

Exercise 8.65 – Spontaneity

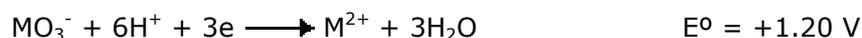
Q865-01 For a thermodynamically spontaneous cell reaction, which statement is correct?

- A. E° (reduction) must be more negative than E° (oxidation) by 0.3V.
- B. E° (oxidation) must be more negative than E° (reduction) by 0.3V.
- C. $E^{\circ}(\text{cell})$ should be negative.
- D. The difference between E° (reduction) and E° (oxidation) must be more than 1.0 V.

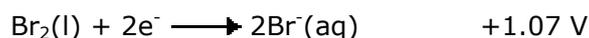
Q865-02 Which signs are correct for a spontaneous reaction occurring in a cell?

- A. E° positive and ΔG° positive
- B. E° positive and ΔG° negative
- C. E° negative and ΔG° positive
- D. E° negative and ΔG° negative

Q865-03 An unknown ion, MO_3^- can be converted in acidic solution into an ion, M^{2+} , according to the redox half equation:

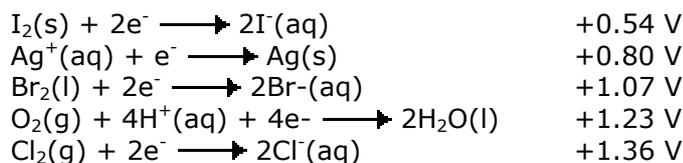


Using the electrode potential data below explain how this value could be used to predict whether MO_3^- would oxidise Br^- ions to Br_2 or whether Br_2 would oxidise colourless M^{2+} to MO_3^- . Write a balanced equation for the reaction that would be expected to occur.

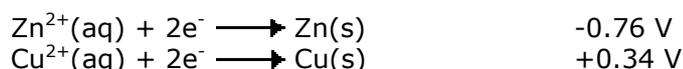


Q865-04 Using the value for the standard electrode potential of copper, +0.34V, determine whether, or not, there is a spontaneous reaction between copper metal and a solution containing hydrogen ions.

Q865-05 Using the following standard electrode potential data below, identify a substance that will oxidise bromide ions, but not chloride ions. Explain your choice and write an equation for the redox reaction that you have chosen.

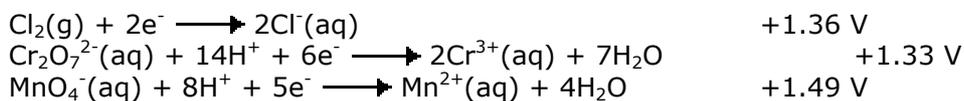


Q865-06 A cell was set up using zinc in zinc sulphate solution and copper in copper (II) sulphate solution, both solutions under standard conditions. Using the following standard electrode potential data below, calculate the cell potential and write an equation for the spontaneous cell reaction.



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Q865-07 Chlorine gas is formed when potassium manganate (VII) is added to concentrated hydrochloric acid. Calculate the cell potential for this reaction and deduce the equation for the reaction. Using the standard electrode potential data below, explain why potassium dichromate (VI) does not react with concentrated hydrochloric acid.



Q865-08 From the following data:

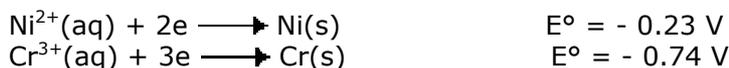


it can be deduced that:

- I. The standard E.M.F. for the cell $\text{Zn} | \text{Zn}^{2+}(\text{aq}) || \text{Fe}^{3+}(\text{aq}), \text{Fe}^{2+}(\text{aq}) | \text{Pt}$ is 0.01 V.
- II. Zinc is a more powerful reductant than Fe^{2+} ions.
- III. Fe^{3+} can oxidize zinc under standard conditions.

- A. I, II and III are correct.
- B. I and II are correct.
- C. II and III are correct.
- D. I is the only correct response.
- E. III is the only correct response.

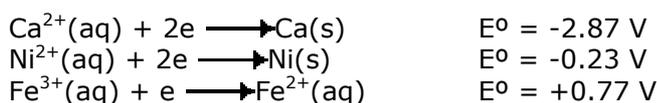
Q865-09 Given the standard electrode (reduction) potentials:



Which pair of substances will react spontaneously?

- A. Ni^{2+} with Cr^{3+}
- B. Ni with Cr^{3+}
- C. Ni^{2+} with Cr
- D. Ni with Cr

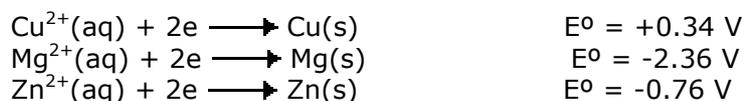
Q865-10 From the given standard electrode potentials which statement is correct:



- A. $\text{Ca}^{2+}(\text{aq})$ can oxidise Ni(s)
- B. $\text{Ni}^{2+}(\text{aq})$ can reduce $\text{Ca}^{2+}(\text{aq})$
- C. $\text{Fe}^{3+}(\text{aq})$ can oxidise Ni(s)
- D. $\text{Fe}^{3+}(\text{aq})$ can reduce $\text{Ca}^{2+}(\text{aq})$

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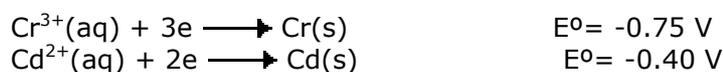
Q865-11 Consider the following reactions:



Which statement is correct?

