

00113

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

B. Sc DEGREE PROGRAMME 2017/ 2018

LEVEL 3 - FINAL EXAMINATION

CMU1121 - PRACTICAL CHEMISTRY

DURATION: 2 HOURS

Date - 28<sup>th</sup> March 2019

Time - Time: 9.30 am to 11.30 am

Answer ALL (04) structured questions. සියළුම ව්‍යුහාත්මක ප්‍රශ්න (04) පිළිතුරු සපයන්න.

- Answer in **ONLY** one medium. Use **ONLY** the space provided to do so.  
එක් මාධ්‍යයකින් පමණක් පිළිතුරු ලියන්න. එසේ පිළිතුරු ලිවීමට ඔබට සපයා ඇති ඉඩ ප්‍රමාණය පමණක් භාවිතා කරන්න.
- Use of a **non-programmable** electronic calculator is permitted.  
ප්‍රක්‍රමණය නොකළ ගණක යන්ත්‍රයක් ඔබට භාවිත කළ හැක.
- **Mobile phones and any other electronic equipment** [other than a non-programmable calculator] **are prohibited**; switch off and leave them out.  
ජංගම දුරකථන හෝ වෙනත් කිසිම ඉලෙක්ට්‍රොනික උපකරණයක් (ප්‍රක්‍රමණය නොකළ ගණක යන්ත්‍ර හැර) ලඟ තබා ගැනීම තහනම් වේ. ඒවා විසන්ධි කර විභාග ශාලාවෙන් පිටත තබන්න.

01. (a) Write down the formula of පහත ඒවායේ සූත්‍ර ලියන්න.

(i) Ammonium Molybdate / ඇමෝනියම් මොලිබ්ඩේට්

(ii) potassium thiosulphate/ පොටෑසියම් තයෝසල්ෆේට්

(iii) Ethyl acetate/ එතිල් ඇසිටේට්

(i)-----

(ii) -----

(iii) -----

(18 marks)

(b) You are provided with an inorganic sample (X) which is drawn from an unlabeled bottle. It is suspected to be either  $BaCl_2$  (A) or  $BaCO_3$  (B) / ලේබල් නොකරන ලද බෝතලයකින් ලබා ගන්නා ලද (X) නම් වූ අකාබනික සංයෝගයක් ඔබට සපයා ඇත. එය එක්කෝ  $BaCl_2$  (A) හෝ  $BaCO_3$  (B) ලෙස සැක කරයි.

(i) Name the physical test and the corresponding observation to distinguish between A and B.

A සහ B වෙන් වෙන්ව හඳුනා ගැනීම සඳහා භාවිත කල හැකි භෞතික පරීක්ෂණයක් නම් කර ඊට අදාළ නිරීක්ෂණය දක්වන්න.

(ii) What is the expected observation if the flame test is carried out with both A and B?

A සහ B දෙකම සඳහා පහන් සිළු පරීක්ෂාව සිදු කලේ නම් බලාපොරොත්තු විය හැකි නිරීක්ෂණය කුමක් ද?

(iii) Supposing the sample is identified as B, write down the relevant chemical tests to confirm the cation and anion in B

මෙහිදී ඔබට ඉහත සපයා තිබූ සංයෝගය B ලෙස හඳුනා ගත්තා යැයි සිතන්න. එසේ නම් එම B සංයෝගයේ පවතින කැටායනය හා ඇනායනය සනාථ කිරීම සඳහා අදාළ වන රසායනික පරීක්ෂණයක් ලියා දක්වන්න.

(20 marks)

- (c) "Chlorine water" test indicated the presence of Iodide ions.  
Write down the expected observation corresponding to the above statement and the relevant balanced chemical equation.  
ක්ලෝරීන් ("Chlorine water" test) පරීක්ෂණය මගින් අයඩයිඩ් අයන ඇති බව හඳුනා ගන්නා ලදී. ඉහත ප්‍රකාශනය සඳහා අනුරූප වන ඔබට බලාපොරොත්තු විය හැකි නිරීක්ෂණය හා ඊට අදාළ කුලීන රසායනික සමීකරණය ලියා දක්වන්න.

(10 marks)

- (d) (i) Write down the expression for solubility product (in aqueous media) of a sparingly soluble salt of the form  $AB_2$  with the aid of a balanced chemical equation.  
ජලයේ මද වශයෙන් ද්‍රාව්‍ය  $AB_2$  නම් ලවණයක ද්‍රාව්‍යතා ගුණිතය (ජලීය මාධ්‍ය තුළ) සඳහා ප්‍රකාශනයක් කුලීන රසායනික සමීකරණය ආධාරයෙන් ලියා දක්වන්න.

- (ii) If the solubility product of  $AB_2$  is  $5.0 \times 10^{-7} \text{ mol}^3 \text{ dm}^{-9}$ , calculate its solubility.  
 $AB_2$  හි ද්‍රාව්‍යතා ගුණිතය  $5.0 \times 10^{-7} \text{ mol}^3 \text{ dm}^{-9}$  වේ නම් එහි ද්‍රාව්‍යතාව ගණනය කරන්න.

(20 marks)

- (e) A student decides to prepare the "Sodium Carbonate Extract" in the usual manner with a salt of the form  $MX_2$

$MX_2$  නම් ලවණයක් සඳහා සාමාන්‍ය ආකාරයට "සෝඩියම් කාබනේට් නිස්සාරකයක්" සෑදීමට සිසුවකු තීරණය කලේය.

- (i) Write down the reason/s for carrying out the preparation of the above extract.  
ඉහත නිස්සාරකය සෑදීම සිදු කරන්නේ ඇයිදැයි හේතුව/හේතු ලියා දක්වන්න.
- (ii) Write down the relevant balanced equation for the reaction in the above process and identify the formula of the residue.  
ඉහත ක්‍රියාවලිය සඳහා අදාළ කුලීන සමීකරණය ලියා දක්වා එහිදී සෑදෙන අවක්ෂේපයේ සූත්‍රය ලියා දක්වන්න.

- (iii) You have been asked to "neutralize" the extract before testing for any of the anions. How would you do this in the laboratory?

මින්දාම ඇනායනයක් සඳහා පරීක්ෂා කිරීමට පෙර ඉහත නිස්සාරකය "උදාසීනීකරණය" කරන ලෙස ඔබෙන් ඉල්ලා සිටියි. ඔබ රසායනාගාරයේ දී මෙය සිදු කරන්නේ කෙසේ ද?

