

Centre Number	Candidate Number	Name
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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CHEMISTRY

5070/02

Paper 2 Theory

May/June 2006

1 hour 30 minutes

Candidates answer on the Question Paper.
Additional Materials: Answer Booklet/Paper

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the work you hand in.
Write in dark blue or black pen.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A

Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.

Section B

Answer any **three** questions.
Write your answers on any lined pages and/or separate answer paper.
You may use a calculator.
A copy of the Periodic Table is printed on page 16.
At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [] at the end of each question or part question.

For Examiner's Use	
Section A	
B8	
B9	
B10	
B11	
Total	

This document consists of **14** printed pages and **2** lined pages.



Section A

Answer **all** the questions in this section in the spaces provided.

The total mark for this section is 45.

A1 Choose from the following elements to answer the questions below.

aluminium

argon

iron

nickel

nitrogen

phosphorus

sodium

Each element can be used once, more than once or not at all.

Name an element which

(a) is used as a catalyst in the hydrogenation of alkenes,

..... [1]

(b) is manufactured by electrolysis,

..... [1]

(c) reacts with oxygen to give an acidic oxide,

..... [1]

(d) forms an ion that carries a negative charge,

..... [1]

(e) reacts with chlorine to form a solid that dissolves in water to give a coloured solution.

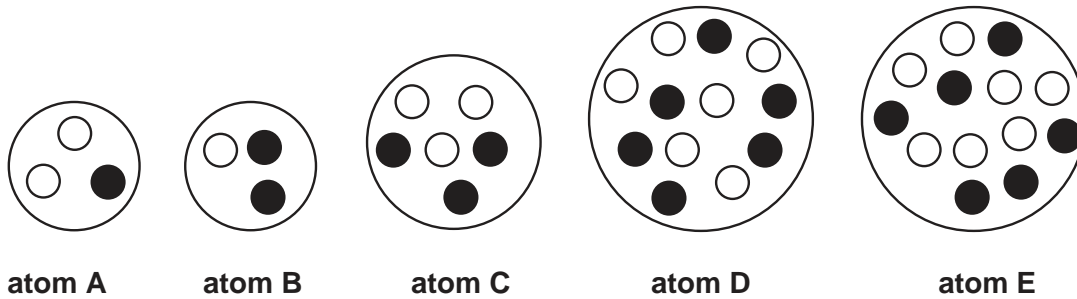
..... [1]

A2 The diagram shows the nuclei of five different atoms.

key

○ neutron

● proton



(a) Which atom has an atomic number of 3?

..... [1]

(b) Which atom has a mass number of 6?

..... [1]

(c) Which **two** atoms are isotopes of the same element?

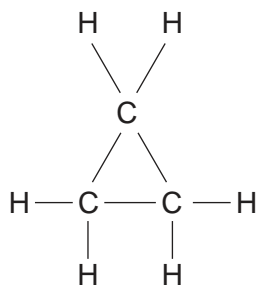
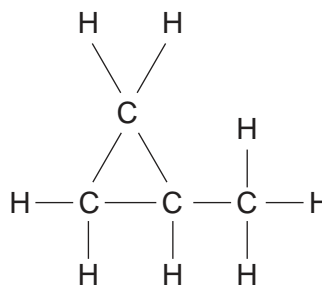
..... and [1]

(d) Complete the table below to show the number of sub-atomic particles in both an atom and an ion of potassium.

	potassium atom ${}^{39}_{19}\text{K}$	potassium ion ${}^{39}_{19}\text{K}^+$
number of protons		
number of electrons		
number of neutrons		

[2]

- A3** The structures shown below are of the first two members of an homologous series known as the cyclopropanes.

compound **D**compound **E**

Members of an homologous series have a general formula.

- (a) (i)** State **one other** characteristic of an homologous series.

..... [1]

- (ii)** Deduce the general formula for the cyclopropane homologous series.

..... [1]

- (b)** Cyclopropanes react in a similar way to alkanes such as methane.

- (i)** Write a chemical equation for the complete combustion of compound **D**.

..... [2]

- (ii)** Suggest the **type** of reaction by which compound **D** reacts with chlorine.

..... [1]

- (c)** Name and draw the structure of an alkene that is an isomer of compound **D**.

name

structure

[2]

A4 This question is about calcium compounds.

(a) Write the equation for the thermal decomposition of calcium carbonate. One of the products of this reaction is calcium oxide.

