KESTEVEN & GRANTHAM GIRLS' SCHOOL.

NAME Margaret Roberts

DATE 28/4/42 FORM VI Lower

SUBJECT Qualitative Chemistry

E.S.A., LONDON.

Confirmatory Tests for Metals & Acid Radicals.

METALS

Silver

With a solution of a soluble silver salt, potassium chromate K_2CrO_4 gives a brick red precipitate of silver chromate which is soluble in nitric acid.

$$K_2CrO_4 + 2AgNO_3 = Ag_2CrO_4 + 2KNO_3.$$

Lead

1. Potassium iodide KI gives a glistening yellow precipitate of lead iodide PbI_2

$$Pb(NO_3)_2 + 2KI = PbI_2 + 2HNO_3$$

2. Potassium chromate gives a yellow precipitate of lead chromate.

$$Pb(NO_3)_2 + K_2CrO_4 = PbCrO_4 + 2KNO_3.$$

Mercury

Stannous chloride $SnCl_2$ gives a grey precipitate of metallic mercury.

a. Mercuric salts — Potassium iodide precipitates mercuric iodide HgI_2. Ppt, yellow — pink — red.

$$Hg(NO_3)_2 + 2KI = HgI_2 + 2KNO_3.$$

At the moment of its formation the mercuric iodide is yellow, but it rapidly changes to scarlet. If more potassium iodide solution is added, the red precipitate

redissolves owing to the formation of the complex soluble compound potassium mercuri-iodide K_2HgI_4

Copper

Potassium ferrocyanide $K_4Fe(CN)_6$ gives a brown precipitate of cupric ferrocyanide.

$$2CuCl_2 + K_4Fe(CN)_6 = 4KCl + Cu_2Fe(CN)_6$$

Cadmium

Caustic soda solution gives a white precipitate of cadmium hydroxide which is not dissolved by excess of caustic soda.

$$CdCl_2 + 2NaOH = 2NaCl + Cd(OH)_2$$

Arsenic

If an arsenic compound is introduced into a mixture of zinc and dil. H_2SO_4, arseniuretted hydrogen AsH_3 is given off with the evolved hydrogen. The test, which is called Marsh's test may conveniently be carried out in a boiling tube, fitted with a cork carrying a glass tube drawn out to a jet. On igniting the issuing gas, the AsH_3 burns with a bluish-white flame. If a piece of cold porcelain be held in the flame, a black deposit of metallic arsenic is formed; this is soluble in bleaching powder solution, whereas the similar stain produced by the Sb in the same test is insoluble.

Antimony

In Marsh's test (see under arsenic) the black stain is produced – in this case metallic antimony – but it is not soluble in bleaching powder solution.

Tin

Mercuric chloride gives a white precipitate of mercurous chloride, which afterwards turns grey owing to the liberation of metallic mercury.

$$SnCl_2 + 2HgCl_2 = Hg_2Cl_2 + SnCl_4$$
$$SnCl_2 + Hg_2Cl_2 = 2Hg\downarrow + SnCl_4.$$

Stannic salts.

Mercuric chloride gives no precipitate.

Iron

Ferrous 1. Potassium ferricyanide $K_3Fe(CN)_6$ gives a dark blue ppt. of Turnbull's blue which is possibly ferrous ferricyanide.

$$2K_3Fe(CN)_6 + 3FeSO_4 = 3K_2SO_4 + Fe_3(Fe(CN)_6)_2$$

2. Caustic soda gives a green ppt. of ferrous hydroxide

$$FeCl_2 + 2NaOH = Fe(OH)_2 + Na_2SO_4.$$

Ferric 1. Potassium ferrocyanide $K_4Fe(CN)_6$ gives a dark blue ppt Prussian blue which is possibly ferric ferrocyanide.

$$4FeCl_3 + 3K_4Fe(CN)_6 = Fe_4[Fe(CN)_6]_3 + 12KCl.$$

2. Potassium thiocyanate gives a blood-red colouration said to be due to the formation of ferric thiocyanate.

$$FeCl_3 + 3KCNS = 3KCl + Fe(CNS)_3.$$

Chromium

A chromium salt when fused with KNO_3 and Na_2CO_3 yields a yellow residue of sodium chromate Na_2CrO_4. Carry out on porcelain. Heat

Aluminium

Potassium ferrocyanide gives a white precipitate of zinc ferrocyanide. Ppt. often yellow.

$$2ZnCl_2 + K_4Fe(CN)_6 + 4KCl.$$

Manganese

When a manganese salt is fused with KNO_3 + Na_2CO_3 a green mass is obtained.