- A. $\text{Cu}^{2+}(\text{aq})$ will oxidise both $\text{Mg}(\text{s})$ and $\text{Zn}(\text{s})$
- B. $\text{Zn}(\text{s})$ will reduce both $\text{Cu}^{2+}(\text{aq})$ and $\text{Mg}^{2+}(\text{aq})$
- C. $\text{Mg}^{2+}(\text{aq})$ will oxidise both $\text{Cu}(\text{s})$ and $\text{Zn}(\text{s})$
- D. $\text{Cu}(\text{s})$ will reduce both $\text{Zn}^{2+}(\text{aq})$ and $\text{Mg}^{2+}(\text{aq})$

Q865-12 Consider the standard electrode potentials of the following reactions

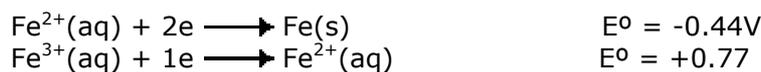


What is the value of the cell potential in volts for the following reaction?



- A. 0.35
- B. 1.15
- C. -0.30
- D. -0.35

Q865-13 The standard electrode potentials for two half-cells involving iron are given below.



What is the equation and the cell potential for the spontaneous reaction that occurs when the two half cells are connected?

- A. $3\text{Fe}^{2+}(\text{aq}) \longrightarrow \text{Fe}(\text{s}) + 2\text{Fe}^{3+}(\text{aq})$ $E^{\circ} = +1.21 \text{ V}$
- B. $\text{Fe}^{2+}(\text{aq}) + \text{Fe}^{3+}(\text{aq}) \longrightarrow 2\text{Fe}(\text{s})$ $E^{\circ} = +0.33 \text{ V}$
- C. $\text{Fe}(\text{s}) + 2\text{Fe}^{3+}(\text{aq}) \longrightarrow 3\text{Fe}^{2+}(\text{aq})$ $E^{\circ} = +0.33 \text{ V}$
- D. $\text{Fe}(\text{s}) + \text{Fe}^{3+}(\text{aq}) \longrightarrow 3\text{Fe}^{2+}(\text{aq})$ $E^{\circ} = +1.21 \text{ V}$

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Q865-14 The standard electrode potentials of three elements are as follows.

X: +1.09V

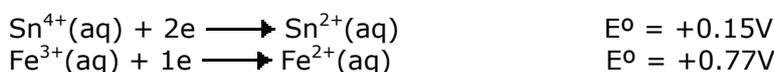
Y: +0.54V

Z: +1.36V

Which statement is correct?

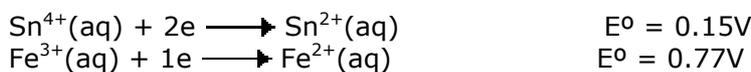
- A. Z will oxidise Y⁻(aq) and X⁻(aq)
- B. Y will oxidise Z⁻(aq) and X⁻(aq)
- C. X will oxidise Y⁻(aq) and Z⁻(aq)
- D. Z will oxidise Y⁻(aq) but not X⁻(aq)

Q865-15 Using the standard electrode potentials below, determine which of the following statements is correct.



- A. Fe²⁺(aq) can spontaneously reduce Sn⁴⁺(aq)
- B. Sn²⁺(aq) is a better reducing agent than Fe²⁺(aq)
- C. These two half cells can be put together to produce a cell with E^o = 0.92V
- D. The Fe³⁺(aq) / Fe²⁺(aq) E^o value must be multiplied by two when calculating the cell voltage for a reaction between Fe³⁺(aq) and Sn²⁺(aq)

Q865-16 Consider the standard electrode potentials of the following reactions:



What is the value of the cell potential (in volts) for the spontaneous reaction?

- A. +1.69
- B. +1.39
- C. +0.92
- D. +0.62

Q865-17 Two half equations and their standard electrode potentials are shown in the table below:

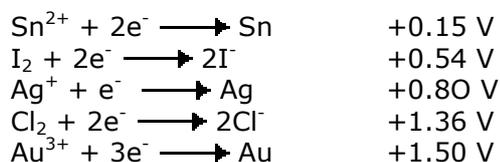
Half equation	E ^o /V
Pb ²⁺ (aq) + 2e → Pb(s)	- 0.13
Ag ⁺ (aq) + 1e → Ag(s)	+ 0.80

What is the cell potential, in volts, for the following reaction? Pb(s) + 2Ag⁺(aq) → Pb²⁺(aq) + 2Ag(s)?

- A. 0.67
- B. 0.93
- C. 1.47
- D. 1.73

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Q865-18 Consider the standard redox potentials for the reactions shown:



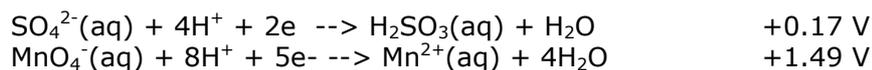
Which one of the following is true?

- A. silver will displace gold from a solution of gold ions
- B. tin ions will displace chlorine from a solution of chloride ions
- C. iodide ions will displace tin from a solution of tin ions
- D. iodine will displace chlorine from a solution of chloride ions

Q865-19 The cell represented below was set up under standard conditions.



Using the following standard electrode potential data below, calculate the e.m.f. of this cell and write an equation for the spontaneous cell reaction.



Q865-20 Blocks of magnesium are bolted onto the hulls of iron ships in an attempt to prevent the iron being converted into iron(II), one of the steps in the rusting process. Use the standard electrode potential below, where appropriate, to calculate the e.m.f. of the cell represented by $\text{Mg}(\text{s})|\text{Mg}^{2+}(\text{aq})||\text{Fe}^{2+}(\text{aq})|\text{Fe}(\text{s})$ under standard conditions, and write an equation for the reaction proceeding at the negative electrode of the cell when current flows.

