

Paper Reference(s) 5CH1H/01

Edexcel GCSE

Chemistry/Science

Unit C1: Chemistry in Our World

Higher Tier

Monday 21 May 2012 – Morning

Time: 1 hour plus your additional time allowance

Centre No.					
Candidate No.					
Surname					
Initial(s)					
Signature					
Paper Reference	5	C	H	1	H / 0 1

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PEARSON

INSTRUCTIONS TO CANDIDATES

- **Write your centre number, candidate number, surname, initials and your signature in the boxes on page 1. Check that you have the correct question paper.**
- **Use BLACK ink or ball-point pen.**
- **Answer ALL questions.**
- **Answer the questions in the spaces provided – there may be more space than you need.**

MATERIALS REQUIRED FOR EXAMINATION

Calculator, ruler

ITEMS INCLUDED WITH QUESTION PAPERS

Nil

(More instructions on page 3)

(Turn over)

INFORMATION FOR CANDIDATES

- **The total mark for this paper is 60.**
- **The marks for EACH question are shown in brackets – use this as a guide as to how much time to spend on each question.**
- **Questions labelled with an ASTERISK (*) are ones where the quality of your written communication will be assessed – you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.**
- **A Periodic Table is provided.**

ADVICE TO CANDIDATES

- **Read each question carefully before you start to answer it.**
- **Keep an eye on the time.**
- **Try to answer every question.**
- **Check your answers if you have time at the end.**

(Turn over)

ANSWER ALL QUESTIONS.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ~~☒~~ and then mark your new answer with a cross ☒.

THE REACTIVITY SERIES

- 1 The list shows some metals in reactivity series order with the most reactive at the top.

MOST REACTIVE

calcium
magnesium
aluminium
zinc
iron
copper
gold

LEAST REACTIVE

(Question continues on next page)

(Turn over)

5

(a) Which of these metals can be found as the uncombined metal in the Earth's crust?

Put a cross (☒) in the box next to your answer. (1 mark)

A calcium

B gold

C magnesium

D zinc

(Question continues on next page)

(Turn over)

6

(b) Metals are extracted by the reduction of their ores.

State the meaning of the term REDUCTION. (1 mark)

(Question continues on next page)

(Turn over)

(c) Aluminium is extracted by the electrolysis of a molten mixture of its ore (bauxite) and cryolite. Iron is extracted by heating a mixture of its ore and carbon.

Explain why electrolysis is used to extract aluminium but is not used to extract iron. (2 marks)

(Question continues on next page)

(Turn over)

(d) An alloy of aluminium with magnesium is used for parts of aeroplanes.

Explain why the aluminium alloy is stronger than pure aluminium. (2 marks)

(Question continues on next page)

(Turn over)

- (e) When aluminium corrodes, it reacts with oxygen to form aluminium oxide, Al_2O_3 .

Complete the balancing of this equation by putting numbers in the spaces provided. (2 marks)



Q1

(Total 8 marks)

(Questions continue on next page)

(Turn over)

CARBON DIOXIDE LEVELS IN THE ATMOSPHERE

- 2 Scientists believe that, about 4500 million years ago, the Earth was very much hotter than it is now.
The atmosphere then was very different from that on Earth today.**
- (a) Explain why it is difficult to be precise about the composition of the Earth's early atmosphere.
(2 marks)**

(Continue your answer on next page)

(Turn over)

(b) As the Earth cooled, oceans formed.

**How did this affect the composition of the atmosphere?
(1 mark)**

(Question continues on next page)

(Turn over)

- (c) The first plants appeared about 400 million years ago.**

Explain how the growth of these plants affected the composition of the atmosphere. (2 marks)

(Question continues on next page)

(Turn over)

(d) What is the current approximate percentage of carbon dioxide in the Earth's atmosphere?

Put a cross (☒) in the box next to your answer. (1 mark)

A 0.04

B 1.0

C 4.0

D 10

(Question continues on next page)

(Turn over)

- (e) The amount of carbon dioxide in the Earth's atmosphere has been rising over the past fifty years, mainly caused by an increase in the quantity of fossil fuels that have been burned.

State another cause of increasing amounts of carbon dioxide in the atmosphere.
(1 mark)

(Total 7 marks) **Q2**

(Questions continue on next page)

(Turn over)

HYDROCARBONS

- 3 (a) During fractional distillation, crude oil is separated into a number of fractions.

The table shows the relative amount of these fractions that can be obtained from crude oil.

