Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	2	5	2	/	0	1	Signature	

Paper Reference(s)

6252/01

Edexcel GCE

Chemistry (Nuffield)

Advanced Subsidiary

Unit Test 2

Wednesday 7 June 2006 – Morning

Time: 1 hour 30 minutes

Materials required for examination
Nil

Items included with question papers
Passage for Section B

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
Total	

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and your signature.
Answer ALL questions in Section A and Section B. Write your answers in the spaces provided in this question paper.
The passage for Section B is provided on a separate sheet.
Final answers to calculations should be given to an appropriate number of significant figures. All blank pages are indicated.

Information for Candidates

A Periodic Table is printed on the back cover of this paper.
The marks for individual questions and the parts of questions are shown in round brackets: e.g. (**2**).
The total mark for this paper is 60. There are 16 pages in this paper.
Calculators may be used.

Advice to Candidates

You are advised to show all steps in any calculations.
You should aim to spend no more than 55 minutes on Section A and 35 minutes on Section B.
You will be assessed on your ability to organise and present information, ideas, descriptions and arguments clearly and logically, taking into account your use of grammar, punctuation and spelling.
Up to 2 marks will be awarded for the Quality of Written Communication used in Section B.

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Answer ALL the questions in Section A and Section B.
Write your answers in the spaces provided.

SECTION A

You should aim to spend no more than 55 minutes on this section.

1. The element iodine can be produced from the mineral Chile saltpetre, which contains sodium iodate, $NaIO_3$. The iodate ions are converted to iodine in a two-step process.

Ionic equations for the reactions are shown below.

Step 1 $IO_3^-(aq) + 3HSO_3^-(aq) \rightarrow I^-(aq) + 3HSO_4^-(aq)$

Step 2 $IO_3^-(aq) + 5I^-(aq) + 6H^+(aq) \rightarrow 3I_2(aq) + 3H_2O(l)$

(a) (i) Describe a test you could carry out to confirm the presence of iodide **ions** in a solution. Indicate the result of the test.

Test .....

.....

Result .....

.....

(2)

(ii) Identify the TWO elements in **Step 1** which show a change of oxidation number during the reaction.

Give their initial and final oxidation numbers.

First element ..... Second element .....

Initial oxidation number ..... Initial oxidation number .....

Final oxidation number ..... Final oxidation number .....

(3)

(iii) The equation for **Step 1** shows that 1 mole of iodate ions, IO_3^-, reacts with 3 moles of hydrogensulphite ions, HSO_3^-. Show that your answers to (ii) agree with this ratio.

(1)

Leave blank

(b) An experiment was carried out to determine the concentration of the iodine prepared in **Step 2**.

A 10.0 cm^3 portion of the iodine solution was titrated with sodium thiosulphate solution of concentration 0.0100 mol dm^{-3}. The volume of sodium thiosulphate solution added at the end-point was 24.0 cm^3.

The equation for the reaction is

$$I_2(aq) + 2Na_2S_2O_3(aq) \rightarrow 2NaI(aq) + Na_2S_4O_6(aq)$$

(i) What piece of apparatus would you use to measure out the 10.0 cm^3 portion?

.....

(1)

(ii) Suggest a suitable indicator to show the end-point of this titration. State the colour change you would see.

Indicator .....

From ..... to .....

(2)

(iii) Calculate the number of moles of sodium thiosulphate used in the titration.

(1)

(iv) Calculate the number of moles of iodine which reacted with the sodium thiosulphate solution.

(1)

Leave blank

(v) Calculate the concentration, in mol dm^{-3}, of the iodine solution.

(1)

Q1

(Total 12 marks)

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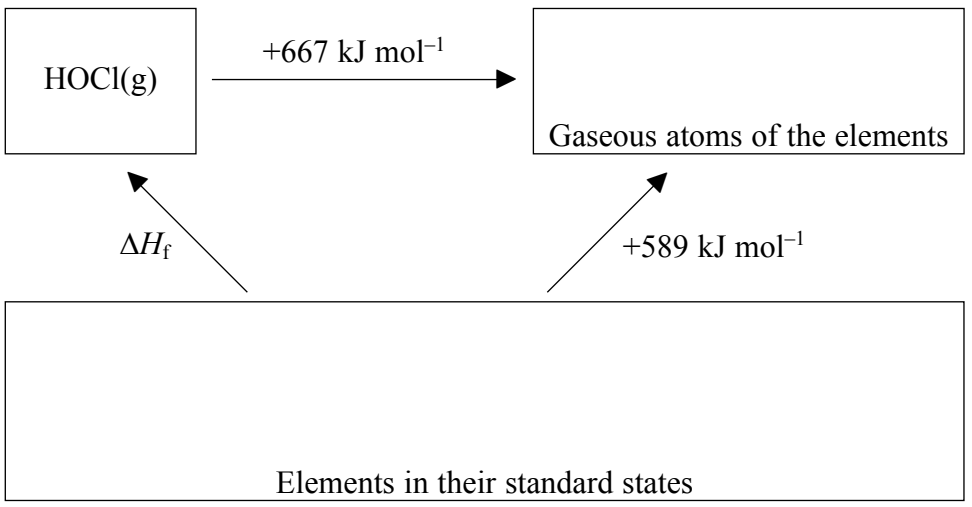
2. The Hess cycle below can be used to estimate the enthalpy change of formation, ΔH_f, of the unstable gaseous compound with the formula HOCl(g).



