

The Open University of Sri Lanka
Foundation Course in Science
CMF 2206 – 2012 /2013
Home Assignment I

1.
 - i) Li shows different properties when compared to other alkali metals. Give reason(s) for this anomalous behaviour giving few examples.
 - ii) What is the trend of solubility of alkaline earth metal hydroxides when going down the Group 2. Give reason(s) for the variation.
 - iii)
 - a. Write the chemical equation for the preparation of H_3BO_3 (boric) acid from B_2H_6 .
 - b. H_3BO_3 is a very weak monobasic acid, not a triprotic acid. Explain.
 - c. Direct titration of Boric acid with NaOH is not possible. Why?
 - d. What is the additional step that you have to follow to do the titration of Boric acid with NaOH?
 - iv) Write relevant chemical equations to show the production of Na_2CO_3 by Solvay process.
 - v) ~~a. Compare and contrast the physical and chemical properties of graphite and diamond.~~
 - b. Write the structures of Carbon monoxide, Carbon dioxide and Carbon suboxide.
 - c. Write relevant chemical equations to show the preparation of above gases.

2.
 - i)
 - a. Write the Lewis dot structure for NO_3^- , SF_6 and NO_2^- .
 - b. Write two chemical equations to show the preparation of PH_3 .
 - c. Predict the products for the following reactions.
 - 1) $3 Cu_{(s)} + 8 \text{dil. } HNO_{3(aq)} \xrightarrow{\hspace{2cm}}$
 - 2) $SbCl_3 (l) + H_2O(l) \xrightleftharpoons{\hspace{2cm}}$
 - 3) $3 S_{(s)} + 6 NaOH_{(aq)} \xrightarrow{\hspace{2cm}}$
 - ii)
 - a. What is the oxidation number of S in H_2SO_3 , HSO_3^- and H_2SO_4 ?
 - b. Write the 3 chemical reactions to show the dehydration ability of H_2SO_4 acid.
 - c. Draw the structure of pyrosulphuric acid
 - iii) Write three properties are change through descend Group 17.
 State whether those properties increase or decrease
 - iv) Write equations for the reactions of chlorine with (i) water and (ii) cold dilute sodium hydroxide solution. Give one use for each reaction.
 - v) Give four reasons why hydrogen may be positioned below,
 - a. Group 1 elements
 - b. Group 17 elements

ශ්‍රී ලංකා විභාග විශ්ලේෂණ විද්‍යාලය

විද්‍යා පදනම් පාඨමාලාව

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පිටුව 1

1.

- (i) Li අනෙකුත් ක්ෂාර ලෝහවලට සාපේක්ෂව වෙනස් ගුණාංග පෙන්වයි. උදාහරණ දෙකක් එයට හේතු දක්වන්න.
- (ii) II වන කාණ්ඩයේ දිගේ පහළට යත්ම ක්ෂාරීය පාංශු ලෝහ හයිඩ්‍රොක්සයිඩ්-වල ප්‍රායෝගික වෙනස් වන්නේ කෙසේද? එම වෙනසට හේතු දක්වන්න.
- (iii) a. B_2H_6 වලින් ආරම්භ කොට H_3BO_3 (කොරික් අම්ලය) තැඳීම සඳහා වන රසායනික සමීකරණය ලියන්න.
 b. කොරික් අම්ලය ඉතා දුබල ඒකප්‍රෝතික අම්ලයක් වන අතර ඊට්‍රිප්‍රෝතික් අම්ලයක් (triprotic acid) හෙවේ. පැහැදිලි කර දක්වන්න.
 c. කොරික් අම්ලය $NaOH$ සමඟ සෘජු අනුමාපනයක් සිදු කළ නොහැක. හේතු දක්වන්න.
 d. කොරික් අම්ලය $NaOH$ සමඟ සෘජු අනුමාපනයක් කිරීමට හම් සිදු කළ යුතු අවස්ථා විස්තර කළ යුතුය.
- (iv) 'කොල්ඩේ' ක්‍රමය භාවිතා කර Na_2CO_3 නිෂ්පාදනයට අදාළ තුළිත රසායනික සමීකරණ ලියන්න.
- (v) a. මිනරන් (ලුරේසිට්) සහ දියමන්තිවල ජ්‍යෙෂ්ඨ හා රසායනික ගුණ සංසන්දනය කරන්න.
 b. කාබන් මොනොක්සයිඩ්, කාබන් ඩයොක්සයිඩ් හා කාබන් සබොක්සයිඩ්වල වෙනස් වන්න.
 c. ඉහත එක් එක් වායුව නිෂ්පාදනයට අදාළ රසායනික සමීකරණ ලියන්න.

