Name : _____ ( ) Class : 4E1

GreenRidge Secondary School

PRELIMINARY EXAMINATION 2001

Subject : Chemistry (5069)
Secondary Four Express
Paper 3

Date : 13 Sep 2001 **Duration : 1 h 30 min**

INSTRUCTIONS TO CANDIDATES

Write your name, index number in the spaces at the top of this page.

Answer **both** questions.
Write your answers in the spaces provided on the question paper.
You should show the essential steps in any calculation and record all experimental results in the spaces provided on the question paper.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.
Qualitative Analysis notes for this paper are printed on page **8**.

FOR EXAMINER'S USE	
1	
2	
Total	/40

This paper consists of 8 printed pages, including this page.

Question 1.

You are provided with solution **P**, an oxidising agent, which liberates iodine when added to acidified aqueous potassium iodide. The iodine can then be titrated with aqueous sodium thiosulphate. The concentration of **P** can be calculated from the titration results.

Q is 0.l00mol/dm^3 sodium thiosulphate.

(a) Put **Q** into the burette.

Pipette a 25.0 cm^3 (or 20.0 cm^3) portion of **P** into a flask and add about a test-tubeful of dilute sulphuric acid followed by about a test-tubeful of aqueous potassium iodide. The solution should turn red-brown. **Do not add the starch indicator at this stage.**

Add **Q** from the burette until the red-brown colour fades to pale yellow, then add a few drops of the starch indicator. This will give a deep blue solution. Continue adding **Q** slowly from the burette, until one drop of **Q** causes the blue colour to disappear, leaving a colourless solution.

Record your results in the table, repeating the whole procedure as many times as you consider necessary to achieve consistent results.

Results

Burette readings

Titration number	**1**	**2**	**3**	
Final reading / cm^3				
Initial reading / cm^3				
Volume of Q used / cm^3				
Best titration results (√)				

Summary

Tick **(√)** the best titration results.

Using these results, the average volume of **Q** required was _____ cm^3.

Volume of solution of **P** used was _____ cm^3. **[12]**

(b) One mole of the oxidising agent in **P** produces sufficient iodine to react with five moles of sodium thiosulphate.

Q is 0.100 mol/dm^3 sodium thiosulphate.
Using your answer to (a). calculate the concentration, in mol/dm^3, of the oxidising agent in **P**. [2]

Concentration of the oxidising agent in **P** is _____ mol/dm^3.

(c) **P** was prepared by dissolving 3.2g of solid **P** in 1 dm^3 of distilled water. Calculate the relative molecular mass of compound **P**. [2]

The relative molecular mass of **P** is _____ .

Question 2.

You are provided with a sample of solution **X** and solid **Y**.
Carry out the following experiments and record your observations in the table. You should test any gas evolved.

Tests on Solution X

Test No.	Test	Observations
1.	(a) To a portion of solution X, add aqueous sodium hydroxide until a change is seen. (b) Add excess aqueous sodium hydroxide to the mixture from **(a).**	
2.	(a) To a portion of solution X, add aqueous ammonia until a change is seen. (b) Add excess aqueous ammonia to the mixture from **(a)**.	
3.	(a) To a portion of solution X, add an equal volume of aqueous silver nitrate. (b) Add dilute nitric acid to the mixture from **(a)**.	

4.	(a) To a portion of solution X, add equal volume of aqueous potassium iodide.	

[7]

Conclusions

The formula of the cation (positive ion) present in solution X is _____. [1]

The formulae of the anion (negative ion) present in solution X is _____ . [1]

Tests on Solid Y

Carry out the following experiments on solid Y and record your observations in the table. You should identify and name any gas evolved.

Divide the solid Y into 2 equal portions.
One portion of solid Y will be used in Test No. 5.
Dissolve the second portion of solid Y in a test-tube (3/4 full of distilled water) to form solution Y. Solution Y will be needed in Test No. 6 to 8.

Test No.	Test	Observations
5.	(a) To a portion of solid Y add concentrated hydrochloric acid until a change is seen. (b) Add distilled water to the mixture from (a) until a change is seen.	
6.	To a portion of solution Y add an equal volume of aqueous sodium carbonate.	
7.	(a) To a portion of solution Y add aqueous ammonia until a change is seen. (b) Add an excess of aqueous ammonia to the mixture from (a) and allow the mixture to stand for a few minutes.	

8.	(a) To a portion of solution Y add an equal volume of aqueous sodium hydroxide and allow the mixture to stand for a few minutes. (b) Filter the mixture from (a). To the filtrate add a piece of aluminium foil and warm gently.	

[13]

Conclusions

The anion in R is _____. [1]

Name the section of the Periodic Table in which you would expect to find the metal in R.

