edexcel

Mark Scheme (Results)

Summer 2015

Pearson Edexcel GCSE in Chemistry (5CH2H/01) Paper 01

Unit C2: Discovering Chemistry

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.

Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Question Number	Answer	Acceptable answers	Mark
1(a)(i)	**A** calcium ion, Ca^{2+}		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	A description including • white (1) • precipitate/ppt/ppte/solid **(1)**	Maximum 1 mark if bubbles / fizzing / effervescence also mentioned Ignore colour of solution Ignore cloudy Ignore off white/milky Allow crystals **(1)** Ignore powder Ignore name of precipitate	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b)	**B** lead chloride		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(c)(i)	(barium chloride (aq) + sodium sulfate (aq) →) sodium chloride (aq) + barium sulfate (s) • sodium chloride (1) • (sodium chloride) (aq) **and** barium sulfate (s) both state symbols matched to the correct product (1)	 Allow NaCl **(1)** Do not allow sodium chlorine Accept $BaSO_4$ for barium sulfate Accept (aq) if sodium chlorine given Do not allow (solid) Do not allow (AQ)	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(c)(ii)	An explanation linking • {barium sulfate/it} is {insoluble / does not dissolve} **(1)** • so it {cannot enter/cannot mix with/is not absorbed} into the {blood(stream)/body} **or** it passes through the body (unchanged) **(1)**	{barium sulfate/it} does not dissolve into the blood(stream) **(2)** Allow barium is insoluble / does not dissolve **(1)** Ignore barium sulfate is a precipitate Ignore it cannot be digested	**(2)**

Total for Question 1 = 8 marks

Question Number	Answers	Acceptable Answers	Mark
2(a)(i)	A displacement		**(1)**

Question Number	Answers	Acceptable Answers	Mark
2(a)(ii)	orange	Any colour or combination of colours from brown, red, orange and yellow Ignore shade of colours Reject other colours combined with these e.g. yellow-green	**(1)**

Question Number	Answers	Acceptable Answers	Mark
2(b)	**C**		**(1)**

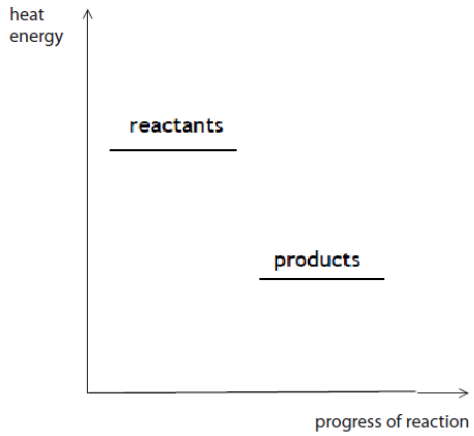
Question Number	Answer	Acceptable answers	Mark
2(c)	(H_2 + Br_2 →) 2HBr • correct formula for HBr **(1)** • balancing of correct formulae **(1)**	Ignore state symbols Allow BrH **(1)**	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(d)	[24 + 2x35.5] **(1)** (= 95)	95 with no working [24 + 2x35.5] with no answer or an incorrect answer scores **(1)**	**(1)**

Question Number	Answers	Acceptable Answers	Mark
2(e)	• relative formula mass =[23 + 19] **(1)** (= 42) • [(19/their relative formula mass) x100] **(1)** (=45.2(%)) **consequential** on their relative formula mass	(19/42) x 100 **(2)** (= 45.2 (%)) (19/[19+23]) x 100 **(2)** (= 45.2 (%)) 45/45.2 (%) with no working **(2)** Ignore additional significant figures Allow 42 seen in working **(1)** Allow (19/23) x 100 = {82.6% / 83%} **(1)**	**(2)**