2.

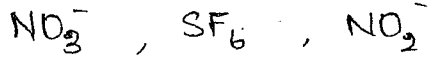
- (i) a. NO_3^- , SF_6 සහ NO_2^- සඳහා ලුවීස් වලිග අඳින්න.
 b. PH_3 නිෂ්පාදනයට අදාළ රසායනික සමීකරණ 2ක් ලියන්න.
 c. පහත ප්‍රතික්‍රියාවල එකක් දක්වන්න.
 - (1) $3Cu(s) + 8 \text{dil. } HNO_3(aq) \longrightarrow$
 - (2) $SbCl_3(s) + H_2O(l) \rightleftharpoons$
 - (3) $3S(s) + 6 NaOH(aq) \longrightarrow$

- (ii) a. H_2SO_3 , HSO_3^- සහ H_2SO_4 වල 6 වල ඔක්සිකරණ අංකය ලියන්න.
- b. H_2SO_4 අම්ලයේ විචලකාරක ගුණය පෙන්වීමට රසායනික සමීකරණ 3 ක් ලියන්න.
- c. පයිරොසල්ෆික් අම්ලයේ ව්‍යුහය අඳින්න.
- (iii) 17 වන කාණ්ඩය දුග්‍ය ජනප්‍රාය යාම්වලට හැරුණුවහු වෙනත් වන ගුණ 3 ක් දක්වන්න. එම ගුණ කාණ්ඩය දුග්‍ය ජනප්‍රාය යන නිම වැඩිවේද? අඩුවේද? රැන්ඩ් සඳහන් කරන්න.
- (iv) ක්ලෝරික් (i) ජලය, (ii) ජංගම හනුක $NaOH$ ද්‍රාවණයක් සමඟ ප්‍රතික්‍රියාවලට අදාළ තුළු සමීකරණ ලියන්න. එම ප්‍රතික්‍රියාවලට අදාළ එක් ප්‍රයෝජනයක් දැක්වී සඳහන් කරන්න.
- (v) ඔසියුරන් ආවර්ණික වශවේ
- පළමු කාණ්ඩයේ මූලද්‍රව්‍ය
 - 17 වන කාණ්ඩයේ මූලද්‍රව්‍ය
- සමඟ ජීවිතව පෙනී 4 කැණි දක්වන්න.

கிளாசிகல் திறந்த பல்கலைக்கழகம்
 வித்தான சித்திவாரியப் பாடநெறி
 CMF 2206 - 2012/2013
 ஷீட்டு ஒப்படை - 1

