

# Atomic Structure and The Periodic Table

## Question Paper 3

Level	IGCSE
Subject	Chemistry
ExamBoard	CIE
Topic	Atoms, Elements and Compounds
Sub-Topic	Atomic structure and the Periodic Table
Paper	(Extended) Theory
Booklet	Question Paper 3

**TimeAllowed:** 87 minutes

**Score:** / 72

**Percentage:** /100

- 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	${}^{19}_9\text{F}^-$
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]



(c) The major ore of strontium is its carbonate,  $\text{SrCO}_3$ . 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 <sub>2</sub>	simple molecules F <sub>2</sub>	single atoms Ne
boiling point/°C	4200	-196	-188	-246

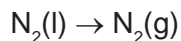
(a) Why does neon exist as single atoms but fluorine exists as molecules?

.....  
 ..... [2]

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

..... [1]

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



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.

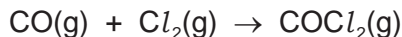
[2]

[Total: 7]



6 Carbonyl chloride,  $\text{COCl}_2$ , 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.



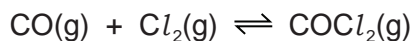
(i) Explain the phrase *photochemical reaction*.

.....  
..... [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.



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]

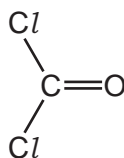
(ii) If the temperature is allowed to increase to above 200 °C, very little carbonyl chloride is formed. Explain why.

.....  
..... [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]