

A-LEVEL PAPER 2 PP9 MS

1. (a) 23.15 1
 volume quoted to 2 dp 1
 (b) moles alkali = moles acid = $1.15(8) \times 10^{-3}$ 1
 concentration = 0.0463 1
 (c) concentration = $1.419 \times 4 = 5.676 \text{ g dm}^{-3}$ 1
 (d) $M_r = 5.676/0.0463 = 122.6$ 1
 (e) several results reduce allow identification of anomalies/ establish pattern/ more reliable 1
- [7]**

2. **X** propene or $\text{CH}_3\text{CH}=\text{CH}_2$ 1 Ignore C_3H_6
 contradiction loses the mark
- Y** propan-1-ol or 1- propanol or $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ 1 Not propan-2-ol nor $\text{C}_3\text{H}_7\text{OH}$
 contradiction loses the mark
 Ignore propanol if correct structure also give
 If reagent wrong or missing, no mark for conditions, but allow conditions following minor slip in formula
 Ignore temperature throughout
- Reaction 1 KOH or NaOH 1 Any mention of conc sulphuric loses both reagent and condition marks
 Incomplete reagent e.g. OH^- penalise once but can score conditions marks in both Reaction 1 and 3
- (Hot) alcoholic or ethanolic 1 Not ethanoic
- Reaction 2 HBr or KBr/ H_2SO_4 (with or without conc or dil) 1 Not KBr alone ignore extra (conc) H_2SO_4
- Reaction 3 KOH or NaOH 1 Any mention of conc sulphuric loses both reagent and condition marks
- (Warm) aqueous 1
- Reaction 4 $\text{K}_2\text{Cr}_2\text{O}_7$ /acidified or H^+ or KMnO_4 /acidified or H^+ 1 Not Fehlings/Tollens penalise incomplete reagent again
 reflux 1
- [9]**

3.

(OH at) 2500-3000 (cm^{-1})	1	Accept a wavenumber within this range.
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[1]

$$(b) \quad K_c = \frac{[Y][H_2O]^2}{[X][CH_3OH]^2}$$

if K_c expression wrong
lose units mark in (e) also

must be [] (1)

(1 mark)

(c) Moles of X $0.25 - 0.13 = 0.12$ (1)

Moles of methanol $0.34 - 0.26 = 0.08$ (1)

Moles of water 0.26 (1)

(3 marks)

(d) Equal no moles on each side of equation (1)

OR V cancels (provided not incorrectly qualified)

(1 mark)

(e) Calculate the value of K_c for this reaction and deduce its units.

Calculation $K_c = \frac{(0.13/V)(0.26/V)^2}{(0.12/V)(0.08/V)^2}$ (1)

..... $= 11.4$ (1)

Units of K_c none (1)

Can score all 3
conseq on (b) and (c)

If different values from
(c) used, allow units
only (conseq on correct K_c)

but lose this mark if K_c wrong
even if none given.

(3 marks)

(f) State the effect, if any, of increasing the temperature on the value of K_c

decrease (1)

(1 mark)

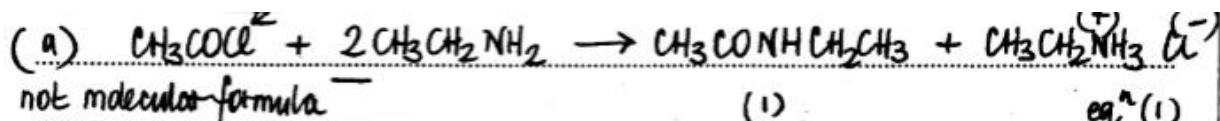
[10]

7. (a) the **scale** of working used (s) **max 4** scoring points
 equation $HOC_6H_4COOH + (CH_3CO)_2O \rightarrow CH_3COOC_6H_4COOH + CH_3COOH$
 calculates theoretical mass of acid to make 5g aspirin (3.83g)
 calculates likely mass of acid to make 5g aspirin (5.11g)
 calculates mass of ethanoic anhydride needed (3.78g)