Nickel

1. Ammonia gives a green precipitate of nickel hydroxide which readily dissolves in excess to form a blue solution.
2. Dimethyl glyoxime produces a pinkish red ppt. in neutral soln.

Cobalt.

1. Ammonia in dilute solution gives a similar precipitate soluble in excess. Brown.
2. Addition of a little acetic acid followed by a concentrated solution of potassium nitrite, results in the gradual deposition of a yellow crystalline precipitate of potassium cobaltinitrite

$$CoCl_2 + 5KNO_2 + 2HNO_3 = K_3Co(NO_2)_6 + 2KCl + H_2O + NO$$

Calcium

Ammonium oxalate gives a white precipitate of calcium oxalate insoluble in acetic acid but soluble in dilute hydrochloric acid.

$$Ca(NO_3)_2 + (NH_4)_2C_2O_4 = CaC_2O_4 + 2NH_4NO_3.$$

Strontium

1. Ammonium oxalate gives a white precipitate of strontium oxalate.

$$Sr(NO_3)_2 + (NH_4)_2C_2O_4 = SrC_2O_4 + 2NH_4NO_3.$$

2. Potassium chromate gives no precipitate except in very concentrated solution (distinction from barium).

Barium

1. Ammonium oxalate gives a white precipitate of barium oxalate.

$$BaCl_2 + (NH_4)_2C_2O_4 = BaC_2O_4 + 2NH_4Cl.$$

2. Calcium sulphate solution gives a white precipitate of barium sulphate.

$$BaCl_2 + CaSO_4 = BaSO_4 + CaCl_2$$

3. Potassium chromate gives a yellow precipitate of barium chromate, soluble in hydrochloric acid but practically insoluble in acetic acid.

$$BaCl_2 + K_2CrO_4 = BaCrO_4 + 2KCl.$$

Magnesium

Ammonium hydroxide gives a white precipitate of magnesium hydroxide.

$$MgSO_4 + 2NH_4OH = Mg(OH)_2 + (NH_4)_2SO_4$$

Ammonium

Nessler's solution gives a brown precipitate or yellowish brown colourations with solutions of ammonia.

Potassium

Tartaric acid gives a white precipitate of potassium hydrogen tartrate, particularly on scratching the tube with a glass rod.

AC11/IC

Carbonates

Soluble carbonates give a white precipitate of calcium carbonate when added to calcium chloride solution.

Chlorides

When heated with manganese dioxide and concentrated sulphuric acid, chlorides yield chlorine which may be detected by its colour and smell and by the fact that it will bleach a moist piece of litmus paper.

$$2NaCl + MnO_2 + 3H_2SO_4 = MnSO_4 + 2NaHSO_4 + 2H_2O + Cl_2$$

2 Soluble chlorides with silver nitrate solution give a white curdy precipitate of silver chloride AgCl. This precipitate goes dark on exposure to light and is insoluble in nitric acid but soluble in ammonia solution.

Sulphates

1 Lead acetate gives a white ppt of lead sulphate which disappears on boiling and reappears on cooling.

Sulphites

1 Soluble sulphites decolourise a solution of ~~sulphite~~ iodine.

$$Na_2SO_3 + H_2O + I_2 = Na_2SO_4 + 2HI$$

2 Barium chloride with a solution of a sulphite gives a white ppt. of barium sulphite soluble in hydrochloric acid.

$$K_2SO_3 + BaCl_2 = BaSO_3 + 2KCl.$$

3 Solutions of a sulphite will decolourise potassium permanganate solution. From the resulting liquid a white precipitate of barium sulphate may be obtained by the addition of barium chloride. The sulphite reduces the permanganate and is itself oxidised to the corresponding sulphate.

Nitrates

A solution of a nitrate mixed with concentrated sulphuric acid gives a red colouration on the addition of brucine

N.B. Brucine is an excessively poisonous substance and must not be used without special permission.

