Pearson Edexcel

Mark Scheme (Results)

November 2020

Pearson Edexcel International GCSE
In Chemistry (4CH1) Paper 2C

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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)		**B** filtration is the correct answer because it will enable sand to be separated from salt solution **A** is not correct because crystallisation will not enable sand to be separated from salt solution **C** is not correct because fractional distillation will not enable sand to be separated from salt solution **D** is not correct because simple distillation will not enable sand to be separated from salt solution		1 comp
	(b)	(i)	X is a thermometer Y is a (Liebig) condenser Z is a beaker		3 cler
		(ii)	salt		1 cler

Total for Q1 = 5

Question number			Answer	Notes	Marks
2	(a)		**A** substance S is the correct answer because S only contains one dye as it produces only one spot **B** is not correct because T does not only contain one dye as it produces two spots **C** is not correct because U does not only contain one dye as it produces three spots **D** is not correct because V does not only contain one dye as it produces two spots		1 comp
	(b)		explanation containing following points M1 (V contains) blue/B and red/R (dyes) M2 because V has spots at same height as those from blue/B and red/R OWTTE		2 grad
	(c)	(i)	M1 correct measurement of distance moved by spot Y M2 correct measurement of distance moved by solvent M3 use and evaluation of $R_f = \dfrac{\text{distance moved by spot Y}}{\text{distance moved by solvent}}$	ALLOW 5.7-6.1 ALLOW 8.7-9.1 ALLOW 1-4 sig fig ALLOW ECF from M1 M2 only if $R_f < 1$	3 exp
		(ii)	spot from yellow food dye/Y does not move as far as spot from red food dye/R OWTTE	ORA	1 exp

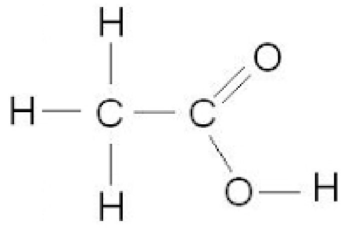
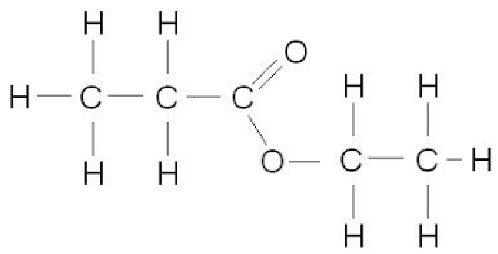
Total for Q2 = 7

Question number	Answer	Notes	Marks
3 (a) (i)	magnesium	ALLOW Mg	1 cler
(ii)	explanation including the following points M1 silver M2 because it is the least reactive (of the metals)	 ALLOW it is very unreactive	2 grad
(b)	explanation including the following points: M1 Method 1/ heating the metal oxide/lead(II) oxide with carbon M2 (because) lead is less reactive than iron (and iron is obtained from iron oxide by carbon extraction) M3 $2PbO + C \rightarrow 2Pb + CO_2$	 ALLOW carbon is more reactive than lead ACCEPT reverse arguments ALLOW $PbO + CO \rightarrow Pb + CO_2$ ALLOW $PbO + C \rightarrow Pb + CO$	3 exp

Question number	Answer	Notes	Marks
3 (c)	Explanation containing the following points Pure metal: M1 (particles/ions/atoms are same size in a regular arrangement so) layers can easily slide over each other Alloy: M2 diagram of alloy structure showing minimum of three layers with at least one different sized circle M3 (having different sized particles/ions/atoms) disrupts/breaks up regular arrangement OWTTE M4 so hard(er) for layers to slide over each other	REJECT molecules once only ALLOW disrupts the lattice / layers / rows (of particles/ions /atoms) ALLOW layers cannot slide over each other IGNORE references to strength/breaking of forces/(metallic) bonds	4 exp

