## Second Term Test - Grade 13-2018

Index No : $\qquad$Chemistry I

## Important

- Periodic Table is provided.
- 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 form (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.

$$
\begin{array}{l|l}
\text { Universal gas constant } \mathrm{R}=8.314 \mathrm{JK}^{-1} \mathrm{~mol}^{-1} & \text { Avogadro constant } \mathrm{N}_{\mathrm{A}}=6.022 \times 10^{23} \mathrm{~mol}^{-1} \\
\text { Planck's constant } \mathrm{h}=6.626 \times 10^{-34} \mathrm{Js} & \text { Velocity of light } \mathrm{C}=3 \times 10^{8} \mathrm{~ms}^{-1}
\end{array}
$$

1. Frequency of a yellow light ray in hydrogen emission spectrum is $5.09 \times 10^{14} s^{-1}$ Wave length of this yellow light is,
2. 589 m
3. 589 nm
4. 337 m
5. 337 nm
6. 203 m
7. Which of the following statement is false,
8. First ionization energy of Nitrogen is higher than the first ionization energy of Oxygen.
9. Radii of all ions are smaller than the radii of their neutral atoms.

3 Second ionization energies of all atoms are larger than their first ionization energies.
4. Shielding effect influence on the atomic radius as well as on ionization energy.
5. Electronegativity of certain element atom changes with its environment.
3. What is the IUPAC name of following compound.


1. 2 - ammine - 3 - ethyl - 4 - formylpent - 3 - enamide
2. 2 - amino - 3,4 - diethyl - 4 - formylbut -3 - enamide
3. 2 - amino - 3,4-diethyl-5-oxopent - 3 - enamide
4. 2 - amino - 3 - ethyl-4-formylhex -3 - enamide
5. 2 - ammine $-3,4$ - diethyl - 5 - oxopent -3 - enamide
6. Which of following set of molecules / ions are with the same electron pair geometry, but different shape,
7. $\mathrm{NH}_{3}, \mathrm{CCl}_{4}, \mathrm{NO}_{3}^{-}$
8. $\mathrm{CCl}_{4}, \mathrm{NO}_{3}^{-}, \mathrm{H}_{2} \mathrm{~S}$
9. $\mathrm{NH}_{3}, \mathrm{CCl}_{4}, \mathrm{NO}_{2}^{-}$
10. $\mathrm{NH}_{3}, \mathrm{CCl}_{4}, \mathrm{H}_{2} \mathrm{~S}$
11. $\mathrm{NH}_{3}, \mathrm{NO}_{2}^{-}, \mathrm{NO}_{3}^{-}$
12. possible quantum number combination of an unpaired valence electron of ${ }_{4} \mathrm{Ag}$ atom in its ground state is,
13. $5,0,0,+\frac{1}{2}$
14. $4,0,0,+\frac{1}{2}$
15. $5,1,+1,+\frac{1}{2}$
16. $5,1,0,+\frac{1}{2}$
17. $4,2,0,+\frac{1}{2}$
18. Dilute $\mathrm{H}_{2} \mathrm{SO}_{4}$ and excess of $\mathrm{H}_{2} \mathrm{O}_{2}$ are added to an aqueous solution containing 3.04 g of $\mathrm{FeSO}_{4}$. Then $\mathrm{H}_{2} \mathrm{O}_{2}$ turns in to $\mathrm{H}_{2} \mathrm{O}$ and $\mathrm{FeSO}_{4}$ turns in to $\mathrm{Fe}_{2}\left(\mathrm{SO}_{4}\right)_{3}$. Needed volume of $0.1 \mathrm{~mol} \mathrm{dm}{ }^{-3} \mathrm{NaOH}$ to convert all of $\mathrm{Fe}_{2}\left(\mathrm{SO}_{4}\right)_{3}$ in to $\mathrm{Fe}(\mathrm{OH})_{3}$ is, $(\mathrm{Fe}=56, \mathrm{~S}=32, \mathrm{O}=16)$
19. $300 \mathrm{~cm}^{3}$
20. $30 \mathrm{~cm}^{3}$
21. $600 \mathrm{~cm}^{3}$
22. $60 \mathrm{~cm}^{3}$
23. $150 \mathrm{~cm}^{3}$
24. Consider the following equilibrium produces at $727^{\circ} \mathrm{C}$.
$A(s) \leftrightharpoons B(s)+C(g)$
Total pressure of the system at $727^{0} \mathrm{C}$ is $4.157 \mathrm{x} 10^{5} \mathrm{~Pa}$. What is equilibrium constant $K_{C}$ for above equilibrium?
25. $50 \mathrm{~mol} \mathrm{dm}{ }^{-3}$
26. $4.157 \times 10^{5} \mathrm{~mol} \mathrm{dm}^{-3}$
27. $4.157 \times 10^{2} \mathrm{~mol} \mathrm{dm}{ }^{-3}$
28. $50 \mathrm{~mol} \mathrm{~m}^{-3}$
29. $500 \mathrm{~mol} \mathrm{~m}^{-3}$
30. Relative molecular mass of a an inorganic compound X is $250,25.6 \%$ of $\mathrm{Cu}, 12.8 \%$ of $S 57.6 \%$ of $O$ and $4 \%$ of H by mass are included in this compound. If all H atoms in X present as water, the formula of anhydrous salt is, $(C u=64, S=32, O=16, H=1)$
31. $\mathrm{CuSO}_{3} \cdot 3 \mathrm{H}_{2} \mathrm{O}$
32. $\mathrm{CuSO}_{4} \cdot 2 \mathrm{H}_{2} \mathrm{O}$
$3 \mathrm{CuSO}_{4}$
33. $\mathrm{CuSO}_{4} \cdot 5 \mathrm{H}_{2} \mathrm{O}$
34. CuS
35. Which of the following statement is false about the chemistry of $A l$ and its compounds.
36. Basicity of $\mathrm{Al}(\mathrm{OH})_{3}$ is higher than the basicity of $\mathrm{Mg}(\mathrm{OH})_{2}$
37. $\mathrm{H}_{2}$ gas is released by the reaction between aluminium and dilute $\mathrm{Ba}(\mathrm{OH})_{2}$
38. $\mathrm{H}_{2}$ gas is released by the reaction between aluminium and dil. $\mathrm{H}_{2} \mathrm{SO}_{4}$.
39. $\mathrm{AlCl}_{3}$ exist as a dimer in its anhydrous form.
40. A white precipitate is produced when HCl is drop wisely added in to a solution obtained by the reaction of $A l$ with excess NaOH .
41. $\mathrm{H}_{1} \underset{1}{\mathrm{H}}$ II In this molecule, oxidation numbers of the labelled atoms (1), (2) and (3) are
 respectively.
42. $-2,-1,+2$
43. $-2,-1,+3$
44. $-2,-2,+3$
45. $-3,-1,+3$
46. $+2,+2,+3$
47. Consider the following equilibria produce at 1100 K .
48. $C(S)+\mathrm{CO}_{2}(g) \rightleftharpoons 2 \mathrm{CO}(g) \quad ; \quad K_{P_{1}=1.0 \times 10^{14} \mathrm{~Pa}}$
49. $\mathrm{CO}(g)+\mathrm{Cl}_{2}(g) \rightleftharpoons \mathrm{COCl}_{2}(g)$; $K_{P_{2}}=6.0 \times 10^{-3} \mathrm{~Pa}^{-1}$
$K_{P}$ value of the following reaction at 1100 K is,

