மொறட்டுவைபல்கலைக்கழகபொறியியற்பீடதமிழ்மாணவர்கள் நடாத்தும்கபொத உயர்தரமாணவர்களுக்கான 7வது முன்னோடிப் பரீட்சை-2016

கல்விப் பொதுத் தராதரப் பத்திர(உயர் தர) முன்னோடிப் பரீட்சை - 2016
General Certificate of Education (Adv.Level) Pilot Examination - 2016

இரசாயனவியல் I Chemistry I	02	E	I	இரண்டு மணித்தியாலம் Two hours

- This paper consists of **11** 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 $N_A = 6.022 \times 10^{23}\ mol^{-1}$

01. The scientist who is ***not*** related with the hydrogen spectrum is,

(1) J.J.Balmer (2) Peter Siemen (3) Linus Pauling
(4) Theodore Lyman (5) Niels Bohr

02. The correct increasing order of first ionization energy of the atoms/ions Na^+, F, Al, Cl^-, C and N is,

(1) $Na^+ < Al < C < N < F < Cl^-$ (2) $Al < C < N < F < Na^+ < Cl^-$
(3) $C < N < F < Al < Na^+ < Cl^-$ (4) $Cl^- < Al < C < N < F < Na^+$
(5) $Cl^- < Al < Na^+ < C < N < F$

03. The IUPAC name of the compound $CH_3 - CH_2 - O - \overset{O}{\overset{\|}{C}} - C \equiv C - \underset{NH_2}{\overset{|}{CH}} - \overset{O}{\overset{\|}{C}} - CH_3$ is,

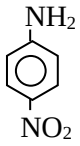
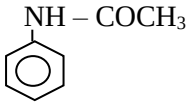
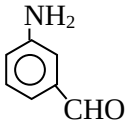
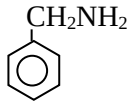
(1) 4-amino-1-ethoxy-5-oxohex-1-one
(2) ethyl 4-amino-5-oxohex-2-ynoate
(3) 3-amino-6-ethoxy-6-oxo-hex-4-yn-2-one
(4) ethyl 4-amine-5-formyl-2-hexyonate
(5) ethoxy 4-amino-5-oxohexanote.

04. Which of the following statements is ***false*** regarding the elements from Na to Cl in the third period?

(1) Their maximum valencies increases gradually along the period.
(2) Most of these elements have a higher negative electron affinity when compared to the elements which belong to the same group in the second period.
(3) The ability of these elements to form covalent bond increases along the period.
(4) When the stable ions are considered aluminium and silicon have the respective lowest and highest ionic sizes
(5) MgO has the highest melting point among the oxides of these elements.

[see page two

05. Consider the following nitrogen compounds.

(a)  (b)  (c)  (d) 

Their basic strength ***decreases*** in the order of,

(1) d > c > a > b (2) d > c> b > a (3) c > d > a > b
(4) c > d > b > a (5) d > a> c > b

06. In which of the following pairs of molecules London dispersion forces contribute highly for the change in their boiling points?

(1) CH_3OH, H_2O (2) NH_3, PH_3 (3) Br_2, ICl
(4) HCl, HBr (5) HCHO, CO_2

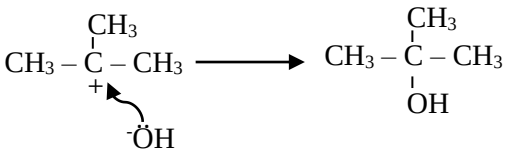
07. In a 125 cm^3 solution of $AgNO_{3(aq)}$, all the Ag^+ ions are precipitated as Ag by passing a steady current of 5A for 9.65 minutes using graphite electrodes. The concentration of $AgNO_{3(aq)}$ solution is, (Faraday constant = 96500 $Cmol^{-1}$)

(1) 0.12$moldm^{-3}$ (2) 0.03$moldm^{-3}$ (3) 0.24$moldm^{-3}$
(4) 0.18$moldm^{-3}$ (5) 0.06$moldm^{-3}$

08. $BaSO_4$ gets precipitated when V volume of excess $BaCl_{2(aq)}$ solution of concentration C_1 $moldm^{-3}$ is mixed with V volume of C_2 $moldm^{-3}$ $H_2SO_{4(aq)}$ solution so that the volume of the resultant solution becomes 2V. If the solubility product of $BaSO_4$ at the considered temperature is K_{sp}, its solubility at this temperature in $moldm^{-3}$ is,

(1) $(K_{sp})^{1/2}$ (2) $\frac{(C_1+C_2)K_{sp}}{2}$ (3) $\frac{2K_{sp}}{C_1+C_2}$ (4) $\frac{2K_{sp}}{C_1-C_2}$ (5) $\left(\frac{2K_{sp}}{C_1+C_2}\right)^{1/2}$

09. Given below is a step in the mechanism of a certain reaction in the organic chemistry.



(A) One of the steps in the mechanism of the reaction between 2-methylpropene and diluted H_2SO_4 is shown above.
(B) One of the steps in the mechanism of reaction between 2-chloro-2-methylpropane and $NaOH_{(aq)}$ is shown above.
(C) The stability of $(CH_3)_3$- C^+ shown here is greater than the stability of CH_2 =CH – CH_2^+.
(D) $(CH_3)_3$ – C^+ is an intermediate product in the reaction between 2-methylpropene and diluted H_2SO_4.

Which of the above statements are true?
(1) A and C (2) A, B and D (3) A, C and D (4) A and D (5) B and D

10. An aqueous solution contains Mg^{2+}, Al^{3+} and Zn^{2+} ions. Which of the following set of reagents can be used to distinguish each of these ions separately?
(1) H_2SO_4, NaOH (2) HCl, NH_4OH (3) H_2SO_4, NH_4OH
(4) NH_4OH, NaOH (5) HCl, NaOH

[see page three

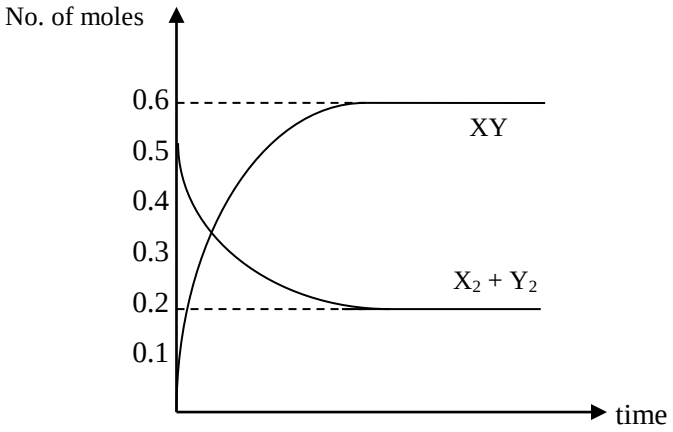
11. Which row gives the correct details about N in dinitrogen difluoride (N_2F_2) in the following table?