2 Brown Ring Test. Take the solution suspected to contain a nitrate and add an excess of freshly prepared ferrous sulphate solution. Then pour concentrated sulphuric acid carefully down the side of the tube so that it forms a layer at the bottom.

If a nitrate is present a brown ring will be formed where the two liquids meet. The explanations of this test is as follows. The nitrate, the ferrous sulphate and the sulphuric acid first react to form nitric oxide.

$2KNO_3 + 6FeSO_4 + 4H_2SO_4 = K_2SO_4 + 3Fe_2(SO_4)_3 + 4H_2O + 2NO$.

The nitric oxide then combines with more ferrous sulphate to form a compound (brown ring) said to have the formula $2FeSO_4.NO$.

Nitrites

1 Ferrous sulphate gives a brown colouration with a solution of a nitrite.

2 If a solution of a nitrite is acidified with dilute hydrochloric acid iodine is liberated on the addition of potassium iodide.

$2KNO_2 + 4HCl + 2KI = 4KCl + 2H_2O + 2NO + I_2$.

The iodine may be detected by the brown colouration, or by the addition of starch paste, when a deep blue colour is produced.

3 Mix the substance which is suspected to be a nitrite with a little phenol (carbolic acid C_6H_5OH) and warm the mixture with a small quantity of concentrated sulphuric acid. If a nitrite is present a dark reddish-brown mass will be formed which soon changes to dark blue or green. Pour this mass into water in an evaporating dish. A red solution will be obtained which goes blue or green on addition of caustic soda solution.

Phosphates

1 Ammonium Molybdate Test. Dissolve some crystals of ammonium molybdate $(NH_4)_2MoO_4$ in a little water in a test-tube add an excess of concentrated nitric acid and boil. Take the substance suspected to be a phosphate and boil it up with an excess of nitric acid. Mix the two boiling solutions, taking more of the ammonium molybdate than the other. If a phosphate

is present a yellow crystalline precipitate will be formed. This is called ammonium phosphomolybdate and varies in composition.

To distinguish between the ortho - meta - and pyro phosphates the following test may be applied.
a) In neutral solution silver nitrate gives a yellow ppt of silver ortho-phosphate with orthophosphates but with meta and pyro-phosphates it gives white precipitates - silver metaphosphate, $AgPO_3$ in the one case and silver pyrophosphate $Ag_4P_2O_7$ in the other. (b) on addition of ammonia and ammonium chloride followed by magnesium sulphate ortho-phosphates give a white precipitate of magnesium ammonium orthophosphate

$$Na_2HPO_4 + MgSO_4 + NH_3 \rightarrow Mg(NH_4)PO_4 + Na_2SO_4$$

Under similar conditions meta-phosphates give no precipitate. Pyro-phosphates, on addition of magnesium sulphate alone, give a white precipitate of magnesium pyrophosphate $Mg_2P_2O_7$ which will dissolve again on addition of more magnesium sulphate.

Acetates

Add conc. H_2SO_4 + alcohol and heat. Ethyl acetate is formed recognised by its fruity odour.

$$2CH_3COONa + H_2SO_4 = 2CH_3COOH + Na_2SO_4$$
$$CH_3COOH + C_2H_5OH \rightleftharpoons CH_3COOC_2H_5 + H_2O.$$

Oxalates

Calcium chloride gives a white precipitate of calcium oxalate which is soluble in HCl but insoluble in acetic acid.

Tartrate

Heat with silver nitrate. Gives a black ppt. of silver.

Formate

1 On heating, silver nitrate gives a black deposit of metallic silver.

2 With conc. H_2SO_4 + alcohol, ethyl formate is formed having a characteristic pungent odour.

Bromides & Iodides

Add chlorine water to displace either Br_2 or I_2, a red or violet layer is formed on the addition of carbon disulphide. Shake the test tube.

May 3rd.

Substance A

Preliminary Tests	Experiment	Result	Inference
Appearance	White crystal. solid.		
Effect of heat	Effect of heat.	Substance melts into colourless liquid. Gives off thick white fumes.	
	Blowpipe Test.	Thick white fumes went on fire.	Compound of Hg, Sb & NH_3
	Borax Bead Test.	Nil.	
	Flame Test.	Nil.	
	Effect of caustic soda and heat.	Ammonia given off. Fumes with HCl.	Ammonium salt.
Confirmatory for Acid Radicle	Add Nessler's solution	Brick red precipitate	Ammonium salt.
Radical			
Acid Radical	Substance soluble in water.		
	Effect of dil. HCl	—	
	Effect of conc. H_2SO_4	A little brown gas evolved. Increased in quantity on addition of copper. $\therefore NO_2$.	Nitrate.
Confirm. Acid. Rad.	Brown Ring Test	Positive.	Nitrate.

