Mark Scheme (Results)

January 2015

Pearson Edexcel International GCSE in Chemistry (4CHO) Paper 1C

Pearson Edexcel Certificate in Chemistry (KCH0) Paper 1C

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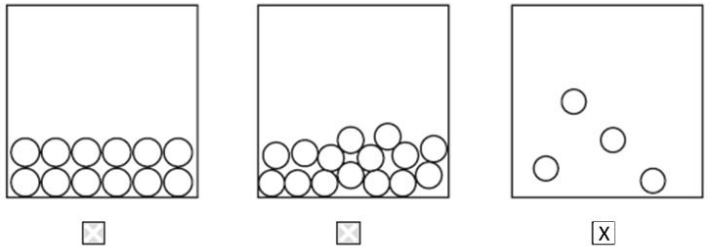
General Marking Guidance

- 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.

Question number			Answer	Notes	Marks
1	a		 ☐ ☐ ☒		1
	b	i	A (an electron)		1
		ii	B (a neutron)		1
		iii	B (electrons and protons)		1
	c		isotopes		3
			atomic numbers		
			mass numbers		
					Total 7 marks

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>2 a i</td><td>tick for P = chromatography
tick for Q = fractional distillation
tick for R = filtration
tick for S = simple distillation
<table><tr><th colspan="2" rowspan="2">Separation</th><th colspan="4">Method of separation</th></tr><tr><th>Chromatography</th><th>Simple distillation</th><th>Filtration</th><th>Fractional distillation</th></tr><tr><td>P</td><td>red ink from a mixture of coloured inks</td><td>✓</td><td></td><td></td><td></td></tr><tr><td>Q</td><td>ethanol from a mixture of ethanol and water</td><td></td><td></td><td></td><td>✓</td></tr><tr><td>R</td><td>sand from a mixture of sand and water</td><td></td><td></td><td>✓</td><td></td></tr><tr><td>S</td><td>water from copper(II) sulfate solution</td><td></td><td>✓</td><td></td><td></td></tr></table></td><td></td><td>1
1
1
1</td></tr>
<tr><td>ii</td><td>R</td><td>Accept (sand from a mixture of) sand and water</td><td>1</td></tr>
<tr><td>b</td><td>  </td><td>M1 for B in first box AND D in last box

M2 for A in box 3 AND C in box 4

M2 dependent on M1 correct</td><td>1

1</td></tr>
<tr><td colspan="3"></td><td>Total 7 marks</td></tr>
</table>

Question number	Answer	Notes	Marks
3 a	burns with a pop/squeak OR use burning/lit splint/flame to see if pop/squeak	Must be reference to test and result Reference to splint/match with no indication of flame is not enough Ignore flame extinguished Reject reference to glowing splint Squeaky pop test on its own is not enough	1
b i	anhydrous/white copper sulfate turns blue OR anhydrous/blue cobalt chloride turns pink	Ignore colourless Accept correct formula Incorrect formula (eg CuSO) counts as near miss Accept correct formula Incorrect formula (eg CoCl) counts as near miss M2 DEP on M1 or near miss	2
ii	measure boiling point / freezing point	Accept boil it / freeze it Ignore heat	2
	100 (°C) / O (°C)	Value must match property Ignore units	
		Answers such as boils/distils at 100 °C / freezes at 0 °C score M2 only	

Question number	Answer	Notes	Marks
3 b iii	cross by carbon dioxide from the air reacts to cause the cloudiness cross by the cloudiness is caused by the formation of a white precipitate ☐ carbon dioxide forms when the hydrogen burns ☒ carbon dioxide from the air reacts to cause the cloudiness ☐ the cloudiness is caused by the formation of calcium hydroxide ☒ the cloudiness is caused by the formation of a white precipitate ☐ the reaction in the limewater is an example of oxidation	If 3 boxes crossed then max 1 If 4 or more boxes crossed then 0	2
			Total 7 marks

Question number	Answer	Notes	Marks
4 a i	reactants labelled wrong way round / OWTTE	Accept manganese(IV) oxide is the solid OR hydrogen peroxide is the liquid Ignore just manganese(IV) oxide/hydrogen peroxide is wrongly labelled	1
ii	bung / cork	Accept stopper Ignore plug	1
iii	to prevent oxygen/gas from escaping OR (without a bung), oxygen/gas would escape/could not be collected	Do not penalise wrong gas, such as hydrogen	1
b	use a (gas) syringe	Accept collect in gas jar by displacement of air in place of syringe	1
c	2 2 (1)	Accept multiples and fractions	1

