**M1.**(a)     (i)      H+

**1**

(ii)     OH–

**1**

(b)     with ethanoic acid:

*‘it’ refers to ethanoic acid*

UI goes Orange/yellow

**1**

but HCl goes red/pink

**1**

**or**

ethanoic acid has pH 4 or above but less than 7 (1)

but HCl has a pH3 / or lower (1)

(c)     completely

**1**

(d)     (i)      conical flask

**1**

(ii)     titration

**1**

(iii)    repeat**or**take average

*allow compare with another student's results*

**1**

**[8]**

**M2.**          (a)     (i)      allow a number between 2.5 and 3  
(inclusive)

*accept just under 3* ***or*** *about 3*

**1**

(ii)     alkaline **or** alkali

**1**

(iii)     25

*ignore any reference to units*

**1**

          (b)     (i)      a circle round KOH or 2 KOH

**1**

(ii)     K2SO4

*do not credit potassium sulphate*

**1**

**[5]**

##

          (a)     sodium ions and chloride ions (not chlorine)  
*allow* sodium chloride/salt/common salt

*for 1 mark*

**1**

(b)     H+  + OH–  →H2O  
H+ from (hydrochloric) acid  
OH- from alkali/sodium hydroxide  
lose 1 mark if no charge shown disregard other ions

*each for 1 mark*

**3**

**[4]**

-

**M4.**          (i)      sulphuric acid / H2SO4

*accept sulfuric           1 for one mark*

**1**

(ii)      exothermic

*for one mark*

**1**

(iii)     Na2SO4 / (Na)2SO4 / Na2(SO4) / (Na+)2SO42–

*for one mark  
lower case O(Na2SO4) not accepted / tops of subscripted letters should be in line or lower than lower case letters of symbols*

**1**

**[3]**

**M5.**          (a)     starts at 0 g pH below 2

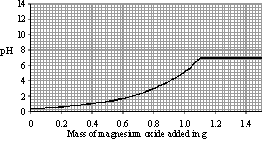
**1**

          as more magnesium oxide added  
smooth curve rises to reach its  
maximum between 1 g and 1.2 g

*accept a straight line from the Y axis to where the ‘curve’ becomes horizontal*

**1**

          levels out 7  1 small squares



*do not credit a rates of reaction shaped curve*

**1**

(b)     heat it

*do not credit catalyst* ***or*** *add hot acid* ***or*** *crushing powder*

**1**

stir it faster **or** shake it

**1**

(c)     (i)      O2–

**1**

(ii)     2H+ + O2–

*1 mark for 2H+ and 1 mark for O2- no ecf*

**2**

(iii)     formula is (H2SO4 which) has two H+ ions

*accept sulphuric acid is diprotic* ***or*** *has two H’s*

(whereas HCl only has one)

*accept it has twice as many H’s as hydrochloric acid* ***or*** *two balanced equations illustrating that 2 mol of magnesium oxide is needed*

**1**

**[9]**

**M6.**          (a)     (i)      sulfuric

*accept H2SO4*

*accept sulphuric*

*allow phonetic spellings*

**1**

(ii)     CuO + H2SO4 → CuSO4 + H2O

***1*** *mark for reactants*

***1*** *mark for products*

*ignore state symbols*

*max* ***1*** *mark for incorrect balancing*

**2**

(b)     any **two** from:

•        particles gain energy **or** particles have more energy

*allow have more activation energy*

•        particles move faster

*allow they collide faster / quicker*

*ignore move / vibrate more*

•        collide more often

*allow more collisions*

•        collide more energetically

•        more of the collisions are successful  
**or** more particles have the activation energy

***NB*** *more successful collisions alone =* ***1*** *mark*

*if particles are identified as electrons = max* ***1*** *mark*

**2**

**[5]**

**M7.**          (a)     (i)      lead chloride/product of lead + chloride ions is insoluble (in water)

*for 1 mark*

**1**

(ii)     Pb2+ + 2C1¯ → PbC12 \*(s)

         (allow (Pb)2+ 2 (C1–) )

*formula  
solid state symbol  
balancing  
for 1 mark each*

**3**

(b)     copper hydroxide   Cu(OH)2

*each for 1 mark*

          lead sulphate          PbSO4

*each for 1 mark*

          no precipitate

*for 1 mark*

*Allow 1 mark for correct formula Na2SO4 in (i)*

*Allow 1 mark for correct formula Mg (NO3)2 in (ii)*

*0 marks for any formula in (iii)*

**5**

**[9]**

**M8.**         Marks awarded for this answer will be determined by the Quality of Written   
Communication (QWC) as well as the standard of the scientific response.