$$
C(S)+\mathrm{CO}_{2}(g)+2 \mathrm{Cl}_{2} \rightleftharpoons 2 \mathrm{COCl}_{2}(g)
$$

1. $6 \times 10^{11} \mathrm{~Pa}^{-1}$
2. $3.6 \times 10^{9} \mathrm{~Pa}^{-1}$
3. $3.6 \times 10^{-6} \mathrm{~Pa}^{-1}$
4. $6 \times 10^{8} \mathrm{~Pa}^{-1}$
5. $3.6 \times 10^{7} \mathrm{~Pa}^{-1}$
6. According to the IUPAC rules, chemical formula of Tetraamminedicyanidoiron(III) nitrate is,
7. $\left[\mathrm{Fe}\left(\mathrm{NH}_{3}\right)_{4}(\mathrm{CN})_{2}\right] \mathrm{NO}_{3}$
8. $\left[\mathrm{Fe}(\mathrm{CN})_{2}\left(\mathrm{NH}_{3}\right)_{4}\right] \mathrm{NO}_{3}$
9. $\left[\mathrm{Fe}\left(\mathrm{NH}_{3}\right)_{2}(\mathrm{CN})_{2}\right] \mathrm{NO}_{2}$
10. $\left[\mathrm{Fe}(\mathrm{CN})_{2}\left(\mathrm{NH}_{3}\right)_{4}\right] \mathrm{NO}_{2}$
11. $\left[\mathrm{Fe}\left(\mathrm{NH}_{3}\right)_{4}(\mathrm{CN})_{2}\right]\left(\mathrm{NO}_{3}\right)_{2}$
12. $50 \mathrm{~cm}^{3}$ of HCl solution with $\mathrm{pH}=1$ and $200 \mathrm{~cm}^{3}$ of HCl solution with $\mathrm{pH}=2$ are mixed together. pH value of the new solution is,
13. 2.44
14. 3.84
15. 1.55
16. 3.5
17. 2.15
18. Sparingly soluble electrolyte $M X_{3}$ produces $M^{3+}$ and $X^{-}$ions in an aqueous solution. At $T K$ temperature if $\mathrm{K}_{\text {sp }}$ of $M X_{3}$ is $x \operatorname{mol}^{4} \mathrm{dm}^{-12}$ then concentration of $X^{-}$ions is,
19. $\left(\frac{x}{27}\right)^{\frac{1}{4}} \mathrm{~mol} \mathrm{dm}{ }^{-3}$
20. $\left(\frac{x}{108}\right)^{\frac{1}{4}} \mathrm{~mol} \mathrm{dm} m^{-3}$
21. $\left(\frac{3 x}{27}\right)^{\frac{1}{4}} \mathrm{~mol} \mathrm{dm}{ }^{-3}$
22. $3\left(\frac{x}{27}\right)^{\frac{1}{4}} \mathrm{~mol} \mathrm{dm} m^{-3}$
23. $3\left(\frac{x}{108}\right)^{\frac{1}{4}} \mathrm{~mol} \mathrm{dm} m^{-3}$
24. An ideal solution is prepared by mixing heptane and octane together. At $25^{\circ} \mathrm{C}$ saturated vapour pressures of these are respectively $4.5 \times 10^{5} \mathrm{~Pa}$ and $1.4 \times 10^{5} \mathrm{~Pa}$. At $25^{0} \mathrm{C}$ what is the total vapour pressure of a mixture containing 2 mol of heptane and \& 3 mol of octane.
25. $13.2 \times 10^{5} \mathrm{~Pa}$
26. $2.64 \times 10^{5} \mathrm{~Pa}$
27. $5.9 \times 10^{5} \mathrm{~Pa}$
28. $1.18 \times 10^{5} \mathrm{~Pa}$
29. $2.36 \times 10^{5} \mathrm{~Pa}$
30. Which of the following is not a resonance structure of phonate ion,

31. 


2.

3.

4.

5.
17. Which of the following statement is true about a catalyst.

