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Pearson Edexcel

Mark Scheme (Results)

January 2020

Pearson Edexcel International GCSE in Chemistry (4CH1)
Paper 2CR

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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.

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Question number	Answer	Notes	Marks
1 (a) (i)	B box 2 The only correct answer is B because box 2 contains two different particles in the same space that are not chemically joined A is not correct because box A shows an element C is not correct because box C shows an element D is not correct because box 4 shows a compound		1
(ii)	C Boxes 1 and 3 The only correct answer is C because boxes 1 and 2 contain one type of atom only. A is not correct because box 2 shows a mixture B is not correct because box 2 shows a mixture D is not correct because box 4 shows a compound		1
(iii)	**M1** (box 5 shows) two (different) elements **M2** (chemically) bonded (together)	**ALLOW** two (different) types of atoms **REJECT** mixture for M1 **ALLOW** (chemically) combined/joined (together) **M2** DEP on mention of elements/atoms in **M1**	2
(b) (i)	C number of protons The only correct answer is B because the elements in the periodic table are arranged in order of proton number A is not correct because elements are not arranged in order of mass number B is not correct because elements are not arranged in order of the number of neutrons D is not correct because elements are not arranged in order of reactivity		1
(ii)	A electrons in the outer shell The only correct answer is A because elements in the same group of the periodic table have the same number of electrons in the outer shell. B Is not the correct answer because elements in the same period have the same number of shells C elements in the same group do not have the same number of neutrons D is not the correct answer because elements in the same group do not have the same number of protons		1

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Question number	Answer	Notes	Marks
2 (a)	**M1** level of the water must be below the dyes/start line **M2** the start line must be drawn in pencil	**ACCEPT** dyes/start line should be above water level	2
2 (b) (i)	2 marks for any two conclusions from (the green food colouring) **M1** contains (dye) B and (dye) D **M2** contains an unknown dye **M3** does not contain A or C **M4** contains three dyes and 1 mark for a correct explanation of given conclusion for the green food colouring eg (explanation for **M1**) because has spots at same level (as B and D) eg (explanation for **M2**) because has a spot at different level (from A B C D) eg (explanation for **M3**) because has no spots at same level (as A and C) eg (explanation for **M4**) because has three spots	 ALLOW is not pure	3
(ii)	**M1** (distance moved by solvent correctly measured) = 9.5 (cm) **M2** use of R_f = $\frac{\text{distance moved by the dye C}}{\text{distance moved by the solvent}}$ **M3** evaluation of R_f	**ALLOW** a tolerance of ±2mm eg $\frac{6.2}{9.5}$ **ALLOW** ECF from **M1** eg $\frac{(6.2)}{(9.5)}$ = 0.65(3) **ALLOW** 1-4 sig fig **ALLOW** ECF from **M2**	3
(iii)	(dye A) is not soluble in water	**ALLOW** solvent for water	1

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Question number	Answer	Notes	Marks
3 (a)	B Precipitation The only correct answer is B the reaction of two solutions to produce an insoluble solid is precipitation. A is not correct because this reaction is not neutralisation C is not correct because this reaction is not a redox reaction D is not correct because this reaction is not thermal decomposition		1
3 (b)	**M1** wash the solid with (deionised) water **M2** suitable method of drying solid eg dry between filter papers/on paper towel/in (warm) oven/in a desiccator	**ALLOW** leave to dry **ALLOW** leave in a warm place **ALLOW** leave for the water to evaporate **IGNORE** dry it alone **REJECT** hot oven or any method of direct heating eg Bunsen burner **REJECT** references (direct or inferred) to silver chloride solution or crystallisation for **M1** and **M2** No M2 if solid washed after drying	2
3 (c)	Any one from: **M1** (hydrochloric acid/it) contains chloride ions **M2 (**hydrochloric acid/it) produces a (white) precipitate with silver nitrate **M3 (**hydrochloric acid/it) reacts with silver nitrate	**ALLOW** contains Cl^-	1
3 (d)	**M1** n($AgNO_3$ or AgCl) = 0.0025 **M2** (mass AgCl) = 0.0025 x 143.5 = 0.35(9)g	**ALLOW** ECF from M1 **ALLOW** one or more sig fig Correct answer without working scores 2 marks.	2

