edexcel

Mark Scheme (Results)

Summer 2015

Pearson Edexcel International GCSE in Chemistry (4CH0) Paper 1CR

Pearson Edexcel International in Science Double Award (4SC0) Paper 1CR

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Summer 2015
Publications Code UG041121

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.

Question number	Answer	Notes	Marks
1 (a)	Diagram shows four circles well-spaced apart	accept minimum of 3 complete circles ignore size and shape of circles ignore arrows and other symbols implying movement ignore a pattern reject any touching circles reject circles joined by bonds no penalty for half-circles at edges of square	1
(b)	move freely/randomly	Accept fast OWTTE ignore references to vibrate	1
(c)	**M1** – (average kinetic) energy of the particles increases **M2** – more particles have enough energy to escape / particles can escape more easily OR more particles overcome the forces (of attraction) holding them together (in the liquid) OR the forces (of attraction) between the particles are overcome more often	accept particles move faster/more rapidly/more quickly allow the energy of the liquid increases accept particles escape more quickly accept molecules/atoms for particles for both M1 and M2 allow bonds for force of attraction	2
			Total 4 marks

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>2 (a)</td><td><u>fractional</u> distillation</td><td>accept fractionation</td><td>1</td></tr>
<tr><td>(b)</td><td><table><tr><th>Fraction</th><th>Description</th></tr><tr><td>A</td><td>it contains only gases</td></tr><tr><td>F</td><td>it is the most viscous</td></tr><tr><td>F</td><td>it contains bitumen</td></tr></table></td><td></td><td>1
1
1</td></tr>
<tr><td>(c)</td><td>as the number of carbon atoms/it/they increases the boiling point increases</td><td>accept reverse argument

allow positive correlation

ignore (directly) proportional
ignore references to hydrogen atoms</td><td>1</td></tr>
<tr><td colspan="4">Total 5 marks</td></tr>
</table>

Question number	Answer	Notes	Marks
3 (a)	**M1** – C **M2** – (it) has a spot in line with/at the same height as (the spot produced by) bute/an illegal drug	 Accept references to travelling same distance / having same R_f value **M2** dep on **M1**	1 1
(b)	a substance/liquid that dissolves a solute/solid/another substance	Accept it forms a solution with a solute/solid/substance	1
(c)	**M1** $\frac{\text{correctly measured distance for lasix spot}}{\text{correctly measured distance of solvent front}}$ **M2** – any value in range 0.73 – 0.77	Lasix spot 62-64 mm / 6.2-6.4 cm Solvent front 84 mm / 8.4 cm Minimum of 2 dp correct answer with no working scores 2 **M2** csq on **M1**	1 1
(d)	the more soluble the substance the further it will travel	Allow distance increases with (increasing) solubility ignore any reference to proportionality	1
			Total 6 marks

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>4 (a)</td><td><table><tr><th>Description of reaction</th><th>Metal</th></tr><tr><td>it explodes on contact with water</td><td>caesium</td></tr><tr><td>it fizzes gently</td><td>lithium</td></tr><tr><td>it reacts violently and forms a lilac flame</td><td>potassium</td></tr></table></td><td>3 correct = 2 marks
1 correct = 1 mark

accept symbols</td><td>2</td></tr>
<tr><td>(b) (i)</td><td>M1 – hydrogen

M2 – H_2</td><td>ignore symbol or formula even if incorrect

reject H
accept H_2(g) as a product in an equation

ignore name even if incorrect
accept LiOH as a product in an equation</td><td>1

1</td></tr>
<tr><td>(ii)</td><td>M1 – lithium hydroxide

M2 – LiOH</td><td>ignore formula even if incorrect

ignore name even if incorrect</td><td>1

1</td></tr>
<tr><td>(iii)</td><td>M1 – add (red) litmus

M2 - turns blue

OR

M1 – use a pH meter / measure pH

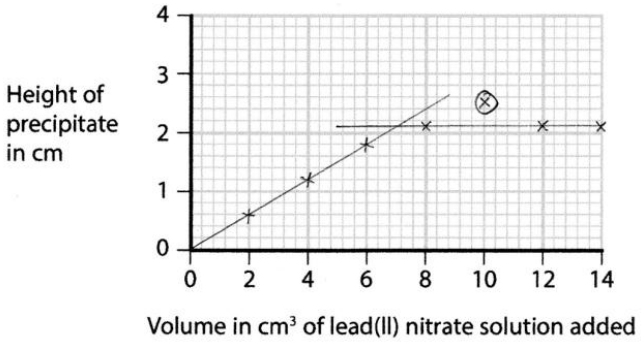
M2 - pH > 7</td><td>accept any named indicator