(a) (i) Insert formulae, with state symbols, into the appropriate boxes, to show the correct quantities of each element.

(1)

(ii) Use the cycle to calculate a value for the enthalpy change of formation, ΔH_f[HOCl(g)].

(1)

(iii) Assuming that the H–O bond energy is +464 kJ mol^{-1}, calculate a value for the O–Cl bond energy.

(1)

Leave blank

(b) (i) Draw a ‘dot and cross’ diagram for the HOCl molecule showing outer electrons only.

(2)

(ii) Predict the HOCl bond angle. Justify your answer.

Angle .....

Justification .....

.....

.....

.....

.....

(2)

(c) HOCl(g) can be made from chlorine(I) oxide by the reversible reaction

$$Cl_2O(g) + H_2O(g) \rightleftharpoons 2HOCl(g)$$

What effect, if any, would an increase in pressure have on the proportion of HOCl(g) at equilibrium? Justify your answer.

.....

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.....

(2) **Q2**

(Total 9 marks)

Leave blank

3. Two reactions of a chloroalkane, **X**, are shown below.

Propan-2-ol ← **Reaction 1** — Chloroalkane **X** — **Reaction 2** → $CH_2{=}CHCH_3$ propene

(a) The chloroalkane **X** can be used to make propan-2-ol in **Reaction 1**.

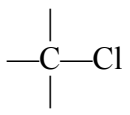
(i) Name and draw the **displayed** formula of the chloroalkane **X**.

Name .....

Displayed formula

(2)

(ii) **Reaction 1** is an example of nucleophilic substitution. The nucleophile is the hydroxide ion. Use the diagram below to show how it is able to attack the chloroalkane **X**.



(2)

(b) (i) What type of reaction is **Reaction 2**?

.....

(1)

(ii) Give the reagent and conditions needed for this reaction.

Reagent .....

Conditions .....

.....

(2)

Leave blank

(c) Propan-2-ol has a higher boiling point than both the chloroalkane **X** and propene.

(i) Name the strongest intermolecular force between propan-2-ol molecules.

.....

(1)

(ii) Draw a diagram to show this force between two propan-2-ol molecules. Clearly mark and label the bond angle between the molecules.

(2)

Leave blank

(d) Propene, $CH_2=CHCH_3$, can be polymerised forming poly(propene).

(i) Draw a section of the poly(propene) polymer chain formed from two monomer units.

(2)

(ii) Explain, in terms of intermolecular forces, why poly(propene) is a solid at room temperature.

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(2)

(iii) Suggest ONE advantage of using poly(propene), rather than natural fibres such as jute or hemp, to make ropes and nets.

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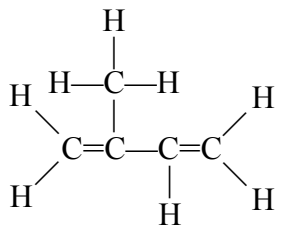
(1)

Q3

(Total 15 marks)

Leave blank

4. (a) The molecule isoprene has the displayed formula



(i) Give the systematic name of isoprene.

.....

(2)

(ii) What colour change occurs when aqueous bromine solution is added to isoprene?

From ..... to .....

(1)

(iii) State the type and mechanism of this reaction.

Type ..... Mechanism .....

(2)

(iv) Suggest the displayed formula of the product formed when excess bromine reacts with isoprene in the dark.

(1)

(b) Compound **Q**, an isomer of isoprene, has the structural formula $CH_2{=}CHCH_2CH{=}CH_2$.

(i) Give the name of the intermolecular force present in both isomers.

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(1)

(ii) Which isomer would you expect to have the higher boiling point? Justify your answer.

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(2) **Q4**

(Total 9 marks)

TOTAL FOR SECTION A: 45 MARKS

Leave blank

SECTION B

You should aim to spend no more than 35 minutes on this section. The passage needed for this section is provided on a separate sheet.

Read the passage on 'BUILDING A BETTER BLEACH – A GREEN CHEMISTRY CHALLENGE' straight through and then more carefully. Answer the following questions.

5. (a) Name sodium hypochlorite, NaOCl, using Stock notation.

.....