- (iv) Why do you neutralize? ඔබ එම නිස්සාරකය උදාසීනීකරණය කරන්නේ ඇයි ?

(32 marks)

02. A primary standard solution of the weak acid HA was prepared by dissolving an accurate weight of the acid in hundred milli liters of distilled water.

දුර්වල අම්ලයක් වන HA හි නිවැරදි බර ප්‍රමාණයක් ආසන්න ජලය මිලි ලීටර් සියයක දියකර ප්‍රාථමික සම්මත ද්‍රාවණයක් පිළියෙල කරන ලදී.

- (a) State two properties of HA that should be fulfilled to call it as a primary standard.

ප්‍රාථමික සම්මතයක් ලෙස හැඳින්වීම සඳහා HA හි තිබිය යුතු ගුණාංග දෙකක් (02) ලියන්න.

(06marks)

- (b) The calculated concentration of the above prepared solution was highly accurate. Write down the essential steps with the **appropriate / relevant** glassware and apparatus that could have been used to prepare the solution. Naming of irrelevant / unnecessary glassware and apparatus will carry **negative marks**.

ඉහත ද්‍රාවණයෙහි ගණනය කරන ලද සාන්ද්‍රණය ඉතා නිවැරදි විය. මෙම ද්‍රාවණය පිළියෙල කිරීම සඳහා අනුගමනය කළයුතු අත්‍යවශ්‍ය පියවර ඊට අදාළ උපකරණ සහ වීදුරු භාජන ද ඇතුළුව සඳහන් කරන්න. වැරදි උපකරණ හෝ වීදුරු භාජන සඳහා ලකුණු අඩු කරනු ලැබේ.

(20marks)

(c) If the weight of HA was 7.2066 g, calculate the concentration of HA.

HA හි බර 7.2066 g නම් HA හි සාන්ද්‍රණය ගණනය කරන්න.

(Relative molar mass of HA= 60.00)

(06marks)

(d) The above solution was used to titrate 25.0 mL of  $M(OH)_2$  using a suitable indicator. The titration curve had only one equivalence point. Sketch and label the expected titration curve.

$M(OH)_2$  ද්‍රාවණයේ 25.0 mL අනුමාපනය කිරීම සඳහා සුදුසු දර්ශකයක් සමඟ ඉහත ද්‍රාවණය යොදා ගැනිණි. මෙම අනුමාපනයේ සමක ලක්ෂ්‍යය එකක් පමණක් තිබුණි. බලාපොරොත්තු විය හැකි අනුමාපන වක්‍රයේ දළ සටහනක් ඇඳ නම් කරන්න.

(12marks)

(e) What is the principle of selecting a suitable indicator for this titration?

මෙම අනුමාපනය සඳහා දර්ශකයක් තෝරා ගැනීමේ දී සැලකිය යුතු මූලික කාරණය කුමක් ද?

(10marks)

- (f) The end point readings (in mL) obtained are given in the following order.  
Eighteen, eighteen point five, nineteen, nineteen point three, eighteen point nine  
tabulate **only** the results that will be considered for calculation.

(Before obtaining each end point, the burette was filled up to zero mark).

ලබාගත් අන්ත ලක්ෂ්‍යයකින් (මි.ලීටර් වලින්) අනුපිළිවෙලින් පහත දී ඇත.

දහ අටයි, දහ අටයි දශම පහයි, දහ නවයයි, දහ නවයයි දශම තුනයි, දහ අටයි දශම නවයයි.

ගණනය කිරීම් සඳහා තෝරා ගන්නා ලද පාඨාංක පමණක් වගුගත කරන්න.

(සෑම අන්ත ලක්ෂ්‍යයක්ම ලබා ගැනීමට පෙර බියුරට්ටුව බිංදුවේ පාඨාංකය දක්වා පුරවන ලදී.)

(10marks)

- (g) Give two reasons for getting different end point readings.

වෙනස් අන්ත ලක්ෂ්‍යයන් ලැබීමට හේතු දෙකක් (02) ලියන්න.

(04 marks)

- (h) The pipette used for the above titration had the following information:  $25.0 \pm 0.03$  mL. What do you mean by this?

ඉහත අනුමාපනය සඳහා භාවිත කරන ලද පිපෙට්ටුවේ  $25.0 \pm 0.03$  mL ලෙස සඳහන් විය.

මේවායින් අදහස් කරන්නේ කුමක් ද?

( 10 marks)

- (i) Calculate the concentration of  $M(OH)_2$ .  $M(OH)_2$  හි සාන්ද්‍රණය ගණනය කරන්න.

( 10 marks)

(j) Comment on the following statement. පහත දී ඇති වාක්‍ය සඳහා අදහස් දක්වන්න.  
 "The principle behind the colour change of the redox indicators is different from that of acid- base indicators"

“ඔක්සිහරණ - ඔක්සිකරණ දර්ශක වල වර්ණ වෙනස්වීමට හේතුවන සාධකය අම්ල - හෂ්ම දර්ශක සඳහා හේතුවන සාධකයට වඩා වෙනස් වේ.”

(12 marks)

03. (a) A student synthesized a compound in the laboratory. It needs to be recrystallized to remove some impurities present in it in trace amounts. විද්‍යාගාරයේ දී ශිෂ්‍යයෙකු සංයෝගයක් සංස්ලේෂණය කළේය. එහි සුළු වශයෙන් අඩංගුව ඇති අපද්‍රව්‍ය ඉවත් කිරීමට පුනර්ස්ඵටිකීකරණය කිරීමට අවශ්‍යව ඇත.

(i) Explain why the solvent you select for recrystallization, should not dissolve the sample at room temperature? පුනර්ස්ඵටිකීකරණය සඳහා තෝරා ගන්නා ද්‍රාවකය තුළ සාම්පලය කාමර උෂ්ණත්වයේ දී දිය නොවිය යුත්තේ ඇයිදැයි පහදන්න.

(ii) What measures do you take to remove coloured impurities? වර්ණවත් අපද්‍රව්‍ය ඉවත් කිරීමට ඔබ ගන්නා ක්‍රියාමාර්ගය කුමක් ද?

(iii) What is meant by hot filtration? “උණුසුම් පෙරීම” (hot filtration) යනුවෙන් අදහස් කරන්නේ කුමක් ද?

