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# Mark Scheme (Results)

January 2013

International GCSE
Chemistry (4CH0) Paper 1C
Science Double Award (4SC0) Paper 1C

Edexcel Level 1/Level 2 Certificate
Chemistry (KCH0) Paper 1C
Science (Double Award) (KSC0) Paper 1C

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| Question number | | | | Answer | Notes | Marks |
|---|---|---|---|---|---|---|
| 1 | a | | M1 | nucleus | | 1 |
| | | | M2 | protons | Accept in either order | 1 |
| | | | M3 | neutrons | | 1 |
| | | | M4 | electrons | | 1 |
| | | | M5 | shells | | 1 |
| | | | M6 | protons AND electrons | In either order | 1 |
| | | | M7 | electrons | | 1 |
| | b | i | | 3 | | 1 |
| | | ii | | 5 | | 1 |
| 2 | a | i | | C | | 1 |
| | | ii | | B | | 1 |
| | b | | | fluorine / $F_2$ | Accept F | 1 |
| | c | i | | hydrogen chloride | | 1 |
| | | ii | | hydrochloric (acid) | | 1 |
| | | iii | | HCl | | 1 |
| | | | | | | |
| | | | | | **Total** | **15** |

| Question number | | | | Answer | Notes | Marks |
|---|---|---|---|---|---|---|
| 3 | a | i | M1 | bubbles / fizzing / effervescence | Accept gas formed /given off | 1 |
| | | | | | Ignore any name or formula | |
| | | | M2 | iron/solid disappears<br>OR<br>green/colourless solution (forms) | Accept iron/solid gets smaller / dissolves | 1 |
| | | | | | Ignore references to heat change / change in pH | |
| | | ii | | iron sulfate AND hydrogen (in either order) | Penalise oxidation states other than (II) | 1 |
| | | | | | Accept ferrous sulfate | |
| | | | | | Reject ferric sulfate | |
| | b | | | 2 (1) 2 | Accept multiples and fractions | 1 |
| | c | i | M1<br>M2 | white<br>blue | Ignore colourless<br>Ignore all qualifiers such as pale / dark | 1<br>1 |
| | | ii | | D | | 1 |
| | | iii | M1<br>M2 | boiling point / melting/freezing point<br>100 ºC / 0 ºC | <br>Accept just º or C but not just number<br>Value must match property<br>Accept correct values in K<br>Ignore other physical properties such as pH / density | 1<br>1 |

| Question number | | | | Answer | Notes | Marks |
|---|---|---|---|---|---|---|
| 3 | d | i | | low density / less dense than air | Accept lighter than air / the lightest gas<br>but not just light / lightweight | 1 |
| | | ii | | non-flammable<br>OR<br>does not burn / explode (when ignited) | Ignore unreactive<br>Accept does not react with oxygen/air | 1 |
| | e | | | $H_2(g) \rightarrow H_2(l)$ | Ignore "+ heat/energy" on RHS<br>Penalise indication of endothermic process | 1 |
| | | | | | | |
| | | | | | **Total** | **12** |

| Question number | | | | Answer | Notes | Marks |
|---|---|---|---|---|---|---|
| 4 | a | i | | oxygen / air | Accept $O_2$ but not just O | 1 |
| | | ii | | iron(III) oxide / ferric oxide | Ignore hydrated<br>Accept iron oxide but not ferrous oxide or iron oxide with an incorrect oxidation state | 1 |
| | b | i | | nail is wet / needs drying<br>OR<br>rust absorbs water/is wet / rust falls off | <br><br>Not just some of the nail/it falls off | 1 |
| | | ii | | bigger/biggest increase/change in mass<br>OR<br>mass of rust greater/greatest | Accept mass increased more<br>Ignore highest mass<br>Ignore just mass increased by 0.3 g<br>Accept weight in place of mass | 1 |
| | | iii | | bigger/biggest increase/change in mass with correct reference to proportion or percentage | | 1 |
| | | iv | | mass has decreased | Accept mass has not increased / should have increased<br>Accept mass cannot decrease<br>Accept nail got lighter | 1 |
| | c | | M1 | grease / oil | | 1 |
| | | | M2 | paint | | 1 |

