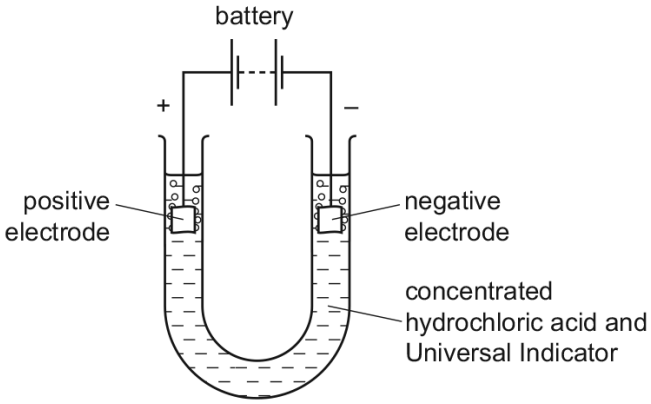
4.1 Electricity and chemistry

01. 0620_m15_qp_62 Q: 3

Electricity was passed through concentrated hydrochloric acid using the apparatus shown.



Effervescence was observed at both electrodes.

(a) Name this process used to break down concentrated hydrochloric acid.

..... [1]

(b) Suggest why the electrodes are made of platinum and not aluminium.

..... [1]

(c) **(i)** Name the gas given off at the positive electrode.

.....

(ii) What would be the colour of the Universal Indicator around the positive electrode at the end of the experiment?

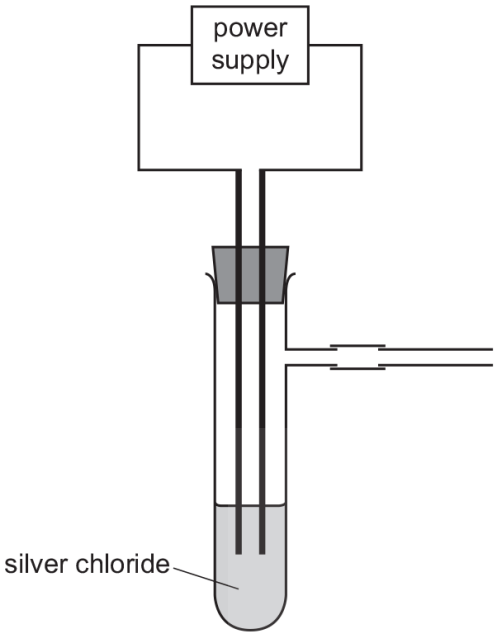
.....
[2]

[Total: 4]

02. 0620_m21_qp_62 Q: 1

Silver chloride is an ionic compound and is insoluble in water. Molten silver chloride breaks down during electrolysis. The products are chlorine and silver.
Chlorine gas is soluble in water and toxic.

A student suggests using the apparatus shown to break down silver chloride.



(a) Draw an arrow on the diagram to show where heat must be applied so that the silver chloride can break down. [1]

(b) Complete the diagram to show how chlorine gas can be collected and the volume of the chlorine measured. Label any apparatus you have drawn. [2]

(c) Give **two** observations that are made as the silver chloride breaks down.

1 .....

2 .....
[2]

(d) The person doing the experiment followed all normal laboratory safety rules.

State **one** additional safety precaution that should be taken when doing this experiment. Give a reason for your answer.

safety precaution .....

reason .....
[2]

(e) Suggest **one** reason why zinc is **not** a suitable material to use as the electrodes.

.....

..... [1]

(f) The chlorine gas was bubbled into an aqueous solution of a sodium salt. The colour of the solution changed from colourless to orange.

Identify the sodium salt and explain what has happened to cause the colour change.

sodium salt .....

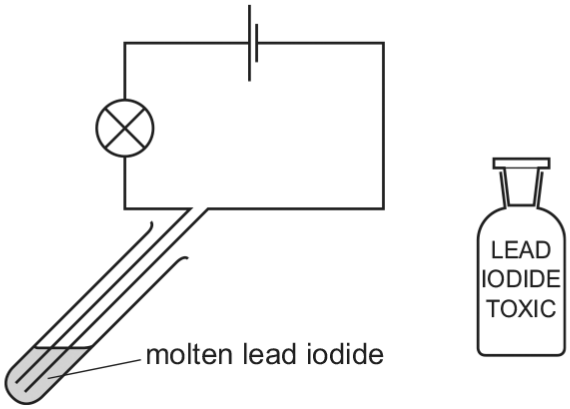
explanation .....

