# Unit 10 · Inorganic Materials

**HARDER PRACTICE QUESTIONS**

Full marks 41

Write your answers on separate paper. Show your working. Write every equation balanced. Data marked "made up" are for this question only.

## 1 Spot the error [4]

Sagar wrote these four equations. Each is wrong. Say what is wrong and write the correct one, or say there is no reaction.

a. $Fe + Cl_2 \rightarrow FeCl_2$

b. $2Fe + 6HCl \rightarrow 2FeCl_3 + 3H_2$

c. $Cu + 2HCl \rightarrow CuCl_2 + H_2$

d. $Cl_2 + NaOH \rightarrow NaCl + NaOCl + H_2O$

## 2 Work backwards [5]

Five bottles have lost their labels. They hold solutions of $CuSO_4$, $FeSO_4$, $FeCl_3$, $NH_4Cl$ and NaCl, in some order.

Sodium hydroxide solution gives a blue precipitate with A, a dirty green one with B and a reddish brown one with C. It gives no precipitate with D or E, but warming D with it gives a gas that turns damp red litmus blue. E gives a white precipitate with silver nitrate.

Name A to E, and write the equations for the reactions of A and D with sodium hydroxide and of E with silver nitrate.

## 3 Read the table [4]

Anisha added 0.5 g of marble powder and 0.5 g of marble chips to the same volume of the same acid, with the acid in excess. These results are made up for this question.

| Time (s) | 0 | 30 | 60 | 90 | 120 | 150 | 180 |
|---|---|---|---|---|---|---|---|
| $CO_2$ from powder ($cm^3$) | 0 | 90 | 118 | 120 | 120 | 120 | 120 |
| $CO_2$ from chips ($cm^3$) | 0 | 22 | 42 | 60 | 76 | 90 | 102 |

She says: "**At 180 s the chips have given less gas, so chips give less carbon dioxide than powder.**"

a. Find the average rate of each in the first 30 s.

b. Why has the powder stopped at 120 $cm^3$?

c. Is she right? What was wrong with stopping at 180 s?

d. The chips' gas in each 30 s falls by 2 $cm^3$ each time. If this goes on, when do they reach 120 $cm^3$?

## 4 Predict, then explain [4]

Write your prediction first, then your reason, with an equation where there is one.

a. Zinc oxide is shaken with dilute hydrochloric acid, and more with sodium hydroxide solution. In which does it react?

b. Dry blue litmus paper, then damp blue litmus paper, is put into a jar of dry hydrogen chloride gas. What happens to each?

c. A dirty aluminium pot is boiled with caustic soda solution. What happens to the pot?

d. Steam is passed over hot copper. What happens?

## 5 Fix the plan [4]

Pradip wants to find out whether a stronger acid reacts faster with marble. He plans this:
Flask 1: 40 mL of dilute acid at 40 °C with 0.5 g of marble chips.
Flask 2: 20 mL of half-strength acid at room temperature with 1 g of marble powder.
Find what makes the plan unfair, and write a fair one. What should he time?

## 6 Which explanation fits the evidence? [3]

Hydrogen peroxide froths when manganese dioxide is added. Kushal says: “The oxygen comes out of the manganese dioxide; look, its formula has oxygen in it.” Sneha says: “It comes from the hydrogen peroxide; manganese dioxide is only a catalyst.”
A class (results made up for this question) weighs 0.50 g of manganese dioxide, uses it, filters and dries it, and gets 0.50 g back. It then does the same in four fresh tubes of hydrogen peroxide. Each froths as strongly as the first, and the powder still weighs 0.50 g.
Which explanation does the evidence support? Give two reasons.

## 7 Estimate [2]

For many reactions, a rise of 10 °C roughly doubles the rate. Januka finds that a dilute acid cleans the scale from a kettle in 10 minutes at 35 °C in Janakpur (made up for this question). Estimate how long the same job takes at 5 °C in a Jumla winter. Why is your answer only rough?

## 8 Two steps with alloys [5]

a. A goldsmith in Patan has 24 g of 22-carat gold, and wants 18-carat gold. How much pure copper must she melt into it?
b. A bell maker has 5 kg of bronze with 90% copper and 10% tin (made up for this question). How much tin must he add to make bell metal with 78% copper?

## 9 Correct the misconceptions [3]

Each statement is wrong. Correct it, with a reason.
a. “Salt is half chlorine, so eating it must be poisonous like breathing chlorine.”
b. “A catalyst gives more product, as the tube with manganese dioxide frothed so much more.”
c. “German silver is a cheap silver alloy.”

## 10 Plan a route [4]

A small factory has only salt, water and electricity, and wants to sell bottled bleach (sodium hypochlorite).
a. Write the two equations of its route.
b. Compare the sodium hydroxide and chlorine the first step makes with what the second step needs.
c. What is left over at the end? What might the factory do with each?

## 11 Reason from the sizes [3]

The radii are copper 128 pm, zinc 134 pm, iron 126 pm and carbon 77 pm.
a. By what percentage does zinc’s radius differ from copper’s, and carbon’s from iron’s?
b. How does this explain which kind of alloy each pair makes?
c. What if a metal with a radius of 130 pm (made up for this question) were added to iron? Which kind of alloy would you expect?