AQA GCSE CHEMISTRY (HIGHER) · 8462

CHEMISTRY



MARK SCHEME

4.8.3 IDENTIFICATION OF IONS BY CHEMICAL AND SPECTROSCOPIC MEANS

SCORE	PERCENTAGE
/219	%

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Q1.

(a) yellow

allow orange
allow orange-yellow

1

(b) copper (ion)

allow Cu^{2+}
allow copper (II)
allow barium (ion)
allow Ba^{2+}

1

(c) (flame) colours are masked

allow (flame) colours mix / blend
allow only see one colour
allow cannot see two colours at once
ignore hard to distinguish

1

(d) Li^+

1

Na^+

1

(e) bromide (ion)

allow Br^-
ignore bromine

1

(f) add barium chloride (solution)

allow barium nitrate (solution)

1

add hydrochloric acid

allow nitric acid
allow acidified
*do **not** accept sulfuric acid*

1

white precipitate produced

dependent on use of a barium compound

1

[9]

Q2.

(a) (i) Filtration

1

(ii) Chlorine

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1

(b) (i) nanoparticles are small / smaller / much smaller / tiny

allow any in range 1−100 nm or 1 × 10^{-9} m − 1 × 10^{-7} m ***or*** *a few hundred atoms in size*

ignore numbers if stated smaller

1

(ii) they have a high surface area to volume ratio

reference to surface area without volume ratio is insufficient

allow nanoparticles are very reactive ***or*** *nanoparticles are more reactive than normal particles.*

1

(c) (sodium hydroxide) produces a white precipitate

accept solid / suspension or ppt or ppte for precipitate.

ignore cloudy / milky

1

which (then) dissolves / disappears (in excess sodium hydroxide)

M2 cannot be awarded unless a solid of some sort has been made

ignore names or formulae of compounds

1

[6]

Q3.

(a) (i) Proton

1

(ii) Neutron

1

(b) In order of increasing atomic number

1

(c) (i) 9

1

(ii) Gas

1

(d) (i) gains (one) electron

1

(to gain a) full outer energy level **or** noble gas configuration

allow because it has seven outer electrons

1

(ii) add sodium hydroxide (solution)

allow ammonia (solution) ***or*** *ammonium hydroxide* ***or*** *any other soluble hydroxide* ***or*** *flame test*

1

(forms a) blue precipitate

second mark dependent on suitable reagent being added

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allow blue−green / blue / green if flame test given

1

[9]

Q4.

(a) copper (II) → blue

iron (III) → brown

more than one line from any box negates the mark

1
1

(b) aluminium

allow correct answer shown in box if answer line blank

1

(c) (i) yellow

allow orange

1

(ii) lilac

allow purple

1

(iii) one colour masks the other

allow colours mixed

1

[6]

Q5.

(a) **X:**

Fe^{2+} / iron(II), SO_4^{2-} / sulfate

allow iron(II) sulfate
or *$FeSO_4$*

1

Y:

Na^+ / sodium, I^- / iodide

allow sodium iodide
or *NaI*

1

Z:

Fe^{3+} / iron(III), Br^- / bromide

allow iron(III) bromide
or *$FeBr_3$*
correct identification of any two ions = one mark
correct identification of any four ions = two marks

1

(b) any **five** from:

allow converse arguments

method 1

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- weighing is accurate
- not all barium sulfate may be precipitated
- precipitate may be lost
- precipitate may not be dry
- takes longer
- requires energy

allow not all the barium hydroxide has reacted

method 2

- accurate
- works for low concentrations

allow reliable / precise

5

[8]

Q6.

(a) (i) Solids

1

(ii) Chlorine

1

(iii) improves dental health **or** reduces tooth decay

1

(b) put a sample of the filtered water in an evaporating basin **or** leave to evaporate

accept any description of evaporation (using a Bunsen or leaving on the windowsill)

1

there will be crystals of salt left

1

(c) sodium and / or chloride ions are bigger than water (molecules) **or** ions are charged **or** molecules are not charged

*do **not** accept sodium chloride molecules as ions is given in the question*

1

[6]

Q7.

