

Write your name here

Surname					Other names				
Centre Number					Candidate Number				
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**Edexcel GCSE**

**Chemistry/Additional Science**  
**Unit C2: Discovering Chemistry**

**Higher Tier**

Monday 21 May 2012 – Morning <b>Time: 1 hour</b>	Paper Reference <b>5CH2H/01</b>
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<b>You must have:</b> Calculator, ruler	Total Marks
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### Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided  
– *there may be more space than you need.*

### Information

- 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.*

### Advice

- 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 ►

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**PEARSON**

# The Periodic Table of the Elements

1	2	3	4	5	6	7	0	
7 <b>Li</b> lithium 3	9 <b>Be</b> beryllium 4	11 <b>Na</b> sodium 11	12 <b>C</b> carbon 6	13 <b>Al</b> aluminium 13	14 <b>N</b> nitrogen 7	15 <b>O</b> oxygen 8	16 <b>F</b> fluorine 9	17 <b>Ne</b> neon 10
19 <b>K</b> potassium 19	20 <b>Ca</b> calcium 20	23 <b>Sc</b> scandium 21	24 <b>Ti</b> titanium 22	25 <b>V</b> vanadium 23	26 <b>Cr</b> chromium 24	27 <b>Mn</b> manganese 25	28 <b>Fe</b> iron 26	29 <b>Co</b> cobalt 27
37 <b>Rb</b> rubidium 37	38 <b>Sr</b> strontium 38	39 <b>Y</b> yttrium 39	40 <b>Zr</b> zirconium 40	41 <b>Nb</b> niobium 41	42 <b>Mo</b> molybdenum 42	43 <b>Tc</b> technetium 43	44 <b>Ru</b> ruthenium 44	45 <b>Rh</b> rhodium 45
55 <b>Cs</b> caesium 55	56 <b>Ba</b> barium 56	57 <b>La*</b> lanthanum 57	58 <b>Hf</b> hafnium 72	59 <b>Ta</b> tantalum 73	60 <b>W</b> tungsten 74	61 <b>Re</b> rhenium 75	62 <b>Os</b> osmium 76	63 <b>Ir</b> iridium 77
87 <b>Fr</b> francium 87	88 <b>Ra</b> radium 88	89 <b>Ac*</b> actinium 89	90 <b>Rf</b> rutherfordium 104	91 <b>Db</b> dubnium 105	92 <b>Sg</b> seaborgium 106	93 <b>Bh</b> bohrium 107	94 <b>Hs</b> hassium 108	95 <b>Mt</b> meitnerium 109
133 <b>Cs</b> caesium 55	137 <b>Ba</b> barium 56	139 <b>La*</b> lanthanum 57	140 <b>Hf</b> hafnium 72	141 <b>Ta</b> tantalum 73	142 <b>W</b> tungsten 74	143 <b>Re</b> rhenium 75	144 <b>Os</b> osmium 76	145 <b>Ir</b> iridium 77
187 <b>Fr</b> francium 87	188 <b>Ra</b> radium 88	189 <b>Ac*</b> actinium 89	190 <b>Rf</b> rutherfordium 104	191 <b>Db</b> dubnium 105	192 <b>Sg</b> seaborgium 106	193 <b>Bh</b> bohrium 107	194 <b>Hs</b> hassium 108	195 <b>Mt</b> meitnerium 109
