GCE 2004
June Series

AQA

ASSESSMENT and
QUALIFICATIONS
ALLIANCE

Mark Scheme

Chemistry
(Subject Code CHM3/P)

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available from:

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CHM3/P Practical Examination

Exercise 1   Skill assessed **Implementing (2)**

Reactions of some ions.

(a)   Points assessed by supervisor during the practical examination.

     (i)   test tube reactions   1   uses appropriate quantities
                                        2   dropwise addition where appropriate
                                        3   no spillages
                                        4   shakes mixture   6 scoring points

                                                                           all   6 = 2 marks
                                                                           any 4 = 1 mark
     (ii) general   5   does not require additional sample

     (iii) safety   6   works safely - eye protection etc

(b)   Points assessed from candidate's written report.

     (i)   the recording of results   results recorded clearly and in full in the table   1 mark
          Notes   * *If you can read it, it is clear*
                     * *Full means completes at least 13 boxes*

(ii) The accuracy of the observations.   15 scoring points

14 – 15 points	5 marks
11 – 13 points	4 marks
7 – 10 points	3 marks
4 – 6 points	2 marks
1 – 3 points	1 mark

Notes   * *Check the teacher observations against the published grid,*
             noting any significant discrepancies;
             Na_2CO_3 and HCl likely to be 'No visible change'
           * *Keep these discrepancies in mind when marking the scripts;*
             allow either the published answer or the teacher alternative
           * *If answers contradict e.g. "No visible change with white precipitate"*
             then scoring point is not awarded
           * *Look for the basic colour; ignore additional shades if the answer*
             is unambiguous; clear is not the same as white/colourless
           * *If centre puts 'red/brown' allow 'red' or 'brown'*
           * *Accept   suspension, sediment, solid deposit as well as <u>precipitate</u>*
                        for 'white precipitate' accept 'milky precipitate' but
                        not 'milky' on its own
                        no change, no reaction, stays the same as well as
                        <u>no visible change</u>
           * *If "cloudy" or "misty" or "emulsion" used throughout instead of*
             precipitate, mark the colours for these boxes, total the points scored, convert
             to a mark out of 5, then deduct 2 marks
           * *If 'precipitate' used at least once, penalise all answers which expect a*
             precipitate in the answer but the word itself is omitted

                                                                        Total 8 marks

Test	Na_2CrO_4 Observations with Solution A	$BaCl_2$ Observations with Solution B	$Pb(NO_3)_2$ Observations with Solution C	KI Observations with Solution D	Na_2CO_3 Observations with Solution E
1. Reaction with silver nitrate solution	red precipitate (1) **or** red/brown precipitate	white precipitate (1)	no visible change (1)	yellow precipitate (1)	white precipitate (1) **or** brown precipitate
2. Reaction with hydrochloric acid	(yellow solution gives) orange solution (1)	no visible change (1)	white precipitate (1)	no visible change (1)	effervescence or bubbles of gas (1) **not fizzes**
3. Reaction with magnesium sulphate solution	no visible change (1)	white precipitate (1)	white precipitate (1)	no visible change (1)	white precipitate (1)

Exercise 2   Skill assessed   **Analysing   (3)**

Determination of the number of molecules of water of crystallisation in hydrated calcium sulphate crystals.

1   Draws best fit straight line   1 mark
     Notes   * *Line must not deviate towards reading at 0.25g*
             * *Line must go through the origin - complete extrapolation if not*
               done by candidate

2   Uses the graph to determine the mass to form 1.000g   1.29g   1 mark
     Notes   * *Allow 1.28 - 1.30*
             * *Allow consequential answer if line drawn is not best fit*

3   Calculate the number of moles in 1.000g of $CaSO_4$ 7.34×10^{-3} 1 mark
     Notes   * *M_r of $CaSO_4$ is 136.2*
             * *Using 136 gives 7.35×10^{-3}; allow here but loses precision mark*
             * *Allow consequential answer from part 2*

4   Calculate the M_r of $CaSO_4.xH_2O$ 175.7   1 mark
     Notes   * *Must use answers from parts 2 and 3 to earn this mark*
             * *Allow consequential answer from part 3*
             * *1.28g gives 174.3; 1.30g gives 177.1;*

5   Calculate the degree of hydration, *x*   2.19 (2)   1 mark
     Notes   * *174.3gives 2.12; 177.1 gives 2.27;*
             * *Allow consequential answer from part 4*