(a) (i) ionic (bonding)

1

(ii) <u>ions</u> cannot move in solid **or** are in fixed positions

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

ignore particles

***must** mention ions*

1

but can move in solution

1

(b) silver chloride formed

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1

which is insoluble

1

(c) (i) aluminium

1

calcium

accept other metal ions that also give white precipitates (such as lead and zinc)

1

(ii) add excess sodium hydroxide solution

the second mark of each pair is dependent on the first mark being awarded.

1

precipitate remains

1

carry out a flame test

1

not red / orange

accept any colour that is not orange / red

*give full credit for answers that correctly eliminate other cations in **(c)(i)** that would give white precipitates with a few drops of NaOH*

1

[11]

Q8.

Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also apply a 'best-fit' approach to the marking.

0 marks
No relevant content

Level 1 (1 – 2 marks)
Any description of a method used and / or a result given

Level 2 (3 – 4 marks)
Description of workable methods used, with results to identify positive **or** negative ions

Level 3 (5 – 6 marks)
Description of methods used to identify both positive **and** negative ions, with relevant results

examples of the points made in the response

extra information

Test: add (platinum / nichrome) wire (for the flame test)

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accept any method of introducing the solution into the flame, eg a splint soaked in the solution or sprayed from a bottle

Result: the sodium compounds result in a yellow / orange / gold flame **or** the potassium compound results in a lilac / purple / mauve flame

student could state that potassium carbonate gives a different colour to the three sodium compounds as long as it is clear that the flame test colour comes from Na^+ or K^+

Test: add dilute nitric acid to all four solutions

allow any acid

Result: sodium carbonate and potassium carbonate will effervesce **or** sodium chloride and sodium iodide will not effervesce

Test: add dilute nitric acid followed by silver nitrate

Result: sodium chloride and sodium iodide produce a precipitate **or** sodium chloride produces a white precipitate and sodium iodide produces a yellow precipitate

accept sodium carbonate and potassium carbonate do not produce a precipitate

[6]

Q9.

(a) (i) *method of introducing sample into flame*

e.g. wire / splint / spray

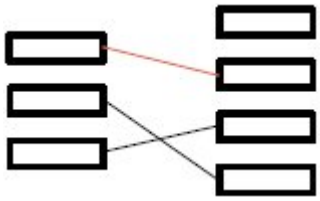
1

clean wire or colourless flame

allow blue / roaring flame

1

(ii)



1
1

(iii) (potassium) chloride

*allow KCl **or** Cl^-*

1

(b) (i) copper

allow Cu^{2+}

1

(ii) sulfate

1

[7]

Q10.

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(a) lithium

allow Li^+ / Li

1

yellow

allow orange

1

(b) silver nitrate (solution)

*incorrect test = **0** marks*
ignore (nitric) acid
*do **not** allow other named acids*

1

white precipitate

1

(c) blue precipitate (with sodium hydroxide) indicates copper ions

allow Cu^{2+}

1

and white precipitate (with barium chloride) indicates sulfate ions

allow SO_4^{2-}
*accept compound X is copper sulfate / $CuSO_4$ for **1** mark*

1

but iron(II) ions produce a green precipitate (with sodium hydroxide)

1

[7]

Q11.

(a) (i) so there are no impurities

accept no other chemicals / not contaminated
allow to get the correct result

1

(ii) high melting point

1

unreactive

1

(iii) yellow-orange

1

(b) (i) bubbles / fizz / effervescence

ignore any named gas

1

(ii) milky

1

(c) fast(er)

1

small(er) amount

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1

[8]

Q12.