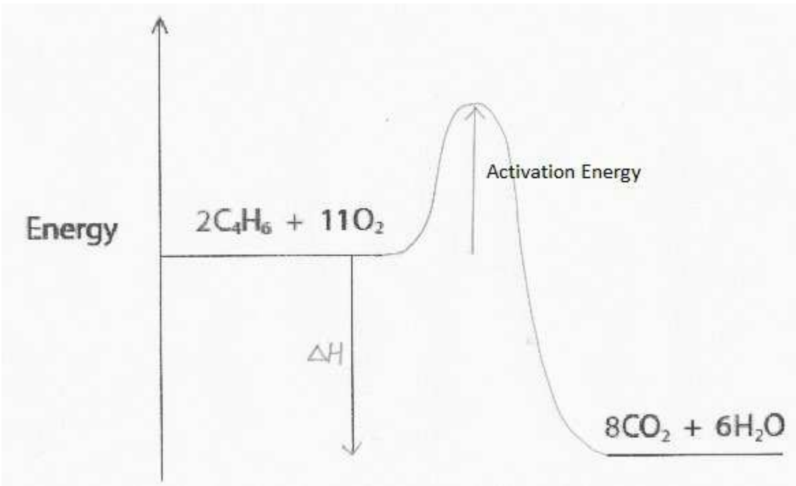
Total for Q3 = 10

Question number	Answer	Notes	Marks
4 (a)	CH_3OH	IGNORE displayed formula	1 grad
(b) (i)	fermentation		1 cler
(ii)	Explanation including four from M1 fermentation/reaction/respiration needs to be anaerobic M2 because in air / aerobic conditions ethanol not produced M3 because in air / aerobic conditions CO_2 and H_2O are produced M4 (if temperature above 40 ℃/too high) enzymes (in yeast) become denatured/lose their structure OWTTE M5 causing fermentation/reaction to slow down /stop	ALLOW M1 in air ethanol would react with oxygen / be oxidised M2 in air ethanol would form ethanoic acid /carboxylic acid/vinegar ALLOW reference to optimum temperature (between 30 ℃ and 40 ℃)	4 exp

Question number	Answer	Notes	Marks
4 (c) (i)	 M1 M2 $C_3H_6O_2$ M3 butanoic acid		3 grad
(ii)	carboxylic (acids)		1 grad
(d) (i)	(acid acts as) a catalyst/to speed up reaction	IGNORE references to activation energy	1 grad
(ii)	 M1 ester linkage M2 rest of molecule fully correct	 M2 DEP M1	2 exp
(iii)	M1 (Property:) distinctive/sweet/fruity smell M2 used in perfumes/flavourings	ALLOW volatile ALLOW any correct use eg in making soaps/ in solvents (for paints/varnishes)	2 exp

Total for Q4 = 15

Question number	Answer	Notes	Marks
5 (a)	Explanation including following points M1 (unsaturated because) contains (carbon to carbon) double bond(s) M2 (hydrocarbon because) contains (the elements/atoms) carbon and hydrogen M3 only	ALLOW contains C=C REJECT molecules M3 DEP on carbon and hydrogen	3 grad
(b) (i)	from orange to colourless	ALLOW yellow for orange or any combination of orange/yellow IGNORE clear	1 grad
(ii)	calculation including following steps M1 calculation of energy involved in bond breaking in reactants M2 calculation of energy involved in bond making in products M3 evaluation of difference M4 correct answer and sign Example calculation M1 2(612) + 1(348) + 6(412) + 2(193) OR 4430 M2 3(348) + 6(412) + 4(276) OR 4620 M3 (4620 - 4430 =) 190 M4 -190	ECF from M1 and M2 IGNORE signs in M1 and M2 ACCEPT 2(612) + 2(193) OR 1610 for M1 and 2(348) + 4(276) OR 1800 for M2 IGNORE sign ACCEPT (1800 – 1610 =) 190 M3 M4 ECF from M1 and M2 If M1 > M2 answer for M4 must be positive If M1 < M2 answer for M4 must be negative -190 with or without working scores 4 (+) 190 with or without working scores 3	4 Exp

