Mark schemes

1 (a) (i) copper is less reactive than hydrogen **or** copper is unreactive

1

(ii) Zinc and dilute hydrochloric acid

1

(b) (gas) syringe

1

(c) (i) 35

allow 3

1

because not close to others

accept it is <u>much</u> lower than the others

ignore references to trends or patterns

dependent on the first mark

1

(ii) (49 + 50 + 48) / 3

= 49

*correct answer with or without working gains **2** marks*

1

*allow ecf from anomaly identified in (i) for **2** marks:*

- *Exp 1 anomalous gives 43.3*
- *Exp. 2 anomalous gives 44*
- *Exp. 4 anomalous gives 44.7*

*answer of 45.5 or 46 (anomaly not excluded) gains **1** mark*

*correct working **excluding anomaly** but with wrong answer gains **1** mark*

1

(iii) so that a mean can be calculated

*accept improves accuracy of the mean **or** so anomalies can be identified / discarded **or** to reduce effect of random errors*

ignore makes it a fair test

ignore reliability, validity, repeatability, reproducibility

1

(d) (i) idea of mixing with oxygen / air, letting air / oxygen in

accept converse

1

(ii) H_2O

do not accept incorrect additional products

1

balancing 2 … (1) … 2

allow fractions or multiples

dependent on first mark

1

[11]

2 (a) time from when the heating is started until

1

the limewater turns cloudy / milky

1

(b) (i) the temperature was not high enough

accept the copper carbonate had not started to decompose / react

accept it takes time to heat up the copper carbonate

1

the bubbles of gas were air

accept no carbon dioxide produced

1

(ii) the copper carbonate was decomposing / reacting

accept the temperature was high enough to cause decomposition / a reaction

1

so carbon dioxide was produced

allow correct word / symbol equation

1

(iii) copper oxide was produced

allow correct word / symbol equation

1

because the copper carbonate had <u>completely</u> decomposed / reacted

ignore all of the carbon dioxide had been given off

1

[8]

3 (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

1

[8]

4 (a) (i) any **two** from:

- bubbles / effervescence / fizzing
  ignore hydrogen / gas produced
- lithium disappears / gets smaller
  allow dissolves
  *do **not** allow melts / burns*
- lithium moves on the surface of the water
  ignore floats
- (universal indicator) turns blue / purple

2

(ii) 2

left-hand side correct

1

2

right-hand side correct
allow multiples for full credit

1

(iii) light / burn, which will give a (squeaky) pop / explosion

1

(iv) all have 1 electron in their outer shell / energy level

allow have the same number of electrons in their outer shell / energy level

1

(b) They react with oxygen

1

They have low melting points

1

(c) (i) electronic structure [2,8,8] is drawn

*incomplete inner shells scores a maximum of **1** mark*

1

charge is +

*allow $[2,8,8]^+$ for **1** mark*

1

(ii) because (in potassium) the outer shell electron is further away from the nucleus **or** because potassium atoms are larger than sodium atoms

*it should be clear that the candidate is referring to the outer shell electron: if this is not clear a maximum of **2** marks can be awarded*

1

therefore the outer shell electron is less strongly attracted to the nucleus **or** is more shielded from the attraction of the nucleus and so the outer shell electron in potassium is more easily lost

1

***3** marks can be scored for answering the question in terms of sodium*

1

[13]

5 (a) (i) magnesium oxide

1

(ii) decomposition

1

(b) (i) bar chart

1

(ii) more

1

(iii) limewater

1

turns cloudy / milky

accept forms a white precipitate

1

[6]

6 (a) (i) yellow

1

(ii) lilac

1

(b) (bubble through) limewater

1

cloudy

allow white / milky

1

(c) (i) silver nitrate solution

1

(ii) white

1

[6]

7 (a) (i) fermentation

1

(ii) cloudy

accept milky / white

1

there is carbon dioxide / CO_2

accept calcium carbonate forms

1

allow a (white) solid / precipitate forms

(b) (i) (the amount of ethanol used) increases (from 1970) to 1989

*if no year(s) or incorrect year(s) indicated then max **1***

correct year(s) only needs to be indicated once to gain full marks

accept values in range 1987-1992

1

then it decreases from 1989 (to 2000)