..... [1]

(b) When water is added to calcium oxide, calcium hydroxide is formed.

(i) Write the equation for the reaction between water and calcium oxide.

..... [1]

(ii) Solid calcium hydroxide reacts slowly with carbon dioxide. Name the calcium containing product of this reaction.

..... [1]

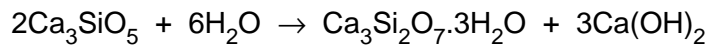
(c) State one large scale use of calcium hydroxide.

..... [1]

(d) Cement is made by heating calcium carbonate and clay together at a very high temperature.

One of the compounds produced is a form of calcium silicate, Ca_3SiO_5 .

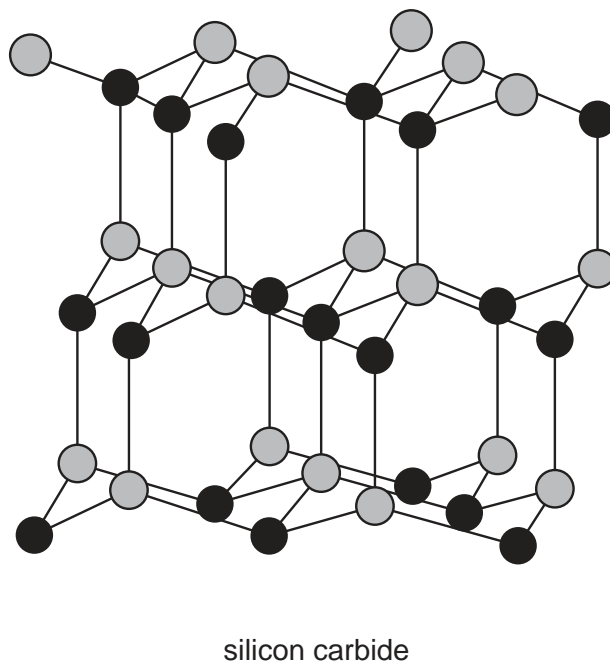
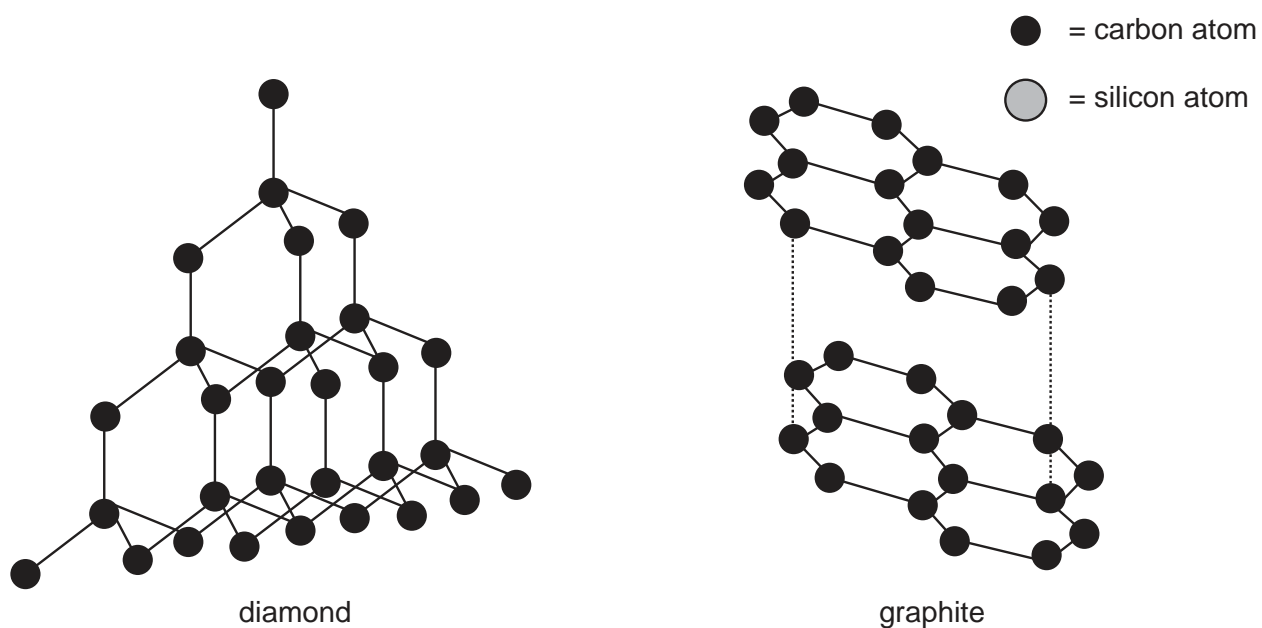
In the presence of water a chemical reaction takes place that helps in the setting of cement.



