Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						7	0	8	1	/	0	2	Signature	

Paper Referencc(s)

7081/02

Examiner's use only

Team Leader's use only

London Examinations GCE

Chemistry

Ordinary Level

Paper 2

Thursday 15 May 2008 – Afternoon

Time: 2 hours

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
7	
8	
9	
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.
The paper is arranged in TWO sections, A and B.
In Section A, answer ALL questions in the spaces provided in this question paper.
In Section B, answer TWO questions in the spaces provided in this question paper.
Indicate which question you are answering by marking the box (☒). If you change your mind, put a line through the box (~~☒~~) and then indicate your new question with a cross (☒).

Information for Candidates

A Periodic Table is printed on the back cover of this question paper.
Calculators may be used.
The total mark for this paper is 100. Marks for parts of questions are shown in round brackets: e.g. **(2)**.
This paper has 9 questions. All blank pages are indicated.

DATA

One mole of any gas occupies 24 000 cm^3 at room temperature and atmospheric pressure.
One mole of electrons carries a charge of 96 500 coulombs or 1 faraday.

Advice to Candidates

Write your answers neatly and in good English.
In calculations, show **all** the steps in your working.

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SECTION A

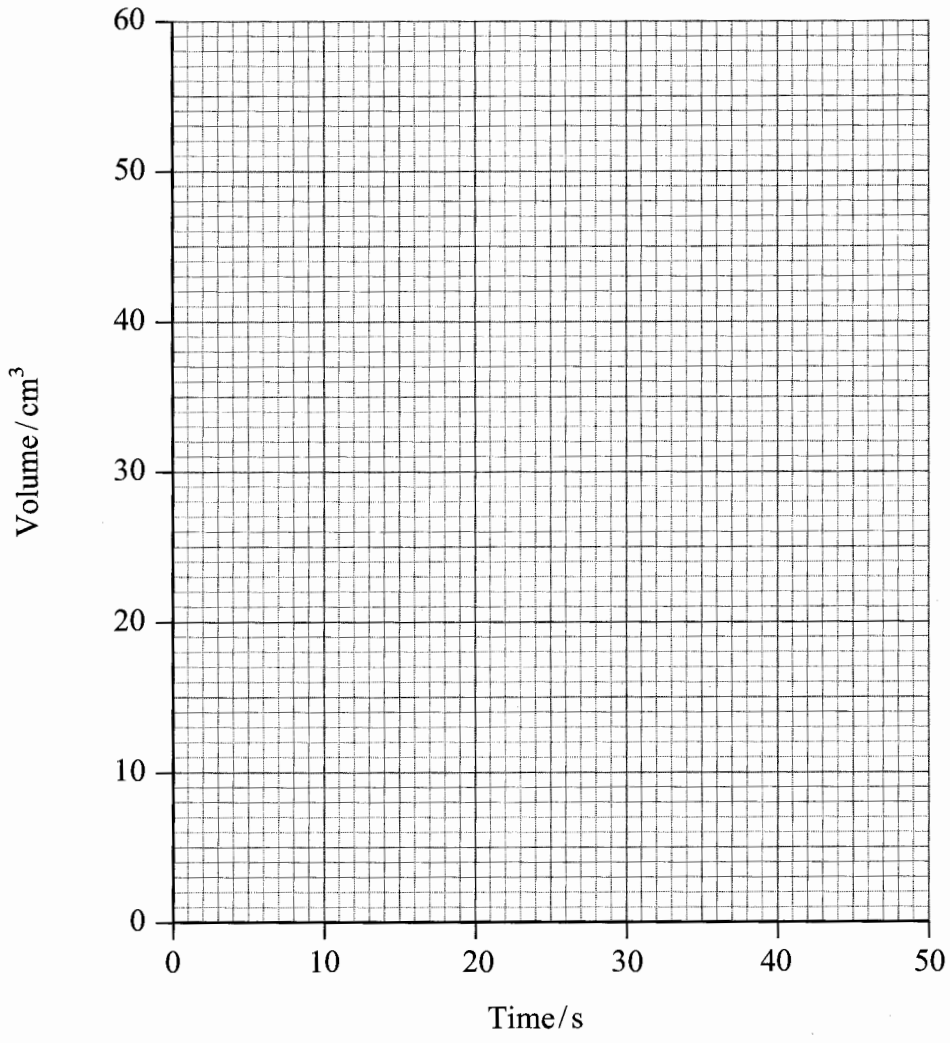
Answer ALL questions in this section.