(1)

(b) Explain what is meant by a **free radical**.

.....

.....

(1)

(c) TAMLs can act as catalysts in the peroxide bleaching process. Explain how catalysts increase the rate of a reaction.

.....

.....

.....

(2)

(d) Describe the THREE key features of an **environmentally benign** process.

.....

.....

.....

.....

(2)

(e) Suggest why **accumulation** of dioxins in the food chain may be harmful to people.

.....

.....

.....

(1)

Leave blank

(f) Describe in no more than 100 words:

- How solid non-chlorine bleaches can remove stains.
- The advantages and disadvantages of solid non-chlorine bleaches in industrial processes.
- Two industrial uses of solid non-chlorine bleaches.

(8)

You are NOT asked to summarise the whole passage, nor to include equations in your summary. At the end of your summary state the number of words you have used.

Credit will be given for answers written in good English, using complete sentences and using technical words correctly and chemical names rather than formulae. Avoid copying long sections from the original text. Numbers count as one word, as do standard abbreviations, units and hyphenated words. Any title you give your passage does not count in your word total.

There are penalties for the use of words in excess of 100.

START YOUR SUMMARY ON PAGE 14

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Leave blank

Q5

(Total 15 marks)

TOTAL FOR SECTION B: 15 MARKS

TOTAL FOR PAPER: 60 MARKS

END

THE PERIODIC TABLE

Period	1	2											3	4	5	6	7	0
	Group																	
1	1 H Hydrogen 1																	2 He Helium 4
2	3 Li Lithium 7	4 Be Beryllium 9											5 B Boron 11	6 C Carbon 12	7 N Nitrogen 14	8 O Oxygen 16	9 F Fluorine 19	10 Ne Neon 20
3	11 Na Sodium 23	12 Mg Magnesium 24											13 Al Aluminium 27	14 Si Silicon 28	15 P Phosphorus 31	16 S Sulphur 32	17 Cl Chlorine 35.5	18 Ar Argon 40
4	19 K Potassium 39	20 Ca Calcium 40	21 Sc Scandium 45	22 Ti Titanium 48	23 V Vanadium 51	24 Cr Chromium 52	25 Mn Manganese 55	26 Fe Iron 56	27 Co Cobalt 59	28 Ni Nickel 59	29 Cu Copper 63.5	30 Zn Zinc 65.4	31 Ga Gallium 70	32 Ge Germanium 73	33 As Arsenic 75	34 Se Selenium 79	35 Br Bromine 80	36 Kr Krypton 84
5	37 Rb Rubidium 85	38 Sr Strontium 88	39 Y Yttrium 89	40 Zr Zirconium 91	41 Nb Niobium 93	42 Mo Molybdenum 96	43 Tc Technetium (99)	44 Ru Ruthenium 101	45 Rh Rhodium 103	46 Pd Palladium 106	47 Ag Silver 108	48 Cd Cadmium 112	49 In Indium 115	50 Sn Tin 119	51 Sb Antimony 122	52 Te Tellurium 128	53 I Iodine 127	54 Xe Xenon 131
6	55 Cs Caesium 133	56 Ba Barium 137	57 ▶ La Lanthanum 139	72 Hf Hafnium 178	73 Ta Tantalum 181	74 W Tungsten 184	75 Re Rhenium 186	76 Os Osmium 190	77 Ir Iridium 192	78 Pt Platinum 195	79 Au Gold 197	80 Hg Mercury 201	81 Tl Thallium 204	82 Pb Lead 207	83 Bi Bismuth 209	84 Po Polonium (210)	85 At Astatine (210)	86 Rn Radon (222)
7	87 Fr Francium (223)	88 Ra Radium (226)	89 ▶▶ Ac Actinium (227)	104 Unq Unnil-quadium (261)	105 Unp Unnil-pentium (262)	106 Unh Unnil-hexium (263)												

Key

Atomic Number
Symbol
Name
Molar mass in g mol^{-1}

▶ Lanthanide elements	58 Ce Cerium 140	59 Pr Praseo-dymium 141	60 Nd Neodymium 144	61 Pm Promethium (147)	62 Sm Samarium 150	63 Eu Europium 152	64 Gd Gadolinium 157	65 Tb Terbium 159	66 Dy Dysprosium 163	67 Ho Holmium 165	68 Er Erbium 167	69 Tm Thulium 169	70 Yb Ytterbium 173	71 Lu Lutetium 175
▶▶ Actinide elements	90 Th Thorium 232	91 Pa Protactinium (231)	92 U Uranium 238	93 Np Neptunium (237)	94 Pu Plutonium (242)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (245)	98 Cf Californium (251)	99 Es Einsteinium (254)	100 Fm Fermium (253)	101 Md Mendelevium (256)	102 No Nobelium (254)	103 Lr Lawrencium (257)