1

(ii) any **one** from:

- Brazil had more oilfields
- cost of crude oil had decreased
- cost of ethanol / sugar (cane) had increased
- demand for ethanol / sugar (cane) had increased
- availability of ethanol / sugar (cane) had decreased

accept availability of land to grow sugar (cane) had decreased

- climate change affects growing sugar (cane)

1

[6]

8 (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 CO_2 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]

9 (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

[7]

10 (a) (i) react

allow neutralise

allow bubbles / fizzes

accept produces gas / CO_2F

ignore rises

1

(ii) stop reacting / producing

stops on its own is insufficient allow stop working / bubbling / fizzing

1

the (hydrochloric) acid / (calcium) carbonate is used up

accept because the (calcium) carbonate has neutralised the (hydrochloric) acid

OR

have been used up (1)

the graph line becomes horizontal / levels out (1)

OR

stays the same / no change (1)

ignore reference to graph line

no further reaction (1)

1

(iii) bubble the gas through limewater / calcium hydroxide solution

allow (add) limewater

test must be correct to gain result mark

1

(the solution) goes cloudy

allow milky

1

(b) advantage > Quarrying limestone provides building materials, employment and new road links

1

disadvantage > Quarrying limestone releases dust, and lorries release carbon dioxide from burning diesel fuel

1

[7]

11 (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]

12 (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

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]

13

(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]

14

(a) limewater / calcium hydroxide

1

(limewater) goes milky / cloudy

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

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]

15 (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

[8]

16 (a) hydrogen

accept H_2

*do **not** accept H*

1

(b) litmus paper / Universal Indicator paper / pH paper

allow any suitable named indicator

1

bleached / turns white **or** loses its colour

*do **not** accept bleached cloth / leaves etc.*

allow second mark unless incorrect indicator given

allow starch iodide paper (1)
goes black / blue black (1)

allow potassium iodide solution (1) goes brown / orange / black precipitate (1)

1

(c) because they have a negative charge **or** opposite charges attract

accept (because) it is Cl^-
*accept chlorine, Cl **or** chlorine ions has a negative charge*

*do **not** accept Cl^- on its own*
*do **not** accept Cl_2 o.e. has negative charge*

1

(d) kill bacteria / germs, etc. **or** sterilise / disinfect

accept destroys bacteria etc.
ignore clean / purify water (owtte)
*do **not** accept just gets rid of bacteria*

1

(e) hydroxide (ion)

accept OH^-

1

[6]

17 (a) F

accept indium / In

1

(b) C

accept sodium / Na

1

(c) A

accept hydrogen / H / H_2

1

[3]

18 (a) (i) H_2O_2 reactant correct

ignore any state symbols

1

$H_2O + O_2$ products correct

1

$2H_2O_2 \rightarrow 2H_2O + O_2$ balanced

accept correct multiple

1

(ii) glowing splint

1

relights

accept 'bursts into flame'

*do **not** accept a lighted splint burns brighter **or** faster*

1

(b) unchanged

*accept **not** used up **or** left (behind)*

1

(c) (i) gas syringe **or** measuring cylinder **either** with scale drawn **or** labelled

1

the apparatus as drawn would work

1

(ii) correct plotting of points

***one** mark to be deducted for each error*

2

best fit graph line drawn (single line drawn)

1

(iii) concentration of hydrogen peroxide decreases

accept less particles of hydrogen peroxide to collide

*do **not** accept hydrogen peroxide gets used up*

1

rate of reaction decreases

accept reaction gets slower

1

(iv) any two from:

- temperature
- pressure
- division of catalyst **or** manganese oxide

*do **not** accept any other factors*

2

[15]

19 (a) (i) test: limewater

accept calcium hydroxide solution

1

result: 'goes' cloudy

*accept white **or** milky*

*do **not** accept misty **or** chalky test must be correct before result mark can be considered*

1

(ii) $2\ NaHCO_3 + H_2SO_4 \rightarrow$

$Na_2SO_4 + (2)\ H_2O + (2)\ CO_2$

1

correctly balanced

1

(b) (i) $H^+ + OH^-$

1

$\rightarrow H_2O$

deduct **one** mark if incorrectly balanced

accept H_3O^+ instead of H^+ then $2H_2O$ needed for balance

1

(ii) pH increases

accept numerical indication

1

(c) addition of sulphuric acid

1

correct use of an indicator

accept idea of forming a neutral solution

1

crystallisation (of neutral solution)

accept description using evaporation

1

[10]

