GCSE Chemistry



Required Practical Answer Book

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| **Name:** | **Class:** | **Teacher:** |

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**Required Practical 1: Making Salts**

**Preparation of a pure, dry sample of a soluble salt from an insoluble oxide or carbonate, using a Bunsen**

**burner to heat dilute acid and a water bath or electric heater to evaporate the solution.**

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| Question 1 | (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** |
| Question 2 | **Level 3 (5–6 marks):**  A coherent method is described with relevant detail, and in correct sequence which demonstrates a broad understanding of the relevant scientific techniques and procedures. The steps in the method are logically ordered. The method would lead to the production of valid results.  **Level 2 (3–4 marks):**  The bulk of the method is described with mostly relevant detail, which demonstrates a reasonable understanding of the relevant scientific techniques and procedures. The method may not be in a completely logical sequence and may be missing some detail.  **Level 1 (1–2 marks):**  Simple statements are made which demonstrate some understanding of some of the relevant scientific techniques and procedures. The response may lack a logical structure and would not lead to the production of valid results.  **0 marks:**  No relevant content.  **Indicative content**  •        sulfuric acid in beaker (or similar)  •        add copper carbonate one spatula at a time  •        until copper carbonate is in excess or until no more effervescence occurs \*  •        filter using filter paper and funnel  •        filter excess copper carbonate  •        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)  •        wear safety spectacles / goggles  \*Students. may choose to use a named indicator until it turns a neutral colour, record the number of spatulas of copper carbonate added then repeat without the indicator. |
| Question 3 | (a)     add excess copper carbonate (to dilute hydrochloric acid)  *accept alternatives to excess, such as ‘until no more reacts’*  **1**  filter (to remove excess copper carbonate)  *reject heat until dry*  **1**  heat filtrate to evaporate some water **or** heat to point of crystallisation  *accept leave to evaporate or leave in evaporating basin*  **1**  leave to cool (so crystals form)  *until crystals form*  **1**  *must be in correct order to gain****4****marks*  (b)     *M*r CuCl2 = 134.5  *correct answer scores****4****marks*  **1**  moles copper chloride = (mass / *M*r = 11 / 134.5) = 0.0817843866  **1**  *M*r CuCO3= 123.5  **1**  Mass CuCO3 (=moles × M2= 0.08178 × 123.5) = 10.1(00)  **1**  *accept 10.1 with no working shown for****4****marks*  (c)    https://app.doublestruck.eu/content/AG_CHM/HTML/M/MSP181H05_files/img01.png  **or**  11.0 × 0.791  **1**  8.70 (g)  **1**  *accept 8.70(g) with no working shown for****2****marks* |

**Required Practical 2: Temperature Changes**

**Investigate the variables that affect temperature changes in reacting solutions such as, e.g. acid plus metals, acid plus carbonates, neutralisations, displacement of metals.**

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| Question 1 | (a)     (i)      5.75 **or** 5.8  *correct answer with or without working gains****2****marks*  *correct working showing addition of any four results and division by 4 gains****1****mark*  ***OR***  *6(.04) for****1****mark*  **2**  (ii)     use a polystyrene cup **or** lid  *accept insulate the beaker*  **1**  to prevent energy/heat gain  *accept to prevent energy/heat transfer*  *do****not****accept energy/heat loss*  **OR**  use a digital thermometer  *allow use a data logger*  easier to read (to 0.1°C)  **1**  (b)     (as mass increases) the final temperature increases  **1**  then stays constant  **1**  correct reference to a value above 8 g up to and including 10 g as mass when the trend changes  **1** |
| Question 2 | (a)     any **one** from:  •        solution becomes colourless or colour fades  •        zinc becomes bronze / copper coloured  *allow copper (forms) or a solid (forms)*  •        zinc gets smaller (*allow zinc dissolves)*  •        bubbles or fizzing.  *ignore precipitate*  **1**  (b)     improvement:  use a plastic / polystyrene cup or add a lid  *accept use lagging / insulation*  **1**  reason - must be linked  reduce / stop heat loss  **OR**  improvement:  use a digital thermometer  *allow use a data logger*  reason - must be linked  more accurate or easy to read or stores data  *allow more precise or more sensitive*  *ignore more reliable*  *ignore improvements to method, eg take more readings*  **1**  (c)     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 and apply a ‘best–fit’ approach to the marking.  **0 marks** No relevant content  **Level 1 (1−2 marks)** There is a statement about the results.  **Level 2 (3−4 marks)** There are statements about the results. These statements may be linked or may include data.  **Level 3 (5−6 marks)** There are statements about the results with at least one link and an attempt at an explanation.  Examples of chemistry points made in the response:  **Description:**  **Statements**  Concentration of copper sulfate increases  Temperature change increases  There is an anomalous result  The temperature change levels off  Reaction is exothermic  **Linked Statements**  Temperature change increases as concentration of copper sulfate increases  The temperature change increases, and then remains constant  After experiment 7 the temperature change remains constant  **Statements including data**  The trend changes at experiment 7  Experiment 3 is anomalous  **Attempted Explanation**  Temperature change increases because rate increases  Temperature change levels off because the reaction is complete  **Explanation**  As more copper sulfate reacts, more heat energy is given off  Once copper sulfate is in excess, no further heat energy produced  **6** |
| Question 3 |  |

