edexcel

Mark Scheme (Results)

January 2014

IAL Chemistry (WCH04/01)

Unit 4: General Principles of Chemistry I

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications come from Pearson, the world's leading learning company. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information, please visit our website at www.edexcel.com.

Our website subject pages hold useful resources, support material and live feeds from our subject advisors giving you access to a portal of information. If you have any subject specific questions about this specification that require the help of a subject specialist, you may find our Ask The Expert email service helpful.

www.edexcel.com/contactus

Pearson: helping people progress, everywhere

Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

January 2014
Publications Code IA037633
All the material in this publication is copyright
© Pearson Education Ltd 2014

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.
- Mark schemes will indicate within the table where, and which strands of QWC, are being assessed. The strands are as follows:

  i) ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear
  ii) select and use a form and style of writing appropriate to purpose and to complex subject matter
  iii) organise information clearly and coherently, using specialist vocabulary when appropriate

Using the Mark Scheme

Examiners should look for qualities to reward rather than faults to penalise. This does NOT mean giving credit for incorrect or inadequate answers, but it does mean allowing candidates to be rewarded for answers showing correct application of principles and knowledge. Examiners should therefore read carefully and consider every response: even if it is not what is expected it may be worthy of credit.

The mark scheme gives examiners:
- an idea of the types of response expected
- how individual marks are to be awarded
- the total mark for each question
- examples of responses that should NOT receive credit.

/ means that the responses are alternatives and either answer should receive full credit.
( ) means that a phrase/word is not essential for the award of the mark, but helps the examiner to get the sense of the expected answer.
Phrases/words in **bold** indicate that the meaning of the phrase or the actual word is **essential** to the answer.
ecf/TE/cq (error carried forward) means that a wrong answer given in an earlier part of a question is used correctly in answer to a later part of the same question.

Candidates must make their meaning clear to the examiner to gain the mark. Make sure that the answer makes sense. Do not give credit for correct words/phrases which are put together in a meaningless manner. Answers must be in the correct context.

Quality of Written Communication
Questions which involve the writing of continuous prose will expect candidates to:
- write legibly, with accurate use of spelling, grammar and punctuation in order to make the meaning clear
- select and use a form and style of writing appropriate to purpose and to complex subject matter
- organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.
Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Section A (multiple choice)

Question Number	Correct Answer	Reject	Mark
1	C		**1**

Question Number	Correct Answer	Reject	Mark
2 (a)	B		**1**

Question Number	Correct Answer	Reject	Mark
2(b)	D		**1**

Question Number	Correct Answer	Reject	Mark
2(c)	B		**1**

Question Number	Correct Answer	Reject	Mark
3	D		**1**

Question Number	Correct Answer	Reject	Mark
4	C		**1**

Question Number	Correct Answer	Reject	Mark
5(a)	D		**1**

Question Number	Correct Answer	Reject	Mark
5(b)	A		**1**

Question Number	Correct Answer	Reject	Mark
6	C		**1**

Question Number	Correct Answer	Reject	Mark
7	D		**1**

Question Number	Correct Answer	Reject	Mark
8	B		**1**

Question Number	Correct Answer	Reject	Mark
9(a)	B		**1**

Question Number	Correct Answer	Reject	Mark
9(b)	A		**1**

Question Number	Correct Answer	Reject	Mark
9(c)	C		**1**

Question Number	Correct Answer	Reject	Mark
10	D		**1**

Question Number	Correct Answer	Reject	Mark
11	D		**1**

Question Number	Correct Answer	Reject	Mark
12	B		**1**

Question Number	Correct Answer	Reject	Mark
13	D		**1**

Question Number	Correct Answer	Reject	Mark
14	C		**1**

Question Number	Correct Answer	Reject	Mark
15	A		**1**

Total for Section A = 20 marks

Section B

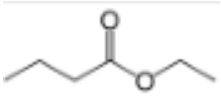
Question Number	Acceptable Answers	Reject	Mark
16(a)	$CH_3CH_2CH_2C\equiv N$ **ALLOW** displayed formula	$CH_3CH_2CH_2CN$ molecular formula	**1**