.....
[2]

[Total: 10]

03. 0620_s12_qp_63 Q: 6

Electricity was passed through molten lead iodide as shown below.



A purple gas was observed coming from the positive electrode (anode).

(a) What piece of apparatus is missing from the diagram?

..... [1]

(b) Clearly label the electrodes on the diagram. [1]

(c) Give **one** other expected observation

(i) during the electrolysis, ...

(ii) when the molten lead iodide cools and solidifies.

..... [2]

(d) Suggest why a stopper is not used in the top of the boiling tube.

..... [1]

(e) Explain the observation at the positive electrode.

.....

..... [2]

(f) Give **one** safety precaution necessary when carrying out this experiment.

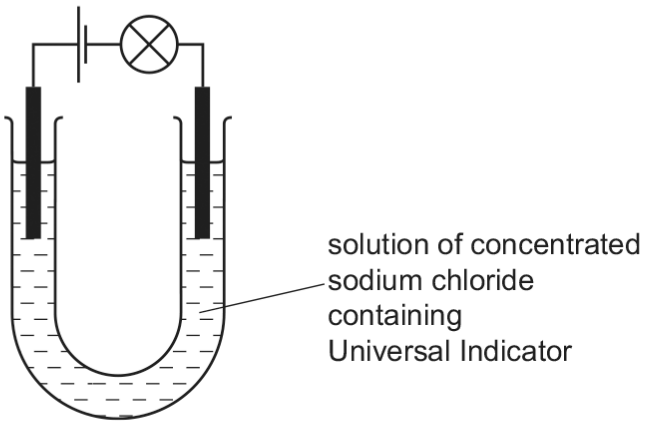
.....

..... [1]

[Total: 8]

04. 0620_s13_qp_63 Q: 2

Electricity was passed through a solution of concentrated sodium chloride containing Universal Indicator using the apparatus shown.



The bulb lit up. The solution near the negative electrode changed colour from green to purple.

(a) Give **one** other expected observation.

..... [1]

(b) Name a suitable non-metallic element for the electrodes.

..... [1]

(c) Name the process which uses electricity to break down solutions.

..... [1]

(d) **(i)** Explain why the Universal Indicator changed colour.

.....

..... [2]

(ii) Predict the colour of the indicator near the positive electrode. Explain your prediction.

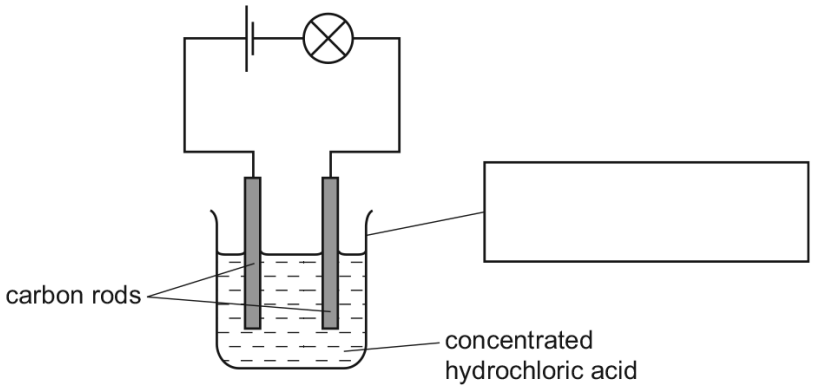
colour .....

explanation ..... [2]

[Total: 7]

05. 0620_s14_qp_62 Q: 1

A student investigated the effect of using electricity to break down a solution of concentrated hydrochloric acid using the apparatus shown.



During the experiment, bubbles were observed at both carbon rods.

(a) Complete the box to identify the piece of apparatus used. [1]

(b) **(i)** Name the process that occurs when electricity is passed through concentrated hydrochloric acid.

..... [1]

(ii) What is the purpose of the carbon rods?

..... [1]

(c) Name **one** of the gases formed and state a test for this gas.

name .....

test .....

result ..... [2]

(d) Draw a diagram of different apparatus that could be used to collect the gases formed at the carbon rods.

