

**Q1.** The following cell has an EMF of +0.46 V.



Which statement is correct about the operation of the cell?

- A** Metallic copper is oxidised by  $\text{Ag}^+$  ions.
- B** The silver electrode has a negative polarity.
- C** The silver electrode gradually dissolves to form  $\text{Ag}^+$  ions.
- D** Electrons flow from the silver electrode to the copper electrode via an external circuit.

**(Total 1 mark)**

**Q2.** In this question consider the data below.

	$E^\ominus / \text{V}$
$\text{Ag}^+(\text{aq}) + \text{e}^- \rightarrow \text{Ag}(\text{s})$	+0.80
$2\text{H}^+(\text{aq}) + 2\text{e}^- \rightarrow \text{H}_2(\text{g})$	0.00
$\text{Pb}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Pb}(\text{s})$	-0.13

The e.m.f. of the cell  $\text{Ag}(\text{s}) \mid \text{Ag}^+(\text{aq}) \parallel \text{Pb}^{2+}(\text{aq}) \mid \text{Pb}(\text{s})$  is

- A** 0.93 V
- B** 0.67 V
- C** -0.67 V
- D** -0.93 V

**(Total 1 mark)**

**Q3.** In this question consider the data below.

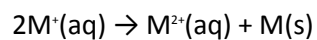
	$E^{\ominus} / \text{V}$
$\text{Ag}^+(\text{aq}) + \text{e}^- \rightarrow \text{Ag}(\text{s})$	+0.80
$2\text{H}^+(\text{aq}) + 2\text{e}^- \rightarrow \text{H}_2(\text{g})$	0.00
$\text{Pb}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Pb}(\text{s})$	-0.13

The e.m.f. of the cell  $\text{Pt}(\text{s}) \mid \text{H}_2(\text{g}) \mid \text{H}^+(\text{aq}) \parallel \text{Ag}^+(\text{aq}) \mid \text{Ag}(\text{s})$  would be increased by

- A** increasing the concentration of  $\text{H}^+(\text{aq})$ .
- B** increasing the surface area of the Pt electrode.
- C** increasing the concentration of  $\text{Ag}^+(\text{aq})$ .
- D** decreasing the pressure of  $\text{H}_2(\text{g})$ .

**(Total 1 mark)**

**Q4.** A disproportionation reaction occurs when a species  $M^+$  spontaneously undergoes simultaneous oxidation and reduction.



The table below contains  $E^\ominus$  data for copper and mercury species.

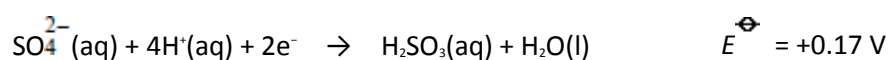
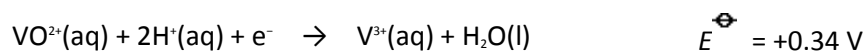
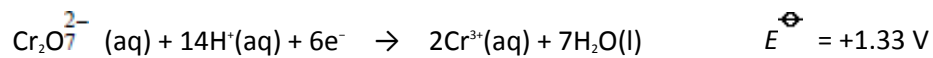
	$E^\ominus / V$
$Cu^{2+}(aq) + e^- \rightarrow Cu^+(aq)$	+ 0.15
$Cu^+(aq) + e^- \rightarrow Cu(s)$	+ 0.52
$Hg^{2+}(aq) + e^- \rightarrow Hg^+(aq)$	+ 0.91
$Hg^+(aq) + e^- \rightarrow Hg(l)$	+ 0.80

Using these data, which one of the following can be predicted?

- A** Both Cu(I) and Hg(I) undergo disproportionation.
- B** Only Cu(I) undergoes disproportionation.
- C** Only Hg(I) undergoes disproportionation.
- D** Neither Cu(I) nor Hg(I) undergoes disproportionation.

**(Total 1 mark)**

Q5.



Based on the above data, which one of the following could reduce 0.012 mol of bromine to bromide ions?

