Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

6533820761

CHEMISTRY **0620/22**

Paper 2 **February/March 2015**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
A copy of the Periodic Table is printed on page 16.
You may lose marks if you do not show your working or if you do not use appropriate units.

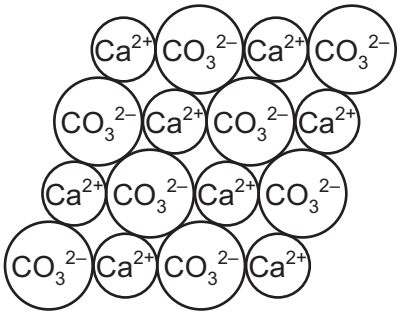
At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

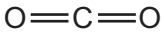
This document consists of **14** printed pages and **2** blank pages.

1 The diagram shows the structures of some substances containing carbon.

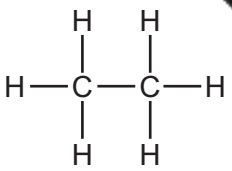
A



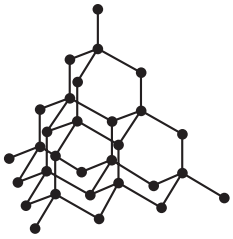
B



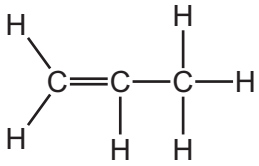
C



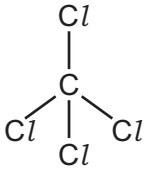
D



E



F



Answer the following questions about these substances.
Each substance may be used once, more than once or not at all.

(a) Which substance, **A**, **B**, **C**, **D**, **E** or **F**

(i) is a saturated hydrocarbon, ...

(ii) has an ionic structure, ...

(iii) is a product of respiration, ...

(iv) is in the same homologous series as methane, ...

(v) is used for cutting? .....

[5]

(b) Substance **D** is an element.

Explain why substance **D** is an element.

..... [1]

[Total: 6]

2 Some properties of the halogens are shown in the table.

halogen	boiling point /°C	state at room temperature and pressure
fluorine	–188	
chlorine	–35	gas
bromine	+59	liquid
iodine	+184	solid
astatine		solid

(a) Use the information in the table to deduce

(i) the boiling point of astatine,

..... [1]

(ii) the state of fluorine at room temperature and pressure.

..... [1]

(b) When chlorine reacts with aqueous potassium iodide, the solution turns brown.

(i) Write a word equation for this reaction.

..... [2]

(ii) Explain why iodine does not react with aqueous potassium chloride.

.....

..... [1]

(c) When sodium reacts with iodine, energy is released.

(i) What is the name given to a reaction which releases energy?

..... [1]

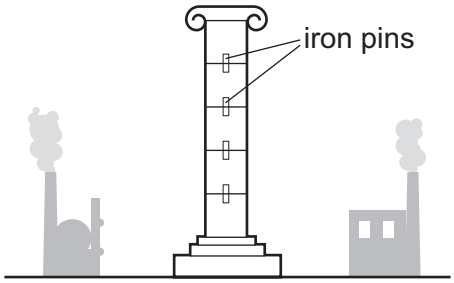
(ii) Explain what happens in terms of electron transfer when a sodium atom reacts with an iodine atom.

.....

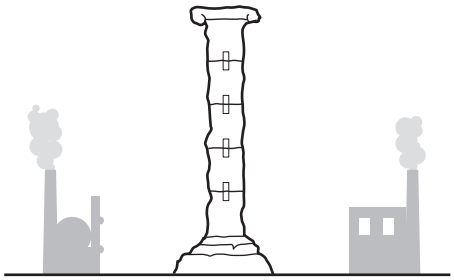
..... [2]

[Total: 8]

3 The diagram shows a limestone column in an industrial town. Limestone is la[illegible]m carbonate.



column when first built



the same column after 40 years

(a) Describe and explain the changes to the column over 40 years.
In your answer refer to

- the change to the limestone,
- the name of a pollutant causing this change,
- the chemistry involved in this change.

.....

.....

.....

.....

.....

.....

..... [4]

(b) The sections of the column are joined with iron pins which rust when exposed to the atmosphere.

Describe **two** methods of rust prevention and explain how they prevent rusting.

.....

.....

.....

..... [3]

(c) Iron is a transition element.

Give **two** properties of transition elements that make them different from non-transition such as magnesium.

.....

..... [2]

(d) An isotope of iron has 58 nucleons.

