00720

Index No: | | | | | |

| For official use | |
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| Ques. No. | Marks |
| 1 | |
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| Total | |

**THE OPEN UNIVERSITY OF SRI LANKA**
**FACULTY OF NATURAL SCIENCES**
**B. Sc DEGREE PROGRAMME 2014 / 2015**
**LEVEL 3 - FINAL EXAMINATION**
**CMU1121 - PRACTICAL CHEMISTRY**
**DURATION: 2 HOURS**

Date : Thursday, 18th November 2015 Time: 9.30 a.m. – 11.30 a.m.

**Answer ALL (04) questions.**
**සියළුම ප්‍රශ්නවලට පිලිතුරු සපයන්න.**
**Use the space provided to write your answers to each question.**
**දී ඇති ඉඩෙහි පිළිතුරු සපයන්න.**

1. (a) You are provided with an inorganic salt (**X**) containing the chloride of the following cations $Mg^{2+}$, $Ca^{2+}$, $Fe^{3+}$.
$Mg^{2+}$, $Ca^{2+}$, $Fe^{3+}$ කැටායනවල ක්ලෝරයිඩ අඩංගු අකාබනික ලවණයක් (**X**) ඔබට සපයා ඇත.

(i) Briefly outline how you would carry out flame test on this sample? What is the expected observation and inference? / මෙම සාම්පලයට පහන් සිළු පරීක්ෂාව ඔබ සිදු කරන්නේ කෙසේ ද, යන්න කෙටියෙන් සඳහන් කරන්න. බලාපොරොත්තු විය හැකි නිරීක්ෂණය සහ නිගමනය කුමක් ද?

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(ii) How would you separate the $Fe^{3+}$ from $Mg^{2+}$ and $Ca^{2+}$? /ඔබ $Fe^{3+}$ කැටායනය $Mg^{2+}$ සහ $Ca^{2+}$ අතරින් වෙන් කරන්නේ කෙසේ ද?

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**(20 marks)**

(b) You are given a mixture of aqueous solutions containing iodide and chloride ions. What is the expected observation when /අයඩයිඩ් සහ ක්ලෝරයිඩ් අයනවල ජලීය ද්‍රාවණ අඩංගු මිශ්‍රණයක් ඔබට සපයා ඇත. පහත දක්වා ඇති පරීක්ෂාවන් සිදු කළවිට බලාපොරොත්තු විය හැකි නිරීක්ෂණ මොනවා ද?

(i) It is allowed to react with dil $HNO_3$ followed by Silver Nitrate solutions. /තනුක $HNO_3$ සමග සිල්වර් නයිට්‍රේට් ද්‍රාවණ එකතු කර ප්‍රතික්‍රියාවීමට සලස්වන ලදී.

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(ii) It is treated with chlorine water followed by the addition of $CCl_4$ /ක්ලෝරීන් දියර සමග $CCl_4$ එක් කර ප්‍රතික්‍රියා වීමට සලසන ලදී.

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( **Give relevant chemical equations in each case./** එක් එක් අවස්ථාව සඳහා අදාල රසායනික ප්‍රතික්‍රියා ලියන්න. ) **(20 marks)**

(c) (i) Write down the expression for solubility product of a sparingly soluble salt of the form $A_xB_y$ with the aid of a balanced chemical equation. / $A_xB_y$ නමැති මඳ වශයෙන් ද්‍රාව්‍ය ලවණයක ද්‍රාව්‍යතා ගුණිතය සඳහා ප්‍රකාශනයක් තුලිත රසායනික ප්‍රතික්‍රියාවක් යොදා ගනිමින් ලියා දක්වන්න.

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(ii) If the solubility of a sparingly soluble compound of the form $AB_2$ is $5.0 \times 10^{-2}$ mol $dm^{-3}$, calculate its solubility product. /මඳ වශයෙන් ද්‍රාව්‍ය සංයෝගයක් වන $AB_2$ හි ද්‍රාව්‍යතාවය $5.0 \times 10^{-2}$ mol $dm^{-3}$, නම්, එහි ද්‍රාව්‍යතා ගුණිතය ගණනය කරන්න.

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(iii) What is the effect of addition of $A^{2+}$ to the above equilibrium in (ii)? Explain in terms of the changes (if any) with respect to solubility and solubility product of $AB_2$. (assume same temperature in all cases)/ ඉහත (ii) හි සමතුලිතතාවයට $A^{2+}$ එක් කළ විට ඇති වන බලපෑම කුමක් වේ ද? $AB_2$ හි ද්‍රාව්‍යතාවය සහ ද්‍රාව්‍යතා ගුණිතයෙහි වෙනස්කම් මගින් (තිබෙනම්) එය පැහැදිලි කරන්න.
(එකම උෂ්ණත්වය සියලුම අවස්ථා සඳහා උපකල්පනය කරන්න.)

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**(25 marks)**

(d) A metal, M, was dissolved using an acid and converted to $M^{2+}$. A student added a reagent HX to a solution of $M^{2+}$ ions expecting the formation of a precipitate, MX(s) based on the equilibrium reaction shown below. However, a precipitate was **NOT** observed. / M නමැති ලෝහය අම්ලයක් මගින් ද්‍රවණය කර $M^{2+}$ බවට පත් කරන ලදී. ශිෂ්‍යයෙක් HX නමැති ප්‍රතිකාරකය $M^{2+}$ අඩංගු ද්‍රාවණයකට එකතු කර MX(ඝන) නම් වූ අවක්ෂේපය බලාපොරොත්තු විය. පහත සමතුලිතතා ප්‍රතික්‍රියාව පදනම් කරගෙන සිදුවන බව අපේක්ෂා කළේය. එහෙත් අවක්ෂේපයක් නොලැබුණි.

$$M^{2+}(aq) + HX(aq) \rightleftharpoons MX(s) + H^{+}(aq)$$

(i) Write down the balanced reaction./ තුලිත ප්‍රතික්‍රියාව ලියන්න.

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(ii) Explain why a precipitate was not formed, and outline how you would achieve precipitation? /අවක්ෂේපයක් නොලැබීමට හේතු දක්වන්න. අවක්ෂේපයක් ලබා ගැනීම සඳහා ඔබ ගතයුතු පියවර කෙසේදැයි සඳහන් කරන්න.

