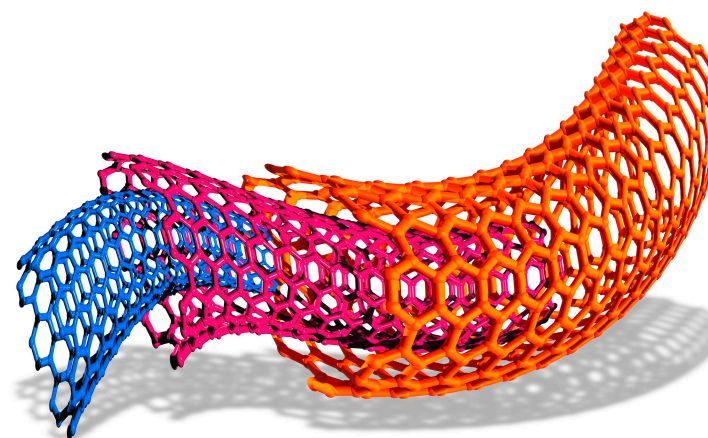


Interactive Example Candidate Responses

Paper 4 (May / June 2016), Question 4

Cambridge IGCSE™
Chemistry 0620



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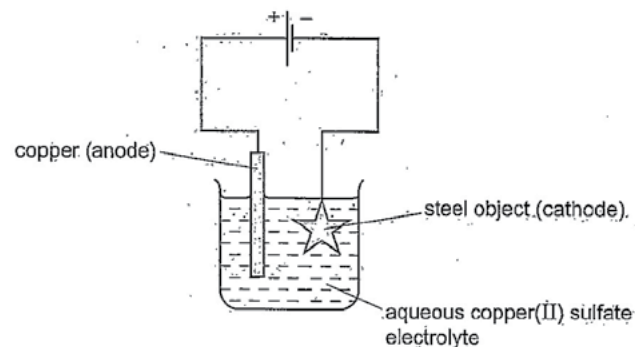
4. Electroplating steel objects with silver involves a three-step process.

step 1 A coating of copper is applied to the object.

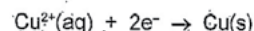
step 2 A coating of nickel is applied to the object.

step 3 The coating of silver is applied to the object.

(a) A diagram of the apparatus used for **step 1** is shown.



(i) The chemical process taking place on the surface of the object is



Explain whether this process is oxidation or reduction.

This process is reduction as the Copper is gaining electrons. [1]

(ii) Explain why the concentration of copper ions in the electrolyte remains constant throughout **step 1**.

The copper anode is not inert and therefore loses ions into the electrolyte. This means that although the copper ions are reducing on the surface of the object, they are constantly being replaced with ions from the anode. [2]

Select
page

Your
Mark

4(a)(i)

4(a)(ii)

4(b)

4(c)

Q4	Mark scheme
(a)(i)	reduction and (the Cu^{2+} ion/copper ions) is gaining electrons/is decreasing in oxidation number;
(a)(ii)	formation of Cu^{2+} /copper ions at the anode happens at the same rate as; removal of Cu^{2+} /copper ions at the cathode or a;
(b)	replace (anode of) copper with nickel; replace electrolyte with nickel(II) sulfate/ NiSO_4 ;
(c)	(good) catalysts; variable oxidation numbers; form coloured compounds/coloured ions;

(b) Give **two** changes which would be needed in order to coat nickel onto the object in step 2.

One would need to change the Copper anode for ~~nickel~~ ^{nickel}
one made of ~~nickel~~ ^{nickel} ~~platinum~~ ^{ion} One would also need
to change the electrolyte for a nickel compound solution.
~~nickel sulfate~~ [2]

(c) Copper, nickel and silver are transition elements.

Typical physical properties of transition elements are a high density and a high melting point.

Give **three** different properties of transition metals which are not typical of other metals.

• They can have variable charges
They often can be used as catalysts
They usually form coloured compounds [3]

[Total: 8]

Your
Mark

4(a)(i)

4(a)(ii)

4(b)

4(c)

Q4	Mark scheme
(a)(i)	reduction and (the Cu^{2+} ion/copper ions) is gaining electrons/is decreasing in oxidation number;
(a)(ii)	formation of Cu^{2+} /copper ions at the anode happens at the same rate as; removal of Cu^{2+} /copper ions at the cathode ora;
(b)	replace (anode of) copper with nickel; replace electrolyte with nickel(II) sulfate/ NiSO_4 ;
(c)	(good) catalysts; variable oxidation numbers; form coloured compounds/coloured ions;

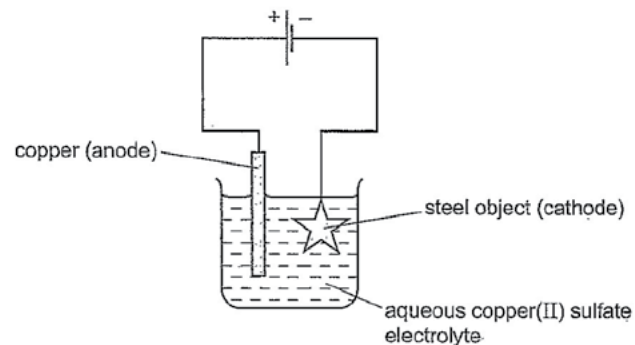
4 Electroplating steel objects with silver involves a three-step process.

step 1 A coating of copper is applied to the object.

