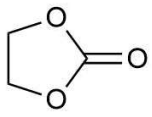
1. This question is about the application of some lithium compounds

(a) (i) +4 ½

(ii) +3 ½

(b) **D** At the cathode, which is the graphite electrode. **1**

Note: The electrode which is the anode (graphite) when the battery is being discharged becomes the cathode when the battery is being charged. Li metal is formed by the reduction of Li^+ ions, which must happen on the cathode, which is the electrode based on graphite.

(c)  **1**

(d) $4Li + {}^3/_2O_2 \rightarrow Li_2O + Li_2O_2$ *or* **1**

$8Li + 3O_2 \rightarrow 2Li_2O + 2Li_2O_2$

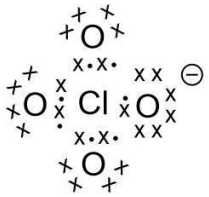
Multiples allowed. No partial credit.

(e) $2Li_2O_2 + 2CO_2 \rightarrow O_2 + 2Li_2CO_3$ *or* **1**

$Li_2O_2 + CO_2 \rightarrow ½O_2 + Li_2CO_3$

No partial credit.

(f) (i) $LiClO_4$ **1**

(ii)  **1**

All electrons on oxygens must be shown. Dots and cross can be alternate way around. The extra electron can be marked with a different symbol.

*No ECF if formula for **(f)(i)** is incorrect.*

(iii) Tetrahedral ½

*No ECF if formula for **(f)(i)** is incorrect.*

(iv) $LiClO_4 \rightarrow 2O_2 + LiCl$ ½

*No ECF if formula for **(f)(i)** is incorrect.*

(g) Two moles of oxygen are produced by the decomposition of 1 mole of **A**.

Two moles of oxygen have a volume of 48.0 dm^3. ½

1 mole of **A** has a mass of 106.39 g, therefore

Volume = (106.39 g) / (2.42 g cm^{-3}) = 43.96 cm^3 ½

Therefore, the oxygen to volume ratio is 48000 cm^3 / 43.96 cm^3 = 1090 **1**

Note: The oxygen to volume ratio must have no units. If units are given for the ratio the maximum mark is 1. If a different amount of compound is used for this calculation then the part marks should be awarded in the same way as here.

Question total 10