NAME:	INDEX NO:
SCHOOL:	STREAM:

233/3 CHEMISTRY THEORY PAPER 3



SERIES 13 EXAMS

INSTRUCTIONS TO CANDIDATES

- Write your name and index number in the spaces provided above.
- Answer ALL the questions in the spaces provided in the question paper.
- You are NOT allowed to start working with the apparatus for the first 15 minutes of the 2 ½ hours allowed for this paper. This time it to enable you to read the question paper and make sure you have all the chemicals and apparatus that you may need.
- All working MUST be clearly shown where necessary
- Mathematical tables and electronic calculators may be used.

FOR EXAMINER'S USE ONLY

QUESTION	MAX. SCORE	SCORE
1	20	
2	14	
3	6	
TOTAL SCORE	40	



- 1. You are provided with: -
 - 4.5g of solid A in a boiling tube.
 - Solution B, 0.06M acidified Potassium manganate (VII)

You are required to determine

- (1) The solubility of solid A at different temperatures.
- (2) The number of moles of water of crystallization in solid A.

PROCEDURE

- (a) Using a burette, add 4cm3 of distilled water to solid A in the boiling tube. Heat the mixture while stirring with the thermometer to about 70°C. When the entire solid has dissolved, allow the solution to cool while stirring with the thermometer. Note the temperature at which crystals of solid A firs appear. Record this temperature in table 1.
- (b) Using the burette, add 2cm³ of distilled water to the contents of the boiling tube. Warm the mixture while stirring with the thermometer until all the solid dissolves. Allow the mixture to cool while stirring. Note and record the temperature at which crystals of solid A firs appear.
- (c) Repeat procedure (b) two more times and record the temperatures in table I. Retain the contents of the boiling tube for use in procedure (e)
- (d) (i) Complete table 1 by calculating the solubility of solid A at the different temperatures. The solubility of a substance is the mass of the substance that dissolves in 100cm³ (100g) of water at a particular temperature. (6 marks)

Table 1

Volume of water in the boiling	Temperature at which crystals	Solubility of solid A (g/100g
tube (cm ³)	of solid A first appear (⁰ C)	water)
4		
6		
8		
10		

(ii) On the grid provided, plot a graph of the solubility of solid A (ve temperature).	ertical axis against (3 marks)
(iii) Using your graph, determine the temperature at which 100g of solid A 100cm ³ of water.	would dissolve in (1 mark)
(e) (i) Transfer the contents of the boiling tube into a 250ml volumetric fla	ask. Rinse both the

(e) (i) Transfer the contents of the boiling tube into a 250ml volumetric flask. Rinse both the boiling tube and the thermometer with distilled water and add to the volumetric flask. Add more distilled water to make up to the mark. Label this solution A. Fill a burette with solution B. Using a pipette and a pipette filler, place 25.0cm³ of solution A into a conical flaks. Warm the mixture to about 70°C. Titrate the hot solution A with solution B until a permanent pink colour persists. Record your readings in table 2. Repeat the titration two more times and complete table 2. (Retain the remaining solution B for use in question 3).

Table 2

Final burette	reading			
Initial burett				
Volume of s	olution B used (cm ³)			
(ii) Calculate	e the:			(3 marks)
I. A	Average volume of solution B	used.		(1 mark)
		• • • • • • • • • • • • • • • • • • • •		
		• • • • • • • • • • • • • • • • • • • •		
II. N	Number of moles of potassium	n manganate (VII)	used.	(1 mark)
III. N	Number of moles of A 250	cm ³ of solution	A given that 2 m	oles of potassium
n	nanganate (VII) react comple	tely with 5 moles	of A.	(1 mark)
	D.1.4. C. 1. C.			(2 1)
VI.	Relative formula mass of	A.		(2 marks)
••••••		• • • • • • • • • • • • • • • • • • • •		•••••

II

III



(iii)		Determine the value of x in the formula given 0.0 and atomic masses of oxygen and hydrogen	
2.		P contains two cations and one anion. Carry out ons and inferences in the spaces provided.	
(a) (b)	filter the mixture into conical flask. Retai	roxide to all of solution P provided. Shake well n both and the residue.	
	vations	Inferences	
	(1 mark)	(1 mark)	
	To about 2cm ³ of the filtrate, add 2m nitracid). Retain the mixture.	ic acid dropwise until in excess (i.e. about 1cm ³	
Obser	vations		
(1 ma	rk)		
	e the mixture in b(i) above into two portion the first portion, add aqueous sodium hyd		
Obser	vations	Inferences	
(1 ma	rk)	(2 marks)	