	Oxidation state	Charge	Hybridization	Electron pair geometry	N-F bond nature
(1)	+1	0	sp	Angular	N (sp h.o) + F (2p a.o)
(2)	+1	0	sp^2	Angular	N (sp^2 h.o) + F (2p a.o)
(3)	+1	0	sp^2	Trigonal planar	N (sp^2 h.o) + F (2p a.o)
(4)	+2	0	sp^2	Trigonal planar	N (sp^2 h.o) + F (2p a.o)
(5)	+1	+1	sp^2	Trigonal planar	N (sp^2 h.o) + F (2p a.o)

12. Two diatomic gases X_2 and Y_2 react with each other as follows.

$$X_{2(g)} + Y_{2(g)} \rightleftharpoons 2XY_{(g)}$$

Mixture A in a closed vessel contains $X_{2(g)}$ and $Y_{2(g)}$, 0.5mol of each. The mixture is heated to carry out the reaction and allowed to attain equilibrium at a particular temperature. A graph representing the change in number of moles with time during the equilibrium is given below.



What is its K_c value during the equilibrium at that particular temperature?
(1) 1.5 (2) 3 (3) 6 (4) 9 (5) 18

13. Which of the following statements is true regarding Li?

(1) Though Li reacts with steam, it does not react with hot water.
(2) Li reacts with excess air at high temperature and produces Li_3N, Li_2O_2 and LiO_2.
(3) Li_2CO_3 is thermally stable.
(4) $LiHCO_3$ cannot be obtained at solid state.
(5) Thermal decomposition of $LiNO_3$ produces $LiNO_2$ and O_2.

14. The IUPAC name of $[Co(NH_3)_5(OH)]NO_2$ is,

(1) Pentaamminehydroxidocobalt(II) nitrate
(2) Pentaaminehydroxidocobalt(III) nitrite
(3) Pentaamminehydroxidocobalt(II) nitrite
(4) penta amminehydroxidocobalt(I) nitrite
(5) penta amine hydroxide cabalt(II) nitrite

[see page four

15. At temperatures below 13°C, Grey Sn, which is an allotropic form of tin can be produced from white Sn, which is also another allotropic form.

	ΔH^{θ}_f / kJmol^{-1}	S^{θ} / JK^{-1}mol^{-1}
White Sn	0	51.4
Grey Sn	-2.09	44.1

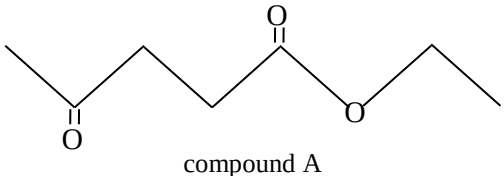
Which of the following correctly represents the change in the Gibb's free energy change ΔG when white Sn changes to grey Sn at 12°C?

(1) ΔG = - 2.09 – 285 (-7.3) (2) ΔG = - 2.09 – 12(+7.3)

(3) ΔG = - 2090 – 12(+7.3) (4) ΔG = - 2090 – 285 (-7.3)

(5) ΔG = - 2090 – 298 (+7.3)

16. Compound A is a diesel fuel additive which reduces the amount of soot formed when the fuel burns.



compound A

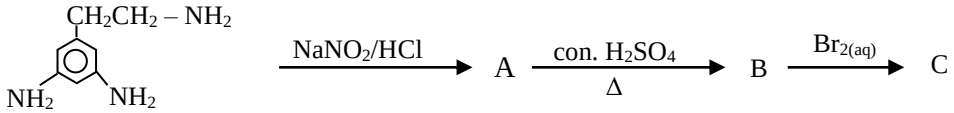
The number of moles of oxygen gas required for the complete combustion of 1 mol of compound A is,

(1) 8 (2) 8.5 (3) 9 (4) 9.5 (5) 10

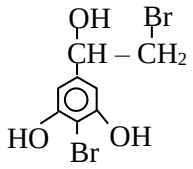
17. When a 100cm^3 of a monobasic weak acid HA of concentration 0.15moldm^{-3} is mixed and shaken with 100cm^3 of CCl_4 layer and allowed to attain the equilibrium, the pH of the aqueous layer was found to be 3. What is the partition coefficient between water and CCl_4 at the considered temperature?

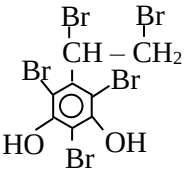
(K_a(HA) = 1x10^{-5} moldm^{-3})

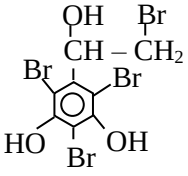
(1) 2 (2) 4 (3) 3 (4) 8 (5) 5

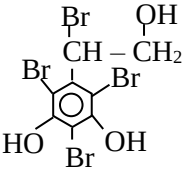
18. 

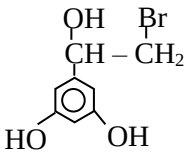
Which of the following is the suitable product C, when B is treated with aqueous Br_2 according to the above reaction scheme?

(1) 

(2) 

(3) 

(4) 

(5) 

[see page five

19. Gaseous state reactant molecules X and Y react with each other to form a gaseous product Z.

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

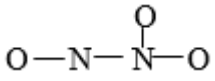
The following table contains the concentrations of X and Y with the rate of formation of Z.

Experiment	[X]/moldm^{-3}	[Y]/moldm^{-3}	Initial rate of formation of $Z_{(g)}$ / moldm^{-3}s^{-1}
1	0.3	0.2	4×10^{-4}
2	0.6	0.4	1.6×10^{-3}
3	0.6	0.8	6.4×10^{-3}

When the concentrations of X and Y are 1.2moldm^{-3} each, what is the rate of formation of Z in moldm^{-3}s^{-1}?

(1) 1.44×10^{-2} (2) 9.6×10^{-2} (3) 1.24×10^{-2} (4) 3.2×10^{-3} (5) 4.8×10^{-3}

20. What is the total number of resonance structures that can be drawn to N_2O_3? (skeletal structure of the molecule is given)



(1) 2 (2) 3 (3) 4 (4) 5 (5) 6

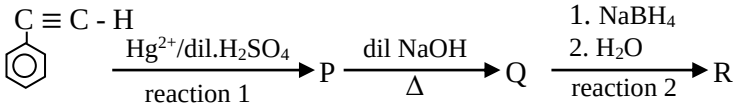
21. An electro chemical cell is formed by connecting two redox electrodes $Pt_{(s)}/Fe^{3+}_{(aq)}$, $Fe^{2+}_{(aq)}$ and $Pt_{(s)}/Sn^{4+}_{(aq)}$, $Sn^{2+}_{(aq)}$. Their standard electrode potentials are given below.

$$E^{\theta}Sn^{4+}_{(aq)}/Sn^{2+}_{(aq)} = +0.15V$$
$$E^{\theta}\ Fe^{3+}_{(aq)}/Fe^{2+}_{(aq)} = +0.77V$$

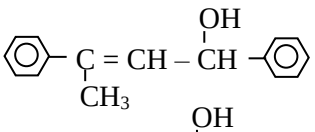
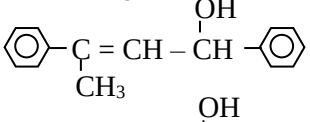
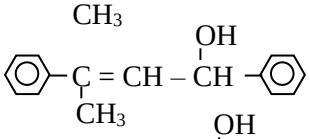
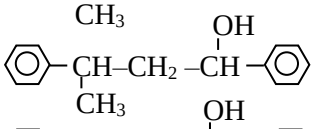
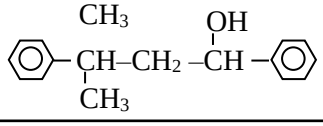
Which of the following statements is ***false*** regarding this cell?