∴ Substance A is Ammonium Nitrate ✓

Substance B.

	Experiment	Result	Inference
Prelim Tests	1 Appearance	Dark red crystal. solid	Salt of Cobalt.
	2 Solubility	Soluble in cold water	
	3 Heat	Turned blue.	
	4 Heat with Na_2CO_3 on Charcoal Block.	Turned blue.	
	5 Flame Test	Very bright sparks.	
	6 Borax Bead	Blue	Cobalt
	7 Add $NaOH$	Blue ppt.	Cobalt.
Syst. tests for Acid rad.	1 Heat with dil. HCl.	—	
	2 Heat with conc H_2SO_4	Gas which fumed in contact with air, evolved fumed with ammonia.	Chloride.
Confirm. Test	Add $AgNO_3$	White ppt. sol in NH_4OH, not in HNO_3.	Chloride.
Syst. tests for Acid Radical.	To soln. add dil. HCl	—	
	2 Add HCl until soln is $2N$ and pass H_2S.	—	
	3 To filtrate add $NH_4Cl + NH_4$	—	

	Experiment	Result	Inference
	To above add H_2S.	Black ppt.	
	Add excess NaOH	Purple ppt. becomes pink on standing	Cobalt.
	∴ Substance B is Cobalt chloride. ✓		

Substance C

Prelim. Test.	Appearance.	White cryst. solid.	
	Heat	–	
	Heat with Na_2CO_3 on charcoal block	–	
	Moisten with $Co(NO_3)_2$ soln. Reheat.	Blue Bead	Aluminium
	Borax bead	–	
	Flame Test	–	
	Add NaOH	White Blue Ppt. sol. in excess.	Al.
Syst. Acidic Tests	Add dil. HCl. Heat	–	
	Add conc. H_2SO_4	–	
	Boil substance with conc. Na_2CO_3 soln. Filter. Test solution. Add $FeSO_4$ soln. + sulph. acid	–	

	Expt.	Result	Inference
	Acidify soln. with dil. HCl. Add $BaCl_2$ soln.	White ppt.	Sulphate.
Syst. Metallic Tests.	To soln. add dil. HCl	–	
	Add HCl until soln is 2 N and pass H_2S.	–	
	To original soln. add $NH_4Cl + NH_3$	White ppt. Sol. in NaOH	Aluminium.
	∴ Substance C is Aluminium Sulphate ✓		

Substance D

Prelim. Tests.	Appearance	white cryst. solid.	
	Solubility	Slight in cold water Rich more in hot water	
	Effect of Heat.	Decrepitation. NO_2 gas off	Nitrate.
	Blowpipe Test.	–	–
	Borax bead test	–	–
	Flame Test	Blue	Lead.
Syst. Acid Tests.	Heat with dil. HCl	–	–

Test.	Experiment	Result	Inference.
	2 Heat with conc. sulphuric acid	NO_2 given off	Nitrate.
Confirm. Test.	3 Brown ring test	—	—
—	2 Heat substance with Na_2CO_3. Repeat brown ring test	Positive	Nitrate.
Syst. Meth.	Add dil. HCl.	White ppt.	Lead, Mercury, Ag.
Tests.	2 Filter off ppt. Pour boiling water on filtrate. Cool filtrate.	White ppt.	Lead.
Confirm.	Add K_2CrO_4 soln.	Yellow ppt.	Lead.
—	Substance D is Lead Nitrate		
	Substance E		
Prelim. Test.	1 White Appearance	White cryst. solid	
—	2 Solubility	Insol. in water and dil. HCl. Sol. in conc. HCl.	
—	3 Effect of heat	Substance Melts.	
—	4 Blowpipe Test.	Yellow-green - Crown	
—	5 Borax bead	—	
—	6 Flame Test.	—	
—	7 Add NaOH	White ppt. sol in excess.	Pb, Sn, Zn, Al.