No relevant content.

**0 marks**

There is a brief description of the method or a risk assessment.

**Level 1 (1–2 marks)**

There is some description of the method that may include a risk   
assessment.

**Level 2 (3–4 marks)**

There is a clear, balanced and detailed description of the method   
and a risk assessment.

**Level 3 (5–6 marks)**

**examples of the chemistry points made in the response**

*The underlined words are needed to gain each bullet point.*

•        sulfuric acid is heated in a beaker and copper oxide is added with stirring

•        until the copper oxide is in excess

•        the mixture is filtered  
or  
the mixture is poured through a funnel and filter paper

•        to remove the excess copper oxide

•        some of the solution is evaporated  
or  
heated in an evaporating basin/dish

•        the solution is allowed to crystallise / cool down

**examples of the risk assessment points made in the response**

•        wear safety goggles – to protect eyes because sulfuric acid is corrosive / an irritant

•        care when heating – to protect against burns

•        wash hands after the preparation – copper sulfate is harmful

•        care when handling glass apparatus – to protect against cuts

**[6]**

**M9.**(a)    any **two** from:

•         effervescence / bubbles / fizzing

*allow gas / hydrogen is given offallow volume of gas*

*allow magnesium floats*

•        magnesium disappears / dissolves

*allow change in mass of magnesium*

•        heat given off / exothermic

*allow temperature changedo* ***not*** *accept temperature decreases*

•        change in pH

*do* ***not*** *accept pH decreases*

**2**

(b)     Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information in the [Marking guidance](../resources/AG_BL/menus/Markingguidance.pdf).

**0 marks**No relevant content.

**Level 1 (1-2 marks)**A simple plan without reference to changing any variable but should include an attempt at measuring rate **or** an attempt at fair testing

**Level 2 (3-4 marks)**A plan including change of concentration / ‘volume’ of acid **and** should include an attempt at measuring rate **and / or** an attempt at fair testing

**Level 3 (5-6 marks)**A workable plan including change of concentration **and** measurement of rate **and** fair testing

**Examples of chemistry points made in the response could include:**

**Plan:**

•        add magnesium to acid

•        time reaction / ‘count bubbles’ / measure volume of gas

•        change concentration / ‘volume’ of acid

**Control Variables:**

•        amount / mass / length / same ‘size’ of magnesium

•        volume / amount of acid

**6**

**[8]**

**M10.**(a)     (i)      2.8.3

*any sensible symbol can be used to represent an electron*

**1**

(ii)     proton(s) **and** neutron(s)

*both needed for the mark*

**1**

(iii)    number of protons is equal to number of electrons

*allow positive and negative charges cancel out*

*allow same amount of protons and electrons*

**1**

(b)     (i)       **2** Al + Fe2 O3 **→** **2** Fe + Al2 O3

*equation must be balanced*

**1**

(ii)     aluminium is more reactive (than iron)

*it = aluminium*

*accept converse*

*accept aluminium displaces iron*

*accept aluminium is higher in the reactivity series (than iron)*

**1**

**[5]**

**M11.**          (i)      carbon dioxide *(allow* CO2*)*

*for 1 mark*

**1**

(ii)      sodium nitrate (accept correct formula)

*for 1 mark*

**1**

**[2]**

**M12.**          hydrogen ions (from acid) or protons / H+

**1**

          react with hydroxide ions (from alkali) / OH

**1**

          to produce water

*H + OH  H2O gains all* ***3*** *marks  
ignore state symbols  
molecules of hydrogen ions and molecules of   
hydroxide ions produce water =* ***2*** *marks  
if they fail to get any of the above marks they can   
get* ***1*** *mark for neutralisation / product neutral*

**1**

**[3]**

**M13.**(a)     (i)      neutrons

*this order only*

**1**

electrons

**1**

protons

**1**

(ii)     box on the left ticked

**1**

(b)     (i)      effervescence / bubbling / fizzing / bubbles of gas

*do* ***not*** *accept just gas alone*

**1**

magnesium gets smaller / disappears

*allow magnesium dissolves*

*allow gets hotter* ***or*** *steam produced*

*ignore references to magnesium moving and floating / sinking and incorrectly named gases.*

**1**

(ii)     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 refer to the information in the Marking Guidance and apply a ‘best–fit’ approach to the marking.

