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# 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>Mg</b> magnesium 12	13 <b>Al</b> aluminium 13	14 <b>Si</b> silicon 14	15 <b>P</b> phosphorus 15	16 <b>S</b> sulfur 16	17 <b>Cl</b> chlorine 17	18 <b>Ar</b> argon 18								
	19 <b>K</b> potassium 19	20 <b>Ca</b> calcium 20	21 <b>Sc</b> scandium 21	22 <b>Ti</b> titanium 22	23 <b>V</b> vanadium 23	24 <b>Cr</b> chromium 24	25 <b>Mn</b> manganese 25	26 <b>Fe</b> iron 26	27 <b>Co</b> cobalt 27	28 <b>Ni</b> nickel 28	29 <b>Cu</b> copper 29	30 <b>Zn</b> zinc 30	31 <b>Ga</b> gallium 31	32 <b>Ge</b> germanium 32	33 <b>As</b> arsenic 33	34 <b>Se</b> selenium 34	35 <b>Br</b> bromine 35	36 <b>Kr</b> krypton 36
	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 [98]	44 <b>Ru</b> ruthenium 44	45 <b>Rh</b> rhodium 45	46 <b>Pd</b> palladium 46	47 <b>Ag</b> silver 47	48 <b>Cd</b> cadmium 48	49 <b>In</b> indium 49	50 <b>Sn</b> tin 50	51 <b>Sb</b> antimony 51	52 <b>Te</b> tellurium 52	53 <b>I</b> iodine 53	54 <b>Xe</b> xenon 54
	55 <b>Cs</b> caesium 55	56 <b>Ba</b> barium 56	57 <b>La*</b> lanthanum 57	72 <b>Hf</b> hafnium 72	73 <b>Ta</b> tantalum 73	74 <b>W</b> tungsten 74	75 <b>Re</b> rhenium 75	76 <b>Os</b> osmium 76	77 <b>Ir</b> iridium 77	78 <b>Pt</b> platinum 78	79 <b>Au</b> gold 79	80 <b>Hg</b> mercury 80	81 <b>Tl</b> thallium 81	82 <b>Pb</b> lead 82	83 <b>Bi</b> bismuth 83	84 <b>Po</b> polonium [209]	85 <b>At</b> astatine [210]	86 <b>Rn</b> radon [222]
	87 <b>Fr</b> francium 87	88 <b>Ra</b> radium 88	89 <b>Ac*</b> actinium 89	104 <b>Rf</b> rutherfordium [261]	105 <b>Db</b> dubnium [262]	106 <b>Sg</b> seaborgium [266]	107 <b>Bh</b> bohrium [264]	108 <b>Hs</b> hassium [277]	109 <b>Mt</b> meitnerium [268]	110 <b>Ds</b> darmstadtium [271]	111 <b>Rg</b> roentgenium [272]	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

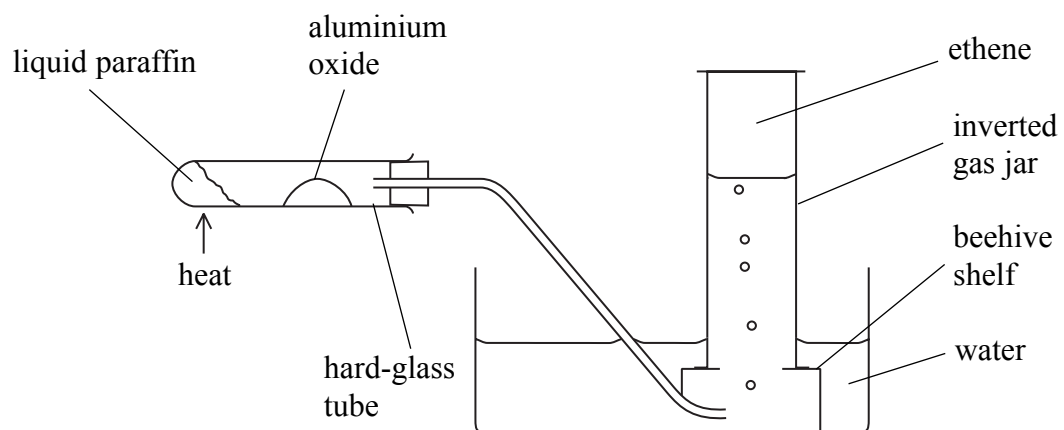
1	<b>H</b>	hydrogen	1
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relative atomic mass
atomic symbol
name
atomic (proton) number



\* 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.

1. (a) Barty used the apparatus shown to investigate the cracking of liquid paraffin.



(i) What conditions are used to crack alkanes?

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 .....  
 (1)

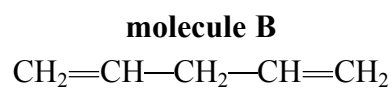
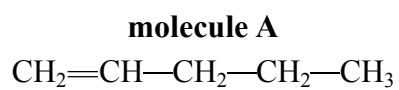
(ii) When liquid paraffin is cracked, long chain alkane molecules can form molecules of shorter chain alkanes and unsaturated hydrocarbons. What type of hydrocarbon are the unsaturated molecules?

.....  
 (1)

(iii) Explain the meaning of the term **unsaturated** molecule.