223 <b>Fr</b> francium 87	226 <b>Ra</b> radium 88	227 <b>Ac*</b> actinium 89	228 <b>Rf</b> rutherfordium 104	229 <b>Db</b> dubnium 105	230 <b>Sg</b> seaborgium 106	231 <b>Bh</b> bohrium 107	232 <b>Hs</b> hassium 108	233 <b>Mt</b> meitnerium 109
285 <b>Cs</b> caesium 55	288 <b>Ba</b> barium 56	289 <b>La*</b> lanthanum 57	290 <b>Hf</b> hafnium 72	291 <b>Ta</b> tantalum 73	292 <b>W</b> tungsten 74	293 <b>Re</b> rhenium 75	294 <b>Os</b> osmium 76	295 <b>Ir</b> iridium 77
337 <b>Cs</b> caesium 55	340 <b>Ba</b> barium 56	341 <b>La*</b> lanthanum 57	342 <b>Hf</b> hafnium 72	343 <b>Ta</b> tantalum 73	344 <b>W</b> tungsten 74	345 <b>Re</b> rhenium 75	346 <b>Os</b> osmium 76	347 <b>Ir</b> iridium 77
401 <b>Cs</b> caesium 55	404 <b>Ba</b> barium 56	405 <b>La*</b> lanthanum 57	406 <b>Hf</b> hafnium 72	407 <b>Ta</b> tantalum 73	408 <b>W</b> tungsten 74	409 <b>Re</b> rhenium 75	410 <b>Os</b> osmium 76	411 <b>Ir</b> iridium 77
449 <b>Cs</b> caesium 55	452 <b>Ba</b> barium 56	453 <b>La*</b> lanthanum 57	454 <b>Hf</b> hafnium 72	455 <b>Ta</b> tantalum 73	456 <b>W</b> tungsten 74	457 <b>Re</b> rhenium 75	458 <b>Os</b> osmium 76	459 <b>Ir</b> iridium 77
503 <b>Cs</b> caesium 55	506 <b>Ba</b> barium 56	507 <b>La*</b> lanthanum 57	508 <b>Hf</b> hafnium 72	509 <b>Ta</b> tantalum 73	510 <b>W</b> tungsten 74	511 <b>Re</b> rhenium 75	512 <b>Os</b> osmium 76	513 <b>Ir</b> iridium 77
561 <b>Cs</b> caesium 55	564 <b>Ba</b> barium 56	565 <b>La*</b> lanthanum 57	566 <b>Hf</b> hafnium 72	567 <b>Ta</b> tantalum 73	568 <b>W</b> tungsten 74	569 <b>Re</b> rhenium 75	570 <b>Os</b> osmium 76	571 <b>Ir</b> iridium 77
621 <b>Cs</b> caesium 55	624 <b>Ba</b> barium 56	625 <b>La*</b> lanthanum 57	626 <b>Hf</b> hafnium 72	627 <b>Ta</b> tantalum 73	628 <b>W</b> tungsten 74	629 <b>Re</b> rhenium 75	630 <b>Os</b> osmium 76	631 <b>Ir</b> iridium 77
681 <b>Cs</b> caesium 55	684 <b>Ba</b> barium 56	685 <b>La*</b> lanthanum 57	686 <b>Hf</b> hafnium 72	687 <b>Ta</b> tantalum 73	688 <b>W</b> tungsten 74	689 <b>Re</b> rhenium 75	690 <b>Os</b> osmium 76	691 <b>Ir</b> iridium 77
741 <b>Cs</b> caesium 55	744 <b>Ba</b> barium 56	745 <b>La*</b> lanthanum 57	746 <b>Hf</b> hafnium 72	747 <b>Ta</b> tantalum 73	748 <b>W</b> tungsten 74	749 <b>Re</b> rhenium 75	750 <b>Os</b> osmium 76	751 <b>Ir</b> iridium 77
801 <b>Cs</b> caesium 55	804 <b>Ba</b> barium 56	805 <b>La*</b> lanthanum 57	806 <b>Hf</b> hafnium 72	807 <b>Ta</b> tantalum 73	808 <b>W</b> tungsten 74	809 <b>Re</b> rhenium 75	810 <b>Os</b> osmium 76	811 <b>Ir</b> iridium 77