1. A catalyst decrease the value of equilibrium constant.
2. A catalyst increase the value of equilibrium constant.
3. A catalyst decrease the enthalpy change.
4. A catalyst decrease the activation energy.
5. A catalyst gives more yield by changing the composition of equilibrium mixture.
6. Consider the following given electrode.
$Z n^{2+}(a q, 1.0 M) / Z n(s) \quad ; \quad E^{\theta} \mathrm{Zn}^{2+} / \mathrm{Zn}=-0.76 \mathrm{~V}$
$\mathrm{Cu}^{2+}(a q, 1.0 \mathrm{M}) / \mathrm{Cu}(s) \quad ; \quad E^{\theta} \mathrm{Cu}^{2+} / \mathrm{Cu}=+0.34 \mathrm{~V}$
$\mathrm{Fe}^{2+}(a q, 1.0 \mathrm{M}) / \mathrm{Fe}(\mathrm{s}) \quad ; \quad E^{\theta} \mathrm{Fe}^{2+} / \mathrm{Fe}=-0.44 \mathrm{~V}$
Electrochemical cells can be prepared by connecting above electrodes using a salt bridge and a voltmeter. Which of following gives the correct cell reaction and voltmeter reading of a cell prepared by above.
7. $\mathrm{Cu}(\mathrm{S})+\mathrm{Fe}^{2+}(a q) \rightleftharpoons \mathrm{Fe}(S)+\mathrm{Cu}^{2+}(a q) ;+0.10 \mathrm{~V}$
8. $\mathrm{Fe}(\mathrm{S})+\mathrm{Cu}^{2+}(a q) \rightleftharpoons \mathrm{Fe}^{2+}(a q)+\mathrm{Cu}(s) ;+0.78 \mathrm{~V}$
9. $\mathrm{Fe}(\mathrm{S})+\mathrm{Zn}^{2+}(a q) \rightleftharpoons Z n(S)+\mathrm{Fe}^{2+}(a q) ;+0.31 \mathrm{~V}$
10. $\mathrm{Zn}(\mathrm{S})+\mathrm{Fe}^{2+}(a q) \rightleftharpoons \mathrm{Fe}(S)+\mathrm{Zn}^{2+}(a q) ;+1.20 \mathrm{~V}$
11. $\mathrm{Cu}(\mathbf{S})+Z n^{2+}(a q) \rightleftharpoons \mathrm{Zn}(S)+\mathrm{Cu}^{2+}(a q) ;+1.10 \mathrm{~V}$
12. 0.5 A electric current is passed through a fused NaCl solution for 1 hour. Mass of $\mathrm{Na}(\mathrm{l})$ release at the cathode is,
( $1 \mathrm{~F}=96500 \mathrm{C}, \mathrm{Na}=23$ )
13. 0.00012 g
14. 0.000238 g
15. 0.429 g
16. 0.000429 g
17. 0.0002145 g
18. Which of the following statement is false about the $\mathrm{H}_{2} \mathrm{O}_{2}$.
19. $\mathrm{H}_{2} \mathrm{O}_{2}$ acts as an oxidizing agent as well as a reducing agent.
20. In an acid medium, $\mathrm{H}_{2} \mathrm{O}_{2}$ reacts with $\mathrm{KMnO}_{4}$ and $\mathrm{O}_{2}$ give gas as a product.
21. In an acidic medium $\mathrm{H}_{2} \mathrm{O}_{2}$ reacts with $\mathrm{MnO}_{2}$ and give $\mathrm{O}_{2}$ gas as a product.
22. In an acidic medium $\mathrm{H}_{2} \mathrm{O}_{2}$ reacts with KI and give $\mathrm{O}_{2}$ gas as a product.
23. $\mathrm{H}_{2} \mathrm{O}_{2}$ reacts with $\mathrm{SO}_{2}(\mathrm{~g})$ and give $\mathrm{H}_{2} \mathrm{SO}_{4}$ as the product.
24. Standard combustion enthalpies of $\mathrm{CH}_{3} \mathrm{CHO}(g), \mathrm{H}_{2}(g)$ and $\mathrm{CH}_{3} \mathrm{CH}_{2} \mathrm{OH}(l)$ are respectively ${ }^{\text {p }}$ $-1167 \mathrm{kJmol}^{-1},-286 \mathrm{kJmol}^{-1}$ and $-1368 \mathrm{kJmol}^{-1}$
Standard enthalpy change of following reaction
$\mathrm{CH}_{3} \mathrm{CHO}(\mathrm{g})+\mathrm{H}_{2}(\mathrm{~g}) \rightarrow \mathrm{CH}_{3} \mathrm{CH}_{2} \mathrm{OH}(\mathrm{l})$ in $\mathrm{kJmol}^{-1}$ is,
25. -85
26. +85
27. -409
28. +409
29.     - 1082
30. Which of the following statement is false about the complex ions of 3 d series.
31. $\left[\mathrm{CuCl}_{4}\right]^{2-}$ Produces by $\mathrm{Cu}^{2+}$ with cone HCl is yellow coloured.
32. $\left[\mathrm{Ni}\left(\mathrm{NH}_{3}\right)_{6}\right]^{2+}$ poduces by $\mathrm{Ni}^{2+}$ with $\mathrm{NH}_{3}$ is dark blue coloured.
33. $\left[\mathrm{Cr}\left(\mathrm{NH}_{3}\right)_{6}\right]^{3+}$ produces by $\mathrm{Cr}^{3+}$ with liquid $\mathrm{NH}_{3}$ is violet coloured.
34. $\left[\mathrm{MnCl}_{4}\right]^{2-}$ produces by $\mathrm{Mn}^{2+}$, with conc. HCl is greenish yellow coloured.
35. $\left[\mathrm{Co}\left(\mathrm{NH}_{3}\right)_{6}\right]^{2+}$ produces by $\mathrm{Co}^{2+}$, with $\mathrm{NH}_{3}$ is yellowish brown coloured.
36. $\mathrm{N}_{2}(\mathrm{~g})+3 \mathrm{H}_{2}(\mathrm{~g}) \leftrightharpoons 2 \mathrm{NH}_{3}(\mathrm{~g})$

Following thermochemical data are given for the above reaction.

$$
\Delta H_{f}^{\theta}\left[\mathrm{NH}_{3}(\mathrm{~g})\right]=-46 \mathrm{~kJ} \mathrm{~mol}^{-1}
$$

Standard entropy change of reaction $-232 \mathrm{~J} \mathrm{~mol}^{-1} \mathrm{~K}^{-1}$ which of the following is true about above reaction.

1. Above reaction is spontaneous at any temperature.
2. Above reaction is non - spontaneous at any temperatures.
3. Above reaction is spontaneous above 396.55 K temerature.
4. Above reaction is non-spontaneous below 396.55 K temperature.
5. Above reaction is spontaneous at 496.55 K temperature.
6. Consider the following reaction.

7. 






5

25.


Structure of A and B with suitable colours are given in which of following response,

|  | Structure of A | Colour of A | Structure of B | Colour of B |
| :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{HO}-\mathrm{O}-\mathrm{N}=\mathrm{N}-\mathrm{O}$ | red |  | orange |
|  | $\mathrm{HO}-\mathrm{O}\rangle-\mathrm{N}=\mathrm{N}-\mathrm{O}$ | orange |  | red |
| 3) | $\mathrm{HO}-\mathrm{O}-\mathrm{N} \equiv \mathrm{~N}-\mathrm{O}$ | red |  | orange |
| (1) | $\mathrm{HO}-\mathrm{O}-\mathrm{N} \equiv \mathrm{~N} \text { O }$ | orange |  | red |
| 5) | $\hat{0}^{-N=N}$ | orange | $)_{0}^{\mathrm{OH}} \mathrm{o}^{\mathrm{N}=\mathrm{N}} \text { ( }$ | red |