(iv) List down the items required for hot filtration (Naming of Irrelevant / Unnecessary items will carry negative marks) උණුසුම් පෙරීම සඳහා අවශ්‍ය වන ද්‍රව්‍ය ලයිස්තු ගත කරන්න. (අනවශ්‍ය ද්‍රව්‍ය සඳහන් කිරීම සෘණ ලකුණු ලැබීමට හේතු වේ.)

(v) Give reasons why the hot filtrate should not be cooled rapidly to get crystals?

උණුසුම් පෙරනයෙන් ස්ඵටික ලබා ගැනීම පිණිස, එය වේගවත් සිසිලනයට ලක් කිරීම සුදුසු නැත්තේ ඇයිදැයි හේතු දක්වන්න.

(50 marks)

(b) The above pure compound A was found to contain C, H and O only. The following tests were done on it to identify the functional groups present in it.

ඉහත සංශුද්ධ A නම් සංයෝගයේ C,H හා O පමණක් අඩංගු වේ. එහි ඇති ක්‍රියාකාරී කාණ්ඩ හඳුනා ගැනීමට පහත පරීක්ෂණ සිදු කරන ලදී.

(i) Give inference for each observation. නිරීක්ෂණ එකිනෙකක් සඳහා නිගමනයන් ලියන්න.

Test පරීක්ෂණය	Observation නිරීක්ෂණය	Inference නිගමනය
1. Add 10% Na <sub>2</sub> CO <sub>3</sub> solution to A. 10% Na <sub>2</sub> CO <sub>3</sub> ද්‍රාවණය A ට එකතු කරන ලදී.	Dissolved with effervescence. බුබුලනය සහිතව දියවුණි	
2. Dissolved A in methanol was added to Br <sub>2</sub> water solution. A මෙතනෝල් හි දියකර එය Br <sub>2</sub> දියර ස්වල්පයකට එකතු කරන ලදී.	Brown colour of the Br <sub>2</sub> solution did not disappear. දුඹුරු පාට Br <sub>2</sub> ද්‍රාවණය අවර්ණ නොවුණි.	
3. A was heated with ethanol in the presence of Conc. H <sub>2</sub> SO <sub>4</sub> and the solution was poured over dil. Na <sub>2</sub> CO <sub>3</sub> solution. සාන්ද්‍ර H <sub>2</sub> SO <sub>4</sub> හමුවේ A, ඇසිටික් අම්ලය සමඟ රත් කර එම ද්‍රාවණය තනුක Na <sub>2</sub> CO <sub>3</sub> ද්‍රාවණය මතට වත් කරන ලදී.	No pleasant smell given off. ප්‍රසන්න සුවඳක් නිකුත් නොවුණි.	



<p>4. A was heated with acetic acid in the presence of Conc. <math>H_2SO_4</math> and the solution was poured over dil. <math>Na_2CO_3</math> solution. සාන්ද්‍ර <math>H_2SO_4</math> හමුවේ A එතනෝල් සමඟ රත් කර එම ද්‍රාවණය තනුක <math>Na_2CO_3</math> ද්‍රාවණය මතට වත් කරන ලදී.</p>	<p>A pleasant smell is given off. ප්‍රසන්න සුවඳක් නිකුත් වුණි.</p>	
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(ii) What is/are the functional group(s) present in A?

A හි අඩංගු ක්‍රියාකාරී කාණ්ඩය/කාණ්ඩ කවරේ ද?

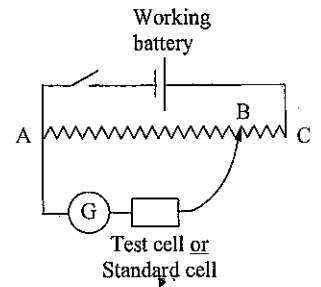
(iii) If you do not have  $Br_2$  water in the laboratory for Test 2, what can you use in place of it?  $Br_2$  දියරය විද්‍යාගාරයේ නොමැති විට පරීක්ෂණ අංක 2 සඳහා භාවිතා කළ හැකි වෙනත් ප්‍රතිකාරකයක් නම් කරන්න.

(iv) What is the type of compound that is formed in Test 4. Write the general formula of it. පරීක්ෂණ අංක 4 හි නිපදවන සංයෝග කාණ්ඩය කුමක් ද? එහි සාමාන්‍ය සූත්‍රය (general formula) ලියන්න.

(v) What is the purpose of pouring the reaction mixtures in Tests 3 and 4 into dil.  $Na_2CO_3$  solution? පරීක්ෂණ අංක 3 හා 4 හිදී ප්‍රතික්‍රියා මිශ්‍රණය තනුක  $Na_2CO_3$  ද්‍රාවණයක් මතට වත් කිරීමට හේතුව කුමක් ද?

(50 marks)

4. (a) At 50°C, a student prepared a Galvanic cell by placing a wire of metal X in solution of its ions,  $X^{2+}(aq)$ , placing a wire of metal Y in solution of its ions,  $Y^{3+}(aq)$ , and then bringing the electrical contact between the two solutions using a salt bridge. He measured its emf using a potentiometer as shown in the diagram. The length AB when there was no current through the Galvanometer, G, was  $(81.0 \pm 0.1)$  cm. He observed that the metal wire Y is connected to the Galvanometer (and X to the variable resistor). He could not find voltmeter to measure the potential difference across AC (i.e. across the terminals of the working battery) during the experiment. However, he found a standard cell in the laboratory and repeated the potentiometer experiment by replacing the test cell with it. With the standard cell in place, he determined the length AB to be  $(53.6 \pm 0.1)$  cm when there was no current through the Galvanometer. On the standard cell, the emf of it was written as  $(1.2 \pm 0.1)$  V.



You are given that for  $y = \frac{a}{b}x$ ,  $\left(\frac{\delta y}{y}\right)^2 = \left(\frac{\delta a}{a}\right)^2 + \left(\frac{\delta b}{b}\right)^2 + \left(\frac{\delta x}{x}\right)^2$

[Assume that the current through the variable resistor remained constant throughout the experiment.]

