மொறட்டுவை பல்கலைக்கழக பொறியியற் பீடம் தமிழ் மாணவர்கள் நடாத்தும் க.பொ.த உயர்தர மாணவர்களுக்கான 9 வது முன்னோடிப் பரீட்சை - 2018

கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர) முன்னோடிப் பரீட்சை - 2018
General Certificate of Education (Adv. Level) Pilot Examination - 2018

இரசாயனவியல் I
Chemistry I

02 E I

இரண்டு மணித்தியாலயம்
Two hours

Instructions:

- Periodic table is also provided
- This paper consists of 8 pages.
- Answer all the questions.
- Use of calculator is not allowed.
- Write your index number in the space provided in the answer sheet.
- In each of the questions 1 to 50, pick one of the alternatives from (1), (2), (3), (4), (5) which is correct or most appropriate and mark your response on the answer sheet with a cross (X) in accordance with the instructions given on the back of the answer sheet.

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

1. The energy of a photon relates with blue light of hydrogen emission spectrum is 4.5×10^{-19}J. The wave length of this blue light is,

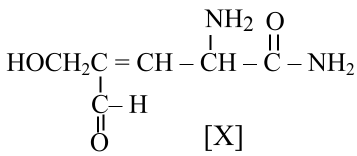
(1) 4.42×10^{-7}nm (2) 400 nm (3) 442nm (4) 560nm (5) 4.72×10^{-7}nm

2. Which of the following statements regarding the given molecules is false ?

SO_2, CO_2, XeF_4, CCl_4 and SF_4

(1) All molecules have same number of covalent bonds.
(2) Central atom of these molecules does not obey to the octet rule.
(3) All molecules have different electron pair geometry.
(4) All molecules have polar covalent bonds.
(5) All molecules have different shapes.

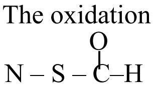
3. The **IUPAC** name of the compound X is?



[X]

(1) 1,2-diamino-4-formyl-5-hydroxypent-3-en-1-one
(2) 2-amino-4-methylhydroxy-5-oxopent-3-enamide
(3) 4,5-diamino-2-methylhydroxy-5-oxopent-3-enal
(4) 2-amino-4-formyl-4-methylhydroxybut-3-enamide.
(5) 2-amino-4-formyl-5-hydroxypent-3-enamide.

4. The oxidation states of N, S and C in the most stable neutral molecule having the skeletal structure



are respectively.

(1) -3, +2,+2 (2) -3, +4, 0 (3) -3, +2, 0 (4) -2, +2, +1 (5) -3, +3, +1

[See page 2

5. Which of the following statements is **true** regarding the difference in electronegativity of central atom of some compounds ?

(1) The variation of electronegativity of N atom in NO_2^+ and NO_3^- is mainly determined by the charge of N atom.

(2) The variation of electronegativity of C atom in CO_2 and CO_3^{2-} is mainly determined by the variation of state of hybridization of C atom

(3) The variation of electronegativity of C atom in CF_4, CCl_4 and CBr_4 is mainly determined by the variation of oxidation states of C atom..

(4) The variation of electronegativity of Cl atom in ClO_3^- and ClO_4^- is mainly determined by the variation of state of hybridization of Cl atom.

(5) The variation of electronegativity of N atom in NH_2^- , NH_3 and NH_4^+ is mainly determined by the variation of oxidation states of N atom.

6. When a certain mass of an organic compound having C, H and O only, undergoes a complete combustion,110g of CO_2 and 45g of water are obtained as the products.The molecular formula of this compound is,(C=12,H=1,O=16)

(1) $C_4H_{10}O$ (2) $C_3H_8O_2$ (3) $C_2H_6O_2$ (4) C_8H_8O (5) $C_5H_{10}O$

7. At a certain temperature, the solubility products of sparingly soluble ionic salts $SrSO_{4(s)}$ and $BaSO_{4(s)}$ are Ksp_1 and Ksp_2 respectively. Consider a saturated solution which contains these two salts at the above considered temperature. The correct expression for concentration of SO_4^{2-} ions in the above solution is,

(1) $Ksp_1 + Ksp_2$ (2) $(Ksp_1 + Ksp_2)^2$ (3) $\left(\frac{1}{Ksp_1} + \frac{1}{Ksp_2}\right)$ (4) $(Ksp_1 + Ksp_2)^{\frac{1}{2}}$ (5) $\left(\frac{1}{Ksp_1} + \frac{1}{Ksp_2}\right)^{\frac{1}{2}}$

8. Which of the following statements regarding the chemistry of Sulphur (S) is **false**?

(1) An aqueous solution of SCl_4 shows bleaching property.

(2) S_8 molecular units are present in both allotropic forms of sulphur such as rhombic sulphur and monoclinic sulphur.

(3) When sulphur is oxidized by hot concentrated nitric acid, the final product is limited to SO_2 in which the oxidation state of S is +4 .

(4) Oxidizing ability of peroxy sulphuric acid (H_2SO_5) is greater than that of sulphuric acid.

(5) When S reacts with a basic solution, it undergoes to disproportionation.

9. The effective nuclear charge which is felt by the one valence electron of Magnesium (Mg) is ?

(1) Greater than that of Sodium (Na) (2) Equal to +1 (3) Equal to +12
(4) Greater than that of Aluminium (Al) (5) Equal to +24

10. Which of the following increases when $Ba(OH)_2$ solution is diluted by adding water ?

(1) Concentration of OH^- ion (2) Density of solution (3) Concentration of Ba^{2+}ion
(4) Concentration of H^+ ion (5) Strength of electrical conductivity

11. Which of the following relationships is **true** regarding the bond angles of following molecules / ions?

(1) $NO_3^- > NO_4^{3-}$ (2) $PH_3 > NH_3$ (3) $BF_4^- > NH_4^+$ (4) $ClO_3^- > ClO_4^-$ (5) $NO_2 < NO_2^-$

12. The correct chemical formula of complex compound tetracarbonyldicyanidochromium(III) chloride according to **IUPAC** rules is,

(1) $[Cr(CO)_4(CN)_2]Cl$ (2) $[CrCl_2(CO)_4](CN)_2$ (3) $[Cr(CN)_2(CO)_4]Cl_2$
(4) $[Cr(CN)_2(CO)_4Cl]$ (5) $[Cr(CN)_2(CO)_4]Cl$

13. $2CO_{(g)} + O_{2(g)} \rightarrow 2CO_{2(g)}$ Which of the following relationships is **true** regarding the enthalpy change (**ΔH**), entropy change (**ΔS**) and Gibbs free energy change (**ΔG**) of the above reaction.

(1) **ΔH** > 0, **ΔS** < 0 and **ΔG**>0 at any temperature (2) **ΔH** > 0, **ΔS** < 0 and **ΔG**<0 at any temperature
(3) **ΔH** < 0, **ΔS** < 0 and **ΔG**<0 at low temperature (4) **ΔH** > 0, **ΔS** > 0 and **ΔG**<0 at high temperature
(5) **ΔH** < 0, **ΔS** < 0 and **ΔG**<0 at high temperature

[See page 3

14. $X_{(g)} \rightarrow Y_{(g)} + Z_{(g)}$

The gas X dissociates at temperature T, according to the above elementary reaction. When a certain amount of gas X is kept in a rigid container at temperature T , pressure of system is $P_o\ Nm^{-2}$. Then the system is allowed to dissociate, the pressure of system becomes as $P\ Nm^{-2}$ at time t. The correct expression for the rate of reaction at time t is.

