



Answer ALL questions in the spaces provided.

Leave  
blank

1. (a) Complete the electronic configurations of the following noble gases.

(i) Neon:  $1s^2$  ..... (1)

(ii) Krypton:  $1s^2$  ..... (1)

(b) Explain whether krypton or neon has the higher boiling temperature.

.....  
.....  
.....  
..... (2)

(c) A mass spectrometer can be used to analyse a sample of a certain element.

Explain how each of the following is achieved in a mass spectrometer.

(i) Ionisation: .....  
.....  
..... (2)

(ii) Acceleration: .....  
..... (1)

(iii) Deflection: .....  
..... (1)

(Total 8 marks)

Q1

--

2. (a) Define the term **relative atomic mass**.

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

(2)

(b) Give the symbol, including the atomic number and mass number, of the isotope whose nucleus contains two more protons and three more neutrons than the isotope  $^{14}_7\text{N}$ .

.....

(2)

(c) The table below shows the first five successive ionisation energy values for an element.

Ionisation energy	Value/kJ mol <sup>-1</sup>
1st	577
2nd	1820
3rd	2740
4th	11 600
5th	14 800

Use this data, and the Periodic Table, to suggest an element which could have produced these results. Explain your answer.

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

(2)

(Total 6 marks)

Q2

--

3. (a) Write equations to illustrate the following reactions of the given Group 1 metals with oxygen.

Leave blank

(i) The reaction of lithium with oxygen, to form its normal oxide.

..... (1)

(ii) The reaction of sodium with oxygen, to form its peroxide.

..... (1)

(iii) The reaction of potassium with oxygen, to form its superoxide.

..... (1)

(b) A piece of sodium was placed in water in a trough, and a reaction occurred.

State TWO observations that you would make.

.....  
.....  
..... (2)

(c) Explain why potassium has a lower first ionisation energy than sodium.

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

Q3

(Total 8 marks)

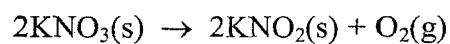
--

4. (a) A 2.20 g sample of potassium nitrate,  $\text{KNO}_3$ , was dissolved in water to produce  $50.0 \text{ cm}^3$  of potassium nitrate solution.

Calculate the concentration of this solution in  $\text{mol dm}^{-3}$ .

(2)

- (b) A 2.20 g sample of potassium nitrate was heated strongly and the following reaction occurred.



- (i) Calculate the mass of potassium nitrite,  $\text{KNO}_2$ , produced.

(2)

- (ii) Calculate the volume of oxygen gas produced.  
(One mole of gas occupies a volume of  $24.0 \text{ dm}^3$  under the conditions of the experiment).

(2)

Leave  
blank

(c) State and explain the trend in the thermal stability of the nitrates of Group 1 as the atomic number increases.

Leave blank

.....

.....

.....

.....

(3)

(d) An analysis of a potassium compound gave the following results.

Element	Percentage by mass
potassium	56.5%
carbon	8.7%
oxygen	34.8%

Deduce the empirical formula of this compound.

(3)

Q4

(Total 12 marks)

--	--

5. (a) Deduce the oxidation number of iodine in the following species.

Leave  
blank

(i)  $I_2O_7$  ..... (1)

(ii)  $IO_4^-$  ..... (1)

(b) Iodine,  $I_2$ , can be reduced to iodide ions,  $I^-$ , by tin(II) ions,  $Sn^{2+}$ , which are themselves oxidised to tin(IV) ions,  $Sn^{4+}$ .

(i) Construct the oxidation and reduction half-equations for the above system.

.....  
..... (2)

(ii) Use the above half-equations to construct the overall ionic equation for the reaction.

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

Q5

(Total 5 marks)

6. (a) Define the term **oxidising agent** in terms of electron transfer, and suggest which element in Group 7 is the strongest oxidising agent.

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

(2)

(b) Chlorine can react with hydroxide ions to produce chloride ions, chlorate(I) ions and water.

(i) Write the ionic equation for this reaction. There is no need to include state symbols.

.....

(2)

(ii) What type of reaction is taking place in (b)(i)?

.....

(1)

(c) (i) Write an equation for the reaction between concentrated sulphuric acid and solid sodium chloride.

.....

(1)

(ii) State ONE observation that you would make.

.....

.....

(1)



(d) Draw the shapes of the following molecules, and mark on the diagram the value of the bond angles in each case.