උෂ්ණත්වය 50°C දී සිසුවෙකු විසින්  $X^{2+}(aq)$  අයන ද්‍රාවණයක ගිල්වූ X ලෝහ කුරක් (ඉලෙක්ට්‍රෝඩයක්) හා  $Y^{3+}(aq)$  අයන ද්‍රාවණයක ගිල්වූ Y ලෝහ කුරක් එකිනෙක සම්බන්ධ කර ගැල්වානී කෝෂයක් සාදා ගත් අතර, එම ද්‍රාවණ දෙක අතර විද්‍යුත් සම්බන්ධතාව ලවණ සේතුවක් ඇසුරින් ගොඩ නගා ගත්තේය. ඔහු ඉහත රූපයේ දක්වා ඇති පරිදි විභවමානයක් ආධාරයෙන් කෝෂයේ වි.ගා.බ. මැන ගන්නා ලදී. ගැල්වනෝමීටරය G හරහා ධාරාවක් නොගලන අවස්ථාවේ AB අතර දුර  $(81.0 \pm 0.1)$  cm විය. එම අවස්ථාවේ Y ලෝහ කුර ගැල්වනෝමීටරයට සම්බන්ධව ඇති බව හා ( X ලෝහ කුල විචල්‍ය ප්‍රතිරෝධකයට සම්බන්ධව ඇති ) බව දක්නට ලදී. පරීක්ෂණය අතරතුර AC අතර විභව අන්තරය මැන ගැනීම සඳහා (එනම් ක්‍රියාකාරී බැටරියේ අග්‍ර අතර විභව අන්තරය මැනීමට) ඔහුට වෝල්ටීමීටරයක් සොයා ගත නොහැකි විය. කෙසේ වෙතත් ඔහුට පරීක්ෂණාගාරයේ තිබූ සම්මත කෝෂයක් හමු වී ඇති අතර, පරීක්ෂණ කෝෂය වෙනුවට සම්මත කෝෂය යොදා ගනිමින් එම විභවමාන පරීක්ෂණය නැවත වරක් සිදු කළේය.

සම්මත කෝෂය සම්බන්ධ කල අවස්ථාවේ, ගැල්වනෝමීටරය හරහා ධාරාවක් නොගලන අවස්ථාවේ AB අතර දුර  $(53.6 \pm 0.1)$  cm ලෙස ඔහු මැන ගන්නා ලදී. සම්මත කෝෂයේ වි.ගා.බ  $(1.2 \pm 0.1)$  V ලෙස ඔහු සටහන් කර ගන්නා ලදී.

$$y = \frac{a}{b}x \quad \text{විට දී} \quad \left(\frac{\delta y}{y}\right)^2 = \left(\frac{\delta a}{a}\right)^2 + \left(\frac{\delta b}{b}\right)^2 + \left(\frac{\delta x}{x}\right)^2 \quad \text{ලෙස දී තිබේ.}$$

(පරීක්ෂණය අතරතුර විචල්‍ය ප්‍රතිරෝධකය හරහා ධාරාව නියතව පවතින බව උපකල්පනය කරන්න.)

- (i) Giving reasons, identify the negative terminal (metal X or Y?) of the cell prepared by the student. සිසුවා විසින් සාදන ලද කෝෂයේ සෘණ අග්‍රය (negative terminal) (X හෝ Y ලෝහ කුරු) යන බව හේතු දක්වමින් හඳුනා ගන්න.

- (ii) Write down the spontaneous cell reaction.  
ස්වයංසිද්ධ කෝෂ ප්‍රතික්‍රියාව ලියා දක්වන්න.

- (iii) Denote the potential difference across AC by P, the length of AC by L and the emf of the cell prepared by the student by E.

Write down the relationship among E, P and L.

AC අතර විභව අන්තරය P ලෙස ද, AC අතර දුර L ලෙස ද, සිසුවා විසින් නිර්මාණය කරන ලද වි.ගා.බ. E ලෙස ද යොදා ගනිමින්, E, P සහ L අතර සම්බන්ධතාවය ලියන්න.

- (iv) Write down the relationship among the emf of the standard cell, P and L.

සම්මත කෝෂයේ වි.ගා.බ සඳහා සම්බන්ධතාවයක් P හා L ඇසුරින් ලියා දක්වන්න.

(v) Calculate E. E ගණනය කරන්න.

(vi) Estimate the error in E. E සඳහා දෝෂය (error) ගණනය කරන්න.

(vii) State E up to the correct significant figures indicating the uncertainty (in standard form).

E නිවැරදි සාර්ථක ගණනකට දක්වමින් අවිනිශ්චිතභාවය (uncertainty) සම්මත ආකාරයෙන් දක්වන්න.

(50 marks)

(b) A student following CMU1121 Practical Chemistry course is required to handle some hazardous chemicals when performing experiments in the laboratory.

ඔබ CMU1121 පාඨමාලාව හදාරන සිසුවෙකු ලෙස පරීක්ෂණාගාරයේදී සිදුකරන පරීක්ෂණ වලදී ඔබට උපද්‍රව සහිත රසායන ද්‍රව්‍ය පාවිච්චි කිරීමට සිදුවේ.

(i) List three general safety guidelines this student is expected to adhere in order to ensure a safe laboratory environment.

ආරක්ෂාකාරී පරීක්ෂණාගාර වටපිටාවක් සඳහා ඔබ විසින් අනුගමනය කළයුතු යැයි අපේක්ෂා කරන ප්‍රධාන ආරක්ෂාකාරී මාර්ගෝපදේශ තුනක් ලියා දක්වන්න.

(ii) The instructor had requested the student to mix concentrated acid with water.

Explain the way the acid must be handled in this dilution process.

විද්‍යාගාරයක් තුළදී පරීක්ෂකවරයා ඔබට සාන්ද්‍ර අම්ලයක් ජලය සමඟ මිශ්‍ර කරන ලෙස පැවසුවේය. මෙම තනුකකරණ ක්‍රියාවලියේ දී ඔබ සාන්ද්‍ර අම්ලය භාවිත කරන ආකාරය විස්තර කරන්න.

(iii) Accidentally this student spilled acid on to her skin. What precautions she should have to take immediately?

අනතුරක් ලෙස, අම්ලය යම් ප්‍රමාණයක් ඔබගේ හම මත හැලුණේ යැයි සිතන්න. ඔබ එහිදී වහාම ගන්නා ක්‍රියාමාර්ගය කුමක් ද?

(25 marks)

(c) (i) Why is it not advisable to wear contact lenses in the Chemistry laboratory?

රසායනික විද්‍යාගාරයක් තුළදී ස්පර්ශ කාව පැළඳීම යෝග්‍ය නැතැයි කියන්නේ ඇයි ද?

(ii) A student is performing an experiment which evolves a gas. Teacher had instructed her to smell the chemical evolved during the reaction. Explain how she would need to smell the chemical.