There is useful data on the front cover and a Periodic Table is printed on the back of this booklet.

1. In order to investigate the rate of reaction between magnesium and dilute sulphuric acid, excess acid was added to a strip of magnesium ribbon and the volume of gas evolved was recorded every 5 seconds. The results are given in the following table.

Volume / cm^3	0	18	30	38	45	50	54	57	59	60	60
Time /s	0	5	10	15	20	25	30	35	40	45	50

(a) Use the grid to plot a graph of volume of gas produced against time.



(3)

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(b) (i) How long did it take for half of the magnesium to react?

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(1)

(ii) What fraction of magnesium remained after 20 seconds?

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(1)

(c) Here is the equation for this reaction.

$$Mg(s) + H_2SO_4(aq) \longrightarrow MgSO_4(aq) + H_2(g)$$

Calculate the mass of magnesium ribbon used.

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(2)

(d) State the effect, if any, on the rate of reaction if the same mass of magnesium powder was used in place of magnesium ribbon. Explain your answer in terms of collision theory.

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(3)

Q1

(Total 10 marks)

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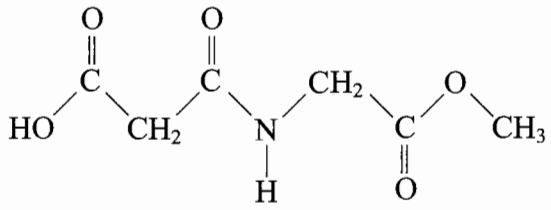
2. The following diagram shows the structure of an artificial sweetener called Sweeterex.



(a) On the diagram draw circles around and label

(i) a carboxylic acid group

(ii) an ester group.

(2)

(b) (i) Write down the molecular formula of Sweeterex.

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(1)

(ii) The relative molecular mass of Sweeterex is 175. Calculate the percentage by mass of carbon in Sweeterex.

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(2)

(c) (i) Suggest what you would observe if Sweeterex was added to sodium carbonate solution.

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(ii) Write an ionic equation to represent this reaction using H^+ for the acidic species.

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(3)

Leave blank

(d) A small pill of Sweeterex is placed in the bottom of a cup of coffee. After standing for a few minutes without stirring, all of the coffee tastes sweet. Explain what happens to the Sweeterex molecules.

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(2)

Q2

(Total 10 marks)

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3. The following table shows some information about the first four compounds in the homologous series of alkenes.

Name	Structural formula	Relative molecular mass	Boiling point / °C
ethene	$CH_2=CH_2$	28	–104
propene		42	–48
	$CH_2=CH–CH_2–CH_3$	56	–6
pentene	$CH_2=CH–CH_2–CH_2–CH_3$		20

(a) Complete the table by adding the missing information.

(3)

(b) Describe the pattern between the length of the carbon chain and the boiling point in this homologous series.

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(1)

(c) Ethene is the starting material in the manufacture of ethanol.

(i) Give the name of the type of reaction involved.

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(1)

(ii) Draw the displayed formula of ethanol.

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Leave blank

(d) Ethanol can be converted into ethanoic acid by atmospheric oxygen.

(i) Write an equation to represent this reaction.

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(1)

(ii) What type of reaction is involved?

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(1)

(e) Name the organic product formed when ethanol is reacted with:

(i) sodium

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(1)

(ii) phosphorus pentachloride.

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(1)

Q3

(Total 10 marks)

Leave blank

4. Chlorine exists as two isotopes $^{35}_{17}Cl$ and $^{37}_{17}Cl$.

(a) Complete the following table.

