Centre No.					Paper Reference					Surname	Initial(s)		
Candidate No.					6	2	4	4	/	0	1	Signature	
	Paper Reference(s) 6244/01 Examiner's use only												

6244/01	
Edexcel	GCE
Chemistry	

Advanced

Unit Test 4

Thursday 12 June 2008 – Afternoon

Time: 1 hour 30 minutes

Materials required for examination	Items included with question papers
Nil	Nil

Candidates may use a calculator.

Instructions	to	Candidates
mon actions	w	Canulate

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature.

Check that you have the correct question paper. The paper reference is shown above.

Answer **ALL** the questions. Write your answers in the spaces provided in this question paper. Do not use pencil. Use blue or black ink.

Show all the steps in any calculations and state the units.

Information for Candidates

The total mark for this paper is 75. The marks for individual questions and parts of questions are shown in round brackets: e.g. (2). There are 20 pages in this question paper. Any blank pages are indicated

A Periodic Table is printed on the back cover of this booklet.

Advice to Candidates

You are reminded of the importance of clear English and careful presentation in your answers.

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 $\begin{array}{c} {\rm Printer's\,Log.\,No.} \\ N30394A \\ {\rm W850/R6244/57570} & 7/7/7/3/3/12,100 \end{array}$





Turn over

Total

Team Leader's use only

Question Number

1

2

3

4

5

6



Answer ALL the questions. Write your answers in the spaces provided.

1. Compound V, the structure of which is shown below, is found in human sweat.

(a) Compound V contains two functional groups.

Compound V

Identify both functional	groups and	state a chemical	test for each.	The result of each

test should also be included in your answer.

One functional group in V

Test and result

The other functional group in V

Test and result

2

(1)

(b) Compound V can be converted into two carbonyl compounds W and X, shown below.

(i) Which of the compounds W or X would react when warmed with Fehling's solution to give a red precipitate? Justify your answer.

(ii) Compound **W** can be reduced in two steps to compound **Y** of molecular formula $C_2H_6O_2$.

Identify Y.

(iii) Compound ${\bf W}$ can be oxidised to compound ${\bf Z}$ of molecular formula $C_2H_2O_4$. Identify ${\bf Z}$.

(1)

		blank
(c) The compounds Y and Z react together under suitable conditions to form a poly	mer.	
(i) Draw the structural formula of the repeating unit for the polymer formed.		
	(2)	
	(2)	
(ii) What type of polymerisation reaction occurs between compounds Y and Z?		
	(1)	Q1
(Total 10 ma		Q1

Leave

	Element	sodium	phosphorus	sulphur
	Formula of the oxide			
				(3)
-	For each of the oxides the show its reaction with wa		± , , , .	vrite an equation to
	(i) Equation for the read	ction of the oxide o	f sodium with water.	
				(1)
	(ii) Equation for the read	ction of the oxide o	f phosphorus with wa	ter.
				(1)
	(iii) Equation for the read	ction of the oxide o	f sulphur with water.	
				(1)
	Suggest why tin(II) chloride does no			Fe ³⁺ ions, whereas
				(2)
l)	Silicon tetrachloride, SiC	Cl ₄ , hydrolyses rapid	lly in cold water.	
	Give an equation for this	reaction. State syr	mbols are not required	d.
				(2)
				(Total 10 marks)

Leave blank

3. Consider the equilibrium

$$N_2O_4(g) \implies 2NO_2(g)$$
 $\Delta H = +58 \text{ kJ mol}^{-1}$

(a) Write the expression for the equilibrium constant, K_p , for the above reaction.

(1)

(b) (i) An equilibrium mixture contains a mole fraction of dinitrogen tetroxide, N_2O_4 = 0.20, and nitrogen dioxide, NO_2 = 0.80. The total pressure of this mixture is 1.1 atm.

Calculate K_p at this temperature, stating its units.

(3)

(ii) Calculate the total pressure required to reduce the mole fraction of N_2O_4 to 0.10.