Question Number	Acceptable Answers	Reject	Mark
16(b)	**IGNORE** conditions and solvents, even if incorrect **Step 1** $LiAlH_4$ **IGNORE** dry ether/ followed by H_2O **ALLOW** lithium tetrahydridoaluminate((III)) lithium aluminium hydride **(1)** **Step 2** PCl_5 **ALLOW** phosphorus(V) chloride/ phosphorus pentachloride HCl /(concentrated) hydrochloric acid PCl_3 / phosphorus(III) chloride/ phosphorus trichloride $SOCl_2$ / thionyl chloride **(1)** **Step 4** HCl/ HCl(aq)/ HCl in water or H_2O **ALLOW** any strong acid/ H^+/ NaOH/ sodium hydroxide **followed by** HCl / hydrochloric acid **(1)** **Step 5** CH_3CH_2OH/ C_2H_5OH (and any strong acid) **ALLOW** ethanol **(1)**	incorrect formulae, including subscripts written as large numbers or superscripts eg LiAlH4/$LiAlH^4$ any charges $NaBH_4$ H_2/ hydrogen dilute hydrochloric acid just 'dilute acid' just 'concentrated acid' just 'H_2O/ water' $OHCH_2CH_3$	**4**

Question Number	Acceptable Answers	Reject	Mark
16(c)	$2CH_3CH_2CH_2COOH + Na_2CO_3 \rightarrow$ $2CH_3CH_2CH_2COO^{(-)}Na^{(+)} + CO_2 + H_2O$ **ALLOW** butanoic acid as $CH_3CH_2CH_2CO_2H$/ $CH_3(CH_2)_2COOH$/$CH_3(CH_2)_2CO_2H$/ C_3H_7COOH/$C_3H_7CO_2H$ and the salt as $CH_3CH_2CH_2CO_2H$ / $CH_3(CH_2)_2COO^{(-)}Na^{(+)}$ / $CH_3(CH_2)_2CO_2^{(-)}Na^{(+)}$ / $C_3H_7COO^{(-)}Na^{(+)}$/ $C_3H_7CO_2^{(-)}Na^{(+)}$ all product formulae correct **(1)** correct balanced equation **(1)** **ALLOW** correct ionic equation for **(1)** $2CH_3CH_2CH_2COOH + CO_3^{2-} \rightarrow$ $2CH_3CH_2CH_2COO^{-} + CO_2 + H_2O$ **IGNORE** state symbols even if incorrect		**2**

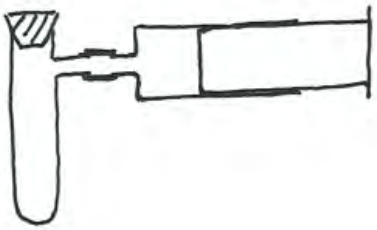
Question Number	Acceptable Answers	Reject	Mark
16(d)	**Any two correct points from:** **First point** butanoic acid has 4 peaks, butan-1-ol has 5 peaks **OR** butanoic acid has one peak fewer **OR** butan-1-ol has one peak more **ALLOW** butanoic acid has fewer peaks/ butan-1-ol has more peaks **(1)** **IGNORE** butanoic acid has 4 proton environments and butan-1-ol has 5 **Second point** ratio of peak heights/ area under each peak is 3:2:2:1 for butanoic acid **and** 3:2:2:2:1 for butan-1-ol **(1)** **Third point** the OH (hydrogens) have different chemical shifts **OR** butanoic acid has a (COOH) peak at 10-12 (ppm) (and butan-1-ol does not) **OR** butan-1-ol has (an OH) peak at 2-4 (ppm) (and butanoic acid does not) **(1)** **Fourth point** peak at 3.0-1.8 (ppm) for H-C-C=O in acid and not in the alcohol **OR** peak at 3.0-4.4 (ppm) for H-C-O- in alcohol and not in acid **OR** the hydrogens on the alpha carbon have different chemical shifts **(1)** **IGNORE** reference to splitting patterns	incorrect numbers of peaks quoted different number of peaks area under peaks in the ratio 8:10 incorrect data quoted incorrect data quoted	**2**

Question Number	Acceptable Answers	Reject	Mark
16(e)	**First mark – bond and range** C=O(stretching) in butanoic acid (has an absorption at) 1725 – 1700 (cm^{-1}) **(1)** **Second mark – bond and both ranges** O-H/ OH (stretching) in butan-1-ol 3750 – 3200 (cm^{-1}) **and** O-H/ OH (stretching) in butanoic acid 3300 – 2500 (cm^{-1}) **ALLOW** COOH in butanoic acid **(1)** **ALLOW** any wavenumber or range of wavenumbers within the ranges above and ranges written in reverse order If no other marks are awarded, then **ALLOW** 1 mark if all 3 ranges are identified but bonds are missing/incorrect **IGNORE** reference to fingerprint region	COOH/ incorrect name of bond/ 1740 – 1720 (cm^{-1})/ other incorrect range incorrect name of bonds	**2**