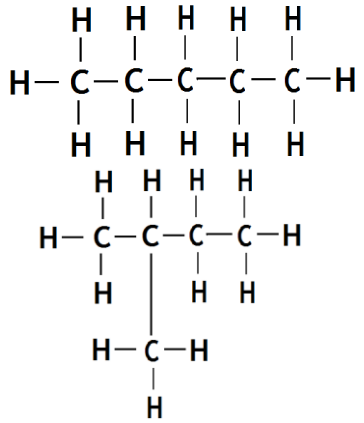
Question number	Answer	Notes	Marks
4 d	(a substance that) increases rate of reaction / speeds up reaction / decreases time of reaction is (chemically) unchanged (at the end) OR mass does not change	Ignore change/decrease in rate Ignore references to element / compound Accept is not used up / does not change Accept reference to lowering activation energy Ignore reference to alternative route Ignore references to yield Ignore reference to not reacting or taking part in reaction Ignore refs to being physically unchanged Ignore references to starting reaction Reject reference to providing/increasing energy for M2 Reject reference to incorrect statement such as removes impurities for M2	1 1
e	(approximately) vertical line between hydrogen peroxide and top of curve AND labelled activation energy / E_a	ignore arrowheads on vertical line	1
	curve starting from hydrogen peroxide line and ending at water + oxygen line AND peak below peak of original curve	Accept near misses, such to and from words Accept curve leaving or joining original curve Do not penalise more than one peak	1
			Total 9 marks

Question number	Answer	Notes	Marks
5 a i	4		1
ii	B (hydrated)		1
b i	aluminium hydroxide AND sodium sulfate	Accept in either order Ignore formulae / oxidation numbers	1
ii	smothers/blankets the fuel/fire / sinks onto to fuel/fire	Accept high density / higher density than air/oxygen Ignore heavier than air/oxygen	1
	(therefore) prevents oxygen/air from reaching the fuel/fire	Accept does not support combustion Ignore carbon dioxide does not burn	1
c i	$Al(OH)_3$ has (s) / is solid /is insoluble / its ions not free / its ions not released		1
	H_2SO_4 has (aq) / is a solution AND (H^+) ions are released		1
ii	B (5.5)		1
			Total 8 marks

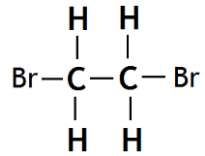
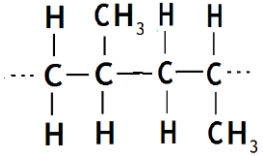
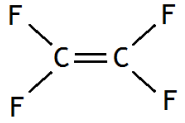
Question number	Answer	Notes	Marks
6 a	C (diffusion)		1
b	ammonia (moves more quickly) AND it travels further /white solid is close(r) to the HCl end / further from the NH_3 end	Ignore reference to solution Ignore reverse argument for HCl Ignore references to reacting more quickly	1
c i	sodium hydroxide / NaOH ammonia / NH_3 blue	Accept other suitable alkalis Reject ammonium Reject all other colours M3 DEP on M2 or near miss	1 1 1
ii	to remove carbonate (ions)/sulfite (ions)	Accept to prevent other ions interfering / to prevent other precipitates from forming Ignore to make sure other reactions do not occur	1
iii	silver nitrate / $AgNO_3$ silver chloride / AgCl	If both name and formula given, both must be correct	1 1
			Total 8 marks

Question number	Answer	Notes	Marks
7 a	fractional distillation/fractionating column/tower (crude oil) heated/vaporised / boiled cooler at top/hotter at bottom/idea of temperature gradient fractions condense /separate at different heights/levels fractions have different boiling points/ranges	Reference to fractional / fractionating needed Ignore references to fracking Accept components / hydrocarbons / compounds / gases Accept separate at different temperatures Ignore references to melting point Any four for 1 mark each If any reference to cracking, MAX 2 M1 - M4 can be scored from suitably labelled diagram	4

Question number	Answer	Notes	Marks
7 b i	C_nH_{2n+2}	Do not penalise inappropriate spaces or failure to show 2 and n as subscripts	1
ii	same/similar chemical properties/reactions/behaviour/characteristics gradation / gradual change / trend / increase / decrease of physical properties same functional group (neighbouring) members differ by CH_2	Ignore specific examples such as react with oxygen Ignore similar (type of) reactivity Do not penalise reference to trends Accept reference to specific property, eg boiling point Reject same / similar physical properties Ignore variable physical properties Ignore reference to specific group Any two for 1 each Accept two answers on one answer line Ignore any reference to properties not specified as physical or chemical	2
c	(1) 5 3 4	Accept multiples and fractions	1
d i	carbon monoxide / CO		1
ii	reduces capacity of blood to carry oxygen / OWTTE	Accept correct explanation involving haemoglobin Ignore references to carbon monoxide reacting with blood / red blood cells	1
iii	nitrogen/N_2 AND oxygen/O_2	Accept in either order Ignore N and O	1