861 <b>Cs</b> caesium 55	864 <b>Ba</b> barium 56	865 <b>La*</b> lanthanum 57	866 <b>Hf</b> hafnium 72	867 <b>Ta</b> tantalum 73	868 <b>W</b> tungsten 74	869 <b>Re</b> rhenium 75	870 <b>Os</b> osmium 76	871 <b>Ir</b> iridium 77
921 <b>Cs</b> caesium 55	924 <b>Ba</b> barium 56	925 <b>La*</b> lanthanum 57	926 <b>Hf</b> hafnium 72	927 <b>Ta</b> tantalum 73	928 <b>W</b> tungsten 74	929 <b>Re</b> rhenium 75	930 <b>Os</b> osmium 76	931 <b>Ir</b> iridium 77
981 <b>Cs</b> caesium 55	984 <b>Ba</b> barium 56	985 <b>La*</b> lanthanum 57	986 <b>Hf</b> hafnium 72	987 <b>Ta</b> tantalum 73	988 <b>W</b> tungsten 74	989 <b>Re</b> rhenium 75	990 <b>Os</b> osmium 76	991 <b>Ir</b> iridium 77
1041 <b>Cs</b> caesium 55	1044 <b>Ba</b> barium 56	1045 <b>La*</b> lanthanum 57	1046 <b>Hf</b> hafnium 72	1047 <b>Ta</b> tantalum 73	1048 <b>W</b> tungsten 74	1049 <b>Re</b> rhenium 75	1050 <b>Os</b> osmium 76	1051 <b>Ir</b> iridium 77
1101 <b>Cs</b> caesium 55	1104 <b>Ba</b> barium 56	1105 <b>La*</b> lanthanum 57	1106 <b>Hf</b> hafnium 72	1107 <b>Ta</b> tantalum 73	1108 <b>W</b> tungsten 74	1109 <b>Re</b> rhenium 75	1110 <b>Os</b> osmium 76	1111 <b>Ir</b> iridium 77
1161 <b>Cs</b> caesium 55	1164 <b>Ba</b> barium 56	1165 <b>La*</b> lanthanum 57	1166 <b>Hf</b> hafnium 72	1167 <b>Ta</b> tantalum 73	1168 <b>W</b> tungsten 74	1169 <b>Re</b> rhenium 75	1170 <b>Os</b> osmium 76	1171 <b>Ir</b> iridium 77
1221 <b>Cs</b> caesium 55	1224 <b>Ba</b> barium 56	1225 <b>La*</b> lanthanum 57	1226 <b>Hf</b> hafnium 72	1227 <b>Ta</b> tantalum 73	1228 <b>W</b> tungsten 74	1229 <b>Re</b> rhenium 75	1230 <b>Os</b> osmium 76	1231 <b>Ir</b> iridium 77
1281 <b>Cs</b> caesium 55	1284 <b>Ba</b> barium 56	1285 <b>La*</b> lanthanum 57	1286 <b>Hf</b> hafnium 72	1287 <b>Ta</b> tantalum 73	1288 <b>W</b> tungsten 74	1289 <b>Re</b> rhenium 75	1290 <b>Os</b> osmium 76	1291 <b>Ir</b> iridium 77
1341 <b>Cs</b> caesium 55	1344 <b>Ba</b> barium 56	1345 <b>La*</b> lanthanum 57	1346 <b>Hf</b> hafnium 72	1347 <b>Ta</b> tantalum 73	1348 <b>W</b> tungsten 74	1349 <b>Re</b> rhenium 75	1350 <b>Os</b> osmium 76	1351 <b>Ir</b> iridium 77
1401 <b>Cs</b> caesium 55	1404 <b>Ba</b> barium 56	1405 <b>La*</b> lanthanum 57	1406 <b>Hf</b> hafnium 72	1407 <b>Ta</b> tantalum 73	1408 <b>W</b> tungsten 74	1409 <b>Re</b> rhenium 75	1410 <b>Os</b> osmium 76	1411 <b>Ir</b> iridium 77
1461 <b>Cs</b> caesium 55	1464 <b>Ba</b> barium 56	1465 <b>La*</b> lanthanum 57	1466 <b>Hf</b> hafnium 72	1467 <b>Ta</b> tantalum 73	1468 <b>W</b> tungsten 74	1469 <b>Re</b> rhenium 75	1470 <b>Os</b> osmium 76	1471 <b>Ir</b> iridium 77
