ADVICE TO EXAMINERS ON THE ANNOTATION OF SCRIPTS

1. Please ensure that you use the **final** version of the Mark Scheme. You are advised to destroy all draft versions.

2. Please mark all post-standardisation scripts in red ink. A tick (✓) should be used for each answer judged worthy of a mark. Ticks should be placed as close as possible to the point in the answer where the mark has been awarded. The number of ticks should be the same as the number of marks awarded. If two (or more) responses are required for one mark, use only one tick. Half marks (½) should never be used.

3. The following annotations may be used when marking. No comments should be written on scripts unless they relate directly to the mark scheme. Remember that scripts may be returned to Centres.

   x = incorrect response (errors may also be underlined)
   ^ = omission mark
   bod = benefit of the doubt (where professional judgement has been used)
   ecf = error carried forward (in consequential marking)
   con = contradiction (in cases where candidates contradict themselves in the same response)
   sf = error in the number of significant figures

4. The marks awarded for each part question should be indicated in the margin provided on the right hand side of the page. The mark total for each question should be ringed at the end of the question, on the right hand side. These totals should be added up to give the final total on the front of the paper.

5. In cases where candidates are required to give a specific number of answers, (e.g. 'give three reasons'), mark the first answer(s) given up to the total number required. Strike through the remainder. In specific cases where this rule cannot be applied, the exact procedure to be used is given in the mark scheme.

6. Correct answers to calculations should gain full credit even if no working is shown, unless otherwise indicated in the mark scheme. (An instruction on the paper to 'Show your working' is to help candidates, who may then gain partial credit even if their final answer is not correct.)

7. Strike through all blank spaces and/or pages in order to give a clear indication that the whole of the script has been considered.

8. An element of professional judgement is required in the marking of any written paper, and candidates may not use the exact words that appear in the mark scheme. If the science is correct and answers the question, then the mark(s) should normally be credited. If you are in doubt about the validity of any answer, contact your Team Leader/Principal Examiner for guidance.

Abbreviations, annotations and conventions used in the Mark Scheme		
	/	= alternative and acceptable answers for the same marking point
	;	= separates marking points
	NOT	= answers which are not worthy of credit
	( )	= words which are not essential to gain credit
	____	= (underlining) key words which **must** be used to gain credit
	ecf	= error carried forward
	AW	= alternative wording
	ora	= or reverse argument

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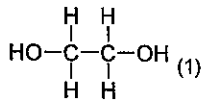
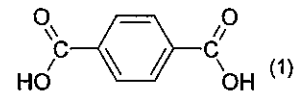
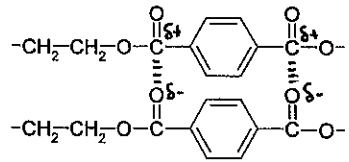
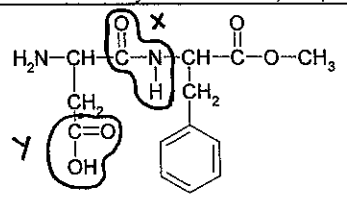
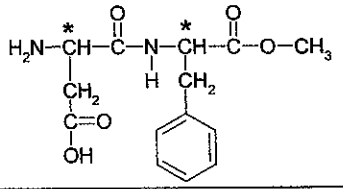
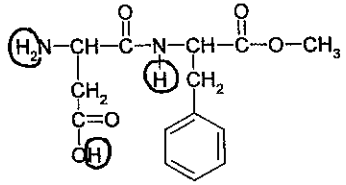
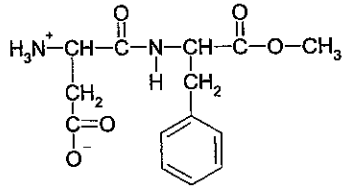
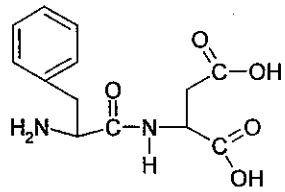
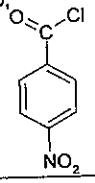
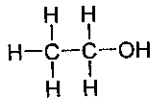
Question	Expected Answers	Marks
1(a)	to prevent oxidation of food/food decomposition/food spoilage/food contamination; to prevent escape of CO_2/gas escaping;	1
1(b)	ester;	1
1(c)	many / lots of; (accept long chain molecule) molecules/units / monomers joined together; small molecule / water is eliminated;	3
1(d)	Monomer A  (1) Monomer B  ;(1) (1) allow 1 mark if 2 carboxylic acid groups (not full structural) are shown in the correct position. **No ambiguous attachments**	3
1(e)(i)	permanent dipole - (permanent) dipole forces (must have idea of between chains)	1
1(e)(ii)	δ^- on O on C=O on one chain; δ^+ on C of carbonyl group; attraction shown clearly between these atoms on separate chains;  Ignore extra correct charges	3
1(f)	4from: chains are more linear in PET; therefore able to pack more closely together/ more points of contact; PET is more crystalline/packed more regularly/more aligned/more ordered; Stronger/more intermolecular forces/increased van der Waals forces in PET (NOT BONDS); more energy needed or more difficult to separate the chains / overcome intermolecular forces/ cause chains to slide over each other (when PET melts) ORA (ignore reference to branched chains in polymer X) (heat and energy interchangeable – not melts)	4
		Total:16

