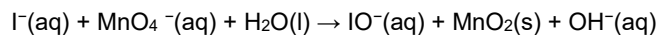


Redox and Electrode Potential (MCQ)

1. Iodide ions, $\text{I}^-(\text{aq})$, react with $\text{MnO}_4^-(\text{aq})$. The unbalanced equation is shown below.



What is the ratio of $\text{MnO}_2(\text{s})$ to $\text{OH}^-(\text{aq})$ in the balanced equation?

- A** 1 : 3
B 1 : 2
C 1 : 1
D 3 : 2

Your answer

[1]

2. Four redox systems relevant to hydrogen–oxygen fuel cells are shown below.

	E° / V
$\text{H}_2\text{O}(\text{l}) + \text{e}^- \rightleftharpoons \text{OH}^-(\text{aq}) + \frac{1}{2}\text{H}_2(\text{g})$	-0.83
$\text{H}^+(\text{aq}) + \text{e}^- \rightleftharpoons \frac{1}{2}\text{H}_2(\text{g})$	0.00
$\frac{1}{2}\text{O}_2(\text{g}) + \text{H}_2\text{O}(\text{l}) + 2\text{e}^- \rightleftharpoons 2\text{OH}^-(\text{aq})$	+0.40
$\frac{1}{2}\text{O}_2(\text{g}) + 2\text{H}^+(\text{aq}) + 2\text{e}^- \rightleftharpoons \text{H}_2\text{O}(\text{l})$	+1.23

Which statement(s) is/are correct for an alkaline hydrogen–oxygen fuel cell?

- 1 The reaction at the positive electrode is: $\frac{1}{2}\text{O}_2(\text{g}) + 2\text{H}^+(\text{aq}) + 2\text{e}^- \rightarrow \text{H}_2\text{O}(\text{l})$
- 2 The overall cell reaction is: $\text{H}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g}) \rightarrow \text{H}_2\text{O}(\text{l})$.
- 3 The cell potential is 1.23 V.

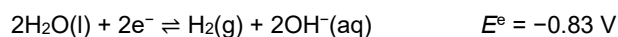
- A** 1, 2 and 3
B Only 1 and 2
C Only 2 and 3
D Only 1

Your answer

[1]

5.2.3 Redox and Electrode Potentials MCQ

3. The redox equilibria for a hydrogen–oxygen fuel cell in alkaline solution are shown below.



What is the equation for the overall cell reaction?

- A** $\text{H}_2(\text{g}) + 4\text{OH}^-(\text{aq}) \rightarrow 3\text{H}_2\text{O}(\text{l}) + \frac{1}{2}\text{O}_2(\text{g})$
B $3\text{H}_2\text{O}(\text{l}) + \frac{1}{2}\text{O}_2 \rightarrow \text{H}_2(\text{g}) + 4\text{OH}^-(\text{aq})$
C $\text{H}_2\text{O}(\text{l}) \rightarrow \text{H}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g})$
D $\text{H}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g}) \rightarrow \text{H}_2\text{O}(\text{l})$

Your answer

[1]

4. Which enthalpy change(s) is/are endothermic?

- 1 The bond enthalpy of the C–H bond
- 2 The second electron affinity of oxygen
- 3 The standard enthalpy change of formation of magnesium

- A** 1, 2 and 3
B Only 1 and 2
C Only 2 and 3
D Only 1

Your answer

[1]

5. A cell is constructed from the two redox systems below.



Which statement(s) is/are correct for the cell?

1. The cell potential is 1.14 V.
2. The reaction at the copper electrode is $\text{Cu}(\text{s}) \rightarrow \text{Cu}^{2+}(\text{aq}) + 2\text{e}^-$.
3. The silver electrode increases in mass.

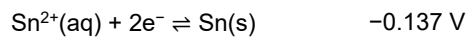
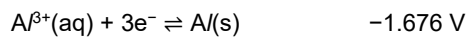
- A** 1, 2 and 3
B Only 1 and 2
C Only 2 and 3
D Only 1

Your answer

[1]

5.2.3 Redox and Electrode Potentials MCQ

6. Electrode potentials are given below.



A standard cell is constructed from $\text{Al}^{3+}(\text{aq})|\text{Al}(\text{s})$ and $\text{Sn}^{2+}(\text{aq})|\text{Sn}(\text{s})$ half cells.

Which statement is correct for the standard cell?

- A** Al is oxidised and the cell potential is 1.539 V.
- B** Sn is oxidised and the cell potential is 1.539 V.
- C** Al is oxidised and the cell potential is 1.813 V.
- D** Sn is oxidised and the cell potential is 1.813 V.