(a) (i) Na_2CO_3: HCl → gas / effervescence / bubbles (1)
CO_2 / carbon dioxide / turns lime water milky (1)

1

NaCl: $AgNO_3$ → white ppt (1)
silver chloride (1)

1

$NaNO_3$: Al + NaOH → pungent / sharp smell / choking gas (1)
NH_3 / ammonia / turns (red) litmus blue(1)

1

Na_2SO_4: $BaCl_2$ → white ppt (1)
barium sulfate (1)

1

*each correct test and one result = **1** mark*

***one** other result for any test = **1** mark this mark can only be awarded <u>once</u>*

(ii) all would give a yellow / yellow-orange (flame) / same coloured (flame) / same results

allow <u>orange</u> (flame) 1

or

they all contain sodium

1

(b) any **two** from:

ignore cost/errors

- fast / quick or comment about speed
  allow precise
- small amounts/sensitive
  allow can be left to run/continuous analysis
- accurate
- ease of automation
  accept operators do not need chemical skills
- sample not used up
- reliable / efficient

2

[7]

Q13.

(a) (i) yellow

1

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(ii) lilac

1

(b) (bubble through) limewater

1

cloudy

allow white / milky

1

(c) (i) silver nitrate solution

1

(ii) white

1

[6]

Q14.

(a) (i) place sample in flame

accept flame test
accept any workable method
allow burn
ignore heat

1

sodium: yellow (flame)

allow orange

1

potassium: lilac (flame)

allow purple

1

(ii) (lilac) colour (of potassium) obscured by (yellow) colour of sodium

allow difficult to see two colours

allow sodium colour is brighter
allow colours mix

1

(b) acidify (with nitric acid)

*do **not** accept if acidified with anything other than nitric acid*

1

add silver nitrate (solution)

1

white precipitate

depends on second marking point
allow white solid
ignore silver chloride
ignore solution goes cloudy / milky

1

(c) (i) add excess (sodium hydroxide)

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allow add sodium hydroxide

1

<u>aluminium</u> (ions / hydroxide (re)dissolve

depends on first marking point
allow if aluminium, (white) precipitate / solid dissolves
allow magnesium (ions / hydroxide) do not (re)dissolve

1

(ii) place sample in flame

accept flame test
accept any workable method
allow burn
ignore heat

1

flame does not go red

accept calcium (ions / hydroxide would produce) red flame
allow magnesium (ions / hydroxide) (produce) no flame colour

1

[11]

Q15.

(a) (i) carbon dioxide / CO_2

1

carbonate / CO_3^{2-}

answers must be in the order shown
marks are independent

1

(ii) ammonia / NH_3

1

litmus

answers must be in the order shown
marks are independent

1

(b) (i) solution is blue

accept blue precipitate only if sodium hydroxide added
allow blue liquid
allow copper sulfate / copper ions are blue

1

(ii) barium chloride / $BaCl_2$

allow barium nitrate / barium ions / Ba^{2+}

1

white

answers must be in the order shown
marks are independent

1

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[7]

Q16.

(a) (i) milky

1

carbonate ions

1

(ii) red

1

(b) (i) smaller

1

(ii) The answer obtained is closer to the true value

1

[5]

Q17.

(a) (i) (bubble gas produced through) limewater
incorrect tests = zero

1

(limewater) goes cloudy / milky

1

(ii) *ignore yes or no*

red flame indicates that calcium / lithium ions present
allow aluminium has no flame colour

or

Ca/Mg also produce a (white) precipitate with NaOH

1

the (white) precipitate formed in test 3 **or** by adding sodium hydroxide solution would dissolve (in excess) if aluminium ions were present

1

(iii) *ignore yes or no*

because a white precipitate is formed in test 4 **or** by adding silver nitrate

1

but chloride ions are in hydrochloric acid

1

(b) (i) mass spectrometry
allow MS

or

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atomic absorption spectroscopy

allow AAS

spectrometry / spectroscopy alone is insufficient

1

(ii) can detect a small(er) amount of the substance

allow can detect small(er) changes

allow small(er) sample sizes

ignore references to precision / accuracy

1

[8]

Q18.