_____ [1]

~ The End ~

NOTES FOR USE IN QUALITATIVE ANALYSIS (5068/3)

Test for anions

anion	*test*	*test result*
carbonate (CO_3^{2-})	add dilute acid	effervescence, carbon dioxide produced
chloride (Cl^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt.
iodide (I^-) [in solution]	acidify with dilute nitric acid, then add aqueous lead(II) nitrate	yellow ppt.
nitrate (NO_3^-) [in solution]	add aqueous sodium hydroxide then aluminium foil; warm carefully	ammonia produced
sulphate (SO_4^{2-}) [in solution]	acidify with dilute nitric acid, then add aqueous barium nitrate	white ppt.

Test for aqueous cations

cation	*effect of aqueous sodium hydroxide*	*effect of aqueous ammonia*
aluminium (Al^{3+})	white ppt., soluble in excess giving a colourless solution	white ppt., insoluble in excess
ammonium (NH_4^+)	ammonia produced on warming	–
calcium (Ca^{2+})	white ppt., insoluble in excess	no ppt.
copper(II) (Cu^{2+})	light blue ppt., insoluble in excess	light blue ppt., soluble in excess giving a dark blue solution
iron(II) (Fe^{2+})	green ppt., insoluble in excess	green ppt., insoluble in excess
iron(III) (Fe^{3+})	red-brown ppt., insoluble in excess	red-brown ppt., insoluble in excess
lead(II) (Pb^{2+})	white ppt., soluble in excess giving a colourless solution	white ppt., soluble in excess
zinc (Zn^{2+})	white ppt., soluble in excess giving a colourless solution	white ppt., soluble in excess giving a colourless solution

Test for gases

gas	*test and test result*
ammonia (NH_3)	turns damp red litmus paper blue
carbon dioxide (CO_2)	turns limewater milky
chlorine (Cl_2)	bleaches damp litmus paper
hydrogen (H_2)	"pops" with a lighted splint
oxygen (O_2)	relights a glowing splint
sulphur dioxide (SO_2)	turns aqueous potassium dichromate(VI) from orange to green

Data Table on Page 6 has to be replaced by 5069/3 version.
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Lab Preparation

Question 1
June 1997 VA Question.

Question 2 (Y from Nov 1994)

X consists of $FeCl_3$ {$30cm^3$ of 0.5M $FeCl_3$)
Y – cobalt nitrate 50g/l $Co(NO_3)_2.6H_2O$ {$30cm^3$}

Special Reagent
Conc. HCl, aq. Na_2CO_3, Al foil, filter paper, silver nitrate solution, potassium iodide solution

Test 1 Most candidates correctly recorded that the solution changed colour from pink to purple/blue on the addition of concentrated hydrochloric acid. Addition of water then turned the solution pink again. The best answers were those that recognised that when the acid was added the colour went from pink to purple to blue. Several candidates talked of the solution becoming colourless on the addition of water and this was not penalised provided the change to pink had been noted earlier. There were a few precipitates, which did not score and several candidates reported layers which also lost marks. Teachers are asked to emphasise the importance of mixing at all times. The practical instructions do not specifically mention mixing as it is assumed that this is part of good practical technique.

Test 2 The majority of candidates reported the formation of a pink or purple precipitate. A wide range of colours was acceptable.

Test 3 The addition of aqueous ammonia produces a green or blue green precipitate which is not soluble in excess. Blue precipitate was not acceptable although if the precipitate did not dissolve in excess this second statement scored. Several candidates clearly decided that copper was present and therefore claimed the precipitate did dissolve thus loosing marks. Candidates should be encouraged to carry out the experiments carefully and record their actual results even if they seem unexpected. If the precipitate is allowed to stand, it settles and the solution above it turns brown and this was correctly observed by the better candidates. Many candidates wasted time in this part of the exercise by testing for ammonia which not surprisingly they were able to find.

Test 4 The reaction with sodium hydroxide produces a blue precipitate which rapidly turns pink before becoming an indistinct off-white colour. Good candidates saw these changes clearly and that the filtrate was colourless. Describing the filtrate as clear did not score a mark. A common error was to talk about a mixture of coloured precipitates rather than the precipitate changing colour. Addition of aluminium foil and warming causes the mixture to effervesce and the gases produced are ammonia, which turns litmus blue, *and* hydrogen, which 'pops' when lit. A disappointing number failed to report the observation 'effervesces' and contented themselves with the statement that ammonia was produced. Candidates are expected to make the observation, test for the gas and then to name the gas. Most candidates noticed the ammonia, far fewer the hydrogen and only a very small number appreciated that two gases are evolved.

Test 5 Addition of sodium chlorate(I) produces a black precipitate which was seen by the majority. Dark green and dark brown were also acceptable colours. Only a disappointing number recognised that the solution then effervesces slowly and produces chlorine which bleaches litmus. Test 5 was the worst done part of the exercise, several Centres appeared to have difficulties in preparing the solution of sodium chlorate(I).

Conclusion

Most candidates correctly identified nitrate (NO_3^-) as the anion. To score this mark they had to have found ammonia in Test 4. The metal was usually described as being a 'Transition' metal, although a few referred to it as being in the 'Third Period' which was not acceptable.