	Experiment	Result	Inference.
Syst. acid Test.	1 Add dil. HCl.	Nil	—
	2 Conc. H_2SO_4 Heat	HCl evolved	Chloride.
Confirm. Cl.	1 Add $MnO_2 + H_2SO_4$	Positive	Chloride.
	2 Add $AgNO_3$	Positive	Chloride.
Syst. Metal.	1 Group I	—	—
	2 Group II	Brown ppt.	
	3 Add NH_4OH	White ppt.	Ag, Zi sn.
	2 To 0.5 . add HCl and Zn. Add Mercuric chloride.	White ppt. going grey on standing.	Sn. Stannous.
	Substance E is Stannous		Chloride.
	Substance F.		
Prelim.	1 Appearance	Green Powder	
	2 Solubility.	Sol. in dil. HCl.	
	3 Effect of Heat	Fumes evolved. Turns brown.	
	4 Blowpipe Test.	—	
	5 Borax Bead Test	Flame Blue-green	∴ Copper.
	6 Flame Test	Green	∴ Copper.
	7 Add NaOH	Blue ppt. turns black on cooling.	Copper.
Syst acid.	1 Add dil. HCl.	—	—

		Experiment	Result	Inference
	3	Add conc H_2SO_4.	CO and CO_2 given off	Oxalate
Confirm Acid	1	Add $CaCl_2$.	White ppt. Sol in HCl insol in acetic acid.	Oxalate
Syst Metal	1	Group I. Add dil. HCl	—	—
	2	Add conc HCl, heat, pass H_2S.	Black ppt.	Hg, Bi, Sn, Cu.
	3	Add NH_4OH	Blue ppt going to deep blue soln.	Copper.
Confirm	1	Add $K_4Fe(CN)_6$	Brown ppt.	Copper.

∴ Substance F is Copper Oxalate ✓

Substance G.

Prelim	1	Appearance	White crystalline solid.	
	2	Solubility	Sol. in water	
	3	Effect of heat	—	
	4	Blowpipe Test	—	
	5	Borax bead	—	
	6	Flame	Intense Yellow	Sodium
	7	Add NaOH	—	—
Syst Acid	1	Add dil. HCl	NO_2 given off	Nitrite.
Confirm	1	Acidify with dil HCl Add KI	Iodine is liberated	Nitrite.
	2	Add ferrous sulphate	Brown coloration	Nitrite.

		Experiment	Result	Inference
Syst Metal	1	Group I	—	—
	2	Group II	—	—
	3	Group III	—	—
	4	Group IV	—	—
	5	Group V	—	—
	6	Add ammonium chloride ammonia, sodium phosphate	—	—
	7	Add potassium pyro antimonate soln.	White ppt.	Sodium
Confirm	1	Add Tartaric Acid. Scratch tube with glass rod.	White ppt. (Potassium hydrogen tartrate)	Sodium.

∴ G is Sodium Nitrite ✓

Substance H

Prelim	1	Appearance	Pink crystalline solid	
	2	Solubility	Sol. in water	
	3	Effect of heat	Steam given off.	
	4	Blowpipe Test	—	
	5	Borax Bead	Amethyst	Manganese.
	6	Flame Test	—	—
	7	Add NaOH	White ppt turning brown	Manganese.

	Experiment	Result	Inference
Acid	1 Add dil HCl	—	
	2 Add conc H_2SO_4	—	
	3 Boil with Na_2CO_3 soln. Acidify with dil HCl Add $BaCl_2$ soln.	White ppt.	Sulphate.
Confirm.	1 Add Lead Oxalate.	White ppt (Lead sulphate)	Sulphate
Acid Rad.	1 Group I	—	—
	2 Group II	—	—
	3 Group III	—	—
	4 Group IV Add NH_4Cl + NH_4OH and pass H_2S.	Pink ppt.	Manganese.
Confirm.	1 Fuse on porcelain with KNO_3 & Na_2CO_3.	Green Mass	Manganese.
	∴ R.H.'s	Manganate Sulphate	✓

Substance I

Prelim.	1 Appearance	White crystl. solid.	—
	2 Solubility	Soluble in water	—
	3 Effect of heat	Steam evolved	
	4 Blowpipe Test	—	
	5 Borax Bead	—	—