Calculate the mass of calcium hydroxide formed from 912 g of Ca_3SiO_5 .

.....
.....
.....
.....
..... [3]

A5 The structures of diamond, graphite and silicon carbide are shown below.



(a) Suggest the formula for silicon carbide.

..... [1]

(b) Explain why graphite conducts electricity but silicon carbide does not.

.....
.....
..... [2]

(c) Silicon carbide has a very high melting point.

(i) Explain why silicon carbide has a very high melting point.

.....
.....
..... [1]

(ii) Suggest why the melting point of diamond is higher than that of silicon carbide.

.....
..... [1]

(d) When a 1.20 g sample of **graphite** is completely burnt in oxygen, 4.40 g of carbon dioxide are produced. What mass of carbon dioxide is made when a 1.20 g sample of **diamond** is completely burnt in oxygen?

mass of carbon dioxide g [1]

A6 Lithium is in Group I of the Periodic Table.

Lithium reacts with water to form lithium hydroxide and hydrogen.

(a) Describe what you would observe when a small piece of lithium is dropped onto the surface of cold water.

.....
..... [2]

(b) Write the equation for the reaction between lithium and water.

..... [1]

(c) When lithium reacts with water, lithium ions, Li^+ , are formed.



Explain why the formation of a lithium ion from a lithium atom is an example of oxidation.

.....
..... [1]

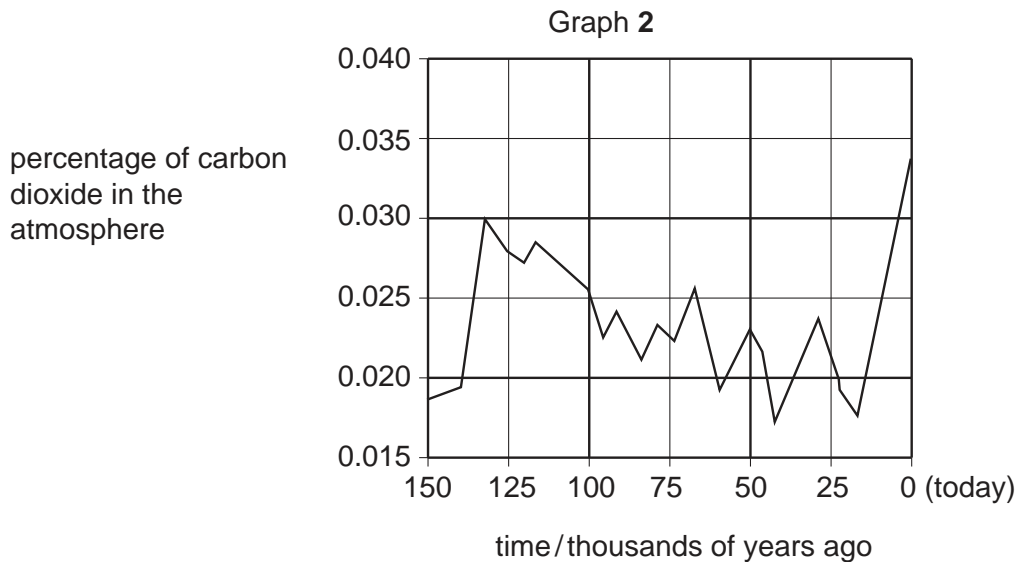
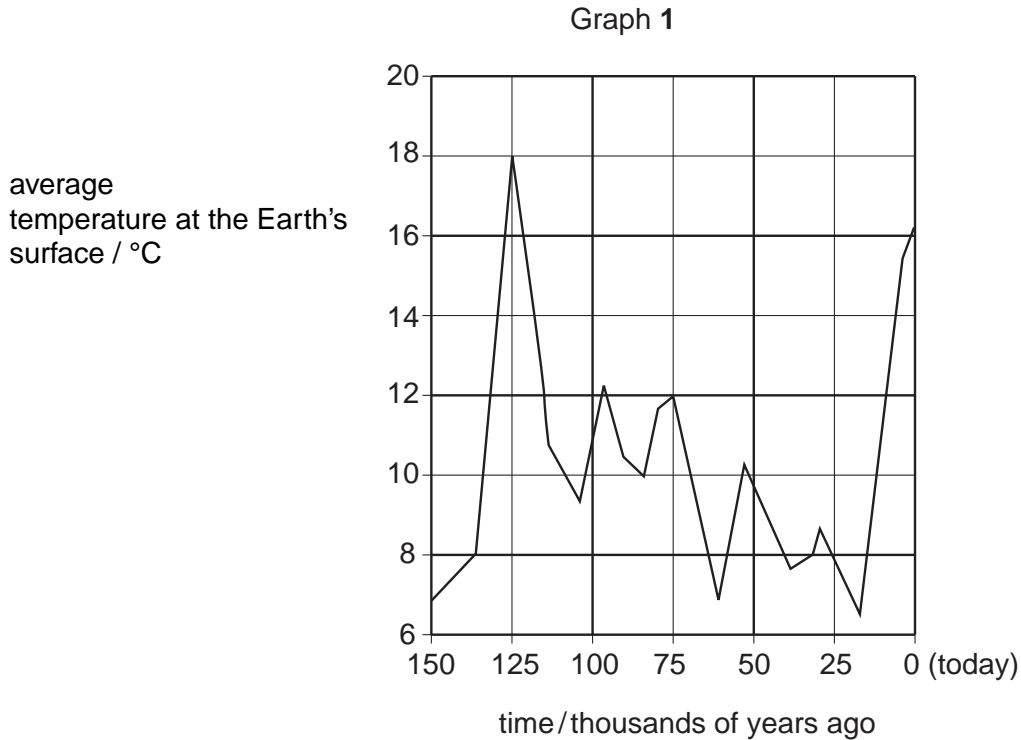
(d) Rubidium, Rb, is another element in Group I.