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Question number	Answer	Notes	Marks
4 (a)	**M1** layers of atoms/positive ions **M2** can slide over one another	**IGNORE** layers unqualified **REJECT** layers of molecules **M2** DEP on mention of layers/atoms/ions in **M1**	2
4 (b) (i)	ions cannot move	**ALLOW** ions are in fixed positions/in a lattice **IGNORE** no free ions **REJECT** any reference to electrons	1
(ii)	$2Br^- \rightarrow Br_2 + 2e^-$		1
(iii)	**M1** lead ions (are positive and) are attracted to the negative electrode / Pb^{2+} (ions) are attracted to the negative electrode **M2** lead ions gain electrons / Pb^{2+} (ions) gain electrons (to form lead)	**ALLOW** cathode for negative electrode **ALLOW** a correct half equation for M2 **IGNORE** references to redox ALLOW lead ions get discharged (to form lead)	2
(iv)	metal or lead connects the electrodes or completes the circuit OWTTE	**ALLOW** metal or lead conducts electricity ALLOW metal or lead allows electrons to flow	1

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Question number	Answer	Notes	Marks
5 (a) (i)	Any two from: **M1** (lithium) moves (on the surface) **M2** (lithium) gets smaller/disappears **M3** colourless solution forms	 **ALLOW** floats **ALLOW** dissolves **IGNORE** white trail forms **REJECT** melts / turns into a ball **ALLOW** temperature increases/heat given off	2
(ii)	(when mixed with air) lit spill/splint or flame gives (squeaky) pop	must refer to test and result **IGNORE** squeaky pop test alone **ALLOW** burns with (squeaky) pop **REJECT** glowing spill/splint and pop	1
5 (b) (i)	Any one from: **M1** more rapid bubbles/fizzing/effervescence **M2** turns into a ball **M3** moves more quickly **M4** catches alight / burns / produces a flame	 **ALLOW** potassium melts **ALLOW** gets smaller/disappears more quickly **IGNORE** flame colour	1
(ii)	**M1** potassium has more shells than lithium **M2** (therefore) there is less attraction between the outer shell/electron and the nucleus **M3** so the electron in the outer shell is more easily lost	**ALLOW** potassium atom is bigger than lithium **ALLOW** outer shell/electron is further from nucleus **ALLOW** more repulsion (from inner shells) or more shielding (from the nuclear attraction) **ALLOW** nuclear pull for the outer shell/electron is weaker **ACCEPT** answers in terms of lithium for **M1, M2** and **M3**	3

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Question number	Answer	Notes	Marks
5 (c) (i)	**M1** n(Li) = $\frac{0.500}{7}$ **OR** 0.0714 **M2** n(H_2) = $\frac{0.0714}{2}$ **OR** 0.0357 **M3** volume of H_2 (= 0.0357 x 24000) = 857 (cm^3)	**ALLOW** ECF from **M1** **ALLOW** ECF **M2** x 24 000 **M3** must be to 3 sig fig Correct answer to 3 sig fig without working scores 3 marks.	3
(ii)	**M1** n(H_2SO_4)= 0.02485 x 0.1 **OR** 0.002485 **M2** n(LiOH) = 2 x 0.002485 **OR** 0.00497 **M3** concentration of LiOH = 0.0331 (mol/dm^3)	**ALLOW** ECF from **M1** **ALLOW** ECF from **M2** (**M2** ÷ 0.150) **ALLOW** any number of sig fig except one for **M1 M2** and **M3** Correct answer without working scores 3 marks.	3

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Question number	Answer	Notes	Marks
6 (a)	A description including the following points:		4
	M1 (use) fractional distillation / fractionating column / fractionating tower		
	M2 (crude oil) heated / vaporised	**ALLOW** boiled	
	M3 column is cooler at top / hotter at the bottom / idea of temperature gradient		
	M4 fractions condense/collected at different heights OWTTE **OR** fractions have different boiling point (ranges)	**ALLOW** fractions with high(er) boiling points/large(r) molecules condense/collected near bottom ORA	
6 (b) (i)	**M1** particles/molecules are closer together	**ALLOW** more particles/molecules per unit volume	2
	M2 therefore more (successful) collisions per unit time	**ALLOW** more frequent (successful) collisions If reference to particles have more energy/move faster, then 0/2	
(ii)	**M1** (a catalyst provides) an alternative pathway	**ALLOW** a catalyst provides a surface for the reaction to take place on	2
	M2 of lower activation energy	**ALLOW** so more collisions/particles have energy greater than the activation energy.	
(iii)	increase the temperature	**ALLOW** heat it up **IGNORE** references to concentration **REJECT** increase the surface area	1