accept correct colour for named indicator
ignore purple

M2 DEP on M1
do not award M1 or M2 if blue litmus is used</td><td>1

1</td></tr>
<tr><td colspan="4">Total 8 marks</td></tr>
</table>

Question number	Answer	Notes	Marks
5 (a) (i)	**M1** – E **M2** – volume of carbon dioxide/gas (given off) is half / is 30 cm^3 (not 60 cm^3)	 accept volume of carbon dioxide/gas is less accept amount for volume ignore references to rate in (i)	1 1
(ii)	**M1 –** C **M2** – curve levels off later / curve is less steep	 Accept the reaction is slower /carbon dioxide/gas given off <u>more</u> slowly / takes <u>longer</u> for reaction to complete	1 1
(iii)	**M1** – B **M2** – curve levels off earlier / curve is steep<u>er</u>	 Accept the reaction is faster / carbon dioxide/gas given off <u>more</u> quickly / takes <u>less</u> time for reaction to complete ignore references to collision theory throughout part (a) **M2** dep on **M1** correct or missing for all answers to part (a)	1 1
(b)	(Gas) syringe / measuring cylinder (over water) / burette (over water)	Allow graduated tube	1
			Total 7 marks

Question number	Answer	Notes	Marks
6 (a)	<u>all</u> of the sodium chloride has reacted / the sodium chloride has been used up	Accept no more sodium chloride left (to react) Accept sodium chloride is the limiting reagent reject all reactants used up Ignore reaction has stopped/is complete	1
(b) (i)		**M1 & M2** - all points correctly plotted deduct one mark for each point incorrectly plotted **M3** – two straight lines drawn lines must be drawn with the aid of a ruler first line does not need to go through origin second line must be horizontal **M4** – lines intersect **M4** dep on **M3**	2 1 1
(ii)	circle drawn around point (2.5,10)		1
(iii)	A (the precipitate was not allowed to settle before its height was measured)		1
(iv)	no precipitate is produced when no lead(II) nitrate is added	Accept the height of precipitate is (directly) proportional to the volume of lead(II) nitrate (added) Accept the two variables (plotted) are (directly) proportional (to one another)	1 1

(v)	7 (cm^3)	Ignore no reaction / reaction not started accept any value between 6.8 and 7.2	
			Total 9 marks

Question number	Answer	Notes	Marks
7 (a) (i)	(saturated) – <u>all</u> (carbon to carbon) bonds are single / no (carbon to carbon) double bonds	accept no (carbon to carbon) multiple bonds ignore any references to hydrogen	1
(ii)	**M1 -** (compounds/substances/molecules) containing hydrogen and carbon (atoms/elements) **M2** - only	reject atoms/elements/ions/mixture in place of compounds reject compounds/substances/molecules in place of atoms/elements accept other terms with same meaning, e.g. solely, exclusively, just **M2** DEP on mention of hydrogen and carbon / C and H and no other element	1 1
(iii)	**C** (C_5H_{12})		1
(b) (i)	$C_8H_{18} + 12.5O_2 \rightarrow 8CO_2 + 9H_2O$ **M1** – all formulae correct **M2** – balanced using correct formulae	 accept multiples	2
(ii)	carbon monoxide	If both name and formula given, mark name only accept correct formula	1

Question number	Answer	Notes	Marks
7 (c) (i)	(provides an alternative pathway of) lower activation energy	Accept (molecules adsorb onto catalyst and covalent) bonds weakened	1
(ii)	silica/silicon dioxide/alumina/aluminium oxide	accept correct formulae accept aluminosilicate(s) accept zeolite(s) ignore silica oxide and alumina oxide If both name and formula given, mark name only	1
(iii)	C_2H_4	Accept structural or displayed formula	1
(iv)	ethene	accept ethylene	1

Question number	Answer	Notes	Marks
8 (a) (i)	**M1** & **M2** – any two from: • does not melt/high melting point • does not colour the flame • inert/unreactive / does not burn/react with oxygen/air	Ignore general physical properties of metals, eg boiling point	2
(ii)	to remove any substance that may affect the colour	ignore references to removing impurities Allow result/flame for colour	1
(iii)	difficult to see the colour produced by the substance (under test)	Accept flame not hot enough (to vaporise the sample) Accept the temperature is not high enough (to vaporise the sample) Allow flame is (already) coloured	1
(b) (i)	(X) **M1** – sodium **M2** – chloride (Y) **M3** – lithium **M4** – sulfate	Accept symbol in any formula accept Li symbol and SO_4 in any formula accept strontium for **M3**	1 1 1 1
(ii)	iron(II) / Fe^{2+} / Fe^{+2} / Fe^{++}	accept ferrous ignore iron ion if both name and formula given both must be correct	1