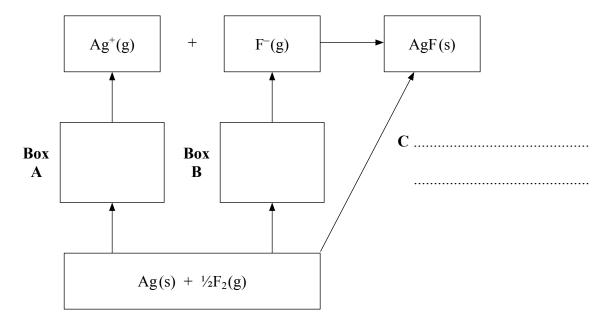
(3)

	(1)
(ii)	Use your answer to (c)(i) to explain the effect of increasing the temperature on the position of equilibrium.
	(2)
	(Total 10 marks)

4. (a) The following data were collected to use in a Born-Haber cycle for silver fluoride, AgF.

	Value / kJ mol ⁻¹
enthalpy of atomisation of silver	+285
first ionisation energy of silver	+731
enthalpy of atomisation of fluorine	+79
enthalpy of formation of silver fluoride	-205
lattice energy of silver fluoride	-958

(i) On the following outline of a Born-Haber cycle, complete boxes **A** and **B** by adding the formula **and** state symbol for the appropriate species. Write the name of the enthalpy change at **C**.



(3)

8

	Leave blank
(ii) Use the data to calculate the first electron affinity of fluorine.	
(2)	
QUESTION 4 CONTINUES ON THE NEXT PAGE	
QUESTION 4 CONTINUES ON THE NEXT TAGE	

(b)	ΔH_{latt}	(theoretical)	is	the	lattice	energy	calculated	assuming	the	crystal	lattice	is
	compl	letely ionic.										

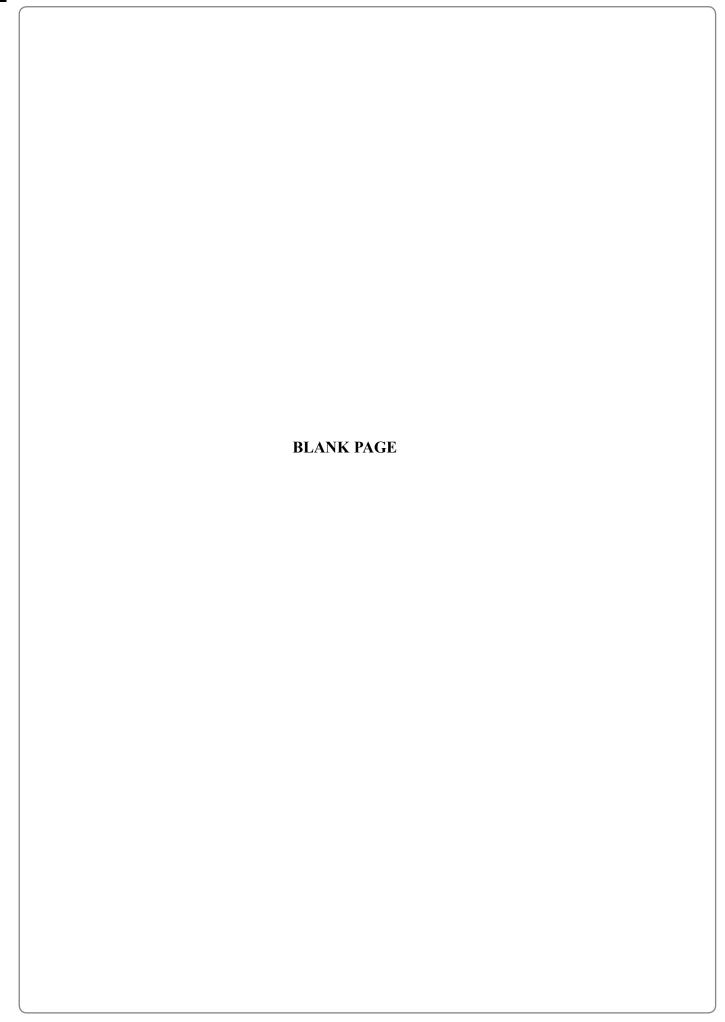
 ΔH_{latt} (experimental) is the lattice energy determined experimentally using the Born-Haber cycle.

