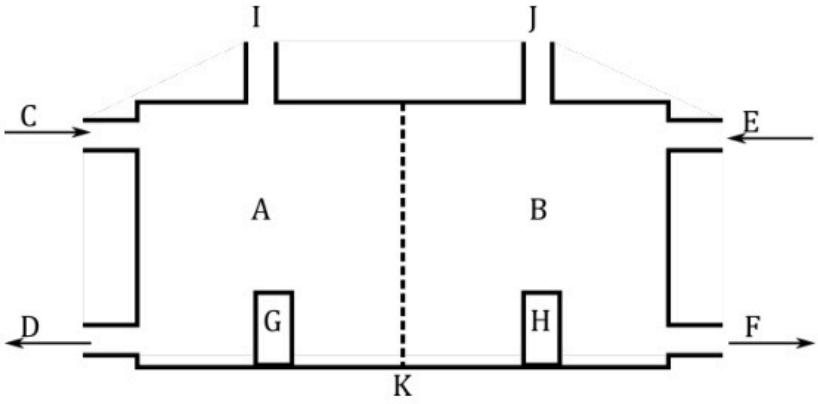
(marks : 50)

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10. a) The "sea" is the main natural resource possessed by Sri Lanka.

(i) It has been proposed to build a chemical industrial park using seawater as the starting source. Name five chemical industries for that industrial park.

(ii) A rough diagram of a cell related to the main industry found in the industrial park using seawater is provided.



I. In the above diagram:

(A) Identify chambers A and B.

(B) What are the species entering / exiting through C, D, E, F?.

(C) Identify the electrodes G and H.

(D) Identify the products exiting through I and J.

(E) State what K is and its function.

II. Describe this production process, mentioning the relevant equations and conditions.

III. Explain how above method of this production process is more efficient than other methods that are carrying out in this production process.

IV. Identify the chemical substance produced using the main product of this industry as a starting material along with plant oils, and briefly describe the main steps of that industry.

V. Name the chemical industry carried out by reacting gas J, which is obtained as a byproduct in this chemical industry, with the most abundant atmospheric gas, and describe that production process.

(marks : 100)

b) The Iran-Israel war in the Middle East region caused a massive environmental destruction

(i) State two points for the effect occurred there to each of

I. The lithosphere

II. The hydrosphere

III. The atmosphere

(ii) Name five major air pollutants added to the atmosphere due to this warfare and state a harmful effect of each pollutant.

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c) Clean water is an essential factor for living beings. Studying water quality parameters is essential to determine the purity/impurity of water.

(i) Name five water quality parameters that should be studied in this manner.

(ii) I. Name four major metal ions that cause water hardness.

II. It has been found that the only species causing hardness in a certain water sample is the presence of $CaCl_2$. in order to determine the Ca^{2+} concentration of the hard water, a sample of 5000 cm^3 was treated with excess soap and allowed the precipitate to settle. The mass of the scum deposited as a precipitate was weighed and found to be 1.212 g.

(i) By considering the soap as $C_{17}H_{35}COO^-Na^+$, write the balanced chemical equation for the reaction between soap and Ca^{2+}

(ii) Calculate the concentration of Ca^{2+} in the sample.
(Ca = 40, C = 12, H = 1, Na = 23)

(marks : 50)

The periodic table

	1																2
1	H																He
	3	4											5	6	7	8	9	10
2	Li	Be											B	C	N	O	F	Ne
	11	12											13	14	15	16	17	18
3	Na	Mg											Al	Si	P	S	Cl	Ar
	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
	55	56	La-	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
6	Cs	Ba	Lu	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
	87	88	Ac-	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118
7	Fr	Ra	Lr	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Nh	Fl	Mc	Lv	Ts	Og

57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
89	90	91	92	93	94	95	96	97	98	99	100	101	102	103
Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

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