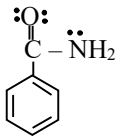
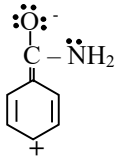
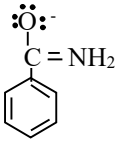
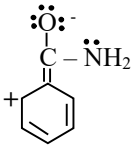
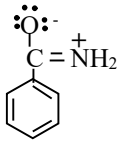
(1) $\left(\frac{k}{RT}\right)^2 [4P^2 - P_o^2]$ (2) $\frac{k}{RT}[2P_0 - P]$ (3) $\frac{k}{RT}[2P - P_0]$

(4) $\left(\frac{k}{RT}\right)^2 [4P_0^2 - P^2]$ (5) $\left(\frac{k}{RT}\right)^2 [2P_0 - P]$

15. A solution is prepared by mixing equal concentration of $50cm^3$ of HNO_3 solution and $50cm^3$ of HCOOH solution. The **correct** increasing order of concentration of H_3O^+, OH^-, NO_3^- , $HCOO^-$ and HCOOH in the resultant solution is,

(1) $[OH^-] < [HCOOH] < [HCOO^-] < [H_3O^+] < [NO_3^-]$
(2) $[OH^-] < [HCOO^-] < [HCOOH] < [NO_3^-] < [H_3O^+]$
(3) $[HCOO^-] < [OH^-] < [HCOOH] < [NO_3^-] < [H_3O^+]$
(4) $[HCOO^-] < [HCOOH] < [OH^-] < [NO_3^-] < [H_3O^+]$
(5) $[HCOO^-] < [HCOOH] < [OH^-] < [H_3O^+] < [NO_3^-]$

16. Which of the followings is not a resonance structure of Benzamide ?

(1) 
(2) 
(3) 
(4) 
(5) 

17. Rate constant of a reaction depends on the factors of

(A) Temperature **(B)** Concentration
(C) The presence of catalysts. **(D)** The pressure of system
(1) **A** only (2) **A** and **B** (3) A, B and C
(4) **A** and **C** (5) **A**, **B**, **C** and **D**

18. The standard electrode potentials of the following electrodes are given below.

$E^{\theta}_{Hg_2Cl_{2(s)}/Hg_{(l)}} = 0.28V$ $E^{\theta}_{Fe^{3+}(aq)/\ Fe^{2+}(aq)} = 0.77V$

The standard electromotive force and cell reaction of the electrochemical cell which is formed by using above two electrodes are respectively

(1) +1.16V, $2Hg_{(l)} + 2Fe^{3+}_{(aq)} + 2Cl^-_{(aq)} \rightarrow Hg_2Cl_{2(s)} + 2Fe^{2+}_{(aq)}$
(2) +0.49V, $Hg_2Cl_{2(s)} + 2\ Fe^{2+}_{(aq)} \rightarrow Hg_{(l)} + 2Fe^{3+}_{(aq)} + 2Cl^-_{(aq)}$
(3) +0.49V, $2Hg_{(l)} + 2Fe^{3+}_{(aq)} + 2Cl^-_{(aq)} \rightarrow Hg_2Cl_{2(s)} + 2Fe^{2+}_{(aq)}$
(4) +0.21V, $2Hg_{(l)} + 2Fe^{3+}_{(aq)} + 2Cl^-_{(aq)} \rightarrow Hg_2Cl_{2(s)} + 2Fe^{2+}_{(aq)}$
(5) +0.49V, $2Hg_{(l)} + 2Fe^{2+}_{(aq)} + 2Cl^-_{(aq)} \rightarrow Hg_2Cl_{2(s)} + 2Fe^{3+}_{(aq)}$

19. $4.48dm^3$ of an air sample which is contaminated by chlorine gas is passed through an excess KOH solution under standard temperature and pressure. Excess $KI_{(aq)}$ and certain amount of diluted $H_2SO_{4(aq)}$ are added to the resultant solution and the evolved I_2 is titrated using $0.01moldm^{-3}$ $Na_2S_2O_3$ solution , the required volume of solution is 10 cm^3 . The amount of chlorine present in air sample (in ppm) is ?

(1) 200ppm (2) 250ppm (3) 400ppm (4) 500ppm (5) 750ppm

20. Which of the following statements regarding nitrogen (N) is **false** ?

(1) The maximum number of electrons which can be present in the valent shell of nitrogen in the compounds of nitrogen is 8.
(2) Only four orbitals are present in the valent shell of nitrogen.
(3) Nitrogen shows the highest valency in second period elements.
(4) Except Li, nitrogen cannot react with other alkali metals.
(5) According to Pauling's scale electronegativity of nitrogen is greater than that of chlorine.

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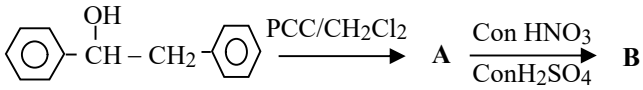
21. $S(s)$ (Rhombic) $+ O_2(g) \rightarrow SO_2(g)$ $\Delta H^{\theta} = -296.06\ kJmol^{-1}$
$S(s)$ (Monoclinic) $+ O_2(g) \rightarrow SO_2(g)$ $\Delta H^{\theta} = -296.36\ kJmol^{-1}$
By considering the above reactions and the enthalpy changes given, the standard formation enthalpies of $SO_2(g)$ and $S(s)$ (Mono clinic) are respectively (in $kJmol^{-1}$),
(1) -296.36, -0.3 (2) -296.06, -0.3 (3) -296.06, +0.3
(4) -296.36, -592.42 (5) -296.36, 0

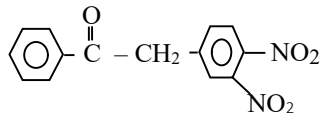
22. Which of the following statements regarding 3d – transition elements and their compounds is **false**?
(1) The Highest valency of the elements from Ti to Cr is equal to number of unpaired electrons in their ground state.
(2) Ti,Cr,V and Mn can form dioxides.
(3) Bivalent metal hydroxides of Mn,Fe and Co can be oxidized easily in the atmosphere.
(4) V,Cr and Mn can form acidic,amphoteric and basic oxides.
(5) The stable, highest valent, anhydrous solid state metal chlorides of Ni, Fe and Cu are yellow in colour.

23. In a closed system $CaCO_3(s)$ undergoes decomposition and attains equilibrium as shown below.
$CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$ $\Delta H^{\theta} = +177.8\ kJmol^{-1}$
Assume that, the decomposition temperature of $CaCO_{3(s)}$ is 835°C. The **correct** statement of the followings is?
(1) At 835°C, ΔG^{θ} and ΔH^{θ} of above reaction are zero.
(2) The pressure of system depends on the magnitude of equilibrium constant of equilibrium reached at 835°C.
(3) $\Delta G^{\theta} > 0$ in the equilibrium reached at the temperature above 835°C.
(4) The entropy of the surrounding molecules increases during the above reaction.
(5) The value of equilibrium constant decreases, when the temperature is increased from 835°C.

24.



The most likely structure of **B** is,

(1)


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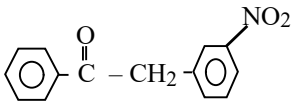
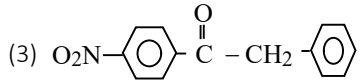


(3)


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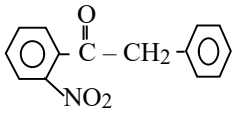

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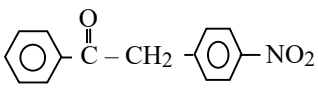
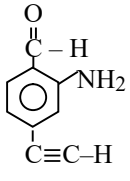


25. Which of the following statements regarding the pollutant gases present in the atmosphere is **true?**
(1) Only NO_2 oxidizes SO_2 in the atmosphere as SO_3 .
(2) The increase in amount of CO_2 and SO_2 in the atmosphere causes acid rain.
(3) NO_2 can cause all environmental problems such as ozone layer depletion, acid rain and global warming.
(4) Since CO_2 is a non polar molecule, it does not have the ability to absorb IR rays.
(5) Hydro Fluoro carbons (HFCs) contribute to ozone layer depletion.

26. Which of the following organic compounds undergoes all three reactions given below?
Reaction A – Evolves NH_3 gas when warmed with an aqueous NaOH solution.
Reaction B – Gives an orange colour precipitate with Brady's reagent.
Reaction C - Decolorizes the orange colour of Br_2/CCl_4

(1)


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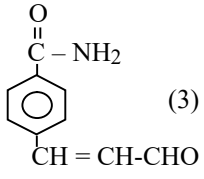
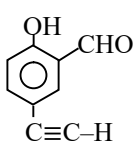


(3)


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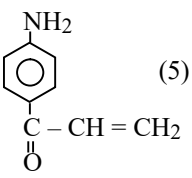
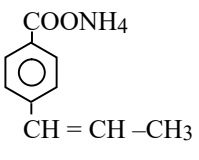


(5)


[See page 5

27. A solution is prepared by adding 0.1mol of $[Cu(NH_3)_4]^{2+}$ and 1mol of NH_3 in $1000cm^3$ of distilled water.

The equilibrium constant of following equilibrium reaction at 25°C is $5x10^{13}mol^{-4}dm^{12}$

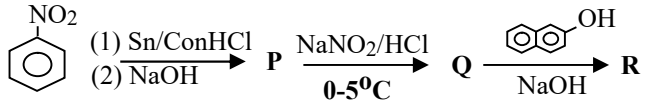
$Cu^{2+}_{(aq)} + 4NH_{3(aq)} \rightleftharpoons [Cu(NH_3)_4]^{2+}_{(aq)}$

The concentration of $Cu^{2+}_{(aq)}$ ion when the equilibrium reaches at 25°C is,

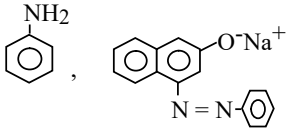
(1) $2x10^{-15}moldm^{-3}$ (2) $2x10^{-14}moldm^{-3}$ (4)$5x10^{-15}moldm^{-3}$

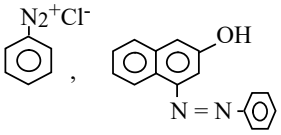
(4) $5x10^{-14}moldm^{-3}$ (5) $1.6x10^{-15}moldm^{-3}$

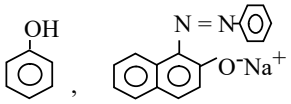
28. Consider the reaction scheme given below.