6   Calculates the percentage error in using the balance   0.4%   1 mark
     Notes   * *Ignore precision of answer*

7   Precision   2 mass to 2 or 3 sig figs   any 2 for 1mark
                    4   M_r to 1 dec place
                    5   value of *x* to 3 sig figs or integer
     Notes   *If candidate uses M_r 136 in part 3 loses precision mark*

8   Nomenclature   clear sharp line on graph   all 3 for 1mark
                             calculations clear & logical, with sensible layout
                             units where used are correct

Notes   * *Incorrect units mean the nomenclature mark is lost*
        * *Two blank sections mean the nomenclature mark is lost*
        * *Don't penalise missing units*
        * *Answer given part 2, 3, 4 or 6 without working means the*
          nomenclature mark is lost

Total 8 marks

Skill assessed   **Evaluating   (4)**

1   (a)   yes / good straight line / can use with confidence   1 mark
         (b)   anomalous result at <u>0.15/0.25 g</u>   1 mark
         Notes   * *Must make a clear written comment for first point*
                   * *Second point in answer here or clearly from the graph*
                   * *Deviation of line of graph loses second mark*

2   ensure reaction complete/ ensure all water lost   1 mark

3   calculations   difference $175.7 - 172.2 = 3.5$ both = 1 mark
                                       percentage $(3.5 * 100)/ 172.2 = 2.0\%$
         Notes   * *Ignore precision of answer*
                      * *Consequential marking from Q3 of Analysis*
                      * *Difference must be clearly stated*
                      * *Lose mark if the candidate answers a different question*
                      * *Alternative values   165.2   difference is 7.0 and % is 4.1*
                                                   174.3   difference is 2.1 and % is 1.2
                                                   177.1   difference is 4.9 and % is 2.8

4   (a)   % errors in <u>weighing/mass</u> are too large with 0.100g   1 mark
                   or hard to <u>weigh</u> accurately

         (b)   may not decompose fully   1 mark

                                                                                               Total 6 marks

Exercise 3   Skill assessed   **Planning   (1)**

Confirming the equation of an acid - metal reaction.

  The mark scheme is in five sections

  (a)   the scale of working used   **s** max 3 scoring points
         states appropriate volume of gas to be collected - *allow 25 - 250 cm^3*
         calculates moles of hydrogen for stated volume
         calculates mass of strontium needed (0.37g Sr gives 100 cm^3 of H_2)
         Notes * *To score last two points need a definite correct link between mass and volume*

  (b)   the apparatus used   **a** max 4 scoring points
         balance - *allow without precision specified, or from a list*
         appropriate container for reaction - *allow test tube or flask but not beaker*
         describes method of collection of gas - over water or in a syringe - *to show they know*
         how measuring cylinder or pipette for <u>acid</u> - *allow without precision specified*
         Notes * *Can score points from a diagram*

  (c)   the method used   **m** max 5 scoring points
         weighs strontium
         adds <u>excess</u> acid
         precaution to avoid gas loss on mixing *not addition from burette or tap funnel*
         allows reaction goes to completion
         measures volume of hydrogen produced
         repeats experiment
         measures room temperature and/or pressure
         Notes * I*gnore additional apparatus unless contradictory - lose apparatus point(s)*
                  * *If method is clearly unworkable, CE; allow 'weighs strontium' and 'repeats*
                     experiment' otherwise allow no other scoring points for the method section;
                     for awkward cases consult DGW

  (d)   the use of results   **r** max 4 scoring points
         correct calculation of moles of strontium
         uses gas equation or 24 dm^3 - *can score from scale section*
         correct calculation of moles of hydrogen produced
         confirms 1:1 ratio of strontium : hydrogen
         Notes * *Last point is only awarded if the rest of the calculation is sensible;*
                    do not award as an isolated statement

(e)   the appreciation of likely hazards and safety precautions   **h** max 2 scoring points

hydrogen/strontium flammable   avoid naked flames or fume cupboard
hydrochloric acid corrosive/irritant   gloves/wash spillages
eye protection
Notes   * *Need hazard and precaution for points 1 and 2*

GRADING

18 scoring points   17 – 18 scores   8 marks   9 – 10 scores 4 marks
                           15 – 16 scores   7 marks   6 – 8   scores 3 marks
                           13 – 14 scores   6 marks   3 – 5   scores 2 marks
                           11 – 12 scores   5 marks   1 – 2   scores 1 mark