



Mark Scheme (Results)

Summer 2017

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

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

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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)	D (Br_2) The only correct answer is D A is not correct because Br is the symbol for bromine B is not correct because the 2 is a superscript not a subscript C is not correct because the 2 is not a subscript		1
(b) (i)	B (diffusion) The only correct answer is B A is not correct because condensation is the change of state from a gas to liquid C is not correct because evaporation is change of state from a liquid to gas D is not correct because the change of state from sublimation is solid to gas		1
(ii)		ALLOW particles evaporate	2

	M1 the bromine/liquid evaporates / the particles escape (from the liquid) M2 (bromine fills the gas jar because) the (gas) particles move freely/randomly/constantly	ALLOW (gas) particles spread ALLOW particles move from a high concentration to low (concentration) IGNORE references to diffusion ACCEPT molecules for particles REJECT atoms once only	
(c)	C The only correct answer is C A is not correct because NH_3 gas diffuses faster HCl gas B is not correct because NH_3 gas diffuses faster HCl gas D is not correct because the position indicated is too close to the right hand end of the tube		1
		Total	5

Question number	Answer	Notes	Marks								
2 (a)	M1 oxygen M2 water (vapour)	ACCEPT O₂ IGNORE O IGNORE air ACCEPT moisture ACCEPT H₂O If both name and formula given, mark name only	2								
(b)	<table><tr><th>Item</th><th>Method</th></tr><tr><td>bicycle chain</td><td>oiling</td></tr><tr><td>bridge</td><td>painting / galvanising</td></tr><tr><td>car body</td><td>painting / galvanising</td></tr></table>	Item	Method	bicycle chain	oiling	bridge	painting / galvanising	car body	painting / galvanising		3
Item	Method										
bicycle chain	oiling										
bridge	painting / galvanising										
car body	painting / galvanising										
(c)	D (zinc) The only correct answer is D A is not correct because zinc is the only metal used to galvanise iron B is not correct because zinc is the only metal used to galvanise iron C is not correct because zinc is the only metal used to galvanise iron		1								
		Total	6								

Question number	Answer	Notes	Marks										
3 (a)	<table><tr><th>Separation</th><th>Method</th></tr><tr><td>to obtain sand from a mixture of sand and water</td><td>filtration</td></tr><tr><td>to separate crude oil into its components</td><td>fractional distillation</td></tr><tr><td>to obtain pure water from salt water</td><td>simple distillation</td></tr><tr><td>to obtain ethanol from a mixture of ethanol and water</td><td>fractional distillation</td></tr></table>	Separation	Method	to obtain sand from a mixture of sand and water	filtration	to separate crude oil into its components	fractional distillation	to obtain pure water from salt water	simple distillation	to obtain ethanol from a mixture of ethanol and water	fractional distillation		4
Separation	Method												
to obtain sand from a mixture of sand and water	filtration												
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to obtain ethanol from a mixture of ethanol and water	fractional distillation												
(b) (i)	M1 (add to) <u>anhydrous/white</u> copper(II) sulfate M2 turns blue OR M1 add to cobalt(II) chloride paper / cobalt chloride paper M2 turns pink	ACCEPT turns copper(II) sulfate from white to blue for 2 marks ACCEPT blue cobalt(II) chloride ALLOW anhydrous cobalt(II) chloride ACCEPT turns cobalt(II) chloride from blue to pink for 2 marks M2 DEP on M1 or near miss e.g. just copper(II) sulfate IGNORE any reference to testing with indicators	2										

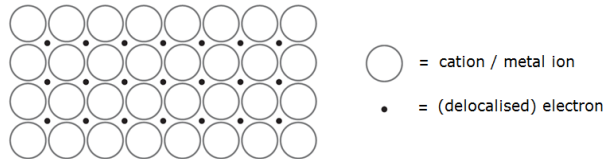
Question number	Answer	Notes	Marks
3 (b) (ii)	M1 measure/determine/test its boiling point M2 100 °C OR M1 measure/determine/test its freezing point M2 0 °C OR M1 measure/determine/test its density M2 1 g/cm³	ACCEPT boil it / heat until it boils it boils at 100 °C ALLOW its boiling point is 100 °C for 1 mark ALLOW heat it and it boils at 100 °C for 2 marks ACCEPT freeze it / cool until it freezes it freezes at 0 °C ALLOW its freezing point is 0 °C for 1 mark ALLOW cool it and it freezes at 0 °C for 2 marks ALLOW its density is 1 g/cm³ for 1 mark M2 DEP on M1 throughout	2
		Total	8