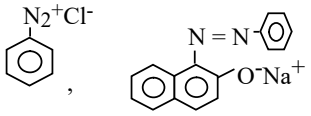


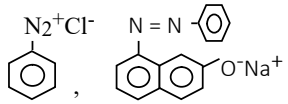
The structures of **Q** and **R** are respectively ,

(1) 

(2) 

(3) 

(4) 

(5) 

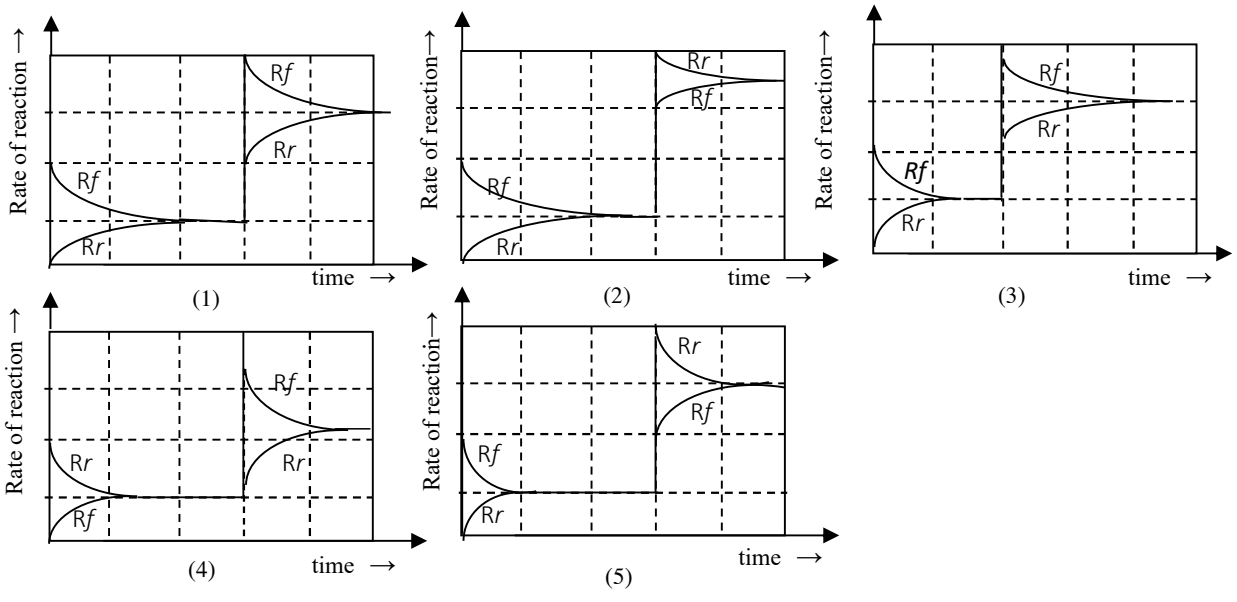
29. Which of the following statements regarding the polymers is **true** ?

(1) Teflon is a thermosetting polymer which can bear high temperature.
(2) Transpolyisoprene is present in natural rubber.
(3) PVC, polyethene and polypropene are saturated, linear polymers.
(4) Ebonite is produced by heating the natural rubber with 1-3% of Sulphur.
(5) The empirical formula of both styrene and polystyrene are different.

30. Equal moles of gases A and B are taken in a closed container (volume of container can be changed) and an elementary reaction equilibrium is established according to the following equation .

$A(g) + B(g) \rightleftharpoons C(g)$

At constant temperature, the pressure of system is doubled by suddenly changing the volume of container as half times of initial and system is allowed to attain equilibrium again. The figure which correctly represents the change of forward reaction rate(R_f) and reverse reaction rate(R_r) of the system with time is,

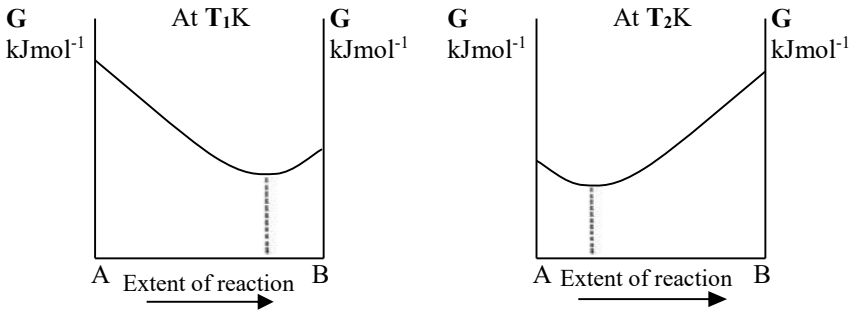


[See page 6

- For each questions **31** to **40**, one or more responses out of the four responses (a), (b), (c), (d) given is/are 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.

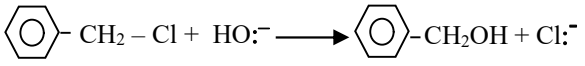
1	2	3	4	5
Only (a) and (b) are correct	Only (b) and (c) are correct	Only (c) and (d) are correct	Only (d) and (a) are correct	Any other number of combination of responses is correct

31. The variation of standard Gibbs free energy of reaction $A_{(g)} \rightleftharpoons B_{(g)}$ with the extent of reaction at constant pressure at two different temperatures T_1 and T_2 (where $T_1 < T_2$) are shown in the figure as follows. Which of the following statement/s is/are **correct** regarding this reaction?



(a) At T_1 K, the forward reaction has a negative ΔG^0 value.
(b) The reverse reaction is spontaneous at T_2 K.
(c) ΔS^0 value of forward reaction is negative.
(d) The forward reaction is endothermic.

32. Which of the following statement /s is/are **true** regarding the reaction given below?



(a) Only one activated intermediate complex forms in this reaction.
(b) Rate order of this reaction is two.
(c) Change in concentration of OH^- ion does not affect the rate of reaction.
(d) This is a nucleophilic substitution reaction.

33. The following statements refer to certain industrial processes. Which of the following statement/s is/are **true**?
(a) In the manufacturing process of sodium bicarbonate using the Solvay process, temperature of towers must be= kept above 30°C.
(b) In the production of iron using blast furnace, CO acts as a main reducing agent.
(c) The cation exchange membrane is used in the large scale production of pure NaOH.
(d) In manufacturing process of Na Using Down's cell method, low electric current and high voltage are used.

34. Which of the following statement/s is/are **false** regarding the elementary reaction?
(a) The overall order of the reaction cannot be zero
(b) The change in concentration of of all reactant species change the rate of reaction.
(c) The overall rate of reaction depends on the rate of formation of intermediate.
(d) The unit of rate constant changes with the change of molecularity

[See page 7

35. The equilibrium constant Kc of the reaction $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ at T K is k.

$\Delta H^{\theta} = -92\ kJmol^{-1}$

At this temperature which of the following statement/s is/are **true**?