	Experiment	Result	Inference
	6 Flame Test	Lilac. Red through blue glass	Potassium.
	7 Add NaOH	—	—
Acid	Add dil HCl	—	—
	2 Add conc H_2SO_4	—	—
	3 Boil with Na_2CO_3 Filter. Add dil HCl and $BaCl_2$	—	—
	4 Add soln to double vol. HNO_3. Add NH_4 molybdate. Heat.	Yellow ppt. before boiling.	Phosphate.
Confirm.	1 Add $AgNO_3$ in neutral soln.	Yellow ppt.	Ortho-phosphate
	2 Add NH_4OH, NH_4Cl and $MgSO_4$	White ppt.	Ortho.
Acid Rad.	1 Group I — V	—	—
	2 Group VI Add Sodium phosphate	—	—
	3 Add Sodium hydrogen tartrate	White ppt.	Potassium
	∴ I.'s	Potassium ortho-phosphate.	✓

Substance J

		Experiment	Result	Inference
Prelim.	1	Appearance	White crystal solid.	
	2	Solubility	Soluble in water.	
	3	Effect of Heat	Melts.	
	4	Blowpipe Test	Pink mass with $Co(NO_3)_2$	Mg.
	5	Borax Bead	—	
	6	Flame Test	—	
	7	Add NaOH	White ppt insol. in excess.	Ca, Ba, Sr, Mg, Cd
Lyst Acid	1	Dil HCl	—	—
	2	Conc H_2SO_4	HNO_2 vapour given off. NO_2 also Cu fillings were added	Nitrate.
Confirm.	1	Brown Ring Test	Positive	Nitrate
Lyst Acid	1	Group $\overline{I} - \overline{V}$	—	—
	2	Group $\overline{VI}$. Add NH_4Cl, NH_4OH and sodium phosphate	White ppt	Magnesium
Confirm	1	Add NH_4OH	White ppt.	Magnesium.

∴ J is Magnesium Nitrate. ✓

K

		Experiment	Result	Inference
Prelim	1	Appearance	White crystal solid	
	2	Effect of Heat	Steam evolved	
	3	Solubility	Sol. in water	
	4	Blowpipe Test	—	
	5	Borax Bead	—	
	6	Flame Test	Apple green	Barium
	7	Add NaOH	White ppt. insol. in excess.	Ca Ba Sr Mg Cd
Lyst acid	1	Add dil. HCl	—	—
	2	Add conc H_2SO_4	Br_2 given off	Bromide
Confirm	1	Add $AgNO_3$	Pale yellow ppt. sol. in ammonia	: Bromide.
Lyst Acid	1	Add dil HCl	—	—
	2	Group $\overline{II} - \overline{V}$	—	—
	3	To 0·5 cd NH_4OH NH_4Cl $(NH_4)_2CO_3$	White ppt.	: Sr. Ba Ca.
	4	Add $Ca SO_4$ 0·5.	White ppt immediately.	: Barium
Confirm	5	Add ammonium oxalate & soln.	White ppt.	: Barium

∴ K is Barium Bromide. ✓

Autumn Term.

To discover the two metals present in an unknown mixture

23rd Sept.	Experiment	Result	Inference
1	Solubility	Sol. in HCl dil.	–
Syst. Anal. 1	Add dil. HCl	–	–
Tests 2	Add conc. HCl, Heat, Pass H_2S	–	–
3.	To O.S. add NH_4Cl NH_4OH	White ppt. Sol in Na.OH.	Al.
Confirm.			
	Filter off ppt. and continue tests on filtrate		
4.	To filtrate add NH_4Cl NH_4OH, pass H_2S.	White ppt.	Zn.
Confirm	Add potass. ferrocyanide	White ppt.	Zn.
	∴ The two metals present are Zn. and Al. ✓		
	Copy up last experiments. Date-qui work.		

30th September 1942.

To Analyse a given mixture.

