

TOPIC 12 HW MS

1. (a) Any **two** from:

Weigh by difference or rinse weighing bottle and add to beaker Rinse beaker and add washings to graduated flask Invert flask several times to ensure uniform solution Use a funnel to transfer to the flask and rinse the funnel Use a stirrer to prepare the solution and rinse the stirrer If more than two answers apply the list rule. Max 2 (b) $K_{a} = [H^{+}]^{2} / [HA]$ Allow any correct expression relating Ka, [44] and [HA] 1 $[HA] = (10^{-2.50})^2 / 1.07 \times 10^{-3}$ M2 also scores M1 1 = 9.35 × 10⁻³ (mol dm⁻³) Do not allow 9.4 (answer is 9.346). Correct answer only scores 1 mark. Do not penalise precision but must be to at least two significant figures. 1 (b) × 138.0 / 4 (C) 1 Using 8.50 × 10-3 gives 0.293 Correct answer scores M1 and M2. Do not penalise precision but must be to at least two significant figures. 1 (d) (c) \times 100 / 0.500 = 64.5% Using 0.293 from (c) gives 58.7% Using 0.347 gives 69.4% Do not penalise precision. 1 1

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MEGA LECTURE

(a) (i)
$$-\log[H_{-}]$$

Penalise missing [] here and not elsewhere
(ii) $[H_{-}][OH_{-}]$
(b) (i) $[H_{-}] = 2.34 \times 10^{-7}$
 $pH = 6.63$
Penalise fewer than 3 sig figs but allow more
than 2 dp
(ii) $[H_{-}] = [OH_{-}]$
(iii) $M_{-}1 = [OH_{-}]$
(iii) $M_{-}1 = [OH_{-}]$
(iii) $M_{-}1 = [H_{-}] = K_{-}[OH_{-}]$
if upside down or CE, allow M3 only for correct
use of their [H_{-}]
 $M_{-}2 = 5.48 \times 10^{-14}/0.140) = 3.91 \times 10^{-13}$
 $M_{-}3 pH = 12.4(1)$
not 12.40 (AE from 12.407)
Penalise fewer than 3 sig figs but allow more
than 3 sts
For values above 10, allow 3sts - do not insist
on 2 top.
For values below 1, allow 2dp - do not insist on
sig figs
Not allow pH = 14 - pOH but can award M3
only for pH = 13.1(46)
Can award all three marks if pK_{-} = 13.26 is
used



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	(c)	M1	mol NaOH = mol OH⁻ = (30 × 10⁻₃) × 0.20 = 6.0 × 10⁻₃ mark for answer			
		М2		₂SO₄ = (25 × 10-₃) × 0.15 = 3.75 × 10-₃ mark for answer	1	
		М3	OR X	$f^{*} = (25 \times 10^{-3}) \times 0.15 \times 2 = 7.5 \times 10^{-3}$ S mol H ₂ SO ₄ = 0.75 × 10 ⁻³ if factor of 2 missed or used wrongly, CE - lose M3 and next mark gained. In this case they must then use K _w to score any more. see examples below	1	
		М4	XS m	XS mol H+ = 1.5 × 10-₃		
					1	
		M5		$(1.5 \times 10^{-3}) \times (1000/55) = 0.0273$ if no use or wrong use of volume, lose M5 and M6 except if 1000 missed AE -1 (pH = 4.56)	1	
		M6		1.56 Penalise fewer than 3 sig figs but allow more than 3 sfs For values above 10, allow 3sfs - do not insist on 2 dp. For values below 1, allow 2dp – do not insist on 3 sig figs	1	[14]
3.	(a)	Proton donor or H₊ donor Allow donator			1	[,-]
	(b)	(i)	ΒB	Both need to be correct to score the mark	1	
		(ii)	AA	Both need to be correct to score the mark	1	
		(iii)	ΒA	Both need to be correct to score the mark		