Question number	Answer	Notes	Marks
4 (a) (i)	B (the number of protons in an atom) The only correct answer is B A is not correct because atomic number is not the number of neutrons in an atom C is not correct because atomic number is not the number of protons plus the number of electrons in an atom D is not correct because atomic number is not the number of protons plus the number of neutrons in an atom		1
(ii)	C (electrons in the outer shell) The only correct answer is C A is not correct because the number of protons does not determine chemical properties B is not correct because the number of neutrons does not determine chemical properties D is not correct because the number of protons and neutrons does not determine chemical properties		1

(b)							One mark for each correct row	3	
		Li	Be	B	C	N			F
	melting point				high	low			low
	structure	giant			giant	molecular			
	acid-base character of the oxide	basic			acidic	acidic	acidic		
							Total	5	

Question number	Answer	Notes	Marks
5 (a) (i)	add acid before magnesium	ORA	1
(ii)	a burette has a better resolution (than a measuring cylinder)	ALLOW greater accuracy (of data) ALLOW greater precision (of data)	1
(b)	M1 and M2 all points plotted correctly to the nearest gridline for both experiments M3 suitable curve of best fit drawn for acid X M4 suitable curve of best fit drawn for acid Y	Deduct one mark for each incorrectly plotted point Missing (0,0) loses 1 mark only	4

Question number	Answer	Notes	Marks
5 (c)	M1 Y (has the greater concentration) M2 (because) the curve (for acid Y) has a steeper slope/greater gradient (showing that the reaction is faster) OR (because) it produces the larger volume of gas/more gas in the same time	M1 DEP M2 OWTTE Mark CSQ on candidate's labelling of their curves If no labelling assume steeper curve is acid Y	2
(d)	M1 vertical line drawn to touch curve at $t = 70$ s OR horizontal line drawn to touch curve at $t = 70$ s M2 value read correctly from candidate's graph to nearest gridline	Expected value in range 16-17 (cm^3)	2
(e)	M1 $17 \text{ (cm}^3\text{)}$ M2 $(17 \div 30) = 0.57 \text{ (cm}^3\text{/s)}$	ACCEPT value read correctly from candidate's graph to nearest gridline ACCEPT any number of sig figs e.g. 0.6, 0.567, 0.56 recurring Mark M2 CSQ on M1	2
		Total	12

Question number	Answer	Notes	Marks
6 (a) (i)	 ○ = cation / metal ion • = (delocalised) electron M1 minimum of 5 circles in regular pattern in at least two rows M2 circle(s) labelled cation(s)/metal ion(s)/positive ion(s)/atom(s) M3 spread of electrons in between circles AND labelled	IGNORE different numbers of ions and electrons + drawn in circle is sufficient IGNORE particle e or e⁻ is sufficient	3
(ii)	M1 delocalised electrons M2 are able to flow (in an electric field)	ACCEPT sea of electrons IGNORE free electrons ACCEPT are able to move / are mobile IGNORE references to carrying a charge/current M2 DEP on mention of electrons Any mention of ions/atoms/nuclei/protons moving scores 0/2	2

Question number	Answer	Notes	Marks
6 (a) (iii)	M1 strong (electrostatic) forces (of attraction) between cations/metal ions and (delocalised) electrons M2 large amount of (thermal/heat) energy needed to overcome the forces	ACCEPT strong forces (of attraction) between nuclei of atoms and (delocalised) electrons ACCEPT strong metallic bonding / metallic bonds Not just strong bonds Not just heat Not just more energy M2 DEP on M1 or near miss, e.g. strong bonds Any mention of ionic bonds or covalent bonds or intermolecular forces being broken or overcome scores 0/2	2