Isotope	Number of protons	Number of neutrons
$^{35}_{17}Cl$		
$^{37}_{17}Cl$		

(2)

(b) The relative atomic mass of chlorine is 35.5. What is the ratio of $^{35}_{17}Cl$ to $^{37}_{17}Cl$ in a sample of naturally-occurring chlorine?

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(1)

(c) Starting from iron, give an equation for the formation of iron(II) chloride and iron(III) chloride.

(i) Formation of iron(II) chloride

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(2)

(ii) Formation of iron(III) chloride

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(2)

(d) Describe a chemical test, including its result, that could be carried out to determine the oxidation state of iron in a solution of an iron compound.

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(3)

(Total 10 marks)

Q4

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5. (a) Draw a diagram to show the arrangement of carbon atoms in graphite.

(2)

(b) Explain, in terms of its structure, why graphite can conduct electricity.

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(2)

QUESTION 5 CONTINUES ON THE NEXT PAGE

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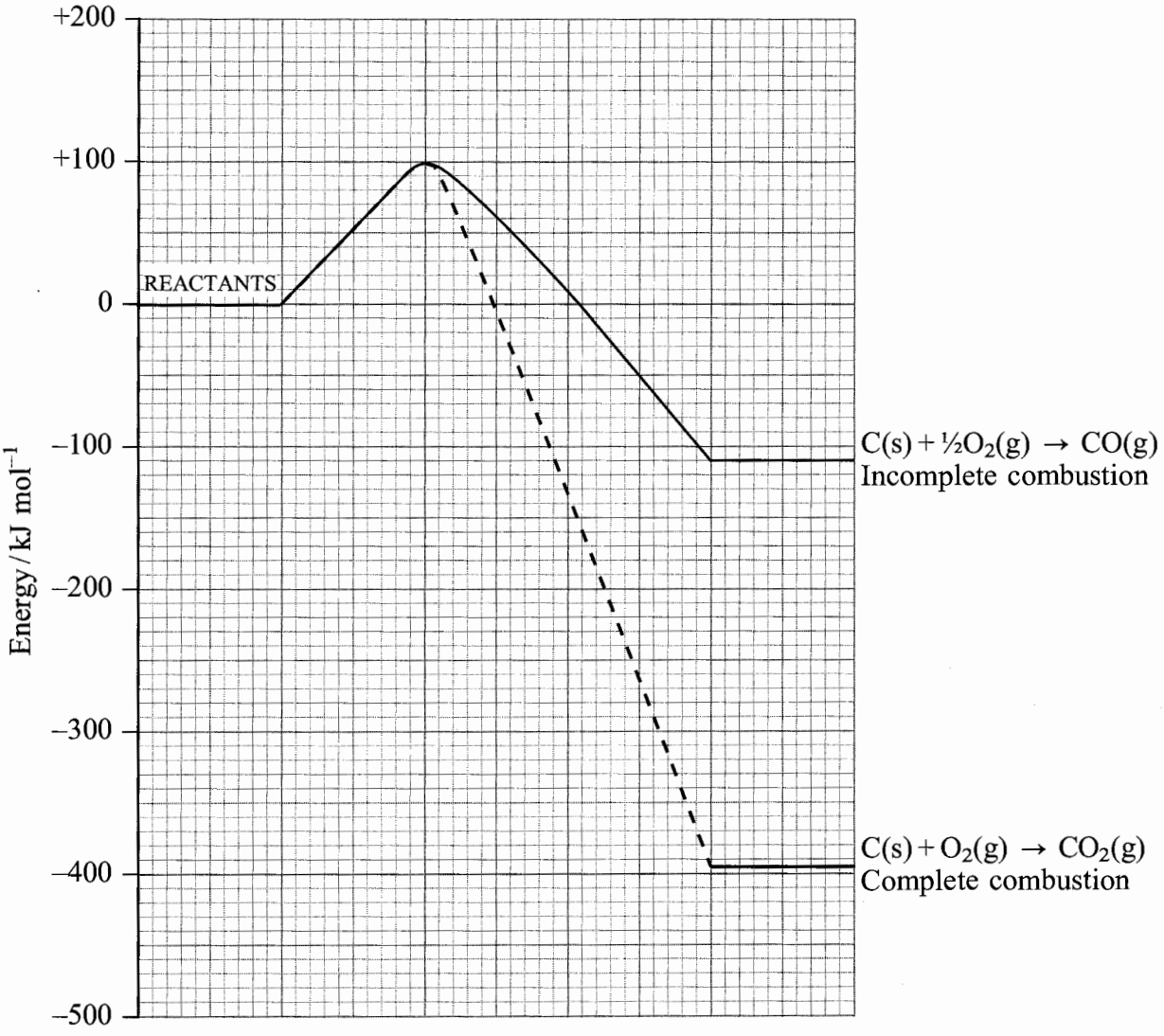
(c) The following graphs show the energy changes which occur during the incomplete and complete combustion of one mole of carbon.