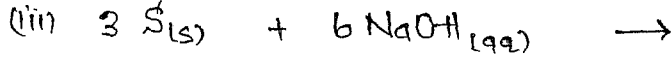
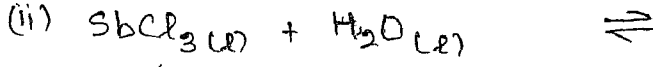
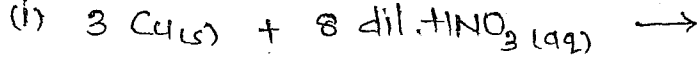
1. i) காரவுலோகங்களின் கியல்புகளுடன் ஒப்பிடுகையில் Li சூனக வலுபுடைய கியல்புகளைக் காட்டுகின்றது. கிம் மாறுபட்ட சிசாதாரண நடத்தையை காரணம் தந்து உதாரணங்களுடன் விளக்குக.
- ii) கூட்டத்தின் வாய்வு கிமலிடுந்து கிழ் சோங்கிச் சவல்குகையில் காரமண உலோக ஐதரோட்சைட்டுக்களின் கைரத்தின் மாறுபடும் விதம் யாகு? கிதற்கான காரணம் யாகு?
- iii) (அ) B_2H_6 கிமலிடுந்து H_3BO_3 (சோரிக்கமிலம்) தயாரிப்பதற்கான கிரசாயனச் சமன்பாட்டைத் தடுக.
- (ஆ) H_3BO_3 சூனக திரையுரோட்சித்தமிலம் (triprotic acid) சில்லாகு கி ஐதான சிர்திவ அமிலமாகும். விளக்குக.
- (இ) சோரிக்கமிலமானக $NaOH$ உடன் சந்ரடி தியமிப்பிற்குட்படாகு கிதை விளக்குக.
- (ஈ) சோரிக்கமிலத்தை $NaOH$ உடன் தியமிப்பதற்கு மேலதிகமாக சடுக்கப்பட வேண்டிய யடுகை யாகு?
- iv) சோல்வே (Solvay) யாந்திரை திலம் Na_2CO_3 தயாரிக்கப்படுவதை சேவையான கிரசாயன சமன்பாட்டை உபயாகித்துக் காட்டுக.
- v) (அ) காரியம் மற்சும் வைரம் சண்பவற்றின் கிரசாயன மற்சும் யளத்த கியல்புகளை ஒப்பிடுக.
- (ஆ) காயகோரோட்சைட்டு, காயகிரோட்சைட்டு மற்சும் காயண்சப்பாட்சைட்டு (carbon suboxide) சண்பவற்றின் கட்டமைப்புக்களை சடுகுக.
- (இ) மேற்கூறப்பட்ட யாயுக்கள் தயாரிக்கப்படுவதை காட்டுக சம்பந்தப்பட்ட கிரசாயனச் சமன்பாட்டை சடுகுக.

i) (a) பின்வருவனவற்றில் காண ஆயில் புள்ளி கட்டமைப்புகளை எழுதுக .

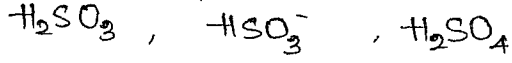


(b) PH_3 தயாரிப்பை ஒரு திரவாமில சமன்பாடுகளை எழுதுவதன் மூலம் காட்டுக .

(c) பின்வரும் தாக்கங்களின் வினைவுகளை உய்த்தறித .



(ii) (a) பின்வருவனவற்றில் 3 வினைவு ஒட்சிசனம் எண் யாது ?



(b) H_2SO_4 அமிலத்தின் ஐதரசனகற்றப்படும் தன்மையை மீண்டும் திரவாமில சமன்பாடுகளை எழுதுவதன் மூலம் காட்டுக .

(c) Pyrosulphuric அமிலத்தின் கட்டமைப்பை வரைக .

(iii) கூட்டம் 17 இல் வட்டிய கிடை கிறங்கும் போது மாற்றத்தை காட்டும் 3 வியல்புகள் , விவியல்புகள் கூடுகின்றதா , குறைகின்றதா என எடுத்துரைக்க .

(iv) பின்வரும் தாக்கங்களிற்றான சமன்பாட்டை எழுதுக .

கிரோமியம் அமிலம், i) நீருடன்

ii) கரிமமான ஐதராக்சைடுடன் சோடியம்மற்றிராட்டைசுட்டுடன்

மெற்கூறப்பட்ட ஒவ்வொரு தாக்கத்தினதும் ஒவ்வொரு உபயோகம் தருக .