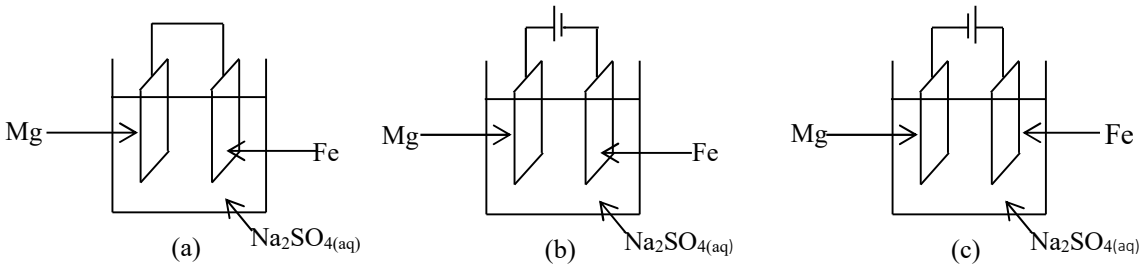
(a) Kc of the reaction $2NH_3(g) \rightleftharpoons N_2(g) + 3H_2(g)$ is. $\frac{1}{k}$

(b) Kc of the reaction $1/2\ N_2(g) + 3/2H_2(g) \rightleftharpoons 2NH_3(g)$ is $\frac{1}{2k}$

(c) With the increase of temperature value of K_c increases from k

(d) Kp of the above reaction is $\frac{k}{R^2T^2}$

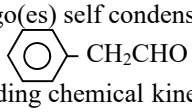
36. In the following instances, the arrangement (a) shows the state of connecting Mg and Fe electrodes while the arrangements (b) and (c) show the electrochemical cells which are formed by connecting Mg and Fe electrodes.



Which of the following statement/s is/are **true** regarding the above arrangements?

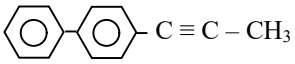
(a) Oxidation of Fe is prohibited more in arrangement (b) than that of arrangement (a)
(b) Oxidation of Fe is prohibited more in arrangement (c) than that of arrangement (a)
(c) The gas evolution takes place in Mg electrode in arrangement (b).
(d) The gas evolution takes place in Mg electrode in arrangement (c).

37. Which of the following compound/ compounds undergo(es) self condensation in alkali solution?

(a) HCHO (b) CH_3CH_2CHO (c)  (d) $(CH_3)_3CCHO$

38. Which of the following statement/s is/are **true** regarding chemical kinetics?

(a) Activation energy of a reaction does not change, eventhough the concentration of reactants change.
(b) Activation energy of a certain reaction may change with the use of different catalysts.
(c) In a reaction the step with lowest activation energy is the rate determining step.
(d) The acivated intermediate complex formed in a reaction is the most stable state.

39. Which of the following statement/s is or are **true** regarding the molecule 

(a) In the above molecule,12 carbon atoms are in sp^2 hybridized while 2 carbon atoms are in sp hybridized sate.
(b) Maximum number of carbon atoms which lie in the same plane is 10.
(c) Both of benzene rings do not lie in the same plane.
(d) Electronegativity of all carbon atoms of benzene rings are same.

40. Which of the following method/ methods minimize / minimizes the amount of CO gas released in atmosphere?

(a) By the oxidation process of soil microorganisms.
(b) By connecting a catalytic converter which consists of thin platinum layer, chromium and copper oxide to silencer of vehicles
(c) By the combustion of a lean mixture which is obtained by tuning up of ratio between air and fuel in vehicle engine.
(d) By passing through the beds of limestone.

- In questions No. 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 correctly explains the first statement
(3)	True	False
(4)	False	True
(5)	False	False

[See page 8

	Fist Statement	Second Statement
41.	The bond angle of NH_3 molecule is greater than that of NF_3 molecule	NF_3 molecule is more polar than NH_3 molecule
42.	The rate of addition reaction of H – Br with propene nitrile (CH_2=CHCN) is higher than that of with propene (CH_3CH =CH_2) under the same conditions	The stability of carbocation $CH_3–\overset{+}{C}H–CN$ is greater than that of $CH_3–\overset{+}{C}H–CH_3$
43.	When CH_3COOH solution and HCl solution with same concentration are diluted separately by adding equal amount of water, the increase in pH of CH_3COOH solution is greater than that of HCl solution.	When an aqueous solution of CH_3COOH is diluted by adding water, the amount of ionization increases.
44.	In an elementary equilibrium reaction, the ratio between the rate constant of forward reaction and that of reverse reaction gives the equilibrium constant.	In an elementary equilibrium reaction, rate constant of forward reaction is equal to that of reverse reaction.
45.	Acetaldehyde can be oxidized easily than Benzaldehyde.	Both acetaldehyde and benzaldehyde can undergo to the nucleophilic addition reaction.
46.	In the reaction of $H_2O_{(l)} \rightleftharpoons H_2O_{(g)}$ at 373.15K temperature and 1 atm pressure conditions, $\Delta H^0 > 0$, $\Delta S^0 > 0$ and $\Delta G^0 = 0$.	When the reaction $H_2O_{(l)} \rightleftharpoons H_2O_{(g)}$ takes place at 373.15K temperature and 1atm pressure, the strength of intermolecular forces become weaker and also $\Delta H^0 = T.\Delta S^0$.
47.	K_2CO_3 cannot be produced through solvay process.	Water solubility of K_2CO_3 is greater than that of Na_2CO_3 .
48.	Except formaldehyde, all other aldehydes react with the mixture of HCN/KCN and give enantiomeric isomers as products.	Enantiomers are stereo isomers which are mirror images to each others.
49.	Ag_2CO_3 is easily soluble in diluted HNO_3 solution, while AgCl is insoluble.	Carbonate ion is a conjugate base of a weak acid, while chloride ion is a conjugate base of a strong acid.
50.	Same amount of heat is released in the hydrogenation reaction of equal moles of but-1-ene and but-2-ene in the presence of Pd catalyst under the same conditions.	Butane is formed as the product in the catalytic hydrogenation of both but-1-ene and but-2-ene .

Periodic Table

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

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

மொறட்டுவை பல்கலைக்கழக பொறியியற் பீட தமிழ் மாணவர்கள்
நடாத்தும் க.பொ.த உயர்தர மாணவர்களுக்கான 9 வது
முன்னோடிப் பரீட்சை - 2018

கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர) முன்னோடிப் பரீட்சை - 2018
General Certificate of Education (Adv. Level) Pilot Examination - 2018

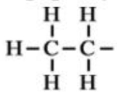
இரசாயனவியல் II / Chemistry II

02 E II

மூன்று மணித்தியாலம் / *Three hours*

Index No :...................................

- *A Periodic Table is provided on page 16.*
- ***Use of calculators is not allowed.***
- *Universal gas constant,* $R = 8.314\ J\ K^{-1}mol^{-1}$
- *Avagadro constant,* $N_A = 6.022 \times 10^{23} mol^{-1}$
- **In answering this paper, you may represent alkyl groups in a condenced manner.**

Example:  may be shown as CH_3CH_2-

❑ **Part A – Structured Essay (Pages 2 - 8)**
- *Answer all the questions on the question paper itself.*
- *Write your answers 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 – Essay (Pages 9 - 15)**
- *Answer four questions selecting two questions from each part. Use the answer sheets provided for this purpose.*
- *At the end of the allotted for this, tie the answers to the three parts* **A,B** *and* **C** *together so that part* **A** *is on the top and hand it over 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		
Percentage		

Final Marks

In Numbers	
In Letters	

Code Numbers

Marking Examiner 1	
Marking Examiner 2	
Checked by	
Supervised by	

[See page 2

Part A – Structured Essay

Answer **all four** questions on this paper it self
(Each question carries **10** marks)

Do not write anything here.

1. (a) Arrange the following in the **increasing** order of the property indicated in parenthesis.

i. C, Li, Si (electron affinity)

……....……<…….....<.....

ii. N_2H_4, $NaNH_2$,NH_2OH (oxidation state of N atom)

……....……<…….....<.....

iii. Li^+, Cl^-, Al^{3+} (Hydration energy)

……....……<…….....<.....

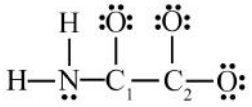
iv. $KHCO_3$,$NaHCO_3$, $Mg(HCO_3)_2$ (Decomposition temperature)

……....……<…….....<.....

v. $Mg(OH)_2$, $Ca(OH)_2$, $Sr(OH)_2$ (Solubility)

……....……<…….....<.....

(b) The compound with the molecular formula $H_3C_2NO_3$ reacts with NaOH $_{(aq)}$ solution and gives a compound with the molecular formula $H_2C_2NO_3Na$ and water as the products. Answer the following questions which are based on the anion of this sodium salt. The **first step** of the Lewis structure of anion is given below,



i. Mark the appropriate formal charges of carbon and oxygen atoms in the above structure.

ii. Draw the **most acceptable** Lewis structure for this anion.

iii. Draw all the possible resonance structures for this anion.

[See page 3

Do not write anything here.

iv. Giving reasons, comment on their relative stabilities of the resonance structures drawn in part (iii) above.