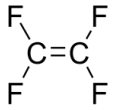
(c)	M1 – add (dilute) acid		1
	M2 – test gas/bubbles/carbon dioxide with limewater	If incorrect gas mentioned, only M1 can be awarded	1
	M3 – limewater turns milky	M3 DEP on mention of gas	1

Question number	Answer	Notes	Marks
9 (a) (i)	green	ignore shades accept yellow-green	1
(ii)	to allow (excess/unreacted) gas to escape/to prevent pressure build up	accept to prevent (the risk of) an explosion/breaking the apparatus	1
(iii)	Chlorine/the gas is toxic/poisonous	ignore harmful, dangerous, etc.	1
(b) (i)	**M1** - $\frac{2.8(000)}{56}$ and $\frac{5.325}{35.5}$ **OR** 0.05(00) and 0.15(00) **M2** – 1:3 **M3 –** $FeCl_3$	award 0/3 if division by atomic numbers / wrong way up / multiplication used do not penalise roundings or minor transcription errors (e.g. 5.235 for Cl) If 71 used for Cl_2, lose **M1** but **M2** and **M3** can be awarded – consequential answer from this error is Fe_2Cl_3 **M2** subsumes **M1** Accept symbols in any order	1 1 1
(ii)	iron(III) chloride	Award 3 marks for correct final answer with no working accept ferric chloride ignore iron chloride accept iron trichloride	1

9 (c)	$Cl_2 + 2\ NaOH \rightarrow NaCl + NaClO + H_2O$ **M1** – all formulae correct **M2** – balanced using correct formulae		2

Question number	Answer	Notes	Marks
10 (a) (i)	$Zn(s) + 2\,HCl(aq) \rightarrow ZnCl_2(aq) + H_2(g)$ **M1** – all formulae correct and equation balanced **M2** – state symbols correct	 **M2** can be awarded for near misses on formulae, e.g. ZnCl and H accept upper case letters for state symbols	2
(b)	**M1** bubbles/fizzing/effervescence **M2** zinc/solid gets smaller/disappears	accept gas given off ignore hydrogen given off accept zinc/solid dissolves / (final) solution is <u>colourless</u> reject zinc melts and other Group 1 observations, eg floats / moves across surface Ignore references to heat and temperature change	2

Question number	Answer	Notes	Marks
10 (c) (i)	<table><tr><th></th><th>Experiment 1</th><th>Experiment 2</th></tr><tr><td>Final burette breading in cm^3</td><td>10.40</td><td>22.70</td></tr><tr><td>Initial burette reading in cm^3</td><td>0.00</td><td>1.90</td></tr><tr><td>Volume of acid added in cm^3</td><td>10.40</td><td>20.80</td></tr></table> **M1** – all four burette readings correct **M2** – subtractions correct **M3** – all six values in table given to 2 decimal places	Ignore trailing zeroes for **M1** and **M2** **M2** CSQ on burette readings given in table	3
(ii)	**M1** – (because) the volume/amount of acid required has doubled **M2** – the concentration is half / 0.37 (mol dm^{-3}) **OR** **M1** for use of an expression such as $V_1c_1 = V_2c_2$ **M2** for indicating how c_2 can be calculated (e.g. because V_1, c_1, and V_2 are known) / for an answer of 0.37 (mol dm^{-3})	Mark independently accept either a calculation or a description	1 1

Question number	Answer	Notes	Marks
11 (a) (i)		ignore bond angles Ignore brackets and n Do not penalise Fl	1
(ii)	**M1** – a long chain (molecule)	accept large molecule / macromolecule	1
	M2 – formed when (many) small molecules/monomers join (together)	Accept react/bond/add/link for join	1
(iii)	poly(tetrafluoroethene)/poly(tetrafluoroethylene)	accept names without brackets Ignore minor spelling errors Ignore PTFE accept Teflon	1
(b)	**M1** (name) – ethene	accept ethylene	1
	M2 (formula) – C_2H_4	reject structural or displayed formula Penalise inappropriate use of upper and lower case letters or numbers No penalty for correct answers on wrong lines	1

(c)	**M1** – (they) do not biodegrade **M2** – (because) they are inert / do not react / are unreactive	accept not broken down by bacteria / microbes / decomposers / microorganisms / enzymes ignore do not react with any named chemical ignore references to bond strengths / bond breaking Mark independently	1 1

Question number	Answer	Notes	Marks
12 (a)	copper	ignore symbol reject copper(II) / copper(II) ions / Cu^{2+}	1
(b)	zinc cannot displace itself	Accept zinc cannot react with zinc ions/zinc nitrate Accept the two metals involved have the same reactivity	1
(c)	aluminium zinc M copper **M1** – aluminium at top <u>and</u> copper at bottom **M2** – zinc above M	 award **M2** irrespective of where zinc is placed in the list	2