(1) $Pt_{(s)}/Sn^{4+}_{(aq)}, Sn^{2+}_{(aq)}$ electrode functions as a negative electrode.
(2) Reducing the concentration of $Sn^{2+}_{(aq)}$ makes the electrode potential of $Pt(s)/Sn_{aq)}^{4+}$, $Sn^{2+}_{(aq)}$ electrode more positive.
(3) Increase in the concentration of $Fe^{3+}_{(aq)}$ makes the electrode potential of $Pt_{(s)}/Fe^{3+}_{(aq)}$, $Fe^{2+}_{(aq)}$ electrode more positive.
(4) Temperature rise increases the amount of current flowing in the external circuit.
(5) When the cell is functioning, the positive ions move towards the cathodic chamber.

22.



Which of the following correctly represents the reaction types of reaction 1 and reaction 2 and the product R in the above reaction scheme?

(1)	Nucleophilic addition	Nucleophilic addition	
(2)	Electrophilic addition	Nucleophilic addition	
(3)	Electrophilic addition	Electrophilic addition	
(4)	Nucleophilic addition	Nucleophilic addition	
(5)	Electrophilic addition	Nucleophilic addition	

[see page six

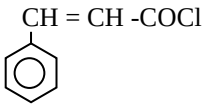
23. $[Ag(NH_3)_2]^+_{(aq)} \rightleftharpoons Ag^+_{(aq)} + 2NH_{3(aq)}$

1 mol of $[Ag(NH_3)_2]^+_{(aq)}$ complex and 2 moles of $NH_{3(aq)}$ are dissolved in distilled water and made as $1dm^3$ solution. If the value of equilibrium constant K_c at this temperature is $5x10^{-8}$ mol^2dm^{-6}, what is the concentration of $Ag^+_{(aq)}$ in the equilibrium solution?

(1) $1x10^{-8}$ $moldm^{-3}$ (2) 5×10^{-8} $moldm^{-3}$ (3) 1.25×10^{-8} $moldm^{-3}$
(4) 2×10^{-8} $moldm^{-3}$ (5) 2.5×10^{-8} $moldm^{-3}$

24. The two liquids P and Q form an ideal solution with each other. When the number of moles of P and Q in an equilibrium mixture formed inside a closed vessel are 2 mol and 4 mol respectively, the vapour pressure of the solution is $200x10^3$ Pa. When the number of moles of P and Q are made to 4 mol each by adding P to the solution, equilibrium pressure is 180×10^3 Pa. What is the molar ratio of P and Q in the vapour phase of the above equilibrium mixture?

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

25. 

When the given compound is reduced by excess $LiAlH_4$ and then hydrolyzed, the reduction in molecular mass is, (Cl - 35.5, H-1,O-16)

(1) 32.5 (2) 18.5 (3) 29.5 (4) 34.5 (5) 31.5

26. The following experiments are made with the solution containing dipositive cation of a 3d transition element X.

1. Gave a precipitate with NH_4OH which dissolves in excess reagent.
2. When the solution formed by the dissolution in excess reagent in 1 is exposed to air, a colour change occurred, which is clearly observable.
3. Gave a blue coloured solution with excess con. HCl

The element X which is suitable for the above observations is,

(1) Cu (2) Ni (3) Ag (4) Co (5) Cr

27. $A_{(g)} + B_{(g)} \rightarrow C_{(g)}$ is an elementary reaction. n mol of A and n mol of B are taken and x mol of A reacted in t seconds. Rate constant related to this reaction is k. If the pressure and volume of the system at second t (instantaneous) are P and V respectively, what is the instantaneous rate of reaction at second t?

(1) $k\left[\frac{P}{RT}-\frac{n}{V}\right]^2$ (2) $k\left[\frac{P}{RT}\right]^2$ (3) $k\left[\frac{P}{RT}-\frac{x}{V}\right]^2$

(4) $k\left[\frac{PV}{RT}-n\right]^2$ (5) $k\left[\frac{PV}{RT}-x\right]^2$

28. Which of the following statements is ***false***?

(1) When MnO_2 solid is added to KCl solid and con. H_2SO_4 is added, Cl_2 gas is obtained.
(2) $Na_2S_4O_6$ is obtained as the product when Cl_2 gas is passed through $Na_2S_2O_3$.
(3) Many metals give their stable higher oxidation state chlorides with Cl_2 gas.
(4) H_2S acts as a reducing agent with H^+/MnO_4^-, $H^+/Cr_2O_7^{2-}$, H^+/AsO_4^{2-}, $FeCl_3$ and SO_2
(5) H_2O_2 acts as a reducing agent with H^+/MnO_4^-, $H^+/Cr_2O_7^{2-}$, H^+/MnO_2, Ag_2O and Cl_2.

[see page seven

29. The product obtained by treating the organic compound X with CH_3MgCl followed by hydrolysis showed optical isomerism. When the product is dehydrated with conc. H_2SO_4, a compound showing diasteriomerism is obtained as the product. Compound X is,

(1) $CH_3CH_2-\overset{\overset{O}{\|}}{C}-CH_3$ (2) $CH_3-\underset{\underset{CH_3}{|}}{CH}-\overset{\overset{O}{\|}}{C}-CH_2CH_3$ (3) $CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2-CHO$

(4) $(CH_3CH_2)_2CH-\overset{\overset{O}{\|}}{C}-CH_3$ (5) $CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}-\overset{\overset{O}{\|}}{C}-\underset{\underset{CH_3}{|}}{CH}-CH_3$

30. Which of the following can be used to identify $[Cu(NH_3)_4]SO_4$ aqueous and $[Ni(NH_3)_6]SO_4$ aqueous?

(1) $H_2S_{(g)}$ (2)conc. HCl (3) $BaCl_2$

(4) $H_2O_{(l)}$ (5)$(CH_3COO)_2Pb$

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

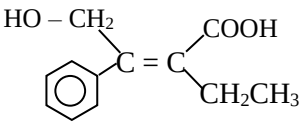
(1) if only (a) and (b) are correct.
(2) if only (b) and (c) are correct.
(3) if only (c) and (d) are correct.
(4) if only (d) and (a) are correct.
(5) if **any other** number or combination of responses is correct.