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**(25 marks)**

(e) A student prepares the "**Sodium Carbonate Extract**" in the usual manner with a salt of the form $MX_3$. **Write down** the relevant balanced equation for the reaction in the above process and identify the composition of the residue and that of the filtrate. / $MX_3$ නම් වූ ලවණය යොදා **'සෝඩියම් කාබනේට් නිස්සාරකය'** සිසුවෙක් සුපුරුදු පරිදි සාදන ලදී. මෙම ක්‍රියාවලිය සඳහා අදාල තුලිත **රසායනික සමීකරණ ලියා** අවක්ෂේපයෙහි සහ පෙරණයෙහි සංයුතිය හඳුන්වා දෙන්න. **(10 marks)**

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2. The following procedure was carried out by a student to analyze the concentration of a given oxalic acid solution. /දී ඇති ඔක්සැලික් අම්ල ද්‍රාවණයක සාන්ද්‍රණය සෙවීම සඳහා පහත සඳහන් ක්‍රමය අනුගමනය කරන ලදී.
"To a 25.00 $cm^3$ of oxalic acid solution 10 $cm^3$ of diluted sulfuric acid was added. The solution was warmed until it was too hot to touch and titrated with 0.010 M $KMnO_4$ solution until a permanent colour was obtained. The titration was repeated. A blank titration was performed"./ "ඔක්සැලික් අම්ල ද්‍රාවණයේ 25.00 $cm^3$ කට තනුක සල්ෆියුරික් අම්ලය 10 $cm^3$ ක් එකතු කරන ලදී. එම ද්‍රාවණය අතින් ඇල්ලීමට නොහැකි වන තරම් උෂ්ණත්වයකට රත් කර සාන්ද්‍රණය 0.010M වන $KMnO_4$ ද්‍රාවණයක් සමඟ ස්ථිර වර්ණ විපර්යාසයක් ලැබෙන තුරු අනුමාපනය කරන ලදී. මෙම අනුමාපනය නැවත වාරයක් කරන ලදී. මේ සඳහා 'පුහු' අනුමාපනයක් ද (blank titration) සිදු කරන ලදී."

(i) Write the correct volume devices that should have been used to measure/ carryout the underlined volumes or processes./ යටින් ඉරි අඳින ලද පරිමාවන් හෝ ක්‍රියාදාමයන් සඳහා භාවිතා කළයුතු නිවැරදි මිනුම් උපකරණ ලියන්න. **(06 marks)**

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(ii) What was the colour change at the end point and how do you make sure that the colour change is permanent? /අන්ත ලක්ෂ්‍යයේ වර්ණ විපර්යාසය කුමක් ද? එම වර්ණ විපර්යාසය ස්ථිර බව ඔබ තහවුරු කරගන්නේ කෙසේ ද? **(10 marks)**

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(iii) Why did he carry out a blank titration? /"පුහු" අනුමාපනයක් කිරීමට හේතු මොනවා ද?

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**(06 marks)**

(iv) How do you carry out the blank titration? /"පුහු" අනුමාපනයක් කරන්නේ කෙසේ ද?

**(10 marks)**

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(v) Write down the balanced equation for the reaction taking place in the above titration. /ඉහත අනුමාපනයේ දී සිදුවන ප්‍රතික්‍රියාව සඳහා තුලිත සමීකරණයක් ලියන්න. **(10 marks)**

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(vi) The above titration was carried out four times to obtain a precised end point. What can you say about the first three results? /යථාතථ්‍ය (précised) අන්ත ලක්ෂයය අගයක් ලැබීම සඳහා ඉහත අනුමාපනය හතර වාරයක් කරන ලදී. ලැබුණු පළමු අන්ත ලක්ෂ්‍යය අගයන් තුන ගැන කිවහැක්කේ කුමක් ද? **(10 marks)**

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(vii) The average end point obtained was 20.00 $cm^3$. The blank titration end point was 0.20 $cm^3$. Calculate the concentration of oxalic acid. /ඉහත අනුමාපනයේ අන්ත ලක්ෂ්‍යයයේ මධ්‍යනය්‍යය අගය ලෙස 20.00 $cm^3$ ද, පුහු අනුමාපනයේ අන්ත ලක්ෂ්‍යය ලෙස 0.20 $cm^3$ ද ලැබුණි. ඔක්සැලික් අම්ලයේ සාන්ද්‍රණය ගණනය කරන්න. **(10 marks)**

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(viii) Do you agree with the following statement? Give reasons for your answer.
"By dissolving 0.4000 g of NaOH in 100.00 $cm^3$ of water 0.1000 M NaOH solution can be prepared". පහත සඳහන් ප්‍රකාශය සමඟ ඔබ එකඟ ද? ඔබේ පිළිතුරට හේතු දක්වන්න.
"NaOH ග්‍රෑම් 0.4000 ක් ආස්‍රැති ජලය 100.00 $cm^3$ ක දියකර මවුලිකතාවය 0.1000 M වූ NaOH ද්‍රාවණයක් සෑදිය හැක." **(10 marks)**

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(ix) (a) Why cannot the concentration of acetic acid be determined by titrating with a standard solution of ammonium hydroxide using an indicator? /දර්ශකයක් භාවිතා කරමින් ඇමෝනියම් හයිඩ්‍රොක්සයිඩ් සම්මත ද්‍රාවණයක් සමඟ අනුමාපනය කිරීමෙන් ඇසිටික් අම්ලයේ සාන්ද්‍රණය සොයා ගත නොහැක. ඒ ඇයි? **(10 marks)**

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(b) Suggest a suitable titrant and an indicator to determine the concentration of acetic acid by a titrimetric method. /ඇසිටික් අම්ලයේ සාන්ද්‍රනය අනුමාපනයක් මගින් සෙවීම සඳහා සුදුසු අනුමාපකයක් හා දර්ශකයක් යෝජනා කරන්න. **(06 marks)**

.....

.....