(d) (i)	oxidation <u>and</u> reduction occur **OR** electron loss <u>and</u> electron gain occur **OR** oxidation number increase <u>and</u> decrease	reject references to oxygen Accept electron transfer Ignore species involved	1
(ii)	**M1** – Ag^+/silver <u>ion</u>(s)		1
	M2 – it gains electron/is reduced **OR** it takes electrons from Mg/magnesium (atoms) **OR** its oxidation number decreases **OR** it causes the oxidation number of Mg to increase	**M2** DEP on **M1** or near miss, e.g. Ag	1

Question number	Answer	Notes	Marks
13 (a)	measuring cylinder/measuring jug	accept burette/pipette	1
(b)	no more bubbles/fizzing/effervescence/gas given off **OR** solid/zinc carbonate can be seen in the beaker **OR** the solid/zinc carbonate stops disappearing/dissolving **OR** a suspension (of zinc carbonate) forms **OR** the liquid turns cloudy	allow solid remains in the solution ignore the reaction stops	1
(c)	filtration	accept filtering accept centrifuging	1
(d)	**M1** – heat/boil to partially evaporate (the water) **M2** – leave to crystallise / leave until crystals form **M3** – filter (to remove excess liquid) **M4** – appropriate method of drying crystals	accept to remove some of the water accept heat to form a saturated/concentrated solution / heat until crystals form on (cold) glass rod / heat until crystals (just start to) form If evaporated to dryness then award no marks for whole question accept leave to cool accept pour off/decant (excess) liquid e.g. use filter paper/blotting paper/kitchen towel / leave in (warm) oven/drying oven Accept leave to dry Do not accept hot oven/heat with a Bunsen flame	1 1 1 1

Question number	Answer	Notes	Marks
14 (a) (i)	**M1** – (covalent) bonds have to be broken	any mention of ions / metallic bonding / molecules / intermolecular forces scores 0/2	1
	M2 – large amount of energy required / bonds are strong	Accept large number of bonds to be broken Accept forces (of attraction) between <u>atoms</u> in place of bonds	1
(ii)	the (covalent) bonding in silicon dioxide is stronger (than the (ionic) bonding in sodium chloride)	Accept the covalent bonds (in silicon dioxide) are stronger than the ionic bonds (in sodium chloride) Accept more energy is required to break the (covalent) bonds in silicon dioxide (than is required to break the (ionic) bonds in sodium chloride) Accept forces (of attraction) between <u>atoms</u> in place of bonds	1
(b)	<u>ions</u> flow/move (to the electrodes)	Accept ions are mobile/can move reject electrons	1
(c)	weak forces (of attraction) between <u>molecules</u> / weak <u>intermolecular</u> forces (of attraction) / little energy is required to separate <u>molecules</u>	Accept boiling point is below room temperature reject any mention of covalent bonds broken	1

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>15 (a)</td><td>
<table>
<tr><td>Titration number</td><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>Volume of $KMnO_4$ solution added / cm^3</td><td>22.80</td><td>22.10</td><td>22.50</td><td>22.20</td></tr>
<tr><td>Concordant titration results (✓)</td><td></td><td>✓</td><td></td><td>✓</td></tr>
</table>
</td><td></td><td>1</td></tr>
<tr><td>(b)</td><td>M1 - $\frac{22.1(0) + 22.2(0)}{2}$

M2 – 22.15 (cm^3)</td><td>CSQ on boxes ticked in (a)
If no results ticked, award M1 only if columns 2 and 4 averaged
If only one result ticked, no marks can be awarded in (b)

CSQ on results averaged, but the results must be taken from the table

Answer must be to 2dp

correct answer with no working scores 2</td><td>1

1</td></tr>
<tr><td>(c)</td><td>D (pipette)</td><td></td><td>1</td></tr>
</table>

Question number	Answer	Notes	Marks
15 (d) (i)	**M1** - $\frac{20(.00) \times 0.02(00)}{1000}$		1
	M2 - 4(.00) x 10^{-4} (mol)	0.4(00) scores 1	1
(ii)	5 x **M2** from (i) / 4(.00) x 10^{-4} x 5 / 2(.00) x 10^{-3}		1
(iii)	10 x answer to (ii) / 2(.00) x 10^{-2}		1
(iv)	answer to (iii) x 152 / (2(.00) x 10^{-2} x 152) = 3.04 (g)		1
(e) (i)	$m(H_2O)$ = (24.2 – 15.2) = 9(.0) (g)		1
(ii)	answer to (i) ÷ 18 / $n(H_2O)$ = (9.00 ÷ 18) = 0.5(0) (mol)		1
(iii)	$n(FeSO_4)$ = (15.2 ÷ 152) = 0.1(00) (mol)		1
(iv)	x = answer to (ii) ÷ answer to (iii) / 5	must be given as a whole number	1

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