- (b) (i) **apparatus** (a) **max 3** scoring points
 measuring cylinders **or** pipettes
 flask **or** other suitable
 balance
 named filtration apparatus eg Buchner or filter funnel and filter paper
 condenser
- (ii) the **method** used (m) **max 5** scoring points
 mixes reagents
 adds a few drops of acid
 care **or** cool if necessary
 reflux 15 minutes
 add water
 care / a little at a time
 filter
- recrystallisation** (r) **max 5** scoring points
 dissolves in the minimum quantity
 of hot water
 cools hot solution
 filters crystals
 dries crystals
 weighs dry sample
 purity check
- (c) **safety** (h) **max 3** scoring points
 ethanoic anhydride / phosphoric acid corrosive
 potential fire hazard with organics **or** no naked flames
 avoid skin contact **or** flood affected areas **or** gloves
 use fume cupboard
 eye protection

Grading	20 scoring points	18 - 20	scores	8 marks
		16 - 17	scores	7 marks
		14 - 15	scores	6 marks
		12 - 13	scores	5 marks
		9 - 11	scores	4 marks
		6 - 8	scores	3 marks
		3 - 5	scores	2 marks
		1 - 2	scores	1 mark

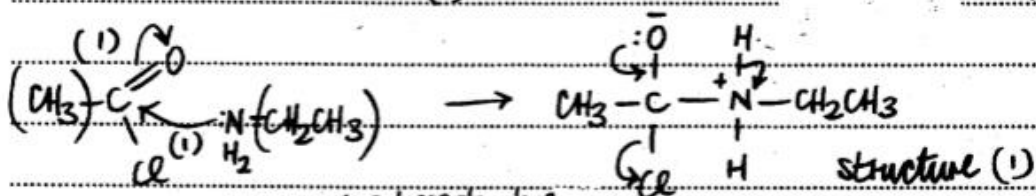
8.



(N)ethyl ethanamide (1)

eqⁿ (1)
 only an if structure c product correct

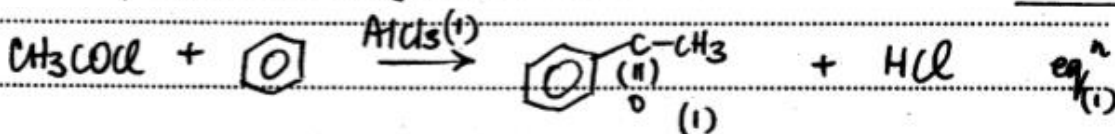
addition-elimination (1)



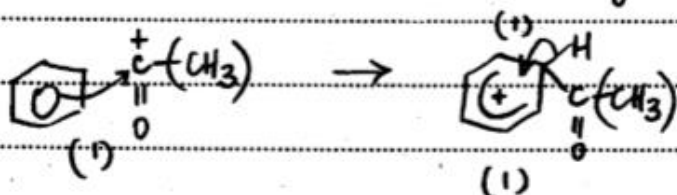
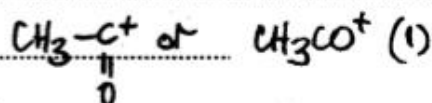
wrong amine loses structure mark.

NH₃ loses first mark gained and structure.

[max 8]



phenyl ethanone (1)