(c) What can you say about the pH at the end point in the titration you are suggesting in (ix) (b)? Give reasons for your answer. /ඔබ ඉහත (ix) (b) සඳහා යෝජනා කරන අනුමාපනයේ අන්ත ලක්ෂ්‍යයෙහි pH අගය ගැන ඔබට කුමක් කිව හැකි ද? ඔබේ පිළිතුරට හේතු දක්වන්න. **(12 marks)**

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3. PART -A / **A - කොටස**

Three pure solid compounds are in separate containers labelled as **A**, **B** and **C**. A student is in need of identifying these compounds by analyzing for the functional groups in them./සංශුද්ධ ඝන සංයෝග තුනක් **A**, **B** හා **C** වශයෙන් නම් කරන ලද බඳුන් තුනක අඩංගු වේ. ක්‍රියාකාරී කාණ්ඩ සඳහා විශ්ලේෂණය මගින් මෙම සංයෝග තුන හඳුනා ගැනීමට ශිෂ්‍යයෙකුට අවශ්‍යව ඇත.

i. Student wants to test the samples for the presence of alcohol (-OH) group in them. Select the solvent/s (out of the list given below) that **cannot be** used as solvents to dissolve the samples *(Circle them)*./ එම සංයෝගවල ඇල්කොහොල (-OH) කාණ්ඩය අඩංගු දැයි පරීක්ෂා කිරීමට ශිෂ්‍යයාට අවශ්‍යය. පහත දී ඇති ලැයිස්තුවේ සඳහන් කුමන ද්‍රාවක/ය එම සංයෝග දිය කිරීම සඳහා යොදා ගත **නොහැකිදැයි** වට කර දක්වන්න.
Acetone, methanol, chloroform, ethanol, diethyl ether, 2,2,4-trimethylpentanol,
1-pentanol, dichloromethane

ii. Give reasons for your answer in above (i)./ ඔබ ඉහත (i) සඳහා දුන් පිළිතුරට හේතු පහදන්න.

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iii. Name a test that can be done to identify the presence of a carbonyl (-C=O) group in them./ ඉහත සංයෝගවල කාබොනයිල් (-C=O) කාණ්ඩය ඇත්දැයි හඳුනා ගැනීමට සිදුකල හැකි පරීක්ෂණයක් නම් කරන්න.

.....

iv. What is your observation for the test you name in (iii) if compounds **B** and **C** contain carbonyl (-C=O) groups?/ ඔබ කාබොනයිල් (-C=O) කාණ්ඩය සඳහා කරන පරීක්ෂාවට **B** හා **C** සංයෝග පිලිතුරු දෙයි නම් ලබා දෙන නිරීක්ෂණය කුමක් ද?

.....

v. Tollen's 'Silver mirror' test was performed on both the compounds **B** and **C** separately. Only **C** gave positive results. / B හා C සංයෝග වෙන් වෙන් වශයෙන් ටොලන්ගේ 'රිදී කැඩපත්' පරීක්ෂාවට ලක් කරන ලදී. **C** පමණක් ධනාත්මක ප්‍රතිඵලයක් දුනි.
What are the functional groups present in **B** and **C**?/**B** හා **C** හි අඩංගු ක්‍රියාකාරී කාණ්ඩ මොනවා ද?

**B** = .....

**C** = .....

vi. **A** is identified as benzoic acid ($C_6H_5COOH$) as it answered for esterification reaction with ethanol ($C_2H_5OH$). What is the observation you expect to make here?/ එතනෝල්($C_2H_5OH$). සමග එස්ටරීකරණ ප්‍රතික්‍රියාවට පිළිතුරු දුන් බැවින් **A** බෙන්සොයික් අම්ලය ($C_6H_5COOH$) බව සඳුනා ගන්නා ලදී. ඔබ බලාපොරොත්තු වන නිරීක්ෂණය කුමක් ද?

.....

vii. Write the esterification reaction between **A** and ethanol ($C_2H_5OH$) giving the structure of the ester formed./ සැදෙන එස්ටරයේ ව්‍යුහ සූත්‍රය දක්වමින් **A** හා එතනෝල් ($C_2H_5OH$). අතර සිදුවන එස්ටරීකරණ ප්‍රතික්‍රියාව ලියා දක්වන්න.

**(40 marks)**

**Part- B/B –** කොටස

i. A solid sample (10 g) contains **D** and **E** compounds in 7:3 ratio. Solubility of **D** and **E** compounds in water at 90°C and 30°C are 10 g/100 mL and 1 g/100 mL respectively. Two recrystallizations are carried out to purify this sample. Fill in the following table and find out the % purities of **D** at each crystallization./ එක්තරා ඝනයක (10 g) **D** හා **E** යන සංයෝග 7:3 අනුපාතයෙන් අඩංගු වේ. D හා **E** හි ජලයේ ද්‍රාව්‍යතාව 90°C හා 30°C උෂ්ණත්වයන්හි පිළිවෙලින් 10 g/100 mL හා 1 g/100 mL වේ. මෙම ඝනය සංශුද්ධ කිරීම පිණිස දෙවරක් පුනර් ස්ඵටිකීකරණය සිදු කරන ලදී. පහත දී ඇති වගුව සම්පූර්ණ කරමින්, එක් එක් පුනර් ස්ඵටිකීකරනයන්හිදී D හි ප්‍රතිශත සංශුද්ධතාව සොයා දක්වන්න.

| | Amounts of **D** and **E**/g **D** හා **E** ප්‍රමාණය/ග්‍රෑම් | | % recovery of **D** ලබාගත හැකි වූ **D** හි% | % purity of **D** **D** හි % සංශුද්ධතාව |
|---|---|---|---|---|
| | In crystals ස්ඵටික වල | In mother liquor/ මවු ද්‍රාවණය තුල | | |
| 1st crystallization 1 වන පුනර් ස්ඵටිකීකරණය | **D** =<br>**E** = | **D** =<br>**E** = | | |
| 2nd crystallization 2 වන පුනර් ස්ඵටිකීකරණය | **D** =<br>**E** = | **D** =<br>**E** = | | |

**(30 marks)**

ii. Give reasons **briefly** for the following steps taken during recrystallizing an impure sample of naphthalene./ අසංශුද්ධ නැප්තලීන් සාම්පලයක් පුනර් ස්ඵටිකීකරණය කිරීමේදී ගන්නා ලද පහත පියවර වලට හේතු සැකෙවින් දෙන්න.

a. A non-polar solvent was used to dissolve the sample./ සාම්පලය දිය කිරීමට නිර්ධ්‍රැවීය ද්‍රාවකයක් යොදා ගැනුනි.

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b. Solution was warmed with activated charcoal./ ද්‍රාවණයට ක්‍රියාකාරී කාබන් යොදා උණුසුම් කරන ලදී.

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c. Preheated glassware were used for gravity filtration./ ද්‍රාවණය පෙරීමේදී උණුසුම් කළ විදුරු උපකරණ භාවිතා කරන ලදී.