Total for Question 2 = 8 marks

Question Number	Answers	Acceptable Answers	Mark
3 (a)(i)	An explanation linking • (substance which) speeds up / increases the rate of (a reaction) **(1)** • (but is chemically) unchanged (at end of reaction) / not used up (in reaction) /mass remains the same **(1)**	Ignore any reference to enzymes Ignore changes/alters the rate Allow provides an alternative route for the reaction with a lower energy / lowers the activation energy / reduces the energy needed for {a reaction to take place/successful collisions} **(1)** Do not allow catalyst is a reactant /product Ignore does not change products of reaction Ignore {does not take part/is not used/is not involved} in the reaction	**(2)**

Question Number	Answers	Acceptable Answers	Mark
3 (a)(ii)	 • labelled horizontal reactant line above product line line can be labelled reactants /carbon monoxide + oxygen /CO + O_2 **(1)** • labelled horizontal product line to right of reactant line line can be labelled product(s) / carbon dioxide / CO_2 **(1)**	Allow 2 lines in the correct positions unlabelled/ with incorrect labels **(1)** Allow reactants and products written in the correct positions without horizontal lines **(1)** Ignore additional curves and arrows Ignore incorrect formulae if written in addition to correct words /names	**(2)**

Question Number	Answers	Acceptable Answers	Mark
3 (a)(iii)	$C_7H_{16} + 11O_2 \rightarrow 7CO_2 + 8H_2O$ • correct formulae on lhs $C_7H_{16} + O_2$ **(1)** • correct formulae on rhs $CO_2 + H_2O$ **(1)** • balancing correct formulae **(1)**	Accept multiples Accept = for → Ignore state symbols, even if incorrect	**(3)**

Question Number	Answers	Acceptable Answers	Mark
3 (b)	An explanation linking • more particles (in the same volume) **(1)** • more frequent collisions (between solute particles) **or** (solute particles) collide more often **or** higher rate of collisions (between solute particles) **or** more collisions (between solute particles) in given time **(1)**	Maximum **(1)** if particles have more energy / move faster Accept this shown in diagrams Accept specific particles – molecules or ions but not atoms Allow (reacting) particles are closer together **(1)** Ignore just "more ({productive/ successful/ effective}) collisions" Ignore collisions are more likely Ignore greater {chance/ probability} of collisions Ignore faster collisions/collide more quickly	**(2)**

Total for Question 3 = 9 marks

Question Number	Answer	Acceptable answers	Mark
4(a)(i)	<table><tr><th>particle</th><th>number</th></tr><tr><td>proton</td><td>29</td></tr><tr><td>neutron</td><td>34</td></tr><tr><td>electron</td><td>29</td></tr></table> all 3 correct **(2)** any 1 or 2 correct **(1)**		**(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	(copper atom has) 4 (shells of electrons)	Do not allow 4 electrons on the outer shell Do not allow 4 outer shells	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)(iii)	An explanation linking • atoms of the (same) element/ atoms with the same {number of protons/atomic number} **(1)** • (but) different {numbers of neutrons/mass numbers} **(1)**	Maximum **(1)** if no mention of atom(s)/atomic Allow the marks if a specific example is given e.g. all chlorine atoms have 17 protons **(1)** but some have 18 neutrons and others have 20 neutrons **(1)** Ignore any reference to numbers of electrons Ignore different forms of an element Allow {more/less} neutrons than the {usual/original} atom **(1)** Do not allow more neutrons than protons Do not allow different (relative) atomic masses	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)(iv)	• (in 100 atoms) mass of copper-63 atoms = 63 x 70 / 63 x 0.7 / 63 x 7 **(1)** (= 4410 / 44.1 / 441) • mass of copper-65 atoms = 65 x 30 / 65 x 0.3 / 65 x 3 **(1)** (= 1950 / 19.5 / 195) • relative atomic mass = $\frac{(63 \times 70 + (65 \times 30)}{100}$ / $\frac{4410 + 1950}{100}$ 44.1 + 19.5/ $\frac{441+ 195}{10}$ **(1)** (= 63.6)	63.6 with no working **(3)** 63.5/64 with no working **(0)** Allow correct working shown to calculate 63.6 then final answer is rounded to 64 **(3)** Note: correct working shown to calculate 63.6 then final answer is incorrectly rounded to 63.5/63 **(2)** Ignore any unit e.g. g Allow TE for third mark e.g if percentages used the wrong way round 64.4 scores **(1)**	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(b)(i)	• two electrons/ $2e^{(-)}$ **(1)** • {loses/gives away} electrons **(1)**	Reject any reference to a covalent bond or sharing electrons (0) $Cu \rightarrow Cu^{2+} + 2e^{(-)}$ **or** $Cu - 2e^{(-)} \rightarrow Cu^{2+}$ **(2)** Allow +2 for charge Allow transfers electrons to another atom **(1)** Allow electrons taken away **(1)** Ignore electrons are missing Ignore references to the nitrate ion/other non-metals Ignore references to full outer shell	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	$Cu(NO_3)_2$	Formula must be totally correct including subscripts, letter case and brackets Allow $Cu^{2+}(NO_3^-)_2$ Ignore any balancing numbers in front of formula Ignore any working/attempted equation to find the formula	**(1)**

