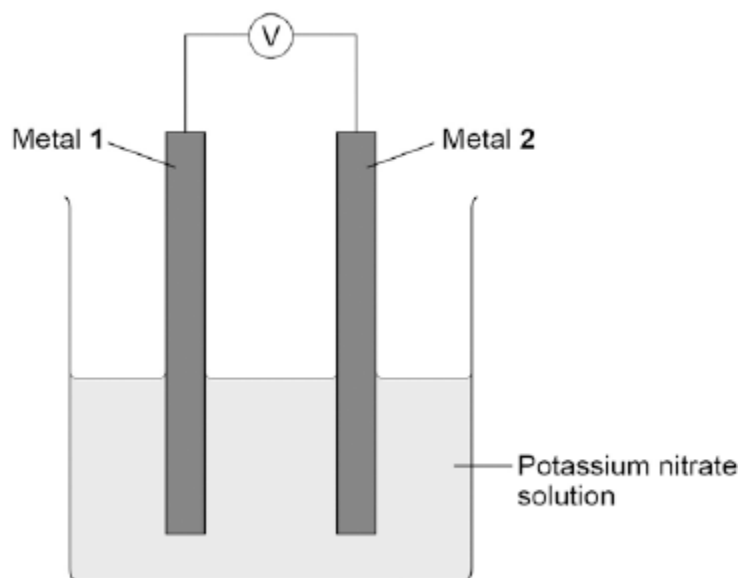


1

A student investigated simple cells using the apparatus shown in the figure below.

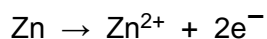


- If metal **2** is more reactive than metal **1** then the voltage measured is positive.
- If metal **1** is more reactive than metal **2** then the voltage measured is negative.
- The bigger the difference in reactivity of the two metals, the larger the voltage produced.

The student's results are shown in the table below.

Metal 2 Metal 1	Chromium	Copper	Iron	Tin	Zinc
Chromium	0.0 V				
Copper	1.2 V	0.0 V			
Iron	0.5 V	not measured	0.0 V		
Tin	0.8 V	-0.4 V	0.3 V	0.0 V	
Zinc	0.2 V	-1.0 V	-0.3 V	-0.6 V	0.0 V

- (a) The ionic equation for the reaction occurring at the zinc electrode in the simple cell made using copper and zinc electrodes is:



Zinc is oxidised in this reaction.

Give a reason why this is oxidation.

.....

.....

(1)

- (b) Look at the table above.

Which **one** of the metals used was the least reactive?

Give a reason for your answer.

Metal

Reason

.....

.....

(2)

- (c) Predict the voltage that would be obtained for a simple cell that has iron as metal **1** and copper as metal **2**.

Explain your answer.

.....

.....

.....

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.....

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.....

.....

(3)

- (d) Hydrogen fuel cells have been developed for cars.

Write a word equation for the overall reaction that takes place in a hydrogen fuel cell.

.....

(1)

- (e) Write the **two** half equations for the reactions that occur at the electrodes in a hydrogen fuel cell.

.....

.....

.....

.....

(2)
(Total 9 marks)

Mark schemes

1

- (a) (zinc has) lost electron(s)
accept loss of electrons

1

- (b) copper is the least reactive

1

because it gave the most negative voltage when it was metal 2

or

it gave the biggest voltage with chromium

or

it gave the most positive voltage when it was metal 1

1

- (c) -0.7 V

1

The voltage with chromium and copper is 1.2

accept use of other cell pairings such as tin with copper and tin with iron

1

The voltage with chromium and iron is 0.5 and copper is less reactive (than iron)

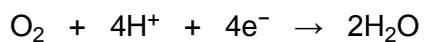
1

- (d) hydrogen + oxygen = water

1

- (e) $\text{H}_2 \rightarrow 2\text{H}^+ + 2\text{e}^-$

1



1

[9]