Your answer

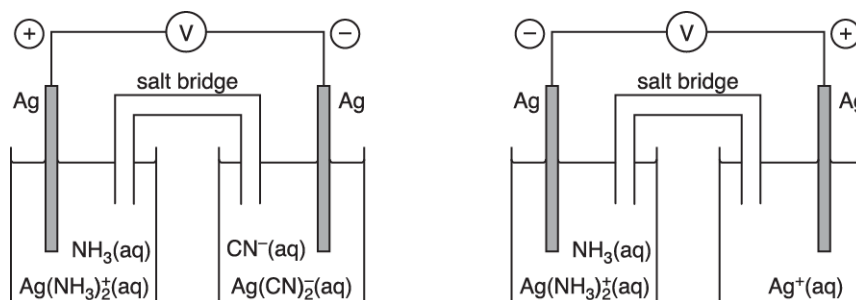
[1]

7. Three redox systems, **C**, **D** and **E** are shown in Table 6.1.

C	$\text{Ag}(\text{NH}_3)_2^{+}(\text{aq}) + \text{e}^{-} \rightleftharpoons \text{Ag}(\text{s}) + 2\text{NH}_3(\text{aq})$
D	$\text{Ag}^{+}(\text{aq}) + \text{e}^{-} \rightleftharpoons \text{Ag}(\text{s})$
E	$\text{Ag}(\text{CN})_2^{-}(\text{aq}) + \text{e}^{-} \rightleftharpoons \text{Ag}(\text{s}) + 2\text{CN}^{-}(\text{aq})$

Table 6.1

The two cells below were set up in an experiment to compare the standard electrode potentials of redox systems **C**, **D** and **E**. The signs on each electrode are shown.



List the three redox systems in order by adding the labels **C**, **D** and **E** to the table below.

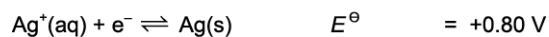
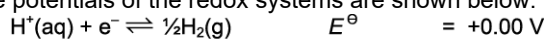
5.2.3 Redox and Electrode Potentials MCQ

E^\ominus	redox system
Most negative	
↑	
Least negative	

[1]

8. A standard cell is set up from $\text{H}^+(\text{aq})|\text{H}_2(\text{g})$ and $\text{Ag}^+(\text{aq})|\text{Ag}(\text{s})$ half cells.

The standard electrode potentials of the redox systems are shown below.



What is the reaction at the negative electrode of the cell?

- A. $\text{H}^+(\text{aq}) + \text{e}^- \rightarrow \frac{1}{2}\text{H}_2(\text{g})$
- B. $\frac{1}{2}\text{H}_2(\text{g}) \rightarrow \text{H}^+(\text{aq}) + \text{e}^-$
- C. $\text{Ag}^+(\text{aq}) + \text{e}^- \rightarrow \text{Ag}(\text{s})$
- D. $\text{Ag}(\text{s}) \rightarrow \text{Ag}^+(\text{aq}) + \text{e}^-$

Your answer

[1]

9. Which property is **not** correct for calcium?

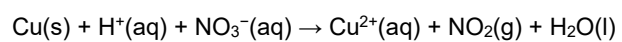
- A. It acts as an oxidising agent
- B. It forms a basic oxide
- C. It reacts with water to form hydrogen gas
- D. Its hydroxide is more alkaline than magnesium hydroxide

Your answer

[1]

5.2.3 Redox and Electrode Potentials MCQ

10. An unbalanced equation for a redox reaction is shown below.



What is the balancing number for H^+ when the equation is balanced using the smallest whole numbers?

- A. 2
- B. 4
- C. 6
- D. 8

Your answer

[1]

END OF QUESTION PAPER

Mark scheme – Redox and Electrode Potentials (MCQ)

Question			Answer/Indicative content	Marks	Guidance								
1			C	1 (AO 2.6)									
			Total	1									
2			C	1 (AO2.1)	Examiner's Comments Only the higher attaining candidates opted for the correct answer of C. Many candidates thought statement 1 was correct, (giving option A as the answer), not realising that this equation refers to acidic conditions not alkaline conditions (as mentioned in the question). Others did not recognise that the cell potential was 1.23V (obtained by calculating the difference between +0.40 and –0.83), and so opted for option B.								
			Total	1									
3			D	1 (AO 2.5)	Examiner's Comments Most candidates knew the correct equation.								
			Total	1									
4			B	1 (AO 1.1)	Examiner's Comments D was the common distractor given as the answer by many candidates, suggesting confusion with the first electron affinity and second electron affinity of oxygen.								
			Total	1									
5			C	1									
			Total	1									
6			A	1									
			Total	1									
7			<table border="1"> <thead> <tr> <th>E°</th> <th>redox system</th> </tr> </thead> <tbody> <tr> <td>Most negative</td> <td>E</td> </tr> <tr> <td></td> <td>C</td> </tr> <tr> <td>Least negative</td> <td>D</td> </tr> </tbody> </table> ✓	E°	redox system	Most negative	E		C	Least negative	D	1	ALL 3 correct for 1 mark Examiner's Comments This part required candidates to apply their knowledge and understanding to three cells. Just over half the candidates were able to list the redox systems by E value. There was no clear pattern with incorrect responses.
E°	redox system												
Most negative	E												
	C												
Least negative	D												
			Total	1									

5.2.3 Redox and Electrode Potentials MCQ

8			B	1	
			Total	1	
9			A	1	
			Total	1	
10			B	1	
			Total	1	