(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. Which of the following statement/statements is/are true regarding electrolysis?

(a) In electrolysis, the pH of the electrolyte reduces with time, if water acts as a reactant only in the anode.
(b) Net energy is conserved in electrolysis.
(c) In the hydrolysis of $CuSO_{4(aq)}$ by using graphite electrodes, the number of copper ions getting precipitated on it in a unit time increases with the increase of the surface area of the cathode.
(d) Mass of the element which gets precipitated or released in the cathode or anode during electrolysis increases with the increase in concentration of ions which are reduced in those electrodes.

32.



Which of the following statement/statements is/are true regarding the given molecule?

(a) Maximum 6 atoms lie in the same plane in this molecule.
(b) The product obtained when this compound is allowed to react with $LiAlH_4$ followed by hydrolysis, does not show geometrical isomerism.
(c) It can undergo both electrophilic addition and nucleophilic substitution.
(d) The product obtained in the reaction with Br_2 gas prevails in four stereo isomeric forms.

[see page eight

33. Which of the following is/are true regarding the production of $NaHCO_3$ of by using Solvay process?

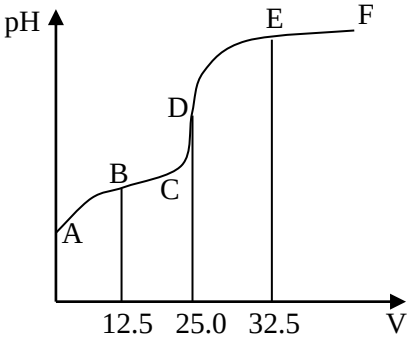
(a) By keeping the temperatures of the towers high, the rate of reaction is increased and higher amount of product is obtained.

(b) NH_3 is recycled by the reaction of initial byproduct with CaO.

(c) $CaSO_4$ is obtained when the final byproduct is treated with mother solution after removing table salt.

(d) Since $KHCO_3$ has higher ionic character than $NaHCO_3$, $KHCO_3$ can be produced easily than $NaHCO_3$.

34. The following graph shows the variation of pH of the solution when 0.1moldm^{-3} $CH_3COOH_{(aq)}$ solution is titrated with 0.1moldm^{-3} NaOH.



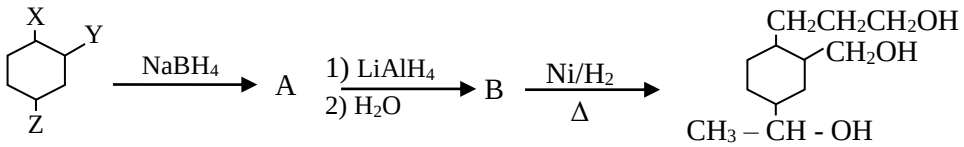
(a) By considering the resultant solutions from A to C, as the added amount of NaOH increases, ionization of $CH_3COOH_{(aq)}$increases in the resultant solution.

(b) The resultant solution at the instance B shows good buffer action against both acid and base.

(c) Hydrolysis of $CH_3COO^-_{(aq)}$ ion is responsible for the pH at the equivalent state.

(d) When few drops of $HCl_{(aq)}$ is added to the solution at instance F, H^+ ions are removed by CH_3COO^- ions.

35.



The above organic conversion is carried out by producing two different products A and B. Which of the following correctly gives the possible structures of X, Y and Z?

(a) - CH = CH – CHO, -COOH, - C(=O)CH$_3$

(b) - CH = CH – CHO, -CHO, - C(=O)CH$_3$

(c) - CH = CH – COOH, – $CONH_2$, - CH(CH$_3$) – CHO

(d) - CH = CH – COOH, – COCl, - C(=O)CH$_3$

36. Which of the following statement / statements is/are ***false*** regarding principal quantum number (n), azimuthal quantum number (ℓ), magnetic quantum number (m_ℓ) and the spin quantum number (m_s)?

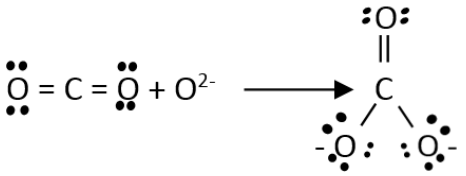
(a) An element containing a valence electron with n = 3 and m_ℓ = -1 should belong to the p block.

(b) Sodium should contain the valence electron with n=3 and m_s = +½

(c) An element containing a valence electron with n = 3 and ℓ = 0 should belong to the s block.

(d) A sub energy level with n + ℓ = 4 could be either 3p or 4s.

[see page nine

37. 

Which of the following statement/statements is/are true regarding the above conversion?

(a) Hybridization of C changes from sp^2 to sp^3.

(b) C – O bond length increases.

(c) All 3 C-O bonds are similar to each other and the angle between them is 120^o in the formed CO_3^{2-}.

(d) Oxidation state of C atom is changed.

38. Which of the following statement / statements is/are true regarding gases?

(a) Volume ratio of two ideal gases of equal masses which have the same mean speed at the same temperature is inversely proportional to their pressure ratio.

(b) Boyle's temperature of He is greater than H_2

(c) A real gas will not satisfy the ideal gas equation at any conditions.

(d) Speed of a gas molecule is directly proportional to the thermo dynamic temperature.

39. An ideal solution is prepared by mixing two components X and Y. The number of moles used to produce the solutions are given below. Vapour pressure of pure X is greater than that of Y.

Solution	A	B	C	D	E	F	G	H	I
No. of moles of X	1	2	3	4	5	6	7	8	9
No. of moles of Y	9	8	7	6	5	4	3	2	1

Which of the following statement/statements is/are true regarding the above solutions and solution preparations?

(a) The enthalpy change in the solution process increases from A to E and then decreases.

(b) The entropy change in the solution process increases from A to E and then decreases.

(c) When the solution are allowed to attain equilibrium in a closed system, vapour pressure increases from A to E and then decreases.

(d) Gibb's free energy change in the solution process decreases from A to E and then increases.

40. Solutions A and B are formed by adding CH_3COONa and HCOONa to CH_3COOH aqueous and HCOOH aqueous respectively which have the same pH at a certain temperature. The number of moles of CH_3COONa and HCOONa added are equal to that of CH_3COOH and HCOOH in the aqueous solution. Which of the following statement/statements is/are true regarding these solutions?

(a) Buffer strength of A is greater than that of B.

(b) As the concentration of acids fall down when diluted with water, their pH values drop to a considerable level.

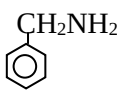
(c) Solution B contains ions in a higher concentration than solution A.

(d) pH of solution A is greater than that of solution B.