26. Which of following statement is false.
27. $\mathrm{CaCl}_{2}$ is added to decrease the melting point of NaCl in manufacturing sodium by the Down's cell method.
28. In manufacturing sodium by Down's cell method, large electric current is passed under a low potential difference.
29. $\mathrm{CaSO}_{4}$ is precipitated at first tank in the manufacturing process of salt.
30. Ni cathode and a Ti anode are used in manufacturing process of sodium hydroxide by the membrane cell method.
31. Saponification is the first step in manufacturing process of soap.
32. Which of following statement is true.
33. $\mathrm{O}_{2}$ is released at anode when electrolyze acidified water using graphite electrodes.
34. Cu is deposited on anode when electrolyze an aqueous $\mathrm{CuSO}_{4}$ solution using Cu electrodes.
35. $\mathrm{H}_{2}(g)$ is released at cathode when electrolyze an aqueous $\mathrm{CuSO}_{4}$ solution using inert electrodes.
36. $\mathrm{H}_{2}(g)$ is released at anode when electrolyze an aqueous NaCl solution using innert electrodes.
37. $N a(l)$ is given at anode when electrolyze of a NaCl solution using innert electrodes.
38. $\mathrm{CH}_{3}-\stackrel{\stackrel{\mathrm{O}}{\mathrm{C}}}{\mathrm{C}}-\mathrm{O}-\mathrm{C}_{2} \mathrm{H}_{5} \xrightarrow[\text { (ii) } \mathrm{H}_{2} \mathrm{O}]{\text { (i) excess } \mathrm{CH}_{3} \mathrm{MgBr} / \text { dry Ether }} \mathrm{A} \xrightarrow{\mathrm{Na}} \mathrm{B} \xrightarrow{\mathrm{CH}_{3} \mathrm{CH}_{2} \mathrm{Br}} \mathrm{D}$

Respectively, structures of $A, B$ and $D$, in above reaction scheme given by



4. $\mathrm{CH}_{3} \mathrm{CH}_{2} \mathrm{OH}, \mathrm{CH}_{3} \mathrm{CH}_{2} \mathrm{O}^{-} \mathrm{Na}^{+}, \mathrm{CH}_{3} \mathrm{CH}_{2}-\mathrm{O}-\mathrm{CH}_{2} \mathrm{CH}_{3}$

 0.1 moldm ${ }^{-3} \mathrm{NH}_{4} \mathrm{OH}(\mathrm{aq})$ solution. pH value of the producing solution is, (at 298 K $\left.K_{b}\left(\mathrm{NH}_{4} \mathrm{OH}\right)=1.8 \times 10^{-5} \mathrm{~mol} \mathrm{dm}^{-3}\right)$

1. 9.26
2. 4.74
3. 3.2
4. 10.8
5. 11.2
6. X is more soluble in $\mathrm{CHCl}_{3}$ than in water and the relevant distribution coefficient is 10.10 g of X is contained in $100 \mathrm{~cm}^{3}$ of water. This aqueous solution is extracted for three times using three $10 \mathrm{~cm}^{3}$ portions of $\mathrm{CHCl}_{3}$. Total mass of X extracted to the $\mathrm{CHCl}_{3}$ is,
7. 8.125 g
8. $\quad 9.25 \mathrm{~g}$
9. $\quad 0.125 \mathrm{~g}$
10. $\quad 8.75 \mathrm{~g}$
11. 9.875 g

- For each of the questions 31 to 40 , one or more responses out of the four responses (a), (b) , (c) and (d) given is /are correct. Select the correct response/responses in accordance with the instructions given on your answer sheet, mark
(1) If only (a) and (b) are correct.
(2) If only (b) and (c) are correct.
(3) If only (c) and (d) are correct.
(4) If only (d) and (a) are correct.
(5) If any other number or combination of responses is correct.

Summary of above Instructions,

| 1 | 2 | 3 | 4 | 5 |
| :---: | :---: | :---: | :---: | :---: |
| Only (a) and (b) <br> are correct | Only (b) and (c) <br> are correct | Only (c) and (d) <br> are correct | Only (a) and (d) <br> are correct | Any other number or <br> combination of <br> responses is correct |

31. Following equilibrium exists in a closed vessel at a constant temperature.
$2 A(g)+2 B(g) \rightleftharpoons C(g)+2 D(g)$
Gas C is introduced to the vessel from outside and allowed to attain the equilibrium again under the earlier temperature. Which of following statements is / are true about the new equilibrium.
a) Partial pressures of D gas is increased.
b) Amount of $\mathrm{B}(\mathrm{g})$ is decreased.
c) Total pressures in the vessel is increased.
d) Partial pressure of $\mathrm{C}(\mathrm{g})$ is increased.
32.     - $\mathrm{CO}_{2}$ releases by reaction with aqueous $\mathrm{Na}_{2} \mathrm{CO}_{3}$

- Give a yellow precipitate with $2,4-D N P$
- Silver mirror is given with the ammonical silver nitrate,

Which of followings give all above observations.
(a)

(b) $\mathrm{COOH}_{3} \mathrm{C}-\mathrm{C}=\mathrm{O}$
(c)

(d)

33. Following statements are about some industrial processes. Which of those statement / s is / are correct.
(a) $\mathrm{Ca}^{2+}, \mathrm{Mg}^{2+}$ and $\mathrm{SO}_{4}^{2-}$ are possible as impurities in salt collected as crystals.
(b) ( $\mathrm{NaCl}(s))$ is used to reduce the melting point of ice.
(c) Anions can exchange through the ion selective membrane in the production of NaOH by membrane cell method.
(d) In manufacturing $\mathrm{Na}_{2} \mathrm{CO}_{3}$ by Solvay process, high temperature is suitable because dissolution of $\mathrm{NH}_{3}(\mathrm{~g})$ in brine solution is endothermic.
34. Following plot illustrates the variation of vapor pressure with temperature of some compounds. According to the plot, which of following/s is / are true.