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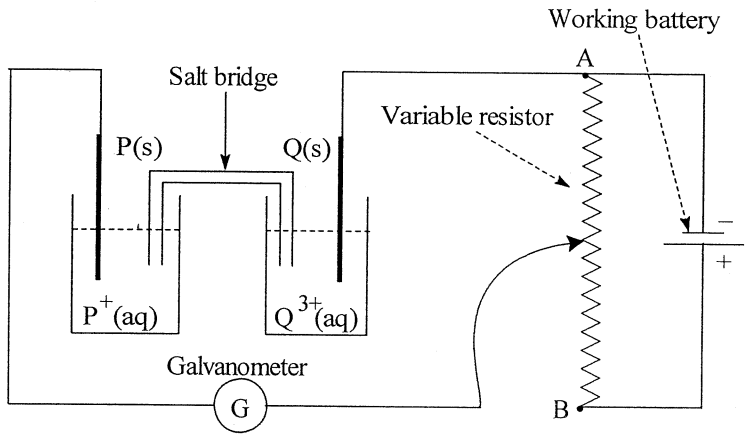
**(30 marks)**

4. (I) (a) A student prepared a galvanic cell by placing two rods of metals P and Q in aqueous solutions of their respective ions $P^{+}(aq)$ and $Q^{3+}(aq)$, and bringing the electrical contact between the two solutions using a salt bridge. He measured the emf of the cell to be 1.17 V using a potentiometer with the electrical connections as shown in the figure./ ශිෂ්‍යයෙක් P සහ Q නම් ලෝහ කුරු දෙකක් $P^{+}$ සහ $Q^{3+}$ අයන අඩංගු ජලීය ද්‍රාවණවල ගිල්වා, එම ද්‍රාවණ අතර විද්‍යුත් සම්බන්ධතාවය ලවණ සේතුවක් ද, යොදා ගනිමින් ගැල්වානික කෝෂයක් සාදන ලදී. ඔහු එම කෝෂයෙහි විද්‍යුත් සම්බන්ධතාවය විභවමානයක් ආධාරයෙන් රූපයේ පෙන්වා ඇති පරිදි සකස් කොට වි.ගා.බ. 1.17 V බව මනින ලදී.




(i) Giving reasons identify the negative terminal of the cell. /හේතු දක්වමින් මෙම කෝෂයෙහි සෘණ අග්‍රය හඳුනාගෙන ලියන්න. **(20 marks)**

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(ii) Write down the **non-spontaneous** cell reaction giving reasons. /ස්වයංසිද්ධ නොවන කෝෂ ප්‍රතික්‍රියාව හේතු දක්වමින් ලියන්න. **(05 marks)**

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(iii) What is the emf assigned to the cell reaction you have written in part (ii) above? /ඉහත (ii) හි සඳහන් කෝෂ ප්‍රතික්‍රියාව සඳහා ලබාදී ඇති වි.ගා.බ. සඳහන් කරන්න.

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**(05 marks)**

(iv) Giving reasons state the smallest possible value of the potential difference across the potentiometer wire (i.e. across points A and B) created by the working battery in the above experiment. /ක්‍රියාකාරී බැටරිය මගින් පරීක්ෂණයේදී විභවමාන කම්බිය හරහා ( A හා B ස්ථාන) ඇති කරන ලද විභව අන්තරයේ ඉතාම කුඩා අගය හේතු සහිතව සඳහන් කරන්න.

**(20 marks)**

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(II) (a) Name the safety symbols that should be present in the label of a bottle containing the following;/ පහත සඳහන් ද්‍රව්‍ය අඩංගු බෝතලයක තිබිය හැකි ආරක්ෂක සංකේත (safety symbols) නම් කරන්න.

(i) Conc $H_2SO_4$ .....

(ii) Ammonia .....

(iii) Acetone .....

(iv) Phenol .....

(v) $Na_2CO_3$ .....

**(10 marks)**

(b) What essential safety measures would you recommend to a student coming into a Chemistry lab first time? /පරීක්ෂණාගාරයක් සඳහා පළමුවර පැමිණෙන සිසුවෙකුට ගතයුතු අත්‍යාවශ්‍ය ආරක්ෂක පියවර මොනවාදැයි ඔබ නිර්දේශ කරන්නේ ද?

**(10 marks)**

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(c) A student is carrying a volatile organic liquid for an experiment. What safety measures should the student look into when working with volatile liquids? /පරීක්ෂණයක් සඳහා සිසුවෙකු වාෂ්පශීලි කාබනික ද්‍රාවණයක් රැගෙන යන ලදී. වාශ්පශීලි සංයෝග රැගෙන යාමේ දී එම සිසුවා ගතයුතු ආරක්ෂක පියවර කවරේද?

**(10 marks)**

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(d) (i) What is meant by enthalpy of neutralization?/උදාසීනිකරණ එන්තැල්පිය ලෙස හඳුන්වන්නේ කුමක්ද?

**(10 marks)**

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(ii) Explain how you carry out the dilution of 0.1 M HCl to 0.01 M HCl? /0.1 M HCl, 0.01 M HCl බවට තනුකකරණය ඔබ සිදුකරන්නේ කෙසේද යන්න පැහැදිලි කරන්න.

**(10 marks)**

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| For official use | |
|---|---|
| வினா இல | புள்ளிகள் |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| மொத்தம் | |

00018

சுட்எண்:

இலங்கை திறந்த பல்கலைக்கழகம்
இயற்கை விஞ்ஞானபீடம்
விஞ்ஞானமானி கற்கைநெறி 2014/2015
மட்டம் 3 - இறுதிப்பரீட்சை
CHU 1121 – செயன்முறை இரசாயனம்
(காலம்: 2 – மணித்தியாலங்கள்)



கார்த்திகை 18ம் நாள்
செவ்வாய்க் கிழமை, 2015

நேரம்: 9.30 முப – 11.30 முப

ஒவ்வொரு வினாவிற்குமான உமது விடைகளை எழுதுவதற்கு வழங்கப்பட்டுள்ள இடத்தைப் பயன்படுத்துக.

1. a) உமக்கு, $Mg^{2+}$, $Ca^{2+}$, $Fe^{3+}$ ஆகிய கற்றயன்களின் குளோரைட்டுக்களைக் கொண்ட அசேதன உப்பு **(X)** தரப்பட்டுள்ளது.

i) இந்த உப்பு மாதிரியில் சுவாலைச் சோதனையை எவ்வாறு நடாத்துவீர் என சுருக்கமாக விபரிக்க. என்ன அவதானங்களும் அனுமானங்களும் எதிர்பார்க்கப்படுகிறது.