The table also shows the relative demand for each of these fractions.

fraction	relative amount obtained	relative demand
LPG	2	6
petrol	12	29
kerosene	16	11
diesel	24	29
fuel oil and bitumen	46	25

(Question continues on next page)

(Turn over)

- (i) For which fractions does the demand exceed the supply?

Put a cross (☒) in the box next to your answer.
(1 mark)

- A kerosene, diesel, fuel oil and bitumen
- B LPG, petrol and diesel
- C LPG, petrol and kerosene
- D petrol, diesel, fuel oil and bitumen

(Question continues on next page)

(Turn over)

- (ii) In another process, called cracking, large molecules in some fractions are converted into smaller molecules.

Explain why cracking is needed. (2 marks)

(Question continues on next page)

(Turn over)

(b) The table shows the number of carbon atoms per molecule in the substances present in each of the fractions.

FRACTION	NUMBER OF CARBON ATOMS PER MOLECULE
LPG	1 – 4
petrol	4 – 12
kerosene	9 – 16
diesel	15 – 25
fuel oil and bitumen	over 25

(Question continues on next page)

(Turn over)

Complete the sentence by putting a cross (☒) in the box next to your answer. (1 mark)

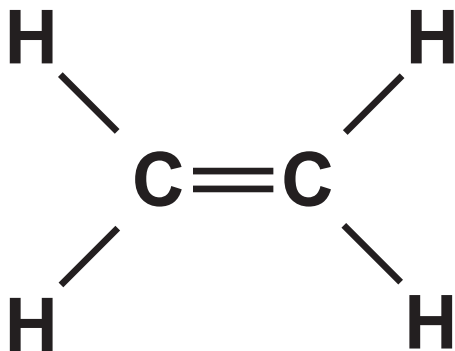
As the number of carbon atoms in the molecules of a hydrocarbon increases

- A the number of hydrogen atoms in the molecule remains the same**
- B the boiling point of the hydrocarbon increases**
- C the hydrocarbon becomes easier to burn**
- D the viscosity of the hydrocarbon decreases**

(Question continues on next page)

(Turn over)

(c) The structure of a molecule of ethene is



(i) What is the formula of a molecule of ethene?

Put a cross (\boxtimes) in the box next to your answer.
(1 mark)

- A CH_2
- B C_2H_4
- C C_nH_{2n}
- D $(\text{CH}_2)_n$

(Question continues on next page)

(Turn over)

- (ii) Ethene can be converted into poly(ethene).

Write a balanced equation for this reaction. (2 marks)

(Question continues on next page)

(Turn over)

- (d) Many power stations generate electricity by burning fossil fuels, such as fuel oil.**

This process adds carbon dioxide to the atmosphere.

- (i) Explain why some people are concerned about the increase in the amount of carbon dioxide in the atmosphere. (2 marks)**

(Continue your answer on next page)

(Turn over)

(ii) Some hydrocarbon fuels can contain sulfur impurities.

Explain how the product of combustion of these sulfur impurities affects the environment. (2 marks)

(Continue your answer on next page)

(Turn over)

(Total 11 marks) ^{Q3}

(Questions continue on next page)

(Turn over)

CALCIUM COMPOUNDS

- 4 Calcium carbonate is an important raw material in the chemical industry. It exists naturally as chalk, marble and limestone.**

(Question continues on next page)

(Turn over)

(a) Which row of the table correctly identifies chalk, marble and limestone as sedimentary or metamorphic rocks?