1521 <b>Cs</b> caesium 55	1524 <b>Ba</b> barium 56	1525 <b>La*</b> lanthanum 57	1526 <b>Hf</b> hafnium 72	1527 <b>Ta</b> tantalum 73	1528 <b>W</b> tungsten 74	1529 <b>Re</b> rhenium 75	1530 <b>Os</b> osmium 76	1531 <b>Ir</b> iridium 77
1581 <b>Cs</b> caesium 55	1584 <b>Ba</b> barium 56	1585 <b>La*</b> lanthanum 57	1586 <b>Hf</b> hafnium 72	1587 <b>Ta</b> tantalum 73	1588 <b>W</b> tungsten 74	1589 <b>Re</b> rhenium 75	1590 <b>Os</b> osmium 76	1591 <b>Ir</b> iridium 77
1641 <b>Cs</b> caesium 55	1644 <b>Ba</b> barium 56	1645 <b>La*</b> lanthanum 57	1646 <b>Hf</b> hafnium 72	1647 <b>Ta</b> tantalum 73	1648 <b>W</b> tungsten 74	1649 <b>Re</b> rhenium 75	1650 <b>Os</b> osmium 76	1651 <b>Ir</b> iridium 77
1701 <b>Cs</b> caesium 55	1704 <b>Ba</b> barium 56	1705 <b>La*</b> lanthanum 57	1706 <b>Hf</b> hafnium 72	1707 <b>Ta</b> tantalum 73	1708 <b>W</b> tungsten 74	1709 <b>Re</b> rhenium 75	1710 <b>Os</b> osmium 76	1711 <b>Ir</b> iridium 77
1761 <b>Cs</b> caesium 55	1764 <b>Ba</b> barium 56	1765 <b>La*</b> lanthanum 57	1766 <b>Hf</b> hafnium 72	1767 <b>Ta</b> tantalum 73	1768 <b>W</b> tungsten 74	1769 <b>Re</b> rhenium 75	1770 <b>Os</b> osmium 76	1771 <b>Ir</b> iridium 77
1821 <b>Cs</b> caesium 55	1824 <b>Ba</b> barium 56	1825 <b>La*</b> lanthanum 57	1826 <b>Hf</b> hafnium 72	1827 <b>Ta</b> tantalum 73	1828 <b>W</b> tungsten 74	1829 <b>Re</b> rhenium 75	1830 <b>Os</b> osmium 76	1831 <b>Ir</b> iridium 77
1881 <b>Cs</b> caesium 55	1884 <b>Ba</b> barium 56	1885 <b>La*</b> lanthanum 57	1886 <b>Hf</b> hafnium 72	1887 <b>Ta</b> tantalum 73	1888 <b>W</b> tungsten 74	1889 <b>Re</b> rhenium 75	1890 <b>Os</b> osmium 76	1891 <b>Ir</b> iridium 77
1941 <b>Cs</b> caesium 55	1944 <b>Ba</b> barium 56	1945 <b>La*</b> lanthanum 57	1946 <b>Hf</b> hafnium 72	1947 <b>Ta</b> tantalum 73	1948 <b>W</b> tungsten 74	1949 <b>Re</b> rhenium 75	1950 <b>Os</b> osmium 76	1951 <b>Ir</b> iridium 77
2001 <b>Cs</b> caesium 55	2004 <b>Ba</b> barium 56	2005 <b>La*</b> lanthanum 57	2006 <b>Hf</b> hafnium 72	2007 <b>Ta</b> tantalum 73	2008 <b>W</b> tungsten 74	2009 <b>Re</b> rhenium 75	2010 <b>Os</b> osmium 76	2011 <b>Ir</b> iridium 77
2061 <b>Cs</b> caesium 55	2064 <b>Ba</b> barium 56	2065 <b>La*</b> lanthanum 57	2066 <b>Hf</b> hafnium 72	2067 <b>Ta</b> tantalum 73	2068 <b>W</b> tungsten 74	2069 <b>Re</b> rhenium 75	2070 <b>Os</b> osmium 76	2071 <b>Ir</b> iridium 77
2121 <b>Cs</b> caesium 55	2124 <b>Ba</b> barium 56	2125 <b>La*</b> lanthanum 57	2126 <b>Hf</b> hafnium 72	2127 <b>Ta</b> tantalum 73	2128 <b>W</b> tungsten 74	2129 <b>Re</b> rhenium 75	2130 <b>Os</b> osmium 76	2131 <b>Ir</b> iridium 77