(a) stop them reacting

owtte

1

(b) (i) fizzing / bubbles / effervescence

owtte

1

(ii) (g)

1

(iii) limewater

1

(c) yellow

1

(d) (i) barium chloride

1

(ii) white

1

(iii) eg don't see what is being bought

ignore references to cost

or

a comment about quality / purity
eg may be impure / contaminated

1

[8]

Q19.

(a) limewater / calcium hydroxide

1

(limewater) goes milky / cloudy

*do **not** allow this mark if lime water added to solution or powder*

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or

gives white precipitate / solid

1

(b) eg flame colour of (Na) and flame colour of (K) interfere / mask / mix with each other

accept difficult to determine the colour

or

hard to distinguish

accept some indication that two distinct colours are not seen

1

(c) (i) barium chloride (solution) / $BaCl_2$

ignore mention of acidification but

*do **not** allow sulfuric acid.*

wrong reagent = no mark

1

white precipitate / white solid

allow white barium sulfate

or

barium sulfate precipitate

1

(ii) white precipitate / white solid

ignore goes milky

*do **not** accept any mention of precipitate dissolving*

1

[6]

Q20.

(a) (i) *it = copper*

(copper) stops barnacles / seaweed (sticking)

accept lead doesn't stop barnacles / seaweed (sticking)

ignore all other properties

1

(ii) *it = Muntz Metal*

(Muntz Metal) is less expensive / cheaper / cheapest

must be a comparison

accept copper is more expensive

ignore other properties

1

(b) (i) atomic absorption spec(troscopy) / spectrometry **or** mass spec(trometry) / spectroscopy

accept spectroscopy / spectrometry alone

allow AAS / MS

*do **not** allow NMR spectroscopy*

***or** IR spectrometry **or** chromatography*

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1

(ii) *it = instrumental method*

sensitive **or** detect (very) small amounts
or only small sample needed

allow (more) precise

ignore accurate

allow converse for chemical method

ignore metal contains small amount / low concentration of iron

1

(c) any **two** from:

transition elements (= they)

- unreactive / not very reactive

  allow does not corrode

  ignore reference to rust

- strong / hard

  ignore tough / durable / hard wearing

- malleable / easy to shape

  ignore ductile / density / melting point

2

[6]

Q21.

(a) (i) *incorrect test or no test = **0** mark*

*testing the solution **or** using blue litmus = **0** mark*

(test ammonia / gas with red) litmus

accept any acid-base indicator with correct result

1

(goes) blue

OR

(conc.) HCl (1)

<u>white</u> fumes / smoke / solid (1)

allow <u>white</u> gas / vapour

OR

(test ammonia / gas with) Universal Indicator (1)

blue / purple (1)

1

(ii) *incorrect test or no test = **0** marks*

add barium chloride / $BaCl_2$ (solution)

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*do **not** accept H_2SO_4 added*

or add barium nitrate / $Ba(NO_3)_2$ (solution)
allow Ba^{2+} solution / aqueous added

1

white precipitate / solid (formed)
allow white barium sulfate / $BaSO_4$
ignore barium sulfate / $BaSO_4$ alone

1

(b) (i) fully / completely ionised / dissociated
or hydrogen ions fully dissociated
accept has more ions than weaker acid / alkali of same concentration
ignore strongly ionised
*do **not** accept ions are fully ionised*
*ignore concentrated **or** reference to concentrations of ions*

1

(ii) methyl orange
accept correct spelling only
accept any strong acid-weak base indicator
*do **not** allow phenolphthalein / litmus / universal indicator*

1

(iii) 32 × 0.05/1000 **or** 0.0016 (mole H_2SO_4)
*accept (0.05 x 32) = (V x 25) **or** 0.05 x 32 / 25*

1

(reacts with) 2 × 0.0016 **or** 0.0032 (mole NH_3 in 25 cm^3)
*accept dividing rhs by 2 **or** multiplying lhs by 2*

1

(0.0032 × 1000/25 =) 0.128
allow ecf from previous stage
*correct answer 0.128 **or** 0.13 with or without working gains all **3** marks*

1

(iv) 2.176 **or** 2.18
correct answer with or without working

or ecf from candidate's answer to (b)(iii)

or 2.55 if 0.15 moles used
if answer incorrect or no answer
*0.128 × 17 **or** 0.13 x 17*
***or** their (b)(iii) × 17*
***or** 0.15 × 17 gains **1** mark*

2

[11]

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Q22.