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ii) $Fe^{3+}$ ஐ $Mg^{2+}$ மற்றும் $Ca^{2+}$ இல் இருந்து எவ்வாறு வேறுபடுத்தி எடுப்பீர்?

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(20 புள்ளிகள்)

b) அயடைட் மற்றும் குளோரைட் அயன்களின் நீர்க்கரைசலைக் கொண்ட கலவை ஒன்று உமக்கு தரப்பட்டுள்ளது. பின்வரும் செய்முறைகளின்போது எதிர்பார்க்கப்படும் அவதானங்கள் என்ன?

i) ஐதான நைத்திரிக்கமிலம் சேர்த்து வெள்ளி நைத்திரேட் கரைசலுடன் தாக்கமடைய விடப்பட்டது.

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ii) இது குளோரீன் நீருடன் பரிகரித்து $CCl_4$ சேர்க்கப்பட்டது.

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ஒவ்வொரு சந்தர்ப்பத்திற்கும் பொருத்தமான இரசாயன தாக்கங்களை தருக.

(20 புள்ளிகள்)

c) i) சமப்படுத்தப்பட்ட இரசாயன தாக்கத்தின் உதவியுடன் $A_xB_y$ எனும் உருவமைப்பிலுள்ள அரிதில் கரையும் உப்பின் கரைதிறன் பெருக்கத்திற்குரிய கோவையை எழுதுக.

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ii) $AB_2$ எனும் உருவமைப்பிலுள்ள அரிதில் கரையும் உப்பு ஒன்றின் கரைதிறன் $5.0 \times 10^{-2}$ mol $dm^{-3}$ எனின், அதன் கரைதிறன் பெருக்கத்தை கணிப்பிடுக.

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iii) பகுதி (ii) இலுள்ள சமநிலைக்கு $A^{2+}$ இன் சேர்க்கை என்ன பாதிப்பை ஏற்படுத்தும். மாற்றம் ஏதும் இருப்பின் கரைதிறன் மற்றும் கரைதிறன் பெருக்கம் சார்பாக விபரிக்க. (வெப்பநிலையில் மாற்றம் இல்லை எனக் கருதுக)

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(25 புள்ளிகள்)

d) ஓர் உலோகமானது அமிலத்தில் கரைக்கப்பட்டு $M^{2+}$ ஆகமாற்றப்பட்டது. ஒரு மாணவன் HX எனும் தாக்கு பொருளை $M^{2+}$ அயனைக் கொண்ட கரைசலுக்கு சேர்த்து கீழே காட்டப்பட்டுள்ள சமநிலைத் தாக்கத்தின்படி MX(s) எனும் வீழ்படிவு உருவாகும் என எதிர்பார்த்தான். ஆனால் அவ்வாறு வீழ்படிவு ஏதும் அவதானிக்கப்படவில்லை.

$$M^{2+}(aq) + HX(aq) \rightleftharpoons MX(s) + H^{+}(aq)$$

i) சமப்படுத்தப்பட்ட சமன்பாட்டை எழுதுக.

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ii) வீழ்படிவு ஏன் தோன்றவில்லை என சுருக்கமாக விபரிக்க. வீழ்படிவு எவ்வாறு பெறப்படலாம் என்பதை சுருக்கமாக விபரிக்க.

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(25 புள்ளிகள்)

e) $MX_3$ வகை உப்பு ஒன்றிற்குரிய சோடியம் காபனேற்று பிரித்தெடுப்பினை வழமையான முறையில் ஒரு மாணவன் தயாரித்தான். மேற்படி முறைக்குரிய தாக்கங்கள் தொடர்பான ஈடுசெய்த சமன்பாடுகளை எழுதுக. அத்துடன் மீதியினதும் வடிதிரவத்தினதும் அமைப்புகளை இனங்காண்க.

(10 புள்ளிகள்)

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2) தரப்பட்ட ஒட்சாலிக்கமிலகரைசல் ஒன்றின் செறிவினை அறிவதற்காக மாணவன் ஒருவனால் பின்வருமாறு ஒருவழிமுறை மேற்கொள்ளப்பட்டது.

"25.00 $cm^3$ ஒட்சாலிக்கமிலகரைசல் ஒன்றிற்கு 10 $cm^3$ ஐதான சல்பூரிக்கமிலம் சேர்க்கப்பட்டது. இக்கரைசலானது கையால் தொடத்தக்க அளவு கூடிய வெப்பம்

அடையும்வரை சூடாக்கப்பட்டு பின் 0.010 M $KMnO_4$ கரைசலால் ஒரு நிரந்தரநிறம் பெறப்படும் வரை நியமிக்கப்பட்டது. இந்நியமிப்பு மீளச்செய்யப்பட்டது. ஒரு வெறுமையான நியமிப்பு மேற்கொள்ளப்பட்டது".

i) கீழ்கோடிட்ட கனவளவுகள் அல்லது செயற்பாடுகள் திருத்தமாக அளவிடல் செய்வதற்குப் பயன்படுத்தவேண்டிய கனவளவுக் கருவிகளை எழுதுக.

(06 புள்ளிகள்)

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ii) முடிவுப் புள்ளியில் ஏற்படும் நிறமாற்றம் என்ன? நிறமாற்றமானது நிரந்தரமானது என்பதை எவ்வாறு உறுதிப்படுத்துவீர்?

(10 புள்ளிகள்)

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iii) ஒரு வெறுமையான நியமிப்பினை ஏன் அவன் மேற்கொண்டான்?

(06 புள்ளிகள்)

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iv) நீர் எவ்வாறு ஒரு வெறுமையான நியமிப்பை மேற்கொள்வீர்?

(10 புள்ளிகள்)

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v) மேலே கூறப்பட்டுள்ள நியமிப்பில் நடைபெறும் தாக்கத்திற்குரிய சமப்படுத்தப்பட்ட சமன்பாட்டை எழுதுக

(10 புள்ளிகள்)

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vi) மிக திருத்தமான இறிதிப் புள்ளியைப் பெறுவதற்காக மேற்கூறிய நியமிப்பானது நான்குமுறை செய்யப்பட்டது. முதல் மூன்று முடிவுகளைப்பற்றி உம்மால் என்ன கூறமுடியும்.

(10 புள்ளிகள்)

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vii) சராசரி முடிவுப்புள்ளி 20.00 $cm^3$ ஆகும். வெறுமையான நியமிப்பின் முடிவுப்புள்ளி 0.20 $cm^3$ எனின் ஒட்சாலிக்கமிலத்தின் செறிவைக் கணிக்குக.