(v) ஐதரசனமிலம் பின்வருவனவற்றில் சேர்க்கப்படுவதற்கான மூலக் காரணங்களைத் தருக .

(a) கூட்டம் 1 லேகங்களிடம்

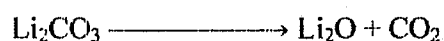
(b) கூட்டம் 17 லேகங்களிடம்

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Answer guide for the home assignment

1. I) Anomalous behaviour of lithium is due to extremely small size of lithium, have small size cation and high nuclear charge. So lithium exerts the greatest polarizing effect out of all alkali metals on negative ion. Therefore lithium ion develops covalent character in its compounds. Unlike other alkali metals, lithium is least reactive among all. It can be noticed by the following properties

- It reacts with water slowly to liberate H_2 . Na reacts vigorously. Reaction with K, Rb and Cs is violent.
- Lithium is the only alkali metal which directly burn with N_2 to form Lithium nitride (Li_3N)
- When burnt in oxygen, lithium form Li_2O , sodium form Na_2O and Na_2O_2 , other alkali metals form monoxide, peroxide and superoxide.
- Li_2O is less basic and less soluble in water than other alkali metal oxide.
- $LiOH$ is weaker base than $NaOH$ or KOH
- Only Li_2CO_3 decomposes on heating



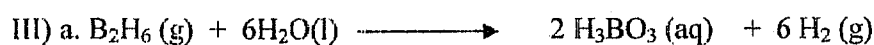
Na_2CO_3 , K_2CO_3 etc. do not decompose on heating.

- $LiNO_3$ and other alkali metal nitrates give different products on heating



II) Solubility of alkaline earth metal hydroxides increases when going down the group. Reason-

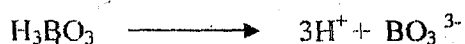
All group 2 elements will produce $2+$ ions (as they all have two electrons in their outer shells that they can lose easily). However the smaller metal ions (for example beryllium, Be^{2+} and magnesium Mg^{2+}) have high charge densities since the $2+$ charge is spread over a small area. This high charge density means that the small ions are able to strongly attract the hydroxide ions, OH^- , and hold them in a strong lattice structure which water molecules find very difficult to break down. Hence magnesium hydroxide tends to dissolve poorly in solution. Strontium and Barium ions (Sr^{2+} and Ba^{2+}) respectively are much larger, The $2+$ charge is spread over a much greater area (these ions are said to have a much lower charge density). This mean that the ions will have less attraction for the hydroxide ions and the much weaker structure is able to break down in water.



b. monobasic acid is an acid which dissociates to give one H^+ per acid molecule. The acidity of H_3BO_3 is due to abstraction of OH^- ion from a water molecule (producing a H_3O^+ ion)

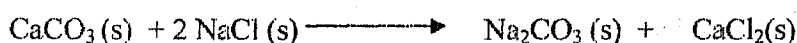
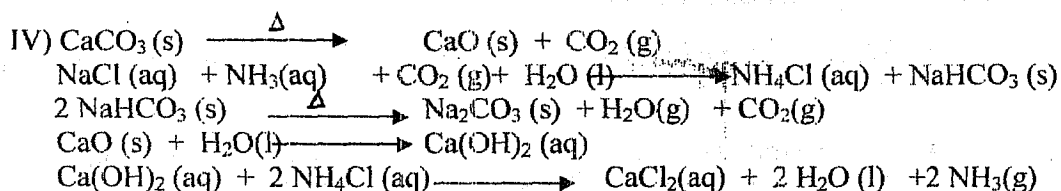


and not due to H^+ donation as follows. So it is a monobasic acid.



