Cambridge O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

8538059393

CHEMISTRY **5070/32**

Paper 3 Practical Test **October/November 2016**

1 hour 30 minutes

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
Qualitative Analysis Notes are printed on page 8.
You should show the essential steps in any calculations and record experimental results in the spaces provided on the Question Paper.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
Total	

This document consists of **6** printed pages and **2** blank pages.

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CAMBRIDGE
International Examinations

[Turn over

1 The percentage by mass of iron in steel can be determined by converting all the iron in the steel into aqueous iron(II) ions and titrating portions of the solution with aqueous potassium manganate(VII).

No indicator is needed for this titration as the products of the reaction are almost colourless and one drop of aqueous potassium manganate(VII) in excess produces a permanent pale pink colour.

P is an aqueous solution of iron(II) ions, Fe^{2+}. The solution was prepared by converting all the iron in a 3.12 g sample of steel into iron(II) ions and making the final volume up to 500 cm^3 by adding water.

Q is 0.0200 mol/dm^3 potassium manganate(VII).

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

The colour of **Q** makes it difficult to see the bottom of the meniscus so you should take all your readings using the top of the meniscus.

Pipette a 25.0 cm^3 (or 20.0 cm^3) portion of **P** into a flask.

Add **Q** from the burette. At first the purple colour disappears quickly but as more **Q** is added the colour disappears less quickly. At the end-point, one drop of **Q** produces a pale pink colour that does not disappear on swirling.

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

Results

Burette readings

titration number	1	2	
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 **P** used was .... cm^3. [12]

(b) **Q** is 0.0200 mol/dm^3 potassium manganate(VII).

Calculate the number of moles of potassium manganate(VII) present in the average volume of **Q** required.

number of moles of potassium manganate(VII) ....[1]

(c) Using your answer from **(b)**, calculate the number of moles of iron(II) ions present in the volume of **P** used in each titration.
[Five moles of iron(II) ions react with one mole of potassium manganate(VII) ions].

number of moles of iron(II) ions ....[1]

(d) Using your answer from **(c)**, calculate the number of moles of iron(II) ions in 500 cm^3 of **P**.

number of moles of iron(II) ions in 500 cm^3 of **P** ....[1]

(e) Using your answer from **(d)**, calculate the mass of iron in the 3.12 g sample of steel.
[The relative atomic mass of iron is 56.]

mass of iron in 3.12 g of the steel .... g [1]

(f) Using your answer from **(e)**, calculate the percentage by mass of iron in the steel.

percentage by mass of iron in the steel .... % [1]

[Total: 17]

2 You are provided with solution **R** and solid **S**.
Carry out the following tests and record your observations in the table.
You should test and name any gas evolved.

test no.	test	observations
1	**(a)** To 1 cm depth of **R** in a boiling tube, add a drop of methyl orange indicator. **(b)** To the mixture from **(a)**, add about twice the volume of aqueous sodium hydroxide. Keep this mixture for use in test **2**.	
2	To the mixture from test **1**, add a piece of aluminium and warm the boiling tube until reaction just begins.	
3	**(a)** To 1 cm depth of **R** in a test-tube, add an equal volume of aqueous potassium iodide. Warm the mixture. **(b)** Allow the mixture to cool and then add a few drops of aqueous starch.	
4	To 2 cm depth of **R** in a boiling tube, add a small amount of copper(II) oxide and then gently warm the mixture.	

test no.	test	observations
5	To 2 cm depth of **R** in a test-tube, add a small amount of **S**. Keep this solution for use in tests **6** and **7**.	
6	Transfer about half of the solution from test **5** to a test-tube and add aqueous sodium hydroxide until no further change occurs.	
7	To the rest of the solution from test **5** in a test-tube, add aqueous ammonia until no further change occurs.	
8	To a small amount of **S** in a hard-glass test-tube, add an equal amount of ammonium chloride and mix the solids together. Heat the mixture.	

[19]

Conclusions

Give the formula of a cation and the formula of an anion in **R**.

The formula of a cation in **R** is ....

The formula of an anion in **R** is ....

Give the formula of a cation and the formula of an anion in **S**.

The formula of a cation in **S** is ....

The formula of an anion in **S** is .... [4]

[Total: 23]

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QUALITATIVE ANALYSIS NOTES

Tests 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 silver nitrate	yellow ppt.
nitrate (NO_3^-) [in solution]	add aqueous sodium hydroxide then aluminium foil; warm carefully	ammonia produced
sulfate (SO_4^{2-}) [in solution]	acidify with dilute nitric acid, then add aqueous barium nitrate	white ppt.

Tests 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., or very slight white 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
zinc (Zn^{2+})	white ppt., soluble in excess giving a colourless solution	white ppt., soluble in excess giving a colourless solution

Tests 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