

MARK SCHEME

GCSE

CHEMISTRY

AQA - COMBINED SCIENCE

C4 - TEST 5

CHEMICAL CHANGES

Advanced

Mark schemes

1.

- (a) **Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.

5–6

Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.

3–4

Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.

1–2

No relevant content

0

Indicative content

A is sodium oxide

B is phosphorus oxide

C is magnesium oxide

D is silicon dioxide

linked statements:

A is sodium oxide

because it has highest pH **or** pH = 14 **or** is a strong alkali

B is phosphorus oxide

because it has lowest pH **or** pH = 3 **or** is an acid

C is magnesium oxide

because it has 2nd highest pH **or** pH = 9 **or** is a (weak) alkali

D is silicon dioxide

because it is neutral **or** pH = 7

or

A and B are sodium oxide **or** phosphorus oxide

because both soluble **or** no solid remains

C is magnesium oxide

because it will be the colourless solution with solid remaining

D is silicon dioxide

because it will be the colourless liquid with solid remaining

for **level 3** the solids must be correctly identified

(b) dilution by a factor of 100

allow pH changes by 1 when solution is diluted by factor of 10

or

allow pH changes by 2

1

(pH =) 5

1

an answer of (pH=) 5 gains 2 marks

[8]

2.

(a) (i) current / charge couldn't flow

allow could not conduct (electricity)

1

because the ions / particles couldn't move

*do **not** accept electrons/ molecules / atoms*

or

(salt) needs to be molten / (1) dissolved (to conduct electricity)

so that the ions / particles can move (1)

*do **not** accept electrons / molecules / atoms*

1

(ii) he had status

*accept he had authority **or** experience*

or

he had evidence / proof

accept the experiment could be repeated

1

(b) hydrogen / H₂

*do **not** allow hydrogen ions*

1

the ions are positive

accept because opposite (charges) attract

1

potassium is more reactive (than hydrogen)

accept potassium ions are less easily discharged (than hydrogen)

or *potassium ions are less easily reduced (than hydrogen)*

1

(c) (i) gain electron(s)

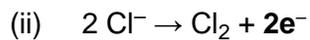
accept fully balanced correct equation for 2 marks

1

one electron

*if no other marks awarded allow (potassium ions) reduced for
1 mark*

1



*must be completely correct, including charge on electron
accept correct multiples*

1

(iii) 2, 8, 8

*accept any combination of dots, crosses, "e" or any other relevant
symbol*

ignore any charges if given

1

[10]

3.

(a) bonded pair of electrons and

6 non-bonded electrons on chlorine

1

(b) **Level 3 (5–6 marks):**

A detailed and coherent explanation of comparative results of a reaction in terms of concentration and ionisation. The response makes logical links between the points raised and uses sufficient examples to support these links.

Level 2 (3–4 marks):

A description of a reaction with results is given but may miss some details. Links are made but may not be fully articulated and / or precise.

Level 1 (1–2 marks):

Simple statements are made. The response may fail to make logical links between the points raised.

0 marks:

No relevant content

Indicative content

Simple statements / descriptions of a reaction

- correct comparative pH, such as, 0–3 (strong) 4–6 (weak)
- named reaction, such as, with a reactive metal or a named carbonate
- comparative results or observations of the named reaction, such as, faster reaction (strong) or greater volume of gas produced in a given time (strong)

Explanations of different results

- weak acids are only partially ionised in aqueous solution
- strong acids are completely ionised in aqueous solution / greater concentration of H⁺ ions
- aqueous solutions of acids at the same concentration / same state of division of metal / powder, same temperature

6

[7]

4.