| Question number | | | | Answer | Notes | Marks |
|---|---|---|---|---|---|---|
| 4 | d | | M1 | galvanising / sacrificial (protection) | Ignore references to anode / cathode | 1 |
| | | | M2 | zinc more reactive (than iron)<br>OR<br>iron less reactive (than zinc) | Accept zinc higher in (re)activity series<br>OR<br>iron lower in (re)activity series<br>Must be comparison, eg not just zinc is reactive without statement that iron is unreactive | 1 |
| | | | M3 | zinc reacts/corrodes/oxidises instead of iron<br>OR<br>zinc reacts/corrodes/oxidises before iron | Accept zinc reacts faster than iron<br>Accept zinc loses electrons instead of/before iron / zinc gives electron(s) to iron (ions)<br>Reject zinc rusts<br>Reject protective layer of zinc oxide<br>Ignore erodes | 1 |
| | | | | | | |
| | | | | | **Total** | **11** |

| Question number | | | | Answer | Notes | Marks |
|---|---|---|---|---|---|---|
| 5 | a | | M1 | (compound/molecule/substance containing) carbon and hydrogen (atoms) | Reject atoms/elements in place of compounds<br>Reject molecules in place of atoms<br>Reject mixture<br>Accept C and H in place of carbon and hydrogen | 1 |
| | | | M2 | only | M2 dependent on M1 or near miss, eg mixture of C and H<br>Accept equivalent wording such as alone / purely / solely | 1 |
| | b | | | contains (C=C) double bonds | Accept multiple bonds<br>Reject implied C=H | 1 |

| Question number | | | | Answer | Notes | Marks |
|---|---|---|---|---|---|---|
| 5 | c | i | | alkene(s) | | 1 |
| | | | | | | |
| | | ii | | $C_nH_{2n}$ | Accept other symbols such as x<br>Accept $H_{2n}C_n$ | 1 |
| | | iii | M1 | same/similar chemical properties | Accept same/similar reactions<br>Do not accept a specific reaction, eg they all burn<br>Ignore similar reactivities | 2 |
| | | | M2 | trend/gradation in physical properties | Accept named trend eg boiling point<br>Accept correct trend eg smaller molecules have lower boiling points, but not incorrect trend such as smaller molecules have higher boiling points | |
| | | | M3 | same functional group | | |
| | | | M4 | (neighbouring) members differ by $CH_2$ | | |
| | | | | | Any two for 1 each | |

| Question number | | | | Answer | Notes | Marks |
|---|---|---|---|---|---|---|
| 5 | d | i | | but-1-ene | Accept butene<br>Ignore mention of cis or trans | 1 |
| | | ii | | $C_4H_8$ | | 1 |
| | | iii | M1 | (compounds/molecules with) same molecular formula / same number of each type of atom | Do not penalise specific compound types, eg hydrocarbons / alkenes<br>If elements/atoms in place of compounds, max 1 for Q<br>Ignore references to chemical/general/empirical formula | 1 |
| | | | M2 | different structure(s) / different structural formula(e) / different displayed formula(e) | Ignore atoms in a different order | 1 |
| | | iv | | displayed formula of but-2-ene or methylpropene | Accept cyclobutane or methylcyclopropane<br>Ignore but-1-ene structure | 1 |
| | e | i | | colourless / decolorised | Ignore clear | 1 |
| | | ii | | $C_2H_4Br_2$ | Insist on correct use of subscripts and cases of letters<br>Do not penalise elements in different order<br>Accept correct structural/displayed formula | 1 |
| | | | | | | |
| | | | | | **Total** | **14** |

| Question number | | | Answer | Notes | Marks |
|---|---|---|---|---|---|
| 6 | a | M1 | (same) volume of solution/liquid | Accept amount in place of volume | 3 |
| | | M2 | (same) concentration (of solution/liquid) | | |
| | | M3 | (same) amount of metal | Accept solid in place of metal<br>Accept moles/mass in place of amount<br>Reject salt in place of metal | |
| | | M4 | (same) (total) surface area / state of subdivision of solid | Accept all powder / all particles same size / size of metal | |
| | | M5 | (same) method/length of time/speed of stirring | | |
| | | | | Ignore references to polystyrene cup / starting temperature | |
| | | | | Any three for 1 each | |
| | b | M1 | 22.4 | Ignore trailing zeroes and award 1 mark for both correct values in wrong order | 1 |
| | | M2 | 17.7 | | 1 |
| | | M3 | 4.7 | Consequential on values used in M1 and M2<br>Reject –4.7 | 1 |

| Question number | | | | Answer | Notes | Marks |
|---|---|---|---|---|---|---|
| 6 | c | i | M1 | magnesium / Mg | | 1 |
| | | | M2 | largest difference in (recorded) temperatures | DEP on M1<br>Do not accept results in place of temperatures<br>Explanation must be comparative:<br>Not just rises are 10.5 and 15.5 without reference to values for other metals<br>Not just very different temperature changes<br>Accept two temperatures furthest apart<br>Not just largest temperature rise<br>No penalty for quoting wrong difference, eg 4 C | 1 |