(a) (i) yellow

1

(ii) lilac

1

(iii) melting point

1

(b) (i) barium chloride

1

solid

1

(ii) white

1

dissolved

1

[7]

Q23.

(a) (acidified) barium chloride / nitrate

*incorrect reagent **or** no reagent = **0** marks*
*do **not** accept acidified with sulfuric*
acid (still allow result mark if correct)
*allow solution of barium ions / salt **not** barium solution*
*do **not** accept barium hydroxide*

1

(white) precipitate / solid

*do **not** accept incorrect colour for precipitate*
allow barium sulfate (formed)
ignore 'it goes white / cloudy'

1

(b) (white) precipitate / solid

allow aluminium hydroxide (formed)
*do **not** allow incorrect colour for precipitate*

1

(precipitate) dissolves (in excess)

allow sodium aluminate (formed)
allow goes clear / colourless
if incorrect colour precipitate then allow dissolves (in excess)

1

(c) any **two** from:

apply list principle

- yellow = sodium (alum)

*allow orange **or** yellow orange*

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- lilac = potassium (alum)
  allow purple
- colourless = ammonium (alum)
  *if no colours given, allow 'different coloured flames' for **1** mark*

2

[6]

Q24.

(a) (i) sodium hydroxide

1

green

1

solid

1

(ii) barium chloride

1

white

1

sulfate ions, SO_4^{2-}

1

(b) some indication of contact between (colourless) flame and the chemical
ignore colour of flame

1

(c) any **one** from:
ignore reference to cost / safer

- accurate
- precise
- sensitive
- reliable
- rapid
- only small amount needed

1

[8]

Q25.

(i) correct named instrumental method

eg

atomic absorption spectroscopy / spectrometry

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accept atomic / absorption spectroscopy
accept aas

or

mass spectrometry / spectroscopy
accept mass spec

or

infrared (spectrometry) / IR

or

ultraviolet / spectroscopy / UV

or

nuclear magnetic spectroscopy / nmr

or

gas-liquid chromatography / GLC

1

(ii) any **one** from:

- fast / quick **or** comment about speed
  ignore lost
  ignore human error
- small amount
  accept operators do not need <u>chemical</u> skills
- sensitive / accurate / precise
  ignore safe / easier to use
- ease of automation
- reliable / efficient
- can be left to run / continuous analysis

1

[2]

Q26.

(a) (i) hydrochloric acid / HCl
accept any (named) acid

1

carbon dioxide / CO_2
*accept bubbles / fizz / gas **or** limewater gets milky*
ignore 'add limewater'
*do **not** accept other named gases*

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2nd mark dependant on first mark

*accept for this answer only heat gives CO_2 / limewater milky = **1** mark*

1

(ii) (white) precipitate / solid

ignore names of substances even if incorrect

accept <u>white</u> deposit / substance

*do **not** accept any coloured precipitate*

1

(iii) eg flame colour of (Na) and flame colour of (K)
interfere / mask / mix with each other

*accept 'can't see the colours' **or** 'difficult to determine the colour' **or** 'both produce <u>different</u> colours' **or** a correct statement of colours **or** hard to distinguish*

1

(b) (i) eg essential (mineral) **or** everyone
needs it / some (salt) **or** problems
with health if have no salt

accept preservative / flavouring / taste

it = salt

(all) foods contain / use it / sodium chloride / salt

1

(ii)

mark positively ie no list principle

advantages

any **two** from:

*ignore economic arguments throughout **or** people eat less salt*

- more people will be healthier
- (should have) less heart disease
- (should have) less cancer
- (more people with) lower blood pressure

2

disadvantages

any **one** from:

ignore references to too much / too little (salt)

- not everyone affected
- not enough evidence
- does not provide choice
- undemocratic

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- less taste / flavour
  ignore <u>no</u> flavour / taste
- shorter shelf life / not preserved (as long)
  ignore references to sell by dates
- too much potassium chloride might be bad

1

[8]

Q27.

