Pearson Edexcel

Mark Scheme (Results)

January 2020

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

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

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

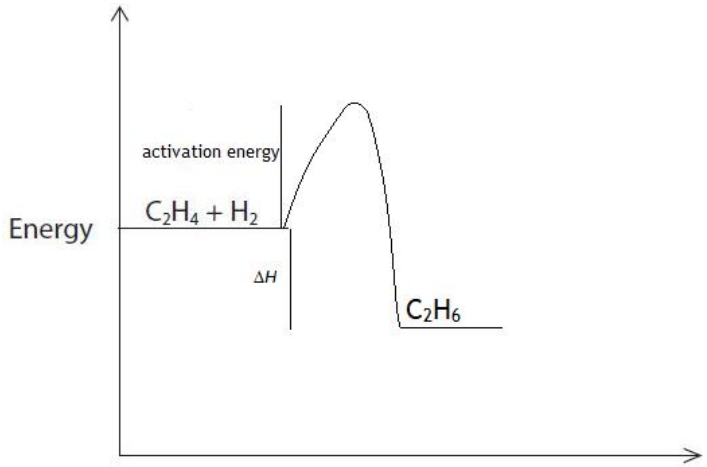
Question number	Answer	Notes	Marks
3 (a)	B Precipitation The only correct answer is B the reaction of two solutions to produce an insoluble solid is precipitation. A is not correct because this reaction is not neutralisation C is not correct because this reaction is not a redox reaction D is not correct 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

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

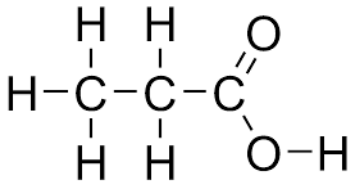
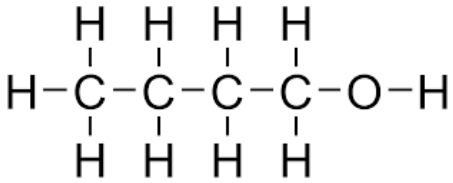
Question number	Answer	Notes	Marks
5 (a) (i)	Any two from: **M1** (lithium) moves (on the surface) **M2** (lithium) gets smaller/disappears **M3** colourless solution forms	 **ALLOW** floats **ALLOW** dissolves **IGNORE** white trail forms **REJECT** melts / turns into a ball **ALLOW** temperature increases/heat 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

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

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

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

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

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