(a) Because intermolecular forces are weak boiling point of A is low.
(b) Intermolecular forces of B are stronger than intermolecular forces of C .
(c) Boiling point of D high, because inter-molecular forces are strong.
(d) At a constant temperature, saturated vapour pressure of A is higher than the saturated vapour pressure of D.
35. Which of following mechanism steps are not feasible.
(a)

(b)

(c)

(d)

36. Which of following statement / s is / are correct about the aqueous solutions of given salts.
(a) In $\mathrm{CH}_{3} \mathrm{COO} \mathrm{Na}(\mathrm{aq})$ solution $\left[\mathrm{H}_{3} \mathrm{O}^{+}(\mathrm{aq})\right]>[\overline{\mathrm{OH}}(\mathrm{aq})] \mathrm{OH}^{-}$
(b) In $\mathrm{CH}_{3} \mathrm{COO} \mathrm{Li}(\mathrm{aq})$ solution $\left[\mathrm{H}_{3} \mathrm{O}^{+}(\mathrm{aq})\right]<[\overline{\mathrm{OH}}(\mathrm{aq})] \mathrm{OH}^{-}$
(c) In $\mathrm{NH}_{4} \mathrm{Cl}(\mathrm{aq})$ solution $\left[\mathrm{H}_{3} \mathrm{O}^{+}(\mathrm{aq})\right]>[\overline{\mathrm{OH}}(\mathrm{aq})] \mathrm{OH}^{-}$
(d) In $\mathrm{CH}_{3} \mathrm{~N}^{+} \mathrm{H}_{3} \mathrm{NO}_{3}^{-}$solution (aq) $[\overline{\mathrm{OH}}(\mathrm{aq})]>\left[\mathrm{H}_{3} \mathrm{O}^{+}(a q)\right] \mathrm{OH}^{-}$
37. The indicator HIn with $\mathrm{p}_{\mathrm{KIn}}=4.0$ at 298 K , is dissociated in an aqueous solution as given below.

$$
\underset{\text { yellow }}{\operatorname{HIn}(a q)}+\mathrm{H}_{2} \mathrm{O}(l) \rightleftharpoons \mathrm{H}_{3} \mathrm{O}^{+}(a q)+\underset{\text { red }}{\operatorname{In}^{-}(a q)}
$$

Which of following statement / s is / are correct
(a) This indicator shows yellow colour in solution with $\mathrm{pH}=7$
(b) This indicator is suitable for a titration between a weak acid and a strong base.
(c) This indicator is suitable for a titration between a strong acid and a weak base.
(d) This indicator is not suitable for a titration between $1 \times 10^{-4} \mathrm{~mol} \mathrm{dm}^{-3} \mathrm{HCl}(\mathrm{aq})$ and $1 \times 10^{-4} \mathrm{~mol} \mathrm{dm}^{-3} \mathrm{NaOH}(\mathrm{aq})$
38. Which of following /s not base assumption of molecular kinetic theory of gasses.
(a) Total kinetic energy of a system remains constant when taking place collisions among gas molecules.
(b) Collisions of gas molecules on the wall of container produce the pressure of gas.
(c) In gas, the molecules move in equal speeds and are with continuous random motions.
(d) Attraction forces are possible among gas molecules.
39. Which of following statement / s are true about the Limonene.

(a) All carbon atoms lie on same plane.
(b) All $\mathrm{C}-\mathrm{C}$ bond distances are same
(c) Four carbon atoms are with $s p^{2}$ hybridization.
(d) All $C-C-C$ bond angles are same.
40. Which of following pair / pairs (is / are) act as buffer solutions.
(a) $\mathrm{NH}_{4} \mathrm{OH} / \mathrm{NH}_{4} \mathrm{Cl}$
(b) $\mathrm{HClO}_{4} / \mathrm{NaClO}_{4}$
(c) $\mathrm{HNO}_{3} / \mathrm{KNO}_{30}$
(d) $\mathrm{HCOOH} / \mathrm{HCOONa}$

- In question numbers 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.

| $\mathbf{1}^{\text {st }}$ Statement | $\mathbf{2}^{\text {nd }}$ Statement | Response |
| :--- | :--- | :--- |
| True | True and $1^{\text {st }}$ statement is explained correctly | 1 |
| True | True and $1^{\text {st }}$ statement is not explained correctly | 2 |
| True | False | 3 |
| False | True | 4 |
| False | False | 5 |
|  |  |  |


|  | $\mathbf{1}^{\text {st }}$ Statement | $\mathbf{2}^{\text {nd }}$ Statement |  |  |
| :--- | :--- | :--- | :--- | :---: |
| 41. | $\mathrm{O}-\mathrm{O}$ bond distance of $\mathrm{H}_{2} \mathrm{O}_{2}$ molecule is <br> less than the $\mathrm{O}-\mathrm{O}$ bonds distance of <br> $\mathrm{O}_{3}$ molecules. | Both $\mathrm{H}_{2} \mathrm{O}_{2}$ and $\mathrm{O}_{3}$ are with two stable <br> resonance structures. |  |  |
| $42 .$All carboxylic acids are well soluble in <br> water. | All carboxylic acids produce inter-molecular <br> hydrogen bonds with water. |  |  |  |
| 43. | At a constant temperature, entropy decreases <br> when pressure increases in the equilibrium <br> system. <br> $2 \mathrm{SO}_{2}(g)+\mathrm{O}_{2}(g) \rightleftharpoons 2 \mathrm{SO}_{3}(g)$ | According to Le-Chateliers principle, <br> equilibrium shifts to right side to reduce the <br> pressure. |  |  |
| 44. | $\mathrm{MgCO}_{3}(s)$ decomposes on heating, but <br> $\mathrm{Na}_{2} \mathrm{CO}_{3}(s)$ does not decomposes on <br> heating. | Decomposition ability increases when ionic <br> character of a compound increases. |  |  |


| 45. | Reactivity of tertiary alkyl halides with nucleophiles is less than the reactivity of secondary alkyl halides. | Tertiary carbocation is more stable than the secondary carbocation. |
| :---: | :---: | :---: |
| 46. | Maximum temperature at which an equilibrium can be produce between liquid water and water vapour is the critical temperature. | No attraction forces among water molecules at higher temperatures than the critical temperature. |
| 47. | In second step of soap manufacturing process, part of glycerin is kept with soap without removing all glycerin. | Glycerin is used to manufacture cosmetic products. |
| 48. | 3 - bromo-1-butene shows the enantiomerism. | 3 - bromo - 1 - butene is with a pair of isomers that are mirror images of each other. |
| 49. | Needed $S^{2-}$ ion concentration for the precipitation of NiS from aqueous $\mathrm{Ni}^{2+}$ solution is higher than the $S^{2-}$ ion concentration needed to precipitate CuS from $\mathrm{Cu}^{2+}$ solution. | Solubility product of NiS less than the solubility product of CuS |
| 50. | Aqueous hydrogen flouride is a weak acid. $(H F(a q))$ | $H-F$ bond is a strong bond. |

## థఅరఠిలు อథర  Periodic Table



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



Index No : $\qquad$

## Chemistry II

- Periodic Table is provided.
- Use of calculations is not allowed.
* Part A - Structures Essay
- Answer all the questions on the question paper itself'
- Write your answer in the space provided for each question. Please note that the space provided is
- sufficient for the answer and that extensive are not expected.
* Part B and Part C - Essay
- Answer four questions selecting two questions from each part. Use the paper supplied for this purpose.