20

(a) oxygen/O_2

for 1 mark

1

(b) water/H_2O

for 1 mark

1

(c) carbon dioxide/CO_2

(if symbols are used they must be correct)

for 1 mark

1

(d) gives out

for 1 mark

1

heat or energy (2 independent marks)

for 1 mark

1

[5]

21

(a) (i) oxygen (not air)

(ii) oxides/monoxides/dioxides

for 1 mark each

Do not allow specific examples

2

(b) (i) water

(ii) sulphur

(iii) carbon

for 1 mark each

3

(c) gives out/releases heat/energy

for 1 mark

1

(d) (i) carbon dioxide

(ii) carbon

for 1 mark each

(allow correct symbols/formulae)

2

[8]

22 (a) nitrogen / N2

[Do not allow N or N^2] for 1 mark

(b) heat

for 1 mark

(c) carbon dioxide / CO_2

for 1 mark

[3]

23 (a) (i) Filtration

1

(ii) Chlorine

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]

24 (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

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

1

[9]

25 (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]

26 (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

- 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]

27 (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]

28 (a) (i) ionic (bonding)

1

(ii) ions 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

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]

29 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)
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]

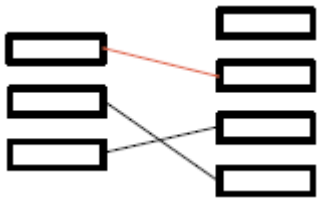
30 (a) (i) *method of introducing sample into flame*
e.g. wire / splint / spray

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]

31 (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]

32 (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 orange (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]

33 (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)

allow add sodium hydroxide

1

aluminium (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]

34 (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*

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]

35 (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)

white fumes / smoke / solid (1)

allow white 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)

*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]

36

(a) (i) yellow

1

(ii) lilac

1

(iii) melting point

1

(b) (i) barium chloride

1

solid

1

(ii) white

1

dissolved

1

[7]

37

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

2

[6]

38

(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]

39 (i) correct named instrumental method

eg

atomic absorption spectroscopy / spectrometry

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]

40 (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*

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

1

[8]

41 (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]

42 (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
- 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]

43 (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

(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]

44 (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

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

1

(b) any **two** from:

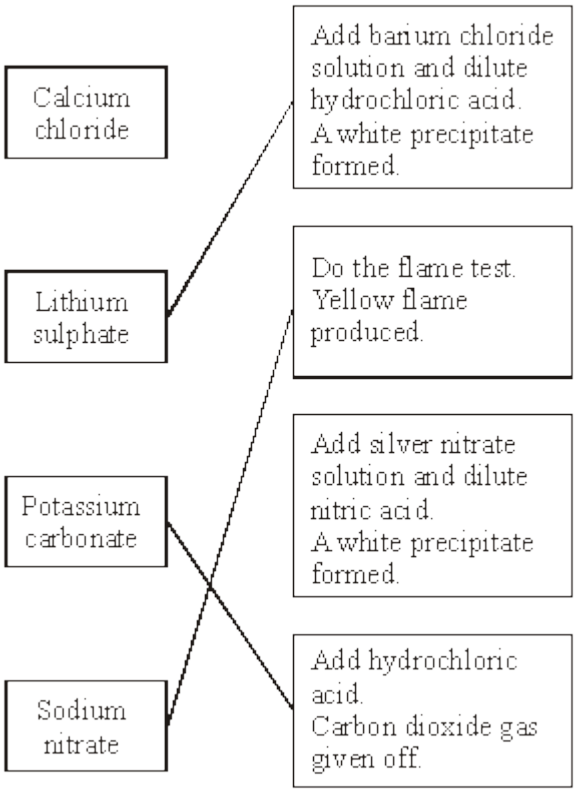
ignore cost

- 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

[8]

45 (a)



*all three correct = **2***
*one or two correct = **1***

2

(b) blue

1

precipitate

solid

1

[4]

46 (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]