(c) (i)	$2C_4H_6 + 7O_2 \rightarrow 2C + 4CO + 2CO_2 + 6H_2O$		1 Exp
(ii)	Explanation including M1 CO/carbon monoxide M2 is poisonous/toxic/reduces capacity of blood to carry oxygen OWTTE **OR** M1 CO_2/carbon dioxide M2 is a greenhouse gas/contributes to global warming/ contributes to climate change OWTTE	M2 DEP M1 correct or missing **ACCEPT** prevents blood from carrying oxygen OWTTE ALLOW correct explanation in terms of haemoglobin eg prevents haemoglobin from carrying oxygen / forms carboxyhaemoglobin	2 Exp
(iii)	 M1 horizontal line below level of reactants with $8CO_2 + 6H_2O$ M2 profile curve rising from reactants level to form "hump" and then falling down to products level M3 activation energy correctly shown and labelled M4 $\triangle H$ correctly shown and labelled	ALLOW double headed arrow REJECT arrow pointing downwards ALLOW double headed arrow REJECT arrow pointing upwards ALLOW -3446 for $\triangle H$ label an endothermic reaction profile can score M2 M3 M4 ECF	4 Exp

Total for Q5 = 15

Question number	Answer	Notes	Marks
6 (a) (i)	zinc would react with sulfuric acid/solution X	IGNORE zinc is too reactive	1 grad
(ii)	bubbles	ALLOW fizzing / effervescence IGNORE gas evolved IGNORE incorrectly named gas	1 grad
(iii)	**B** a burning splint gives a squeaky pop is correct because this is the test for hydrogen **A** is incorrect because a glowing splint relights is not the test for hydrogen **C** is incorrect because a burning splint goes out is not the test for hydrogen **D** is incorrect because limewater turns cloudy is not the test for hydrogen		1 comp
(b)	description including M1 add barium chloride/$BaCl_2$ M2 white ppt forms	 ACCEPT barium nitrate/$Ba(NO_3)_2$ IGNORE references to adding (dilute) HCl/HNO_3 REJECT add H_2SO_4 M2 DEP M1	 2 Grad
(c) (i)	(graduated) pipette	ALLOW burette	1 Cler

(ii)	calculation with following steps M1 setting out of how to calculate n(KOH) M2 evaluation Example calculation M1 n(KOH) = 0.125 x 25 ÷ 1000 M2 = 0.003125 / 3.125 $\times 10^{-3}$	 ALLOW any number of sig figs except one If no division by 1000 giving answer of 3.125 award 1 mark correct answer with no working scores 2	 2 Exp

(iii)	calculation with following steps M1 calculate n (H_2SO_4) = M2 from (i) ÷ 2 M2 calculate vol H_2SO_4 = (M1 x 1000) ÷ 0.10 M3 evaluation of volume Example calculation M1 0.003125 ÷ 2 = 0.0015625 / 1.5625 $\times 10^{-3}$ M2 0.0015625 x 1000 ÷ 0.10 M3 = 15.625/15.63/15.6 /16 (cm^3)	 Mark ECF from M1 Mark ECF from M2 ALLOW any number of sig figs except one correct answer with no working scores 3 Do not penalise not multiplying by 1000 in (iii) if they have not divided by 1000 in (ii) 31.25/31.3/31 scores 2 62.5/63 scores 2	3 Exp

Total for Q6 = 11

Question number	Answer	Notes	Marks
7 (a)	calculation with following steps M1 calculation of $n(K_2CO_3)$ M2 deduction of $n(CO_2)$ and vol(CO_2) by multiplying by 24 (dm^3) M3 correct evaluation of volume in cm^3 Example calculation M1 $n(K_2CO_3)$ = 6.9 ÷ 138 OR 0.05 M2 vol(CO_2) = 0.05 x 24 (dm^3) M3 1200 (cm^3)	Mark ECF from M1 correct answer with no working scores 3 1.2 scores 2 marks	3 Exp
(b) (i)	M1 higher yield of CO M2 because (equilibrium shifts to the right as the forward) reaction is endothermic	ACCEPT more CO is produced IGNORE references to Le Chatelier's Principle eg increasing temperature favours the forward reaction M2 DEP M1 correct or missing	2 Exp
(ii)	M1 no effect (on yield) OWTTE M2 because equal numbers of moles/molecules (of gas) on both sides	M2 DEP M1 correct or missing	2 Exp

Total for Q7 = 7

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