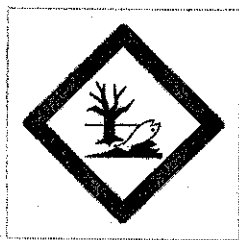
යම් වායුවක් මුක්ත කරන පරීක්ෂණයක් ඔබ සිදු කරන්නේ යැයි සිතන්න. එහිදී උපදේශකයා විසින් ඔබට එම වායුවේ /රසායන ද්‍රව්‍යයේ ගන්ධය ආඝ්‍රාණය කරන ලෙස කියා සිටියේ ය. මෙම කටයුත්ත ඔබ සිදුකරන්නේ කෙසේ දැයි විස්තර කරන්න.

(iii) What is MSDS? And what is the main objective of MSDS?

MSDS යනු කුමක් ද? එහි ප්‍රධාන අභිමතාර්ථය කුමක් ද?

(iv) Identify the following hazard warning symbols (a) and (b).

පහත (a) හා (b) උපද්‍රව අනතුරු ඇඟවීමේ සංකේත දෙක හඳුනා ගන්න.



(a)



(b)

(25 marks)

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[Type here]

Index No:

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00025



THE OPEN UNIVERSITY OF SRI LANKA  
B. Sc DEGREE PROGRAMME 2017/ 2018  
LEVEL 3 - FINAL EXAMINATION  
CMU1121 - PRACTICAL CHEMISTRY

DURATION: 2 HOURS

28<sup>th</sup> March 2019

Time: 9.30 am to 11.30 am

Answer ALL (04) structured questions.

எல்லா (04) வினாக்களுக்கும் விடையளிக்க.

- Answer in **ONLY** one medium. Use **ONLY** the space provided to do so.
- ஒரு மொழியில் மாத்திரம் விடையளிக்க. அதற்கென வழங்கப்பட்ட இடத்தில் விடையளிக்க
- Use of a **non-programmable** electronic calculator is permitted.
- செயல்நிற்படுத்தப்படாத கணிப்பான்களின் (**non-programmable** electronic calculator) பாவனை அனுமதிக்கப்படும்.
- **Mobile phones and any other electronic equipment** [other than a non-programmable calculator] **are prohibited**; switch off and leave them out.
- பரீட்சையின் போது கையடக்கத் தொலைபேசியின் பாவனைக்கு அனுமதியில்லை. அவற்றை அணைத்து பாதுகாப்பான இடத்தில் வைக்கவும்.

01.

(a) Write down the formula of  
சூத்திரத்தை எழுதுக

(i) Ammonium Molybdate -----

(ii) Potassium thiosulphate -----

(iii) Ethyl acetate -----

(18 Marks)

- (b) You are provided with an inorganic sample (X) which is drawn from an unlabeled bottle. It is suspected to be either  $BaCl_2$  (A) or  $BaCO_3$  (B).

உங்களுக்கு அசேதன மாதிரி (X) ஆனது பெயரிடப்படாத போத்தலில் அடைத்து தரப்பட்டுள்ளது. இது  $BaCl_2$  (A) அல்லது  $BaCO_3$  (B) என சந்தேகிக்கப்படுகின்றது.

- (i) Name the physical test and the corresponding observation to distinguish between A and B

A மற்றும் B ஐ வேறுபடுத்தும் பௌதீக பரிசோதனையையும் அதற்குரிய அவதானத்தையும் தருக.

- (ii) What is the expected observation if the flame test is carried out with both A and B?

சுவாலை பரிசோதனையின்போது A, B ஆகியவற்றிற்கு எதிர்பார்க்கப்படும் அவதானம் யாது?

- (iii) Supposing the sample is identified as B, write down the relevant chemical tests to confirm the cation and anion in B

மாதிரியானது B என அறியப்படுமிடத்து, அதில் காணப்படும் கற்றயன் மற்றும் அன்னயன் என்பவற்றிற்கான உறுதி செய்யும் இரசாயன பரிசோதனைகளை தருக.

(20 Marks)

- (c) "Chlorine water" test indicated the presence of Iodide ions.

"குளோரின் நீர்" சோதனையானது அயடைடு அயன்களின் பிரசன்னத்தை குறித்துக் காட்டுகின்றது.

Write down the expected observation corresponding to the above statement and the relevant balanced chemical equation

மேற்படி கூற்று தொடர்பாக எதிர்பார்க்கப்படும் அவதானத்தையும் அதற்கு பொருத்தமான ஈடுசெய்த இரசாயன சமன்பாட்டையும் தருக.

(10 Marks)



- (d) (i) Write down the expression for solubility product (in aqueous media) of a sparingly soluble salt of the form  $AB_2$  with the aid of a balanced chemical equation.

சமப்படுத்திய இரசாயன சமன்பாட்டின் உதவியுடன்  $AB_2$  எனும் பகுதியாக கரையும் உப்பின் கரைதிறன் பெருக்கத்திற்கான (நீர்க் கரைசல் ஊடகத்தில்) வெளிப்பாட்டினை எழுதுக.

- (ii) If the solubility product of  $AB_2$  is  $5.0 \times 10^{-7} \text{ mol}^3 \text{ dm}^{-9}$ , calculate its solubility.

$AB_2$  இன் கரைதிறன் பெருக்கம்  $5.0 \times 10^{-7} \text{ mol}^3 \text{ dm}^{-9}$  ஆயின், அதன் கரைதிறனை கணிக்கുക.

(20 Marks)

- (e) A student decides to prepare the "Sodium Carbonate Extract" in the usual manner with a salt of the form  $MX_2$ .

மாணவன்  $MX_2$  எனும் வடிவிலான உப்பில் இருந்து சாதாரண முறையில் சோடியம் காபனேற்று பிரித்தெடுப்பை மேற்கொள்ள தீர்மானித்தான்.

- (i) Write down the reason/s for carrying out the preparation of the above extract.

மேற்கூறப்பட்ட பிரித்தெடுப்பை தயாரிப்பதற்கான காரணம் அல்லது காரணங்களை தருக.

- (ii) Write down the relevant balanced equation for the reaction in the above process and identify the formula of the residue.

மேற்கூறப்பட்ட செயன்முறையுடன் தொடர்பான தாக்கத்திற்கான ஈடுசெய்த இரசாயன சமன்பாட்டையும் தருவதுடன் மீதியின் சூத்திரத்தையும் தருக.

- (iii) You have been asked to “neutralize” the extract before testing for any of the anions. How would you do this in the laboratory?