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- (c) **M1** $[H_{+}] = 10_{-1.25}$ OR 0.05623
 - **M2** mol HCl = $(25 \times 10^{-3}) \times 0.0850$ (= 2.125 × 10⁻³) Mark for Working

$$=\frac{2.125\times10^{-3}}{0.05623}$$

M3 vol

= 0.0378 dm³ or 37.8 cm³

allow 0.0375 – 0.038 dm³ or 37.5 – 38 cm³ Units and answer tied Lose M3 if total given as (25 + 37.8) = 62.8 cm³ Ignore "vol added = 12.8 cm³ " after correct answer

(d) (i) 4.52

Must be 2dp

(ii) $K_a =$ ignore = but this may score M1 in (d)(iii) Must have all brackets but allow () Allow HA etc NO mark for 10^{-pKa} (iii) M1 $K_a =$ or with numbers Allow [$\frac{H}{H}$] = (Ka × [HA]) for M $\sqrt{1}$

- **M2** $[H_{-}] = ((3.01 \times 10^{-5} \times 0.174) = (5.24 \times 10^{-5}))$ = 2.29 × 10⁻³ - 2.3 × 10⁻³ *Mark for <u>answer</u>*
- **M3** pH = 2.64 (allow more than 2dp but not fewer) *Allow 1 for correct pH from their wrong [H·] If square root forgotten, pH = 5.28 scores 2 for M1 and M3*

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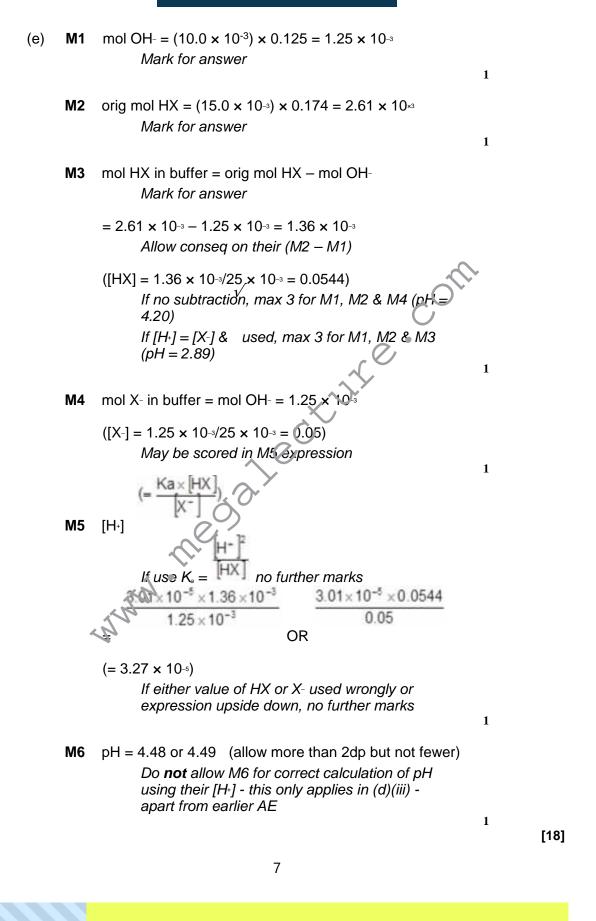
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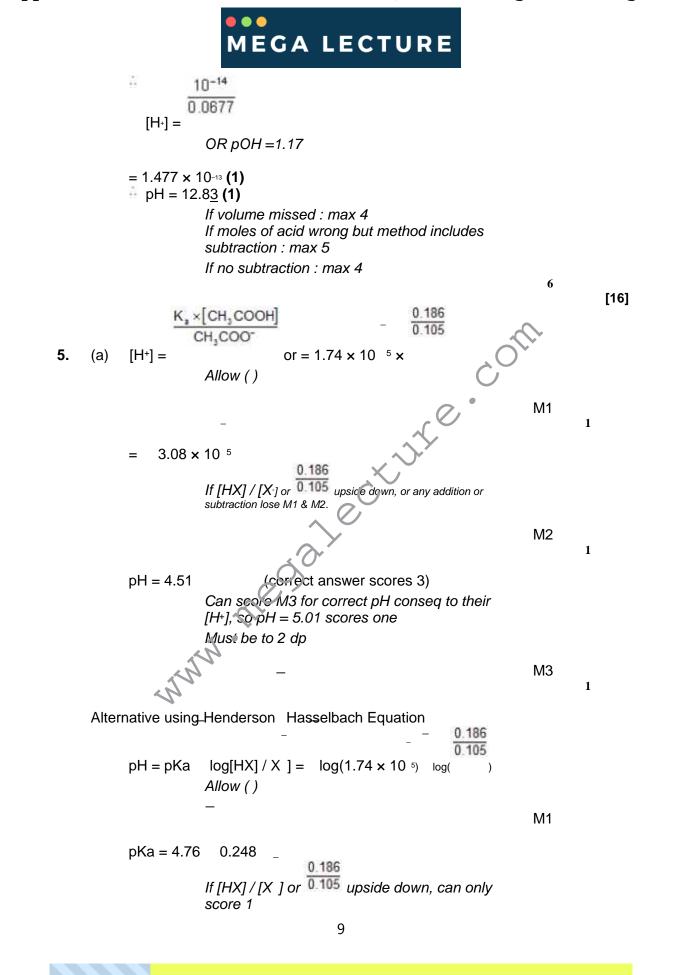
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MEGA LECTURE

