Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	2	4	2	/	0	1	Signature	

Paper Reference(s)

6242/01

Edexcel GCE

Chemistry

Advanced Subsidiary

Unit Test 2

Wednesday 18 January 2006 – Morning

Time: 1 hour

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
Total	

Materials required for examination
Nil

Items included with question papers
Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature.
Answer **ALL** the questions. Write your answers in the spaces provided in this question paper.
Show all the steps in any calculations and state the units.

Information for Candidates

The total mark for this paper is 60. The marks for individual questions and parts of questions are shown in round brackets: e.g. (**2**). There are 12 pages in this question paper.
A Periodic Table is printed on the back cover of this question paper.
You may use a calculator.

Advice to Candidates

You are reminded of the importance of clear English and careful presentation in your answers.
You will be assessed on your Quality of Written Communication in this paper.

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

1. One stage in the manufacture of sulphuric acid is the exothermic reaction

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

(a) In a closed container this mixture of gases would be in dynamic equilibrium. State the meaning of the words **dynamic** and **equilibrium** in this context.

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(2)

(b) (i) State the conditions of temperature and pressure used industrially for the manufacture of SO_3.

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(2)

(ii) Justify the choice of **temperature** for this reaction in terms of yield and rate.

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(3)

(iii) The yield of products would be greater if a higher pressure were to be used for the reaction.

Suggest a reason why a higher pressure than you have given in (i) is **not** used.

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(1)

Leave blank

(c) (i) Calculate ΔH for the forward reaction, given the enthalpies of formation below.

	ΔH_f / kJ mol^{-1}
$SO_2(g)$	– 297
$SO_3(g)$	– 395
$O_2(g)$	0

(2)

(ii) State why the enthalpy of formation of oxygen, $O_2(g)$, is zero.

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(1)

Leave blank

(d) (i) State the **formula** of the catalyst used in the industrial process.

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(1)

(ii) Draw an enthalpy level diagram to show the reaction profiles of the uncatalysed and catalysed reactions.

(3)

(iii) Explain how the catalyst increases the reaction rate.

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(2)

Leave blank

(e) Suggest why the sulphur trioxide produced is passed into concentrated sulphuric acid rather than water to form sulphuric acid at the end of the process.

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(1)

Q1

(Total 18 marks)

Leave blank

2. (a) State Hess's Law.

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(2)

(b) Methane burns in oxygen.

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$$

(i) Calculate the enthalpy change for this reaction, using the bond enthalpies given below.

	Bond enthalpy / kJ mol^{-1}
C – H	+435
O = O	+498
C = O	+805
H – O	+464

(3)

(ii) State the name of this enthalpy change.

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(1)

(iii) The value of this enthalpy change, under standard conditions, is – 890 kJ mol^{-1}. State the meaning of **standard conditions**.

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(2)

Leave blank

(iv) Suggest, with a reason, why the enthalpy change calculated in (i) is different from the standard value quoted in (iii).

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(2)

(c) Although the reaction between methane and oxygen is exothermic, it does not occur unless the mixture is ignited.

Use these facts to explain the difference between thermodynamic and kinetic stability.

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(4)

Q2

(Total 14 marks)

Leave blank

3. Bromine reacts with both ethane, C_2H_6, and ethene, C_2H_4.

(a) The reaction of bromine with ethane occurs in ultraviolet light.

(i) By what type of mechanism does this substitution reaction occur?

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(1)

(ii) Write the equation for a reaction of ethane with bromine.

(1)

(b) Bromine reacts rapidly with ethene without the need for light.

(i) Give the equation for this reaction using structural formulae.

(2)

(ii) Name the product. .....

(1)

(c) Explain, in terms of the bonding in the two hydrocarbons, why the reaction of bromine with ethene occurs so much more readily than that with ethane.

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(3) **Q3**

(Total 8 marks)

Leave blank

4. (a) (i) Draw the structural formulae of the two geometric isomers of but-2-ene, C_4H_8.

(2)

(ii) Explain, in terms of structure and bonding, why but-2-ene exists as two geometric isomers whereas but-1-ene does not.

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(3)

(iii) Draw the structural formula of another isomer with formula C_4H_8.

(1)

(b) Alkenes can be used to make polymers.

(i) Draw enough of the chain of poly(propene) to make its structure clear.

(2)

(ii) Explain why poly(alkenes) cause problems when they are disposed of in a landfill site.

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(2)

(Total 10 marks)

Q4

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5. Consider the following series of reactions

$$C_4H_8 \rightarrow C_4H_9Br \rightarrow C_4H_9OH \rightarrow CH_3CH_2COCH_3$$
A **B** **D** butanone

Compound **A** has an unbranched chain.

(a) (i) Draw the structure of the alcohol **D** which is oxidised to butanone.

(1)

(ii) State the reagents and conditions used to oxidise **D** to butanone.

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(3)

(iii) Suggest reagents and conditions for conversion of the halogenoalkane **B** to alcohol **D**.

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(2)

(iv) When compound **A** reacts with HBr, only one product, **B**, is formed.
Draw the structural formula of compound **A**.

(1)

(b) An isomer of **D** is **not** oxidised under the conditions used in (a)(ii).

Draw the structural formula of this **isomer** of **D**.

(1)

Leave blank

(c) If the conditions used in (a)(iii) to convert **B** to **D** are changed, then **B** will give two organic products: the original compound **A** and a structural isomer **G**.

Both **A** and **G** have an unbranched chain and molecular formula C_4H_8. **G** reacts with HBr to form two isomers with formula C_4H_9Br.

(i) Draw the structural formula of **G**.

(1)

(ii) In what way are the conditions changed to give this result?

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(1)

Q5

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

Key

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

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