**Required Practical 3: Rates of Reaction**

**Investigate how changes in concentration affect the rates of reactions by both measuring the volume of a gas produced and monitoring a change in colour or turbidity.**

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| Question 1 | (a)     (s) (aq) (aq) (g)  *must be in this order*  ***2****marks if all four correct*  ***1****mark if 2 or 3 correct*  **2**  (b)     (i)      55  *ignore units*  **1**  (ii)     54  *allow ecf from****(b)(i)***  **1**  (iii)    0.92  *correct answer with or without working gains****2****marks*  *ecf from volume in****(b)(i)***  *accept 2 d.p. up to calculator value*  *if answer incorrect, allow rate = (b)(i) / 60 for****1****mark*  **2**  (c)     (i)      circle round point at (48,22)  **1**  (ii)     problem (1) and explanation (1)  *explanation****must****give lower volume of gas or slower reaction*  *ignore human error unless qualified*  **problem with bung**  e.g. bung not placed in firmly / quickly enough  so gas lost  **or**  **problem with reagent**  e.g. acid was diluted **or** acid not replaced  so reaction slower  **or**  **problem with temperature**  e.g. temperature was lower than recorded temperature  so reaction slower  **or**  **problem with measurement**  e.g. length of magnesium less than 8 cm **or** timed for less than a minute  so less gas produced  **2**  (d)     repeat the experiment (several times)  **1**  because anomalous results could be excluded  **1**  and then the mean can be determined / calculated  *accept suggestion of alteration to method, which is explained as to why it would reduce the error, for****3****marks (e.g. place the magnesium in a container within the flask (1) so it can be tipped into the acid once the bung is in place (1). This will prevent anomalous results or gas loss (1))*  *ignore idea of more accurate gas syringe ignore shorter time intervals*  **1**  (e)     (i)      use clean magnesium **or** use magnesium without oxide coating  **1**  compare results  **1**  (ii)     **either**  measure the temperature of the acid before (adding magnesium)  **1**  and after adding magnesium  **or**  place the conical flask in a water bath (at 40 °C) (1)  compare results (1)  **1** |
| Question 2 | (a)     because sulfur / S (forms)  **1**  (which) is solid / insoluble / a precipitate / a suspension  **1**  (b)     any **two** from:  •        volume of sodium thiosulfate  *ignore amount of sodium thiosulfate*  •        volume of (hydrochloric) acid  *ignore amount of (hydrochloric) acid*  •        concentration of sodium thiosulfate  •        concentration of (hydrochloric) acid  *if no other mark, allow****1****mark for same cross****or****same flask****or****unspecified volume****or****unspecified concentration*  *ignore same person*  *do****not****accept references to temperature*  **2**  (c)     rate increases  **1**  because particles move faster  *accept particles have more energy*  **1**  so frequency of collisions increases  *accept particles are more likely to collide****or****more chance of collisions*  *ignore more collisions*  **1**  more particles / collisions have energy greater than (or equal to) the activation energy  **1**  (d)     cool  *accept refrigerate****or****method to decrease temperature*  **or**  decrease the temperature (of the solutions)  **1** |

**Required Practical 4: Chromatography**

**Investigate how paper chromatography can be used to separate and tell the difference between coloured substances.**

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| Question 1 | (a)     The start line was drawn in ink  **1**  The water level was above the spots  **1**  (b)     3  **1**  (c)     **A**  **1**  (d)     *(distance moved by dye A)* 38 (mm)  *allow values in range 36-40*  **1**  *(distance from start line to solvent front)*  102 (mm)  *allow values in range 101-103*  **1**  https://app.doublestruck.eu/content/AG_CHM/HTML/M/MSP182F04_files/img01.png  *allow ecf from Table 1*  **1**  0.37254 …  *allow values in range 0.35 − 0.39*  **1**  0.37  **1**  *accept 0.37 with no working shown for****5****marks* |
| Question 2 | drinks / colours B **and** C are safe  **1**  drinks / colours A **and** D are not safe  *accept a pair of one safe colour****and****one not safe colour identified for****1****mark*  *accept A, B, C and D all contain one safe colour for****1****mark*  *ignore references to shading*  **1** |
| Question 3 | (a)     (improve) appearance  *allow add colour*  *allow these food colourings have not been proven to cause hyperactive behaviour in young children*  *do****not****accept taste / flavour / preservatives*  *ignore reference to E-numbers*  **1**  (b)     X  **1**  (c)     any **three** from:  •        S contains six / 6 colourings  •        P contains five / 5 colourings  *if neither of first 2 bullet points given allow****1****mark for S contains more colours than P****or****converse*  •        both S and P contain the same  five / 5 colourings  •        both contain W **and** Y  •        both sweets (may) cause hyperactivity  *ignore unsafe*  •        neither contain X **and** Z  **3** |