[see page ten

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

	Statement One	Statement Two
41	Oxidizing ability of Sn^{2+} in the aqueous state is higher than that of aqueous state Ag^{+}.	Oxidizing ability of an ion depends on the number of electrons it can accept.
42.	$CH_2=CH_2$ easily involves to electrophilic addition when compared to 	Electro negativity of C atom in $CH_2=CH_2$ is greater than that in 
43.	If a coloured gas evolution occurs when diluted HCl is added to an aqueous solution, presence of NO_2^- is the only conclusion that can be made.	NO_2^- is an anion of a weak acid.
44.	All the atoms in propynenitrile (HC≡C-CN) lie in a straight line.	Carbon and nitrogen atoms in propynenitrile molecule are in sp hybridization.
45.	The bond length between O atoms in O_2^{2-} is greater than the bond length in O_2^-	Oxidation state of O in O_2^{2-} is higher than that in O_2^-
46.	When H_2 and D_2 molecules with same mean speed are considered, the temperature of D_2 molecules should be greater than that of H_2 molecules.	Mean speed distribution of gas molecules depend on the molecular mass and temperature.
47.	The increase in the rate of forward reaction of an exothermic equilibrium is higher than the rate of the backward reaction with the increase of temperature.	Activation energy of the forward reaction of an exothermic equilibrium reaction is greater than that of backward reaction.
48.	 is an aromatic primary amine but  is an aliphatic primary amine.	 gives diazonium salt with nitrous acid at low temperatures but  does not give diazonium salt with nitrous acid at low temperatures.
49.	The degree of dissociation of the equilibrium reaction $2AB_{3(g)} \rightleftharpoons A_{2(g)} + 3B_{2(g)}$ depends only on temperature.	K_p of the equilibrium reaction $2AB_{3(g)} \rightleftharpoons A_{2(g)} + 3B_{2(g)}$ depends only on temperature.
50.	Formation of photo chemical smog can be controlled by attaching a catalytic converter to the vehicle silencers.	NO_2 and hydrocarbons which are emitted from vehicles are the primary pollutants for the formation of photochemical smog.

[see page eleven

PERIODIC TABLE OF THE ELEMENTS

1 IA												13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIIIA
1 H 1.008	2 IIA																2 He 4.00
3 Li 6.94	4 Be 9.01											5 B 10.81	6 C 12.01	7 N 14.1	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.30	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8	9 VIIIB	10	11 IB	12 IIB	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.06	17 Cl 35.45	18 Ar 39.95
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.94	24 Cr 52.00	25 Mn 59.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.1	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.75	52 Te 127.60	53 I 126.91	54 Xe 131.29
55 Cs 132.91	56 Ba 137.33	57 *La 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183.85	75 Re 186.21	76 Os 190.2	77 Ir 192.2	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226.02	89 †Ac 227.03	104 Rf (261)	105 Db (262)	106 Sg (266)	107 Bh (264)	108 Hs (277)	109 Mt (268)	110 Ds (271)	111 Rg (272)							

*Lanthanide Series	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm (145)	62 Sm 150.4	63 Eu 151.97	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 169.93	70 Yb 173.04	71 Lu 174.97
†Actinide Series	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 X (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (262)

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கல்விப் பொதுத் தராதரப் பத்திர(உயர் தர) முன்னோடிப் பரீட்சை - 2016
General Certificate of Education (Adv.Level) Pilot Examination - 2016

இரசாயனவியல் II Chemistry II	02	E	II

மூன்று மணித்தியாலம்
Three hours

சுட்டெண் : .....

[see page two

Part – B Structured Essay

*Answer **all** the questions **on this paper itself.***

Do not write anything here

01. (a) Arrange the following in the increasing order of the properties mentioned in the brackets.

i. H, Si, C, Br (Electronegativity)

……..……..<……..……..<…….<…….

ii. Li, B, Cl, F (Electron affinity)

……..……..<……..……..<…….<…….

iii. SCl_2, SF_2, SF_4, SF_6 (Bond length)

……..……..<……..……..<…….<…….

iv. K_2CO_3, $MgCO_3$, $(NH_4)_2CO_3$, $CaCO_3$ (Decomposition temperature)

……..……..<……..……..<…….<…….

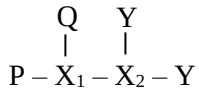
v. NO_2^-, SO_2, SO_3, CO_2 (Bond angle)

……..……..<……..……..<…….<…….

vi. NH_2^-, OH^-, CH_3O^-, HCO_3^- (Basic character)

……..……..<……..……..<…….<…….

(b) P, Q, X and Y are 4 elements with atomic numbers less than 20. These are not their actual notations. P, Q and X can form neutral oxides. Y obtains positive oxidation state only in the compound produced in the reaction between Y and P. The highest oxidation state oxide of X shows strongly acidic nature. Q does not have lone pair electrons in any of the covalent compounds formed by it. The skeletal structure of the molecule QX_2Y_2P formed by these elements is given below.



i. Identify the elements P, Q, X and Y.

……

……

ii. Draw the most acceptable Lewis structure of this molecule.

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iii. Draw the resonance structures of the above molecule and compare their relative stabilities with reasons.

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iv. Write down the

1. Electron pair geometry around the atom
2. Geometrical shape around the atom
3. Hybridization of the atom
4. Approximate value of the bond angles around the atom of the atoms X_1 and X_2 in the following table.

[see page three

Do not write anything here

	X_1	X_2
Electron pair geometry		
Shape		
Hybridization		
Bond angle		

v. Compare the electro negativities of X_1 and X_2 with proper reasons.
……
……
……
……

(c) i. Write down the types of lattices of the following compounds using the terms given in the brackets. [Ionic lattice, nonpolar molecular lattice, metallic lattice, homogenous atomic lattice, polar molecular lattice, heterogeneous atomic lattice]

1. $CsCl_{(s)}$ …….....
2. Silicon [$Si_{(s)}$]...……...…….....
3. Dry ice ……..……..…….
4. Cu …….....
5. Rhombic sulphur ……..

ii. Consider the following carbon compounds.
Formaldehyde (H_2CO), Formic acid (H_2CO_2), oxalic acid ($H_2C_2O_4$)

1. Arrange them in the increasing order of their boiling point and acidic nature.
   Boiling point ……<……<……
   Acidic nature ……<……<……

2. Mention all the types of molecular attractive forces present in the following compounds.
   Formaldehyde …….
   Formic acid …….....
   Oxalic acid …….…….

02. (a) A s-block element X is releases the same gas Y when treated with NaOH aqueous and HCl aqueous separately. At a high temperature X and Y react together and produces a basic compound Z which is white in colour. When compound Z reacts with water evolution of gas Y occurs. Chromate salt of X does not dissolve in acetic acid. It gives a solution W when it reacts with dilute HNO_3.

i. Identify the element X.
……
ii. Give the chemical formulae of W, Y and Z.
……
……
iii. Write down the balanced chemical equation for the reaction between compound Z and water.
……

[see page four

Do not write anything here

iv. Write down the balanced chemical equation and the observation for the reaction between chromate salt of X and dilute HNO_3.