(a) copper sulfate → blue precipitate

1

iron(II) sulfate → green precipitate

1

(b) eg some idea of contamination
allow so you can see the colour change clearly / easily

or

give misleading / incorrect results / lead to wrong conclusion
allow to get accurate / reliable results
ignore fair test

1

(c) white

1

[4]

Q28.

(a) (i) red / brick-red / orange-red / red-orange
allow red-brown or brown-red
*do **not** accept orange alone eg 'red or orange' = 0*

1

(ii) sodium
allow sodium compounds
ignore incorrect symbol

or Na / Na^+
*if symbol alone given do **not** accept Na^{2+} **or** Na^-*

1

(iii) any **one** from

- accurate / sensitive
- use small amounts
- fast / quick / rapid

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- ease of automation
- reliable / efficient
- operatives do not need chemical skills

  *ignore cost / safety / human error **or** ease of use **or** shows all the elements*

1

(iv) (atomic absorption) spectroscopy **or** (mass) spectrometry

*accept AAS / aas **or** mass spec*
accept atomic absorption
ignore ms / MS
*do **not** allow UV / IR / NMR / chromatography / GLC*

1

(b) any **three** from:

- (safe because) similar to mothers. milk

  allow calcium carbonate is in breast milk
  allow some mothers unable to breast feed
  ignore 'recommended' alone

- babies (in developing world) would die

  accept causes malnutrition

- if banned there would be a cost involved

  allow it is free

- it is not a pollutant / harmful / dangerous

  accept not all chemicals are pollutants / harmful / dangerous

- not mass medication
- not just used for gravestones

  allow it has many uses
  *ignore only small amounts of it **or** it occurs naturally*

- (calcium carbonate) is needed for bones / teeth / health

  allow 'essential mineral'

- Mrs Right has a personal interest **or** not impartial **or** distorts information / bias **or** she is paid by a charity

  accept 'it is (only) her opinion'

3

[7]

Q29.

(a) kills bacteria / sterilises (water)

allow kills microorganisms / microbes / germs
*allow 'makes (water) safe (to drink)' **or** disinfectant*
*ignore cleans water **or** removes impurities / bacteria*

1

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(b) goes colourless / decolourised (from red / red-brown / brown / yellow / orange)

allow colour disappears
*ignore 'goes clear' **or** discoloured*
*do **not** accept incorrect initial colour*
*do **not** accept precipitate*

1

(c) (i) Br_2 **and** $2Cl^-$

allow multiples / fractions if whole equation balanced

1

(ii) changes to red / red-brown / brown / yellow / orange

*do **not** accept effervescence / fizzing / precipitate / gas given off*
ignore vapour / temperature changes / ignore initial colour

1

(d) (i) 7 outer electrons **or**

same number of outer electrons

allow last / final shell for outer
allow energy level / orbit / ring for shell
allow 'need to gain 1 e^- to have a full outer shell'
ignore 'similar number of outer electrons'

1

(ii) bromine / it (atom) is bigger **or**

must be a comparison

outer electrons (level / shell) further from nucleus **or** more shells

*do **not** accept more outer shells*
ignore more electrons

forces / attractions are weaker **or** more shielding **or** attracts less

*do **not** accept magnetic / gravitational / intermolecular forces*
allow 'electron(s) attracted less easily'

electron(s) gained less easily

*"outer / last / final" must be mentioned once, otherwise max **2** marks.*
accept converse for chlorine throughout where clearly stated

3

(e) (i) white precipitate **or** white solid

ignore names of chemicals

1

(ii) cream precipitate **or** cream solid

allow pale yellow / off-white precipitate / solid
ignore names of chemicals

1

[10]

Q30.

