

Name of the Student: _____

Max. Marks : 18 Marks

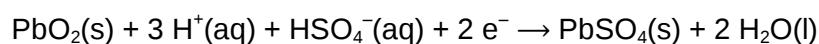
Time : 18 Minutes

Q1.

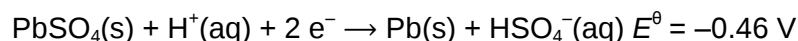
A cell with EMF = +2.15 V is made from two electrodes.

The half-equations for the two electrodes are shown.

Positive electrode:



Negative electrode:



What is the standard electrode potential of the $\text{PbO}_2 / \text{PbSO}_4$ electrode?

A -2.61 V

☐

B -1.69 V

☐

C +1.69 V

☐

D +2.61 V

☐

(Total 1 mark)

Q2.

Which statement correctly describes a trend down Group 7 from Cl to I?

X represents Cl, Br or I

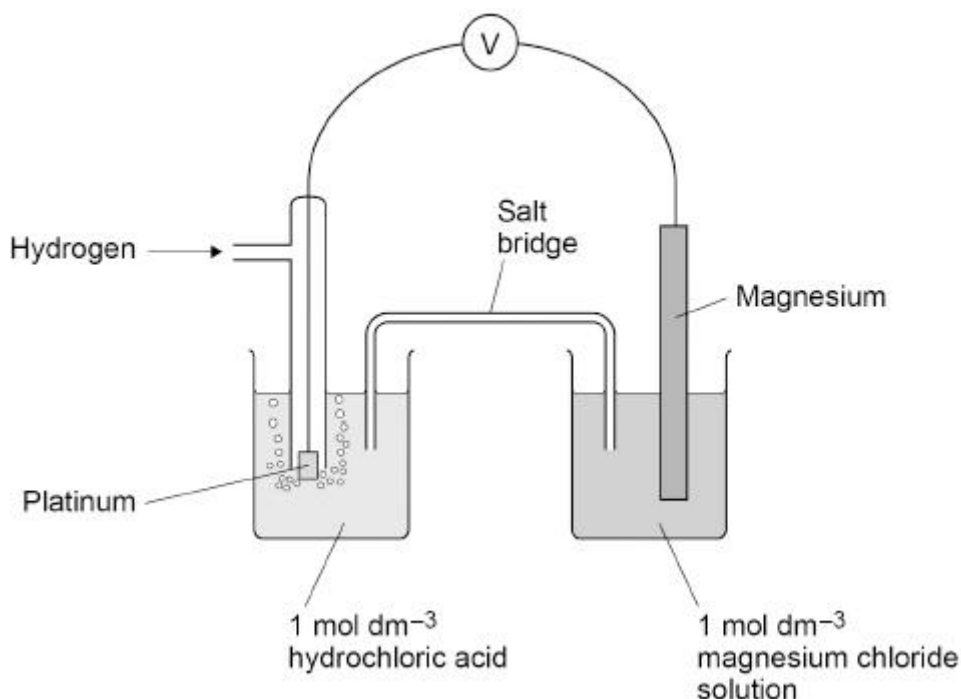
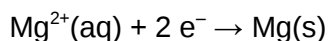
- A** The boiling point of HX increases.
- B** The bond dissociation energy of H–X increases.
- C** The standard electrode potential value for
 $X_2(aq) + 2 e^- \rightarrow 2 X^-(aq)$ becomes more positive.
- D** The solubility of AgX in ammonia increases.

☐☐☐☐

(Total 1 mark)

Q3.

The figure below shows a cell used to measure the standard electrode potential for the half-cell



- (a) State the purpose of the salt bridge.

Identify an ionic compound that could be used in the salt bridge.

Purpose _____

Identity _____

(2)

- (b) State how, if at all, the EMF of this cell will change if the surface area of the platinum electrode is increased.

(1)

The standard electrode potential, E° for the half-cell is shown.



- (c) Water is added to the beaker containing the magnesium chloride solution.

What is the effect on the magnitude of the EMF of the cell?

Tick ☒ **one** box.

EMF increases

☐

EMF stays the same

☐

EMF decreases

☐

(1)

(d) The voltmeter **V** shown in the diagram above is replaced by a bulb.

Give an equation for the overall reaction that occurs when the cell is operating.

(1)

(Total 5 marks)

Q4.

This question is about catalysis.

- (a) Zeolites are used as heterogeneous catalysts in the catalytic cracking of alkanes.

Tetradecane ($C_{14}H_{30}$) can be cracked to form octane and a cycloalkane.

Give an equation for this reaction.

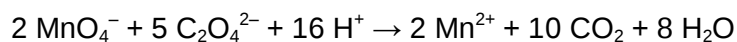
State the meaning of the term heterogeneous.

Equation

Heterogeneous _____

(2)

- (b) A student determines the concentration of ethanedioate ions in an acidified solution by titration with potassium manganate(VII) solution.

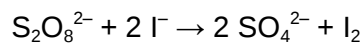


The mixture is warmed before the addition of potassium manganate(VII) solution because the reaction is slow at first. When more potassium manganate(VII) solution is added, the mixture goes colourless quickly due to the presence of an autocatalyst.

Explain the meaning of the term autocatalyst.

Explain, using equations where appropriate, why the reaction is slow at first and then goes quickly.

- (c) The reaction between peroxodisulfate ions and iodide ions in aqueous solution can be catalysed by Co^{2+} ions.



The table below gives relevant standard electrode potentials.

Electrode half-equation	$E^\ominus / \text{V}$
$\text{S}_2\text{O}_8^{2-}(\text{aq}) + 2 \text{e}^- \rightarrow 2 \text{SO}_4^{2-}(\text{aq})$	+2.01
$\text{Co}^{3+}(\text{aq}) + \text{e}^- \rightarrow \text{Co}^{2+}(\text{aq})$	+1.82
$\text{I}_2(\text{aq}) + 2 \text{e}^- \rightarrow 2 \text{I}^-(\text{aq})$	+0.54

Use the electrode potential data to suggest how Co^{2+} catalyses the reaction.

(3)

(Total 11 marks)