(iii) To the second portion, add aqueous ammoni	a drowise until in excess.
Observations	Inferences
(1 mark)	(1 mark)
(c) To 2cm ³ of the filtrate, add 3 drop of pota	assium iodide solution.
Observations	Inferences
(1 mark)	(1 mark)
(d) To 2cm ³ of filtrate, add 3 drops of acidifi	ed harium nitrate solution
(d) To 2cm ³ of filtrate, add 3 drops of acidifi	
(d) To 2cm ³ of filtrate, add 3 drops of acidifications	ed barium nitrate solution. Inferences
Observations (1 mark)	Inferences (1 mark)
Observations	Inferences (1 mark)
Observations (1 mark)	Inferences (1 mark) acid and allow it to filter into a boiling tube.
Observations (1 mark) (e) To the residue in (a) add 8cm ³ of dilute nitric	Inferences (1 mark) acid and allow it to filter into a boiling tube.
Observations (1 mark) (e) To the residue in (a) add 8cm³ of dilute nitric (i) To 2cm³ of this filtrate, add aqueous ammonia	Inferences (1 mark) acid and allow it to filter into a boiling tube. a dropwise until in excess.
Observations (1 mark) (e) To the residue in (a) add 8cm³ of dilute nitric (i) To 2cm³ of this filtrate, add aqueous ammonia	Inferences (1 mark) acid and allow it to filter into a boiling tube. a dropwise until in excess.
Observations (1 mark) (e) To the residue in (a) add 8cm³ of dilute nitric (i) To 2cm³ of this filtrate, add aqueous ammonia	Inferences (1 mark) acid and allow it to filter into a boiling tube. a dropwise until in excess.
Observations (1 mark) (e) To the residue in (a) add 8cm³ of dilute nitric (i) To 2cm³ of this filtrate, add aqueous ammonia	Inferences (1 mark) acid and allow it to filter into a boiling tube. a dropwise until in excess.
Observations (1 mark) (e) To the residue in (a) add 8cm³ of dilute nitric (i) To 2cm³ of this filtrate, add aqueous ammonia	Inferences (1 mark) acid and allow it to filter into a boiling tube. a dropwise until in excess.

3. Dissolve all of solid G in about 10cm^3 of distilled water in a boiling tube. Use the solution for tests (a) to (c) below.



(a) Place 2cm ³ of the solution in a test manganate (VII), solution B from the be	tube and add 2 drops of acidified potassium arette.
Observations	Inferences
October various	Intercinces
(1 mark)	(1 mark)
(b) To 2cm ³ of the solution in another test-	tube, add 2-3 drops of bromine water.
Observations	Inferences
(1 mark)	(1 mark)
(c) To 2cm ³ of the solution in a third test powder provided.	t-tube add a spatula full of the sodium hydrogen
Observations	Inferences
(1 mark)	(1 mark)