**0 marks**No relevant content

**Level 1 (1−2 marks)**There are simple statements of some of the steps in a procedure for obtaining magnesium chloride.

**Level 2 (3−4 marks)**There is a description of a laboratory procedure for obtaining magnesium chloride from dilute hydrochloric acid and magnesium.

The answer must include a way of ensuring the hydrochloric acid is fully reacted **or** a method of obtaining magnesium chloride crystals.

**Level 3 (5−6 marks)**There is a well organised description of a laboratory procedure for obtaining magnesium chloride that can be followed by another person.

The answer must include a way of ensuring the hydrochloric acid is fully reacted **and** a method of obtaining magnesium chloride crystals.

**examples of the points made in the response:**

•        hydrochloric acid in beaker (or similar)

•        add small pieces of magnesium ribbon

•        until magnesium is in excess or until no more effervescence occurs \*

•        filter using filter paper and funnel

•        filter excess magnesium

•        pour solution into evaporating basin / dish

•        heat using Bunsen burner

•        leave to crystallise / leave for water to evaporate / boil off water

•        decant solution

•        pat dry (using filter paper).

\*Student may choose to use a named indicator until it turns a neutral colour, record the number of pieces of magnesium added then repeat without the indicator.

**6**

**[12]**

**M14.**(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 much 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)     H2O

*do not accept incorrect additional products*

**1**

balancing 2 … (1) … 2

*allow fractions or multiples*

*dependent on first mark*

**1**

**[11]**

**M15.**(a)     neutralisation

*ignore reference to exothermic or endothermic*

**1**

(b)     2 HCl + CaO ➔ CaCl2 + H2O

*accept multiples and fractions*

formulae

*ignore state symbols*

**1**

balancing (dependent on first mark)

**1**

(c)     (the carbonate has) fizzing / bubbles / effervescence

*ignore dissolving*

*ignore gas produced*

**1**

(d)     add excess calcium carbonate to acid (and stir) / add CaCO3 until fizzing stops

*ignore heating the acid*

*accept answer using calcium oxide in place of calcium carbonate*

**1**

(remove excess calcium carbonate by) filter(ing)

**1**

warm until a saturated solution forms / point of crystallisation / crystals start to form

*do* ***not*** *accept heat until all water gone*

**1**

leave to cool

*dependent on previous mark*

*If solution* ***not*** *heated allow leave to evaporate (1)*

*until crystals form (1)*

**1**

(e)     (i)      *white* precipitate / *solid* (forms)

**1**

insoluble in excess **or** remains **or** no (further) change in excess

*dependent on a precipitate / solid forming*

**1**

(ii)     same result with magnesium (ions)

*do* ***not*** *accept reference to any other ion(s) that do not give a white precipitate*

*accept other named ions that do give a white precipitate*

**1**

(iii)    flame test **or** description of flame test

**1**

gives a red flame

*accept brick red* ***or*** *orange-red* ***or*** *scarlet*

*do* ***not*** *accept crimson*

**1**

**[13]**

**M16.**(a)     any **three** from:

•        concentration of (salt) solution

•        volume of (salt) solution

*ignore amount of solution*

•        **initial** temperature (of the solution)

*ignore room temperature*

•        surface area / form of metal

•        moles of metal

*allow mass / amount*

*ignore time*

*ignore size of tube*

**3**

(b)     20

**1**

32

**1**

12

*allow ecf*

**1**

(c)     (i)      four bars of correct height

*tolerance is + / - half square*

*3 correct for* ***1*** *mark*

**2**

bars labelled

**1**

(ii)     *one variable* is non-continuous / categoric

*accept qualitative or discrete*

*accept no values between the metals*

**1**

(iii)    magnesium

**1**

because biggest temperature change

*accept gives out most energy*

*ignore rate of reaction*

*dependent on first mark*

**1**

(iv)    does not react / silver cannot displace copper

**1**

because silver not more reactive (than copper) **or** silver below copper in reactivity series

*do* ***not*** *accept silver is less reactive than copper sulfate*

**1**

(v)     replace the copper sulfate

*could be implied*

**1**

with any compound of a named metal less reactive than copper

*allow students to score even if use an insoluble salt*

**1**

**[16]**