		Experiment	Result	Inference.
Preliminary Tests	1	Effect of Heat	–	–
	2	Blowpipe	–	–
	3	Borax Bead	Yellow-brown	Iron.
	4	Flame Test	Intense yellow	Sodium.
	5	Nessler's Soln.	Brick-red ppt.	∴ Ammonia.
	6	Solubility	Sol in dil. HCl.	–
Syst. Anal. Acids	1	Add dil. HCl.	CO_2 given off. Lime water milky.	Carbonate.
	2	Add conc. H_2SO_4	CO_2 given off.	∴ Carbonate.
	3	Brown ring test	–	–
	4	Add dil. HCl and $BaCl_2$.	White ppt.	∴ Sulphate
Syst. Anal. Metals	1	Dil. HCl	–	Group I absent.
	2	Pass H_2S.	–	" II "
	3	To O.S. add NH_4Cl and NH_4OH	Green ppt.	Fe or Cr.
	4	Filter ppt. boil with HNO_3.	Brown soln.	Ferrous.
Confirm.		Add K ferricyanide to O.S.	Positive (blue ppt.)	Ferrous.
continue with filtrate.	5	Pass H_2S with NH_4Cl and NH_4OH present	–	Group IV absent.

Experiment	Result	Inference
6 Tofilkadd NH_4Cl, NH_4OH $(NH_4)_2CO_3$ and boil.	—	Group V absent
7 Ammonia confirmed by Nessler's soln. Presence of sodium inferred by flame test but unable to confirm. ∴ Substance contains	Ferrous, Ammonium Carbonate and Sulphate	Sodium suspected

Bricciy — Ind C
Peace

Oct 8th / 9th
9-15 → + 30 next morning

3 Friday 10 AM.

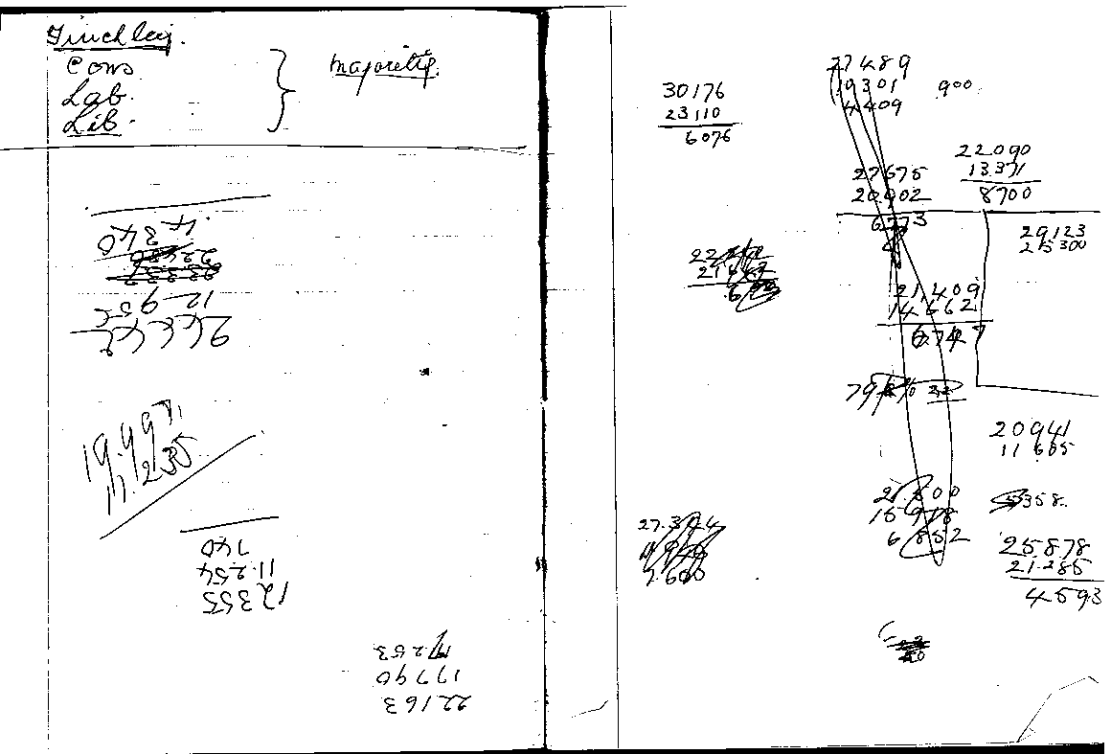
Today 9-15 — + 0 AM.

Fri 6/30 AM. 5 Pm 8/10

Conservatives		
Elected	Gains	Losses

Socialists		
Elected	Gains	Losses

Truckley
Cons
Lab
Lib
} majority



$$\frac{29.224}{24 \times 4 \times 2} = \frac{}{478}$$