1 **(a** Complete the table which gives the names, symbols, relative masses and relative charges of the three subatomic particles.

name	symbol	relative mass	relative charge
electron			
proton		1	
	n		0

[3]

(b) Use the information in the table to explain the following.

(i) Atoms contain charged particles but they are electrically neutral because they have no overall charge.

.....

..... [2]

(ii) Atoms can form positive ions.

.....

..... [2]

(iii) Atoms of the same element can have different masses.

.....

..... [2]

(iv) Scientists are certain that there are no undiscovered elements missing from the Periodic Table from hydrogen to lawrencium.

..... [1]

[Total: 10]

2 Use your copy of the periodic table to help you answer these questions.

(a) Predict the formula of each of the following compounds.

(i) barium oxide ..... [1]

(ii) boron oxide ..... [1]

(b) Give the formula of the following ions.

(i) sulphide ..... [1]

(ii) gallium ..... [1]

(c) Draw a diagram showing the arrangement of the valency electrons in one molecule of the covalent compound nitrogen trichloride.

Use x to represent an electron from a nitrogen atom.
Use o to represent an electron from a chlorine atom. [3]

(d) Potassium and vanadium are elements in Period IV.

(i) State **two** differences in their physical properties.

.....

..... [2]

(ii) Give **two** differences in their chemical properties.

.....

..... [2]

(e) Fluorine and astatine are halogens. Use your knowledge of the other halogens to predict the following:

(i) The physical state of fluorine at r.t.p. .....

The physical state of astatine at r.t.p. ..... [2]

(ii) **Two** similarities in their chemical properties

.....

..... [2]

[Total 15]

3 The table below gives the number of protons, neutrons and electrons in atoms or ions.

particle	of protons	number of electrons	number of neutrons	symbol or formula
A		10	10	$^{19}_{9}F^{-}$
B	1	11	12	
C	1	18	22	
D	1	18	16	
E	1	10	14	

(a) Complete the table. The first line is given as an example. [6]

(b) Which atom in the table is an isotope of the atom which has the composition 11p, 11e and 14n? Give a reason for your choice.

.....

..... [2]

[Total: 8]

4 Strontium and zinc are both metals with a valency of 2. Strontium is more reactive than zinc. Its chemistry is similar to that of calcium.

(a) Complete the following table that shows the number of protons, electrons and neutrons in each particle.

particle		electrons	neutrons
^{88}Sr			
^{90}Sr			
$^{65}Zn^{2+}$			

[3]

(ii) Explain why ^{88}Sr and ^{90}Sr are isotopes.

.....

[1]

(iii) Complete the electron distribution of an atom of strontium.

2 18 + ... + ... [1]

(b) The major ore of zinc is zinc blende, ZnS.

(i) Describe how zinc is extracted from zinc blende.

.....

.....

.....

[2]

(ii) Give a use of zinc.

.....

[1]

(c) The major ore of strontium is its carbonate, $SrCO_3$. Strontium is extracted by the electrolysis of its molten chloride.

(i) Name the reagent that will react with the carbonate to form the chloride.

..... [1]

(ii) The electrolysis of molten strontium chloride produces strontium metal and chlorine. Write ionic equations for the reactions at the electrodes.

negative electrode (cathode) .....

positive electrode (anode) ..... [2]

(iii) One of the products of the electrolysis of concentrated aqueous strontium chloride is chlorine. Name the other two.

..... [2]

(d) Both metals react with water.

(i) Write a word equation for the reaction of zinc and water and state the reaction conditions.

word equation ..... [1]

conditions ..... [2]

(ii) Write an equation for the reaction of strontium with water and give the reaction condition.

equation ..... [2]

condition ..... [1]

5 The table below includes information about some of the elements in Period 2.

element	carbon	nitrogen	fluorine	neon
symbol	C	N	F	Ne
structure	macromolecular	simple molecules N_2	simple molecules F_2	single atoms Ne
boiling point / °C	4200	–196	–188	–246

(a) Why does neon exist as single atoms but fluorine exists as molecules?

.....

..... [2]

(b) What determines the order of the elements in a period?

..... [1]

(c) When liquid nitrogen boils the following change occurs.

$$N_2(l) \rightarrow N_2(g)$$

The boiling point of nitrogen is very low even though the bond between the atoms in a nitrogen molecule is very strong. Suggest an explanation.

.....

..... [2]

(d) Draw a diagram showing the arrangement of the outer shell (valency) electrons in a molecule of nitrogen.

[2]

[Total: 7]

6 Carbonyl chloride, $COCl_2$, is widely used in industry to make polymers, dyes and pharmaceuticals.

(a) Carbonyl chloride was first made in 1812 by exposing a mixture of carbon monoxide and chlorine to bright sunlight. This is a photochemical reaction.

$$CO(g) + Cl_2(g) \rightarrow COCl_2(g)$$

(i) Explain the phrase *photochemical reaction*.

.....

..... [2]

(ii) Give another example of a photochemical reaction and explain why it is important either to the environment or in industry.

.....

.....

..... [3]

(b) Carbonyl chloride is now made by the reversible reaction given below.

$$CO(g) + Cl_2(g) \rightleftharpoons COCl_2(g)$$

The forward reaction is exothermic.
The reaction is catalysed by carbon within a temperature range of 50 to 150 °C.

(i) Predict the effect on the yield of carbonyl chloride of increasing the pressure. Explain your answer.

.....

..... [2]

(ii) If the temperature is allowed to increase to above 200 °C, very little carbonyl chloride is formed. Explain why.

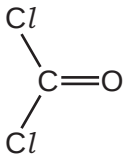
.....

..... [2]

(iii) Explain why a catalyst is used.

..... [1]

(c) The structural formula of carbonyl chloride is given below.



Draw a diagram showing the arrangement of the outer (valency) electrons in one molecule of this covalent compound.

Use o to represent an electron from a carbon atom.
Use x to represent an electron from a chlorine atom.
Use ● to represent an electron from an oxygen atom.

[3]

[Total: 13]