அன்னயன்களுடனான பரிசோதனைக்கு முன்னதாக இவ் வடிதிரவத்தை நடுநிலையாக்குமாறு நீர் கேட்கப்படுகிறீர். ஆய்வு கூடத்தில் இதனை எவ்வாறு செய்வீர்?

- (iv) Why do you neutralize?  
ஏன் நடுநிலையாக்குகிறீர்?

(32 Marks)

02. A primary standard solution of the weak acid HA was prepared by dissolving an accurate weight of the acid in hundred milli liters of distilled water.

மென்னமில்ம் HA இன் நியம முதன்மை கரைசல் ஆனது, அமிலத்தின் திருத்தமான திணிவு நூறு மில்லிலீட்டர் காய்ச்சி வடித்த நீரில் கரைப்பதன் மூலம் தயாரிக்கப்பட்டது.

- (i) State two properties of HA that should be fulfilled to call it as a primary standard.

நியம முதன்மை எனும் பதத்தை பூர்த்தி செய்ய HA யிடம் காணப்படும் இரண்டு இயல்புகளை தருக.

(06 Marks)

- (ii) The calculated concentration of the above prepared solution was highly accurate. Write down the essential steps with the **appropriate / relevant** glassware and apparatus that could have been used to prepare the solution. Naming of irrelevant / unnecessary glassware and apparatus will carry **negative marks**.

மேற்கூறப்பட்ட கரைசலின் கணிக்கப்பட்ட செறிவு ஆனது மிகவும் திருத்தமானது எனின், கரைசலை தயாரிக்கும் படிமுறைகளையும், அதற்கு தேவையான அத்தியாவசிய உபரணங்களையும், கண்ணாடிப் பொருட்களையும் பட்டியலிடுக. தேவையற்ற உபகரணம் மற்றும் கண்ணாடிப்பொருட்களின் பட்டியல் மறை மதிப்பெண்களை பெற்றுத்தரும்.

(20 marks)

- (iii) If the weight of HA was 7.2066 g, calculate the concentration of HA.  
(Relative molar mass of HA= 60.00)

HA இன் திணிவு 7.2066 g எனின், அதன் செறிவை கணிக்க.  
(HA இன் சார் மூலக்கூற்றத்திணிவு 60.00)

(06 marks)

- (iv) The above solution was used to titrate 25.0 mL of  $M(OH)_2$  using a suitable indicator. The titration curve had only one equivalence point. Sketch and label the expected titration curve.

மேற்கூறப்பட்ட கரைசலானது 25.0 mL  $M(OH)_2$  உடன் பொருத்தமான காட்டி முன்னிலையில் நியமிக்கப்பட்டது. நியமிப்பு வளையி ஆனது ஒரு சமநிலைப்புள்ளியை மட்டுமே கொண்டுள்ளதாயின், எதிர்பார்க்கப்படும் வளையியை வரைந்து பெயரிடுக.

(12 marks)

- (v) What is the principle of selecting a suitable indicator for this titration?  
இந்நியமிப்பிற்கு பொருத்தமான காட்டியை தெரிவு செய்வதற்கு உள்ள கொள்கை/தத்துவம் யாது?

(10 marks)

- (vi) The end point readings (in mL) obtained are given in the following order. Eighteen, eighteen point five, nineteen, nineteen point three, eighteen point nine.

பெறப்பட்ட முடிவுப்புள்ளி வாசிப்புக்கள் (மில்லிலீற்றரில்) பின்ருமாறு ஒழுங்கில் தரப்பட்டுள்ளது. பதினெட்டு, பதினெட்டு தசம் ஐந்து, பத்தொன்பது, பத்தொன்பது தசம் மூன்று, பதினெட்டு தசம் ஒன்பது.

Tabulate **only** the results that will be considered for calculation.

(Assume that, before obtaining each end point, the burette was filled up to zero mark).

கணிப்பீடகளுக்காக தேவைப்படும் முடிவுகளை மாத்திரம் அட்டவணை படுத்துக.

(ஒவ்வொரு வாசிப்பிற்கும் முன்னரும் அளவியானது பூஜ்ஜிய நிலைக்கு நிரப்பப்பட்டுள்ளது எனக் கொள்க.)

(10 marks)

- (vii) Give two reasons for getting different end point readings.  
வித்தியாசமான முடிவுப்புள்ளிகள் பெறப்படுவதற்கான காரணங்கள் இரண்டு தருக.

(04 marks)

- (viii) The pipette used for the above titration had the following information:

24 °C and 25.0 ±0.03 mL on it. What do they mean?

பயன்படுத்தப்பட்ட pipette இல் பின்வரும் விபரம் தரப்பட்டிருந்தது:

24 °C and 25.0 ±0.03 mL, இதனால் விளக்கப்படுவது யாது ?

(10 marks)

- (ix) Calculate the concentration of  $M(OH)_2$ .  
 $M(OH)_2$  இன் செறிவினை கணிக்கുക.

(10 marks)

- (x) Comment on the following statement.  
 "The principle behind the color change of the redox indicators is different from that of acid- base indicators"  
 பின்வரும் கூற்று தொடர்பாக கருத்து தெரிவிக்கുക.  
 "ரெடொக்ஸ் (redox) காட்டிகள் காட்டும் நிறமாற்றத்தின் கொள்கை/தத்துவம் ஆனது அமில - கார காட்டிகளில் இருந்து வித்தியாசப்படுகின்றது."

(12 marks)

03.

- (a) A student synthesized a compound in the laboratory. It needs to be recrystallized to remove some impurities present in it in trace amounts.

மாணவன் ஒருவன் ஆய்வு கூடத்தில் ஓர் சேர்வையை தயாரித்தான். மிகச்சிறியளவில் காணப்படும் மாசுக்களை அகற்றுவதற்காக அச்சேர்வையை மீள்பளிங்காக்கினான்.

- (i) Explain why the solvent you select for recrystallization, should not dissolve the sample at room temperature?

மீள்பளிங்காக்க நீர் தெரிவு செய்த கரைப்பானானது, மாதிரியை அறை வெப்பநிலையில் ஏன் கரைக்கக்கூடாது என விளக்குக.

- (ii) What measures do you take to remove colored impurities?

நிறமுள்ள மாசுக்களை அகற்ற நீர் மேற்கொள்ளும் நடவடிக்கைகள் எவை?

(iii) What is meant by hot filtration?  
வெப்ப வடிகட்டல் என்றால் என்ன?