Question Number	Acceptable Answers	Reject	Mark
16(f)	 **IGNORE** bond lengths and bond angles **ALLOW** any orientation		**1**

Question Number	Acceptable Answers	Reject	Mark
16(g)	**First step** – PCl_5/ phosphorus(V) chloride/ phosphorus pentachloride **ALLOW** PCl_3 / phosphorus(III) chloride/ phosphorus trichloride $SOCl_2$ / thionyl chloride **(1)** **Second step** – **conditional on first mark** CH_3CH_2OH/ C_2H_5OH/ ethanol **(1)** **Advantage - stand alone mark** higher yield (of ester) **OR** reaction goes to completion/ not an equilibrium reaction/ not reversible **OR** no heat energy needed/ reacts at room temperature/ no (concentrated acid) catalyst needed **(1)** **IGNORE** atom economy/ faster/ requires less energy	HCl	**3**

Total for Question 16 = 15 marks

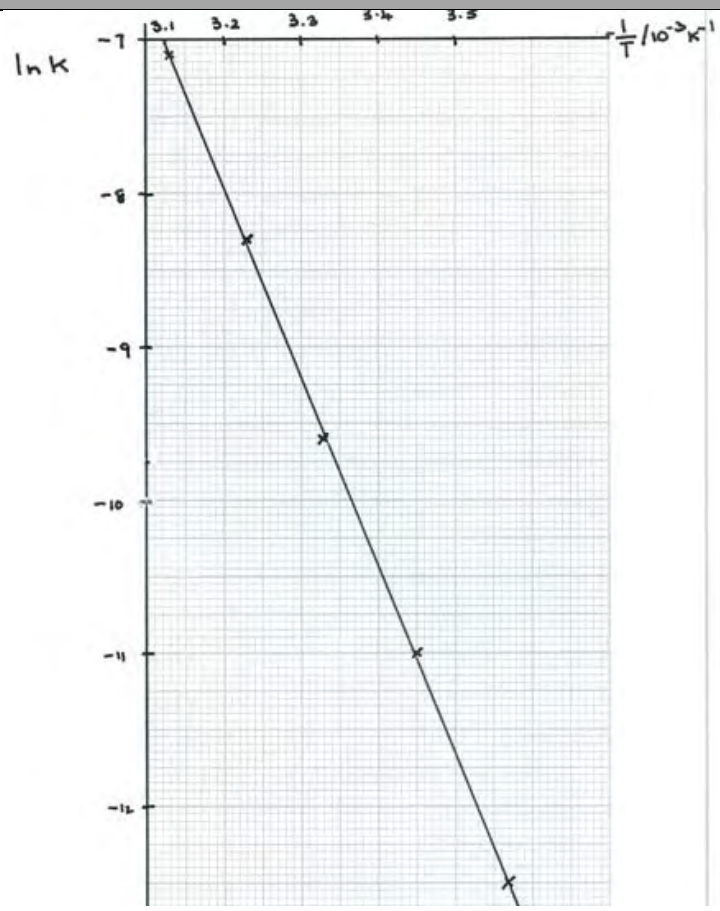
Question Number	Acceptable Answers	Reject	Mark
17(a)	 **Method 1 – gas collection** **Diagram 2 marks** stoppered/ sealed side arm test tube/ stoppered/ sealed test tube with delivery tube/ stoppered/ sealed side arm flask/ stoppered/ sealed flask with delivery tube **(1)** gas syringe **OR** collection of gas over water in a measuring cylinder/ upturned burette/ graduated gas tube **(1)** **IGNORE** heat **Measurements** **volume** of gas **and** time **(1)** **Method 2 – mass loss** **Diagram 2 marks** digital balance **(1)** flask with cotton wool/ mineral wool in neck **OR** open flask/ beaker **(1)** **Measurements** mass (loss) **and** time **(1)** **Method 3 – colour change** **Diagram 2 marks** colorimeter **(1)** light and filter shown **(1)** **Measurements** transmission/ absorbance **and** time **(1)**	amount of gas	**3**

