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

Thursday 18 January 2007 – Morning

Time: 1 hour

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
7	
Total	

Materials required for examination
Nil

Items included with question papers
Nil

A calculator may be used.

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 16 pages in this question paper. All blank pages are indicated.
A Periodic Table is printed on the back cover of this question paper.

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. (a) Draw the **full** structural formulae, showing all bonds, of:

(i) 2,4-dimethylpentane

(1)

(ii) 2-bromopropan-2-ol

(1)

Leave blank

(b) Pent-2-ene shows geometric isomerism.

Draw the structures of the two geometric isomers.

Isomer 1 **Isomer 2**

(2)

(c) Classify the following reagents:

(i) Ammonia, NH_3, in the reaction with iodoethane.

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.....

(1)

(ii) Cl• in the reaction with ethane.

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(1)

(iii) Acidified potassium dichromate(VI), $K_2Cr_2O_7$, in the reaction with ethanol.

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.....

(1) **Q1**

(Total 7 marks)

Leave blank

2. (a) Define the term **standard enthalpy of formation**.

.....

.....

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.....

.....

(3)

(b) In the Haber process, ammonia is manufactured from nitrogen and hydrogen as shown in the equation.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

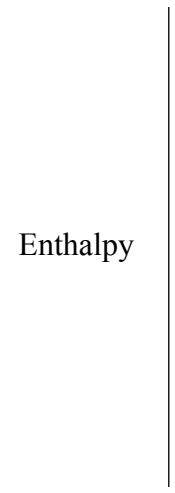
(i) Use the bond enthalpies below to calculate the standard enthalpy of formation of ammonia.

Bond	Bond enthalpy / kJ mol^{-1}
N≡N in N_2	+945
H—H in H_2	+436
N—H in NH_3	+391

(4)

Leave blank

(ii) Draw a labelled enthalpy level diagram for the formation of ammonia in the Haber process.



(2)

(iii) State the temperature used in the Haber process and explain in terms of the rate of reaction and position of equilibrium, why this temperature is chosen.

Temperature .....

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.....

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.....

(3)

Leave blank

(iv) Identify the catalyst used in the Haber process and state what effect, if any, it has on the equilibrium yield of ammonia.

Catalyst .....

Effect on yield .....

(2)

(v) Explain why it is necessary to use a catalyst in this process.

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(1)

(c) The pressure used in the Haber process is 250 atmospheres.

(i) State and explain an advantage of increasing the pressure to 1000 atmospheres.

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(2)

(ii) Suggest a disadvantage of using a pressure of 1000 atmospheres.

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(1)

Q2

(Total 18 marks)

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3. 2-bromobutane, $CH_3CH_2CHBrCH_3$, can be converted into butane, $CH_3CH_2CH_2CH_3$, in two steps.

$$CH_3CH_2CHBrCH_3 \xrightarrow{\textbf{Step 1}} CH_3CH_2CH{=}CH_2 \xrightarrow{\textbf{Step 2}} CH_3CH_2CH_2CH_3$$

Give the reagents and conditions needed for each step.

(a) **Step 1**

Reagent

.....

Condition

.....

(2)

(b) **Step 2**

Reagent

.....

Condition

.....

(2) **Q3**

(Total 4 marks)

Leave blank

4. Aluminium is obtained by electrolysis.

(a) Identify the electrolyte used in the manufacture of aluminium.

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.....

(2)

(b) Write the ionic half-equation for the reaction that takes place at the cathode.

.....

(1)

(c) From what material are the electrodes made?

.....

(1)

(d) The anodes need to be replaced frequently. Write an equation to show why this is necessary.

.....

.....

(1)

(e) Calculate the mass of aluminium oxide, Al_2O_3, needed to produce 1.0 tonne of aluminium.

[1.0 tonne = 1.0×10^6 g]

(3)

Leave blank

(f) (i) About one third of the electrical energy needed to produce aluminium is used in the electrode reactions.

Suggest what most of the remainder of the energy is used for.

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.....

(1)

(ii) Recycling aluminium requires only 5% of the energy needed to produce the same mass of aluminium by electrolysis.

Suggest TWO reasons for this.

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(2)

(Total 11 marks)

Q4

Leave blank

5. Bromine needs ultraviolet radiation to react with ethane, C_2H_6, but reacts with ethene, C_2H_4, in the dark.

(a) Complete the equations.

(i) $C_2H_6 + Br_2 \rightarrow$ .....

(1)

(ii) $C_2H_4 + Br_2 \rightarrow$ .....

(1)

(b) (i) Identify and state the **type** of covalent bond in the hydrocarbon molecules that are broken during these two reactions.

Ethane

bond broken ..... type .....

Ethene

bond broken ..... type .....

(2)

(ii) Use your answer to (b)(i) to suggest why the reaction of bromine with **ethene** occurs more readily than with ethane in the dark.

.....

.....

(1)

Q5

(Total 5 marks)

Leave blank

6. (a) (i) Draw a Maxwell-Boltzmann distribution of molecular energies in a gas at a temperature T.

(2)

(ii) Add a curve to your diagram to show the distribution at a higher temperature and label it T_H.

(1)

(iii) Mark on your diagram a line at a suitable place for the activation energy, E_a, for a reaction.

(1)

(b) (i) Use your answer to (a) to explain, in terms of the **frequency** and **energy** of collisions, why an increase in temperature increases the rate of a reaction.

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(4)

(ii) Suggest whether the frequency of the collisions or the energy of collisions is more important in increasing the rate.

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(1)

Q6

(Total 9 marks)

Leave blank

7. (a) An organic compound, **W**, with molecular formula $C_4H_{10}O$ reacts with phosphorus pentachloride to give compound **X**, C_4H_9Cl.

When **W** is heated with potassium dichromate(VI) and dilute sulphuric acid there is no colour change.

(i) Identify the functional group present in **W**.

.....

(1)

(ii) Draw the structural formulae of **W** and **X**.

W

X

(2)

(iii) When a structural isomer of **W** is heated under reflux with acidified potassium dichromate(VI), it produces compound **Y**, $C_4H_8O_2$.

Suggest a possible identity for **Y**.

(1)

Leave blank

(b) Propene, C_3H_6, reacts with hydrogen bromide, HBr.

Draw the structures of the two possible products and indicate which is the major product.

(2) **Q7**

(Total 6 marks)

TOTAL FOR PAPER: 60 MARKS

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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