Values for the silver halides are listed below.

Formula of halide	ΔH_{latt} (theoretical)	$\frac{\Delta H_{\text{latt}}}{\text{(experimental)}}$	ΔH_{latt} (theoretical) minus ΔH_{latt} (experimental)
manac	/ kJ mol ⁻¹	/ kJ mol ⁻¹	/ kJ mol ⁻¹
AgF	-920	-958	38
AgCl	-833	-905	72
AgBr	-816	-891	75
AgI	-778	-889	111

(i)	Explain why the theoretical lattice energies become less exothermic from AgF to AgI.
	(3)
(ii)	Explain why the values of the theoretical and experimental lattice energies are different.
	(2)

	•••••			
				(2)
(c) (i)		the data below to calculate a value ution, for silver fluoride.	for the enthalpy	change of solution,
				1
			Value / kJ mol ⁻¹	
		lattice energy of AgF(s)	-958	
		enthalpy of hydration of Ag ⁺ (g)	-464	
		enthalpy of hydration of F ⁻ (g)	-506	
				(2)
(ii)	-	your answer to part (c)(i) to sugg de, AgF, to be soluble or insoluble in		vould expect silver
(ii)	-			vould expect silver
(ii)	-			vould expect silver
(ii)	-			vould expect silver



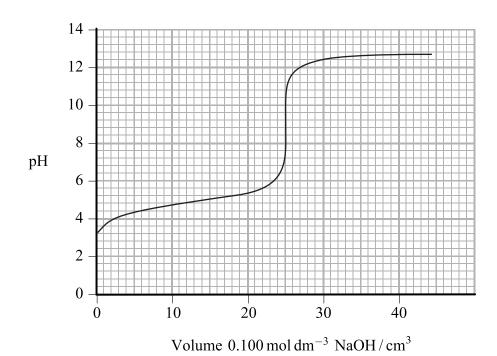
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5.	(a)	The values of the ionic product of water, $K_{\rm w}$, at two different temperatures are shown
		in the table below.

Temperature / °C	$K_{\rm w}$ / mol ² dm ⁻⁶
25	1.00×10^{-14}
50	5.48×10^{-14}

I		2.10 / 10	
rite an eq	uation to represent the	e ionisation of water.	
			(1)
rite the ex	Expression for $K_{\rm w}$.		
••••••			(1)
efine the t	term pH .		
			(1)
alculate th	ne pH of pure water at	50 °C.	
			(2)
xplain wh	y pure water at 50 °C	is neutral despite the fa	act that its pH is not 7.
			(1)
	efine the the	rite the expression for $K_{\rm w}$. efine the term pH . cloulate the pH of pure water at	

(b) The pH curve shown below was obtained when a 0.100 mol dm⁻³ solution of sodium hydroxide was added to 25.0 cm³ of a 0.100 mol dm⁻³ solution of ethanoic acid.



(i) What volume of sodium hydroxide solution is required to neutralise half of the ethanoic acid in this reaction?

(ii) Use the graph to determine the pH when the volume of sodium hydroxide you have stated in part (i) has been added.