| Question number | | | | Answer | Notes | Marks |
|---|---|---|---|---|---|---|
| 6 | c | ii | M1 | magnesium / Mg | | 1 |
| | | | M2 | largest temperature rise/change | DEP on M1<br>Do not accept results in place of temperatures<br>Accept answers stating most heat produced / most exothermic | 1 |
| | | iii | | silver/it is less reactive (than copper) / lower in the reactivity series<br>OR<br>no reaction | Must be implied comparison<br>Accept copper more reactive than silver but not just silver is unreactive | 1 |
| | | | | | Reject references to differences in reactivities of silver and copper ions / silver and copper sulfate | |
| | | iv | | silver and X both have no temperature rise/change<br>OR<br>two metals show no temperature rise/change | Accept two metals did not react<br>Accept two showed zero (temperature rises) | 1 |
| | d | | | $Zn + CuSO_4 \rightarrow Cu + ZnSO_4$ | Ignore state symbols<br>Accept correct ionic equation with or without spectator ions | 1 |
| | | | | | | |
| | | | | | **Total** | **13** |

| Question number | | | | Answer | Notes | Marks |
|---|---|---|---|---|---|---|
| 7 | a | i | M1 | (A) reduced AND (B) oxidised | If first column blank, M1 can be scored from words in second column: eg reduction is gain of electrons in 2nd column for A scores M2<br>oxidation is gain of oxygen in 2nd column for B scores M3<br>Both above statements would score M1 as well<br><br>If M1 wrong way round, then 0/3<br><br>If 1st column has oxidation ×2 or reduction × 2, then no M1, but it will sometimes be possible to award either M2 or M3 for a correct matching statement. | 1 |
| | | | M2 | (A) gain of electrons | If species identified, must be correct, eg not aluminium gains electrons<br>Ignore reference to loss of oxygen | 1 |
| | | | M3 | (B) gain of oxygen | Ignore reference to loss of electrons | 1 |
| | | ii | M1 | $2O^{2-} \rightarrow O_2 + 4e^{(-)}$ | Both formulae correct and on correct sides of equation | 1 |
| | | | M2 | | Balancing including electrons | 1 |
| | | | | | Accept electrons lost on LHS<br>Accept $O^{2-} \rightarrow O + 2e^{(-)}$ followed by $2O \rightarrow O_2$ | |
| | | iii | | electrodes burn /get smaller / decrease (in mass) / have to be replaced | Ignore erode / corrode / wear / damage | 1 |

| Question number | | | | Answer | Notes | Marks |
|---|---|---|---|---|---|---|
| 7 | a | iv | M1 | coke | Ignore coal / carbon<br>Reject other raw materials such as limestone/haematite | 1 |
| | | | M2 | produces heat / exothermic (reaction) | M2 independent<br>Accept makes carbon dioxide which then produces CO/reducing agent | 1 |
| | b | i | | carbonating drinks / in drinks | | 1 |
| | | | M2 | soluble (in water) / reacts with water | M2 dependent on M1<br>Accept just solubility, ignoring qualifying statements such as only slightly soluble, or only dissolves under pressure | 1 |
| | | | M3 | fire extinguishers / putting out fires | | 1 |
| | | | M4 | denser than air / does not support combustion | Accept denser than oxygen<br>Ignore does not burn<br>M4 dependent on M3<br>Ignore references to covering / sitting on fire | 1 |
| | | | | | Accept M1+M2, and M3+M4 reversed | |

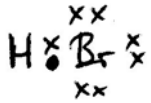
| Question number | | | | Answer | Notes | Marks |
|---|---|---|---|---|---|---|
| 7 | b | ii | M1 | $SO_2 + H_2O \rightarrow H_2SO_3$ | Accept $SO_2 + H_2O + ½O_2 \rightarrow H_2SO_4$ | 1 |
| | | | | | Do not accept unconventional formulae such as $SO_3H_2$ | |
| | | | M2 | adverse effect on plants/trees/crops/vegetation<br>OR<br><br>adverse effect on fish / water animals / aquatic life<br>OR<br><br>adverse effect on iron/steel/metal<br>OR<br><br>adverse effect on stonework/limestone/marble | eg kills / harms / damages / destroys / stunts growth<br><br>eg kills / harms / damages / destroys /reduces fish population<br><br>eg damages / causes rusting/corrosion<br><br>eg causes corrosion / damages<br>Not just buildings/structures/statues<br><br>Ignore changes in pH<br>Ignore effects on animals/birds<br>Ignore just habitats<br>Do not accept burning/weathering/erosion as adverse effects<br>Not just affects plants/fish/etc | 1 |
| | | | | | Do not apply list principle | |