Total for Question 4 = 11 marks

Question Number	Answers	Acceptable Answers	Mark
5 (a)	**D** is inert		**(1)**

Question Number	Answers	Acceptable Answers	Mark
5 (b)	An explanation linking • {atoms/cations/ions} are in {layers /sheets} **(1)** • { layers/sheets} can {slide/slip/ move/roll} (over each other) (1)	Any mention of intermolecular forces/covalent bonds/ionic bonds (0) Accept a diagram showing layers with labelled {atoms/cations/ions} Ignore rows /lines/ lattice Do not allow electrons can slide/slip/move over each other Ignore references to delocalised electrons	**(2)**

Question Number	Answers	Acceptable Answers	Mark
5 (c)	P Br mass 3.1/31(= 0.1) 24/80 (=0.3) **(1)** A_r ratio 1 3 **(1)** formula PBr_3 **(1)**	Allow PBr_3 with no working or incorrect working **(1)** PBr_3 with some correct working **(3)** Accept Br_3P Allow TE for second and third marks e.g. P Br 31/3.1(= 10) 80/24 (= 3.33) **(0)** 3 1 **(1)** P_3Br **(1)** P_3Br with no working **(0)**	**(3)**

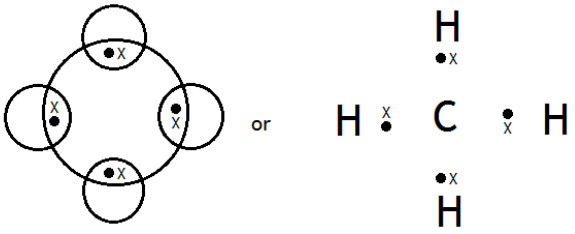
Question Number		Indicative content	Mark
QWC	**5(d)**	A description / explanation including some of the following points **Description** • effervescence / fizzing / bubbles • float /on surface • move • produce hydrogen (may be shown in word or balanced equation) • {an alkaline/metal hydroxide} solution (may be shown in word or balanced equation) • gets smaller / disappears / dissolves • reactivity increases with {increasing atomic number/ down the group} / potassium effervesces more than sodium and lithium / potassium moves faster than sodium or lithium • sodium and potassium melt/form a (silver-coloured) ball • hydrogen burns when potassium/ sodium react • potassium gives a lilac flame/sodium gives a yellow flame • Universal Indicator added to water turns blue/purple **Explanation** • (group 1 metals) react by losing one electron • electron is more easily lost with {increasing atomic number/ down the group} • {electron/ outer shell} is further away from nucleus/ atomic radius increases/ there are more electron shells with {increasing atomic number/ down the group} • {more shielding (of outer electron)/ less attraction between nucleus and outer electron/ more shells between outer electron and nucleus} with {increasing atomic number/down the group}	**(6)**
Level	0	No rewardable material	
1	**1-2**	• a limited description of one or two points describing the reactions or explaining them e.g. reactivity increases down the group. • the answer communicates ideas using simple language and uses limited scientific terminology. • spelling, punctuation and grammar are used with limited accuracy.	
2	**3-4**	• a simple description of at least three points describing the reactions OR a combination of three points from the description and explanation e.g. they all float on water, fizz and potassium gives a lilac flame. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately. • spelling, punctuation and grammar are used with some accuracy.	
3	**5-6**	• a detailed description and explanation of at least five points describing the reactions **and** explaining the pattern of reactivity e.g. the metals all fizz, float and produce hydrogen, the reactivity increases down the group because the outer electron is more easily lost. • the answer communicates ideas clearly and coherently and uses scientific terminology accurately. • spelling, punctuation and grammar are used with few errors.	