……
……
……

v. Predict the pH changes in the solutions when X is allowed to react with NaOH aqueous and HCl aqueous separately.

$NaOH_{(aq)}$ ……..

$HCl_{(aq)}$ …….

vi. Sulphate salt of element X occupies an important place in medical usage. Write down its usage.

……

(b) The following compounds are included in the test tubes named from A to E. The compounds are not given in the respective order.

H_2SO_4, $AgNO_3$, $CuSO_4$, Al_2S_3, $Ba(NO_2)_2$

The following table contains the details about the experiments done to identify the above mentioned compounds and the observations.

Compound	Experiments and observations
A	When $KI_{(aq)}$ is added, a white precipitate is formed.
B	A white precipitate is formed with $Na_2S_2O_{3(aq)}$ and turns black after some time.
C	Gives white fume with PCl_5.
D	Evolution of brown colour gas with dilute HCl.
E	A gelatin like white precipitate and a foul smelling gas are produced when water is added.

i. Identify the compounds from A to E.

A……..…….. B…… C……..

D……..…….. E……

ii. Write down the balanced chemical equations for each of the experimental reactions of the compounds from A to E. Use the symbol ↓ to denote the precipitates.

A ……
……

B ……
……

C ……
……

D ……
……

E ……
……

[see page five

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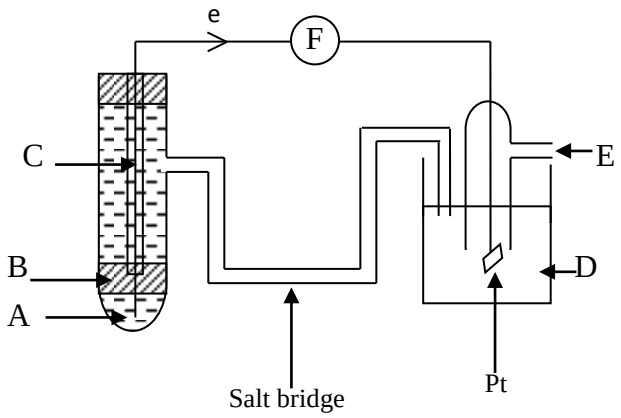
03. (a) A setup of an electro chemical cell made using a standard Calomel electrode and a standard chlorine electrode is given below. (Arrow head denotes the direction of electron flow)



Answer the following questions based on the above cell.

i. Name the parts from A to E. Mention the physical state, concentration and pressure where necessary.

……

ii. Give the electrode equilibriums present in the electrodes before connecting the two half cells.

1. Calomel electrode ……
2. Chlorine electrode ……

iii. Write down the cell reaction.

……

……

.

iv. Give the standard cell notation of the above cell.

……

……

v. 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

If the free energy change related to the cell is - 212.3 $kJmol^{-1}$, calculate the standard electromotive force of the cell.

……

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[see page six

Do not write anything here

vi. If the electromotive force of the standard chlorine electrode is $E^{\theta}Cl_{2(g)}/Cl^{-}_{(aq)}$ = +1.36V, then calculate the electromotive force of the standard Calomel electrode.

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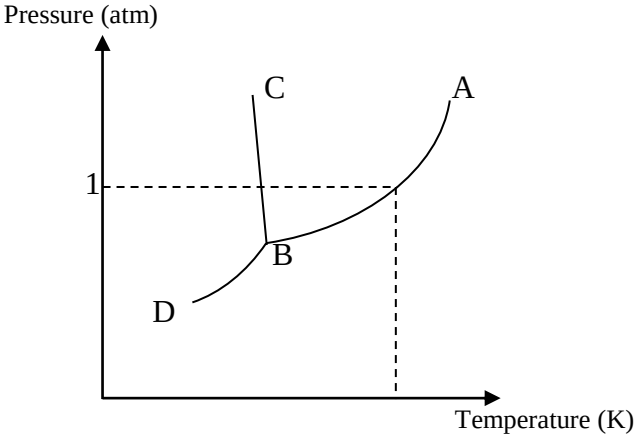
……
……
……

(b) The phase diagram of water is given below.



i. What do you understand by the critical temperature of water?

……
……

ii. Denote the regions for solid, liquid and gaseous state of water as X, Y and Z respectively in the above phase diagram.

iii. Mention the temperature and pressure at which all the three phases of water are present together in equilibrium.

Temperature ……..
Pressure ……..

iv. If the temperature of ice is raised at a pressure level below the above mentioned value, what will be the change in its physical state?

……..……
……..

v. Write down the temperatures at which lines BC and BA intersect 1 atm pressure condition.

BC ……
BA……..……

[see page seven

Do not write anything here

04. (a) A, B, C, D and E are five mono substituted benzene compounds with molecular formula $C_{10}H_{14}O$. While D and E give instant turbidity with anhydrous $ZnCl_2$, conc. HCl , A, B and C give turbidity at a very slow rate. Only B and D show stereo isomerism. B is dehydrated, and then Br_2/CCl_4 is added. Compound F is formed when the product is involved to dehydro halogenation using ethanol/KOH. F gives white turbidity with $NH_3/AgNO_3$. When oxidized with PCC/ CH_2Cl_2, A and C produce G and H respectively. Though G involves to self condensation in basic medium, H does not involve to self condensation.

i. Draw the structures of A, B, C, D, E, F, G and H in the cages given below.

A B C

D E F

G H

ii. Draw the structure of the product formed when G involves to self condensation in the basic medium.

……
……
……

iii. F $\xrightarrow{HgSO_4/dil.H_2SO_4}$ product P $\xrightarrow{2,4\text{-DNPH}}$ product Q

Draw the structure of product Q obtained in the above reaction sequence of F.

……
……
……
……....

[see page eight

Do not write anything here

iv. The product obtained by the dehydration of E,

a. Does it show geometrical isomerism?

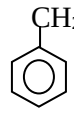
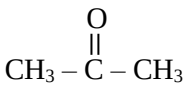
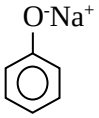
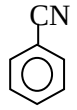
……

b. Give the reason for your answer.

……

……

(b) i. The following table contains the reactants and reagents involved in the reactions from 1 to 5. Write down the types 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		$H - C \equiv C^- Na^+$		
2		HCN / KCN		
3	$(CH_3)_2CHCHBrCH_3$	C_2H_5OH / KOH		
4		CH_3COCl		
5		$FeCl_3$ / Cl_2		
6		Br_2 / CCl_4		

ii. Write down the mechanism of the reaction 6 in b (i).