[2]

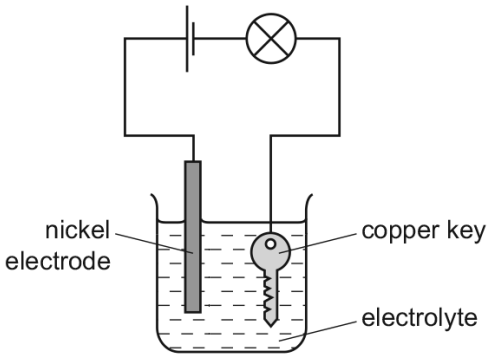
[Total: 7]

06. 0620_s14_qp_63 Q: 3

A student carried out an investigation to coat a copper key with nickel. He followed these instructions.

1 Rub the copper key with sandpaper.

2 Set up the circuit as shown.



3 Switch on the circuit for ten minutes.

4 Remove the key, wash it and dry.

(a) Name the process used to coat the copper key with nickel.

[1]

(b) Why was the key rubbed with sandpaper?

[1]

(c) Name a possible electrolyte that could be used.

[1]

(d) Give one expected observation during the investigation that tells you it was switched on.

[1]

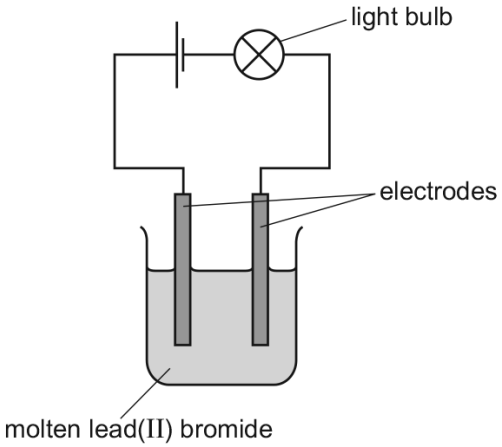
(e) Describe how the key would be washed and dried.

[1]

[Total: 5]

07. 0620_s15_qp_61 Q: 2

Electricity was passed through molten lead(II) bromide using the apparatus shown.



The formation of a brown gas was observed at the positive electrode.

(a) Give **one** other expected observation.

..... [1]

(b) (i) Name a non-metal that could be used for the electrodes.

..... [1]

(ii) Suggest why iron is not used for the electrodes.

..... [1]

(c) (i) Name the brown gas formed.

..... [1]

(ii) Suggest the result of testing this gas with damp blue litmus paper.

..... [1]

(d) Name the product formed at the negative electrode.

..... [1]

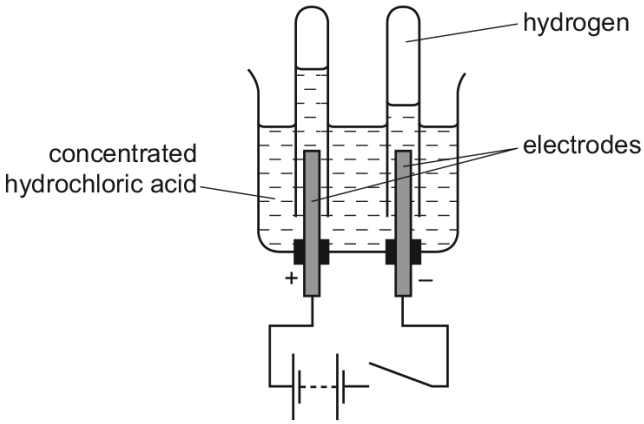
(e) State **one** safety precaution that should be used when doing this experiment.

..... [1]

[Total: 7]

08. 0620_s15_qp_62 Q: 6

Concentrated hydrochloric acid was electrolysed.



Hydrogen gas formed at the cathode (negative electrode).

(a) Name a suitable metal to use for the electrodes.

..... [1]

(b) Why does hydrogen form at the negative electrode?

..... [1]

(c) **(i)** Identify the gas given off at the anode (positive electrode).

..... [1]

(ii) Give a test for this gas.

test .....

result .....