(10 புள்ளிகள்)

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viii) பின்வரும் கூற்றுடன் நீர் உடன்படுகின்றீரா? உமது விடைக்கான காரணங்களைத் தருக.

''0.4000g NaOH இனை 100.00$cm^3$ நீரில் கரைப்பதன் மூலம் 0.1000M NaOH கரைசல் தயாரிக்கலாம்?

(10 புள்ளிகள்)

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ix) a) ஓர் காட்டி முன்னிலையில், நியம அமோனியம் ஐதரொட்சைட்டு கரைசலினால் நியமிப்பதன் மூலம் ஏன் அசற்றிக்கமிலக் கரைசல் ஒன்றின் செறிவை துணிய முடியாது?

(10 புள்ளிகள்)

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b) நியமிப்புமுறை மூலம் அசற்றிக்கமிலக் கரைசல் ஒன்றினைத் துணிவதற்குப் பொருத்தமான ஒரு நியமிப்பு பதார்த்தத்தையும் ஒரு காட்டியினையும் தருக.

(06 புள்ளிகள்)

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c) பகுதி (ix) b இல் நீர் குறிப்பிட்ட நியமிப்பில் முடிவுப்புள்ளியின் pH பற்றி நீர் யாது கூறமுடியும்? உமது விடைக்கான காரணங்களைத் தருக.

(12 புள்ளிகள்)

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3) பகுதிA

மூன்று தூய திண்ம சேர்வைகள் தனித்தனி A, B, C என பெயரிடப்பட்ட கொள்கலன்களில் தரப்பட்டுள்ளன. அவற்றிலுள்ள தொழிற்பாட்டு கூட்டங்களை பகுத்தறிவதன் மூலம் இச் சேர்வைகளை இனம் காண வேண்டிய தேவை ஒரு மாணவனுக்கு உண்டு.

i) மாணவன் இம்மாதிரிகளிலுள்ள அற்ககோல் (-OH) கூட்டத்திற்கு சோதிக்க வேண்டும். இம் மாதிரிகளை கரைக்கப் பயன்படுத்த முடியாத கரைப்பான்/களை (கீழுள்ள அட்டவணையிலிருந்து) தெரிவுசெய்க. (அவற்றினைச் சுற்றி வட்டமிடுக.)
அசற்றோன், மெதனோல், குளோரோபோம், எதனோல், ஈர்எதையில் ஈதர், 2,2,4-trimethylpentanol, 1-pentanol, ஈர்குளோரோமெதேன்

ii) மேற்படி (i) இல் உமது விடைக்கான காரணங்களைத் தருக.

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iii) அவற்றின் ஒரு காபனைல் (-C=O) கூட்டம் இருப்பதனைக் காட்டுவதற்கு செய்யமுடியுமான ஒரு சோதனையைப் பெயரிடுக.

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iv) சேர்வைகள் Bயும் Cயும் காபனைல் (>C=O) கூட்டத்தினை கொண்டிருக்குமாயின் பகுதி (ii)இல் நீர் பெயரிட்டசோதனையின் அவதானம் யாது?

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v) தொலனின் ''வெள்ளியாடி'' சோதனையானது B, Cக்கு தனித் தனி மேற்கொள்ளப்பட்டது. C மட்டும் விடையளித்து B, C யில் உள்ள தொழிற்பாட்டு கூட்டங்கள் யாவை?

B – .....

C – .....

vi) எதனோலுடன் ($C_2H_5OH$) உடன் எசுத்தராக்கல் தாக்கத்திற்கு விடையளித்ததால் A யானது பென்சோயிக் அமிலம் ($C_6H_5COOH$) என இனங்காணப்படுகிறது.

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vii) A க்கும் எதனோலுக்கும் இடையிலான எசுத்தராக்கத் தாக்கத்தின் விளைவான எசுத்தரின் கட்டமைப்பை வரைக.

(40 புள்ளிகள்)

3) பகுதி B

i) ஒரு திண்மமாதிரி (10g) ஆனது சேர்வைகள் D, E யினை 7 : 3 என்ற விகிதத்தில் கொண்டுள்ளது. 90 $^oC$ யிலும் 30 $^oC$யிலும் சேர்வைகள் D, E யின் கரைதிறன் முறையே 10 g/100 ml, 1 g/100ml இல் ஆகும். இச்சேர்வைகளை தூய்தாக்குவதற்கு இரு மீள் பளிங்காக்கங்கள் மேற்கொள்ளப்பட்டன. பின்வரும் அட்டவணையைப்

பூர்த்திசெய்வதுடன் ஒவ்வொரு பளிங்காக்கலிலும் D யின் தூய்மையின் % ஐக் கணிக்குக.

| | D இனதும் E இனதும் அளவுகள் / g | | மீள்எடுக்கப்பட்ட D % | D யின் தூய்மை % |
|---|---|---|---|---|
| | பளிங்கில் | தாய்த்திரவத்தில் | | |
| 1வது | D = | D = | | |
| பளிங்காக்கல் | E = | E = | | |
| 2வது பளிங்காக்கல் | D=<br><br>E = | D =<br><br>E = | | |

(30 புள்ளிகள்)

ii) தூய்மையற்ற நப்தலீன் மாதிரியின் மீள்பளிங்காக்கத்திற்கு மேற்கொள்ளவேண்டிய பின்வரும் படிகட்கான காரணங்களை சுருக்கமாகத் தருக.

a. மேற்படி மாதிரிகளைக் கரைக்க முனைவற்ற கரைப்பான் பயன்படுத்தப்பட்டது.

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b. ஏவப்பட்ட மரக்கரியுடன் கரைசல் சூடாக்கப்பட்டது.

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c. ஈர்ப்பினாலான வடித்தலில் சூடாக்கப்பட்ட கண்ணாடி உபகரணங்கள் பயன்படுத்தப்பட்டன.