Question Number	Acceptable Answers	Reject	Mark
17(b)(i)	s^{-1} **ALLOW** 1/s sec^{-1} any actual unit of time to power -1	$time^{-1}$ t^{-1}	**1**

Question Number	Acceptable Answers	Reject	Mark
17(b)*(ii)	**First mark** 1st Step – slow 2nd Step – fast 3rd Step – fast **(1)** **Second mark – stand alone** the slow(est)/ first step is the rate determining step **(1)** **Third mark – consequential on correct first mark** (1 mol) N_2O_5 is in the rate equation so the reaction with N_2O_5 is the slow/ rate determining step **OR** only the species in the rate equation is in the first/ slow/ rate determining step **ALLOW** (there is only 1 mol of) one species/ N_2O_5 in the first/ slow/ rate determining step **(1)** **ALLOW** 1st Step – fast 2nd Step – slow 3rd Step – fast **(1)** the slow(est) step/second step is the rate determining step **(1)** there is only (1 mol of) one species in the steps up to and including the rate determining step **(1)**		**3**

Question Number	Acceptable Answers	Reject	Mark
17(c)(i)	(thermostatically controlled) water bath/ ice bath **ALLOW** oil bath	direct heating with flame electrical heater	**1**

Question Number	Acceptable Answers	Reject	Mark
17(c)(ii)	(1/T) 3.13 x 10^{-3}/ 3.125 x 10^{-3} **(1)** (ln*k*) −7.1/ −7.05/ -7.0528 **(1)**	3.12 x 10^{-3} -7.0	**2**

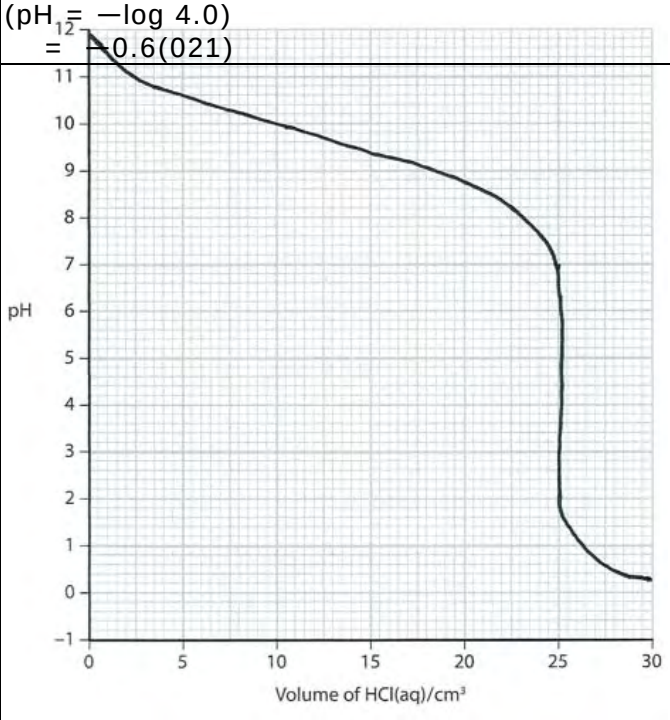
Question Number	Acceptable Answers	Mark
17(c) ***(iii)**	 **Graph – 3 marks** **First mark** axes correct with sensible scales i.e. points/line covering at least 3 large squares on the x axis and 5 on the y axis, with ln*k* values becoming more negative down the axis and the negative signs shown **(1)** **Second mark** both axes labelled, with units on x axis and no units on y axis x axis: 3.1-3.5 1/T /$10^{-3}K^{-1}$ **OR** 3.1-3.5 1/Tx$10^{3}/K^{-1}$ **OR** 0.0031-0.0035 **OR** 3.1 x 10^{-3}-3.5 x 10^{-3} 1/T /K^{-1} **ALLOW** x axis labels at bottom of page **(1)** **Third mark** points correctly plotted and straight line drawn **(1)**	