[2]

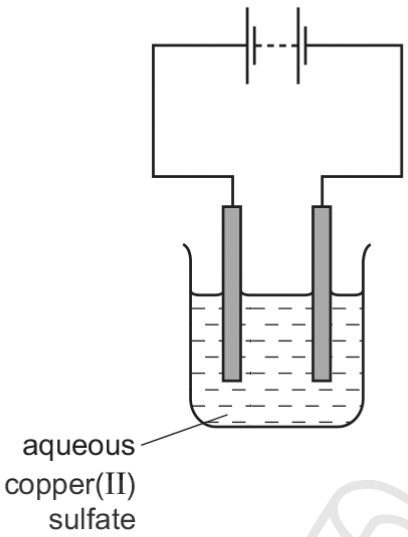
(d) Suggest why the volume of gas formed at the positive electrode is less than the volume of hydrogen.

..... [1]

[Total: 6]

09. 0620_w12_qp_61 Q: 2

Electricity was passed through aqueous copper(II) sulfate using inert electrodes as shown in the diagram below.
Copper was deposited at one of the electrodes.



(a) Name a suitable material for the electrodes.

..... [1]

(b) At which electrode was copper deposited?

..... [1]

(c) Give **one** other observation seen during the electrolysis.

..... [1]

The electrode at which copper was deposited was removed at intervals, washed, dried and weighed.
The results are shown in the table on page 4.

(d) **(i)** Suggest how the electrode was washed?

..... [1]

(ii) How could the electrode be dried quickly?

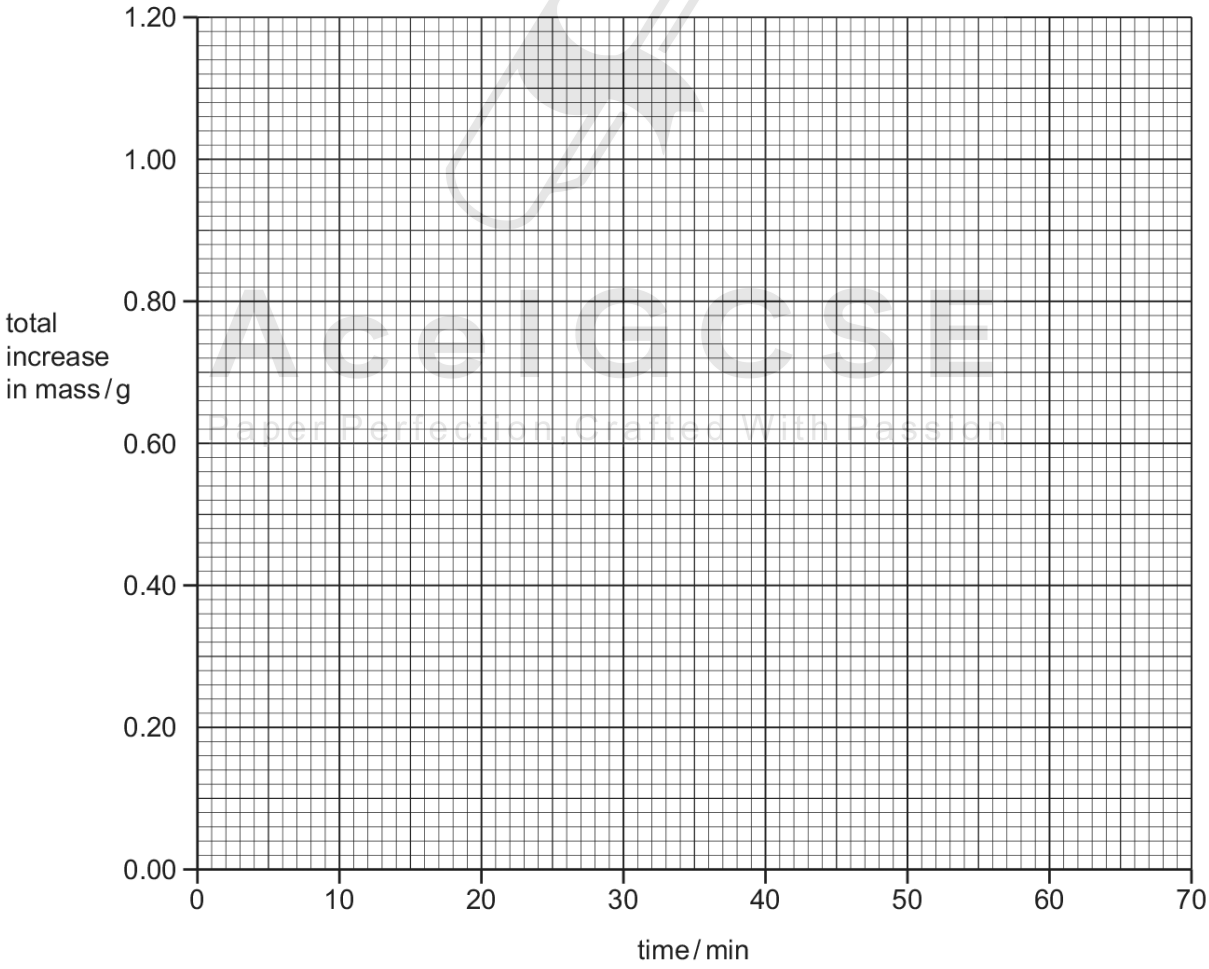
..... [1]

