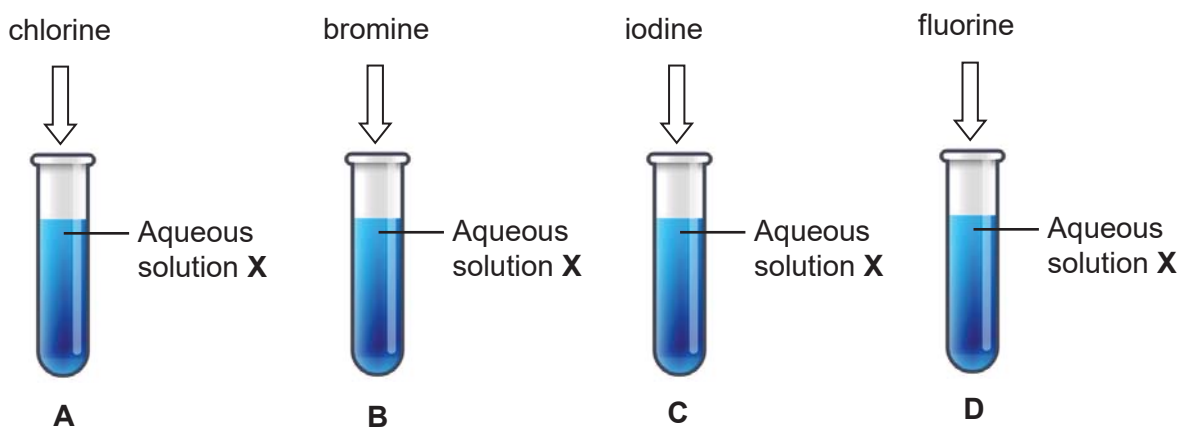


Section B

Answer any **two** questions from this section in the spaces provided.

- 3** The diagrams below show the addition of some Group VII elements, also known as halogens, to aqueous solution **X**.



- (a) The aqueous solution **X** in test tubes **A** and **D** changed from colourless to brown while no chemical reaction occurred in test tubes **B** and **C**.

Suggest a possible identity of aqueous solution **X**.

.....[1]

- (b) Explain your answer in **3(a)**.

.....

[2]

- (c) Chlorine exists as diatomic molecules. Draw the dot-and-cross diagram of a chlorine molecule.

[2]

- (d) Chlorine reacts with some metals to form a metal chloride. The time taken for the metals to completely react with chlorine is related to the metals' reactivity.

The table below shows the time taken for four metals, **P**, **Q**, **R** and **S** to completely react with chlorine.

Metal	Time taken / s
P	89
Q	120
R	17
S	32

- (i) By using the table above, identify the most reactive metal in **P**, **Q**, **R** and **S**. Explain your answer.

.....
.....[1]

- (ii) Write the chemical formula of the product formed when chlorine reacts with aluminium.

.....[1]

- (e) Other than the reactions described in **3(a)**, **(b)** and **(d)** above, halogens such as bromine can also react with alkenes. Name the type of reaction when bromine reacts with alkenes.

.....[1]

4 The table below shows information about some metals.

metal	melting point / °C	boiling point / °C
sodium	97.8	882.8
magnesium	650.0	1091.0
aluminium	660.3	2470.0

(a) With reference to the table above, draw the arrangement of atoms in

(i) sodium at the same temperature when magnesium boils,



[1]

(ii) aluminium at the same temperature when magnesium freezes.



[1]

(b) Magnesium oxide has a melting point of 2852 °C and is commonly used as a refractory material in furnaces where temperatures are above 1000 °C. Magnesium oxide is formed by burning magnesium metal in oxygen.

(i) Draw the dot-and-cross of magnesium oxide, showing only the valence electrons.

[2]

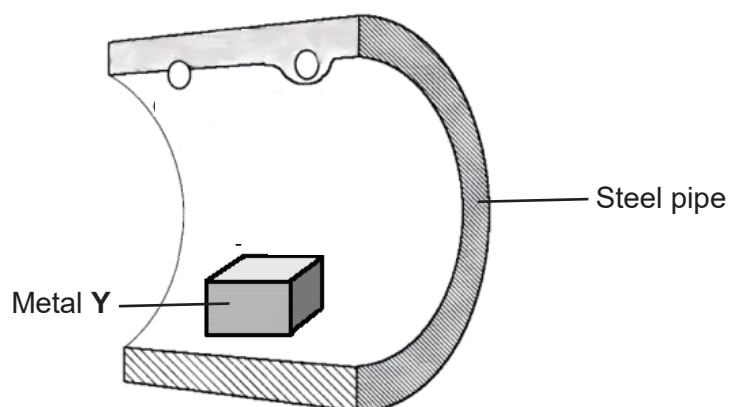
(ii) In terms of structure and bonding, explain why magnesium oxide is suitable as a refractory material in furnaces.

.....

.....

.....[2]

(c) The diagram below shows how steel pipes in ships can be protected from rusting.



(i) Metal Y is able to safely protect the steel pipe from rusting. Suggest an identity of metal Y and describe how the method shown in the diagram above prevents the steel from rusting.