(i) Are the reactions endothermic or exothermic? Explain your answer.

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(1)

(ii) Use the graphs to estimate the enthalpy change, ΔH, for each reaction.

$C(s) + \frac{1}{2}O_2(g) \longrightarrow CO(g)$ $\quad \Delta H =$ ..... kJ mol^{-1}

$C(s) + O_2(g) \longrightarrow CO_2(g)$ $\quad \Delta H =$ ..... kJ mol^{-1}

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(d) State **two** disadvantages of the incomplete combustion of carbon.

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2 .....

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(2)

Q5

(Total 10 marks)

TOTAL FOR SECTION A: 50 MARKS

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SECTION B

Answer TWO questions in this section.

Where appropriate, equations and diagrams should be given to clarify your answers.

If you answer question 6, put a cross in this box ☒.

6. State the principle involved in each of the following processes and give an account of how it is used industrially to prepare the product given in brackets.

Your account should include details of starting materials and details of how the product is obtained.

(a) Electrolysis (aluminium)

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(9)

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(b) Fractional distillation (petrol)

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(8)

QUESTION 6 CONTINUES ON THE NEXT PAGE

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(c) Catalysis (sulphur trioxide)

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(8)

Q6

(Total 25 marks)

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If you answer question 7 put a cross in this box ☒.

7. Describe simple experiments you would carry out in the laboratory to demonstrate that each of the following statements is correct.

(a) The blue colour of copper(II) sulphate crystals is due to water in the structure.

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(b) Iron is more reactive than copper but less reactive than zinc.

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(c) Ammonia diffuses more quickly than hydrogen chloride.

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(d) The rate of reaction between zinc and dilute hydrochloric acid increases with temperature.

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(e) The green colour in plant leaves is a mixture of two or more substances.

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(5)

Q7

(Total 25 marks)

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If you answer question 8 put a cross in this box ☒.

8. (a) Using copper as an example, state three chemical properties which are only found in transition metals and their compounds.

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(b) Copper can be converted into copper(II) sulphate by the following sequence of reactions:

Reaction 1 **Reaction 2**

copper $\longrightarrow$ copper(II) oxide $\longrightarrow$ copper(II) sulphate

Describe how you would carry out each reaction in order to obtain a pure dry crystalline sample of copper(II) sulphate.

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(c) Heating each of the following compounds produces copper(II) oxide. For each reaction, name the other product(s) and write an equation.

(i) $CuCO_3$

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(2)

(ii) $Cu(OH)_2$

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(2)

(iii) $Cu(NO_3)_2$

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(3)

Q8

(Total 25 marks)

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If you answer question 9 put a cross in this box ☒.

9. (a) Nylon-6.6 is a condensation polymer made from two monomers, each of which contains 6 carbon atoms. The structures of the monomers used in its manufacture can be represented as $H_2N{-}(CH_2)_x{-}NH_2$ and $HOOC{-}(CH_2)_y{-}COOH$.

Write the structural formulae of these monomers, giving the values of x and y, and the structural formula of the repeating unit of the polymer they form.