	Gradient – 2 marks – this may be shown on the graph gradient = −11550 to −12760 (K) negative sign **(1)** value (ignore sf) **(1)** maximum 1 mark if an incorrect unit is given **ALLOW** these marks if the correct sign and value for the gradient are shown in the calculation for E_a **Calculation - 2 marks** **If E_a = (+)96.0 to (+)106 kJ mol^{-1} or (+)96000 to (+)106000 J mol^{-1}, award 2 marks** **If E_a is in this range but is not given to 3 sf, or the units are incorrect or missing, award 1 mark** **If not,** E_a = −8.31 x their gradient OR gradient = -Ea/R **(1)** value to 3 sf **and** units **and** consequential sign if negative **(1)** **ALLOW** correct answer to 3 sf, in range, **with sign and units**, but no working for gradient or E_a **(3)**	**7**

Total for Question 17 = 17 marks

Question Number	Acceptable Answers	Reject	Mark
18(a)(i)	**IGNORE** sf except 1 **If answer is 8.485 x 10^{-3}** ($mol dm^{-3}$), **award 2 marks** If not, $[OH^-(aq)] = \sqrt{(K_b\ [NH_3])}$ $= \sqrt{(1.8 \times 10^{-5} \times 4.0)}$ **(1)** $= 8.485 \times 10^{-3}$ ($mol\ dm^{-3}$) **(1)**		**2**

Question Number	Acceptable Answers	Reject	Mark
18(a)(ii)	**IGNORE** sf except 1 **If answer is 11.9(3)/12**, **award 2 marks** If not, **EITHER – Method 1** $[H^+] = \frac{1 \times 10^{-14}}{[OH^-]}$ $= \frac{1 \times 10^{-14}}{8.485 \times 10^{-3}}$ **(1)** $= 1.179 \times 10^{-12}$ **ALLOW** ecf from their answer to (i) pH = $-\log 1.179 \times 10^{-12} = 11.9(3)$ **ALLOW** ecf from their answer for $[H^+]$ **(1)** **OR – Method 2** pOH = $-\log 8.485 \times 10^{-3} = 2.07$ **ALLOW** ecf from their answer to (i) **(1)** pH = (14 – 2.07 =) 11.9(3) **ALLOW** ecf from their answer to pOH **(1)**		**2**

Question Number	Acceptable Answers	Mark
18(b)(i)	(pH = −log 4.0) = −0.6(021)	1
	 **First mark** graph starting at 11.9/ answer to a(ii), ± 1 small square, provided above 7 **(1)** **Second mark** buffering region to **25** cm^3 **ALLOW** any line showing a decrease in pH from 0 to 25 cm^3 of HCl added **(1)** **Third mark** straight **vertical** portion between 8 and 1, midpoint below 7 and between 2 and 7 pH units long **(1)** **Fourth mark** finishing at +0.5 to −0.8, with at least 27.5 cm^3 of HCl added **ALLOW** final pH as answer to (b)(i), within 1 pH unit, if pH is less than answer to (b)(i) or within 1 small square if pH is more than answer to (b)(i) **(1)** **ALLOW** If graph is drawn with aqueous ammonia added to hydrochloric acid, only the second and third marks are available for the correct vertical portion at 25cm^3	4

Question Number	Acceptable Answers	Reject	Mark
18(b)*(iii)	**First mark** any indicator from 4 to 10 or 12, 13 in the Data booklet – see end **ALLOW** ecf from the vertical portion on their graph **(1)** **Second mark** alkaline to acidic colour change for their stated indicator **ALLOW** acidic to alkaline colour change if their curve shows alkali added to acid **(1)** **Third mark** pH range (of indicator) is within the vertical section of the graph **OR** p*K*in (± 1) is in the vertical section of the graph **OR** p*K*in is nearest to the pH at the end/ equivalence point **ALLOW** indicator will change colour in the vertical section of the graph **ALLOW** Indicator will change colour at the end/ equivalence point **ALLOW** (because it is a) titration of a strong acid with a weak base **(1)**	universal indicator loses all 3 marks litmus loses first mark only	**3**

Question Number	Acceptable Answers	Mark
18(c)(i)	**IGNORE** sf except 1 **If answer is 3.84** (mol dm^{-3}), **award 3 marks** If not, number of moles of acid = $\frac{24.0 \times 4}{1000} = 0.096$ **(1)** **EITHER** number of moles ammonia = 0.096 **in 25 cm^3** **(1)** concentration of ammonia $= \frac{0.096 \times 1000}{25}$ = 3.84 (mol dm^{-3}) **(1)** **OR** number of moles ammonia = 0.288 **in 75 cm^3** **(1)** concentration of ammonia $= \frac{0.288 \times 1000}{75}$ = 3.84 (mol dm^{-3}) **(1)** **IGNORE** unit unless incorrect **ALLOW** ecf in both methods on their number of moles of ammonia	**3**