.....  
 .....  
 (1)

(b) The structures of two unsaturated molecules are shown.



Which of these molecules is polyunsaturated?  
 Explain your answer.

.....  
 .....  
 .....  
 (1)



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(c) Margarine can be made from monounsaturated or polyunsaturated vegetable oils.

(i) In terms of forces between particles, explain why polyunsaturated oils are far less viscous than saturated oils.

.....  
.....

(1)

(ii) What is reacted with vegetable oils to make margarine?

.....  
.....

(1)

(d) Food is broken down by enzymes in the human body to make new tissue and provide energy.

(i) What is an enzyme?

.....

(1)

(ii) Suggest what would happen to a human body if the enzymes in it failed to work.

.....  
.....

(1)

Q1

(Total 8 marks)



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2. In the periodic table the element fluorine is shown as

19
<b>F</b>
fluorine
9

- (a) All fluorine atoms are identical.  
State the name, number and position of the particles in one atom of fluorine.

.....  
.....  
.....

(3)

- (b) Calcium fluoride is ionic.  
It contains calcium ions,  $\text{Ca}^{2+}$ , and fluoride ions,  $\text{F}^-$ .

- (i) What is an ion?

.....

(1)

- (ii) What is the formula of calcium fluoride?

.....

(1)

- (iii) Calcium and fluorine can react to form calcium fluoride.  
Write the balanced equation for this reaction.

.....

(1)

(Total 6 marks)

Q2



3. In the 1970s Harry Kroto was researching chains of carbon atoms in molecules found in space.  
His research group searched for, and found, evidence of molecules containing chains of carbon atoms such as  $\text{H}-\text{C}\equiv\text{C}-\text{C}\equiv\text{C}-\text{C}\equiv\text{N}$ .

An experiment was carried out in September 1985 to simulate the chemistry that occurs in space.

The experiment proved that the chains could be produced and revealed a surprise result, the existence of the  $\text{C}_{60}$  molecule.

(a) Suggest why carbon atoms are able to form long chain molecules.

.....  
.....  
**(1)**

(b) Buckminsterfullerene,  $\text{C}_{60}$ , was found by chance.  
What further work should scientists do, after such a chance discovery, before they assume a new substance has been found?

.....  
.....  
.....  
**(1)**

(c) Lithium and carbon are in the same period in the periodic table.  
Lithium is a metal and carbon is a non-metal.

In terms of the structure of lithium,  
(i) explain why lithium is malleable.

.....  
.....  
.....  
**(1)**

(ii) explain how lithium conducts an electric current.

.....  
.....  
.....  
**(1)**



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(d) One form of carbon is graphite.

The carbon atoms in graphite are joined by covalent bonds.

(i) Describe how a covalent bond is formed between two carbon atoms.

.....

.....

(2)

(ii) Describe the structure of graphite and explain how it is able to conduct an electric current.

.....

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.....

.....

(3)

Q3

(Total 9 marks)



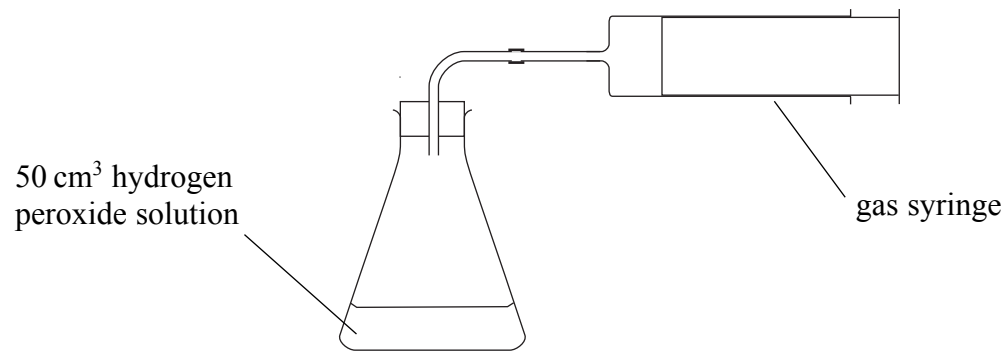
4. Hydrogen peroxide,  $\text{H}_2\text{O}_2$ , decomposes to form water and oxygen.

(a) (i) Write the balanced equation for this reaction.

.....  
(2)

(ii) Describe an experiment to find the effect of temperature on the rate of decomposition of a given hydrogen peroxide solution.

Use  $50\text{ cm}^3$  samples of the hydrogen peroxide solution in the apparatus shown and describe what you would do and what readings you would take.



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.....  
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.....  
.....  
(3)



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(b) Alex investigated a reaction between a solid and a liquid. The reaction produced a gas.  
Alex wanted to know if any of the substances X, Y or Z were catalysts for the reaction.  
He carried out the reaction without any X, Y or Z.  
He repeated the reaction three more times under exactly the same conditions but he added a small amount of X, Y or Z.  
In each case he timed how long it took for the reaction to finish.  
The results are shown in the table.

substance added	time (s)
None	167
X	156
Y	169
Z	8

State if each of X, Y and Z acted as a catalyst and give reasons for your answers.

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.....  
.....  
.....

(2)

Q4

(Total 7 marks)

**TOTAL FOR PAPER: 30 MARKS**

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