

	Example solution	Comments/marks
Q1	A galvanic cell <u>produces</u> electricity from a chemical reaction, and an electrolytic cell causes a chemical reaction by <u>applying</u> electricity.	(2)
Q2	(a) $5e^- + 8H^+ + MnO_4^- \rightarrow Mn^{2+} + 4H_2O$ $2I^- \rightarrow I_2 + 2e^-$ The negative/iodide/iodine electrode is the anode, since oxidation occurs at the anode.  (b) - permanganate half-cell has the cathode (+) - electrons flow to the permanganate half-cell - ions in salt bridge flow in direction that completes the circuit	(1) must be balanced (1) must be balanced (1) must include statement and reason  (1) (1) (1) Electrodes are most likely graphite since solid permanganate and iodine cannot carry current and would probably crumble anyway.
Q3	(a) - electrons are flowing to the spoon - spoon should be marked as the negative electrode - electrolyte labelled - nickel electrode labelled  (b) The cathode, as reduction occurs there.  (c) (i) Anode (oxidation): $Ni \rightarrow Ni^{2+} + 2e^-$ (ii) Cathode (reduction): $Ni^{2+} + 2e^- \rightarrow Ni$	(1) (1) (1) (1)  (1) statement, (1) reason Reduction converts metal ions into metal.  (1) (1)
Q4	(a) - zinc solid is oxidised to zinc ions at the anode - electrons flow to the cathode to reduce the permanganate ions - anode marked -, cathode marked +  (b) The salt bridge <u>connects the half-cells</u> and <u>completes the circuit</u>  (c) Active electrodes are consumed (involved in the reaction), inert ones are not.	(1) (1) (1)  (1) + (1) Free ions flow to carry charge.  (1)
Q5	Fuel cells are galvanic cells in which the electrode reactants are available in continuous supply.  Advantages include higher operating efficiency (and mass-to-power ratio), consistent operation, electrodes and electrolyte are not consumed, minimal maintenance is required  Disadvantages include possibility of contamination ruining the catalyst or electrolyte, the high purity fuels required are costly, many cells require high temperatures, catalysts can be costly, and some electrolytes are corrosive.	(1)  (1) any 3 of these or other legitimate advantages will do  (1) any 3 of these or other legitimate disadvantages will do  Note: the questions ask for advantages etc <b>compared with other galvanic cells</b> . If you've stated one or more that compare with burning hydrocarbons or something, you lose half a mark.
Q6	A rechargeable galvanic cell can <u>reverse the electrode reactions</u> by <u>applying an external electrical supply</u> .  During discharging, the original oxidiser and reducer are used up, producing electricity. During recharging, the oxidiser and reducer are regenerated by application of electricity in the opposite direction.	(1)  (1) (1)
Q7	- diagram shows electrons flowing to cathode - cathode marked negative  - reduction/cathode equation e.g. $Na + e^- \rightarrow Na$ - oxidation/anode equation e.g. $2Cl^- \rightarrow Cl_2 + 2e^-$	(1) (metal ions reduced by gain of electrons) (1)  (1) (1) Electrolyte MUST be molten (since reactive metal)