[H+][A-] [H*][CH3COO-] [HA] [CH₃COOH] 4. before any KOH added: K_a = (1) (a) or [H⁺]² [CH₃COOH] $K_a =$ (1) $\sqrt{1.74 \times 10^{-5} \times 0.160}$ = 1.67 × 10⁻³ (1) [H+] = 2 pH = 2.78 (1) 4 at 8 cm₃ KOH: (b) Moles KOH added = $(8 \times 10^{-3}) \times 0.210 = 1.68 \times 10^{-3}$ (1) moles of CH₃COO- formed = 1.68×10^{-3} (1) Original moles of CH₃COOH = $(25 \times 10^{-3}) \times 0.160 = 4.0 \times 10^{-3}$ (1) moles of CH₃COOH left = $(4.0 \times 10^{-3}) - (1.68 \times 10^{-3})$ = 2.32 × 10-3 (1) [CH3COOH] [CH3COOT] $[H_{+}] = K_a \times$ (1) 2.32×10 $1.68 \times 10^{-3} / V$ = 1.74 × 10-5 × = 2.40 × 10-5 (1) pH = 4.62 (1) It forget subtraction : max 5 If K_a expression not used max 5 if moles of CH₃COOH wrong but substitution used max 5 7 at 40 cm³ of KOH: (c) Total moles of KOH = $(40 \times 10^{-3}) \times 0.21 = 8.4 \times 10^{-3}$ (1) excess moles of KOH = (8.4 × 10-3) - (4.0 × 10-3) = 4.4 × 10-3 (1) in total volume = $40 + 25 = 65 \text{ cm}_3$ (1) 1000 $[OH-] = 4.4 \times 10^{-3} \times 65 = 0.0677$ (1) 8

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M2

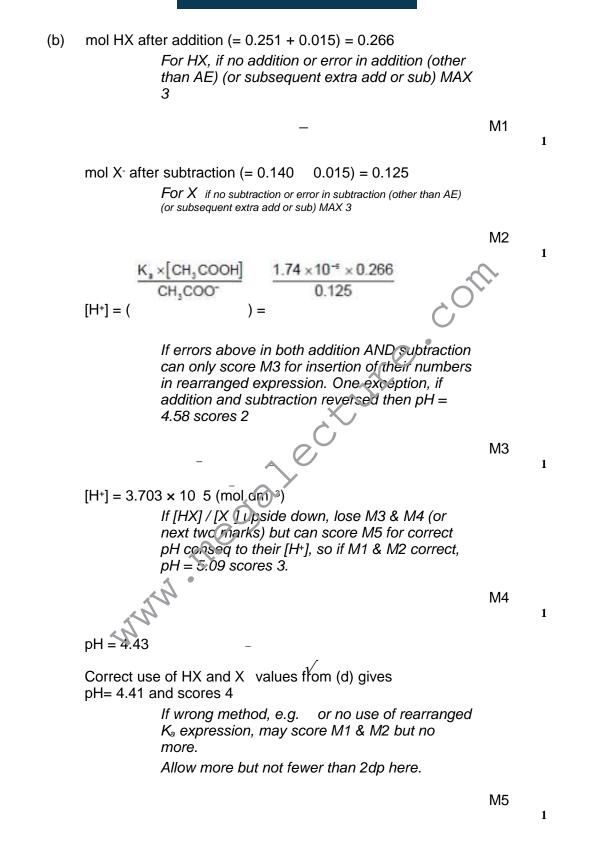
pH = = 4.51 so pH = 5.01 Must be to 2 dp