Total for Question 5 = 12 marks

Question Number	Answer	Acceptable answers	Mark
6(a)(i)	4		**(1)**

Question Number	Answer	Acceptable answers	Mark
6(a)(ii)	**D** they both have high melting points		**(1)**

Question Number	Answer	Acceptable answers	Mark
6(a)(iii)	An explanation linking • layers can slide / move/slip (over each other) **(1)** • (because)weak forces between layers (of atoms) **(1)**	Any mention of ions (0) Ignore can be rubbed off Accept weak bonds for weak forces Accept sheets for layers Ignore mention of {intermolecular /intramolecular} forces/bonds Ignore weak forces between molecules	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(b)	Diagram showing  • 1 shared pair between C and H **(1)** • rest of diagram correct **(1)**	Ignore inner electrons, even if incorrect Accept electrons on/in ring (if ring drawn) Accept all dots or all crosses Accept circles touching and electrons shown where they touch	**(2)**

Question Number		Indicative Content	Mark
QWC	***6(c)**	An explanation including some of the following points **Sodium chloride** • contains {charged particles/ ions} • contains Na^+ and Cl^- • (regular) giant structure/lattice (hence crystalline) • strong (electrostatic) forces (of attraction) between {ions/particles}/ strong bonds between {ions/particles}/strong ionic bonds • a lot of (heat) energy is needed to separate the {ions/particles}/ a lot of (heat) energy is needed to {overcome/ break } the {forces/ bonds/ lattice} (hence high melting point) • {ions/ charged particles} free to move (so it conducts electricity) when molten/ dissolved in water **Water** • covalent bonds between (hydrogen and oxygen) atoms/ (pair of) electrons shared between atoms • contains molecules • H_2O • simple molecular/ simple covalent • weak intermolecular forces/ weak {forces/ bonds} between {molecules/ particles} • not much energy needed to separate the {molecules/ particles}/ not much energy is needed to break the {forces/ bonds between particles} (hence liquid at room temperature) • does not contain any charged particles/ ions/ {delocalised/ free} electrons (hence does not conduct electricity)	**(6)**

Level	**0**	No rewardable content
1	**1 - 2**	• a limited explanation of one or two points e.g. water contains molecules. • the answer communicates ideas using simple language and uses limited scientific terminology. • spelling, punctuation and grammar are used with limited accuracy.
2	**3 - 4**	• a simple explanation of at least three points from sodium chloride or water OR a combination of three or four points from sodium chloride and water e.g. sodium chloride contains ions and water contains H_2O molecules. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately. • spelling, punctuation and grammar are used with some accuracy.
3	**5 - 6**	• a detailed explanation of at least five points, including at least one point from sodium chloride **and** at least one point from water e.g. sodium chloride contains ions held together by strong forces and it has a high melting point as lot of energy is needed to separate the ions, water contains molecules and has a low melting point as there are weak forces between the molecules • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately. • spelling, punctuation and grammar are used with few errors.

Total for Question 6 = 12 marks

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