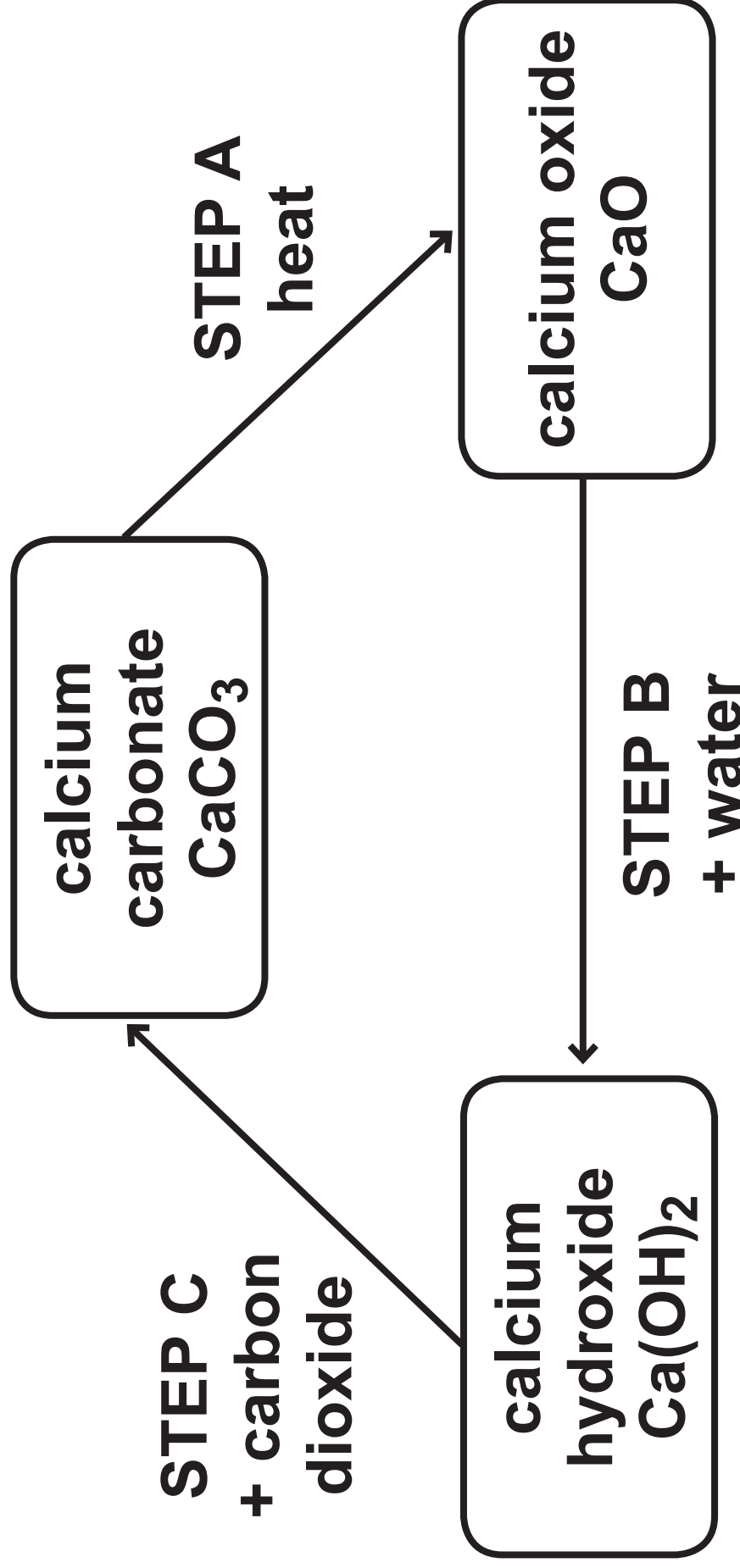
Put a cross (☒) in the box next to your answer. (1 mark)

	CHALK	MARBLE	LIMESTONE
<input type="checkbox"/>	A sedimentary	sedimentary	metamorphic
<input type="checkbox"/>	B metamorphic	metamorphic	sedimentary
<input type="checkbox"/>	C sedimentary	metamorphic	sedimentary
<input type="checkbox"/>	D metamorphic	sedimentary	metamorphic

(Question continues on next page)

(Turn over)

(b) The diagram shows reactions of some calcium compounds.



(Question continues on next page)

(Turn over)

- (i) Both calcium carbonate and calcium oxide are white solids.

Suggest how you could show that, when calcium carbonate is heated, a reaction takes place.
(2 marks)

(Question continues on next page)

(Turn over)

- (ii) Describe what you would observe when water is added, one drop at a time, to cold calcium oxide (STEP B). (2 marks)

(Question continues on next page)

(Turn over)

(iii) Write the balanced equation for the reaction of calcium hydroxide with carbon dioxide (STEP C). (2 marks)

(iv) State the common name for calcium hydroxide solution. (1 mark)

(Question continues on next page)

(Turn over)

(c) Explain why calcium carbonate removes acidic gases from emissions in power station chimneys. (2 marks)

(Total 10 marks) **Q4**

(Questions continue on next page)

(Turn over)

ELECTROLYSIS

5 Electrolysis occurs when solutions of some compounds are decomposed by passing direct electric current through them.

(a) Sodium chloride solution was electrolysed.

The reaction produced chlorine and hydrogen.

The remaining solution contained sodium hydroxide, NaOH.