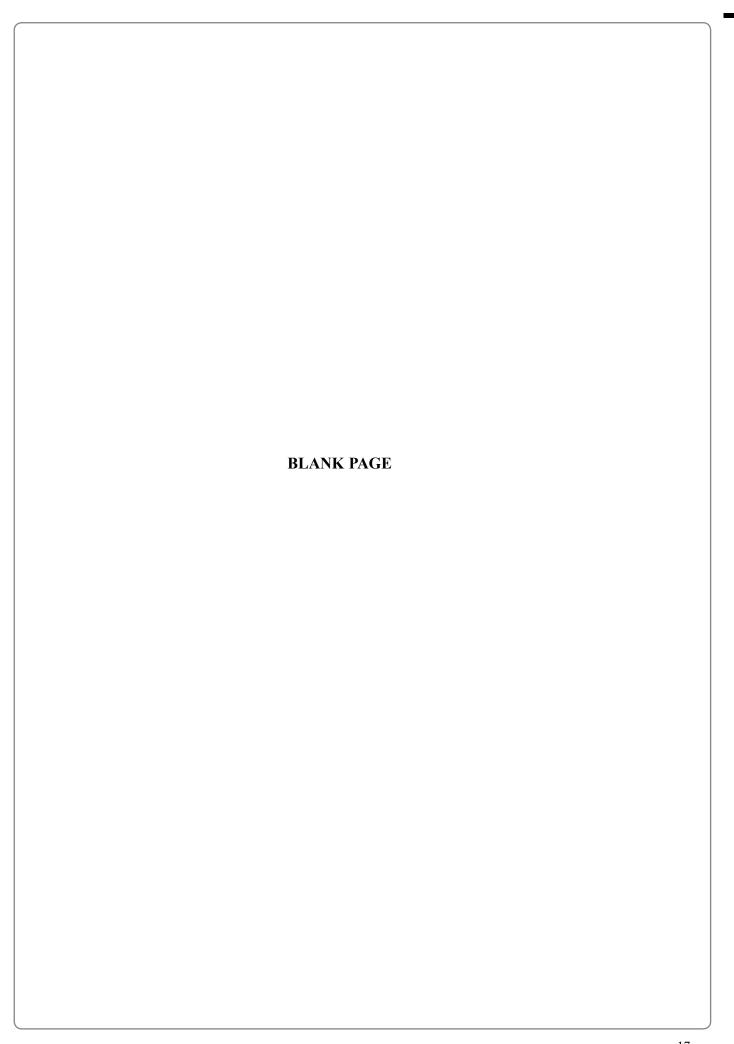
pH is(1)

(iii) Write an expression for the acid dissociation constant, K_a , of ethanoic acid, CH₃COOH.

(1)

(iv) He ways anguage to norte (ii) and (iii) to determine the value of V for the value.
(iv) Use your answers to parts (ii) and (iii) to determine the value of K_a for ethanoic acid at the temperature of the titration. Give your answer to two significant figures.
(2)
Phenolphthalein is a suitable indicator for a titration between ethanoic acid and sodium hydroxide solutions whereas methyl orange is not a suitable indicator.
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Phenolphthalein is a suitable indicator for a titration between ethanoic acid and sodium hydroxide solutions whereas methyl orange is not a suitable indicator. Explain why this is so.

Acid	$\Delta H_{ m neut}^{\oplus}$	
	/ kJ mol ⁻¹	
hydrochloric acid, HCl	-57	
nitric acid, HNO ₃	-57	
hydrocyanic acid, HCN	-12	
propanoic acid, CH ₃ CH ₂ COOH	-51	
hat conclusion can you draw from the faid is so much less exothermic than that		
		value of hydrocyanic
		value of hydrocyanic
		value of hydrocyanic cid?



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6. (a) (i) Ethanal, CH₃CHO, can be converted into 2-hydroxypropanoic acid, CH₃CH(OH)COOH.

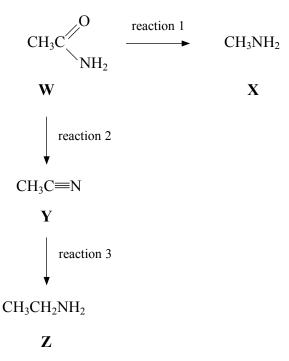
State the reagents and conditions needed for **each** step in this synthesis.

(ii) Draw the structural formula of the organic product of the reaction between ethanal and ethylmagnesium bromide, C_2H_5MgBr , followed by acidification.

(1)

(4)

(b) Consider the following reaction scheme involving several compounds, labelled W, X, Y and Z.



(i)	Give the names of compounds W, X and Y.
	Name of W is
	Name of X is
	Name of Y is
	(3)
(ii)	Identify the reagents used for
	Reaction 1
	Reaction 2
	Reaction 3
	(3)
(iii	State the type of reaction which occurs in
(111)	Reaction 2
	Reaction 3
	(2)
	(Total 13 marks)
	TOTAL FOR DARED, 75 MADIZO
	TOTAL FOR PAPER: 75 MARKS
	END



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