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

Thursday 17 January 2008 – Morning

Time: 1 hour 30 minutes

Examiner's use only		

Team Leader's use only		

Question Number	Leave Blank
1	
2	
3	
4	
Total	

Materials required for examination
Nil

Items included with question papers
Passage for Section B

A calculator may be used.

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.
Some questions must be answered with a cross in a box (☒). If you change your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross (☒).
The passage for Section B is provided on a separate insert.
Final answers to calculations should be given to an appropriate number of significant figures.
Do not return the insert with the question paper.

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. All blank pages are indicated.

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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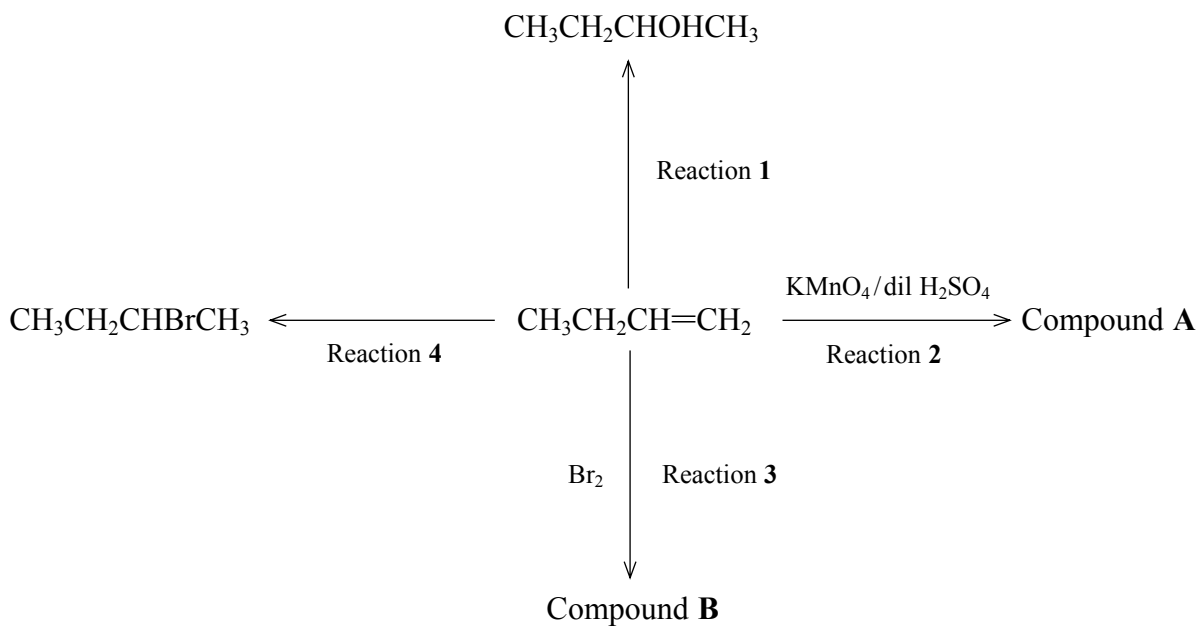
Leave blank

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

SECTION A

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

1. (a) Four reactions of but-1-ene are summarised on the chart below.



(i) Give the TWO reagents you would use for Reaction **1** in the laboratory.

.....

.....

(2)

(ii) Give the **name** of the product, Compound **A**, of Reaction **2**.

.....

(1)

(iii) Give the **name** of the product, Compound **B**, of Reaction **3**.

.....

(1)

(iv) Suggest the reagent needed for Reaction **4**.

.....

(1)

Leave blank

(b) All four reactions are addition reactions. Explain what is meant by an **addition reaction**.

.....

.....

.....

(1)

(c) (i) Explain what is meant by an **electrophile**.

.....

.....

(1)

(ii) Give the formula of the attacking electrophile in Reaction **3**.

.....

(1)

(d) (i) Select ONE reaction from **1**–**4** which involves oxidation of but-1-ene.

Reaction .....

(1)

(ii) Explain what is meant by oxidation in this reaction.

.....

.....

(1)

Leave blank

(e) 1-chlorobutane can be made from but-1-ene in a two-step process. The but-1-ene is first reduced and then a chlorine atom is substituted for a hydrogen atom.

$$CH_3CH_2CH{=}CH_2 \xrightarrow[\text{Reaction } \mathbf{5}]{} \text{Compound } \mathbf{C} \xrightarrow[\text{Reaction } \mathbf{6}]{} CH_3CH_2CH_2CH_2Cl$$

(i) Identify compound **C**.