Question number	Answer	Notes	Marks
6 (b)	M1 (Cu ²⁺) blue precipitate M2 (Fe ²⁺) green precipitate	IGNORE shades IGNORE names of precipitates or formulae REJECT any other colours Both colours correct but no mention of precipitates score 1/2	2
(c) (i)	it is unreactive / it is not very reactive / it is low in the reactivity series	ACCEPT it is not as reactive as iron/it is below iron in the reactivity series IGNORE inert	1
(ii)	CO ₂ + C → 2CO / 2C + O ₂ → 2CO	ACCEPT multiples and halves	1
(iii)	M1 iron / Fe M2 (because) it loses oxygen / because oxygen has been removed M2 DEP on M1	ALLOW it loses O IGNORE gains electrons ALLOW the iron(III) <u>ion</u> / Fe ³⁺ (is reduced because it) has gained electrons for 1 mark ALLOW Iron(III) oxide/Fe ₂ O ₃ /Fe ³⁺ (is reduced because it) has lost oxygen for 1 mark	2
(iv)	M1 calcium carbonate decomposes/forms/changes into calcium oxide M2 calcium oxide reacts with silicon dioxide/silica	ACCEPT limestone for calcium carbonate ACCEPT correct chemical equations IGNORE sand ALLOW calcium carbonate reacts with silicon dioxide for 1 mark IGNORE reacts with impurities	2
		Total	15

Question number	Answer	Notes	Marks
7 (a) (i)	silver does not react with (dilute sulfuric) acid	ACCEPT silver is below hydrogen in the reactivity series IGNORE silver is unreactive / silver has a low reactivity / silver is inert	1
(ii)	D (zinc and sulfuric acid) The only correct answer is D A is not correct because copper does not react with dilute sulfuric acid B is not correct because gold does not react with dilute hydrochloric acid C is not correct because the reaction between potassium and dilute hydrochloric acid is explosive and therefore not safe		1
(b) (i)	Experiment 3 because the volume collected is much lower than / very different to the other three	ACCEPT any answer that suggests the result/value in experiment 3 is much lower/much different to the other three e.g. it is much lower than the other three or there is a large difference between it and the other three	1

(ii)	M1 chooses 64, 67 and 63 M2 65 (cm³)	ACCEPT 194 ACCEPT any number of sig figs except 1 eg 64.7 / 64.67 / 64.667 / 64.6 recurring Correct answer with no working scores 2 ALLOW 1 mark for correct calculation using all four volumes (58.5 / 59)	2
(iii)	to increase the validity/reliability (of the measurements/data)	ACCEPT to check for anomalous results IGNORE references to increased accuracy	1
		Total	6

Question number	Answer	Notes	Marks
8 (a)	M1 $(54.4 \div 127) = 0.428$ AND $(45.6 \div 35.5) = 1.28$ M2 Divide by the smaller number to obtain 1:3 ratio OR $0.428:1.28 = 1:3$	ACCEPT any number of sig figs except 1, but allow use of 0.4 in calculation of ratio in M2 ALLOW answers to M1 given as fractions only if it is clear that division by smaller has taken place to obtain a ratio	2
(b) (i)	M1 rate of forward reaction = rate of backward reaction M2 amounts/concentrations/masses of reactants (and products) remain constant / constant macroscopic properties	IGNORE forward reaction = backward reaction IGNORE amounts/concentrations of reactants and products are equal	2
(ii)	M1 (liquid) (contains) ions that can flow/move/are mobile M2 (solid) (does not contain any) charged particles that can flow/move/are mobile	IGNORE references to carry charge REJECT any reference to electrons moving ACCEPT molecules are not charged/are neutral ACCEPT no electrons that can flow/move/are mobile ACCEPT no delocalised electrons ACCEPT no sea of electrons IGNORE free electrons REJECT any suggestion that the solid is ionic or contains ions	2
		Total	6

Question number	Answer	Notes	Marks
9 (a) (i)	halogens are poisonous/toxic	ACCEPT any named halogen IGNORE harmful/dangerous/irritant IGNORE (named) products are toxic	1
(ii)	M1 chlorine most reactive AND iodine least reactive OR chlorine > bromine > iodine M2 chlorine glows most brightly / glows very brightly AND iodine glows least brightly / glows dimly	IGNORE reactivity of the halogens decreases down the group IGNORE references to heat given out	2
(iii)	M1 the statement/student is incorrect M2 because vapours/gases were used (so the physical states at room temperature are irrelevant)	ACCEPT the reactivity can be found M1 DEP on M2	2