## Part A - Structured Essay

Answer all four questions on this paper itself. ( Each question carries 10 marks)

1. (a) Cyanic acid (HCNO) is a monobasic weak acid
(i) Draw the most acceptable Lewis structure for cyanic acid (HCNO)
(ii) Draw the resonance structures for this cyanic acid
(iii) Based on the Lewis structure drawn in (i) above, complete the table is given below.

| Atom | O | C | N |
| :--- | :--- | :--- | :--- |
| 1. Hybridization |  |  |  |
| 2. VSEPR pairs |  |  |  |
| 3. Electron pair <br> geometry |  |  |  |
| 4. oxidation number |  |  |  |

(b) Consider the following chemical species

$$
\mathrm{H}_{3} \mathrm{O}^{+}, \mathrm{NO}_{2}, \mathrm{CH}_{2} \mathrm{O}, \mathrm{CO}_{2}, \mathrm{BF}_{3}, \mathrm{~N}_{2} \mathrm{O}
$$

Which one of the above species is more suitable for the given property in the table

| i | Linear polar molecule |  |
| :---: | :--- | :--- |
| ii | Trigonal planer non - polar molecule |  |
| iii | Having with zero oxidation state for central atom |  |
| iv | Electron pair geometry of central atom is tetrahedral |  |
| v | can dimerize when reacts with water |  |
| vi | Weakly acidic |  |

## (C) Explain by giving reasons

i. NaCl is soluble in water but $\mathrm{CCl}_{4}$ is not soluble in water
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
ii. Reactivity of $N a$ is greater than that of $M g$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
iii. Ionic property of $A g F$ is less than that of $A g I$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
(02) (a) $A$ and $B$ are the third period elements. By reacting A and B can form a non - polar covalent compound ( $X$ ) having with $A$ as the central atom. The shape and electron pair geometry of $X$ is trigonal bipyramidal $X$ can react with water to produce two acids as a strong acid $D$ and a weak acid $C$
(i) Identify element $A$ and $B$ by giving chemical symbols

A -

B -
(ii) Draw the Lewis structures for $X, C$ and $D$

X C
D
(iii) By reacting A and B can form a polar - covalent compound write the molecular formula for this polar compound.
(b) $\quad M$ is a solid element which can react with water at room temperature but It is not a $d$ - block element. $M$ does not form solid bicarbonate. Hydroxide of $M$ is basic and its sulphate is completely dissolved in water.
(i) Identify element M $\qquad$
(ii) Write the balanced chemical equation for the reaction of $M$ with water
(iii) Write the balanced chemical equation for the thermal decomposition of the nitrate of M
(iv) What is the Flame color for $M$ when doing the Flame test
(c) $\quad A$ and $B$ are sodium containing compounds. See the given reaction and observations regarding with $A$ and $B$

| A (aq) |  | X White (ppt) | $\xrightarrow{\text { dil } \mathrm{HCl}}$ | Y insoluble |
| :---: | :---: | :---: | :---: | :---: |


$\mathrm{B}(\mathrm{aq}) \mathrm{AgNO}_{3}(a q) \xrightarrow{\text { Q white (ppt) }} \xrightarrow{$|  withing a short  |
| :--- |
|  period of time  |$} \mathrm{R}$ black (ppt)

(i) Write the chemical formula for A and B

$$
A=
$$

$$
B=
$$

(ii) Write the chemical formula for $X$ and $Q$
$X=$
$Q=$
(iii) Write the balanced chemical equation for the conversion of $Q$ in to $R$
(03) (a) (i) Calculate the number of $\mathrm{H}^{+}$ions in 1.0 ml of the solution of the $P^{\mathrm{OH}}$ is 10 at $25^{\circ} \mathrm{C}$
(ii) HA is a weak acid, write the equation for the dynamic equilibrium for HA in water.
$\qquad$
$\qquad$
(iii) Write the equation for the dissociation constant of HA (aq)
$\qquad$
$\qquad$
(iv) PH value of the $0.1 \mathrm{~mol} \mathrm{dm}{ }^{-3} \mathrm{HA}$ solution at $25^{\circ} \mathrm{C}$ is 4 . Calculate the dissociation constant of $H A$ at $25^{\circ} C$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
(b) Saturated vapour pressure of pure liquid A is 80 mmHg at 300 K . When liquid A and liquid B are mixed $300 K$ the resulting mixture is an ideal solution (liquid B is also volatile) mole fraction of B in liquid phase is 0.4 at 300 k total pressure of the vapour phase is 88 mmHg at 300 k
(i) Calculate the saturated vapour pressure of pure B at 300 k and state the assumptions that you made when doing this calculation.
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
(ii) Which one has the highest boiling point ( A or B )
(i) Draw an appropriate vapour pressure composition phase diagram for the above system and should be completely labeled it.
(C) Rate constant for $2 \mathrm{~N}_{2} \mathrm{O}_{5} \rightarrow 4 \mathrm{NO}_{2}+\mathrm{O}_{2}$ is $3.0 \times 10^{-5} \mathrm{~S}^{-1}$ at 300 k When rate of the reaction at 300 k is $2.4 \times 10^{-5}$ moldm ${ }^{-3} \mathrm{~S}^{-1}$ Calculate the concentration of $\mathrm{N}_{2} \mathrm{O}_{4}$ at 300 k
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
(04) (a) A is an organic compound which contains only $C, H$ and $O$

1. A reacts with $\mathrm{Na}_{2} \mathrm{CO}_{3}$ to evolve $\mathrm{CO}_{2}$
2. One mole of A can react with excess Na to give 2.0 mole of $\mathrm{H}_{2}$
3. A is an optically active compound
(i) Draw the structure for A by considering minimum number of atoms.
(ii) Write the IUPAC name of A
$\qquad$
(iii) Show how compound A could be synthesized by using $\mathrm{CH}_{3} \mathrm{Br}$ as the staring compound in less than 6 steps.
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
(b) (i) Draw the structure of the major product of following reactions.
(i) $\mathrm{C}_{6} \mathrm{C}_{5} \mathrm{OH} \xrightarrow{\mathrm{CH}_{3} \mathrm{COCl}}$
(ii) $\mathrm{CH}_{3} \mathrm{COOH} \xrightarrow{\mathrm{NH}_{3} / \Delta}$
(iii)

(iv) $\stackrel{C}{0}_{\mathrm{COCH}_{3}}^{\mathrm{C}_{2} \mathrm{H}_{5} \mathrm{O} \cdot \mathrm{Na}^{-}}$

(iii) i. Complete the conversion is given below.