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கல்விப் பொதுத் தராதரப் பத்திர(உயர் தர) முன்னோடிப் பரீட்சை - 2016
General Certificate of Education (Adv.Level) Pilot Examination - 2016

இரசாயனவியல் II Chemistry II	02	E	II

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

Part B - Essay

05) (a) Hydrogen gas can be produced in large amounts when methane gas is mixed with steam and allowed to react with each other.
The values of standard enthalpy change and standard entropy change are given below.

$CH_{4(g)}+H_2O_{(g)} \longrightarrow CO_{(g)}+3H_{2(g)}$

Substances	ΔH^{θ}_f/kJmol^{-1}	S^{θ}/JK^{-1}mol^{-1}
$CH_{4(g)}$	-75	186
$H_2O_{(g)}$	-242	189
$CO_{(g)}$	-111	198
$H_{2(g)}$	0	131
$CO_{2(g)}$	-394	214

(i) Calculate the enthalpy change ΔH^{θ} of the reaction between methane and steam using the provided data.
(ii) Find the entropy change ΔS^{θ} in this reaction.
(iii) From the values you calculated for ΔH^{θ} and ΔS^{θ}, calculate the minimum possible temperature required for the above reaction to take place.
(iv) What could be the reason for the variation between actual and calculated values?

(b) (i) A certain mass of NH_4Cl solid dissociates and attain equilibrium at 27^{O}C inside a rigid container of volume 4.157dm^3.

$NH_4Cl_{(s)} \rightleftharpoons NH_{3(g)} + HCl_{(g)}$

If the pressure of the system is 8 x 10^4 Nm^{-2},

1. Calculate the Kp of the equilibrium system at 27^{O}C.
2. Calculate the minimum mass of $NH_4Cl_{(s)}$ required to make the above equilibrium. (N – 14, H – 1, Cl – 35.5)

(ii) $NH_4HS_{(s)}$ was allowed to dissociate and to attain equilibrium inside the same container at the same temperature.

$NH_4HS_{(s)} \rightleftharpoons NH_{3(g)} + H_2S_{(g)}$

If the pressure of the system is 6 x 10^4Nm^{-2},

1. Calculate the Kp of the above equilibrium system at 27^{O}C.
2. Calculate the minimum mass of $NH_4HS_{(s)}$ required to make the above equilibrium. (N – 14, H – 1, S – 32)

[see page ten

(iii) The same mass of $NH_4Cl_{(s)}$ and $NH_4HS_{(s)}$ which are used in part (i) 2. and part (ii) 2. are taken inside the same container at 27^OC and allowed to attain the equilibrium.

1. Calculate the partial pressure of $NH_{3(g)}$ in the container.
2. Calculate the mass of $NH_4HS_{(s)}$ which haven't dissociated during the equilibrium.

06) (a) Hydrazine (N_2H_4) ionizes in the aqueous state as follows.

$$N_2H_{4(aq)} + H_2O_{(l)} \rightleftharpoons N_2H_5^+{}_{(aq)} + OH^-{}_{(aq)}$$

(i) Calculate the pH of 0.1 $moldm^{-3}$ Hydrazine solution. (log 3 = 0.4771)

(ii) Consider the equilibrium of $N_2H_5^+{}_{(aq)}$ in the aqueous state.

$$N_2H_{5(aq)} + H_2O_{(l)} \rightleftharpoons N_2H_{4(aq)} + H_3O^+{}_{(aq)}$$

Calculate the minimum mass of $AgNO_{3(aq)}$ necessary to initiate the precipitation in a 100cm^3 Hydrazinium chloride (N_2H_5Cl) solution of pH = 4.4.
($10^{0.6} = 4$, $K_{sp}(AgCl) = 1 \times 10^{-10}\ mol^2dm^{-6}$, Ag=108, N=14, O=16)

(b) 1) A 100 cm^3 of NH_3 aqueous solution is shaken with 50 cm^3 of an organic solvent A at 25^OC and allowed to attain equilibrium. When a 25 cm^3 of the aqueous layer is titrated with 1 $moldm^{-3}$ HCl solution, 6 cm^3 is required. A 25 cm^3 of the organic layer is separated and titrated with 0.5 $moldm^{-3}$ HCl solution. The volume of HCl required was 5 cm^3.

(i) Write down the expression for the partition coefficient K_D of NH_3 between water and the organic layer A.

(ii) Calculate the partition coefficient of NH_3 between water and the organic layer A.

(iii) Give a suitable indicator for the above titrations. Mention the colour change of the solution at the endpoint.

2) 50 cm^3 of 3 $moldm^{-3}$ NH_3 solution is shaken with a 50 cm^3 of 0.2 $moldm^{-3}$ $CuSO_4$ solution and a 200 cm^3 of an organic solvent A and allowed to attain equilibrium. At the equilibrium, 25 cm^3 of organic layer is separated and titrated with a 0.5 $moldm^{-3}$ HCl solution. The required volume of HCl was 12.5 cm^3.
$K_c\ [Cu(NH_3)_4]^{2+} = 1 \times 10^{12}\ mol^{-4}dm^{12}$

(i) Calculate the concentration of NH_3 found freely(excluding the NH_3 found in the complex) in the aqueous layer.

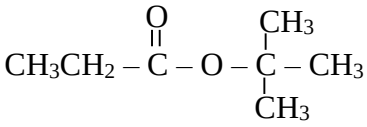
(ii) Calculate the concentration of $[Cu\ (NH_3)_4]^{2+}$ complex.

(iii) Calculate the concentration of free Cu^{2+} ions in the aqueous layer.

[see page eleven

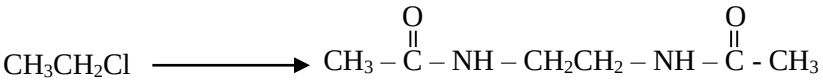
07) (a) Synthesize compound A using only the organic compounds and reagents given below.

PCC, Mg, CH_3OCH_3, $K_2Cr_2O_7$, dil.H_2SO_4, PCl_3, dry ether, CH_2Cl_2, Fe, conc. H_2SO_4, CH_3OH, CH_3CH_2OH.



Compound A

(b) How would you synthesize the compound Q using compound P only?



Compound P Compound Q

(c) (i) Compare the acidic nature of ethanol and phenol.

(ii) Write down the reason for your answer in c (i).

(iii) Ethanol reacts with PCl_5 and produces ethyl chloride but phenol does not react with PCl_5. Explain.

Part C – Essay

08) a) A and B are water soluble salts of 3d transition elements. Pink colour solutions X and Y are formed by diluting A and B with water. Some experiments carried out to identify A and B are given below.