(a) limewater **or** calcium hydroxide solution

1

(reacts with carbon dioxide and) turns cloudy / milky

linked to first point

if no other mark awarded 'puts out lighted splint' gains 1 mark

1

(b) (i) any **two** from:

- same volume / amount of the acids
- concentration of the acids
- temperature
- same surface area / size / mass / amount of calcium carbonate
- same measuring equipment

2

(ii) any **three** from:

- (after about 4 minutes) the sulfuric acid stops reacting **or** nitric acid continues to react
accept more CO₂ with nitric acid at any time after 4 minutes
- (initially) the reaction with sulfuric acid is faster
- (the reaction stops) because calcium sulfate is a solid
allow sulfuric acid produces a solid
- (the reaction continues) because calcium nitrate is soluble / in solution / aqueous
allow nitric acid produces an (aqueous) solution
- because the calcium sulfate prevents the sulfuric acid reacting with the calcium carbonate
- (the rate is faster) because sulfuric acid contains two hydrogens

3

[7]

5.

- (a) $2\text{Cl}^- - 2\text{e}^- \rightarrow \text{Cl}_2$ (allow unaltered LHS to produce $\frac{1}{2} \text{Cl}_2$)
 $\text{Na}^+ + \text{e}^- \rightarrow \text{Na}$ (allow $\times 2$ for **all** terms)

(credit candidates who point out that hydrogen / H₂ is in fact produced)
for 1 mark each

2

- (b) for product 1*, *idea of a solid / precipitate* **or** silver bromide
gains 1 mark

but solid / a precipitate of silver bromide
gains 2 marks

for product 2*, *idea of aqueous / a solution / dissolved (in water) / or sodium nitrate*
gains 1 mark
(do not allow liquid)

but aqueous / a solution / dissolved (in water) of sodium nitrate

(*do not credit formulae)
gains 2 marks

4

[6]

6.

- (a) 52.9(411765) / 53

correct answer with or without working = 2 marks
*if answer incorrect allow $2 \times 27 = 54$ **or** $27/102 \times 100$ **or** 26.5 for 1 mark*

2

- (b) (i) because it lowers the melting point (of the aluminium oxide)
allow lowers the temperature needed
*do **not** accept lowers boiling point* 1
- so less energy is needed (to melt it)
accept so that the cell / equipment does not melt 1
- (ii) 2O^{2-} on left hand side
accept correct multiples or fractions 1
- 4e^- on right hand side
accept -4e^- on left hand side 1
- (iii) because the electrode reacts with oxygen **or**
 because the electrode burns 1
- to form carbon dioxide **or**
 electrode made from carbon / graphite 1

[8]

7.

(a) **Level 3 (5–6 marks):**

A full, detailed and coherent plan covering all the major steps is provided, which outlines the apparatus required and sets out the steps needed in a logical manner that could be followed by another person to produce a pure, dry sample of copper nitrate.

Level 2 (3–4 marks):

The substantive content of a plan is present but may be missing some steps. The plan may not be in a completely logical sequence but leads towards the production of a pure, dry sample of copper nitrate.

Level 1 (1–2 marks):

Simple statements relating to relevant apparatus or steps are made but they may not be in a logical order. The plan would not allow another person to produce the sample.

0 marks:

No relevant content

Indicative content

- pour a suitable volume of nitric acid into a suitable container
- add a small amount of copper carbonate to the acid and stir until the effervescence stops
- continue to add small amounts of copper carbonate to the acid and each time stir until any effervescence stops
- eventually when there is no reaction / effervescence when the copper carbonate is added filter the mixture to remove the excess copper carbonate
- pour the filtrate (copper nitrate solution) into an evaporating basin and heat to evaporate a small amount of the water
- leave the copper nitrate solution to crystallise
- remove the crystals from the solution remaining and dry the crystals

6

(b) 1 mole carbon dioxide = $14 + (16 \times 2) = 46$ g

1

14 g is 0.30 mole

1

1 mole is 6.02×10^{23} molecules

1

so 14 g has 1.81×10^{23} molecules

allow 1.81×10^{23} with no working shown for 4 marks

1

answer not given in standard form max. 3 marks

[10]