| Question number | | | | Answer | Notes | Marks |
|---|---|---|---|---|---|---|
| 7 | c | | M1 | $M_r(PbCO_3)$ = 267 / $A_r$ (Pb) = 207 | Accept 414 for Pb | 1 |
| | | | M2 | n($PbCO_3$) / n(Pb) = 1.87 mol | Accept 1.9 | 1 |
| | | | M3 | m(Pb) = 387 – 388 g | | 1 |
| | | | | **OR** | | |
| | | | M1 | $M_r(PbCO_3)$ = 267 / $A_r$ (Pb) = 207 | | 1 |
| | | | M2 | m(Pb) = $\frac{207 \times 500}{267}$ | | 1 |
| | | | M3 | m(Pb) = 387 - 388 g | | 1 |
| | | | | **OR** | | |
| | | | M1 | $M_r(PbCO_3)$ = 267 / $A_r$ (Pb) = 207 | | 1 |
| | | | M2 | % Pb = $\frac{207 \times 100}{267}$ = 77.5 % | | 1 |
| | | | M3 | m(Pb) = 500 × 0.775 = 387.5 g | | 1 |
| | | | | | Correct final answer with or without working scores 3<br>Accept answer in kg<br>Apply ECF throughout | |
| | | | | | Accept other valid methods<br>774-776 scores 2 | |
| | | | | | | |
| | | | | | **Total** | **17** |

| Question number | | | | Answer | | Notes | Marks |
|---|---|---|---|---|---|---|---|
| 8 | a | i | M1 | reversible (reaction)<br>/ goes forwards and/or backwards<br>/ can go in either direction | | Ignore equilibrium | 1 |
| | | | M2 | enthalpy/heat/energy change | | Ignore kJ/mol<br>Reject energy produced/released | 1 |
| | | ii | | exothermic / heat/energy given out/lost | | Accept enthalpy in place of heat/energy<br>Ignore references to temperature | 1 |
| | b | | M1 | two (vaguely) horizontal lines:<br>one with reactants or their formulae<br>AND<br>one with products or their formulae | | Ignore all curves and connecting lines<br>Ignore line representing *x*-axis and any label<br>Accept R for reactants and P for products | 1 |
| | | | M2 | reactants (line) above products (line) | | No penalty for products to left of reactants | 1 |
| | | | | | | Accept formulae in place of words for reactants and products<br>Do not penalise minor errors in formulae (e.g. NH instead of $NH_3$) or missing coefficients | |
| | c | | M1 | (effect of temp on rate) | increased | | 1 |
| | | | M2 | (effect of temp on yield) | decreased | | 1 |
| | | | M3 | (effect of catalyst on rate) | increased | | 1 |
| | | | M4 | (effect of catalyst on yield) | unchanged | | 1 |

| Question number | | | | Answer | Notes | Marks |
|---|---|---|---|---|---|---|
| 8 | d | i | M1 | decreased | No ECF from increased / no effect<br>Accept longer time for reaction<br>Ignore references to equilibrium | 1 |
| | | | M2 | particles further apart/more widely spaced / more space to move in / concentration decreases | Accept molecules<br>Reject atoms/ions in M2 only<br>If neither of M2 and M3 scored, accept fewer collisions with no reference to frequency or time | 1 |
| | | | M3 | less frequent (successful) collisions / fewer (successful) collisions per second/minute | Accept more time between collisions<br>Ignore decreased chance / probability / likelihood of collisions | 1 |
| | | | | | References to change in energy/speed of particles means M2 and M3 cannot be scored | |
| | | ii | M1 | shifted to right / more products / shifts in exothermic/forward direction | Ignore references to rate<br>No ECF from shift to left / no change<br>Accept forward reaction favoured | 1 |
| | | | M2 | more (gas) moles/molecules on right | Accept fewer (gas) moles on left<br>Accept favours side with more (gas) moles<br>Accept 9 moles on left and 10 moles on right | 1 |
| | e | | | 4 (1) 2 4 | Accept fractions and multiples | 1 |
| | | | | | | |
| | | | | | **Total** | **15** |

| Question number | | | | Answer | Notes | Marks |
|---|---|---|---|---|---|---|
| 9 | a | i | M1 | 35 on lines 1 and 3 | | 1 |
| | | | M2 | 44 on line 2 | | 1 |
| | | ii | | isotopes | | 1 |
| | | | | | | |
| | | iii | | same number of electrons (in outer shell)<br>OR<br>same electron arrangement or configuration | Ignore references to protons and neutrons unless incorrect, eg different numbers of protons, same number of neutrons | 1 |
| | | iv | M1 | $^{79}Br$ | Accept just 79 | 1 |
| | | | M2 | 79 is closer to 79.9/more accurate value | Accept 79 is closer to relative atomic mass<br>M2 dependent on M1 | 1 |