(iv) List down the items required for hot filtration (Naming of Irrelevant, / Unnecessary items will carry negative marks)  
வெப்ப வடிகட்டலை மேற்கொள்ள தேவையான பொருட்களை பட்டியல் படுத்துக. தேவையற்ற பொருட்களின் பட்டியல் மறை மதிப்பெண்களை பெற்றுத்தரும்.

(v) Give reasons why the hot filtrate should not be cooled rapidly to get crystals?  
பளிங்குகளை பெறுவதற்கு குடாக்கப்பட்ட வடதிரவத்தை சடுதியாக குளிர்ந்தக்கூடாது. காரணம் தருக.

(50 marks)

(b) The above pure compound A was found to contain C, H and O only. The following tests were done on it to identify the functional groups present in it.  
மேற்கூறப்பட்ட சேர்வை A ஆனது C, H, O ஆகியவற்றை மட்டும் கொண்டுள்ளது. இதில் காணப்படும் தொழிற்பாட்டுக் கூட்டங்களை இனம் காண்பதற்கு கீழ் காட்டப்பட்ட சோதனைகள் செய்யப்பட்டன.

(i) Give inference for each observation.

ஒவ்வொரு அவதானத்திற்குமுரிய அனுமானங்களை தருக.

Test / சோதனை	Observation / அவதானம்	Inference / அனுமானம்
1. Add 10% Na <sub>2</sub> CO <sub>3</sub> solution to A. A இற்கு 10% Na <sub>2</sub> CO <sub>3</sub> கரைசல் சேர்க்கப்பட்டது.	Dissolved with effervescence. நுரைத்தலுடன் கரைந்தது.	
2. Dissolved A in methanol was added to Br <sub>2</sub> water solution. மெதனோலில் கரைக்கப்பட்ட A ஆனது Br <sub>2</sub> நீர் கரைசலுடன் சேர்க்கப்பட்டது.	Brown color of the Br <sub>2</sub> solution did not disappear. கபில நிற Br <sub>2</sub> கரைசல் மறையவில்லை.	

<p>3. A was heated with ethanol in the presence of Conc. <math>H_2SO_4</math> and the solution was poured over dil. <math>Na_2CO_3</math> solution.</p> <p>செறிந்த <math>H_2SO_4</math> முன்னிலையில் A ஆனது எதனாலுடன் சூடாக்கப்பட்டு, கரைசல் ஐதான <math>Na_2CO_3</math> கரைசலின் மீது ஊற்றப்பட்டது.</p>	<p>No pleasant smell given off.</p> <p>இதமான நறுமணம் வெளிவிடப்படவில்லை.</p>	
<p>4. A was heated with acetic acid in the presence of Conc. <math>H_2SO_4</math> and the solution was poured over dil. <math>Na_2CO_3</math> solution.</p> <p>செறிந்த <math>H_2SO_4</math> முன்னிலையில் A ஆனது அசற்றிக்கமிலத்துடன் சூடாக்கப்பட்டு, கரைசல் ஐதான <math>Na_2CO_3</math> கரைசலின் மீது ஊற்றப்பட்டது.</p>	<p>A pleasant smell is given off.</p> <p>இதமான நறுமணம் வெளிவிடப்பட்டது.</p>	

(ii) What is/are the functional group(s) present in A?

A இல் காணப்படும் தொழிற்பாட்டுக் கூட்டம்/(ங்கள்) எவை?

(iii) If you do not have  $Br_2$  water in the laboratory for Test 2, what can you use in place of it?

சோதனை 2 ஐ செய்வதற்கு தேவையான கரைசல் ஆய்வு கூடத்தில் இல்லை ஆயின், அதற்கு பதிலாக நீர் எதனை பயன்படுத்துவீர்?

(iv) What is the type of compound that is formed in Test 4. Write the general formula of it.

சோதனை 4 இல் எவ்வகையான சேர்வை உருவாக்கப்படும். இதற்கான பொது சூத்திரத்தை தருக.

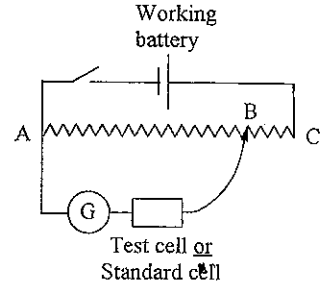
(v) What is the purpose of pouring the reaction mixtures in Tests 3 and 4 into dil.  $Na_2CO_3$  solution?

சோதனை 3 மற்றும் சோதனை 4 இல் பெறப்பட்ட தாக்க கலவையை ஐதான  $Na_2CO_3$  கரைசலின் மீது ஊற்றுவதற்கான நோக்கம் யாது?

(50 marks)

04.

- (a) At 50°C, a student prepared a Galvanic cell by placing a wire of metal X in solution of its ions,  $X^{2+}(aq)$ , placing a wire of metal Y in solution of its ions,  $Y^{3+}(aq)$ , and then bringing the electrical contact between the two solutions using a salt bridge. He measured its emf using a potentiometer as shown in the diagram. The length AB when there was no current through the Galvanometer, G, was  $(81.0 \pm 0.1)$  cm. He observed that the metal wire Y is connected to the Galvanometer (and X to the variable resistor). He could not find voltmeter to measure the potential difference across AC (i.e. across the terminals of the working battery) during the experiment. However, he found a standard cell in the laboratory and repeated the potentiometer experiment by replacing the test cell with it. With the standard cell in place, he determined the length AB to be  $(53.6 \pm 0.1)$  cm when there was no current through the Galvanometer. On the standard cell, the emf of it was written as  $(1.2 \pm 0.1)$  V.