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(a) (i) get wrong coloured flame/result owtte

or

to get the correct result
allow contaminated

1

(ii) high melting point

1

unreactive

1

(iii) yellow-orange

1

(b) (i) bubbles / fizz / effervescence
ignore any named gas

1

(ii) milky

1

(c) fast(er)

1

small(er) amount

1

Q31.

(a) (i) *each correct test and one result = **1** mark*
*one other result for any test **= 1 mark***
this mark can only be awarded <u>once</u>

1

Na_2CO_3: HCl → (odourless) gas (1)
CO_2 / carbon dioxide (1)

1

NaCl: $AgNO_3$ → white ppt (1)
silver chloride (1)

1

$NaNO_3$: Al + NaOH → pungent /sharp smell / choking gas (1)
NH_3 / ammonia (1)

1

Na_2SO_4: $BaCl_2$ → white ppt (1)
barium sulphate (1)

1

(ii) all would give a <u>yellow</u> / <u>yellow-orange</u> (flame) / <u>same</u> coloured (flame) / <u>same</u> results
allow <u>orange</u> (flame)

or

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they all contain <u>sodium</u> owtte

1

(b) any **two** from:

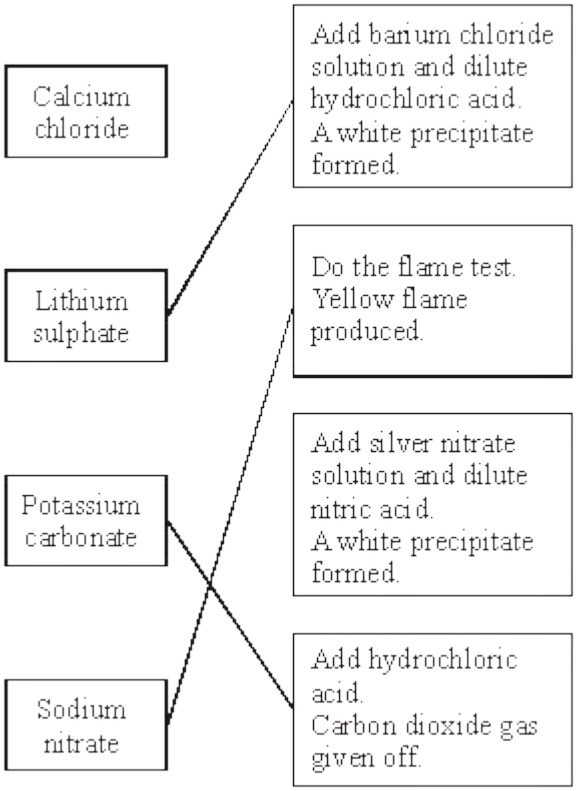
ignore cost

- fast / quick or comment about speed
  ignore human error
- small amounts
  accept any valid answer
- sensitive / accurate
  accept operators do not need <u>chemical</u> skills
- ease of automation
- sample not used up
- reliable / efficient
- can be left to run / continuous analysis
  ignore results can be saved

2

Q32.

(a)



all three correct = **2**

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*one or two correct = **1***

2

(b) blue

1

precipitate

solid

1

[4]

Q33.

(a) sodium carbonate / sodium hydrogencarbonate / sodium bicarbonate

Na_2CO_3 / $NaHCO_3$

ie
*sodium / sodium ions (**1** mark)*
carbonate / carbonate ions
*(**1** mark)*
incorrect formula including Na and
*CO_3 = **1** mark*

2

(b) calcium chloride

$CaCl_2$

*ie calcium / calcium ions (**1** mark) chloride / chloride ions (**1** mark) incorrect formula including Ca and Cl = **1** mark*

2

(c) iron or iron(II) ions

Fe^{2+} ferrous ions
ignore anions
ignore nickel / chromium
do not accept iron(III) or ferric ions5

1

[5]

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