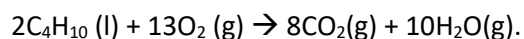
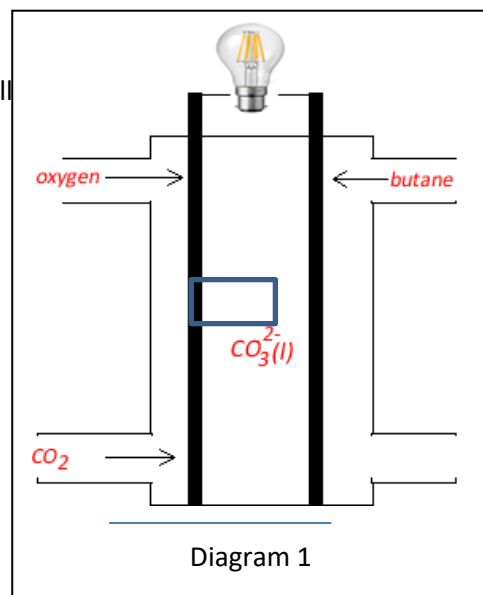


Revision – fuel cells, primary and secondary cells.

1. A molten carbonate fuel cell (MCFC) uses liquid butane as a fuel. This fuel cell operates at 800°C and 100 kPa. The overall reaction for the combustion of butane is given below.



- a. Give the balanced half equations, with states, taking place at the:
- i. Anode (2 marks)
- ii. Cathode (2 marks)



- b. The exhaust gases coming out of the fuel cell at 800°C can be used to generate more electricity. Suggest how. (1 mark)
- c. Indicate in the box shown in diagram 1 the direction of anion movement through the electrolyte.
- d. An amount of 40.0 litres of liquid butane is burnt in the fuel cell. What is the total volume, in litres, of greenhouse gases produced? Density of butane 0.810 g/mL (4 marks)

- e. Compare the efficiency of the method of creating electrical energy with the exhaust gases, as suggested in question b. above, with the efficiency of the molten carbonate fuel cell. Explain your reasoning.

(2 marks)

- f. Give two advantages and two disadvantages of operating at such high temperatures.

Advantage 1

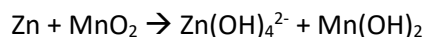
Advantage 2

Disadvantage 1

Disadvantage 2

(1+1+1+1 = 4 marks)

2. A Zn/MnO₂ rechargeable alkaline battery has the following overall, unbalanced chemical equation when discharging.



- a. Write the balanced half-equation, states not required, for the reaction taking place at the anode during discharge. (2 marks)

- b. Write the balanced half-equation, states not required, for the reaction taking place at the cathode during discharge. (2 marks)

- c. Write the balanced overall equation taking place during discharge. (1 mark)

- d. Write the balanced half equation taking place at the negative electrode during recharge. (1 mark)

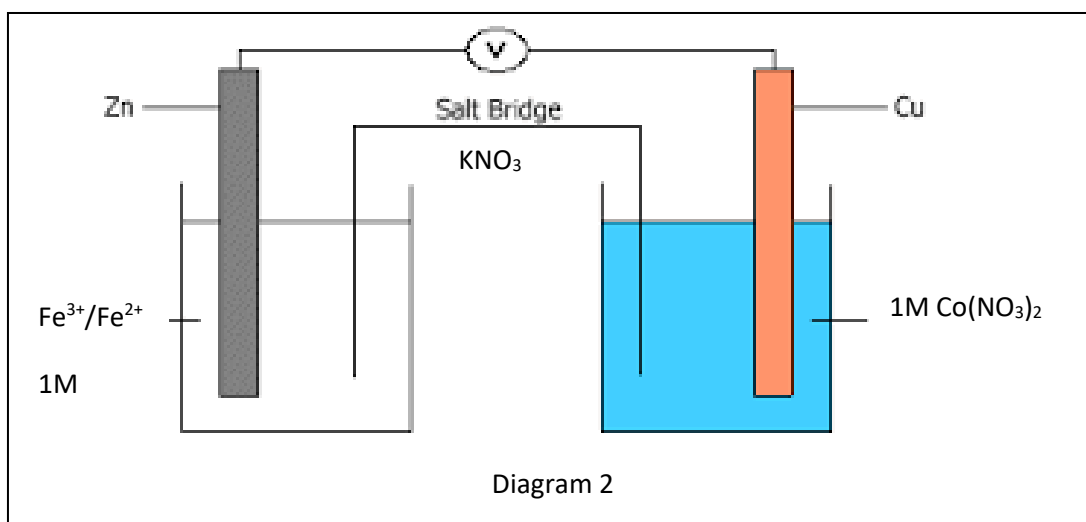
- e. How does the pH of the electrolyte change as the cell: (1+1 =2 marks)
 - i. discharges

 - ii. recharges

3. Complete the table below comparing a primary cell during discharge and secondary cell during recharge. (6 marks)

	Primary cell during discharge	Secondary cell during recharge
Difference 1		
Difference 2		
Similarity 1		

4. Consider the setup shown below.



- a. Predict:
- if a spontaneous reaction will occur. Yes / No . Justify your decision by writing the balanced overall reaction equation, states included. (2 marks)
 - the type of energy produced if the answer to i. is yes. Justify your decision (2 marks)
- b. The Zn electrode is replaced with a graphite electrode.
- Predict:
- if a spontaneous reaction will occur. Yes / No . Justify your decision by writing the balanced overall reaction equation, states included. (2 marks)
 - the type of energy produced if the answer to i. is yes. Justify your decision (2 marks)
 - Predict what will happen to the reactions taking place in the galvanic cell if AuNO_3 is used instead of KNO_3 . (2 marks)

[Solutions](#)