

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 C carbon 6	13 Al aluminium 13	14 N nitrogen 7	15 O oxygen 8	16 F fluorine 9	17 Ne neon 10									
	19 K potassium 19	20 Ca calcium 20	23 Sc scandium 21	24 Ti titanium 22	25 V vanadium 23	26 Cr chromium 24	27 Mn manganese 25	28 Fe iron 26	29 Co cobalt 27	30 Ni nickel 28	31 Cu copper 29	32 Zn zinc 30	33 Ga gallium 31	34 Ge germanium 32	35 As arsenic 33	36 Se selenium 34	37 Br bromine 35	38 Kr krypton 36
	85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	90 Zr zirconium 40	91 Nb niobium 41	92 Mo molybdenum 42	93 Tc technetium 43	101 Ru ruthenium 44	102 Rh rhodium 45	103 Pd palladium 46	104 Cd cadmium 47	106 Ag silver 47	108 In indium 49	112 Sb antimony 51	115 Sn tin 50	118 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	[209] Po polonium 84	[210] At astatine 85	[222] 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

Key
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.

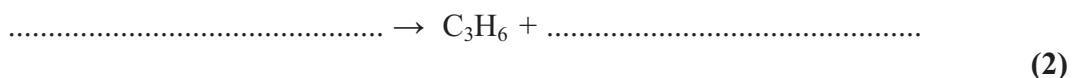


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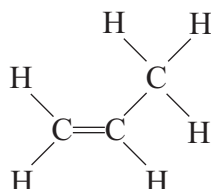


1. One molecule of propane can be cracked to form one molecule of propene, C₃H₆, and one molecule of another gas.

(a) Complete the balanced equation for this reaction.



(b) The structure of a molecule of propene is shown.



(i) Calculate the relative formula mass of propene.
(Relative atomic masses H = 1.0, C = 12)

.....
answer = (1)

(ii) The propene molecule is unsaturated.
Explain why the molecule is said to be unsaturated.

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

(iii) Many propene molecules can react together to form a polymer.
Give the name of the polymer formed.

..... (1)

(iv) When this polymer is manufactured, the reaction has a very high atom economy.
Apart from profit, why is a high atom economy an advantage?

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



- (v) Propene reacts with hydrogen chloride to make chloropropane.
The word equation for this reaction is



Ethene reacts with hydrogen chloride in a similar way.
Suggest the name of the product that will be formed by completing the word equation.

The word equation for this reaction is



(1)

Q1

(Total 7 marks)



2. Information about three group 1 metals is given in the table.

element	atomic number	electronic configuration	formula of ion
lithium	3	2.1	Li ⁺
sodium	11	2.8.1	Na ⁺
potassium	19	2.8.8.1	K ⁺

(a) The atomic number of lithium is 3.
What information does this give about the nucleus of a lithium atom?

.....

 (1)

(b) Use information in the table to give a reason why these metals are all in group 1 of the periodic table.

.....

 (1)

(c) The formula of an oxide ion is O²⁻.
Using this and the formula for the sodium ion, give the formula of the sodium oxide formed by these ions.

.....
 (1)

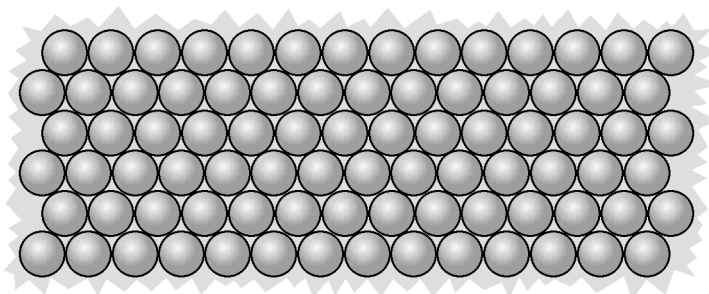
(d) The reactivity of the elements increases from lithium to potassium.
Explain why, in terms of the electrons in their atoms.

.....

 (2)



- (e) Lithium is a metal.
Its structure is



Explain how lithium conducts an electric current.

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

(2)

- (f) An alloy of aluminium and lithium is used to manufacture parts of an aircraft.
Suggest one property this alloy may have that would make it suitable for this use.

.....
.....

(1)

(Total 8 marks)

Q2



3. Chlorine, Cl₂, is a yellow-green, toxic gas.
The electronic configuration of a chlorine atom is 2.8.7.

(a) Draw a dot and cross diagram to show a chlorine molecule, Cl₂.
Show only the outer shell electrons.

(2)

(b) There are two isotopes of chlorine.

isotope	mass number	abundance
chlorine-35 (³⁵ Cl)	35	75%
chlorine-37 (³⁷ Cl)	37	25%

(i) In terms of the structures of their atoms, describe the difference between these two isotopes.

.....
.....

(1)

(ii) Use the information in the table to calculate the relative atomic mass of chlorine.
Show your working.

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

answer =

(1)



(c) Chlorine reacts vigorously with sodium to form sodium chloride, NaCl.



Sodium chloride is an ionic compound.

(i) Explain how sodium atoms, Na, and chlorine atoms, Cl, react to form sodium ions, Na⁺, and chloride ions, Cl⁻.

.....

(2)

(ii) The melting point of sodium chloride is 801 °C.
 Explain why sodium chloride has such a high melting point?

.....

(2)

(iii) Calculation shows that 2.30 g of sodium reacts with excess chlorine to produce 5.85 g of sodium chloride.

In an experiment, 2.30 g of sodium produced only 3.51 g of sodium chloride.
 Calculate the percentage yield of sodium chloride in this experiment.

.....

answer =

(1)

(Total 9 marks)

Q3



4. Each year, more than 300 000 tonnes of ethanol are produced by reacting ethene with steam.



The reaction is exothermic and can reach a dynamic equilibrium.

- (a) Give a use of ethanol other than in alcoholic drinks.

.....
(1)

- (b) What is meant by a **dynamic equilibrium**?

.....

(2)

- (c) Ethene reacts with steam at 300 °C and under a pressure of about 65 atm.

- (i) Using these conditions, the reaction is still slow.
 How can the rate of the reaction be increased without changing these conditions?

.....

(1)

- (ii) If the reaction is carried out under a higher pressure, the equilibrium yield of ethanol increases.
 Explain why.

.....

(2)

(Total 6 marks)

Q4

TOTAL FOR PAPER: 30 MARKS

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