For solution X,

1.	Heating with HCl and NaOH separately	Gas evolution is not observed.
2.	Heating with Al powder and NaOH	Evolved gas changed Nesler's reagent to brown colour
3.	Passing H_2S after adding NH_4OH and NH_4Cl	Black precipitate P formed
4.	Dissolving precipitate P in conc.HNO_3 and then adding excess conc.HCl	Blue colour solution is obtained

For solution Y,

1.	Adding conc.H_2SO_4 and $H_2Cr_2O_7$	Reddish brown colour gas Q evolved.
2.	Passing gas Q into NaOH solution	Yellow colour solution R is obtained
3.	conc.HNO_3, $(CH_3COO)_2Ba$ is added to solution R	Yellow colour precipitate formed.
4.	Adding PbO_2, conc. HCl	Violet colour solution S is obtained.

(i) Identify the salts A and B.

(ii) Write down the ions responsible for the colour of solutions R and S and identify P and Q.

(iii) Write down the balanced chemical equations for the reactions in 2, 5 and 8.

[*see page twelve*

b) Element E is present in gaseous state at room temperature. Electron affinity of E is greater than other elements.

(i) Identify the element E.
(ii) Mention the stable oxidation states of E.
(iii) Write down an oxide of E for each of the oxidation states that you have mentioned above.
(iv) What are the possible products formed when the temperature of a mixture containing the oxides EO_2 and EO_3 is reduced?
(v) Write down the balanced chemical equation for the reaction between EO_2 and NaOH and mention the reaction type.

c) An alloy plate made of Fe and Ni is coated with Sn to prevent corrosion. A 20.00g sample of the alloy plate is dissolved completely in excess diluted H_2SO_4. Resultant solution is diluted up to $500cm^3$ by adding distilled water. $25cm^3$ of this solution is separated and allowed to react with 0.05 $moldm^{-3}$ $K_2Cr_2O_7$. The required volume of $K_2Cr_2O_7$ is $40cm^3$. Another $25cm^3$ sample of the solution is heated with excess NaOH and then allowed to cool down. The precipitate obtained is removed and excess $HgCl_2$ is added to the resultant solution. When the precipitate obtained is dried and weighed, the mass is found to be 0.471g.

(i) Write down balanced chemical equation for all the reactions that take place in the above experiment.
(ii) Find the mass ratio of Fe in the alloy plate. (Fe – 56, Hg -200, Cl – 35.5)

9) (a) 1. Answer the following questions regarding the production of caustic soda by using the membrane cell method.

(i) Give the raw material and the byproducts of this industry.
(ii) Give the balanced chemical equations for the reactions which occur at anode and cathode.
(iii) Give the anode and cathode used in this cell. What factors should be considered when selecting these electrodes?
(iv) Give the functions of the membrane septum.
(v) Show how this industry can be extended to produce PVC from limestone, coke and the byproducts obtained by using only the balanced chemical reactions.

2. Answer the following questions by considering the industrial production of urea.

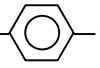
(i) Give the raw materials used in this industry. How are these raw materials obtained?
(ii) Give the main steps and the reactions involved in this industry giving the appropriate reaction conditions.
(iii) State two advantages of using urea as a fertilizer.

[*see page thirteen*

(b) Some of the gases released to the atmosphere due to human activities and natural processes contribute to the acid rain.

(i) What are the gases responsible for the acid rain?
(ii) Give 4 ways in which these gases enter the atmosphere.
(iii) Show how the gases dissolve in water and form the acid rain with the help of suitable equations.
(iv) Show how a dolomite rock dissolves in the less acidic and highly acidic states of the acid rain by using suitable chemical equations.
(v) Give 3 adverse effects that occur in the environment due to the acid rain.
(vi) Explain how a gas stated in (i) above contribute to the depletion of ozone layer by forming radical in the photochemical smog reactions.

(c) The list of chemicals that are related with the polymer industry is given below.

$CF_2 = CF_2$, HOOC–  –COOH, 2-methylbuta -1, 3-diene, HCHO,

 –OH,  –$CH = CH_2$, HO - CH_2CH_2 - OH

(i) Which of these chemicals can form a thermoplastic polymer?
(ii) Which of the above can form a condensation polymer?
(iii) One of the above substances is used in the regiform industry. Give that substance and its repeating unit.
(iv) Natural rubber has high elasticity. What is the reason for this?
(v) Give the repeating unit and a use of polyester which is produced from the given compounds.

10) (a) X_1 and Y_1 are simple 3d transition metal salts with the same anion. The following tests were carried out with the solution made by dissolving the above salts.
A yellowish brown precipitate X_2 is formed when KCN was added to a portion of an aqueous solution of X_1. A yellow colour solution X_3 is formed when excess KCN is added. The solution X_4 is obtained when another portion of the solution X_1 is heated with H_2O_2, dil.HCl and allowed to cool. A blue precipitate X_5 was obtained when X_3 is added to the resulting solution. A white precipitate Z is obtained when $BaCl_2$/dil.HNO_3 was added to a portion of solution containing Y_1. When the solution X_3, KI and excess conc. HCl are added to the separate portions of Y_1, a brown precipitate Y_2, white precipitate Y_3, a yellow solution Y_4 are formed respectively.

(i) Identify the salts X_1 and Y_1.
(ii) Identify the chemical species X_2, X_3, X_4, X_5, Y_2, Y_3, Y_4 and Z which are formed during the above tests.
(iii) Give the IUPAC names of the ionic species which are responsible for the yellow colour in X_3 and Y_4.
(iv) Give the balanced chemical equations for the formation of the following species in the above experiments.
a)X_4 b)Y_2 c)Y_3
(v) Suppose, if you are given with a salt solution containing only the salts X_1 and Y_1, give a clear scheme to determine the concentrations of the salts X_1 and Y_1 by using your knowledge in qualitative analysis.

[*see page fourteen*

(b)The reaction between the gaseous molecules A and B is given below.

$$3A_{(g)}+B_{(g)} \longrightarrow C_{(g)}+D_{(g)}$$

The rate of formation of the product C and the initial concentrations of the reactants are given in the table below. The known mechanism of the above reaction is also given.

Step I $\quad (A) + (A) \xrightarrow{\text{slow}} (C) + (E)$

Step II $\quad (E) + (A) + (B) \xrightarrow{\text{fast}} (D)$

The rate expression for this reaction is

$$R=k[A]^x[B]^y$$

Some of the basic information obtained from this reaction at 25^OC are given below.

Experiment	Initial concentration of [A] ($moldm^{-3}$)	Initial concentration of [B] ($moldm^{-3}$)	Initial rate of reaction ($moldm^{-3}s^{-1}$)
1	4.2×10^{-4}	2.8×10^{-3}	3.2×10^{-4}
2	2.1×10^{-4}	2.8×10^{-3}	R
3	C	5.6×10^{-3}	1.28×10^{-3}

(i) Give the values of x and y

(ii) Find the value of the rate of reaction R in experiment 2.

(iii) Find the concentration C of A in experiment 3.

(iv) Give the value of rate constant k and its value at the given temperature.

(v) What are the actions that can be taken in the above experiment to change the value of k?