		1	1		17	11:	++++				T			77		DE:	17.7	T	7.7.7	774		-		* + =	7 7 4	4-	10000				100
	THE			11	++			tt	194	4.4	1	1-1-1			1.1.	111		1			317	T	Timb		1 1	7		1 *	100		
	TIT	TT	Fig. 1	1	1		1	111		-	4	4.64			1 1	11	11			1		1		117		1	ing. i	1 1		+-	1
	11:11	17.11	111	257	11	7375	-	11			-	1	1.1	111	1.1		1		15 20 1			1		173	111	1	9 100	1		1	
	TITT	7777	777				+++				++	111	14	11.								1	17	112	1777	7	14-6	1	-44	. !	.14
1111				111	104-	-1-1-	1-1-1	****	-1	4	4	i i	- 4	1.1			FF	[]	FTT	177	77	-1-	75.	11:		77	1			+ +	
			i i i i i	TTT	++-				1.1	14	4			1.5									100	1	****	-1		-		4-1	4.4
TIII	TITE	1		1	11			+	11	-		-14		1.	1.7	1	1	11		TT		1		1	7797	1		1	-1-1-	1.	44
		- totale		r fris	4-1-		-	4 44	-	11	1		1	1.1		11	11					1	10 11	1:	1-4-1	177	14+		-	was.	
Titt					1	++	-	111	1	11	1		11	11	10	11	TT					-		11	** *	4		1-1-1	-14		-
111	TITL	1	77	-	11	-	100		+	+	11.	1	1.1	11		3.0	T-I	1				1		++	114	1 1		111	-		
TIT			1	-	1 17	4	+++		-	14.	Ц.	44.1	11		1.1					177	77	1	130	1	100	+-	- toda		-1-4	4.4	44
THE	THE		7.	-	1-1			1-2-1	-	++-	1.	1.1.1		1.1.	1			9		17	II.			10	* 444	1	In.			44	4.3
		i arr		1-1-	-	+ ! !	1-1-		1.5.	1.		1.1.1	_1	11				28		1	T		111	1	1 1	+		1-1-4		1-4	
	CCCI:	1777		-1-1-	Fri	+++	++-					111	4.1	1						177	13			17	70	1000		1.1		1.,	
1.1.1.1	111				1	113	10		11	+	1-1-	114	1-1	-		-	CE.		1.7	177	00				-+-	777				++	++
111	111					100	11	111	-1-4-	4-1-	1-1-		++	4	1		1		11			1		1		4	111	177	TIT	1	4
		1	8			177	-	111	1 .	1-1-	4		L	11.	-	11	4.2.4	111				1			11	1	11	1	TT	1-7	4
	1 1	1 .			3	11	11	100	++	14.		-	11			- 1	1.1.1			11	1	1	al de		- 61	1		1 7 7	71	1.	
1.1				150	7		-	11	1	1 1	-	++	-			1.1	1	401	13	1188	1 1	1				1		1	-	51	· in L
-		1 1 1 1		111	1	111	1-1-	-	-1	17	-	1 -	-	1		14		1	1			100	1000		Post.	1	11	111	11	1	11
		1111		1		+++	11	++	++	14	-		-	1		-	111					1			1	1 1	11	100	700	1	1
				11885	17.	117	*		7-1-			-1-1-	+	111			1 1 2						The same		1	111	111	1	4	1	4
					-	4-1-4	-	-	+	-	14	-	14	14	-	41						1				1	4.1	****	++	1 :	14
		7777	777		77	TTT			-1			-++	44	444								-		THE		1-1-1		1	11.4	4-1-	1
1.1.1		1		STE	1	***	1		+-			44.	11	1	14	41	1					1		TT		135	7	775			+ 4
					1	Tit	1-1-					-	-		4.1		1 1	1	11	83.1	8 8	T.				1	11	177	-	1	4-1
111					-	111	++	11	-2		+	++	14	1-1-1	-	1.6	1				2	1	He/II			111			+++	-	++
		1		111	1	Titl	7.34	+-	1		-		Section 2	1 1 4	-	11	1				308					13	1	100	-	2-4-	24
		111		111	1	111	1 : :	-	1	-	-		1 5	111			1.1	11			11	1	THE	13		1			++1	-	++
					* *	4-1-1	1-1-1	* *	+	1				1.1.1		14	- 1	11			90%		1.44	160	stoly.	1	the l		3048		1
		1 3 1		TH	11	111	- reject	-++	1-1-		-		-L	1.1.1	4	1 1	1	7 4			21	1		288		111		11	+ + +	++-	++-
	1111	1		TI	17.3	111	1	1	-	2.4	+		1.1	1 1	44	11.	- 1		13	SIGH		0.1	A SE			17	1:11	11	1-1-4	-	fit:
			171	111	T	TIT	1-1-1	+	T-in-		+	-	1	1	1		1	1.1		48		1	4 330				101	1	111	+	4 4
		7777			1	+++	+	77	4			+4.	4.	144				LE	3.10				3.5	133			1 1	-	117	+	14
1-1-1		1.1.1.1		100	1	TIT	171	TT	1	1	++	11		1-1-4		4-1-2	4-	-	100			1			TI	7.7	77.7			- 4-	
1		1 1 1 1			1	TIT	177	11	117	+	-	++	4		14	44	1.1		1		1 1	1.							177	-	
				111			711	T	1"	1	++	++	1		44	1.1.	1	4.4	1.			1		CE.			4.4		1	1	-
		1111					Titl	77	1-1-1	-	14	++-			++	44.		4					THE	1.53		5 3 3 7	135		1		1
1-1-1-1		1111			4 6	111	111	11	11	-	+	1	-	-	-	qui.	5.1	11			212	1	I I	199	HOLE					1	1
1111			1 1		1		111		11	11	++	44-	1	++			4!	1.	11	11		T	Editor.	0903				1			
4441	Hill			ESEC			171	117	T	11	1-1-	+++	·i-		11		1.					1					15		11		1-2-
1		L	1 1	111	1		111	77	! inti	+++	+++	1			44.		11		10	1		1		1/2	1	1		-		1	1
	LLLL	1111		TIT	1		111	111	111	***	++	1-1-1	+	100	4+	111		10.10	1.1.1	+ +	i de	1			1 1 1	101	7 1	100	100	1	
				TIT	6	111	111	77-			++	+++			1-	-1-1						1		1			m	111	7	-1-4	+
444	1111				11	1	111	****		- in-	++		+-		1			1.1.								77	-	77		- 1	-
	and were been being as	LILL			11	TT	111	1+-	111	11	++		-4-		1-	144		i.i.	1.1.1				111	153			1	1111	1 1	1	***
14.1.1	1.1	1 1	1 1	111	1		TIT		1	++		1-1-1		++	1	1	11	1.1.	1 4							104		1 1-	1	11	et-
1 1	1111					TT	TIT		1	11	1	111			1	1	1.1	1.0							111			1 1	TY	-	et i
1.1.1		1111		111	1		TIT	1+		++	1	+ 1	4-			111	1	11	1 1						177	TE		Tri	11	-1-1	11
111			111	Tir	1	111	TTT	7-1-	H	40	++	1	-4.	44	14.		4.1.	9		1 3			13.1	1		1.1	1	17		1 1	
1					T	1	111	11		10	+	+++	+	-	1.	1	1.1				1			is.			7	1 1	11	4-4	-
4-1-1-1	111			111	1	T	17-1-		+++	++	11-		4-1	11	1.	1.1	1.			11					1	117	17	111	T	+	de
المرام لمرام			111.		7.1.			11		-	++-	111		4.4	1.	4.1	11						1837		1	73	1.	1	++	+	
				-					10.00		on the re-	i	- l- i		20.1	1001000	VIETO VIETO		000 000		100		-	THE STATE OF	100	24 - 20		Section 4		4-1	1

