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 17 January 2008 – Morning

Time: 1 hour

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
Nil

Candidates may use a calculator.

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

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.

Printer's Log. No.
N29260A
W850/R6242/57570 7/7/7/3/3/8600

N 2 9 2 6 0 A 0 1 1 6

Turn over

edexcel
advancing learning, changing lives

Leave blank

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

1. Aluminium is extracted industrially from aluminium oxide, Al_2O_3, using electrolysis. The aluminium oxide is obtained from an aluminium ore.

(a) Name an ore of aluminium.

.....

(1)

(b) What is carbon used for in the extraction process?

.....

.....

(1)

(c) (i) Write the half-equation for the process occurring at the cathode.

.....

(1)

(ii) The process occurring at the anode is shown by the following half-equation.

$$2O^{2-} \rightarrow O_2 + 4e^-$$

Name this type of change and explain your answer in terms of electrons.

.....

.....

(2)

(d) State the temperature used in the electrolysis.

.....

(1)

(e) State the role of cryolite in this process.

.....

.....

(1)

(f) What is the major cost in the manufacture of aluminium?

.....

(1)

Leave blank

(g) State ONE major use of aluminium and state ONE property of aluminium that makes it suitable for this use.

.....

.....

(1) **Q1**

(Total 9 marks)

Leave blank

2. This question is about ammonia, NH_3, which is produced as shown in the following equation.

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

(a) Use oxidation numbers to explain why this is a redox reaction.

.....

.....

.....

(2)

(b) (i) Use the average (mean) bond enthalpy data to calculate a value for the enthalpy change for this reaction. You are reminded to show **all** your working.

Bond	Average bond enthalpy /kJ mol^{-1}
N≡N	944
H—H	436
N—H	388

(3)

Leave blank

(ii) The actual standard enthalpy change for this reaction is –92 kJ mol^{-1}. Explain why the value you calculated in (b)(i) is not the same as this.

.....

.....

(1)

(iii) At room temperature, a mixture of nitrogen and hydrogen is thermodynamically unstable with respect to ammonia, but is kinetically stable.

Use the data in (b)(i) and (ii) to help you explain why this mixture is

thermodynamically unstable

.....

.....

.....

.....

.....

.....

kinetically stable

.....

.....

.....

.....

.....

.....

(3)

Leave blank

(c) The manufacturer of ammonia would like to achieve a high rate of reaction and a high equilibrium yield of product.

(i) State and explain, in terms of collision theory, TWO ways to increase the rate of the reaction. An increase in pressure does **not** alter the rate in this process.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(6)

Leave blank

(ii) State and explain TWO ways to increase the equilibrium yield of ammonia.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(4)

(d) At equilibrium in the Haber Process only a small percentage of the hydrogen and nitrogen is converted to ammonia.

(i) How is the ammonia separated from unreacted nitrogen and hydrogen?

.....

.....

(1)

(ii) How is nearly all the hydrogen eventually converted to ammonia?

.....

.....

(1)

Q2

(Total 21 marks)

BLANK PAGE

Leave blank

3. (a) Compound **A**, $CH_3CHBrCH_2CH_3$, can be converted into butan-2-ol by reaction with potassium hydroxide solution.

(i) Name compound **A**.

.....

(1)

(ii) Write an equation for the conversion of compound **A** into butan-2-ol.

.....

(1)

(iii) Identify the solvent required for this reaction.

.....

(1)

(iv) Classify this reaction.

.....

(1)

(b) Compound **A** can also be converted into a mixture of the structural isomers but-1-ene and but-2-ene by reaction with potassium hydroxide under different conditions.

(i) Write the **ionic** equation for the conversion of compound **A** into **either** but-1-ene **or** but-2-ene.

.....

(1)

(ii) What is the solvent required for this reaction?

.....

(1)

(iii) Classify this reaction.

.....

(1)

Leave blank

(c) But-2-ene exists as two geometric isomers.

(i) Draw the structural formulae of these TWO geometric isomers.

(1)

(ii) Explain why but-2-ene exists as two geometric isomers.

.....

.....

.....

.....

.....

(2)

(d) Both but-1-ene and but-2-ene react with hydrogen, in the presence of a suitable catalyst, to give the same product.

(i) Identify the catalyst.

.....

(1)

(ii) Identify the product of this reaction.

.....

(1)

Leave blank

(e) Compound **A**, $CH_3CHBrCH_2CH_3$, reacts with ammonia.

(i) Write an equation for this reaction.

.....

(1)

(ii) Give ONE essential condition for this reaction.

.....

(1)

(iii) With excess halogenoalkane, further substitution of the hydrogen atoms in the ammonia molecule takes place and a different product, compound **B**, is formed.

Analysis of compound **B** gave the following data.

Element	% by mass
carbon	74.4
hydrogen	14.7
nitrogen	10.9

Use the data to calculate the empirical formula of compound **B**.

(2)

Q3

(Total 16 marks)

Leave blank

4. (a) (i)

Formula of substance	Standard enthalpy of formation /kJ mol^{-1}
$CH_4(g)$	–75
$O_2(g)$	0
$CO_2(g)$	–394
$H_2O(g)$	–242

The equation for the complete combustion of methane at 150 °C is:

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

Use the given data to calculate the enthalpy of combustion of methane under these conditions.

(2)

(ii) The **standard** enthalpy of combustion of methane is –891 kJ mol^{-1}.

Explain why this is very different from the value you have calculated in (a)(i).

.....

.....

(1)

Leave blank

(iii) Here are some data about different fuels:

Name	Formula	Standard state	Energy evolved per gram / kJ	Relative cost per kJ
hydrogen	H_2	gas	143	2
octane	C_8H_{18}	liquid	48.4	70

State and explain the advantages and disadvantages of using hydrogen compared with octane as a fuel for aeroplanes.

Use the data in the table above and your knowledge of the combustion of fuels to help you.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(4)

Leave blank

(b) Ethanol is a primary alcohol and can be oxidised if heated with an acidified solution of potassium dichromate(VI). Two possible organic oxidation products may be obtained.

(i) Draw the **full** structural formula, showing all bonds, of **both** oxidation products.

(2)

(ii) Give the name **and** structural formula of an alcohol that would **not** be oxidised by heating it with an acidified solution of potassium dichromate(VI).

(2)

Leave blank

(c) Ethanol can be converted in the laboratory into ethene as shown by the following equation.

$$C_2H_5OH \rightarrow CH_2{=}CH_2 + H_2O$$

Give the other substance needed to achieve this conversion.

.....

(1)

(d) (i) Ethene can be polymerised to produce poly(ethene).

Draw the repeat unit of poly(ethene).

(1)

(ii) Give ONE major use for poly(ethene).

.....

(1)

Q4

(Total 14 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																	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