

Chapter 14 — Practice FRQ

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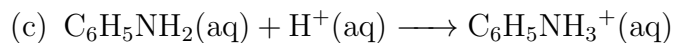
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1. (a)

$$k_b = \frac{[\text{C}_6\text{H}_5\text{NH}_3^+][\text{OH}^-]}{[\text{C}_6\text{H}_5\text{NH}_2]} \quad (1)$$

(b)

$$\begin{aligned} [\text{OH}^-] &= 10^{8.82-14} = 6.61 \cdot 10^{-6} \\ k_b &= \frac{(6.61 \cdot 10^{-6})^2}{.1} \\ &= 4.37 \cdot 10^{-10} \end{aligned} \quad (2)$$



	$\text{C}_6\text{H}_5\text{NH}_2$	H^+	$\text{C}_6\text{H}_5\text{NH}_3^+$
I	.0025	.0005	0
C	-.0005	-.0005	.0005
E	.002	0	.0005

$$[\text{C}_6\text{H}_5\text{NH}_2] = \frac{.002}{.03} = .066\bar{6} \quad (3)$$

$$[\text{C}_6\text{H}_5\text{NH}_3^+] = \frac{.0005}{.03} = .016\bar{6}$$

$$p\text{OH} = -\log_{10}(4.37 \cdot 10^{-10}) + \log_{10}\left(\frac{.016\bar{6}}{.066\bar{6}}\right)$$

$$p\text{H} = 14 - 8.757 = 5.24$$

(d)

	$\text{C}_6\text{H}_5\text{NH}_2$	H^+	$\text{C}_6\text{H}_5\text{NH}_3^+$
I	.0025	.0025	0
C	-.0025	-.0025	.0025
E	0	0	.0025

$$[\text{C}_6\text{H}_5\text{NH}_2] = \frac{.0025}{.05} = .05$$

$$k_a = \frac{k_w}{k_b} = 2.29 \cdot 10^{-5}$$

$$\frac{x^2}{.05} = 2.29 \cdot 10^{-5}$$

$$x = .00107$$

$$-\log_{10}(.00107) = 2.97$$
(4)

(e) Erythrosine is the best option because its $\text{p}k_a$ is closest to the pH (3 is close to 2.97)