Question number	Answer	Notes	Marks
9 (b) (i)	$\text{H}_2 + \text{Br}_2 \rightarrow 2\text{HBr}$	ACCEPT multiples and halves	1
(ii)	M1 bonding pair of electrons M2 non-bonding pairs correct	M2 DEP on M1 ALLOW any combination of dots and crosses If overlapping/touching circles used both electrons must be within the overlapping/touching area IGNORE inner electrons on chlorine even if incorrect	2
(iii)	hydrochloric acid		1
		Total	9

Question number	Answer	Notes	Marks
10 (a) (i)	M1 (magnesium ribbon) shiny / silvery	IGNORE grey	2
	M2 (magnesium oxide) white (powder/solid/smoke/ash)	IGNORE grey	
(ii)	(lift the lid) to allow oxygen into the crucible	ACCEPT air ACCEPT to allow magnesium to react with <u>oxygen</u>	2
	(replaces the lid) minimise the loss of magnesium oxide/product	ACCEPT smoke for magnesium oxide ALLOW prevent the loss of magnesium oxide, etc	
(b)	M1 $n[\text{Mg}] = 0.6 \div 24$ OR 0.025 (mol) M2 mass of $\text{O}_2 = 0.4$ (g) OR (M1 $\div 2$) $\times 32$ evaluated correctly Alternative method M1 48 (g) require 32 (g) M2 0.6 (g) require 0.4 (g)		2
(c)	$3\text{Mg} + \text{N}_2 \rightarrow \text{Mg}_3\text{N}_2$	ACCEPT multiples and halves	1
		Total	7

Question number	Answer	Notes	Marks
11 (a) (i)	D (C_nH_{2n+2}) The only correct answer is D A is not correct because C_nH_n is not the general formula for the alkanes B is not correct because C_nH_{2n-2} is not the general formula for the alkanes C is not correct because C_nH_{2n} is not the general formula for the alkanes		1
(ii)	C (C_nH_{2n}) The only correct answer is C A is not correct because C_nH_n is not the general formula for the cycloalkanes B is not correct because C_nH_{2n-2} is not the general formula for the cycloalkanes D is not correct because C_nH_{2n} is not the general formula for the cycloalkanes		1

(iii)	Any two from: M1 similar/same chemical properties M2 graded physical properties / trend in physical properties M3 same functional group M4 each member differs (from the previous member) by CH₂	ALLOW they all react in the same way/in a similar way ACCEPT description of a graded physical property e.g. boiling increases as number of carbon atoms increases IGNORE different physical properties	2
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Question number	Answer	Notes	Marks
11 (b)	(i)	(the molecule) contains only single bonds	1
	(ii)	ACCEPT contains no (carbon-carbon) double bonds/multiple bonds IGNORE references to no more atoms can be added, or contains the maximum number of hydrogen atoms IGNORE bond angles	1
	(iii)	IGNORE bond angles	1
(c)	(i)	ultraviolet/uv (light/radiation)	1
	(ii)	ALLOW sunlight IGNORE references to temperature or catalyst ACCEPT any number of bromine atoms substituted	1
Total			9

Question number	Answer	Notes	Marks
12 (a)	M1 add water (and stir) M2 filter	ALLOW dissolve in water ACCEPT description of filtration ACCEPT decant M2 DEP on M1 M2 not scored if any mention of evaporating the solution	2
(b) (i)	M1 (cation) ammonium / NH_4^+ M2 (anion) chloride / Cl^-	If both name and formula given, both must be correct One mark if both correct but given in wrong order	2
(ii)	ammonia / NH_3	If both name and formula given, both must be correct	1
(c) (i)	M1 (anion) carbonate / CO_3^{2-} M2 (because) carbon dioxide/ CO_2 is given off (when hydrochloric acid/HCl is added)	ACCEPT hydrogencarbonate / HCO_3^- If both name and formula given, both must be correct ALLOW the gas is carbon dioxide	2
(ii)	M1 (test) flame test M2 (result) brick-red (colour)	ACCEPT description of flame test ACCEPT red / orange-red REJECT all other colours M2 DEP on M1 or near miss e.g. heat the solid but REJECT if solid is heated in a test tube, etc	2
		Total	9