Question number	Answer	Notes	Marks
7 e		Penalise missing H atoms once only provided all bonds are correctly shown Penalise missing bonds in both structures	1 1

Question number	Answer	Notes	Marks
7 f i	setting out correct division of each % by A_r OR 4.4, 11.1 and 1.1	Award 0/3 if division by any atomic numbers / wrong way up / multiplication used / wrong atomic mass (eg 16 for C) Do not penalise roundings and minor misreads of % values, eg 11 for H and 36.5 for S If molecular mass used for H, no M1, but can award M2 and M3 but no CQ in ii Using 2 for H gives C_4H_5S Working required for this answer	1
	division by smallest /ratio of 4 : 10 : 1	M2 subsumes M1	1
	$C_4H_{10}S_{(1)}$	Accept elements in any order Award 3 for correct final answer with no working No ECF from M2 Accept use of 90 from ii, i.e. 90 × 0.533 = 48 etc scores M1 ratio scores M2, answer scores M3	1
ii	$C_4H_{10}S_{(1)}$	Accept elements in any order No other answer acceptable	1
			Total 17 marks

Question number	Answer	Notes	Marks
8 a	hydrogen / H_2	Ignore H	1
b	only single bonds (between carbon atoms) /single bond(s) between carbon atoms	ignore between C and H Accept no double bond(s) / no multiple bond(s) Ignore answers that refer to numbers of hydrogens	1
c i		Accept Br atoms in any position provided one on each carbon	1
ii	C (the product of the reaction is colourless)		1
d		M1 for 4 × C AND 6 × H and 2 × CH_3 M2 for extension bonds and two CH_3 groups on alternate carbon atoms (can be both above or both below carbon chain) M2 DEP on M1 Do not penalise bonds to H of CH_3 Ignore brackets and subscripted n If any double bond shown, then 0/2	2
e		Reject any extension bonds Ignore bond angles Do not penalise more than one correct structure	1

Question number	Answer	Notes	Marks
8 f i	(polymer) breaks down / decomposes / decays	Do not penalise compound / object / molecule / substance in place of polymer Reject element in place of polymer Ignore rots / degrades / digests / disintegrate If reference to <u>not</u> breaking down etc, only M2 can be awarded	1
	by bacteria / microbes / microorganisms	Ignore naturally / enzymes	1
ii	inert / unreactive / OWTTE	Ignore do not react with named chemical Ignore references to bond strengths / bond breaking	1
			Total 10 marks

Question number	Answer	Notes	Marks
9 a	C (lithium reacts with water to form an alkali)		1
b	A (have the same number of outer shell electrons)		1
c	(similar) bubbles / fizzing / effervescence OR moves / darts / floats OR gets smaller / disappears potassium shows a flame / sparks / explodes OR potassium melts / forms ball	Accept gas given off /evolved/formed/produced Accept hydrogen gas Ignore identity of gas Accept dissolves Accept reverse arguments for lithium	1 1
d	K_2O KCl	Accept K_2O_2 and KO_2 Reject KO If formula shown as product of an equation, ignore reactants and balancing Ignore coefficients	1 1
e	s l aq g		1
f	85 AND 87 calculated (even if not identified) (85 × 0.72) + (87 × 0.28) = 85.6	Accept 37+48 and 37+50 Correct final answer = 2 marks 85.5 or 85.56 = 1 mark No ECF from incorrect mass numbers Ignore units	1 1
			Total 9 marks

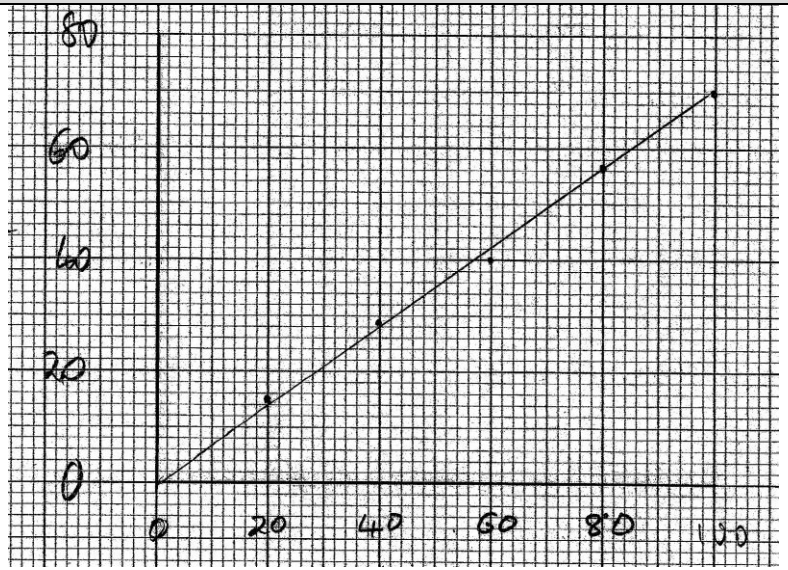
Question number	Answer	Notes	Marks
10 a	mix / add / react (the two) solutions / salts together stir filter wash (with water) suitable method of drying identifying two suitable pieces of apparatus	Ignore references to volumes Accept swirl Accept description of filtration eg warm / heat / place in oven / leave on window ledge / leave to dry / dry with filter paper or kitchen towel Not just dry Any four above for 1 mark each If M3 not scored then M4 and M5 cannot be awarded If description of evaporation of solution, then M4 and M5 cannot be awarded Any two of • beaker / flask / test tube (for mixing) • (glass) rod (for stirring) • (filter) funnel/paper (for separation) Reference to filter paper or filter funnel scores M3 and counts as one of M6 If any other substance added, then MAX 4	4 1