ii. Write the name of the reaction type of step 01 and 03

Step 1 $\qquad$

Step 3 $\qquad$
(c) i. Write the reaction mechanism for the reaction of $\mathrm{CH}_{3} \mathrm{COCl}$ with $\mathrm{C}_{2} \mathrm{H}_{5} \mathrm{OH}$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
ii. According to the reaction mechanism respectively the acid chloride, Name the reaction type.
$\qquad$

## Second Term Test - 2018

## Chemisty 2018 - PART B

## - Answer two question only ( Each question carries 15 mark)

(05) (a) (i) Derive the mathematical expression for the ostwald's dilution law by considering weak base of $B(a q)$
(ii) Calculate the Degree of dissociation of $5 \mathrm{moldm}^{-3} B(a q)$ solution dissociation constant of B is of $4.5 \times 10^{-5} \mathrm{moldm}{ }^{-3}$ at $25^{\circ} \mathrm{C}$
(iii) Calculate the pH value of the above solution at $25^{\circ} \mathrm{C}$
(b) (i) Calculate the pH value of the mixture of $500 \mathrm{~cm}^{3}$ of $0.2 \mathrm{moldm}^{-3} \mathrm{CH}_{3} \mathrm{COOH}(\mathrm{aq})$ and $500 \mathrm{~cm}^{3}$ of $0.2 \mathrm{moldm}^{-3} \mathrm{HCl} \mathrm{cm}{ }^{3}$ at $25^{\circ} \mathrm{C}$ state the assumptions that you made when doing this calculation. Degree of dissociation of $\mathrm{CH}_{3} \mathrm{COOH}(a q)$ at $25^{\circ} \mathrm{C} 1.75 \times 10^{-5} \mathrm{moldm}{ }^{-3}$.
(ii) When 6.0 g of NaOH is added into the above (I) mixture at $25^{\circ} \mathrm{C}$ calculate the $\mathrm{P}^{\mathrm{H}}$ value of the resulting solution (ignore the changing of volume due to the addition of NaOH )
(c) (i) $\mathrm{CH}_{3} \mathrm{COONH}_{4}(\mathrm{aq})$ Can behave as a buffer solution. explain the buffer action of this solution. (ii) $\left(\mathrm{NH}_{4}\right)_{2} \mathrm{CO}_{3}(\mathrm{aq})$ is a basic solution explain this by giving reasons,
(06) (a) By dissolving 6.5 g of a mixture of $\mathrm{Na}_{2} \mathrm{CO}_{3}$ and $\mathrm{NaHCO}_{3}$ in water It was prepared $1 \mathrm{dm}^{3}$ of the solution. By getting $25 \mathrm{~cm}^{3}$ of the prepared solution titrated with $0.1 \mathrm{~mol} \mathrm{dm}{ }^{-3} \mathrm{HCl}$ with the presence of methyl orange as an indicator. the end point was $25 \mathrm{~cm}^{3}$. calculate the mass percentage of $\mathrm{Na}_{2} \mathrm{CO}_{3}$
(b) Consider the electrochemical cell is given below.

(i) Name the anodic and cathode
(ii) Write the anode and cathodic reactions when the cell is operating
(iii) Write the cell reaction.
(iv) calculate the electromotive force of the cell
(v) Write the cell notation for the give cell
(c) When $A(s)$ and $B(g)$ were heated in a closed container at $930^{\circ} C$ they reacted as
$A(s)+B(g) \rightleftharpoons C(g)+D(g)$
given a dynamic equilibrium at the equilibrium 0.2 moles of $B$ was in the container and total pressure of the container was $1 \times 10^{7} \mathrm{~Pa} \quad\left(R T=10^{4} \mathrm{Jmol}^{-1}\right)$
(i) Calculate the number of moles of $B(g)$ at the biginig
(ii) Calculate the $K_{p}$ at $930^{\circ} \mathrm{C}$
(iii) Calculate the $K_{c}$ by using the $K_{p}$
(iv) explain what happens to the total pressure of the container after addition of some amount of solid A into the system at same temperature.
(07) (a) Show how you would synthesize compound $\mathrm{H}-\mathrm{C} \equiv \mathrm{C}-\mathrm{CH}_{2} \mathrm{OCH}_{2}-\mathrm{CH}=\mathrm{CH}_{2}$ by using $\mathrm{HO}-\mathrm{CH}_{2} \mathrm{CH}_{2} \mathrm{CH}_{2} \mathrm{Cl}$ as the starting organic compound.
(b) explain following by giving reasons
(i) Acetic acid is more acidic than phenol
(ii) Ethyl amine is more basic than ethanol
(iii) Phenol does not participate for the nucleophilic substitution reactions.
(c) Using only the chemicals given in the list, show how you would carry out the following conversion.

list of chemicals. PCC , alcoholic $\mathrm{KOH}, \mathrm{HBr}, \mathrm{PCl}_{5}, \mathrm{NaOH}, \mathrm{NaBH}_{4}, \quad \mathrm{H}_{2} \mathrm{SO}_{4}$

## Part - C essay

## - Answer two question only ( Each question carries 15 marks)

(08) (a) M is a s- block element. Sulphate of $M$ is water soluble but its carbonate is insoluble in water. Hydroxide of M is insoluble in NaOH but soluble in HCl M reacts with steam and form its oxide as a product of $M$
(i) Identify element $M$
(ii) Give reasons for the insoluble of hydroxide of M in NaOH but soluble in HCl
(iii) Write the balanced chemical equation for the reaction of $M$ with water
(iv) If you are provided the two samples as nitrate of M and $\mathrm{NaNO}_{3}$ how to identify these two from each other.
(b) $X$ is white solid compound. When $X$ is heated it gave $Y$ as a white solid and colorless gas $Z . Y$ can react with dil. HCl to give a brown color gas. When $Y$ is heated with $\mathrm{NH}_{4} \mathrm{Cl}$. It gives colorless gas D and compound E . when X is heated with $\left(\mathrm{NH}_{4}\right)_{2} \mathrm{SO}_{4}$. it gives colorless gas $G$ and $F$ as a white solid when E and F are tested for flame test both given yellow color flame. When $D$ is heated with $C a$ it gives $H$ as a white solid. H can react with water to give an alkaline solution (I) and $\mathrm{NH}_{3}$
(i) Give the chemical formulae or symbols for $X, Y, Z, E, F, D, H$ and $I$
(ii) Give balanced chemical equations which took place in the above given procedure.
(c) A, B, C and D are the aqueous solution having with a single cation. Tests 1,2 , and 3 were carried out to identify the cations. The tests and observations are given below.

