Unit 6 · Oxidation and Reduction

WORKSHEET

Full marks 33

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 33

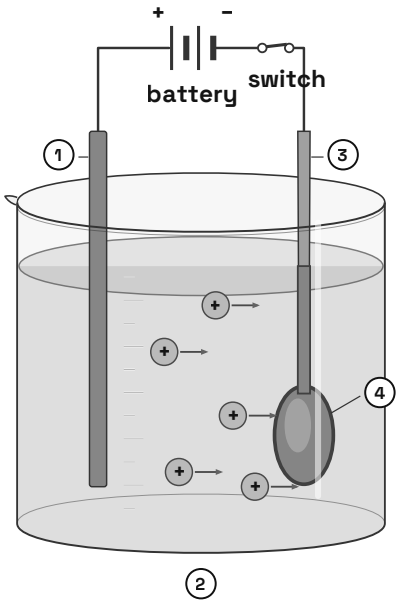
1 Key words [4]

Match each term in column A with its meaning in column B. Two meanings in column B are not needed. Each match carries 0.5 mark.

Column A		Column B
1. oxidation	☐	**a.** the gain of electrons
2. reduction	☐	**b.** the loss of electrons
3. oxidizing agent	☐	**c.** a substance that gives electrons to another and is itself oxidized
4. reducing agent	☐	**d.** the mass of a substance deposited by one coulomb
5. oxidation number	☐	**e.** one element both oxidized and reduced in the same reaction
6. disproportionation	☐	**f.** the charge of one mole of electrons, 96,500 C
7. electrolyte	☐	**g.** a substance that takes electrons from another and is itself reduced
8. Faraday constant	☐	**h.** the electrode joined to the positive terminal of the battery
		i. a substance that conducts electricity, by its ions, when molten or dissolved
		j. the charge an atom would have if every bonding pair went to the more electronegative atom

2 Label the diagram [2]

The diagram shows an iron spoon being plated with copper. Write the names of the parts 1 to 4. Each carries 0.5 mark.



1. _____ **2.** _____

3. _____ **4.** _____

3 Multiple choice [5]

Choose the correct option for each of the following questions.

i. What is the oxidation number of phosphorus in phosphoric acid, H_3PO_4? [1]

a. +3 **b.** +5

c. −3 **d.** +7

ii. In an electrolytic cell, the cathode is the electrode: [1]

a. joined to the positive terminal, where oxidation happens

b. joined to the positive terminal, where reduction happens

c. joined to the negative terminal, where oxidation happens

d. joined to the negative terminal, where reduction happens

iii. In the reaction $CuO + H_2 \rightarrow Cu + H_2O$, which substance is the reducing agent? [1]

a. CuO **b.** H_2

c. Cu **d.** H_2O

iv. Copper(II) sulphate solution is electrolyzed with platinum electrodes. What is given off at the anode? [1]

a. copper **b.** hydrogen

c. oxygen **d.** sulphur dioxide

v. The same current flows through a silver nitrate cell and a copper(II) sulphate cell in series. If 0.10 mol of silver is deposited in the first cell, how much copper is deposited in the second? [1]

a. 0.025 mol **b.** 0.050 mol

c. 0.10 mol **d.** 0.20 mol

4 Short answers [7]

Write short answers to the following questions.

a. Solid sodium chloride does not conduct electricity, but molten sodium chloride does. Why? What carries the current in the connecting wires, and what carries it in the molten salt? [2]

b. Ammonium nitrate is NH_4NO_3. Find the oxidation number of each of its two nitrogen atoms. [2]

c. Molten lead(II) bromide, $PbBr_2$, is electrolyzed with graphite electrodes. Write the reaction at each electrode, and say which electrode is the site of oxidation. [3]

5 Long answer [4]

Write a long answer to the following question.

Define oxidation in three ways: in terms of oxygen and hydrogen, of electrons, and of oxidation number. Show all three in the reaction $2\,Mg + O_2 \rightarrow 2\,MgO$, and explain why oxidation never happens without reduction.

6 Numerical problems [8]

Solve the following problems. Show your working. Take F = 96,500 C/mol and Ni = 58.7.

a. Balance: [4]

i. by the oxidation number method, the reaction of zinc with very dilute nitric acid: $Zn + HNO_3 \rightarrow Zn(NO_3)_2 + NH_4NO_3 + H_2O$;

ii. by the ion-electron method, in acidic solution: $MnO_4^- + H_2O_2 \rightarrow Mn^{2+} + O_2$.

Answer: _____

b. A steel tap is nickel-plated in a bath of nickel sulphate, $Ni^{2+} + 2e^- \rightarrow Ni$, with a current of 1.5 A for 40 minutes. [4]

i. How much charge passes?

ii. How many moles of electrons is that?

iii. What mass of nickel is deposited?

iv. How long would the same current take to deposit 2.00 g of nickel?

Answer: _____

7 Think [3]

Asmita says, "Any substance can act as either an oxidizing agent or a reducing agent, depending on what it reacts with." Use the oxidation numbers of chlorine in Cl^-, of manganese in MnO_4^-, and of sulphur in SO_2 to show that she is only partly right.

8 Activity: A nail in blue solution

(not marked)

Dissolve a spoonful of copper sulphate (नीलो तुथो) in half a glass of water. Clean an iron nail with sandpaper and stand it in the solution. Look at it after 5 minutes, after an hour and the next day. Wash your hands afterwards: copper sulphate is poisonous.

Time	What the nail looks like	Color of the solution
at the start		
5 minutes		
1 hour		
next day		

What was oxidized, and what was reduced? Write the ionic equation.