Complete the table to show

- the number of electrons and neutrons in this isotope of iron,
- the relative charges on each particle.

particle	number of each particle present	relative charge on the particle
electron		
neutron		no charge
proton	26	

[4]

(e) Iron reacts with hydrochloric acid to form iron(II) chloride and a gas which 'pops' with a lighted splint.

Complete the symbol equation for this reaction.

$$Fe + \text{.....} HCl \rightarrow FeCl_2 + \text{.....}$$

[2]

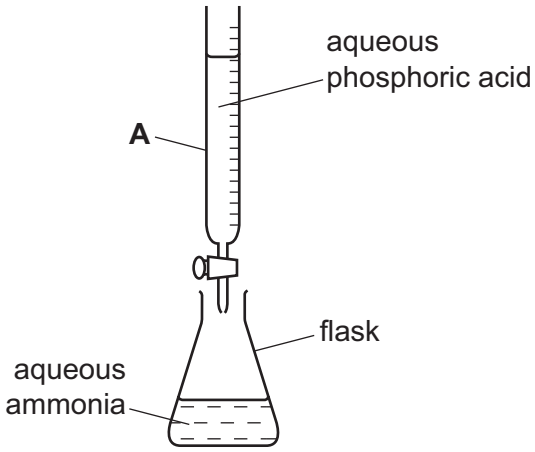
[Total: 15]

4 Ammonium phosphate, $(NH_4)_3PO_4$, is a fertiliser.

(a) Which **two** elements in ammonium phosphate are important for plant growth?

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

(b) Aqueous ammonium phosphate can be made in the laboratory by reacting aqueous ammonia with aqueous phosphoric acid.



(i) State the name of the piece of apparatus labelled **A**.

..... [1]

(ii) Suggest the pH value of aqueous phosphoric acid.

..... [1]

(iii) Describe how the pH of the mixture in the flask changes as the acid is added.

..... [1]

(iv) Which **one** of the following best describes the reaction of aqueous ammonia with aqueous phosphoric acid?
Put a ring around the correct answer.

combustion **decomposition** **neutralisation** **reduction**

[1]

(c) When sodium hydroxide is added to ammonium phosphate, ammonia is released.

Complete the symbol equation for this reaction.

$$(NH_4)_3PO_4 + 3NaOH \rightarrow Na_3PO_4 + ...NH_3 + 3 .....$$

[2]

[Total: 7]

5 The table shows the concentration of some ions present in a sample of seawater.

name of ion	formula of ion	concentration in g / dm^3
bromide	Br^-	0.06
calcium	Ca^{2+}	0.30
chloride	Cl^-	20.00
	I^-	0.04
magnesium	Mg^{2+}	1.00
potassium	K^+	0.50
sodium	Na^+	11.00
sulfate	SO_4^{2-}	0.80

(a) (i) Which positive ion in the table has the lowest concentration?

..... [1]

(ii) Give the name of the ion with the formula I^-.

..... [1]

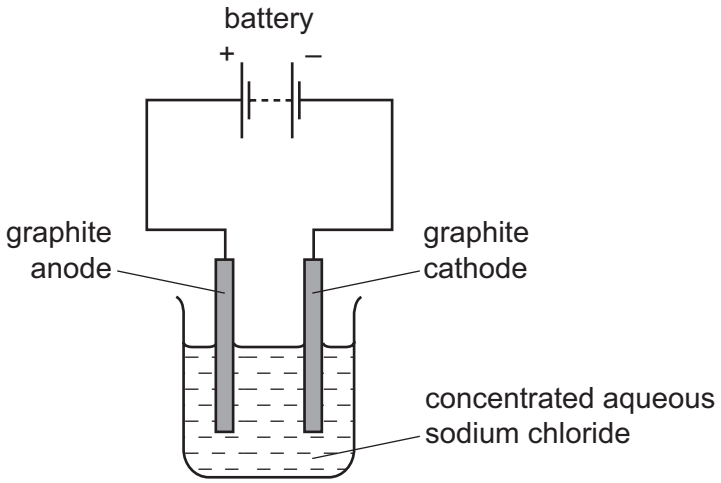
(iii) Which **two** ions in the table are formed from elements in Group II of the Periodic Table?

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

(iv) Give the names of **two** ions in the table which move towards the anode (positive electrode) when a sample of this seawater is electrolysed.

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

(b) Sodium chloride can be extracted from seawater.
Concentrated aqueous sodium chloride is electrolysed using the apparatus shown.