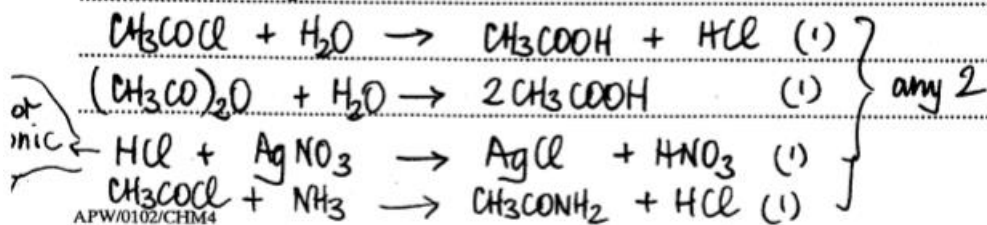


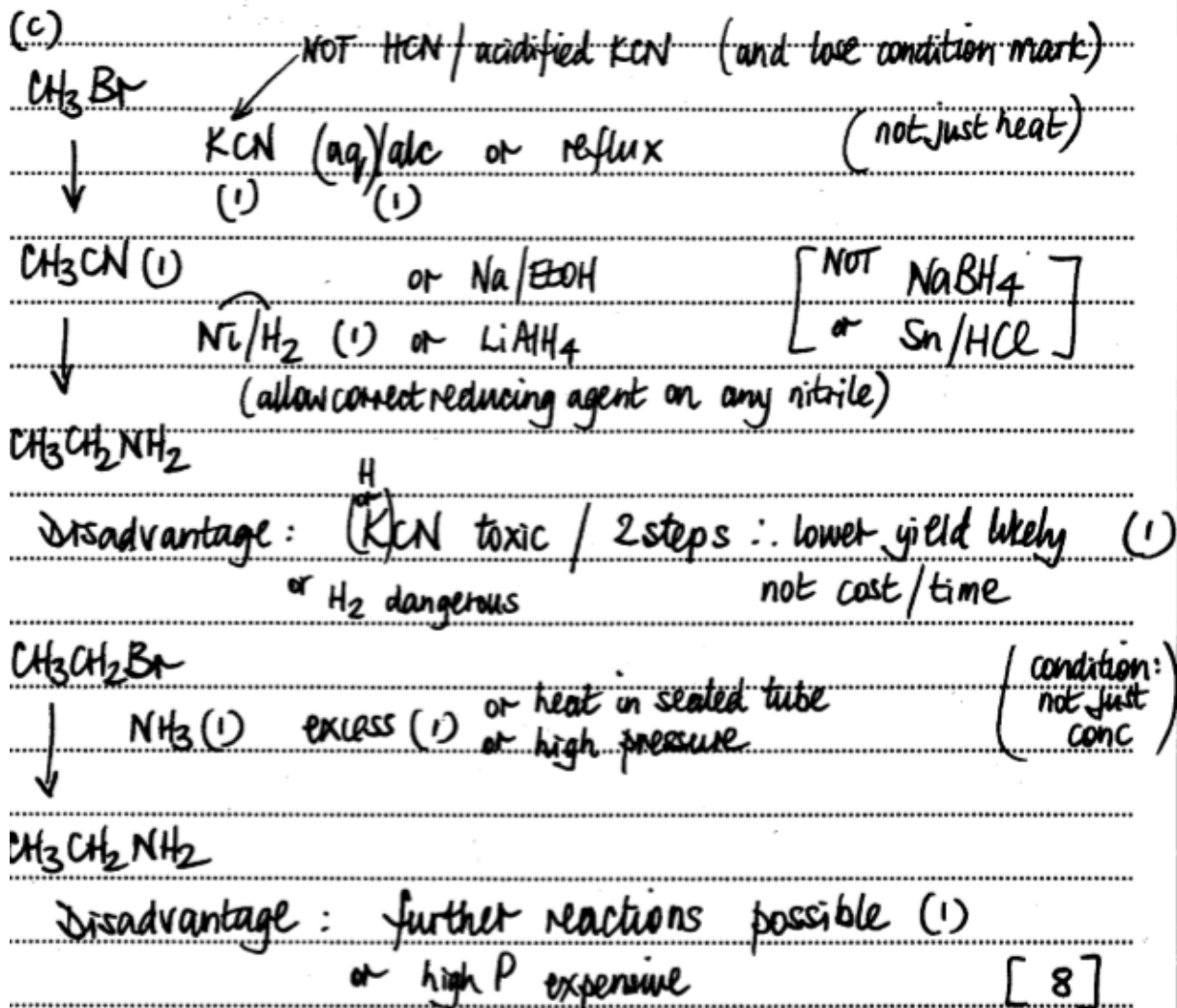
electrophilic substitution (1)