2181 <b>Cs</b> caesium 55	2184 <b>Ba</b> barium 56	2185 <b>La*</b> lanthanum 57	2186 <b>Hf</b> hafnium 72	2187 <b>Ta</b> tantalum 73	2188 <b>W</b> tungsten 74	2189 <b>Re</b> rhenium 75	2190 <b>Os</b> osmium 76	2191 <b>Ir</b> iridium 77
2241 <b>Cs</b> caesium 55	2244 <b>Ba</b> barium 56	2245 <b>La*</b> lanthanum 57	2246 <b>Hf</b> hafnium 72	2247 <b>Ta</b> tantalum 73	2248 <b>W</b> tungsten 74	2249 <b>Re</b> rhenium 75	2250 <b>Os</b> osmium 76	2251 <b>Ir</b> iridium 77
2301 <b>Cs</b> caesium 55	2304 <b>Ba</b> barium 56	2305 <b>La*</b> lanthanum 57	2306 <b>Hf</b> hafnium 72	2307 <b>Ta</b> tantalum 73	2308 <b>W</b> tungsten 74	2309 <b>Re</b> rhenium 75	2310 <b>Os</b> osmium 76	2311 <b>Ir</b> iridium 77
2361 <b>Cs</b> caesium 55	2364 <b>Ba</b> barium 56	2365 <b>La*</b> lanthanum 57	2366 <b>Hf</b> hafnium 72	2367 <b>Ta</b> tantalum 73	2368 <b>W</b> tungsten 74	2369 <b>Re</b> rhenium 75	2370 <b>Os</b> osmium 76	2371 <b>Ir</b> iridium 77
2421 <b>Cs</b> caesium 55	2424 <b>Ba</b> barium 56	2425 <b>La*</b> lanthanum 57	2426 <b>Hf</b> hafnium 72	2427 <b>Ta</b> tantalum 73	2428 <b>W</b> tungsten 74	2429 <b>Re</b> rhenium 75	2430 <b>Os</b> osmium 76	2431 <b>Ir</b> iridium 77
2481 <b>Cs</b> caesium 55	2484 <b>Ba</b> barium 56	2485 <b>La*</b> lanthanum 57	2486 <b>Hf</b> hafnium 72	2487 <b>Ta</b> tantalum 73	2488 <b>W</b> tungsten 74	2489 <b>Re</b> rhenium 75	2490 <b>Os</b> osmium 76	2491 <b>Ir</b> iridium 77
2541 <b>Cs</b> caesium 55	2544 <b>Ba</b> barium 56	2545 <b>La*</b> lanthanum 57	2546 <b>Hf</b> hafnium 72	2547 <b>Ta</b> tantalum 73	2548 <b>W</b> tungsten 74	2549 <b>Re</b> rhenium 75	2550 <b>Os</b> osmium 76	2551 <b>Ir</b> iridium 77
2601 <b>Cs</b> caesium 55	2604 <b>Ba</b> barium 56	2605 <b>La*</b> lanthanum 57	2606 <b>Hf</b> hafnium 72	2607 <b>Ta</b> tantalum 73	2608 <b>W</b> tungsten 74	2609 <b>Re</b> rhenium 75	2610 <b>Os</b> osmium 76	2611 <b>Ir</b> iridium 77
2661 <b>Cs</b> caesium 55	2664 <b>Ba</b> barium 56	2665 <b>La*</b> lanthanum 57	2666 <b>Hf</b> hafnium 72	2667 <b>Ta</b> tantalum 73	2668 <b>W</b> tungsten 74	2669 <b>Re</b> rhenium 75	2670 <b>Os</b> osmium 76	2671 <b>Ir</b> iridium 77
2721 <b>Cs</b> caesium 55	2724 <b>Ba</b> barium 56	2725 <b>La*</b> lanthanum 57	2726 <b>Hf</b> hafnium 72	2727 <b>Ta</b> tantalum 73	2728 <b>W</b> tungsten 74	2729 <b>Re</b> rhenium 75	2730 <b>Os</b> osmium 76	2731 <b>Ir</b> iridium 77
2781 <b>Cs</b> caesium 55	2784 <b>Ba</b> barium 56	2785 <b>La*</b> lanthanum 57	2786 <b>Hf</b> hafnium 72	2787 <b>Ta</b> tantalum 73	2788 <b>W</b> tungsten 74	278		