Table of results

time / min	mass of electrode / g	total increase in mass / g
0	3.75	0.00
10	4.00	0.25
20	4.25	0.50
30	4.50	
40	4.75	
50	4.90	
60	4.90	
70	4.90	

(e) Complete the table by calculating the total increase in mass for the remaining time intervals. [1]

(f) Plot the points on the grid below. Draw a graph with two intersecting straight lines.



[3]

(g) Suggest why the last three readings were the same.

.....

..... [1]

[Total: 10]

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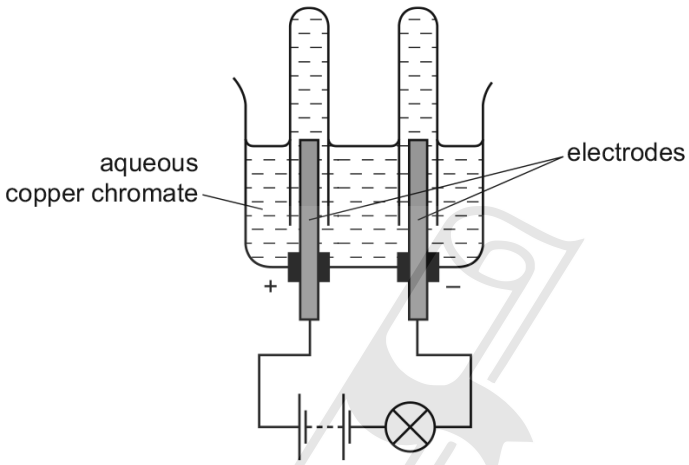
10. 0620_w14_qp_63 Q: 3

Electricity was used to break down an aqueous solution of copper chromate, $CuCrO_4$, which is green.
The apparatus used is shown.



A brown deposit was seen forming at one electrode and oxygen was evolved at the other electrode.

(a) Suggest a suitable non-metal for the electrodes.

..... [1]

(b) Give **one** other observation expected during this experiment.

..... [1]

(c) Name the brown deposit and identify at which electrode it is formed.

..... [2]

(d) Name the process when electricity breaks down aqueous solutions.

..... [1]

[Total: 5]

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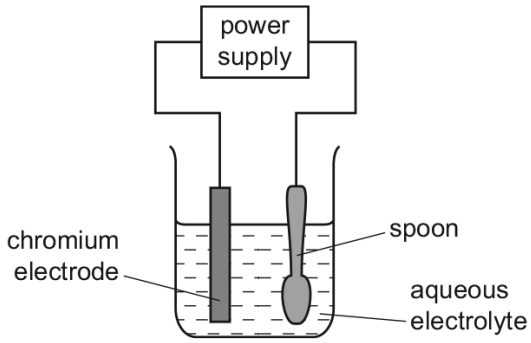
11. 0620_w15_qp_63 Q: 2

A steel spoon can be coated in chromium using electrolysis. The spoon has to be very clean and free of grease.



(a) Name this process of coating a metal object with another metal.

..... [1]

(b) Suggest **one** advantage of putting a layer of chromium on the spoon.

..... [1]

(c) Which electrode should be the spoon?