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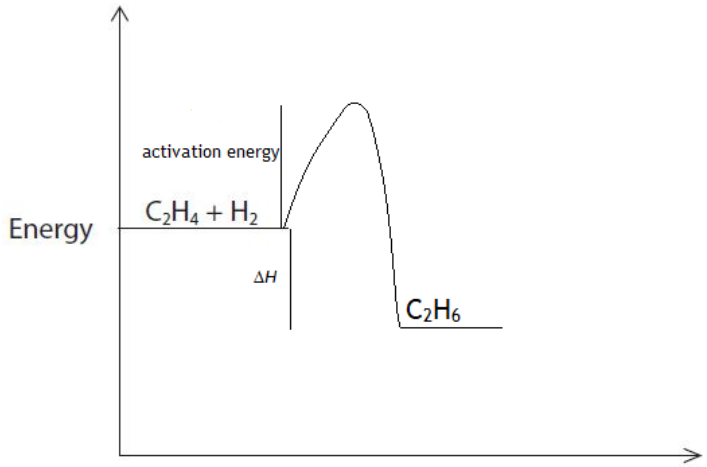
6 (b) (iv)	 **M1** C_2H_6 on horizontal line below the reactants **M2** activation energy correctly shown and labelled **M3** ΔH correctly shown and labelled	**ACCEPT** arrow pointing upwards or double headed arrow **ACCEPT** arrow pointing from reactants level to product level or double headed arrow ALLOW max 2 for a correctly labelled endothermic reaction	3
(c)	• find energy needed to break bonds • find energy released when bonds form • correct evaluation of ΔH Example calculation **M1** (4 x 412) + 612 + 436 OR 2696 **M2** (6 x 412) + 348 OR 2820 **M3** -124 if M1 M2 correct	**IGNORE sign** **ALLOW** 1048 **IGNORE sign** **ALLOW** 1172 -124 without working scores 3 (+)124 scores 2 **ALLOW M3** ECF **M1 M2**	3

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Question number	Answer	Notes	Marks
7 (a) (i)	CO_2		1
(ii)	(otherwise) ethanoic acid will form	**ALLOW** (otherwise) ethanol will be oxidised or react with oxygen **ALLOW** fermentation/reaction/respiration needs to be anaerobic **ALLOW** (otherwise) ethanol would not be formed / CO_2 and H_2O would be formed	1
(iii)	**M1** (reaction is catalysed by) enzymes (in yeast) **M2** which will denature (above 40°C)	**IGNORE** yeast unqualified **ALLOW** enzymes do not work above 40°C	2
(iv)	**M1** maximum mass of ethanol = 8 x 46 = 368 (g) **M2** $\frac{55.2}{368}$ x 100 (=15%) **Alternative method:** **M1** actual yield of ethanol in mol = $\frac{55.2}{46}$ = 1.2 **M2** $\frac{1.2}{8}$ x 100 (=15%)		2
(b) (i)	**M1** rate of the forwards reaction = the rate of the backwards reaction **M2** the concentrations of reactants and products remain constant	**IGNORE** it is reversible reaction **REJECT** concentrations of reactants and products are equal or are the same	2
(b) (ii)	**M1** an increase in temperature shifts the (position of) equilibrium in the endothermic direction (so backwards reaction is endothermic) **M2** so forward reaction is exothermic	**IGNORE** references to Le Chatelier's Principle **ALLOW** heating for increase in temperature **M2 DEP M1** or near miss	2

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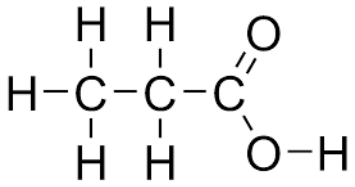
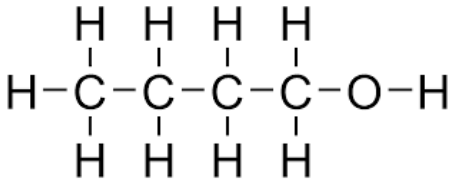
7 (c) (i)	**M1** (displayed formula of A - propanoic acid)  **M2** (displayed formula of B - butan-1-ol) 	**ALLOW** 1 mark if both OH but otherwise correct	2
(c) (ii)	**M1** add a named carbonate or hydrogencarbonate **M2** effervescence/bubbles/fizzing **OR** **M1** add a suitable named metal e.g. magnesium, aluminium, zinc, iron **M2** effervescence/bubbles/fizzing **OR** **M1** add a named alcohol (and some concentrated sulfuric acid and warm) **M2** sweet smell (of an ester)	**ALLOW** correct formula **M2 DEP M1** or near miss **ALLOW** carbon dioxide/CO_2 produced **REJECT** incorrect gas **ALLOW** correct symbol **REJECT** a metal that is too reactive e.g. potassium or too unreactive e.g. copper **M2 DEP M1** or near miss **ALLOW** hydrogen/H_2 produced **REJECT** incorrect gas **ALLOW** correct formula **M2 DEP M1** or near miss	2

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