Question number	Answer	Notes	Marks
13 (a)	M1 use the <u>burette</u> to add the (sulfuric) acid (to the sodium hydroxide) M2 until there is a change in colour (of the indicator/methyl orange/solution) M3 take initial and final readings of acid (and subtract to calculate the volume added) Plus any one from: M4 add acid dropwise (when near to the end point) M5 swirl the solution (when near to the end point) M6 repeat to obtain concordant results	If both initial and final colours are given both must be correct ACCEPT orange/pink/red as the final colour ACCEPT correct colours of any alternative indicator chosen e.g. (pink) to colourless for phenolphthalein (blue) to purple/red/pink for litmus REJECT Universal Indicator ALLOW repeat to obtain accurate/reliable results	4

Question number	Answer	Notes	Marks
13 (b) (i)	20(.0) °C		1
(ii)	17.5 cm ³		1
(iii)	10 (cm ³) AND 25 (cm ³)		1
		Total	7

Question number	Answer	Notes	Marks
14 (a)	B (changes from shiny to dull) The only correct answer is B A is not correct because a freshly exposed surface of lithium does not bubble and fizz when in contact with air C is not correct because a freshly exposed surface of lithium does not burst into flame when in contact with air D is not correct because a freshly exposed surface of does change when in contact with air		1
(b) (i)	burns with a pop/squeak OR use burning/lit spill to see if pops/squeaks OR use flame to see if pops/squeaks	Must be reference to test and result Reference to spill/match with no indication of flame is not enough REJECT reference to glowing spill/splint IGNORE flame extinguished 'Squeaky pop test' alone is not sufficient	1

(ii)	M1 lithium hydroxide/LiOH/hydroxide <u>ion(s)</u>/OH⁻ (formed) M2 (therefore) the <u>solution</u> is alkaline	If both name and formula given both must be correct ACCEPT pH is of the <u>solution</u> greater than 7 ALLOW <u>solution</u> is basic	2
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Question number	Answer	Notes	Marks												
14 (c)	<table><tr><th>Name of compound</th><th>Formula of compound</th><th>Formula of cation in compound</th><th>Formula of anion in compound</th></tr><tr><td></td><td>Li₂O</td><td></td><td></td></tr><tr><td></td><td></td><td></td><td>CO₃²⁻</td></tr></table>	Name of compound	Formula of compound	Formula of cation in compound	Formula of anion in compound		Li ₂ O						CO ₃ ²⁻		2
Name of compound	Formula of compound	Formula of cation in compound	Formula of anion in compound												
	Li ₂ O														
			CO ₃ ²⁻												
14 (d) (i)	<table><tr><td>the reaction with caesium is more vigorous</td><td>✓</td></tr><tr><td>the reaction with caesium produces a different gas</td><td></td></tr><tr><td>the reaction with caesium produces an acidic solution</td><td></td></tr><tr><td>the reaction with caesium produces a different compound</td><td>✓</td></tr><tr><td>the reaction of caesium is endothermic</td><td></td></tr></table>	the reaction with caesium is more vigorous	✓	the reaction with caesium produces a different gas		the reaction with caesium produces an acidic solution		the reaction with caesium produces a different compound	✓	the reaction of caesium is endothermic			2		
the reaction with caesium is more vigorous	✓														
the reaction with caesium produces a different gas															
the reaction with caesium produces an acidic solution															
the reaction with caesium produces a different compound	✓														
the reaction of caesium is endothermic															
(d) (ii)	2Cs + 2H₂O → 2CsOH + H₂ M1 all formulae correct M2 correctly balanced	ACCEPT multiples and halves M2 DEP on M1	2												

Question number	Answer	Notes	Marks
15 (a)	M1 $0.02(00) \times 0.2(00)$ M2 $0.004(00)$ (mol)	ACCEPT 4 for 1 mark Correct answer with no working scores 2	2
(b)	M1 $0.004(00) \div 0.1(00)$ OR M2 from (a) $\div 0.1(00)$ M2 $0.04(00) \text{ dm}^3 / 40(.0) \text{ cm}^3$ OR M2 from (a) $\div 0.1(00)$ correctly evaluated	Unit required Correct answer, using M2 from part (a), with no working scores 2	2
(c)	M1 $n(\text{NaOH}) = 0.03(00) \times 0.2(00)$ OR $0.006(00)$ (mol) M2 mass of NaOH = 0.24 g OR M1 $\times 40$ correctly evaluated	Correct answer with no working scores 2	2
		Total	6