.....

(1)

(ii) Name the reagent and catalyst required for Reaction **5**.

Reagent .....

Catalyst .....

(2)

(iii) Name the reagent and conditions for Reaction **6**.

Reagent .....

Conditions .....

(2)

Q1

(Total 15 marks)

Leave blank

2. (a) Silicon, phosphorus and sulphur form chlorides with molecular formulae $SiCl_4$, PCl_3, SCl_2.

Draw the shapes you would expect for these molecules, suggesting a value for the bond angle in each case.

$SiCl_4$

ClSiCl bond angle .....

PCl_3

ClPCl bond angle .....

SCl_2

ClSCl bond angle .....

(3)

Leave blank

(b) Calculate the standard enthalpy change of formation of gaseous silicon tetrachloride, $\Delta H_f^{\ominus}[SiCl_4(g)]$.

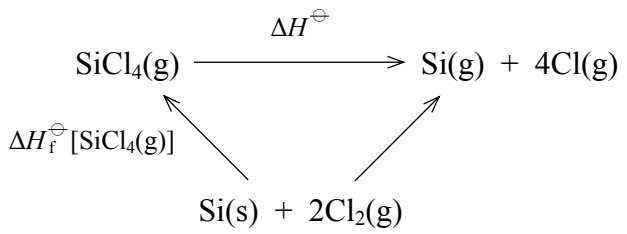
Your answer should include a sign and units.

Use the Hess cycle below and the following data at 298 K.

$\Delta H_{at}^{\ominus}[Si(s)] = +455.6\ kJ\ mol^{-1}$

$\Delta H_{at}^{\ominus}[½Cl_2] = +121.7\ kJ\ mol^{-1}$

Bond energy, E (Si-Cl) $= +407.4\ kJ\ mol^{-1}$



(3)

Leave blank

(c) (i) Phosphorus trichloride reacts with oxygen to form phosphorus oxychloride in an equilibrium reaction.

$$PCl_3(g) + \tfrac{1}{2}O_2(g) \rightleftharpoons POCl_3(g) \qquad \Delta H^{\ominus} = -153.6\ \text{kJ mol}^{-1}$$

Suggest how you would adjust the temperature and pressure to increase the yield of this reaction. Justify your answer in each case.

Temperature .....

.....

.....

.....

Pressure .....

.....

.....

.....

(2)

(ii) State the effect of the adjustments you propose in part (i) on the rate of the reaction.

Temperature .....

.....

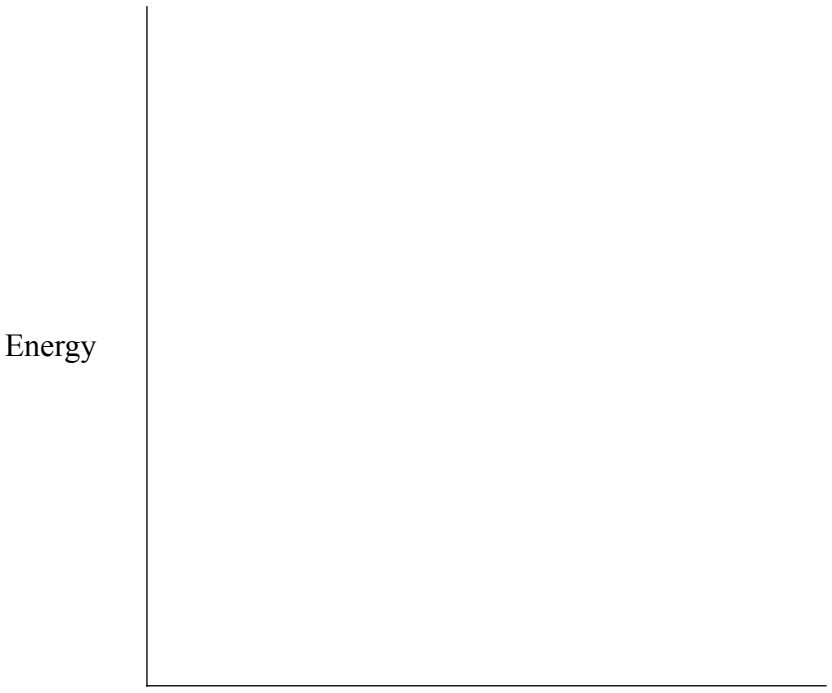
Pressure .....

.....