Predict what you would observe when a small piece of rubidium is dropped onto cold water.

.....
.....
..... [2]

A7 Graph 1 shows how the average temperature at the Earth's surface may have changed over the last 150 thousand years.

Graph 2 shows how the percentage of carbon dioxide in the atmosphere may have changed over the last 150 thousand years.



(a) Carbon dioxide is a greenhouse gas. Scientists think that an increase in the greenhouse gases will result in global warming.

(i) Explain how graphs 1 and 2 support this statement.

.....
 [1]

(ii) Describe **two** consequences of global warming.

.....
.....
.....
..... [2]

(b) Draw a 'dot and cross' diagram for carbon dioxide. Show the outer shell electrons only.

[2]

(c) Chlorofluorocarbons, CFCs, are also greenhouse gases.

(i) Name **one** other greenhouse gas found in the atmosphere.

..... [1]

(ii) State the origin of this greenhouse gas, named in part (i).

.....[1]

(iii) Describe how the presence of CFCs in the upper atmosphere increases the amount of ultra-violet light reaching the Earth's surface.

.....
.....
..... [2]

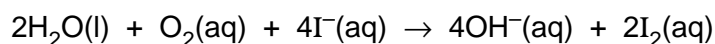
Section B

Answer **three** questions from this section.

The total mark for this section is 30.

B8 River water contains many substances including minerals, dissolved oxygen, organic material, nitrates and phosphates.

- (a) Give one source of phosphates in water. [1]
- (b) Excess dissolved phosphates in river water cause *eutrophication*. Describe the process of eutrophication. [3]
- (c) (i) Describe a chemical test to show the presence of the nitrate ion. [2]
(ii) Suggest why it might be difficult to test for the presence of the nitrate ion in a sample of river water. [1]
- (d) The concentration of dissolved oxygen in river water can be determined by a series of reactions that is summarised by the equation below.

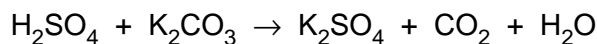


When a 2000 cm³ sample of river water was tested, 0.508 g of iodine was liberated.

Calculate the concentration, in mol/dm³, of dissolved oxygen in the river water sample. [3]

B9 Fertilisers are soluble salts containing one or more of the essential elements required for plant growth.

- (a) Ammonium chloride can be prepared by the reaction between aqueous ammonia and hydrochloric acid.
Write an **ionic** equation for this reaction. [1]
- (b) State suitable reagents and outline the experimental procedure by which a pure sample of the fertiliser potassium chloride could be prepared in the laboratory. [4]
- (c) Potassium sulphate can be prepared by the reaction between dilute sulphuric acid and potassium carbonate.



