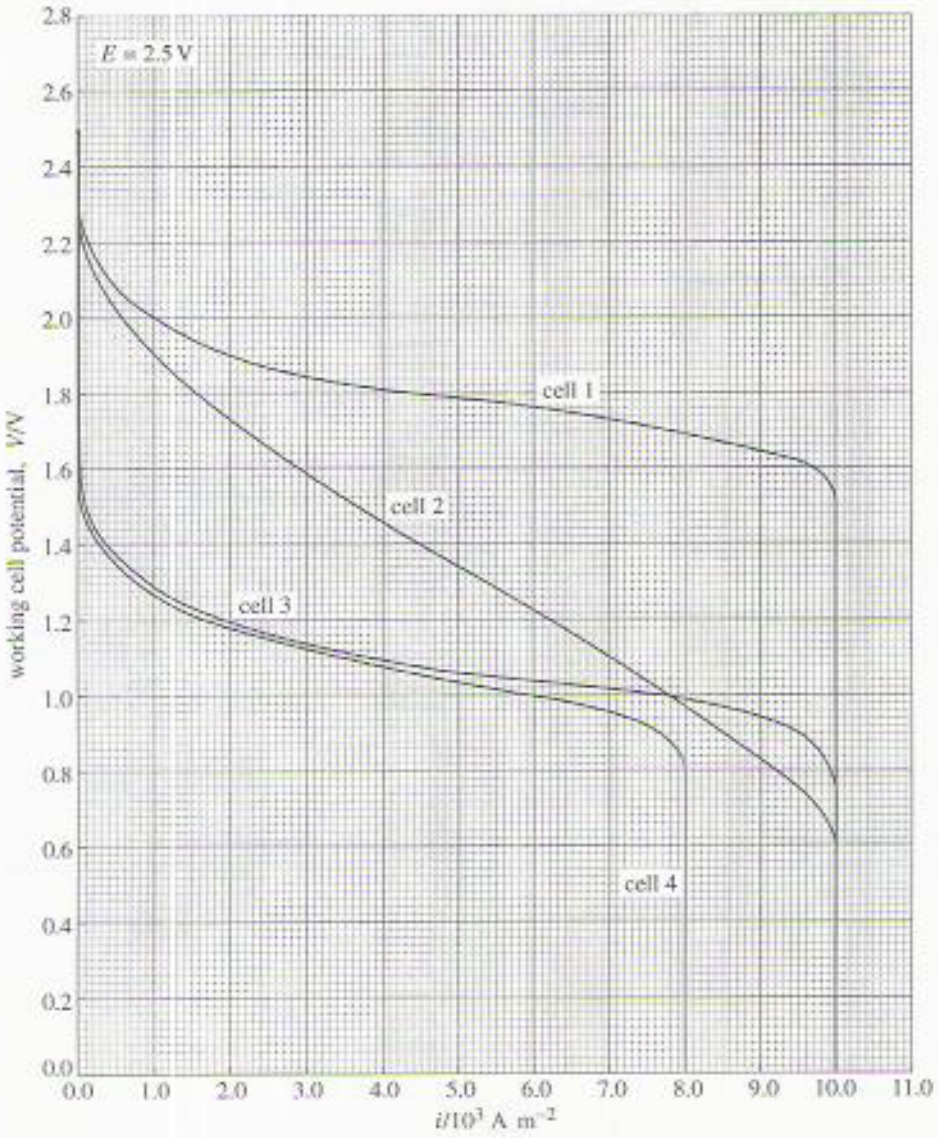

Figure 6.6 Plots of overall cell potential against current density for hypothetical self-driving cells 1 to 4 at 298.15 K.

PART I *(Block 8 and Topic Study 3)*

To answer the questions in Part I, you will need to use the information on the corrosion characteristics of a metal M in Figures 6.7 and 6.8. Figure 6.7 is the Pourbaix diagram for metal M at 298.15 K, with superimposed lines representing the pH-dependence of the electrode potentials for two possible cathodic processes—reduction of hydrogen ions (equation 6.16) and reduction of oxygen (equation 6.17):

$$H^+(aq) + e = \tfrac{1}{2}H_2(g) \qquad (6.16)$$

$$\tfrac{1}{2}O_2(g) + 2H^+(aq) + 2e = H_2O(l) \qquad (6.17)$$

The Evans diagram for corrosion of metal M at pH = 0 and 298.15 K is shown in Figure 6.8. As well as the metal anodic process:

$$M(s) = M^{2+}(aq) + 2e \qquad (6.18)$$

Figure 6.8 includes both possible cathodic processes (equations 6.16 and 6.17).

Any further information you need should be taken from the Data Book.

Q6.44 The key lists statements about the construction or interpretation of the Pourbaix diagram in Figure 6.7. Assuming that each statement refers to a temperature of 298.15 K, select the *three* statements that are **correct**.

KEY for Q6.44

A The horizontal line separating the regions labelled 'M' and 'M^{2+}' in Figure 6.7 represents the standard electrode potential of the (M^{2+}|M) couple.

B The dashed line labelled (b) in Figure 6.7 has a slope of –0.0592 V.

C According to thermodynamic arguments *alone*, if metal M is exposed to a moist environment at pH = 2, then either of the cathodic processes included in Figure 6.7 could couple with the metal anodic reaction (equation 6.18) to give corrosion.

D According to thermodynamic arguments *alone*, if metal M is exposed to a moist environment at pH = 7, then neither of the cathodic processes included in Figure 6.7 could couple with the metal anodic reaction (equation 6.18) to give corrosion.

E If the metal oxide, MO, forms a protective layer on the metal, then the region labelled 'MO' in Figure 6.7 corresponds to the 'immunity' region in the Pourbaix corrosion diagram for metal M.

F According to Figure 6.7, if the potential difference V is made more negative than –0.80 V (relative to the S.H.E.), then metal M cannot corrode at any pH.