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v. State the followings regarding the C and N atoms, given in the table below.

1. VSEPR pairs around the atom
2. electron pair geometry (arrangement of electron pairs) around the atom
3. shape around the atom
4. hybridization of the atom

		C_1	C_2	N
ρ	VSEPR pairs			
ς	electron pair geometry			
σ	shape			
τ	hybridization			

vi. Identify the atomic/ hybrid orbitals involved in the formation of the following σ bonds in the Lewis structure drawn in part (ii) above.

1. C_1–C_2 ……...
2. C_1 – N ……...…
3. N – H……
4. C_1 – O ……...…

vii. When dil HCl is added to the above anion, a compound with molecular formula $H_3C_2NO_3$ is obtained.

1. Draw the structure obtained, by considering whether H^+ ion joins with oxygen atom / nitrogen atom.

2. By considering the atom in which H^+ ion is joined, underline the suitable phrase.
   State of Hybridization (changes/ does not change)
   Oxidation state (increases/ decreases/ does not change)
   Charge (increases/ decreases/ does not change)
   Number of VSEPR pairs (increases/ decreases/ does not change)
   Electronegativity (increases/ decreases/ does not change)

(c) Among the following molecules which one /ones will have the following intermolecular attractive forces.

$CS_{2(l)}$, $CH_2Cl_{2(l)}$, $NH_2OH_{(l)}$, $XeO_{3(l)}$, $C_6H_{6(l)}$

i. hydrogen bond

.....

ii. dipole – dipole interaction

.....

iii. london dispersion forces.

....

Do not write anything here.

02.(a) A third period element "A" reacts with water and gives a solution B and gas molecules C, where C is a molecule of an element belongs to same group of A. The highest oxidation state oxides D and E of the elements which belong to the period of A react with solution B and give colourless solutions F and G respectively. When $BaCl_{2(aq)}$ is added separately to these solutions , white colour precipitates H and I are obtained respectively. When diluted HNO_3 is added to these precipitates, only H dissolves and gives a clear colourless solution.

i. Identify A,B,C,D,E,F,G,H and I.

A…… B…… C……

D…… E…… F……..

G…… H…… I…….

ii. Write the balanced chemical equations for the chemical reactions described above.

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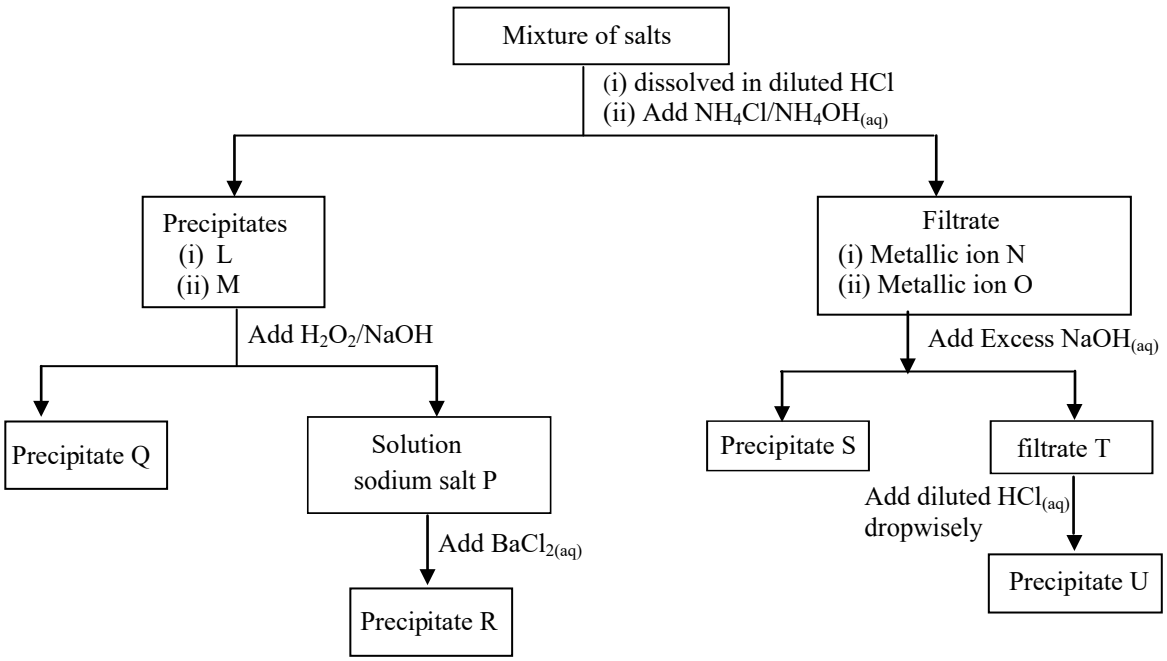
(b) A flow chart for the analysis of a salts sample contanining $MgCl_2$,$Fe(NO_3)_3$,$Cr_2(SO_4)_3$ and $ZnCl_2$ is given below.



i. By considering the above flow chart, give the precipitates Q, R, S and U and the salts P and T which are present in the solution state.

P…… Q…… R……

S…… T…… U…….

[See page 5

Do not write anything here.

ii. What is the colour of precipitate R? What will be the colour of resultant solution obtained when diluted HNO_3 is added to this precipitate R? Give the appropriate balanced chemical equation for this change.

Colour of the precipitate R……...

Colour of the resultant solution ……..

Chemical equation …….. .

iii. Give **a chemical test** with the relevant **observations** to identify the metal ions in the precipitates S and U.

Test :……..……..

Observations

S:……..……

U:……..……

iv. Give a test to identify the cation present in the precipitate Q .

……

……

03. (a) At 25ºC temperature, an aqueous solution S was prepared by adding two mono basic weak acids HA and HB each of initial concentration 1moldm^{-3}. The degree of dissociation of HA and HB in this solution were α and β and the dissociation constants of them were K_1 and K_2 respectively (At 25ºC, $K_1 = 4x10^{-6}$moldm^{-3} and $K_2 = 1.2\ x10^{-5}$ moldm^{-3}).

i. Giving reasons, deduce which of the above two acids is more acidic.

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ii. Obtain a relationship, between the degree of dissociation α,β and dissociation constants K_1,K_2 of the above acids.

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[See page 6

Do not write anything here.

iii. Show that the pH of the solution S can be given as, pH = - ½ log(K_1 +K_2).

……

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……

iv. Show that $\alpha + \beta = 4x10^{-3}$.

……

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v. Calculate the values of degree of dissociation α and β using the relationships obtained in part (ii) and (iv).

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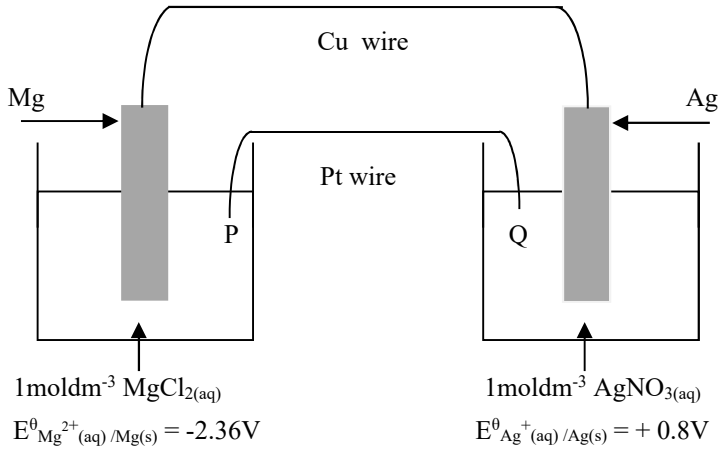
(b) The following diagram shows a set up constructed by a student using standard Magnesium electrode, standard silver electrode, Pt wire and Cu wire.



i. Identify,whether the ends of Pt wires P and Q, Mg electrode and Ag electrode are positive terminal or negative terminal.

Mg…… Ag……

P…… Q ……

ii. Mark the direction of electron flow in the Cu wire and Pt wire in the above circuit by using arrow marks.

iii. Give the electrode reactions of Mg and Ag electrodes.

……

……

[See page 7

Do not write anything here.

iv. Calculate the electric potential difference between Mg and Ag electrodes at the initial state?

……

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……

……

v. Give the balanced chemical equations for the reactions take place at the ends P and Q of Pt wire which presents in the solution of two half cells.

……

……

vi. Write the balanced chemical equations for the reactions take place at the terminals P and Q when Cu wire is used instead of Pt wire.