Calculate the mass of potassium sulphate that can be prepared from 3.45 g of potassium carbonate. [3]

- (d) Give electronic structures, including the charges, of the ions present in potassium chloride. [2]

B10 Brass is an alloy containing zinc and copper.

(a) Explain why the physical properties of brass are different from those of zinc and copper. [1]

(b) A sample of powdered brass is added to excess dilute nitric acid.

The mixture is heated gently until all the brass reacts.

The resulting solution, **A**, contains aqueous copper(II) ions and aqueous zinc ions.

(i) Suggest the colour of solution **A**. [1]

(ii) Describe and explain, with the aid of equations, what happens when aqueous sodium hydroxide is slowly added to solution **A**. [5]

(c) Another sample of powdered brass is added to excess dilute hydrochloric acid.

The mixture is heated and an aqueous solution of a compound **B** together with a solid **C** are formed.

(i) Name both **B** and **C**. [2]

(ii) Write an ionic equation for this reaction. [1]

B11 Macromolecules are large molecules built up from many small units.

Proteins and fats are natural macromolecules.

Poly(chloroethene) and poly(ethene) are synthetic macromolecules.

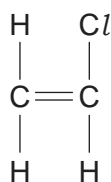
(a) Name the type of linkage joining the units in fats. [1]

(b) Proteins can be hydrolysed into monomers by boiling with concentrated hydrochloric acid.

(i) Name the monomers produced in this hydrolysis. [1]

(ii) Suggest why clothes made from nylon are damaged by concentrated hydrochloric acid. [1]

(c) Poly(chloroethene) is made from the monomer chloroethene. The structure of chloroethene is shown below.



(i) Draw the structure of poly(chloroethene). [1]

(ii) Explain why poly(chloroethene) has a low melting point. [1]

(iii) Describe what you would observe when bromine reacts with chloroethene and state what type of reaction takes place.

Explain why bromine will **not** readily react with poly(chloroethene). [3]

(d) State and explain why plastics such as poly(ethene) may cause problems of pollution. [2]

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DATA SHEET
The Periodic Table of the Elements

		Group										
		I	II	III	IV	V	VI	VII	VIII	IX	X	
1	1											
7	9	1										
3	4	2										
11	12	13	14	15	16	17	18	19	20	21	22	
19	20	21	22	23	24	25	26	27	28	29	30	
37	38	39	40	41	42	43	44	45	46	47	48	
55	56	57	58	59	60	61	62	63	64	65	66	
87	88	89	90	91	92	93	94	95	96	97	98	
103	104	105	106	107	108	109	110	111	112	113	114	
121	122	123	124	125	126	127	128	129	130	131	132	
151	152	153	154	155	156	157	158	159	160	161	162	
171	172	173	174	175	176	177	178	179	180	181	182	
201	202	203	204	205	206	207	208	209	210	211	212	
231	232	233	234	235	236	237	238	239	240	241	242	
261	262	263	264	265	266	267	268	269	270	271	272	
291	292	293	294	295	296	297	298	299	300	301	302	
321	322	323	324	325	326	327	328	329	330	331	332	
351	352	353	354	355	356	357	358	359	360	361	362	
381	382	383	384	385	386	387	388	389	390	391	392	
411	412	413	414	415	416	417	418	419	420	421	422	
441	442	443	444	445	446	447	448	449	450	451	452	
471	472	473	474	475	476	477	478	479	480	481	482	
501	502	503	504	505	506	507	508	509	510	511	512	
531	532	533	534	535	536	537	538	539	540	541	542	
561	562	563	564	565	566	567	568	569	570	571	572	
591	592	593	594	595	596	597	598	599	600	601	602	
621	622	623	624	625	626	627	628	629	630	631	632	
651	652	653	654	655	656	657	658	659	660	661	662	
681	682	683	684	685	686	687	688	689	690	691	692	
711	712	713	714	715	716	717	718	719	720	721	722	
741	742	743	744	745	746	747	748	749	750	751	752	
771	772	773	774	775	776	777	778	779	780	781	782	
801	802	803	804	805	806	807	808	809	810	811	812	
831	832	833	834	835	836	837	838	839	840	841	842	
861	862	863	864	865	866	867	868	869	870	871	872	
891	892	893	894	895	896	897	898	899	900	901	902	
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951	952	953	954	955	956	957	958	959	960	961	962	
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1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	
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1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	
1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	
1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	
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1761	1762	1763	1764	1765	1766	1767	1768	1769	1770	1771	1772	
1791												