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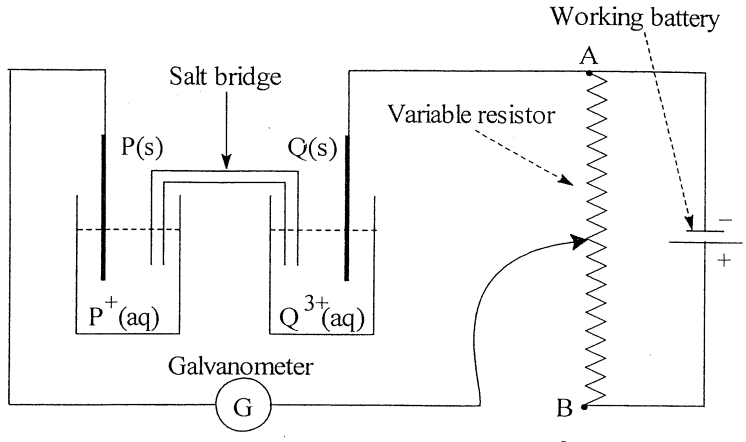
(30 புள்ளிகள்)

4. I a. உலோகங்கள் P இனதும் Q இனதும் கோல்களை அவற்றின் கற்றயன் கரைசல்கள் $P^+$ (aq), $Q^{3+}$ (aq)க்குள் முறையே வைப்பதன் மூலம் ஒரு கல்வானிக் கலத்தை ஒரு மாணவன் தயாரித்தான்.




இரு கரைசல்கள் இடையேயும் ஒரு மின்தொடுகையை ஏற்படுத்த உப்புப்பாலம் பயன்படுகிறது. படத்தில் காட்டியவாறு மின்னியல் இணைப்பை அழுத்தமானியுடன் ஏற்படுத்துவதன் மூலம் அக்கலத்தின் மின்னியக்கவிசை(emf) 1.17 V என அளந்தான்.

i. கலத்தின் மறைமுனைவை அடையாளங் காண்பதற்குரிய காரணங்களைத் தருக.

(20 புள்ளிகள்)

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ii. சுயாதீனமற்ற கலத்தாக்கங்கட்கான காரணங்களைத் தருக.

(05 புள்ளிகள்)

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iii) மேலே பகுதி (ii) இல் உம்மால் எழுதப்பட்ட தாக்கத்திற்குரிய கலத்தின் மின்னியக்கவிசை (emf) யாது?

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(05 புள்ளிகள்)

iv) தொழிற்படுகின்ற கலத்தினால் அழுத்தமானிக் கம்பிக்குக் குறுக்காக (முனைகள் A, B க்கு குறுக்காக) உருவாக்கப்படும் அழுத்தவேறுபாட்டின் ஆகக் குறைந்த சாத்தியமான பெறுமானத்துடன் அதற்கான காரணங்களைத் தருக.

(20 புள்ளிகள்)

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II a) பின்வருவனவற்றினைக் கொண்டுள்ள போத்தல்களின் பாதுகாப்புக் குறிகளைப் பெயரிடுக.

i. செறி $H_2SO_4$ .....

ii. அமோனியா .....

iii. அசற்றோன் .....

iv. பீனோல் .....

v. $Na_2CO_3$ .....

(10 புள்ளிகள்)

b. முதன்முதலாக இரசாயன ஆய்வுகூடத்திற்கு வரும் மாணவனுக்கு அவசியமான பாதுகாப்பு அளவீடுகள் எத்தகையவற்றை நீர் சிபார்சு செய்வீர்?

(10 புள்ளிகள்)

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c) ஒரு மாணவன் ஆவிப்பறப்புடைய சேதன திரவமொன்றை ஒரு பரிசோதனையில் கையாள்கின்ற போது பாதுகாப்பு அளவீடுகள் தொடர்பாக அம்மாணவன் அவதானிக்க வேண்டியவை யாவை?

(10 புள்ளிகள்)

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d. i) நடுநிலையாக்க வெப்பவுள்ளுறை என்பதால் கருதப்படுவது யாது?

(10 புள்ளிகள்)

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ii) 0.1 M HCl இலிருந்து ஐதாக்கத்தினால் 0.01M HClஐ எவ்வாறு ஆக்கலாம் என விளக்குக.

(10 புள்ளிகள்)

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| For official use | |
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| Ques. No. | Marks |
| 1 | |
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# THE OPEN UNIVERSITY OF SRI LANKA

## FACULTY OF NATURAL SCIENCES

## B. Sc DEGREE PROGRAMME 2014 / 2015

## LEVEL 3 - FINAL EXAMINATION

## CMU1121 - PRACTICAL CHEMISTRY

**DURATION: 2 HOURS**

Thursday, 18th November 2015 Time: 9.30 a.m. – 11.30 a.m.

**Answer ALL (04) questions.**

**Use the space provided to write your answers to each question.**

1. (a) You are provided with an inorganic salt (**X**) containing the chloride of the following cations $Mg^{2+}$, $Ca^{2+}$, $Fe^{3+}$.

(i) Briefly outline how you would carry out flame test on this sample? What is the expected observation and inference?

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(ii) How would you separate the $Fe^{3+}$ from $Mg^{2+}$ and $Ca^{2+}$?

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**(20 marks)**

(b) You are given a mixture of aqueous solutions containing iodide and chloride ions. What is the expected observation when

(i) It is allowed to react with dil $HNO_3$ followed by Silver Nitrate solutions.

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(ii) It is treated with chlorine water followed by the addition of $CCl_4$

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**Give relevant chemical equations in each case.**

**(20 marks)**

(c) (i) Write down the expression for solubility product of a sparingly soluble salt of the form $A_xB_y$ with the aid of a balanced chemical equation.

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(ii) If the solubility of a sparingly soluble compound of the form $AB_2$ is $5.0 \times 10^{-2}$ mol $dm^{-3}$, calculate its solubility product.

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(iii) What is the effect of addition of $A^{2+}$ to the above equilibrium in (ii)? Explain in terms of the changes (if any) with respect to solubility and solubility product of $AB_2$. (assume same temperature in all cases)

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**(25 marks)**

(d) A metal, M, was dissolved using an acid and converted to $M^{2+}$. A student added a reagent HX to a solution of $M^{2+}$ ions expecting the formation of a precipitate, MX(s) based on the equilibrium reaction shown below. However, a precipitate was **NOT** observed.

$$M^{2+}(aq) + HX(aq) \rightleftharpoons MX(s) + H^{+}(aq)$$

(i) Write down the balanced reaction.

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(ii) Explain why a precipitate was not formed, and outline how you would achieve precipitation?

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**(25 marks)**

(e) A student prepares the "**Sodium Carbonate Extract**" in the usual manner with a salt of the form **$MX_3$**. **Write down** the relevant balanced equation for the reaction in the above process and identify the composition of the residue and that of the filtrate.