- A 40 cm<sup>3</sup> of a 0.10 mol dm<sup>-3</sup> solution of Cr<sub>2</sub>O<sub>7</sub><sup>2-</sup>(aq)
- B 80 cm<sup>3</sup> of a 0.30 mol dm<sup>-3</sup> solution of Fe<sup>3+</sup>(aq)
- C 50 cm<sup>3</sup> of a 0.24 mol dm<sup>-3</sup> solution of V<sup>3+</sup>(aq)
- C 50 cm<sup>3</sup> of a 0.24 mol dm<sup>-3</sup> solution of H<sub>2</sub>SO<sub>3</sub>(aq)

(Total 1 mark)

Q6. Use the data in the table below to answer this question.

	$E^{\ominus} / \text{V}$
$\text{MnO}_4^- (\text{aq}) + 8\text{H}^+(\text{aq}) + 5\text{e}^- \rightarrow \text{Mn}^{2+}(\text{aq}) + 4\text{H}_2\text{O}(\text{l})$	+ 1.52
$\text{Cr}_2\text{O}_7^{2-} (\text{aq}) + 14\text{H}^+(\text{aq}) + 6\text{e}^- \rightarrow 2\text{Cr}^{3+}(\text{aq}) + 7\text{H}_2\text{O}(\text{l})$	+ 1.33
$\text{Fe}^{3+}(\text{aq}) + \text{e}^- \rightarrow \text{Fe}^{2+}(\text{aq})$	+ 0.77
$\text{Cr}^{3+}(\text{aq}) + \text{e}^- \rightarrow \text{Cr}^{2+}(\text{aq})$	- 0.41
$\text{Zn}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Zn}(\text{s})$	- 0.76

The most powerful oxidising agent in the table is

- A  $\text{Mn}^{2+}(\text{aq})$
- B  $\text{Zn}(\text{s})$
- C  $\text{MnO}_4^-(\text{aq})$
- D  $\text{Zn}^{2+}(\text{aq})$

(Total 1 mark)

**Q7.** Use the data in the table below to answer this question.

	$E^{\ominus} / \text{V}$
$\text{MnO}_4^- (\text{aq}) + 8\text{H}^+(\text{aq}) + 5\text{e}^- \rightarrow \text{Mn}^{2+}(\text{aq}) + 4\text{H}_2\text{O}(\text{l})$	+ 1.52
$\text{Cr}_2\text{O}_7^{2-} (\text{aq}) + 14\text{H}^+(\text{aq}) + 6\text{e}^- \rightarrow 2\text{Cr}^{3+}(\text{aq}) + 7\text{H}_2\text{O}(\text{l})$	+ 1.33
$\text{Fe}^{3+}(\text{aq}) + \text{e}^- \rightarrow \text{Fe}^{2+}(\text{aq})$	+ 0.77
$\text{Cr}^{3+}(\text{aq}) + \text{e}^- \rightarrow \text{Cr}^{2+}(\text{aq})$	- 0.41
$\text{Zn}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Zn}(\text{s})$	- 0.76

Which one of the following statements is **not** correct?

- A  $\text{Fe}^{2+}(\text{aq})$  can reduce acidified  $\text{MnO}_4^- (\text{aq})$  to  $\text{Mn}^{2+}(\text{aq})$
- B  $\text{Cr}_2\text{O}_7^{2-} (\text{aq})$  can oxidise acidified  $\text{Fe}^{2+}(\text{aq})$  to  $\text{Fe}^{3+}(\text{aq})$
- C  $\text{Zn}(\text{s})$  can reduce acidified  $\text{Cr}_2\text{O}_7^{2-} (\text{aq})$  to  $\text{Cr}^{2+}(\text{aq})$
- D  $\text{Fe}^{2+}(\text{aq})$  can reduce acidified  $\text{Cr}^{3+}(\text{aq})$  to  $\text{Cr}^{2+}(\text{aq})$

**(Total 1 mark)**