Question	Expected Answers	Marks
2(a)	3 from: dissolve/ forms a solution; in minimum owtte amount ;of hot methanol (not reflux/distill/to evaporate) cool to recrystallise; 1 from: filter/dry/ wash; *QWC: Min. of 2 sentences/ bullet points with 2 of the following processes correctly used:dissolve,filter,solvent/methanol,solution.*	4(+1)
2(b)	 Correctly labelled (ie no labels scores 1)	2
2(c)(i)		2
2(c)(ii)	four different groups attached to the carbon atom	1
2(d)	 Deduct 1 mark for each additional H circled above 3. (max 3)	3
2(e)	 Correct zwitterion without charges scores 1 (accept condensed formula for carboxylate ion)Proton must be transferred to and from correct functional groups	2
2(f)	reflux/heat/warm (not high temperature/boil); with moderately concentrated /(4M-6M) hydrochloric acid/sodium hydroxide/ sulphuric acid/ acid/alkali; (not nitric acid)	2

2(g)	amide link correct; rest of molecule;  any structure shown i.e. structural or skeletal	2
		Total: 19

Question	Expected Answers	Marks
3(a)(i)	Compound X is C_2H_5OH (1) Other product is H_2O (1)	2
3(a)(ii)	concentrated sulphuric acid allow formula	1
3(b)	structural formula of acyl chloride group; rest of molecule; **(no ambiguous attachments)** 	2
3(c)(i)	R-C<u>H</u>$_3$ =1.2; R-O<u>H</u> =2.7 ; **must have R group** R-C<u>H</u>$_2$-O =3.8 ;	3
3(c)(ii)	**full structural** formula of ethanol ; **(no ambiguous attachments)** 	1
		Total: 9

Question	Expected Answers	Marks
4(a)(i)	correctly plotted data (2) (all points should be +/- 1 scale division),1 incorrect point ((1); smooth curve;	3
4(a)(ii)	each half life correctly drawn and **clearly labelled** = 1 mark (2 max) (two half lives correctly drawn without labels scores 1) Half life clearly labelled in words or letters showing the correct horizontal portion	2
4(a)(iii)	1800-2200s	2
4(a)(iv)	first order wrt sucrose; half lives (almost) constant; ecf from (a)(iii) half lives not constant; therefore not first order (no ecf to 4b); (half lives must be present in (a)(iii) to get reason mark) (values should be different by≥100 to score different mark)	2
4(a)(v)	draw a tangent to the curve at t=0s owtte; find the gradient ie concentration÷time; not just line	2
4(b)	rate = k[H$^+$] [sucrose]; 1 mark for each correct component of RHS ecf if zero or second order wrt sucrose in (a)(iv)	3
4(c)	rate would halve	1
		Total:15

5(a)	different sized atoms ; interrupt orderly arrangement of atom in metal lattice/less regular lattice; layers of atoms prevented from slipping; (Marks can be awarded for clearly annotated diagram) (Diagram showing different sized atom scores 1)	3
5(b)	4 from: make up solutions of known concentrations; range/different concentrations; range in correct region; choose filter/ set colorimeter at the correct wavelength; zero with water; measure absorbance/transmittance;	4
5(c)(i)	2.65×10^{-2} - 2.70×10^{-2} (mol dm^{-3})	1
5(c)(ii)	2.65×10^{-2} x 63.5(1) =1.68g in $1dm^{-3}$; ecf 2.70×10^{-2} x 63.5 =1.71g answer÷10 (1) 0.168g – 0.171g in sample (1) 2/3sf	3
5(c)(iii)	$\frac{0.168}{0.200}$ x 100 =84.0% - $\frac{0.171}{0.200}$ x 100 = 85.5% allow ecf only if < 100%	1
		Total 12

Question	Expected Answers	Marks
6(a)(i)	$Cu^{2+} + Zn \rightarrow Zn^{2+} + Cu$	1
6(a)(ii)	1.1V	1
6(b)(i)	$3d^{10}$;$4s^1$; (allow 1 mark for $3d^9$; $4s^2$)	2
6(b)(ii)	9	1
6(c)	(central) metal ion; (ignore atom) surrounded by/bonded to ligands/ negatively charged ions/molecules with lone pairs;	2
6(d)	4 from: ligands cause splitting of sub shell into two energy levels; d orbitals partially filled; electron is promoted/excited from lower energy level to a higher energy level difference in energy corresponds to visible region of EMS/light (energy) is absorbed; light not absorbed/transmitted/reflected gives colour;	4
6(e)	Equilibrium lies neither to the left or right; AW	1
6(f)	$K_c = \frac{[CuCl_4(H_2O)_2^{2-}]\ ([H_2O]^4)}{[Cu(H_2O)_6^{2+}][Cl^-]^4}$ top component=1 bottom component =1 K_c & powers =1	3
6(g)(i)	solution would turn pale blue; stability constant is greater for $edta^{4-}$ complex /$edta^{4-}$ complex is more stable than $[CuCl_4(H_2O)_2]^{2+}$;	2
6(g)(ii)	solution would remain pale blue/ no colour change; stability constant for ammonia complex is smaller/ ammonia complex is less stable than $edta^{4-}$ complex;	2
		Total 19