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VCE Chemistry ¾

Secondary Cells & Connected Cells [2.3]

Test

20 Marks. 1 Minute Reading. 17 Minutes Writing.

Results:

Test Questions	_____ / 15
Extension Questions	_____ / 5

Section A: Test Questions (15 Marks)

Question 1 (4 marks)

Tick whether the following statements are **true** or **false**.

Statement	True	False
a. Secondary cells differ from primary cells in that they do not involve spontaneous reactions.		
b. When batteries are recharged, the anode has a positive polarity.		
c. The reason secondary cells can be recharged is because they can be connected to a power source and electrolysed to reverse the reaction(s).		
d. Battery life can be improved by ensuring that the cell reactions occur at high temperatures.		
e. The reason the majority of reactants and products in a lead-acid accumulator are in the solid state is so that the cell can be recharged effectively.		
f. The half-equation occurring at the positive electrode during discharge is the same as the half-equation occurring at the negative electrode during recharge.		
g. A redox flow battery is essentially a rechargeable fuel cell.		
h. When two galvanic cells are connected in series, there is typically a power source powering the circuit.		

Space for Personal Notes

Question 2 (6 marks)

The following overall reaction takes place during the **recharge** of an alkaline zinc-manganese battery:

$$ZnO(s) + MnO(s) \rightarrow Zn(s) + MnO_2(s)$$

a.

i. Write the half-equation occurring at the negative electrode as the cell **generates** energy. (1 mark)

_____

_____

_____

ii. Write the anode half-equation during **recharge**. (1 mark)

_____

_____

_____

b. This battery makes use of a zinc electrode and a carbon electrode. Explain how these electrodes function during both discharge and recharge, in terms of their polarities as well as the types of equations (reduction or oxidation) occurring at each electrode. (3 marks)

_____

_____

_____

_____

_____

_____

c. Propose one way in which the number of discharge-recharge cycles can be maximised for this battery. (1 mark)

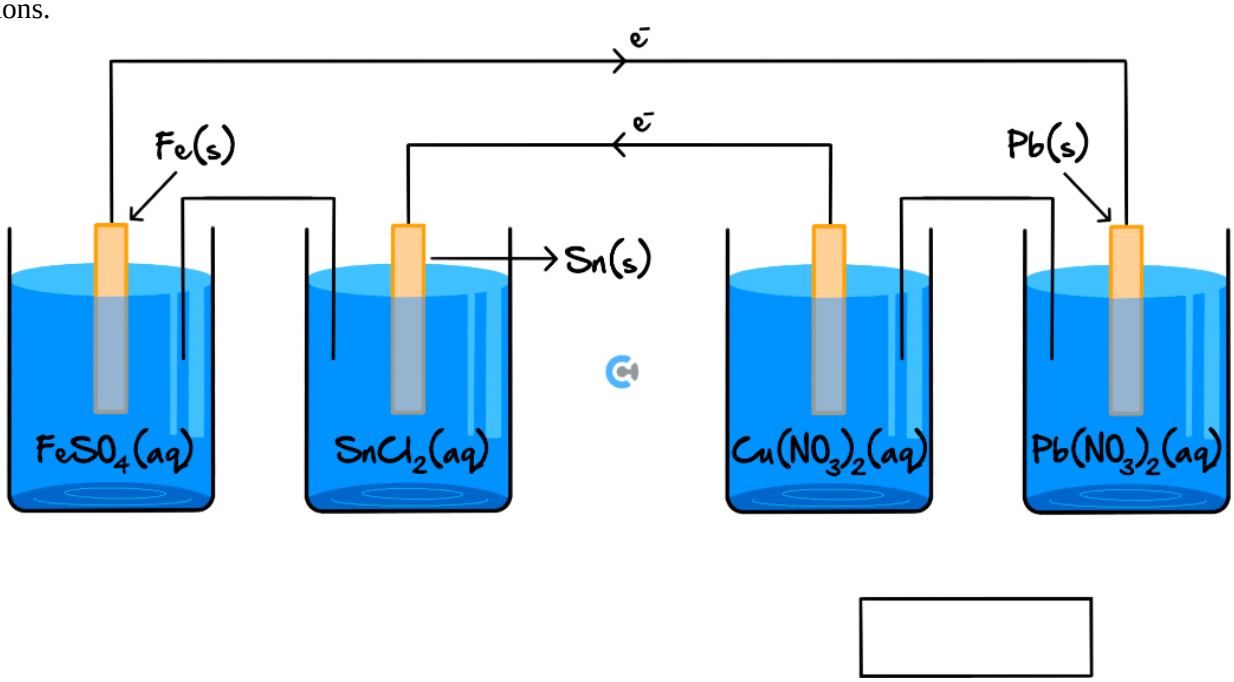
_____

_____

Question 3 (5 marks)

Charmaine connects the following beakers and observes what occurs over a period of time.