(i) Suggest why the anode and cathode are made of graphite.

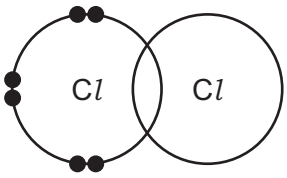
..... [1]

(ii) Give the name of the product formed at the cathode (negative electrode).

..... [1]

(iii) Chlorine is formed at the anode.

Complete the electronic structure of a chlorine molecule. Show only the outer shell electrons.



[2]

(c) Molten magnesium bromide is electrolysed.

Predict the products at the anode (positive electrode) and cathode (negative electrode).

anode .....

cathode .....

[2]

[Total: 11]

6 Zinc oxide is used for making baby soap and cream for treating sunburn.

(a) Suggest why the zinc oxide used for these purposes needs to be pure.

.....

(b) Zinc oxide can be reduced by carbon. Carbon monoxide is one of the products.

(i) What is the meaning of the term *reduction*?

..... [1]

(ii) Write a word equation for the reaction of zinc oxide with carbon.

..... [1]

(iii) Explain why, in the laboratory, the reaction should be carried out in a fume cupboard.

..... [1]

(c) The table shows how easy it is to reduce various metal oxides by heating with carbon.

metal oxide	ease of reduction with carbon
lead oxide	easily reduced at 300 °C
magnesium oxide	not reduced at 900 °C
nickel oxide	easily reduced at 500 °C
zinc oxide	fairly easily reduced at 900 °C

Use the information in the table to put the metals in order of their reactivity.

least reactive ⟶ most reactive

[2]

(d) Zinc oxide reacts with sulfuric acid.

Complete the word equation for this reaction.

zinc oxide + sulfuric acid → zinc sulfate + ...

[1]

(e) Pure dry crystals of zinc sulfate can be made by the reaction of dilute sulfuric acid with excess zinc.

(i) How is excess zinc removed from the reaction mixture?

..... [1]

(ii) Describe how you would obtain pure dry crystals of zinc sulfate from an aqueous solution of zinc sulfate.

.....

.....

.....

..... [3]

(iii) Zinc sulfate can be made from the reaction of sulfuric acid with zinc oxide or zinc.

Give the name of another compound that reacts with sulfuric acid to produce zinc sulfate.

..... [1]

(f) A student reacts zinc with excess sulfuric acid.
She obtains 16.1 g of zinc sulfate from 6.5 g of zinc.

(i) Calculate the mass of zinc sulfate she would obtain from 26.0 g of zinc.

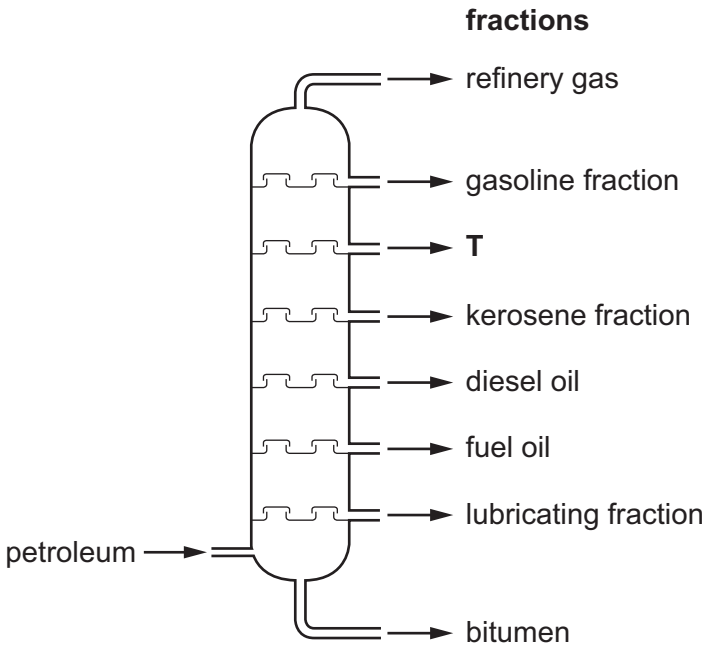
[1]

(ii) Calculate the relative formula mass of zinc sulfate, $ZnSO_4$.

[2]

[Total: 15]

7 Petroleum is separated into useful fractions by fractional distillation.



(a) (i) Put an **X** on the diagram to show where the temperature in the column is the highest. [1]

(ii) Give the name of the fraction labelled **T**.

..... [1]

(iii) The lubricating fraction is used to make lubricants.