[max 8/9]

(b) Any two from cheaper / no HCl / toxic / less corrosive / less easily hydrolysed (2)

TEST: Add (to) H₂O (1) or alcohol or ammonia OR add (aqueous) AgNO₃ (1) [NOT Na₂CO₃]
 anhydride: no gas fumes (1) OR no ppt (1)
 chloride: (misty) gas fumes (1) OR vigorous reaction OR (white) ppt (1)
 or pH test on gas described

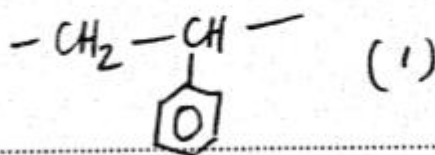




[30]

9.

Type of polymerisation addition (1)



Repeating unit (2 marks)

[2]

10. (a) (i) $\begin{matrix} \text{CH}_3 \\ | \\ \text{H}_3\text{N}^+-\text{C}-\text{COO}^- \\ | \\ \text{H} \end{matrix}$ 1
- (ii) $\text{H}_2\text{N}-\text{CH}_2\text{CH}_2-\text{COOH}$ not $\text{H}_2\text{N}-\text{C}_2\text{H}_4-\text{COOH}$ 1
- (iii) ethan(e)-1,2-diamine allow ethylene diamine or 1,2-diaminoethane 1
but penalise wrong numbers
- butan(e)-(-1,4-)dioic acid NOT dibutanoic acid 1

(b)	(i)	addition	not additional	1
	(ii)	3-methylpent-2-ene		1
(c)	(i)	HOCH ₂ CH ₂ OH		1
		HOOCCH ₂ CH ₂ COOH	or ClOCCH ₂ CH ₂ COCl	1
	(ii)	HOCH ₂ CH ₂ COO ⁻	allow -COONa but not covalently bonded Na	1
(d)	(i)	van der Waals	allow vdW or London forces or dispersion forces	1
	(ii)	dipole- dipole	QWC Not temporary dipole- induced dipole	1

[11]

11. (a) Incomplete reagent (e.g. carbonate) loses reagent mark, but mark on

If more than one test **including a different test on P and Q** ; give worst mark for one test; if either reagent wrong - no marks at all

For "no reaction" allow "nothing" **Wrong reagent is CE = zero**

(i)	reagent	Br ₂ not Br₂/uv	KMnO ₄ / acidified or H ⁺	(1)
	P	no reaction	no reaction or stays purple	(1)
	Q	bromine decolourised	colourless or brown	(1)
(ii)	reagent	Na ₂ CO ₃ / NaHCO ₃	UI PCl ₅ PCl ₃ Suitable	(1)
		named carbonate	litmus SOCl ₂ metal	
	R	no reaction	No reaction No reaction No reaction	(1)
	S	effervescence or CO ₂ or dissolves	red fumes effervescence or H ₂ or dissolves	(1)

Alternate:

(ii)	reagent	Bradys or 2,4,dnph	I ₂ /NaOH or NaOCl/KI	named alcohol /acid (catalyst)	(1)
	R	Orange/yellow ppt	Yellow ppt	No reaction	(1)
	S	No reaction	No reaction	Smell	(1)
(iii)	reagent	K ₂ Cr ₂ O ₇ /	KMnO ₄ /		(1)
		acidified or H ⁺	acidified or H ⁺		
	T	turns green	colourless or brown		(1)
	U	no reaction	no reaction		(1)
		stays orange	stays purple		

(b) CDCl_3 or CCl_4 or D_2O or C_6D_6 (1)

V ethanoic anhydride (1)

W dimethylethan(e)dioate (ignore numbers) (1)

V has peak at $\delta = 2.1 - 2.6$ (and **W** doesn't) **or**

W has peak at $\delta = 3.7 - 4.1$ (and **V** doesn't) (1)

Allow δ for **W** is higher than δ for **V** or peak for **W** is further to left etc

but if use numbers both must be correct.

[13]