| Test | A | B | C | D |
| :--- | :--- | :--- | :--- | :--- |
| (1) acidified with dill HCl <br> and added $\mathrm{H}_{2} \mathrm{~S}(\mathrm{~g})$ | - | black ppt | orange ppt | - |
| (2) added excess <br> $\mathrm{NH}_{4} \mathrm{OH}$ solution <br> dropwise | dark blue color <br> solution | dark blue <br> color solution | - | gave a white ppt <br> then dissolved to <br> give colorless <br> solution |
| (3) alkalized and then <br> added $\mathrm{H}_{2} \mathrm{~S}$ | black ppt | black ppt | orange ppt | white ppt |

Identify the cations in $\mathrm{A}, \mathrm{B}, \mathrm{C}$ and D solution.
(09) (a) When $\mathrm{NH}_{3}$ and $\mathrm{NaNO}_{2}$ were added in to a $\mathrm{Co}_{2}\left(\mathrm{SO}_{4}\right)_{3}$ solution $\mathrm{Co}^{3+}$ ion formed two complex as A and B with $\mathrm{NH}_{3}, \mathrm{NO}_{2}^{-}$and $\mathrm{SO}_{4}^{2-}$ mass percentage of A and B are very same $C o=20.6 \% \quad H=5.2 \% \quad N=29.4 \% \quad O=33.6 \% \quad S=11.2 \%$ When excess $\mathrm{Bacl}_{2}$ solution was added into the solution having with $3 \times 10^{-4}$ moles of A . It gave 0.0816 g of solid $\mathrm{BaSo}_{4}$ but B does not give precipitation with $\mathrm{Bacl}_{2}$
( $C o=57, S=32, O=16, N=14, H=1, B a=137$ )
(i) Calculate the empirical formula of $A$ or $B$
(ii) By giving reasons, deduce the chemical formulae of $A$ and $B$
(iii) Write the IUPAC name of $A$ and $B$
(b) $P$ and $Q$ are the inorganic compounds having with anions and cations. Test carried out along with observation to identity them are as Follows.

| Test | Observations |
| :---: | :---: |
| (1) mixing of aqueous solution of $P$ and $Q$ and then filter off | gave $Z$ as a white ppt and colured solution of $D$ |
| (2) added $\mathrm{K}_{3}\left[\mathrm{Fe}(\mathrm{CN})_{6}\right]$ solution in to a portion of aqueous solution of $D$ | gave blue color solution |
| (3) $Z$ was heated with water and kept to cool | z dissolved in hot water and when it was cold, formed needle shape crystals. |
| (4) Added newly prepared $\mathrm{FeSO}_{4}$ to D and then after added few drops of conc. $\mathrm{H}_{2} \mathrm{SO}_{4}$ | gave a brown ring |
| (5) $P$ and $Q$ heated seperatly | gave a brown color gas only by $P$ |
| (6) added $\mathrm{Na}_{2} \mathrm{~S}_{2} \mathrm{O}_{3}$ solution in to the aqueous solution of $P$ | gave a white ppt |
| (7) heated white ppt of test ( 6) | turned in to black ppt |

(i) Write the chemical formulae for $P$ and $Q$
(ii) What is the species which involve to give blue color
(iii) Write the balanced chemical equations taking place in tests 5, 6 and 7
(a) In a given aqueous solution contains $0.01 \mathrm{moldm}^{-3} \mathrm{Ag}^{+}$and $0.01 \mathrm{moldm}^{-3} \mathrm{Ba}^{2+}$ at $25{ }^{\circ} \mathrm{C} \quad \mathrm{K}_{2} \mathrm{CrO}_{4}$ Solution is added slowly while mixing the solution at $25^{\circ} \mathrm{C}$
$\mathrm{Ag}_{2} \mathrm{CrO}_{4}(\mathrm{~s})$ of $K_{S P}=1.1 \times 10^{-12} \mathrm{~mol}^{3} \mathrm{dm}^{-9}$
$\mathrm{BaCrO}_{4}(\mathrm{~s})$ of $K_{S P}=2.2 \times 10^{-10} \mathrm{~mol}^{2} \mathrm{dm}^{-6}$
(i) Calculate the minimum concentration of $\mathrm{CrO}_{4}^{2-}$ required in solution to initiate the precipitations of $\mathrm{Ag}_{2} \mathrm{CrO}_{4}$ and $\mathrm{BaCrO}_{4}$ at $25^{\circ} \mathrm{C}$ and state assumptions if any you used in the above calculations
(ii) According to above calculation which precipitate was able to get at the first.
(iii) Calculate the cation concentration that remains in solution of the salt when precipitated first when the second salt begins to precipitate.
(iv) Is it successful method, addition of $\mathrm{K}_{2} \mathrm{CrO}_{4}$ in to the solution to remove $\mathrm{Ag}^{+}$ions from $\mathrm{Ba}^{2+}$ ions give reasons for your answer.
(b) The following procedure was used to determine the concentration of $\mathrm{SO}_{3}^{2-}, \mathrm{SO}_{4}^{2-}$ and $\mathrm{C}_{2} \mathrm{O}_{4}^{2-}$ in the aqueous solution.

Step 1 By getting $50 \mathrm{~cm}^{3}$ of the given aqueous solution. Added excess $\mathrm{HNO}_{3}$ and $\mathrm{BaCl}_{2}$ and measured dry mass of the precipitate as 0.233 g
Step 2 By getting another $50 \mathrm{~cm}^{3}$ of the given solution it was needed $50 \mathrm{~cm}^{3}$ of acidified $0.1 \mathrm{~mol} \mathrm{dm}{ }^{-3} \mathrm{KMnO}_{4}$ to react. When added excess $\mathrm{HNO}_{3}$ and $\mathrm{BaCl}_{2}$ into the resulting solution it was obtained a precipitate dry mass of the precipitate was 0.699 g
( $B a=137, S=32, C=12, O=16$ )
(i) Write balanced chemical equations for the reactions taking place in step 01 and step 02
(ii) Calculate the concentration of $\mathrm{SO}_{3}^{2-}, \mathrm{SO}_{4}^{2-}$ and $\mathrm{C}_{2} \mathrm{O}_{4}^{2-}$
(c) You are provided an aqueous solution having with $\mathrm{Ag}^{+}, \mathrm{Cu}^{2+}, \mathrm{Cr}^{3+}, \mathrm{Ba}^{2+}$ and $\mathrm{Zn}^{2+}$ only. give a procedure to identify each cation in the solution by using your knowledge of group separation.


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