*Leave blank*

(i)  $\text{BCl}_3$

(2)

(ii)  $\text{PCl}_5$

(3)

Q6

(Total 12 marks)

--	--

Leave blank

7. Explain each of the following.

(a) Silicon and phosphorus are both covalent substances, but silicon has a much higher melting temperature than phosphorus.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(5)

(b) Solid sodium and sodium chloride are both lattice structures. Solid sodium conducts electricity, but solid sodium chloride does not.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(4)

Q7

(Total 9 marks)

TOTAL FOR PAPER: 60 MARKS

END

# THE PERIODIC TABLE

	1	2	Group										3	4	5	6	7	0																		
Period																																				
1	1 <b>H</b> Hydrogen 1																		4 <b>He</b> Helium 2																	
2	7 <b>Li</b> Lithium 3		9 <b>Be</b> Beryllium 4																		11 <b>B</b> Boron 5		12 <b>C</b> Carbon 6		14 <b>N</b> Nitrogen 7		16 <b>O</b> Oxygen 8		19 <b>F</b> Fluorine 9		20 <b>Ne</b> Neon 10					
3	23 <b>Na</b> Sodium 11		24 <b>Mg</b> Magnesium 12																		27 <b>Al</b> Aluminium 13		28 <b>Si</b> Silicon 14		31 <b>P</b> Phosphorus 15		32 <b>S</b> Sulphur 16		35.5 <b>Cl</b> Chlorine 17		40 <b>Ar</b> Argon 18					
4	39 <b>K</b> Potassium 19		40 <b>Ca</b> Calcium 20		45 <b>Sc</b> Scandium 21		48 <b>Ti</b> Titanium 22		51 <b>V</b> Vanadium 23		52 <b>Cr</b> Chromium 24		55 <b>Mn</b> Manganese 25		56 <b>Fe</b> Iron 26		59 <b>Co</b> Cobalt 27		59 <b>Ni</b> Nickel 28		63.5 <b>Cu</b> Copper 29		65.4 <b>Zn</b> Zinc 30		70 <b>Ga</b> Gallium 31		73 <b>Ge</b> Germanium 32		75 <b>As</b> Arsenic 33		79 <b>Se</b> Selenium 34		80 <b>Br</b> Bromine 35		84 <b>Kr</b> Krypton 36	
5	85 <b>Rb</b> Rubidium 37		88 <b>Sr</b> Strontium 38		89 <b>Y</b> Yttrium 39		91 <b>Zr</b> Zirconium 40		93 <b>Nb</b> Niobium 41		96 <b>Mo</b> Molybdenum 42		99 <b>Tc</b> Technetium 43		101 <b>Ru</b> Ruthenium 44		103 <b>Rh</b> Rhodium 45		106 <b>Pd</b> Palladium 46		108 <b>Ag</b> Silver 47		112 <b>Cd</b> Cadmium 48		115 <b>In</b> Indium 49		119 <b>Sn</b> Tin 50		122 <b>Sb</b> Antimony 51		128 <b>Te</b> Tellurium 52		127 <b>I</b> Iodine 53		131 <b>Xe</b> Xenon 54	
6	133 <b>Cs</b> Caesium 55		137 <b>Ba</b> Barium 56		139 <b>La</b> Lanthanum 57		178 <b>Hf</b> Hafnium 72		181 <b>Ta</b> Tantalum 73		184 <b>W</b> Tungsten 74		186 <b>Re</b> Rhenium 75		190 <b>Os</b> Osmium 76		192 <b>Ir</b> Iridium 77		195 <b>Pt</b> Platinum 78		197 <b>Au</b> Gold 79		201 <b>Hg</b> Mercury 80		204 <b>Tl</b> Thallium 81		207 <b>Pb</b> Lead 82		209 <b>Bi</b> Bismuth 83		210 <b>Po</b> Polonium 84		210 <b>At</b> Astatine 85		222 <b>Rn</b> Radon 86	
7	223 <b>Fr</b> Francium 87		226 <b>Ra</b> Radium 88		227 <b>Ac</b> Actinium 89																															

**Key**

Molar mass g mol<sup>-1</sup>

Symbol

Name

Atomic number

140 <b>Ce</b> Cerium 58	141 <b>Pr</b> Praseodymium 59	144 <b>Nd</b> Neodymium 60	(147) <b>Pm</b> Promethium 61	150 <b>Sm</b> Samarium 62	152 <b>Eu</b> Europium 63	157 <b>Gd</b> Gadolinium 64	159 <b>Tb</b> Terbium 65	163 <b>Dy</b> Dysprosium 66	165 <b>Ho</b> Holmium 67	167 <b>Er</b> Erbium 68	169 <b>Tm</b> Thulium 69	173 <b>Yb</b> Ytterbium 70	175 <b>Lu</b> Lutetium 71
----------------------------------	--	-------------------------------------	--	------------------------------------	------------------------------------	--------------------------------------	-----------------------------------	--------------------------------------	-----------------------------------	----------------------------------	-----------------------------------	-------------------------------------	------------------------------------

232 <b>Th</b> Thorium 90	(231) <b>Pa</b> Protactinium 91	238 <b>U</b> Uranium 92	(237) <b>Np</b> Neptunium 93	(242) <b>Pu</b> Plutonium 94	(243) <b>Am</b> Americium 95	(247) <b>Cm</b> Curium 96	(245) <b>Bk</b> Berkelium 97	(251) <b>Cf</b> Californium 98	(254) <b>Es</b> Einsteinium 99	(253) <b>Fm</b> Fermium 100	(256) <b>Md</b> Mendelevium 101	(254) <b>No</b> Nobelium 102	(257) <b>Lr</b> Lawrencium 103
-----------------------------------	--	----------------------------------	---------------------------------------	---------------------------------------	---------------------------------------	------------------------------------	---------------------------------------	---	---	--------------------------------------	--	---------------------------------------	---