M3

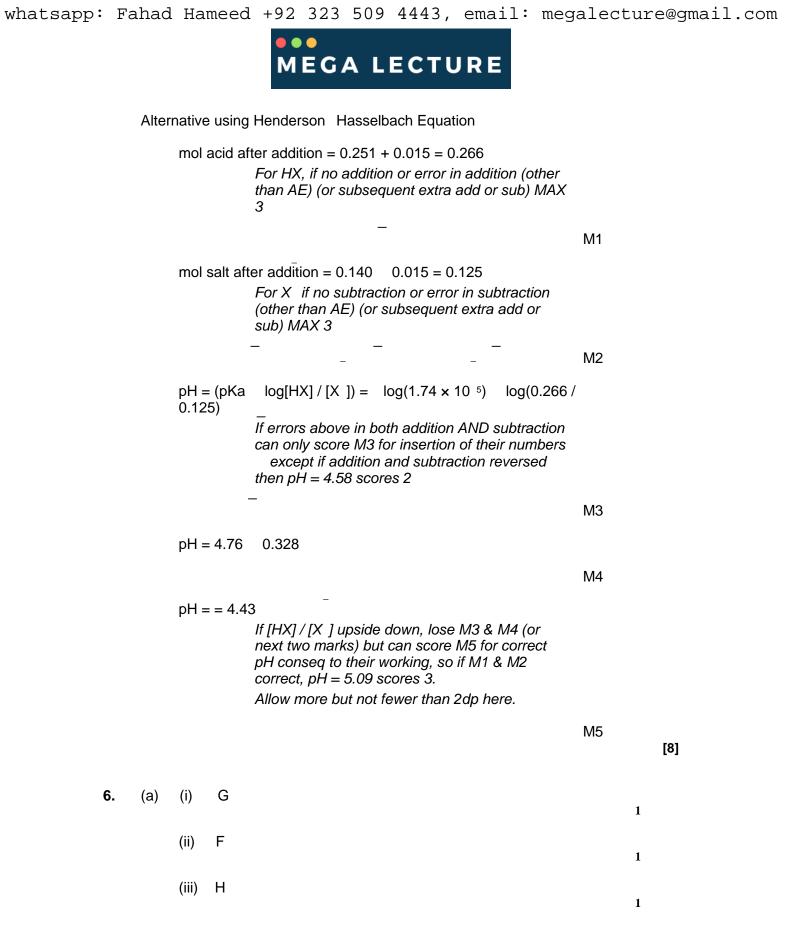


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(b) (i) cresol purple 1 (ii) yellow to red both colours needed and must be in this order 1 (iii) yellow or pale yellow Not allow any other colour with yellow 1 [6] 7. NH_{4^+} $NH_3 + H_1$ (a) Accept multiples. Accept $NH_{4^+} + H_2O$ $NH_3 + H_3O_+$ Ignore state symbols, even if incorrect. 1 (b) indicator / conc HCI Test Do not accept 'smell'. Do not accept precipitation reactions of aqueous ammonia. 1 Observation colour for an alkali / white fumes If wrong test then lose second mark. 1 [3] 8. (Calibrate) meter with solution(s) of known pH/buffer(s) Do not accept 'repeat reading' 1 Adjust meter/plot calibration curve 1 [2] 9. С [1] 10. D [1] 11. В [1] 12. D [1]

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13. A

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