| Question number | | | | Answer | Notes | Marks |
|---|---|---|---|---|---|---|
| 9 | b | i | M1 |  | shared pair of electrons | 1 |
| | | | M2 | | other electrons correct (not necessary to be paired) | 1 |
| | | | | | M2 dependent on M1<br>Accept any combinations of dots and crosses<br>Circles not needed but if drawn must overlap or touch – if not, then 0/2<br>Ignore inner electron shells even if incomplete or incorrect | |
| | | | | | Do not penalise incorrect symbols, eg br/BR<br>If Na used in place of H, max 1<br>No marks if ions shown | |
| | | ii | M1 | shared (two/pair of) electrons | Not share an electron | 1 |
| | | | M2 | attracted to <u>both</u> nuclei | M2 dependent on M1 or near miss<br>eg the electrons are attracted to the nucleus scores 0<br>the electrons are attracted to both nuclei scores M2 but not M1 | 1 |
| | | | | | 0/2 if references to ions / ionic bond / intermolecular forces | |

| Question number | | | | Answer | Notes | Marks |
|---|---|---|---|---|---|---|
| 9 | b | iii | M1 | (sodium bromide) ionic bonding / + and – ions | Reject covalent bonding / shared electrons | 1 |
| | | | M2 | (hydrogen bromide) attraction between molecules<br>/ intermolecular forces (of attraction) | Accept dipole-dipole attractions / van der Waals' forces / IMF / vdW<br>Ignore hydrogen bonds<br>Reject ions/ionic | 1 |
| | | | M3 | ionic bonding stronger<br>OR<br>IMF / attractions between HBr molecules weaker | Accept ionic bonds stronger<br>M3 dependent on comparison of intermolecular forces and ionic bonding<br>Accept correct references to energy needed to overcome bonding / attractions | 1 |
| | | | | | Ignore references to reactivity and mass | |

| Question number | | | | Answer | | | Notes | Marks |
|---|---|---|---|---|---|---|---|---|
| 9 | c | | M1 | Na<br>$\frac{13.8}{23}$ | Br<br>$\frac{47.9}{80}$ | O<br>$\frac{38.3}{16}$ | 0/3 if division by atomic number(s) /division wrong way round<br>If only two elements shown correctly, only M1 can be awarded | 1 |
| | | | M2 | 0.6 | 0.6 | 2.4 | Accept 1 : 1: 4 | 1 |
| | | | M3 | $NaBrO_4$ | | | Accept elements in any order<br>Penalise M3 for incorrect symbol, eg $SBrO_4$ or $NaBO_4$ | 1 |
| | | | | | | | Dividing by 160 instead of 80 gives Na2BrO8<br>Dividing by 32 instead of 16 gives NaBrO2<br>Award 2 in these cases<br>Both these errors give Na2BrO4<br>Award 1 in this case | |
| | | | | | | | Correct final answer scores 3 marks | |
| | | | | | | | | |
| | | | | | | | **Total** | **16** |

| Question number | | | | Answer | Notes | Marks |
|---|---|---|---|---|---|---|
| 10 | a | | | organic compounds flammable<br>OR<br>decreases chance of fire<br>OR<br>less vapour/gas escapes | Ignore references to breaking boiling tube / beaker/escape of mercury / need to hold boiling tube / being burned by flame / loss of heat<br>Ignore liquid escapes<br>Accept stops/prevents vapour escaping<br>Reject references to reactions inside the beaker | 1 |
| 10 | b | i | M1<br>M2 | all five points correct | to nearest gridline<br>Deduct 1 mark for each error<br>If points not visible, assume they are under the line | 2 |
| | | | M3 | straight line of best fit | Must be drawn with a ruler<br>Does not need to be extrapolated<br>Line should go through any two correctly plotted points | 1 |
| | | ii | | correct qualitative relationship | eg boiling point increases as relative formula mass increases / positive correlation<br>Accept statement "wrong" way round<br>Reject mass in place of relative formula mass<br>Reject temperature in place of boiling point<br>Reject (directly) proportional | 1 |
| | | iii | | 117 (ºC) ±1º | CQ on candidate graph | 1 |
| | | iv | | E | | 1 |
| | | | | | | |
| | | | | | **Total** | **7** |

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