(i) State a hazard associated with chlorine gas. (1 mark)

(Question continues on next page)

(Turn over)

- (ii) Describe a test that can be used to identify a sample of gas as chlorine. (2 marks)**

(Question continues on next page)

(Turn over)

(iii) State a use of chlorine. (1 mark)

(iv) Complete and balance the equation for the overall reaction taking place when sodium chloride solution is electrolysed. (2 marks)

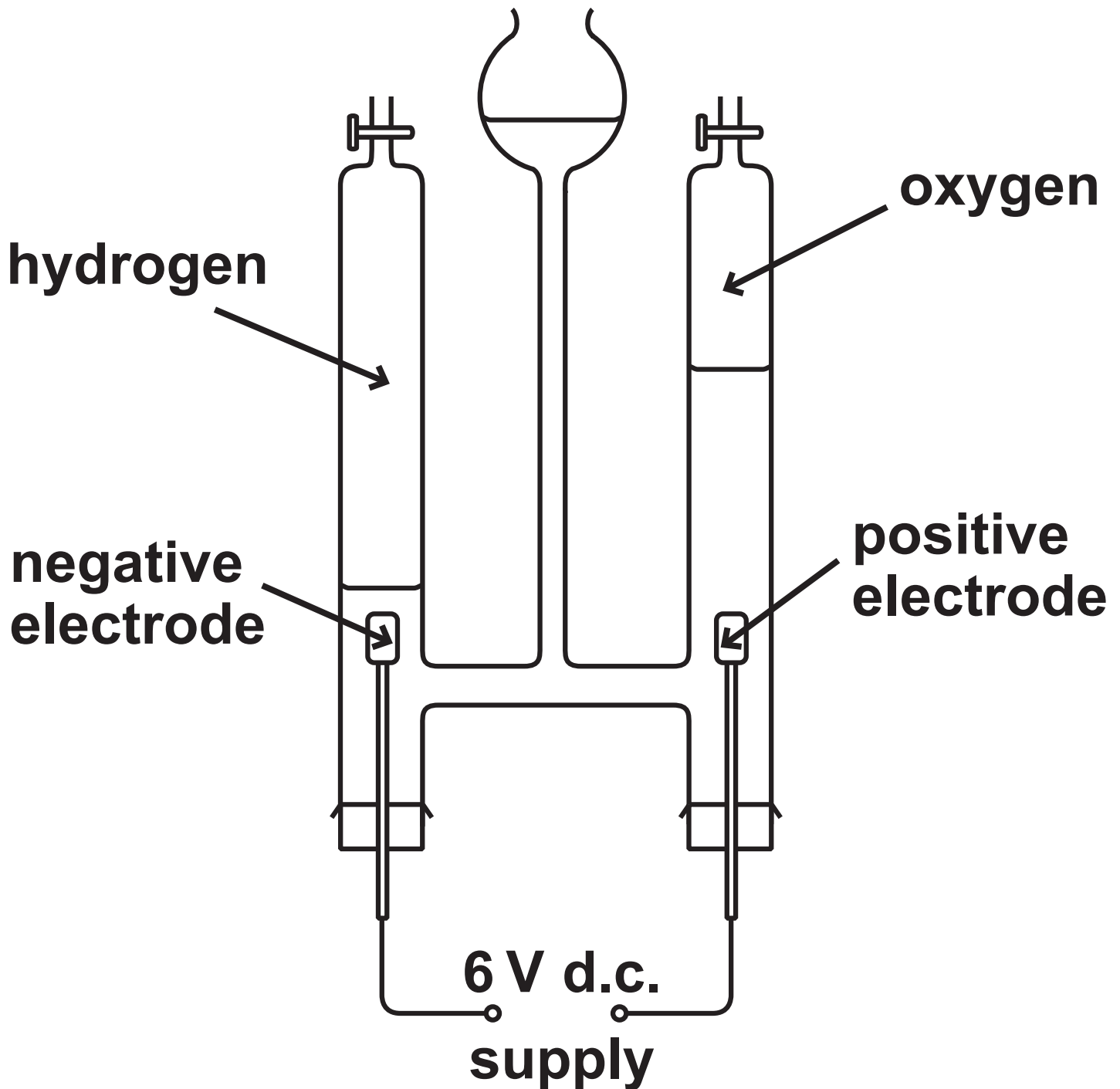
34



(Question continues on next page)

(Turn over)

***(b) Water was decomposed by electrolysis in the apparatus shown.**



(Question continues on next page)

(Turn over)

The water decomposed into hydrogen and oxygen.