Question Number	Acceptable Answers	Mark
18(c)(ii)	**IGNORE** sf except 1 (concentration of ammonia in trichloromethane =) 0.16 (mol dm^{-3}) **ALLOW** ecf from their answer to (c)(i), provided it is less than 4.0 and given to 2 or more sf	**1**

Question Number	Acceptable Answers	Reject	Mark
18(c)(iii)	**Expression for *K*c and answer needed for the mark** $K_c = \frac{[NH_3(aq)]}{[NH_3(CHCl_3)]}$ **ALLOW** one state symbol missing $= \frac{3.84}{0.16}$ = 24(.0) **IGNORE** sf, including 1 sf, and units **ALLOW** ecf from answers to (c)(i) and (c)(ii)	K_c expressions without both state symbols	**1**

Question Number	Acceptable Answers	Reject	Mark
18(c)(iv)	(ammonia/ it is much more soluble in water) as can form **hydrogen bonds with water** **ALLOW** more/ stronger hydrogen bonds with water (than with trichloromethane) **IGNORE** answers based on polarity/ hydrophilic		**1**

Total for Question 18 = 18 marks

Question Number	Acceptable Answers	Mark
19(a)(i)	**Penalise lack of + sign once only in (a)(i) or (ii) in each final answer** **IGNORE** sf in (a)(i), (ii), and (iii) in each final answer, except 1 sf **FIRST, CHECK THE FINAL ANSWER** +479.7 J mol^{-1} K^{-1} scores **3** marks 479.7 J mol^{-1} K^{-1} scores **2** marks (+ sign missing) +479.7/ 479.7 scores **2** marks (units and/or + missing) +1709.7 J mol^{-1} K^{-1} scores **2** marks – multiple of 12 used for oxygen 1709.7 J mol^{-1} K^{-1}/ +1709.7/ 1709.7 score **1** mark – multiple of 12 used for oxygen and positive sign and/or units If these answers are not given, award marks as follows: **First mark** correct data for CO_2 (213.6) **and** H_2O (69.9) **(1)** **Second mark** correct multiples (12, 11, 1 and 24) **and** Hess's Law applied $\Delta S^{\ominus}_{system}$ = 12 x 213.6 + 11 x 69.9 −(392.4 + 24 x 102.5) **ALLOW** ecf from incorrect data for CO_2 and/or H_2O **(1)** **Third mark** correct answer with sign and units = +479.7 J mol^{-1} K^{-1} **ALLOW** ecf from incorrect data for CO_2 and/or H_2O and incorrect multiples **(1)**	**3**

Question Number	Acceptable Answers	Reject	Mark
19(a)(ii)	**If answer is +18925.2 J mol^{-1} K^{-1}/ +18.9252 kJ mol^{-1} K^{-1}, then award 2 marks** **If not,** $\Delta S^{\ominus}_{surroundings} = \frac{-\Delta H^{\ominus}}{T}$ **(1)** $= -\frac{(-5639.7) \times 1000}{298}$ = + 18925.2 J mol^{-1} K^{-1} / +18.9252 kJ mol^{-1} K^{-1} **(1)**	+18925.1 J mol^{-1} K^{-1}/ +18.9251 kJ mol^{-1} K^{-1}	**2**

Question Number	Acceptable Answers	Mark
19(a)(iii)	**First mark** ($\Delta S^{\ominus}_{total} = \Delta S^{\ominus}_{surroundings} + \Delta S^{\ominus}_{system}$ = 18925.2 + 479.7) = (+)19404.9 (J mol^{-1} K^{-1})/ (+)19.4049 (kJ mol^{-1} K^{-1}) if units given they must be correct **ALLOW** (+)19500 (J mol^{-1} K^{-1})/ (+)19.5 (kJ mol^{-1} K^{-1}) (from 19.0 + 0.480) **ALLOW** ecf on adding answers to (a)(i) and (a)(ii) in the same units (1) **Note** If answer to (a)(i) was +1709.7, $\Delta S^{\ominus}_{total}$ = +20634.9 (J mol^{-1} K^{-1}) / +20.6349 (kJ mol^{-1} K^{-1}) **Second mark** ($\Delta S^{\ominus}_{total}$ is positive so) reaction is (thermodynamically) spontaneous/ feasible/ goes to completion **ALLOW** thermodynamically unstable If their sign for $\Delta S^{\ominus}_{total}$ is negative, then **ALLOW** reaction is not spontaneous/ not feasible/ does not go to completion **(1)**	**2**