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**Questions begin on next page.**



**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 ☒.

**Group 3**

1 The elements in group 3 of the periodic table are boron, aluminium, gallium, indium and thallium.

(a) Elements can be classified as metals or non-metals.

Explain, using its position in the periodic table, whether indium is a metal or a non-metal.

(2)

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.....

(b) Each aluminium atom has 13 electrons.

State the electronic configuration of an aluminium atom.

(1)

.....

(c) Boron has an atomic number of 5.

There are two isotopes of boron, boron-10 and boron-11.

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

Every boron atom contains

(1)

- A** five protons
- B** five neutrons
- C** eleven electrons
- D** eleven neutrons



(ii) Explain what is meant by the term **isotopes**.

(2)

.....

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.....

.....

(iii) A sample of boron contains the two isotopes, boron-10 and boron-11.  
The relative atomic mass of boron is 10.8

Give the reason why the relative atomic mass is closer to 11 than 10.

(1)

.....

.....

**(Total for Question 1 = 7 marks)**



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**Patterns in properties**

2 (a) Copper is a metal.

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

Copper conducts electricity because particles in it move through the structure.

These particles are

(1)

- A** positive and negative ions
- B** positive ions only
- C** atoms
- D** electrons

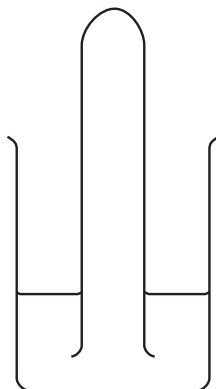
(ii) Copper forms coloured compounds.

Give the name of the type of metals that form coloured compounds.

(1)



- (b) A test tube was filled with hydrogen chloride gas. The test tube was inverted in water and left.



The liquid level rose up to the top of the test tube.

Explain what was formed in the test tube after the water had entered.

(2)

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- (c) When chlorine is bubbled into potassium bromide solution, the solution turns orange.

Explain why this happens.

(2)

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(d) Barium sulfate can be prepared as a white precipitate.

Describe how you could prepare a pure, dry sample of barium sulfate from barium chloride solution and sodium sulfate solution.

(3)