..... [1]

(d) Suggest the name of a compound that could dissolve in water to form the electrolyte.

..... [2]

(e) Why must the spoon be very clean and free of grease?

..... [1]

(f) Suggest **one** mistake in the apparatus set up.

..... [1]

[Total: 7]

12. 0620_w16_qp_62 Q: 4

Metal rings can be coated with a layer of copper using electricity.
Plan an experiment to electroplate a small metal ring with copper.
You are provided with common laboratory apparatus, a copper rod, copper(II) sulfate crystals, water and a small metal ring.
Include a labelled diagram in your answer.

.....

.....

.....

.....

.....

.....

.....

.....

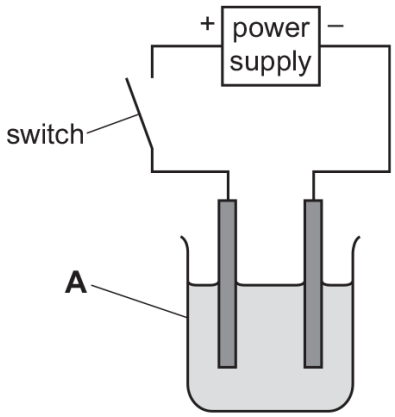
.....

..... [6]

[Total: 6]

13. 0620_w20_qp_62 Q: 1

The diagram shows the apparatus used to pass an electric current through concentrated hydrochloric acid. Hydrogen and chlorine were formed at the electrodes.



(a) Name the item of apparatus labelled **A**.

..... [1]

(b) The electrodes were made of platinum.

(i) Give **two** reasons why platinum is a suitable material for the electrodes.

1 .....

2 .....
[2]

(ii) Suggest another material suitable to use as electrodes in this experiment.

..... [1]

(c) The teacher doing this experiment wore safety glasses, gloves, had their hair tied back and stood up throughout the experiment.

State **one** other safety precaution that should be taken when doing this experiment.
Explain your answer.

safety precaution .....

explanation .....
[2]

[Total: 6]

01. 0620_m15_ms_62 Q: 3

(a) electrolysis (1) [1]

(b) aluminium would react / platinum is inert / less reactive (1) [1]

(c) **(i)** chlorine (1)

(ii) colourless / bleached / pale yellow (1) [2]

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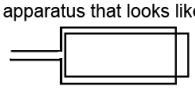
02. 0620_m21_ms_62 Q: 1

Question	Answer	Marks
(a)	an arrow pointing to the bottom of the test tube.	1
(b)	apparatus that looks like a gas syringe in approximately horizontal orientation connected to delivery tube 	1
	graduations shown OR labelled as (gas) syringe	1
(c)	any 2 from: • yellow / green gas • bubbles / effervescence • shiny liquid / metal / solid / deposit / substance max 2	2
(d)	M1 Precaution: use a fume cupboard / well ventilated space	1
	Reason: chlorine is toxic / poisonous M2 must link to M1 to score	1
(e)	(zinc) reacts (with chlorine / silver chloride)	1
(f)	sodium bromide	1
	bromine is displaced by chlorine OR chlorine is more reactive than bromine OR chlorine oxidises bromide	1

03. 0620_s12_ms_63 Q: 6

(a) Bunsen burner (1) **ignore**: switch [1]

(b) labels on correct positions (1) [1]

(c) **(i)** bulb lights/idea of molten lead (1)

(ii) bulb goes out/no fizz (1) [2]

(d) pressure of gas build up/explode owtte (1) [1]

(e) iodine formed (1) **not**: iodide from iodide ions (1) [2]

(f) fume cupboard/well ventilated area (1)
allow gloves if reason specified **ignore**: goggles [1]

[Total: 8]

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04. 0620_s13_ms_63 Q: 2

(a) fizz / bubbles / effervescense (1) [1]

(b) carbon / graphite (1) [1]

(c) electrolysis (1) [1]

(d) **(i)** alkali formed (1) sodium hydroxide formed (2) [2]

(ii) colourless / red (1)

chlorine bleaches / chlorine is an acidic gas / acid produced (1) [2]

---

05. 0620_s14_ms_62 Q: 1

(a) beaker (1) [1]

(b) **(i)** electrolysis (1) [1]