……

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04. (a) Organic compounds A, B, C, D and E have same molecular formula $C_5H_{10}O$. All these compounds can give orange colour precipitates with Brady's reagent. Only A exhibits optical activity. When the compounds A,B and C are reduced by $NaBH_4$ and involved to the dehydration, F,G and H are obtained as the products respectively. H exhibits diastereomerism. When H is treated with diluted H_2SO_4 and then oxidized by PCC, the compound D is obtained. When F and G are involved in hydration with diluted H_2SO_4, I is obtained as the only one product. "I" can give an instant turbidity with anhydrous $ZnCl_2$/con.HCl. The compound E does not involve to self condensation in diluted NaOH solution.

i. Give the structures of A, B, C, D, E, F, G, H and I in the boxes given below.

A	B	C
D	E	F
G	H	I

[See page 8

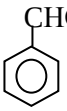
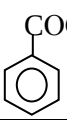
Do not write anything here.

ii. Draw the structures of diastereomers of H.

iii. Write the compounds F,G and H in the increasing order of their stability.

……

(b) The following table contains the reactants and reagents involved in the reactions from 1-6. Write down the type of reactions [nucleophilic addition (A_N), electrophilic addition (A_E), nucleophilic substitution(S_N), electrophilic substitution(S_E) and Elimination(E)] and the major products in the suitable cages.

	Reactant	Reagent	Type of reaction	Major Product
1	$CH_3CH=CH_2$	HBr		
2	$CH_3CH_2–\underset{\displaystyle Cl}{\overset{\displaystyle |}{C}}–(CH_3)_2$	C_2H_5OH / KOH		
3	$CH_3C\equiv C–MgCl$	CH_3CH_2Cl		
4		$CH_3–\underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}}–CH_2Cl$ / Dry $AlCl_3$		
5		2,4 - DNPH		
6		dil $Ba(OH)_{2(aq)}$		

(c) Write the mechanism for the following reaction.

$$(CH_3)_3– C – OH \xrightarrow{\text{Con.HBr}} (CH_3)_3 – C – Br$$

[See page 9

கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர) முன்னோடிப் பரீட்சை - 2018
General Certificate of Education (Adv. Level) Pilot Examination - 2018

இரசாயனவியல் II
Chemistry II

02 E II

PART B- ESSAY

*Answer two questions only. (each question carries **15 marks**)*

05. (a) At a given temperature, $NH_4Cl_{(s)}$ and $NH_4Br_{(s)}$ are taken in a closed rigid container and they are allowed to decompose and reach an equilibrium according to the following equations.

$$NH_4Cl\ (s) \rightleftharpoons NH_3(g) + HCl(g) \quad Kp = 3x10^8\ Pa^2$$
$$NH_4Br(s) \rightleftharpoons NH_3(g) + HBr(g) \quad Kp = 6x10^8\ Pa^2$$

i. Calculate the partial pressure of $NH_3(g)$
ii. Calculate the partial pressures of HCl(g) and HBr(g)?

When the temperature of system is slightly increased HBr molecules are partially decomposed to form H_2 and Br_2 as products. In addition to above two equilibriums the following equilibrium is also obtained,when the system is allowed to come to the initial temperature

$$2HBr_{(g)} \rightleftharpoons H_{2(g)} + Br_{2(g)}$$

At the new equilibrium state, the partial pressure of HCl(g) is 6×10^3 Pa. Calculate the followings at the new equilibrium,

iii. partial pressure of $NH_3(g)$
iv. equilibrium constant Kp for the equilibrium of $2HBr\ (g) \rightleftharpoons H_2(g) + Br_2(g)$

(b) i. $100cm^3$ of aqueous solution containing 17.5 ppm composition of A is mixed with 50 cm^3 of $CHCl_3$ layer and the mixture is shaken well, then the system is allowed to attain the equilibrium at 25°C temperature. If the equilibrium equilibrium composition of A in the $CHCl_3$ layer is 25 ppm, Calculate the partition coefficient of A in between $CHCl_3$ and water.

ii. **A+B → Products.**

The following experiments were carried out in order to determine the rate law of the above reaction. A is the substance mentioned in part (i) above. B is insoluble in chloroform. At 25^0C, the solute A was dissolved in water, chloroform was added and allowed to attain the equilibrium. The reaction was started by adding B. The results of the experiment carried out are given in the table below.

Experiment No.	V_{CHCl_3}/cm^3	$V_{(aq)}/cm^3$	Amount of A Added to the system/ mol	Amount of B added to the system /mol	Initial rate ($moldm^{-3}\ s^{-1}$)
i.	0.0	50.0	0.001	0.002	$4x10^{-6}$
ii.	50.0	50.0	0.012	0.002	$8x10^{-6}$
iii.	100.0	100.0	0.012	0.002	$1x10^{-6}$

The rate order with respect to A and B are a and b and the rate constant of reaction is k.

1. Write an expression for the rate of the reaction.
2. Calculate the values of a and b.
3. What is the overall order of reaction.
4. Calculate the rate constant of the reaction.

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(c) A and B are two miscible solvents which can form a binary ideal solution. 64g of solvent A and 46g og solvent B are mixed togather in a closed rigid vessel at 25°C. when the mixture is allowed to attain the equilibrium at this temperature the pressure and the volume of vapour phase are 2.4×10^5Pa and 8.314dm^3 respectively and the mole fraction of A in vapour phase is 0.75. Calculate the saturated vapour pressure of A and B at 27°C.
(Relative molecular masses of A and B are 32 and 46 respectively.)

06. (a) The salt BA of the weak acid HA and the weak base BOH can ionize completely in water.
The hydrolysis reaction of BA is given below.

$$B^+_{(aq)} + A^-_{(aq)} + H_2O_{(l)} \rightleftharpoons HA_{(aq)} + BOH_{(aq)}$$

The ionization constants of HA and BOH are K_a and K_b respectively and the ionic product of water is Kw.

i. By considering the hydrolysis reaction of BA, show that, $pH = \frac{1}{2}[p^{kw} + P^{ka} - p^{kb}]$.

ii. At 25^{0}C, calculate the pH of 1 moldm^{-3} $CH_3COONH_3CH_3$ aqueous solution using the above conclusion in part (i). Consider at 25^{0}C, K_a of $CH_3COOH = 1x10^{-5}$moldm^{-3}, K_b of $CH_3NH_3OH = 1x10^{-4}$ moldm^{-3} and $K_w = 1x10^{-14}$ mol^{2}dm^{-6}

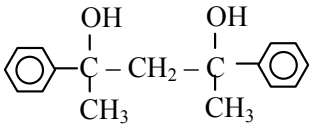
(b) i. At 25^{0}C, Calculate the pH of 0.1 moldm^{-3} NH_4OH aqueous solution. At 25°C, K_b of $NH_4OH = 1x10^{-5}$ moldm^{-3} and $K_w = 1x10^{-14}$ mol^{2}dm^{-6}

ii. At 25^{0}C, 0.66g of $(NH_4)_2SO_4$ solid is dissolved in 1dm^3 of 0.1moldm^{-3} NH_4OH aqueous solution. Calculate the pH of resultant solution (N-14, S-32, O-16, H-1)

iii At 25^{0}C, Calculate the minimum mass of solid MCl_2 need to be added in the above solution in part (ii) for just starting the precipitation of $M(OH)_2$. Consider that, solubility product (K_{sp}) of $M(OH)_2$ is $1x10^{-11}$mol^{3}dm^{-9}. (M-24, Cl-35.5)

iv. At 25°C determine whether $Ca(OH)_2$ can/can't be precipitated when $CaCl_2$ solid is added to the solution in part (ii). The solubility product (K_{sp}) of $Ca(OH)_2$ is $4x10^{-6}$ mol^{3}dm^{-9} (Ca -40, Cl-35.5)

07.(a) Show how would you synthesize the compound 2,4-diphenyl-2,4-pentanediol, using the starting component and suitable reagents only from the list of chemicals provided.