After five minutes, the volumes of hydrogen and oxygen in the tubes were measured.

Two further experiments were carried out changing only one factor in each experiment. All other factors were kept the same.

The table on page 37 shows the conditions and results of all three experiments.

(Question continues on next page)

(Turn over)

experiment	time / minutes	current / amps	volume of hydrogen / cm³	volume of oxygen / cm³
1	5	0.50	20.0	10.0
2	10	0.50	40.0	20.0
3	5	0.75	30.0	15.0

(Question continues on next page)

(Turn over)

Use these results of electrolysis to compare the volumes of hydrogen and oxygen formed and to show the effect of changing the time and the current on the volumes of these gases. (6 marks)

**(Continue your answer on next page)
(Turn over)**

(Total 12 marks) **Q5**

(Questions continue on next page)
(Turn over)

ALTERNATIVE FUELS

6 Known crude oil deposits are being used up.

In the past, most of our fuels, such as petrol, have been obtained from crude oil.

(a) Fuels such as those obtained from crude oil are non-renewable. Efforts are being made to replace these types of fuels with renewable fuels.

Explain the difference between NON-RENEWABLE and RENEWABLE fuels. (2 marks)

(Continue your answer on next page)

(Turn over)

***(b) Evaluate the advantages and disadvantages of using bioethanol, instead of petrol, as a fuel for cars. (6 marks)**

(Continue your answer on next page)
(Turn over)

(Question continues on next page)

(Turn over)

(c) The photograph shows one of the new buses for London.



The bus uses hydrogen as a fuel.

There are six hydrogen fuel tanks, which can be seen on the roof of the bus.

The hydrogen from the tanks reacts with oxygen from the air in a fuel cell to release energy to power the bus.

- (i) Write the balanced equation for the overall reaction that takes place when the hydrogen reacts with oxygen in the fuel cell.
(3 marks)

(Question continues on next page)

(Turn over)

- (ii) Like all fuels, hydrogen, when mixed with air and ignited, explodes.

Apart from the possibility of an explosion, state another disadvantage of using hydrogen, rather than diesel, as a fuel for buses. (1 mark)

(Total 12 marks) **Q6**

TOTAL FOR PAPER = 60 MARKS

END

The Periodic Table of the Elements

1	2	3	4	5	6	7	0										
7 Li lithium 3	9 Be beryllium 4	11 Na sodium 11	12 Mg magnesium 12	13 Al aluminium 13	14 N nitrogen 7	15 P phosphorus 15	16 O oxygen 8	17 F fluorine 9	18 Ne neon 10								
19 K potassium 19	20 Ca calcium 20	21 Sc scandium 21	22 Ti titanium 22	23 V vanadium 23	24 Cr chromium 24	25 Mn manganese 25	26 Fe iron 26	27 Co cobalt 27	28 Ni nickel 28	29 Cu copper 29	30 Zn zinc 30	31 Ga gallium 31	32 Ge germanium 32	33 As arsenic 33	34 Se selenium 34	35 Br bromine 35	36 Kr krypton 36
37 Rb rubidium 37	38 Sr strontium 38	39 Y yttrium 39	40 Zr zirconium 40	41 Nb niobium 41	42 Mo molybdenum 42	43 Tc technetium 43	44 Ru ruthenium 44	45 Rh rhodium 45	46 Pd palladium 46	47 Ag silver 47	48 Cd cadmium 48	49 In indium 49	50 Sn tin 50	51 Sb antimony 51	52 Te tellurium 52	53 I iodine 53	54 Xe xenon 54
55 Cs caesium 55	56 Ba barium 56	57 La* lanthanum 57	72 Hf hafnium 72	73 Ta tantalum 73	74 W tungsten 74	75 Re rhenium 75	76 Os osmium 76	77 Ir iridium 77	78 Pt platinum 78	79 Au gold 79	80 Hg mercury 80	81 Tl thallium 81	82 Pb lead 82	83 Bi bismuth 83	84 Po polonium 84	85 At astatine 85	86 Rn radon 86
[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[261] Rf rutherfordium 104	[262] Db dubnium 105	[266] Sg seaborgium 106	[264] Bh bohrium 107	[277] Hs hassium 108	[268] Mt meitnerium 109	[271] Ds darmstadtium 110	[272] Rg roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

1 H hydrogen 1

relative atomic mass atomic symbol name atomic (proton) number

* The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.