Unit 8 · Chemical Reaction

HARDER PRACTICE QUESTIONS

Full marks 49

Write your answers on separate paper. Show your working. H = 1, C = 12, N = 14, O = 16, Na = 23, Cl = 35.5, K = 39, Ag = 108. Molar volume at STP = 22.4 L.

1 Spot the errors [3]

Find the two mistakes and correct them.

Dolma was asked what mass of potassium chlorate gives 1.68 L of oxygen at STP when it is heated with 1 g of manganese dioxide. She wrote:
"$n(O_2) = 1.68 \div 22.4 = 0.075$ mol. So I need 0.075 mol of $KClO_3 = 0.075 \times 122.5 = 9.19$ g. The manganese dioxide gives some of the oxygen, so I need 1 g less: **8.19 g**."

2 Three unlabeled solutions [5]

Karma has three solutions, each one of these salts: copper sulphate, iron(III) chloride and potassium nitrate. He does two tests on each.

Solution	With sodium hydroxide	With silver nitrate
A	a reddish-brown precipitate	a white precipitate
B	a pale blue jelly	no precipitate
C	no precipitate	no precipitate

i. Name A, B and C.
ii. Write the full equation for A with sodium hydroxide.
iii. Write the ionic equation for A with silver nitrate.
iv. Which one further test could confirm B's sulphate?
v. Predict how each solution acts on litmus, with a reason.

3 Reading the results [5]

Sabina decomposed two equal samples of hydrogen peroxide solution at the same temperature, one with a pinch of manganese dioxide and one without, and collected the oxygen. These are made-up results, measured as at STP.

Time (min)	0	1	2	3	4	5
With MnO_2: oxygen (mL)	0	30	45	52	56	56
Without: oxygen (mL)	0	1	2	3	4	5

i. Find the average rate (mL/min) in the first minute with the catalyst, and without it.
ii. Why does the first row stop at 56 mL?
iii. Her friend says, "Without MnO_2 it would never reach 56 mL." Do you agree? Give a reason from the catalyst's properties.
iv. What mass of hydrogen peroxide was in each sample?

4 Balance by electrons [3]

Aluminium metal reacts with copper(II) ions in solution to give aluminium ions, Al^{3+}, and copper.

i. Write the two half-equations and name which is oxidation.
ii. How many aluminium atoms and copper ions must react so that the electrons lost equal the electrons gained?
iii. Write the balanced ionic equation, and name the reducing agent.

5 One reaction, several names [4]

A reaction may have several names. For each reaction, give its names, and say whether it is a redox reaction and why.

i. $2AgBr \rightarrow 2Ag + Br_2$, in light
ii. $FeCl_3 + 3NaOH \rightarrow Fe(OH)_3\downarrow + 3NaCl$
iii. $2NaCl\,(molten) \rightarrow 2Na + Cl_2$, with a current
iv. $N_2 + 3H_2 \rightleftharpoons 2NH_3$, with iron

6 What if? [4]

Sagun mixes a solution holding 3.4 g of silver nitrate with one holding 0.585 g of sodium chloride.

i. Which is used up first?
ii. What mass of silver chloride forms?
iii. Which dissolved salts are left after filtering?
iv. How could he show, using the clear liquid after filtering, that silver ions were still present?

7 A pipe on a fire [4]

A broken PVC pipe of mass 1 kg is burned in the open, and suppose all its chlorine comes off as hydrogen chloride gas.

i. Find the molar mass of the repeating unit, C_2H_3Cl.
ii. If the chains have 2,000 repeating units on average, find their molar mass.
iii. What mass of chlorine is in the pipe?
iv. What volume of hydrogen chloride at STP would that give?

8 Work backward [3]

A chain of glycine (molar mass 75 g/mol) has a molar mass of 5,718 g/mol. Water, 18 g/mol, is given off at each link.

i. Show that a chain of n glycines has a molar mass of $57n + 18$.
ii. How many glycines are in the chain?
iii. How many water molecules were given off?

9 Which explanation fits the evidence? [3]

A polythene bag stays in the soil for centuries, while a cotton bag rots.

Dipesh: "Polythene lasts because its molecules are giant chains. Long chains are too big to break."

Kanchan: "Polythene has no link that water can open. Cotton's chains have links made by condensation, which hydrolysis can split."

Cotton is almost pure cellulose. Decide between them, using what you know about cellulose and about how a cow digests grass.

10 Prove it's a catalyst [4]

Anjali has hydrogen peroxide solution, manganese dioxide powder, a balance, filter paper and funnel, test tubes, and glowing splints. Plan an experiment to show that manganese dioxide is a catalyst for the decomposition of hydrogen peroxide.

i. What will she compare, and what shows that the reaction is faster?
ii. How does she show it isn't used up?
iii. How does she show it still works afterward?
iv. Name one thing she must keep the same in i.

11 Correct the misconceptions [3]

The paragraph has three mistakes. Write each mistake and correct it.

> Aishwarya wrote: "In $CuO + H_2 \rightarrow Cu + H_2O$, hydrogen is the oxidizing agent because it is oxidized. A balanced equation like $Cu + 2HCl \rightarrow CuCl_2 + H_2$ proves the reaction happens. Sugar is hydrolyzed when it dissolves in water, because it disappears."

12 Choose the material [3]

For each job, choose one polymer from the list and give the property that decides it: **Bakelite, nylon, PTFE, polythene, PVC, vulcanized rubber**. No polymer twice.

i. a non-stick coating on a *tawa*
ii. a climbing rope
iii. the coating of an electric wire

13 Think [3]

100 g of starch from rice is hydrolyzed completely to glucose. Bishal says this breaks the law of conservation of mass, because more than 100 g of glucose comes out. Find how much glucose forms, and settle the argument. (The repeating unit is $C_6H_{10}O_5$, 162 g/mol; glucose is 180 g/mol.)

14 Make your own [2]

Write a reaction from this unit that has at least two names, and a question of your own whose answer depends on seeing both. Give the answer.