Question Number	Acceptable Answers	Reject	Mark
19(a)(iv)	**IGNORE** comments on $\Delta S^{\ominus}_{system}$ **First mark** ($\Delta S^{\ominus}_{surroundings} = -\Delta H^{\ominus}/T$ so increase in T makes) $\Delta S^{\ominus}_{surroundings}$ less positive/ decreases **ALLOW** more negative **(1)** **Second mark** ($\Delta S^{\ominus}_{total} = \Delta S^{\ominus}_{surroundings} + \Delta S^{\ominus}_{system}$ so increase in T makes) $\Delta S^{\ominus}_{total}$ less positive/ decreases **ALLOW** more negative **NOTE no ecf** on $\Delta S^{\ominus}_{surroundings}$ increases **(1)** **Third mark** (because $\Delta S^{\ominus}_{total}$ is so large and positive to start with) there is an insignificant effect on the extent of the reaction **ALLOW** $\Delta S^{\ominus}_{total}$ is still positive so reaction still goes to completion/is spontaneous **ALLOW** ecf on $\Delta S^{\ominus}_{total}$ increases **(1)**	more exothermic	**3**

Question Number	Acceptable Answers	Reject	Mark
19(a)(v)	**First mark** (stable because) high activation energy/ E_a (for combustion of sucrose) **ALLOW** sucrose is kinetically stable/ inert **(1)** **Second mark** (hazardous because small particles/ powder have/ has) larger surface area **and** react faster **(1)** **IGNORE** any reference to temperature If answers are not linked to stability and hazardous, still award both marks even if the points are written in the wrong order		**2**

Question Number	Acceptable Answers	Reject	Mark
19(a)(vi)	Any two of: obesity/ weight gain/ stored as fat/ get fat **(1)** tooth decay/ cavities/ toothache **(1)** diabetes/ glycosuria **(1)** heart/ cardiovascular condition/ disease/ attack **(1)** strokes **(1)** damage to the immune system **(1)** high insulin levels **(1)** high blood pressure **(1)** kidney damage **(1)** liver disease **(1)** headaches/ migraines **(1)** arthritis **(1)** high cholesterol **(1)** **IGNORE** risk of cancer/ high blood sugar/ stomach ulcers		**2**

Question Number	Acceptable Answers	Reject	Mark
19(b)(i)	circles or asterisks on carbons 2-5 all four correct **(2)** 3 or 2 correct **(1)** 1 or 0 correct **(0)** **ALLOW** 5 carbons circled **(1)**	all 6 carbons circled (0)	**2**

Question Number	Acceptable Answers	Reject	Mark
19(b)(ii)	rotate the plane of (plane-) polarized light **ALLOW** rotate plane-polarized light **IGNORE** optically active/ optical activity/ non-superimposable	just 'rotate light'	**1**

Question Number	Acceptable Answers	Reject	Mark
19(b)(iii)	**First mark – colour change** from a **blue** (solution) to a **red/ orange/ brown/ yellow precipitate** **ALLOW** solid or (s) for precipitate which could be shown in formula or equation **(1)** **Second mark – functional group** (glucose/it is) an aldehyde / (has) a CHO group **(1)** **Third mark – oxidation / reduction** copper(II)/Cu^{2+} is **reduced** (to copper(I)/Cu^{+} oxide by the aldehyde group) /$Cu^{2+} + e^{(-)} \rightarrow Cu^{+}$ **OR** the aldehyde/ glucose is **oxidized** (to the carboxylate/carboxylic acid)/ RCHO + [O] → RCOOH **OR** Benedict's and Fehling's (solutions) are oxidizing agents **ALLOW** equation showing oxidation of aldehyde and reduction of Cu^{2+} even if not balanced **(1)**	incorrect observation for one of the reagents for first mark only, eg. silver mirror formed	**3**

Total for Question 19 = 20 marks

Pearson Education Limited. Registered company number 872828
with its registered office at Edinburgh Gate, Harlow, Essex CM20 2JE