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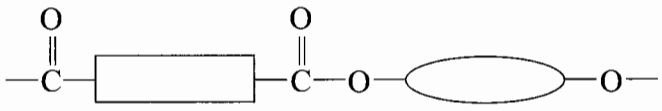
(4)

(b) Terylene is another condensation polymer. The following diagram represents the repeating unit of Terylene.



Name the type of condensation polymer and draw structures that represent the monomers used in its manufacture.

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(c) (i) State **two** differences between addition polymerisation and condensation polymerisation.

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(ii) Starting from a fraction obtained from crude oil, name and describe the process used to produce ethene. Give an equation for a typical reaction that occurs during this process.

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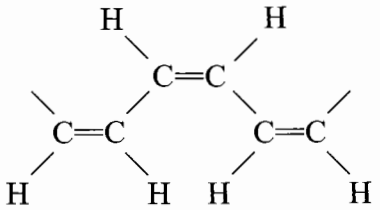
(d) Ethyne has the structure H—C≡C—H. It polymerises in exactly the same way as ethene forming the polymer poly(ethyne).



(i) Draw a diagram to show part of a poly(ethene) molecule containing six carbon atoms.

(1)

(ii) State one difference between the structure of poly(ethyne) and poly(ethene).

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(1)

(iii) Give the empirical formula of poly(ethene) and of poly(ethyne).

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(2)

(iv) Describe a chemical test to distinguish between poly(ethene) and poly(ethyne), giving the result for each polymer.

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(3)

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(v) State one reaction that would take place with both poly(ethyne) and poly(ethene) and give the products of this reaction for both polymers.

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(2)

Q9

(Total 25 marks)

TOTAL FOR SECTION B: 50 MARKS

TOTAL FOR PAPER: 100 MARKS

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THE PERIODIC TABLE

Period	1	2											3	4	5	6	7	0
			Group															
1	1 H Hydrogen 1																	2 He Helium 4
2	3 Li Lithium 7	4 Be Beryllium 9											5 B Boron 11	6 C Carbon 12	7 N Nitrogen 14	8 O Oxygen 16	9 F Fluorine 19	10 Ne Neon 20
3	11 Na Sodium 23	12 Mg Magnesium 24											13 Al Aluminium 27	14 Si Silicon 28	15 P Phosphorus 31	16 S Sulphur 32	17 Cl Chlorine 35.5	18 Ar Argon 40
4	19 K Potassium 39	20 Ca Calcium 40	21 Sc Scandium 45	22 Ti Titanium 48	23 V Vanadium 51	24 Cr Chromium 52	25 Mn Manganese 55	26 Fe Iron 56	27 Co Cobalt 59	28 Ni Nickel 59	29 Cu Copper 63.5	30 Zn Zinc 65	31 Ga Gallium 70	32 Ge Germanium 73	33 As Arsenic 75	34 Se Selenium 79	35 Br Bromine 80	36 Kr Krypton 84
5	37 Rb Rubidium 86	38 Sr Strontium 88	39 Y Yttrium 89	40 Zr Zirconium 91	41 Nb Niobium 93	42 Mo Molybdenum 96	43 Tc Technetium 99	44 Ru Ruthenium 101	45 Rh Rhodium 103	46 Pd Palladium 106	47 Ag Silver 108	48 Cd Cadmium 112	49 In Indium 115	50 Sn Tin 119	51 Sb Antimony 122	52 Te Tellurium 128	53 I Iodine 127	54 Xe Xenon 131
6	55 Cs Caesium 133	56 Ba Barium 137	57 La Lanthanum 139	72 Hf Hafnium 179	73 Ta Tantalum 181	74 W Tungsten 184	75 Re Rhenium 186	76 Os Osmium 190	77 Ir Iridium 192	78 Pt Platinum 195	79 Au Gold 197	80 Hg Mercury 201	81 Tl Thallium 204	82 Pb Lead 207	83 Bi Bismuth 209	84 Po Polonium 210	85 At Astatine 210	86 Rn Radon 222
7	87 Fr Francium 223	88 Ra Radium 226	89 Ac Actinium 227															

Key

Atomic number
Symbol
Name
Relative atomic mass