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**(10 marks)**

2. The following procedure was carried out by a student to analyze the concentration of a given oxalic acid solution.

"To a 25.00 $cm^3$ of oxalic acid solution 10 $cm^3$ of diluted sulfuric acid was added. The solution was warmed until it was too hot to touch and titrated with 0.010 M $KMnO_4$ solution until a permanent colour was obtained. The titration was repeated. A blank titration was performed".

(i) Write the correct volume devices that should have been used to measure/ carryout the underlined volumes or processes. **(06 marks)**

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(ii) What was the colour change at the end point and how do you make sure that the colour change is permanent? **(10 marks)**

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(iii) Why did he carry out a blank titration? **(06 marks)**

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(iv) How do you carry out the blank titration? **(10 marks)**

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(v) Write down the balanced equation for the reaction taking place in the above titration. **(10 marks)**

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(vi) The above titration was carried out four times to obtain a precised end point. What can you say about the first three results? **(10 marks)**

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(vii) The average end point obtained was 20.00 $cm^3$. The blank titration end point was 0.20 $cm^3$. Calculate the concentration of oxalic acid. **(10 marks)**

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(viii) Do you agree with the following statement? Give reasons for your answer.
"By dissolving 0.4000 g of NaOH in 100.00 $cm^3$ of water 0.1000 M NaOH solution can be prepared". **(10 marks)**

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(ix) (a) Why cannot the concentration of acetic acid be determined by titrating with a standard solution of ammonium hydroxide using an indicator? **(10 marks)**

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(b) Suggest a suitable titrant and an indicator to determine the concentration of acetic acid by a titrimetric method.

**(06 marks)**

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(c) What can you say about the pH at the end point in the titration you are suggesting in (ix) (b)? Give reasons for your answer. **(12 marks)**

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3. **Part A**

Three pure solid compounds are in separate containers labelled as **A**, **B** and **C**. A student is in need of identifying these compounds by analyzing for the functional groups in them.

i. Student wants to test the samples for the presence of alcohol (-OH) group in them. Select the solvent/s (out of the list given below) that **cannot be** used as solvents to dissolve the samples *(Circle them)*.
Acetone, methanol, chloroform, ethanol, diethyl ether, 2,2,4-trimethylpentanol, 1-pentanol, dichloromethane

ii. Give reasons for your answer in above (i).

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iii. Name a test that can be done to identify the presence of a carbonyl (-C=O) group in them.

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iv. What is your observation for the test you name in (iii) if compounds **B** and **C** contain carbonyl (-C=O) groups?

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v. Tollen's 'Silver mirror' test was performed on both the compounds **B** and **C** separately. Only **C** gave positive results.
What are the functional groups present in **B** and **C**?

**B** = .....

**C** = .....

vi. **A** is identified as benzoic acid ($C_6H_5COOH$) as it answered for esterification reaction with ethanol ($C_2H_5OH$). What is the observation you expect to make here?

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vii. Write the esterification reaction between **A** and ethanol ($C_2H_5OH$) giving the structure of the ester formed.

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**(40 marks)**

**Part B**

i. A solid sample (10 g) contains **D** and **E** compounds in 7:3 ratio. Solubility of **D** and **E** compounds in water at 90°C and 30°C are 10 g/100 mL and 1 g/100 mL respectively. Two recrystallizations are carried out to purify this sample. Fill in the following table and find out the % purities of **D** at each crystallization.

| | Amounts of **D** and **E**/g | | % recovery of **D** | % purity of **D** |
|---|---|---|---|---|
| | In crystals | In mother liquor | | |
| 1st crystallization | **D** =<br>**E** = | **D** =<br>**E** = | | |
| 2nd crystallization | **D** =<br>**E** = | **D** =<br>**E** = | | |

**(30 marks)**

ii. Give reasons **briefly** for the following steps taken during recrystallizing an impure sample of naphthalene.

a. A non-polar solvent was used to dissolve the sample.

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b. Solution was warmed with activated charcoal.

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c. Preheated glassware were used for gravity filtration.

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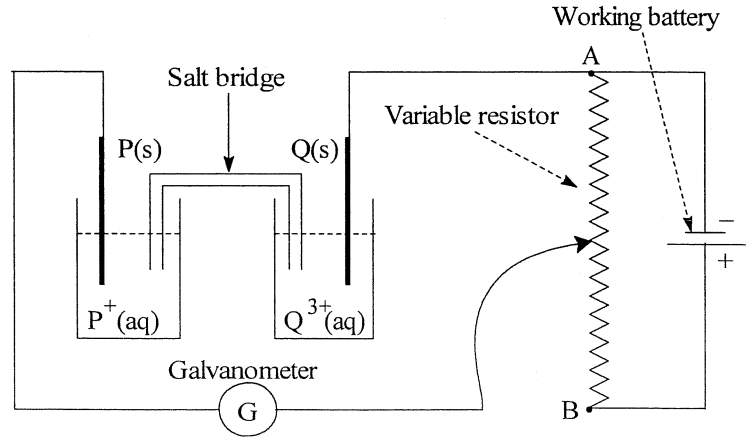
..... **(30 marks)**

4. (I) (a) A student prepared a galvanic cell by placing two rods of metals P and Q in aqueous solutions of their respective ions $P^{+}(aq)$ and $Q^{3+}(aq)$, and bringing the electrical contact between the two solutions using a salt bridge. He measured the emf of the cell to be 1.17 V using a potentiometer with the electrical connections as shown in the figure.




(i) Giving reasons identify the negative terminal of the cell. **(20 marks)**

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(ii) Write down the **non-spontaneous** cell reaction giving reasons. **(05 marks)**

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(iii) What is the emf assigned to the cell reaction you have written in part (ii) above?

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**(05 marks)**

(iv) Giving reasons state the smallest possible value of the potential difference across the potentiometer wire (i.e. across points A and B) created by the working battery in the above experiment. **(20 marks)**

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(II) (a) Name the safety symbols that should be present in the label of a bottle containing the following;

(i) Conc $H_2SO_4$ .....

(ii) Ammonia .....

(iii) Acetone .....

(iv) Phenol .....

(v) $Na_2CO_3$ .....

**(10 marks)**

(b) What essential safety measures would you recommend to a student coming into a Chemistry lab first time? **(10 marks)**

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(c) A student is carrying a volatile organic liquid for an experiment. What safety measures should the student look into when working with volatile liquids?

**(10 marks)**

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(d) (i) What is meant by enthalpy of neutralization? **(10 marks)**

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(ii) Explain how you carry out the dilution of 0.1 M HCl to 0.01 M HCl?

**(10 marks)**

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