**Required Practical 5: Water Purification**

**Analysis and purification of water samples from different sources. To include pH measurement, removal of dissolved solids and distillation.**

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| Question 1 | (a) *(as part of glassware attached to bung)*  salt solution in (conical) flask  *allow suitable alternative equipment, eg boiling tube*  **1**  *(at end of delivery tube)*  pure water in test tube which must not be sealed  *allow suitable alternative equipment, eg, beaker, condenser*  **1**  heat source (to heat container holding salt solution)  **1**  *if no other mark obtained allow for****1****mark suitable equipment drawn as part of glassware attached to bung****and****at end of delivery tube*  (b)     determine boiling point  **1**  should be at a fixed temperature 100°C  *allow should be 100°C*  *allow if impure will boil at a temperature over 100°C*  **1**  (c)     high energy requirement  **1** |
| Question 2 | **two**methods and **1 linked**explanation **or 1**method and **two**explanations, **1**linked = **3**marks            no linking of method and explanation then max **2**marks  *ignore references to removal of hardness*  **method 1:**            filter  *ignore screening / sedimentation*  **explanation 1:**            remove insoluble substances / remove solids / small bits / dirt / mud/ soil / sand / silt  **method 2:**            precipitate / flocculate / add eg. alum  *allow other named substances*  **explanation 2:**            removes (some) soluble material as solids / removes (some) metal ions  **method 3:**            add chlorine / chlorine dioxide / ozone  **explanation 3:**            sterilise / kill bacteria / microorganisms / microbes  *ignore ‘remove bacteria’*  *ignore disinfect* |
| Question 3 | (a)     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**  (b)     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** |
| Question 4 | (a)     any **one** from:  •        heat  •        stir  **1**  (b)     filter  *accept use a centrifuge*  *accept leave longer (to settle)*  **1**  (c)     any **one** from:  •        wear safety spectacles  •        wear an apron  **1**  (d)     evaporation at **A**  **1**  condensation at **B**  **1**  (e)     100  **1** |

**Required Practical 6: Electrolysis**

**Investigate what happens when aqueous solutions are electrolysed using inert electrodes.**

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| Question 1 | (a)     (i)      so ions can move (and carry charge)  *accept so current can flow*  *allow so it can conduct (electricity)*  *allow so charged particles can move*  *do****not****accept so electrons can move*  **1**  (ii)     because zinc ions gain electrons  *accept because zinc ions are reduced*  **1**  2 (electrons)  **1**  zinc is formed  *accept correct half equation for****3****marks*  *if no mark gained allow*  *positive ions go to negative electrode****or***  *opposites attract****or***  *reduction (of zinc)****or***  *(zinc) gains electrons for****1****mark*  **1**  (iii)    **2 Cl–**  https://app.doublestruck.eu/content/AG_CHM/HTML/M/M14S2H04_files/img01.png Cl2 + **2** e–  *must be completely correct*  **1**  (b)     (i)      because the magnesium is *a gas*  *allow magnesium goes from solid to gas*  **1**  (ii)     (a reaction which) takes in energy (from the surroundings)  *accept more energy needed to break bonds than released by forming bonds*  *accept correct reference to energy level diagram*  *allow (a reaction which) takes in heat (from the surroundings)*  **1**  (iii)    (*M*r MgO =) 40  *accept (2 Mr MgO =) 80*  **1**  1.2 / 24 (x40) **or** 0.05 (x40)  **or**  40 / 24 (x1.2) **or** 1.67 (x1.2)  *allow ecf from step 1*  **1**  2(.0)  *allow ecf carried through from step 1*  *correct answer with or without working gains****3****marks*  **1**  (iv)    75(%)  **1**  (v)     any **one** from:  •        the reaction is reversible  *accept incomplete reaction*  *ignore equilibrium not reached*  •        *some lost / escaped / released (when* separated)  •        some of the reactant may react in different ways from the expected reaction  •        *impure reactant(s)*  *ignore measurement and calculation errors*  **1** |
| Question 2 | (a)     (i)      bulb lights up  **1**  bubbles / fizz / gas or chlorine given off  **1**  (ii)     in solid, ions  **1**           are not free to move / (charged) particles cannot move or converse  *atoms / electrons cannot move worth 0 marks*  **1**  (b)     (i)      breakdown / decomposition / splitting up  ***not****separation*  **1**  by using electricity  **1**  (ii)     gas **A** = chlorine / oxygen  **1**           deposit **B** = copper  **1**  (c)     any one from:  •        manufacturer of chlorine / sodium hydroxide / hydrogen / sodium  •        electroplating of steel / reference to plating  ***not****galvanising*  •        extraction of aluminium / metal reactivity series specified  •        purification of copper  ***not****making copper*  **1** |
| Question 3 | (a)     Gas A = Chlorine / Cl2 not Cl and Gas B = Hydrogen / H2 not H  *for 1 mark*            Solution C = sodium hydroxide/NaOH/spent brine  *for 1* mark  **2**  (b)     (i)      2, 2  *for 1* mark  (ii)     2, 2  *for 1* mark  **2**  (c)     water/H2O/hydrogen oxide not hydrogen hydroxide  *for 1 mark*  **1**  (d)     ions/positive ions/negative ions/cations/anions not charged particles/positive particles/negative particles not H+ / Cl-/Na+ / OH- Allow hydrogen ions etc. not sulphate ions  *for 1 mark*  **1** |