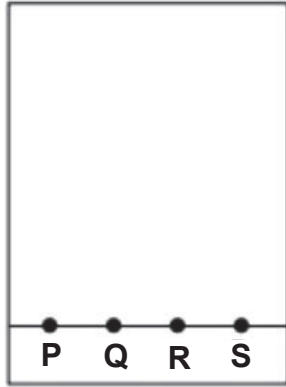
.....

.....[1]

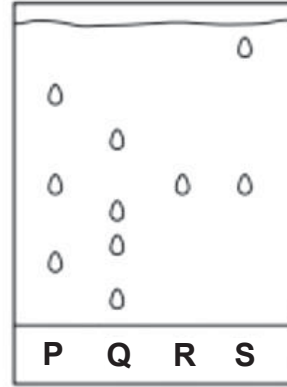
(ii) Suggest **another** method that can be used to further prevent the steel pipe from rusting.

.....[1]

- 5 The diagram below shows the chromatography of four different food colourings, P, Q, R and S.



at the start of the experiment



the final chromatogram

- (a) Based on the results of the chromatography, a student described that there are a total of three pure substances.

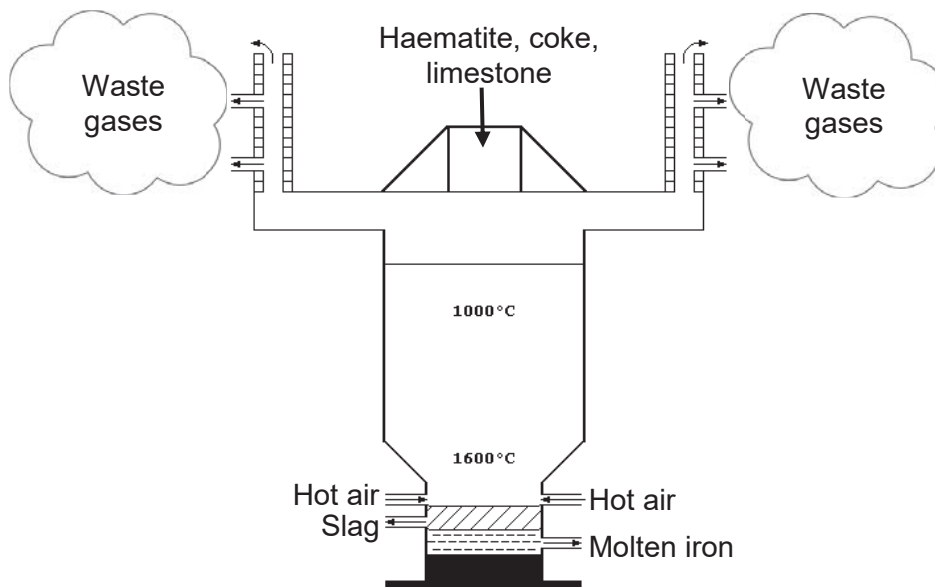
Do you agree with the student? Explain your answer by referring to the results of the chromatography.

.....
[2]

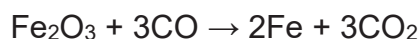
- (b) Food colourings that come from the same manufacturer often have identical component(s). Which of the food colourings are from the same manufacturer?

.....[1]

- (c) Iron is extracted from haematite in a blast furnace as shown below. The hot air that was blown into the furnace is a mixture of gases. During extraction, temperatures in the blast furnace can reach as high as 1000 °C or higher.



- (i) Below shows the balanced chemical equation for one of the reactions occurring in the blast furnace.



By using balanced chemical equations, show how carbon monoxide in the reaction above is formed in the blast furnace.

.....
[1]

- (ii) Waste gases emitted at the top of the furnace is a mixture of unreacted gases as well as gaseous products from the reactions that occurred inside the furnace.

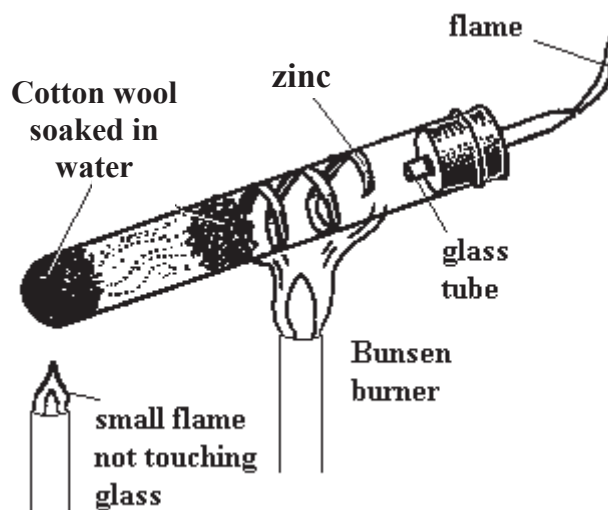
Name a type of air pollutant that can be found in the mixture of the waste gases.

.....[1]

(iii) Describe one effect of the air pollutant on the environment.

.....
[1]

(d) The diagram below shows the reaction of zinc in an experiment.



The flame at the end of the test tube was produced due to the burning of the hydrogen gas formed from the reaction.

(i) Write a balanced chemical equation for the reaction of zinc shown above.

.....[1]

(ii) Suggest your observation if silver was used instead of zinc. Explain your answer.

.....
[1]

--- The End ---