Begin your response to **QUESTION 4** on this page.

4. A student is asked to prepare a buffer solution made with equimolar amounts of $CH_3NH_2(aq)$ and $CH_3NH_3Cl(s)$. The student uses 25.00 mL of 0.100 M $CH_3NH_2(aq)$, which contains 0.00250 mol of CH_3NH_2, to make the buffer.

(a) Calculate the mass of $CH_3NH_3Cl(s)$ that contains 0.00250 mol of CH_3NH_3Cl.

The student has the following materials and equipment available.

• Distilled water	• Electronic balance	• 50 mL beaker	• Pipets
• 0.100 M $CH_3NH_2(aq)$	• Weighing paper	• 10.0 mL graduated cylinder	• pH meter
• Solid CH_3NH_3Cl	• 50.00 mL buret	• Small spatula	

(b) The following table contains a partial procedure for making the buffer solution. Fill in steps 1 and 4 to complete the procedure using only materials and equipment selected from the choices given. (Not all materials listed will be used. Assume that all appropriate safety measures are already in place.)

Step	Procedure
1	
2	Place the solid in the 50 mL beaker.
3	Clean the buret and rinse with distilled water.
4	
5	Use the buret to add 25.00 mL of 0.100 M $CH_3NH_2(aq)$ to the beaker.
6	Mix well.
7	Check the pH with the pH meter.

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Continue your response to **QUESTION 4** on this page.

The value of K_b for $CH_3NH_2(aq)$ is 4.4×10^{-4}, and the pH of the buffer the student prepared is 10.64.

(c) The student prepares a second buffer solution. The student uses 25.00 mL of 0.050 M $CH_3NH_2(aq)$ instead of 25.00 mL of 0.100 M $CH_3NH_2(aq)$, and half the mass of $CH_3NH_3Cl(s)$ that was used in the first buffer. Is the pH of the second buffer greater than, less than, or equal to the pH of the first buffer? Justify your answer.

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Question 4: Short Answer   4 points

(a)	For the correct calculated value:	**1 point**

$$0.00250 \text{ mol CH}_3\text{NH}_3\text{Cl} \times \frac{67.52 \text{ g}}{1 \text{ mol}} = 0.169 \text{ g}$$

(b)	For a correct description of step 1:	**1 point**

Accept one of the following:

- *Use the spatula, balance, and weighing paper to measure out exactly* 0.169 g *of* $\text{CH}_3\text{NH}_3\text{Cl}(s)$.
- *Use the balance to weigh out the mass of solid in part (a).*

For a correct description of step 4:	**1 point**

Rinse the buret with a small amount of 0.100 M $\text{CH}_3\text{NH}_2(aq)$, *drain, and refill with* 0.100 M $\text{CH}_3\text{NH}_2(aq)$.

Total for part (b)	**2 points**

(c)	For the correct answer and a valid justification:	**1 point**

Equal to. The ratio of weak acid to conjugate base is still 1:1.

Total for question 4	**4 points**