**Required Practical 7: Neutralisation**

**Determination of the reacting volumes of solutions of a strong acid and a strong alkali by titration.**

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| Question 1 | (a)     (sulfuric acid is) completely / fully ionised  **1**  In aqueous solution **or** when dissolved in water  **1**  (b)     H+(aq) + OH−(aq) → H2O(l)  *allow multiples*  ***1****mark for equation*  ***1****mark for state symbols*  **2**  (c)     adds indicator, eg phenolpthalein / methyl orange / litmus added to the sodium hydroxide (in the conical flask)  *do****not****accept universal indicator*  **1**  (adds the acid from a) burette  **1**  with swirling **or** dropwise towards the end point **or** until the indicator just changes colour  **1**  until the indicator changes from pink to colourless (for phenolphthalein) or yellow to red (for methyl orange) or blue to red (for litmus)  **1**  (d)     titrations 3, 4 and 5  **or**  https://app.doublestruck.eu/content/AG_CHM/HTML/M/MSP181H08_files/img01.png  **1**  27.12 cm3  *accept 27.12 with no working shown for****2****marks*  **1**  *allow 27.1166 with no working shown for****2****marks*  (e)     Moles H2SO4 = conc × vol = 0.00271  *allow ecf from 8.4*  **1**  Ratio H2SO4:NaOH is 1:2  **or**  Moles NaOH = Moles H2SO4 × 2 = 0.00542  **1**  Concentration NaOH = mol / vol = 0.00542 / 0.025 = 0.2168  **1**  0.217 (mol / dm3)  *accept 0.217 with no working for****4****marks*  **1**  *accept 0.2168 with no working for****3****marks*  (f)        https://app.doublestruck.eu/content/AG_CHM/HTML/M/MSP181H08_files/img02.png   ×   0.18 = no of moles  **or**  0.15 × 40 g  **1**  0.144 (g)  **1**  *accept 0.144g with no working for****2****marks* |
| Question 2 | 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 apply a ‘best-fit’ approach to the marking.  **Level 3 (5 – 6 marks)**  There is a description of titrations that would allow a comparison to be made between the two solutions of hydrochloric acid.  **Level 2 (3 – 4 marks)**  There is a description of an experimental method including addition of acid to alkali which may include an indicator or colour change and may include a measurement of volume.  **Level 1 (1 – 2 marks)**  There is a simple description of using some of the apparatus.  **0 marks**  No relevant content.  **examples of chemistry points made in the response could include:**  •        acid in burette **or** flask  •        alkali/sodium hydroxide **or** acid in burette **or** flask  •        volume of acid **or** alkali measured using the pipette  •        indicator in flask  •        white tile under the flask  •        slow addition  •        swirling/mixing  •        colour change of indicator  •        burette volume measured |

**Required Practical 8: Identifying Ions**

**Use of chemical tests to identify the ions in unknown single ionic compounds covering the ions from Flame tests and sulphates.**

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| Question 1 | 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* |
| Question 2 | 1. calcium ions   *allow Ca2+*  **1**  sodium ions  *allow Na+*  **1**  (b)     two different colours  **or**  Ca2+ / one is orange-red and Na+ / the other is yellow  *allow brick red for Ca2+ and / or orange for Na+*  *allow incorrect colours if consistent with answer to****7.5***  **1**  (so) colours mix  **or**  (so) one colour masks the other  **1**  (c)     (Student **A** was incorrect) because sodium compounds are white not green  **or**  because sodium carbonate is soluble  **1**  so can’t contain sodium ions  **1**  (Student **B** was incorrect) because adding acid to carbonate produces carbon dioxide  **1**  so must contain carbonate not chloride ions  **1** |