



Resources available from

**kickstart  
tutors**

Student number

|  |  |  |  |  |
|--|--|--|--|--|
|  |  |  |  |  |
|--|--|--|--|--|

Name \_\_\_\_\_

Date \_\_\_\_\_

Attempt/Time taken \_\_\_\_\_

# GCSE CHEMISTRY

Topic Paper: 2.1 Chemical bonds, ionic, covalent and metallic  
Part 1

---

Time allowed: 5 minutes

## Materials

For this paper you must have:

- the Periodic Table/Data Sheet, provided as an insert (enclosed)
- a ruler with millimetre measurements
- a calculator, which you are expected to use where appropriate.

## Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- All working must be shown.
- Do all rough work in this book. Cross through any work you do not want to be marked.

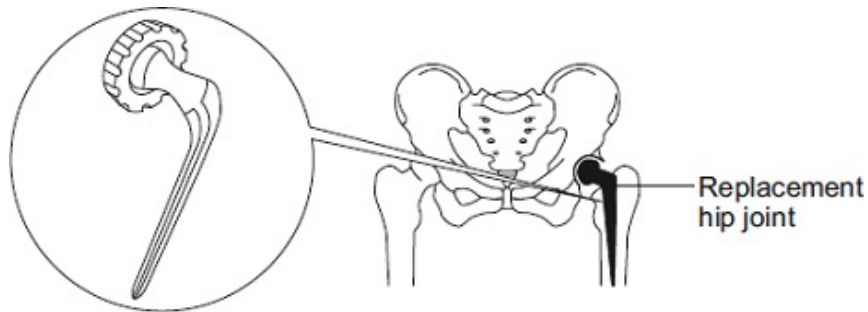
## Information

- The Periodic Table/Data Sheet is provided as in insert.
- You are reminded of the need for good English and clear presentation in your answers.
- When answering questions you need to make sure that your answer:
  - is clear, logical, sensibly structured
  - fully meets the requirements of the question
  - shows that each separate point or step supports the overall answer.

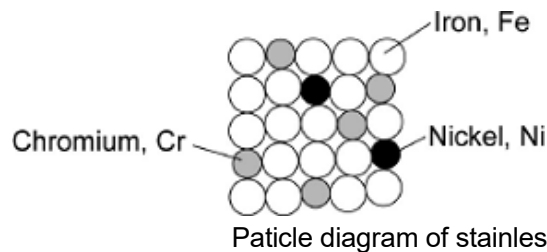


**22 Marks**

**Q1.** The hip joint sometimes has to be replaced.  
Early replacement hip joints were made from stainless steel.



Stainless steel is an alloy of iron, chromium and nickel.  
The diagram below represents the particles in stainless steel.



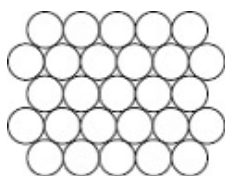
(a) Use the diagram to complete the percentages of metals in this stainless steel.

The first one has been done for you.

| Element      | Percentage (%) |
|--------------|----------------|
| Iron, Fe     | 72             |
| Chromium, Cr |                |
| Nickel, Ni   |                |

(2)

(b) Pure iron is a soft, metallic *element*.



(i) Why is iron described as an *element*?

.....

.....

(1)



(ii) Pure iron would **not** be suitable for a replacement hip joint.

Suggest why.

.....  
.....

(1)

(iii) The three metals in stainless steel have different sized atoms. Stainless steel is harder than pure iron.

Explain why.

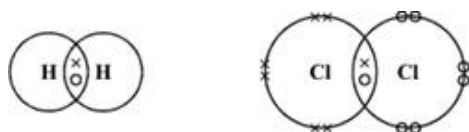
.....  
.....  
.....  
.....

(2)

(Total 6 marks)

**Q2.** Hydrogen chloride (HCl) can be made by the reaction of hydrogen (H<sub>2</sub>) with chlorine (Cl<sub>2</sub>).

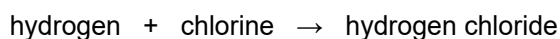
(a) The diagrams represent molecules of hydrogen and chlorine.



Draw a similar diagram to represent a molecule of hydrogen chloride (HCl). You need show only the outer energy level (shell) electrons.

(1)

(b) The word equation for the reaction of hydrogen with chlorine is shown below.



Write a balanced symbol equation for this reaction.

.....

(2)



- (c) Hydrogen chloride gas reacts with magnesium to form the ionic compound called magnesium chloride. Use the table of ions on the Data Sheet to help you to write the formula of magnesium chloride.

.....

(1)

- (d) Why does magnesium chloride have a much higher melting point than hydrogen chloride?

.....

.....

.....

.....

(2)

(Total 6 marks)

- Q3.** (a) A tin of red kidney beans contains calcium chloride as a firming agent.

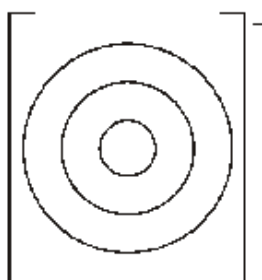


Calcium chloride is an ionic compound which contains calcium ions ( $\text{Ca}^{2+}$ ) and chloride ions ( $\text{Cl}^-$ ).

- (i) The diagram on the left represents the electronic structure of a chlorine atom.



Complete a similar diagram on the right to represent a chloride ion.



(2)



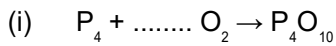
(ii) Explain how a calcium **atom** changes into a calcium **ion** which has a 2+ charge.

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

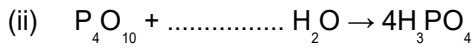
(2)

(b) Cola drinks contain phosphoric acid,  $H_3PO_4$ . The two equations show how phosphoric acid can be made from phosphorus.

Balance these two equations.



(1)

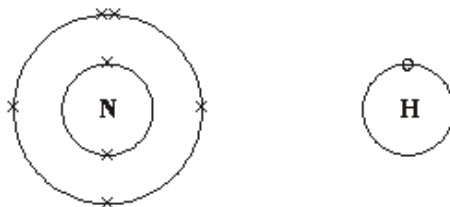


(1)

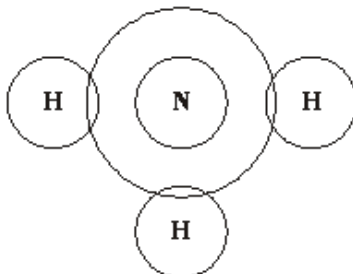
(Total 6 marks)

**Q4.** Ammonia ( $NH_3$ ) is an important chemical which is used to make fertilisers. Ammonia is made from nitrogen and hydrogen,

(a) The diagrams represent the electron arrangements in atoms of nitrogen and hydrogen.



Complete the diagram showing the arrangement of electrons in a molecule of ammonia.



(1)



- (b) Name the type of bonding which holds the nitrogen and hydrogen atoms together in an ammonia molecule.

.....

(1)

(Total 2 marks)

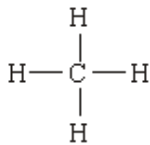
- Q5.** (a) A piece of lithium is placed on the surface of some water in a beaker. Hydrogen is given off. Lithium hydroxide is also formed.

Write a word equation for this reaction.

.....

(2)

- (b) The diagram shows the structure of a molecule of methane.



Write down everything that this diagram tells you about a methane molecule.

*To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

.....

.....

.....

.....

.....

.....

.....

(4)

(Total 6 marks)