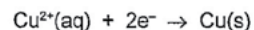
step 2 A coating of nickel is applied to the object.

step 3 The coating of silver is applied to the object.

(a) A diagram of the apparatus used for step 1 is shown.



(i) The chemical process taking place on the surface of the object is



Explain whether this process is oxidation or reduction.

A reduction because ~~is~~ when a reduction occurs electrons are being gained. [1]

(ii) Explain why the concentration of copper ions in the electrolyte remains constant throughout step 1.

Because the copper anode replaces the copper ions that were used up. [2]

Select page

Your Mark

4(a)(i)

4(a)(ii)

4(b)

4(c)

Q4 Mark scheme

(a)(i)	reduction and (the Cu^{2+} ion/copper ions) is gaining electrons/is decreasing in oxidation number;
(a)(ii)	formation of Cu^{2+} /copper ions at the anode happens at the same rate as; removal of Cu^{2+} /copper ions at the cathode ora;
(b)	replace (anode of) copper with nickel; replace electrolyte with nickel(II) sulfate/ NiSO_4 ;
(c)	(good) catalysts; variable oxidation numbers; form coloured compounds/coloured ions;

- (b) Give **two** changes which would be needed in order to coat nickel onto the object in **step 2**.

The electrolyte would need to be changed to a substance of nickel and the ^{anode} electrode would have to be changed as well

[2]

- (c) Copper, nickel and silver are transition elements.

Typical physical properties of transition elements are a high density and a high melting point.

Give **three** different properties of transition metals which are not typical of other metals.

They form coloured ions, they are generally quite unreactive and they conduct electricity and heat well one element has more than 1 form [3]

[Total: 8]

Your
Mark

4(a)(i)

4(a)(ii)

4(b)

4(c)

Q4	Mark scheme
(a)(i)	reduction and (the Cu^{2+} ion/copper ions) is gaining electrons/is decreasing in oxidation number;
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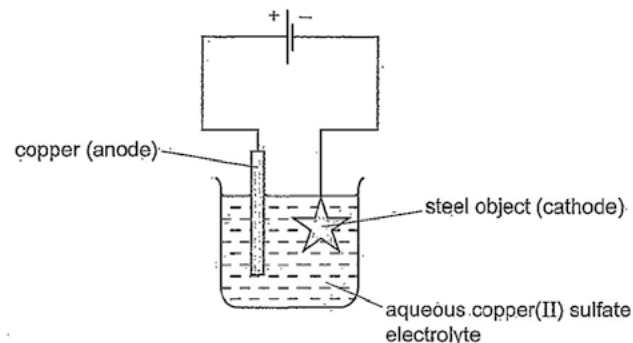
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step 1 A coating of copper is applied to the object.

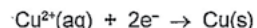
step 2 A coating of nickel is applied to the object.

step 3 The coating of silver is applied to the object.

(a) A diagram of the apparatus used for **step 1** is shown.



(i) The chemical process taking place on the surface of the object is



Explain whether this process is oxidation or reduction.

The reaction is oxidation because there is a loss of electrons [1]

(ii) Explain why the concentration of copper ions in the electrolyte remains constant throughout step 1.

Because they are copper(II) and are not attached are mixed with sulfate [2]

Select
page

Your
Mark

4(a)(i)

4(a)(ii)

4(b)

4(c)

Q4 Mark scheme

(a)(i)	reduction and (the Cu^{2+} ion/copper ions) is gaining electrons/is decreasing in oxidation number;
(a)(ii)	formation of Cu^{2+} /copper ions at the anode happens at the same rate as; removal of Cu^{2+} /copper ions at the cathode ora;
(b)	replace (anode of) copper with nickel; replace electrolyte with nickel(II) sulfate/ NiSO_4 ;
(c)	(good) catalysts; variable oxidation numbers; form coloured compounds/coloured ions;

(b) Give two changes which would be needed in order to coat nickel onto the object in step 2.

A different electrolyte and a different nickel anode
at the anode

[2]

(c) Copper, nickel and silver are transition elements.

Typical physical properties of transition elements are a high density and a high melting point.

Give three different properties of transition metals which are not typical of other metals.

- Malleable

- Ductile

- Shiny

[3]

[Total: 8]

Your
Mark

4(a)(i)

4(a)(ii)

4(b)

4(c)

Q4	Mark scheme
(a)(i)	reduction and (the Cu^{2+} ion/copper ions) is gaining electrons/is decreasing in oxidation number;
(a)(ii)	formation of Cu^{2+} /copper ions at the anode happens at the same rate as; removal of Cu^{2+} /copper ions at the cathode or;
(b)	replace (anode of) copper with nickel; replace electrolyte with nickel(II) sulfate/ NiSO_4 ;
(c)	(good) catalysts; variable oxidation numbers; form coloured compounds/coloured ions;

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