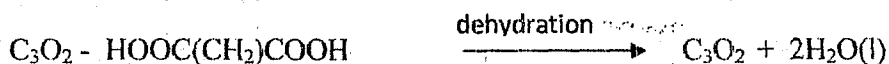
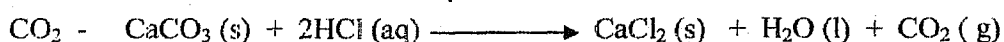
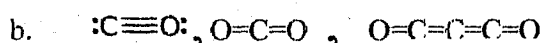
c. Boric acid is a very weak acid and direct titration with NaOH is not possible.

d. An auxiliary reagent that contributes to the release of protons in a known stoichiometry facilitates this type of very weak acid–base titration. H_3BO_3 can be converted to relatively strong mono basic acid by reacting with mannitol or glycerol. Then those products have to titrate with NaOH.

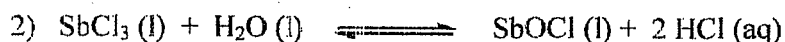
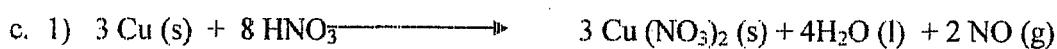
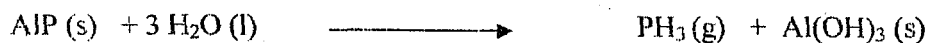
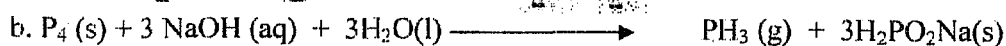
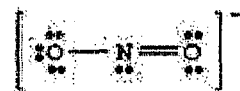
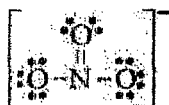


V) a.

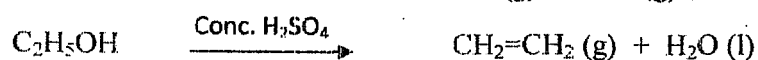
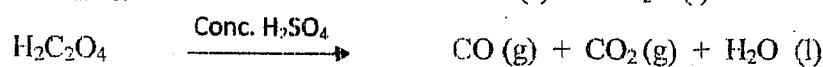
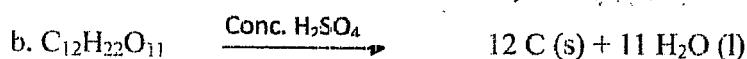
Graphite	Diamond
Each C atom is covalently bonded to another 3 C atoms	Each C atom is covalently bonded to another 4 C atoms
C atoms are arranged as layers	3-D network structure
Soft and can used as lubricating agent	Extremely hard and can used as cutting tool (abrasive)
Good electrical conductor due to free electrons	No free electrons. Non electrical conductor
Opaque	Extremely transparent
Less expensive allotropic form of C	Very expensive allotropic form of C



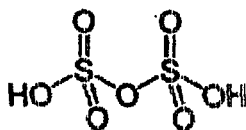
2. I) a.



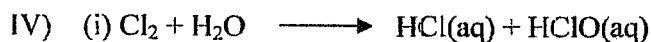
II) a. $\text{H}_2\text{SO}_3 = +4$, $\text{HSO}_3^- = +4$, $\text{H}_2\text{SO}_4 = +6$



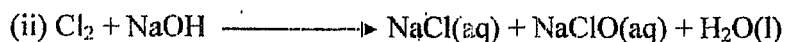
c.



III) Boiling point - increases, Electronegativity & Oxidizing power - decreases



This is known as chlorine water and used to sterilise water; HClO is a sterilising agent or oxidizing agent



This is used to make bleach (bleaching agent)

V) a. H has some properties that is similar to other alkali metals.

- H has one electron in its outer most shell.
- H forms monopositive ion H^+ .
- H gets discharge at cathode in electrolysis.

b. H shows some properties that is similar to group 17 as well.

- H needs only one electron to attain noble gas electron configuration.
- H forms H^- ions with electropositive metals.
- H_2 is a diatomic gas.