Question number	Answer	Notes	Marks
10 b i	B (the products are both elements)		1
ii	electrons on wrong side / should be on right /should be $-2e^-$	Accept + in front of electrons (should be —)	1
	2Br should be Br_2	Accept product is shown as a bromine atom / should be shown as a bromine molecule Equation correctly rewritten scores both marks	1
iii	ions stop moving / ions not free to move OR electrons stop moving (through wires)	Ignore liquid becomes solid / no free ions Accept electric current in place of electrons Reject implication that electrons stop flowing through liquid	1
			Total 9 marks

Question number	Answer	Notes	Marks
11 a i	pipette		1
ii	pink	Ignore purple Accept red	1
	colourless	Ignore clear Ignore white Award 1 mark for both colours correct in wrong order	1
b	(after) 23.15 (before) 1.40 (added) 21.75	 CQ on before and after readings Award 1 mark for both readings correct but in wrong order All values must be to 2 dp Penalise answers to other than 2 dp once only	1 1 1
c i	ticks in columns 3 and 4		1
ii	$\frac{21.10 + 21.20}{2}$	CQ on any combination of ticked results If no results ticked, award M1 if only columns 3 and 4 averaged If only 1 result ticked, then no marks can be awarded in (c)	1
	21.15	CQ on results averaged - see separate table Answer should be to 2 dp, except that trailing zero not needed Correct final answer without working scores 2	1

Question number	Answer	Notes	Marks
11 d i	0.300 × $\frac{200}{1000}$		1
	0.06(00) (mol)	Correct final answer scores 2 marks 60 scores 1 mark in di No marks for answers such as 0.6 / 6 / 600	1
clip ii	di ÷ 2 / 0.03(00) (mol)		1
clip iii	M_r = 98	Award 1 mark for 98 anywhere in iii	1
	2.94 (g)	ECF from incorrect M_r Moles CQ on ii Must be 2 or more sig figs	1
			Total 14 marks

Question number	Answer	Notes	Marks
12 a	mass / amount	Accept weight Ignore number of marble chips	1
	surface area / size / volume	Ignore length / width / height / thickness / shape / type Ignore temperature / purity / density	1
b	gas/carbon dioxide escapes / OWTTE	Ignore references to solid dissolving Ignore references to acid spray / vapour Do not penalise incorrectly named gas (eg hydrogen)	1
c	prevents loss of acid (spray)/liquid	Ignore references to evaporation / water vapour / spilling of liquid Reject references to stopping gases/marble chips escaping	1
d i	210 (s)		1
	some indication of mark on curve OR vertical line from 50% / horizontal line from 210 s	Mark M1 and M2 independently	1
ii	B (the loss of mass was greater than 1.0g		1
e	1 ÷ 210	Accept any time value in range 200 - 210	1
	evaluation of M1 / 0.00476	Accept answer in range 0.004- 0.005 Accept any number of sig fig	1

Question number	Answer	Notes	Marks
12 f	 all five points plotted to nearest gridline straight line of best fit	Deduct 1 mark for each error up to max 2 Line need not be extrapolated to origin If line not extrapolated, it should go to the origin if extrapolated Must be drawn with a ruler CQ on candidate's plotted points	2 1

Question number	Answer	Notes	Marks
12 g	more particles (in a given volume)	Accept ions Reject atoms / molecules Accept quantitative answer such as twice as many particles when concentration doubles	1
	more collisions (between particles) / OWTTE		1
	per unit time / OWTTE	more frequent collisions scores M2 and M3 Ignore greater chance/likelihood of collisions Accept reverse argument if clear that decreasing concentration is being considered MAX 1 if any reference to particles moving faster / having more energy	1
			Total 15 marks

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