(ii) electrodes (1) [1]
allow: conduct electricity / to transfer electrons
ignore: attract ions

(c) hydrogen:

lighted splint (1)

pops (1)

OR

chlorine:

litmus (1)

bleached (1) [2]

(d) diagram to show test-tubes above electrodes (1)

containing liquid (1) [2]

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06. 0620_s14_ms_63 Q: 3

(a) electroplating (1) [1]
allow: electrolysis

(b) to clean / remove dirt / impurities (1)

so nickel coats evenly / efficiently (1) [2]

(c) aqueous / solution in water(1)

named nickel salt (1) [2]
allow: nickel ions

(d) bulb lights / (silver) deposit on key (1) [1]

(e) rinse with water and suitable method to dry e.g. oven / hairdryer (1) [1]

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07. 0620_s15_ms_61 Q: 2

(a)	bulb lights / silver-grey liquid or solid forms / bubbles;	1	
(b)(i)	carbon / graphite;	1	
(b)(ii)	it reacts / is reactive;	1	**A** corrodes / rusts **I** dissolves
(c)(i)	bromine / Br_2;	1	**R** bromide
(c)(ii)	bleaches / turns white;	1	
(d)	lead;	1	**R** lead(II) / lead ions
(e)	fume cupboard / well-ventilated area;	1	**I** references to goggles / safety clothing

08. 0620_s15_ms_62 Q: 6

(a)	platinum;	1	
(b)	opposites attract / hydrogen ions are positive / cations / H^+;	1	**A** hydrogen is positive **A** hydrogen gains electrons / hydrogen is reduced
(c)(i)	chlorine;	1	
(c)(ii)	(red or blue) litmus; bleached / goes white;	2	**R** other indicators
(d)	gas is soluble / chlorine is soluble / gas dissolves / chlorine dissolves;	1	**I** hydrogen ions from water

09. 0620_w12_ms_61 Q: 2

(a) carbon/graphite/platinum (1) [1]

(b) negative/cathode (1) [1]

(c) bubbles/fizz/ colour of solution pales (1) **not:** gas given off ignore wrong gas [1]

(d) **(i)** with distilled/pure water (1) **accept:** organic solvents [1]

(ii) use of hairdryer/oven (1) **allow:** heat/heater [1]

(e) increase in masses completed correctly (1) [1]

0.75 1.00 1.15 1.15 1.15 accept 1 for 1.00

(f) points plotted correctly (2), –1 any incorrect [3]

two straight lines through points (1)

(g) reaction finished/all copper deposited owtte/all copper sulfate used up (1) [1]

10. 0620_w14_ms_63 Q: 3

(a) carbon / graphite (1) [1]

(b) bulb lights / fizzing / bubbles (1) [1]
ignore: names of electrodes
allow: solution gets paler / changes colour / green colour fades

(c) copper (1)
negative electrode / cathode (1) [2]

(d) electrolysis (1) [1]

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11. 0620_w15_ms_63 Q: 2

(a)	electroplating;	**1**	**R:** electrolysis
(b)	prevent rusting / corrosion / attractive appearance / shiny;	**1**	
(c)	the negative / cathode;	**1**	
(d)	**M1** chromium (salt) / chromium + *any named* anion; **M2** nitrate / sulfate / chloride / ethanoate / *suitable* named anion;	**1** **1**	**M2** is dependent on **M1**
(e)	coating will not stick / be even / dirt or grease will be trapped;	**1**	**I:** it will not conduct
(f)	spoon not completely immersed in electrolyte / only half of spoon will be plated;	**1**	

12. 0620_w16_ms_62 Q: 4

	clean / sandpaper the metal ring dissolve copper(II) sulfate in water / copper(II) sulfate solution set up circuit / switch on electricity / complete circuit copper rod anode(+ve electrode) metal ring cathode(–ve electrode) rotate the metal ring / agitate remove the metal ring, wash and dry	**6**

13. 0620_w20_ms_62 Q: 1

Question	Answer	Marks
(a)	beaker	**1**
(b)(i)	conduct electricity	**1**
	inert	**1**
(b)(ii)	carbon / graphite	**1**
(d)	use a fume cupboard	**1**
	chlorine is toxic	**1**