50 °C இல் ஒரு மாணவன் கம்பி X இனை  $X^{2+}$  கரைசலில் வைப்பதன் மூலமும், கம்பி Y இனை  $Y^{3+}$  கரைசலில் வைப்பதன் மூலமும் இரு தொகுதிகளை அமைத்து அவற்றுக்கிடையில் ஒரு உப்புப் பாலத்தினைப் பயன்படுத்துவதன் மூலம் மின் தொடர்பை ஏற்படுத்தி ஒரு கல்வானிக் கலத்தைத் தயாரித்தான். அவன் படத்தில் காட்டியவாறு, ஒரு அழுத்தமானியை பயன்படுத்தி, இக் கலத்தின் மி.இ.வி ஐ அளந்தான். கல்வானிக் கலம் G இனூடாக மின் பாயாத நிலையில் AB என்பவற்றுக்கிடையிலான தூரம்  $(81.0 \pm 0.1)$  cm. இப் பரிசோதனையின் போது அவன் கம்பி Y இனை கல்வானிக் கலத்திற்கும், கம்பி X இனை மாறும் தடையிற்றும் இணைத்தான். இதன் போது AC முனைகளுக்கிடையில் (வேலை செய்யும் கலத்தின் முனைகளுக்கிடையில்) அழுத்தமானி வாசிப்பு எதனையும் அவன் பெறவில்லை. பின்னர் அவன் பரிசோதனை கலத்திற்கு பதிலாக, ஆய்வு கூடத்தில் காணப்படும் ஓர் நியம கலத்தினை பொருத்தி இதே செயன் முறையை செய்தான். இதன் போது கல்வானிக் கலத்தினூடாக மின் பாயாத நிலையில் AB முனைகளுக்கிடையிலான தூரம்  $(53.6 \pm 0.1)$  cm என பெற்றான். நியம கலத்தில் அதன் மி.இ.வி  $(1.2 \pm 0.1)$  V என எழுதப்பட்டிருந்தது.

You are given that for, உங்களுக்கு பின்வரும் தொடர்பு தரப்பட்டுள்ளது.

$$y = \frac{a}{b}x, \quad \left(\frac{\delta y}{y}\right)^2 = \left(\frac{\delta a}{a}\right)^2 + \left(\frac{\delta b}{b}\right)^2 + \left(\frac{\delta x}{x}\right)^2$$

[Assume that the current through the variable resistor remained constant throughout the experiment.]

[பரிசோதனையின் போது மாறும் தடையினூடான மின் ஆனது மாறவில்லை எனக் கொள்க]

- (i) Giving reasons, identify the negative terminal (metal X or Y) of the cell prepared by the student.

காரணங்களை தருவதன் மூலம் மாணவன் தயாரித்த கலத்தின்

மறைமுடிவிடத்தை (உலோகம் X அல்லது Y) அடையாளம் காண்க.



(ii) Write down the spontaneous cell reaction.  
சுயாதீன கலத்தாக்கத்தை எழுதுக.

(iii) Denote the potential difference across AC by  $P$ , the length of AC by  $L$  and the emf of the cell prepared by the student by  $E$ . Write down the relationship among  $E$ ,  $P$  and  $L$ .

AC இற்கிடையிலான அழுத்த வித்தியாசம்  $P$  எனவும், நீளம்  $L$ , மி.இ.வி  $E$  எனவும் கொண்டு,  $E$ ,  $P$ ,  $L$  ஆகியவற்றுக்கிடையிலான தொடர்பை எழுதுக.

(iv) Write down the relationship among the emf of the standard cell,  $P$  and  $L$ .  
கலத்தின் நியம மி.இ.வி,  $P$ ,  $L$  ஆகியவற்றுக்கிடையிலான தொடர்பை எழுதுக.

(v) Calculate  $E$ .  
 $E$  ஐ கணிக்க.

(vi) Estimate the error in  $E$ .  
 $E$  இற்கான வழுவைக் கணிக்க.

- (vii) State E up to the correct significant figures indicating the uncertainty (in standard form).

E இன் நிச்சயமற்ற தன்மையை சரியான குறிப்பிடத்தக்க இலக்கங்களில் குறிப்பிடுக.

(50 marks)

- (b) A student following CMU1121 Practical Chemistry course is required to handle some hazardous chemicals when performing experiments in the laboratory.

CMU1121 பரிசோதனை இரசாயனவியலை பின்பற்றும் மாணவன், ஆய்வு கூடத்தில் பரிசோதனைகளை மேற்கொள்ளும் போது அபாயகரமான இரசாயன திரவியங்களை கையாள வேண்டிய நிலை ஏற்படும்.

- (i) List three general safety guidelines this student is expected to adhere in order to ensure a safe laboratory environment.

பாதுகாப்பான ஆய்வக சூழலை உறுதிபடுத்துவதற்காக இந்த மாணவன் கடைபிடிக்க வேண்டிய மூன்று பொதுவான பாதுகாப்பு வழிகாட்டுதல்களை பட்டியலிடுக.

- (ii) The instructor had requested the student to mix concentrated acid with water. Explain the way the acid must be handled in this dilution process.

கற்பிப்பவரினால், மாணவன் செறிந்த அமிலத்தை நீருடன் கலக்குமாறு வேண்டப்படுகின்றான். இவ் ஐதாக்கும் செயல்முறையில் அமிலம் கையாளப்பட வேண்டிய முறையை விளக்குக.

- (iii) Accidentally this student spilled acid on to her skin. What precautions she should have to take immediately திடீரென இவ் அமிலமானது மாணவனின் தோலில் சிந்திவிட்டது. உடனடியாக அவன் எடுக்க வேண்டிய முன்னெச்சரிக்கை நடவடிக்கைகள் எவை?

(25 marks)

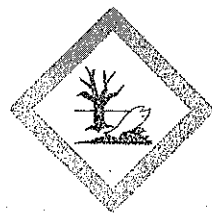
(c) (i) Why is it not advisable to wear contact lenses in the Chemistry laboratory?  
 இரசாயனவியல் ஆய்வுகூடங்களில் கண்ணுடன் தொடுகை உள்ள வில்லைகள் (Contact Lenses) அணிய வேண்டாம் என அறிவுறுத்தப்படுவதற்கான காரணம் யாது?

(ii) A student is performing an experiment which evolves a gas. Teacher had instructed her to smell the chemical evolved during the reaction. Explain how she would need to smell the chemical.

மாணவன் ஒருவன் மேற்கொண்ட பரிசோதனையின் போது வாயு ஒன்று வெளிவிடப்பட்டது. இதன் போது வெளியான இரசாயன திரவியத்தின் மணத்தை நுகருமாறு ஆசிரியரினால் அம்மாணவன் கேட்கப்படுகின்றான். அம் மாணவன் அத் திரவியத்தை எவ்வாறு நுகர வேண்டும் எனவிளக்குக.

(iii) What is MSDS ? And what is the main objective of MSDS?  
 MSDS என்றால் என்ன? MSDS இன் நோக்கம் யாது?

(iv) Identify the following hazard warning symbols (a) and (b).  
 பின்வரும் (a), (b) ஆகிய இரு அபாயகர குறியீடுகளையும் இனம் காண்க.



(a)



(b) (25 marks)