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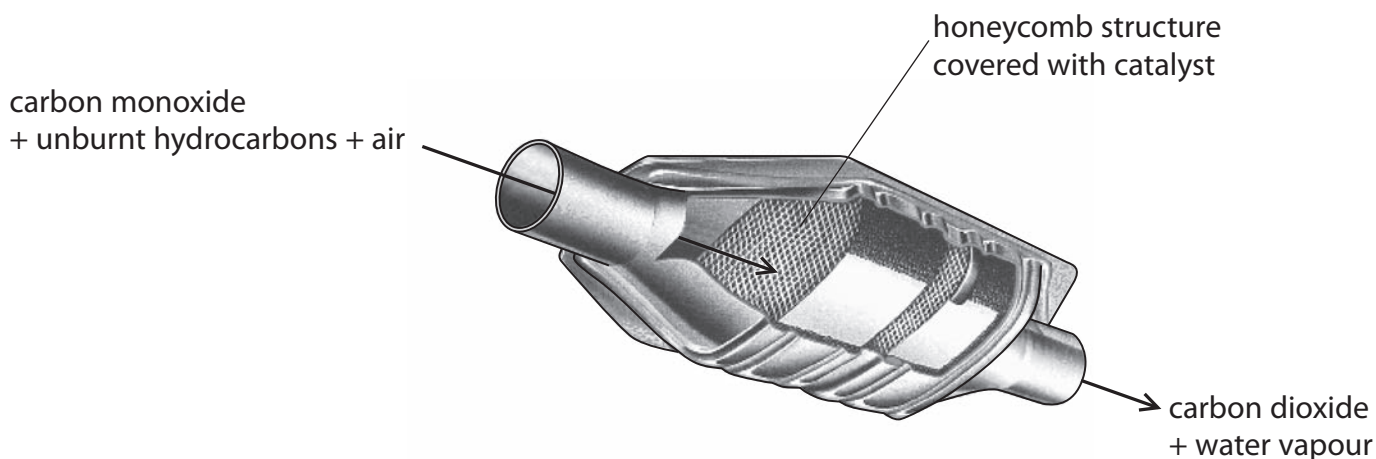
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**(Total for Question 2 = 9 marks)**



### Rates of reaction

- 3** The diagram shows a catalytic converter used in car exhaust systems. Gases from the car engine pass into the catalytic converter. In the catalytic converter, carbon monoxide and unburnt hydrocarbons are changed into carbon dioxide and water vapour.



- (a) What type of reaction occurs in the catalytic converter?

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

(1)

- A** cracking
- B** displacement
- C** oxidation
- D** precipitation

- (b) It is important that the reactions in the catalytic converter happen quickly.

- (i) Explain why the catalyst is spread onto the honeycomb structure rather than used as large pieces.

(2)

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(ii) Hot gases from the engine pass over the catalyst.

Explain why the catalyst is more effective when the engine has been running for a short time rather than when the engine is first started.

(2)

.....

.....

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.....

(c) Carbon monoxide reacts with oxygen,  $O_2$ , to form carbon dioxide in the catalytic converter.

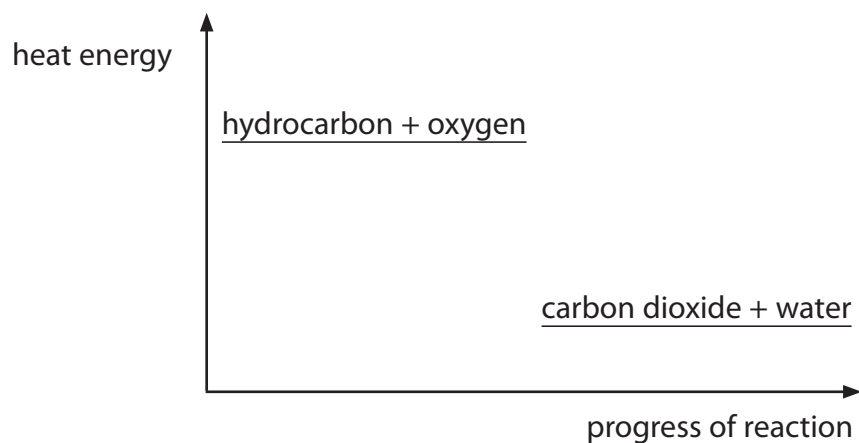
Write the balanced equation for this reaction.

(3)

.....

(d) In the catalytic converter, a hydrocarbon is converted to carbon dioxide and water.

The diagram shows the heat energies of the reactants and products in this reaction.



Explain what the diagram shows about the type of reaction occurring.

(2)

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.....

**(Total for Question 3 = 10 marks)**



**Metal halides**

4 (a) Copper(II) chloride contains copper ions,  $\text{Cu}^{2+}$ , and chloride ions,  $\text{Cl}^-$ .