(2,4 –diphenyl-2,4-pentanediol)

List of chemical substances.
CH_3MgBr, CH_3CH_2OH,
Br_2, PCl_5, $AlCl_3$, $KMnO_4$,
NaOH, H_2SO_4, CCl_4

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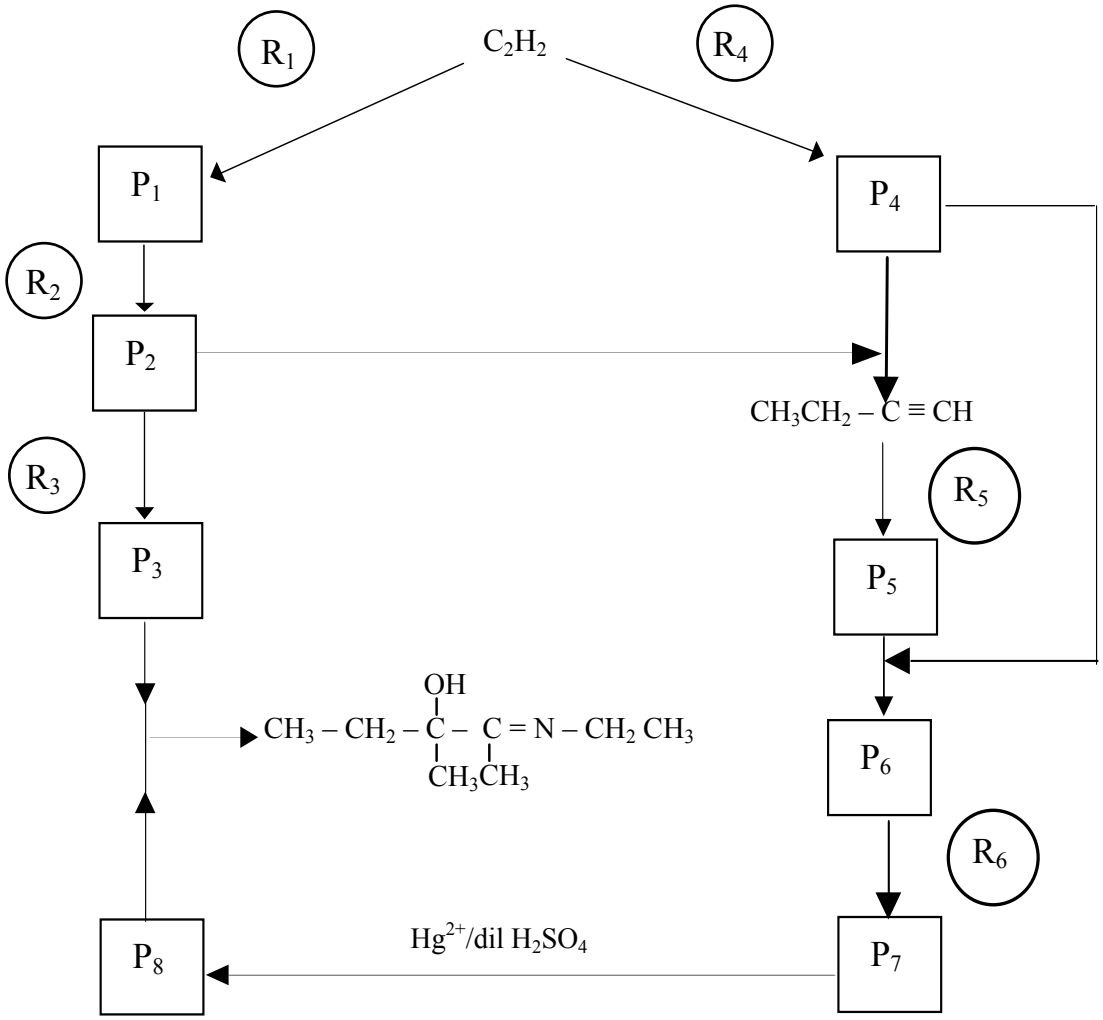
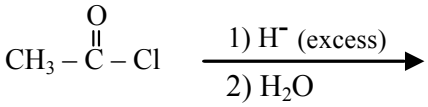
(b) Identify the suitable reagents $R_1 - R_6$ and the products P_1-P_8 in order to complete the following reaction scheme.



(c) Give the product and the mechanism for the following reaction, by using your knowledge about the mechanism in the Organic chemistry.



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PART C - ESSAY

*Answer two questions only. (each question carries **15 marks**)*

08.(a) When an inorganic salt P is heated with $K_2Cr_2O_7$ and concentrated H_2SO_4, a white colour precipitate Q and red colour vapour R are obtained as the products. When R is passed through NaOH solution, a yellow colour solution S is obtained. When P is added in to this solution, a yellow colour precipitate T is obtained. When this precipitate is dissolved in diluted H_2SO_4, the precipitate Q and solution U are obtained as the products. When P is involved to flame test a yellowish green colour flame is observed.

i. Identify P,Q,R,S,T and U

ii. Give the colour change that takes place when diluted NaOH is added to solution U.
Give the chemical equation relevant to the above observatio in part (ii).

(b) An aqueous solution X Contains three metal ions. The following experiments were carried out to identify these metal ions.

Procedure A

Experiment	Observation
Solution X was acidified with diluted HCl, and H_2S was bubbled through the solution	No precipitates were obtained
Excess NH_4Cl/NH_4OH was added to the resultant solution.	A mixture of precipitates (P1+P2) was obtained
Precipitates were removed by filtration, and $Na_2C_2O_4$ was added.	A precipitate P_3 was obtained

The following experiments were carried out with the precipitates P_1,P_2 and P_3.

Procedure B

Experiment	Observation
(1) Mixture of precipitates P_1 and P_2 was dissolved in dil HCl, and excess NaOH was added to the solution obtained.	A pinkish white colour precipitate P_4 was obtained. When precipitate was filtered and exposed, it changed to brown colour with time.
(2) Excess HCl solution was added to solution obtained in (1) and then excess NH_4OH was also added.	A white gelatinous precipitate (P_5) was obtained
(3) Acetic acid was added to precipitate P_3	It was insoluble in acetic acid.
(4) Then it (P_3) was dissolved in HCl and the solution was subjected to the flame test.	A brick red colour flame was obtained.

i. Identify the three metal ions in solution X (Reasons are not required)

ii. Write the chemical formulae of the precipitates P_3,P_4 and P_5

iii. Give a test to identify the metal ion present in precipitate P_4

(c) The ascorbic acid is the chemical component of Vitamin C. Since it is a mild reducing agent, it can minimize the oxidation (Antioxidant). It is essential for the formation of collagen fibers and it is believed to minimize the formation of cancer cells. The following procedures were used to determine the amount of ascorbic acid in a vitamin C tablet.

Procedure I

$10cm^3$ of 10% KI (It is very much enough to create I_3^-)and $10cm^3$ of diluted H_2SO_4 were added in to $25cm^3$ of 0.02 $moldm^{-3}$ KIO_3 solution.

Procedure II

Two vitamin C tablets of each 500mg were dissolved in distilled water to form $500cm^3$ solution.The solution obtained in Procedure I was added completely to 25 cm^3 portion of this prepared solution. When the resultant solution was titrated using 0.1 $moldm^{-3}$ $Na_2S_2O_3$ solution in the presence of starch indicator 25 cm^3 of $Na_2S_2O_3$ solution was required.

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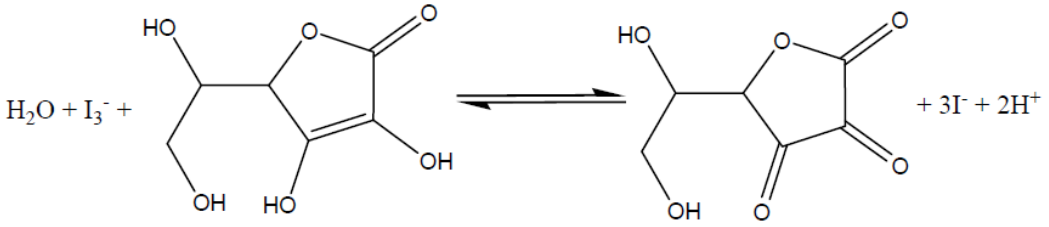
I_3^- can react with ascorbic acid according to the following equation