Give **one** other use of this fraction.

..... [1]

(b) Each fraction contains alkanes.

Which **two** of the following statements are correct?
Tick **two** boxes.

Alkanes burn to form carbon dioxide and hydrogen.	☐
Ethene is an alkane with two carbon atoms.	☐
Alkanes polymerise to form poly(alkanes).	☐
Alkanes are generally unreactive apart from burning.	☐
Methane is an alkane present in natural gas.	☐

[2]

(c) Hydrogen can be made by cracking.

(i) What is meant by the term *cracking*?

.....

..... [2]

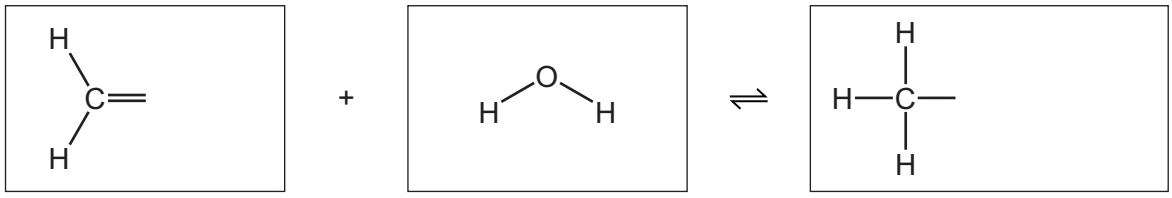
(ii) Complete the equation for the cracking of propane.

$$C_3H_8 \rightarrow \text{.....} + H_2$$

[1]

(d) Ethanol is formed by the catalytic addition of steam to ethene.

(i) Complete the structures of ethene and ethanol in the equation below, showing all atoms and bonds.



ethene ethanol

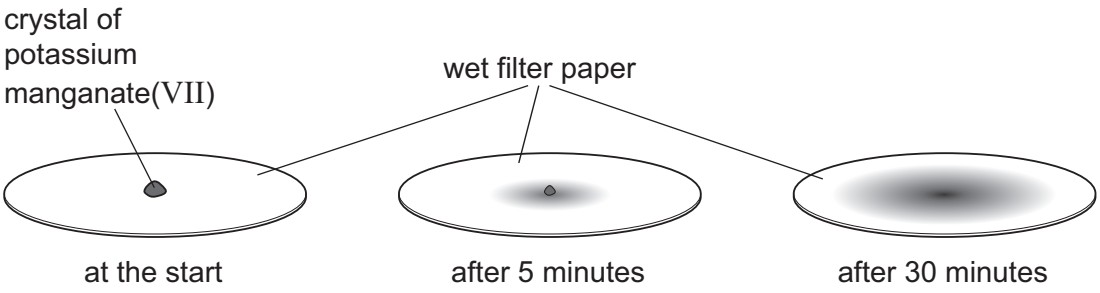
[2]

(ii) What does the symbol ⇌ mean?

..... [1]

[Total: 11]

8 A student placed a crystal of purple potassium manganate(VII) on a filter paper which was soaked in water.
After 5 minutes, a purple colour had spread out from the crystal.
After 30 minutes, the purple colour had spread further out.



(a) Use the kinetic particle theory to explain these observations.

.....

.....

.....

.....

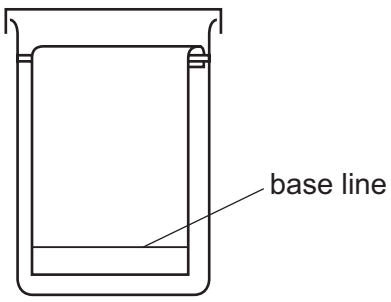
..... [3]

(b) Describe the closeness and motion of the particles in a crystal of potassium manganate(VII).

closeness .....

motion .....
[2]

(c) Mixtures of dyes can be separated by paper chromatography using the apparatus shown below.



On the diagram above

- draw a line to show the solvent level at the beginning of the experiment,
- put a cross to show where the spot of dye mixture is placed at the beginning of the experiment.

[2]

[Total: 7]

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DATA SHEET
The Periodic Table of the Elements

Group																	
I	II										III	IV	V	VI	VII	0
							1 H Hydrogen 1									4 He Helium 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
23 Na Sodium 11	24 Mg Magnesium 12										27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
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	64 Cu Copper 29	65 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
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	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
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	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 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	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

*58-71 Lanthanoid series
†90-103 Actinoid series

Key: a = relative atomic mass; X = atomic symbol; b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).