(i) What is the formula of this copper chloride?

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

A  $\text{CuCl}$

B  $\text{Cu}_2\text{Cl}$

C  $\text{CuCl}_2$

D  $\text{Cu}_2\text{Cl}_2$

(1)

(ii) In a reaction 0.64 g copper are reacted to produce copper chloride.  
The theoretical yield of this reaction is 1.35 g copper chloride.

Explain what is meant by **theoretical yield**.

(2)

.....

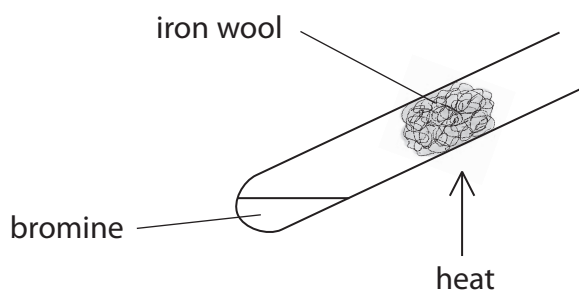
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(b) Bromine reacts with hot iron wool to produce solid iron(III) bromide,  $\text{FeBr}_3$ .



- (i) Write the balanced equation for the reaction between iron and bromine gas. Include state symbols.

(3)

- (ii) Calculate the relative formula mass of iron(III) bromide,  $\text{FeBr}_3$ .  
(Relative atomic masses: Fe = 56, Br = 80)

(1)

relative formula mass = .....

- (iii) Iron also reacts with iodine to form iron(II) iodide,  $\text{FeI}_2$ .

Calculate the percentage by mass of iron in iron(II) iodide.  
(Relative formula mass  $\text{FeI}_2 = 310$ )

(2)

percentage by mass of iron = .....%

- (iv) Hydrogen peroxide reacts with some iron compounds.  
The molecular formula of hydrogen peroxide is  $\text{H}_2\text{O}_2$ .

Give the empirical formula of hydrogen peroxide.

(1)

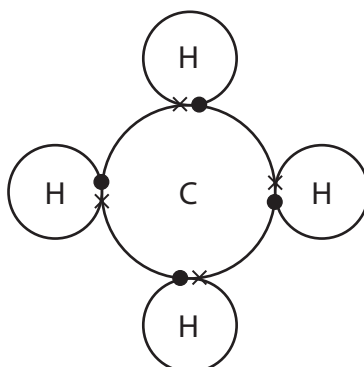
**(Total for Question 4 = 10 marks)**



### Covalent substances

5 Many substances exist as molecules.

(a) The diagram shows the outer shell electrons in a molecule of methane,  $\text{CH}_4$ .



(i) Each hydrogen atom is bonded to the carbon atom by a covalent bond.

Give the meaning of the term **covalent bond**.

(1)

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

Methane is a typical simple molecular, covalent compound.

A property of methane is that

(1)

- A it has a high melting point
- B it is a good conductor of electricity
- C there are weak bonds in its molecule
- D it has a low boiling point





### Sodium chloride

- 6 (a) The table shows some information about the atoms and the ions of chlorine and sodium.

Complete the table.

(3)

	symbol of		number of electrons in	
	atom	ion	atom	ion
chlorine	Cl	Cl <sup>-</sup>	17	
sodium	Na			10

- (b) When silver nitrate solution, AgNO<sub>3</sub>, is added to sodium chloride solution a white precipitate is formed.

(i) Write the balanced equation for this reaction.

(2)

- (ii) Silver nitrate solution can be added to a solution to test for the presence of chloride ions.

In this test, dilute nitric acid is added to the solution, followed by the silver nitrate solution.

A white precipitate shows the presence of chloride ions.

Why must the dilute nitric acid be added to make this a reliable test?

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

(1)

- A** to dilute the solution of chloride ions
- B** because the precipitate only forms if dilute nitric acid is added
- C** to stop the white precipitate changing colour
- D** to remove other ions that would also form a white precipitate







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