For **part a.** and **part b.** of this question, assume the cell is functional. That is, ignore the E^0 values of the reactions.



a. In the diagram above, label the right cell as either galvanic or electrolytic based on the type of reaction(s) that would be observed. (1 mark)

b. Outline **two** colour changes that would be observed in the electrolytes present in the set-up above. (2 marks)

1. _____

_____

2. _____

_____

c. In reality, however, Charmaine notices that no colour changes occur whatsoever when she sets up the cells above exactly as shown, at SLC and 1.0 *M* concentrations.

However, when she connects the electrolytic cell to a 12 *V* power supply instead of to the galvanic cell, she indeed notices the two colour changes outlined in **part b.** Justify the two realisations above. (2 marks)

_____

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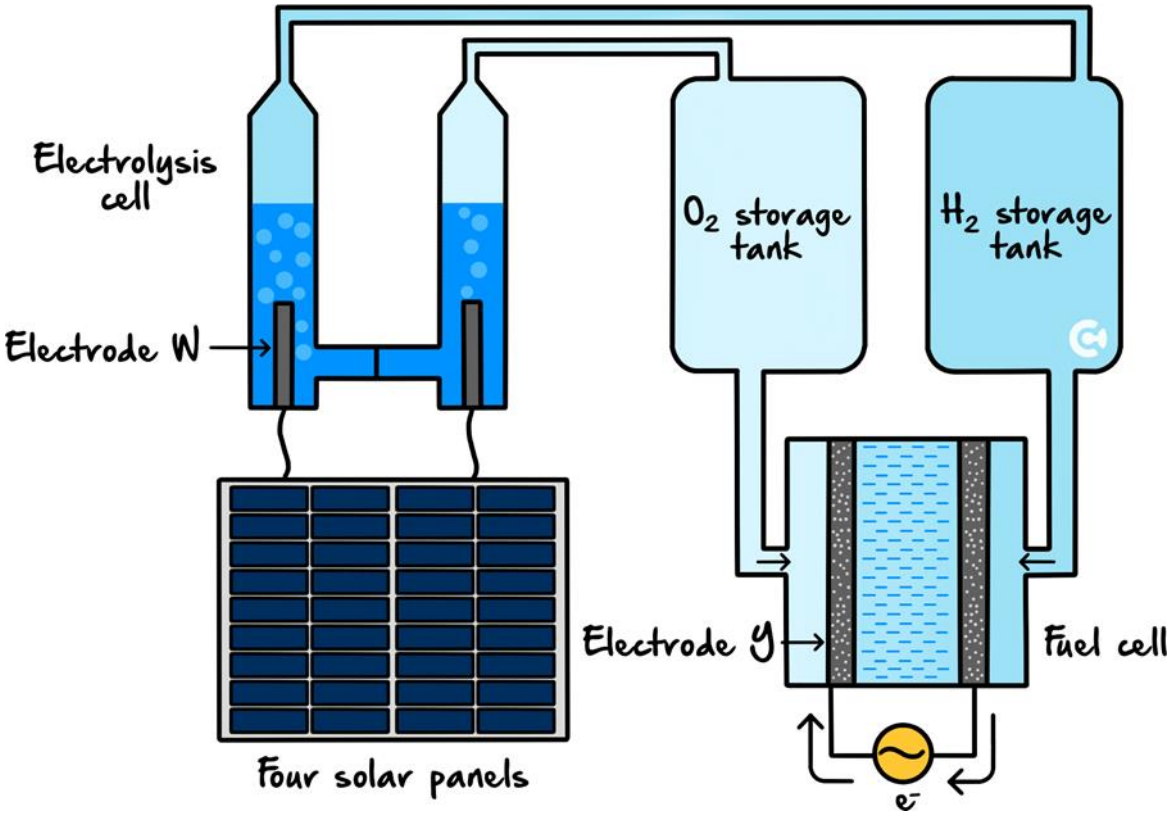
Section B: Extension Questions (5 Marks)

Question 4 (5 marks)

The following connected cell is being investigated in recent times due to its numerous environmental benefits to society. A schematic is shown below, where the liquid inside the electrolysis cell is water.



a.

i. Write the half-equation at Electrode *W* in the electrolysis cell. (1 mark)

_____

ii. State the polarity of Electrode *W* in the electrolysis cell. (1 mark)

_____

b. State the polarity of Electrode *Y* in the fuel cell. Justify your answer. (1 mark)

_____

_____

c. If there were no side reactions or external factors impacting this cell, explain whether or not it would be able to operate indefinitely. (2 marks)

_____

_____

_____

_____

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