(2)

Leave blank

(iii) On the axes below, sketch the energy profiles of the reaction in (c)(i) with and without a catalyst. Label the profiles.



(2)

(d) Sulphur dichloride, SCl_2, reacts with chlorine at low temperatures to form yellow crystals of SCl_4, thought to consist of SCl_3^+ and Cl^- ions.

Draw a 'dot and cross' diagram for SCl_3^+ showing outer electrons only.

(2)

Q2

(Total 14 marks)

Leave blank

3. This question is about the four halogenoalkanes:

E 1-chlorobutane, $CH_3CH_2CH_2CH_2Cl$
F 2-chloro-2-methylpropane, $CH_3CCl(CH_3)CH_3$
G 1-iodobutane, $CH_3CH_2CH_2CH_2I$
H 2-iodo-2-methylpropane, $CH_3CI(CH_3)CH_3$

(a) (i) Explain why 1-iodobutane has a higher boiling point than 1-chlorobutane.

.....

.....

(2)

(ii) Which has the higher boiling point, 1-chlorobutane or 2-chloro-2-methylpropane? Justify your answer.

.....

.....

.....

.....

(2)

(iii) Which of the halogenoalkanes, **E**, **F**, **G** or **H**, has the highest boiling point?

Put a cross (☒) in the box of the correct answer. If you change your mind about the answer, put a line through the box (☒) and then mark your new answer with a cross (☒).

E	☒
F	☒
G	☒
H	☒

(1)

Leave blank

(b) All four halogenoalkanes form precipitates when mixed with hot aqueous silver nitrate.

E 1-chlorobutane, $CH_3CH_2CH_2CH_2Cl$
F 2-chloro-2-methylpropane, $CH_3CCl(CH_3)CH_3$
G 1-iodobutane, $CH_3CH_2CH_2CH_2I$
H 2-iodo-2-methylpropane, $CH_3CI(CH_3)CH_3$

(i) Which of these halogenoalkanes would react most rapidly?

Put a cross (☒) in the box of the correct answer. If you change your mind about the answer, put a line through the box (☒) and then mark your new answer with a cross (☒).

E	☒
F	☒
G	☒
H	☒

(1)

(ii) Which of these halogenoalkanes would take the longest time to react? Justify your answer.

.....

.....

.....

(2)

(iii) Name the functional group present in the organic product formed when halogenoalkanes react with the water in hot aqueous silver nitrate.

.....

(1)

(iv) Write an ionic equation to represent the part of the reaction which forms the precipitate, using **X** to represent the halogen. Include state symbols.

(1)

Leave blank

(v) Which TWO of the halogenoalkanes **E**, **F**, **G** and **H** would form a precipitate which would darken in sunlight?

Put a cross (☒) in the box of the correct answer. If you change your mind about the answer, put a line through the box (☒) and then mark your new answer with a cross (☒).

E and **F**	☒
E and **G**	☒
F and **H**	☒
G and **H**	☒

(1)

(c) (i) Under appropriate conditions, halogenoalkanes react with ammonia.

What are these conditions?

.....

.....

.....

(2)

(ii) Complete the balanced equation for the reaction of 1-iodobutane with ammonia.

$CH_3CH_2CH_2CH_2I \quad + \quad 2NH_3 \quad \rightarrow$

(2)

(iii) Name the organic product of the reaction in (c)(ii).

.....

(1)

Q3

(Total 16 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.

4. Read the passage on 'Fluorine' straight through and then more carefully. Answer the following questions.

(a) (i) Suggest why the electrolytic cell needs to be cooled.

.....

.....

(1)

(ii) Explain why water at 80 °C is used to cool the cell rather than water at a lower temperature.

.....

.....

(1)

(b) Give the oxidation numbers of:

Chlorine in chlorine trifluoride .....

Sulphur in disulphur decafluoride .....

(2)

(c) In the production of uranium(VI) fluoride from uranium(IV) oxide, in which of the reactions is uranium oxidised?

Justify your answer.

.....

.....

.....

(1)

Leave blank

(d) Suggest ONE reason for and ONE reason against the enrichment of uranium.

.....

.....

.....

.....

.....

.....

(2)

(e) Describe in no more than 100 words the industrial production of fluorine.

(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. You should write your summary on the lined pages provided in this question paper.

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

Leave blank

Leave blank

Q4

(Total 15 marks)

TOTAL FOR SECTION B: 15 MARKS

TOTAL FOR PAPER: 60 MARKS

END

THE PERIODIC TABLE

Period	1	2	Group										3	4	5	6	7	0
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)