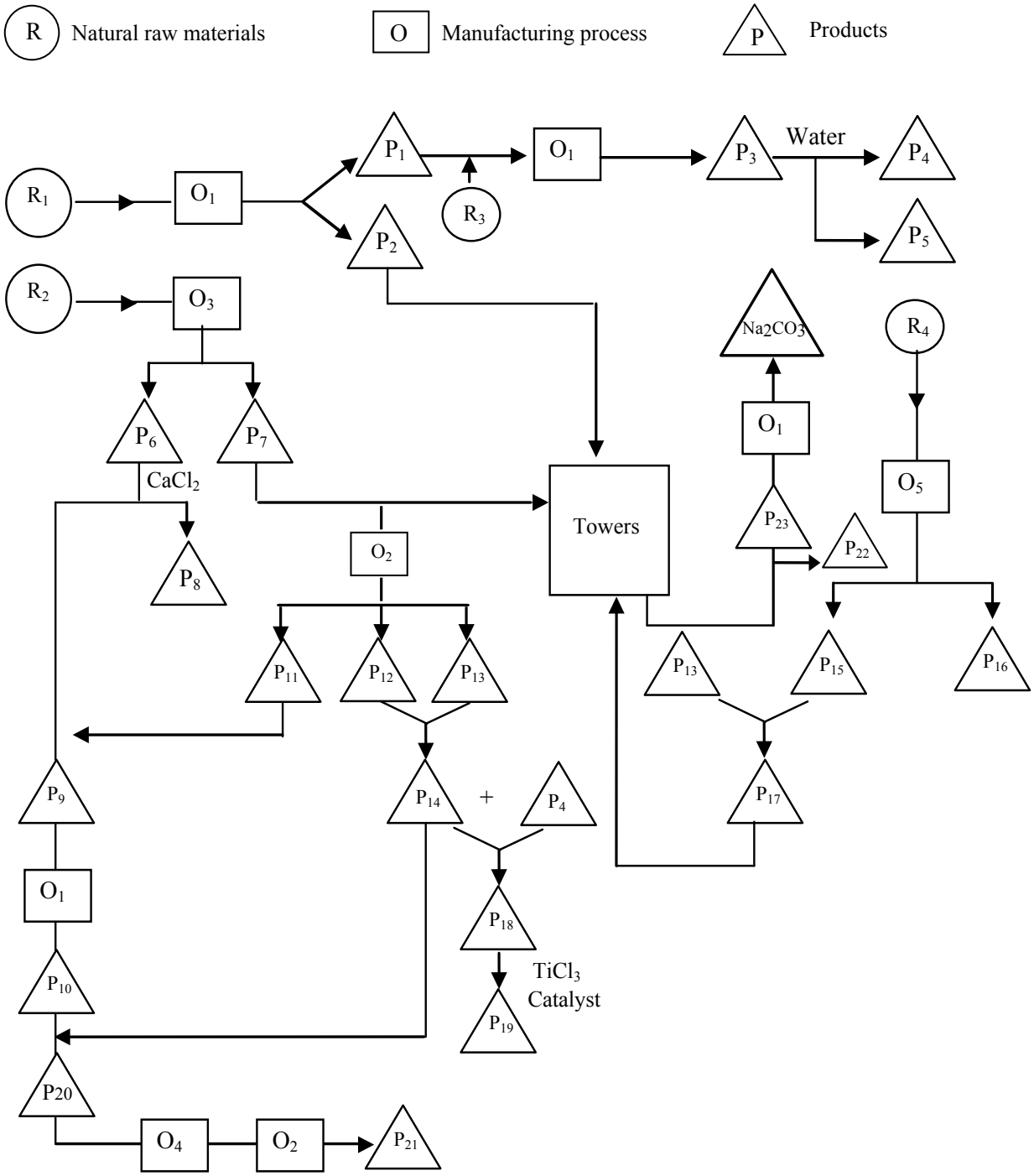


i. Give the balanced chemical equation for the formation of I_3^- by the reaction between IO_3^- and I^- in the acidic medium.

ii. Calculate the number of moles of I_3^- released in the solution in Procedure I

iii. Calculate the mass percentage of ascorbic acid in a vitamin C tablet on the basis of procedure (II)

09. (a) Flow chart for the manufacture of some industrial products is shown below. The following symbols are used to represent natural raw materials, manufacturing processes and products.



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P_4 - can induce ripening of fruits
P_{21} - used as a sacrificing metal in the process of protecting iron corrosion
P_{19} - polymer used in the production of water pipes

i. Identify the natural raw materials R_1 to R_4
ii. Identify the manufacturing processes O_1 to O_5
iii. Identify the products P_1 to P_{23}
iv. Write the name of manufacturing process which produces P_{17} using P_{13} and P_{15}. State the conditions used in this reaction procedure
v. Write the balanced chemical equation for the regeneration of raw material used in the production of P_{23} using P_5 and P_{22}.

(b) The gases such as CO, CO_2, NO, NO_2 and SO_2 are released to the atmosphere from the vehicle engines and machines used in industries.

i. All these above gases can cause a particular environmental problem. Identify that problem?
ii. State how this environmental problem mentioned in (i) above is caused by these gas molecules ?
iii. Which one of the above gases makes most contribution to that problem ?
iv. Give 4 adverse effects on the environment caused by this problem mentioned in (i) above.
v. "Water vapour molecules do not contribute to that environmental problem." Justify this statement.
vi. Which one of the above gases will contribute to all four environmental problems such as Acid rain (AR), Global warming (GW), ozone layer depletion (OLD) and photo chemical smog (PCS)?
vii. State using balanced chemical equations in necessary places, how the gas in (vi) above will cause all four environmental problems given above.
viii. How does SO_2 contributes to acid rain? show this using appropriate balanced chemical equation.
ix. State how natural resources can be used to minimize the entering of SO_2 in the atmosphere and also give an appropriate chemical equation, for this.
x. Catalytic converter is used in vehicle silencers to convert the most poisonous gases such as NO and CO to less poisonous. Give the chemical components used in catalytic converter and give balanced chemical equations for the above conversion.

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10. (a) P,Q,R and S are four coordination compounds of cobalt. They have an octahedral geometry. The cobalt ion in all the compounds has the same oxidation state. The molecular formula of P and Q is $CoN_5H_{15}BrCl_2$ and the molecular formula of R and S is $CoN_5H_{15}Br_2Cl$. The above samples are dissolved in distilled water separately. When the solutions obtained are shaken well with carbon tetra chloride solution which is saturated by chlorine Q,R and S show the colour change in the organic layer while P doesn't show any colour change in the organic layer.
When excess $AgNO_3$ solution is added separately to the equal volumes of solutions of samples R and S having equal volume and same concentration, the mass of the precipitate obtained in S is greater than that of R.

i. Give the oxidation state of cobalt in these coordination compounds.
ii. Write the structural formulae and the IUPAC names of P,Q,R and S.
iii. Give the precipitate/ precipitates which formed when $AgNO_3$ is added to the samples of solutions R and S.
iv. The structure of glycinato (gly) is given below.

$$NH_2\text{-}\ CH_2 - \overset{\overset{O}{\|}}{C} - O^-$$

The glycinato coordinates the metallic ion Cr^{3+} through the nitrogen and oxygen atoms to give a complex ion T, which has an octahedral geometry. Write the structural formula of T and draw its structure also.
Note :- Use the abbreviation 'gly' to denote the glycinato in your structural formula.

(b) X is a particular element and Hydrogen. Data related to this element X and hydrogen are given below at 25^0C temperature and 1atm pressure.

Chemical component	$H_{2(g)}$	$X_{(s)}$	$H^+_{(aq)}$	$X^+_{(aq)}$
Standard enthalpy /kJmol^{-1}	0	0	0	-240
Standard entropy /Jmol^{-1}K^{-1}	131	51	0	59

i. Consider the reaction $2X^+_{(aq)} + H_{2(g)} \longrightarrow 2X_{(s)} + H_{2(g)}$ at 25^oC and 1 atm pressure. calculate the followings of this reaction.
1. ΔH^θ
2. ΔS^θ
3. ΔG^θ

ii. $2X_{(s)} + 2H^+_{(aq)} \longrightarrow 2X+(aq) + H_{2(g)}$ consider this reaction. By using the calculated values in (i) above, deduce the followings of this reaction.
1. ΔH^θ
2. ΔS^θ
3. ΔG^θ

iii. Determine whether the X is above or below the position of H_2 in electro chemical series?
iv. Consider, an electro chemical cell is made by using the above electrodes.
1. Give the notation of anode and cathode.
2. Give the anodic reaction and cathodic reaction of cell.
3. Give the cell reaction
4. Give the standard cell notation
5. The Gibb's energy change ΔG^θ of the cell can be defined by the equation,
$$\Delta G^\theta = -nFE^\theta$$
Here n is the number of moles of electrons involved in the balanced cell reaction. (number of moles of electrons exchanged between the oxidizing agent and the reducing agent)
F - Faraday constant (F = 96500 Cmol-1)
E^θ - Electromotive force of the cell
Calculate the standard electromotive force of the cell.
6. Give the ways to increase the electromotive force (EMF) of the cell.

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Periodic table

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

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