

Buffers: Capacity and Evidence

Student Worksheet | g10_u05_w20

I can: use a weak-acid/conjugate-base model and mole accounting to explain limited buffer action.

Supplied model: Buffer B contains 100.0 mL with 0.0100 mol weak acid HA and 0.0100 mol conjugate base A^- . Assume added strong acid supplies H^+ and added strong base supplies OH^- , with complete reaction in the mole model. Work only from these cards—no mixing, tasting, or chemical handling. A buffer resists a pH change within a limited range; it does not hold pH perfectly constant.

card	addition	amount added	relevant starting inventory
Acid card	H^+	0.00100 mol	0.0100 mol A^-
Base card	OH^-	0.00100 mol	0.0100 mol HA
Capacity card	H^+	0.0120 mol	0.0100 mol A^-

1. Identify the weak acid and the conjugate base in Buffer B.

2. What makes HA/A^- a conjugate pair?

3. In plain language, define a buffer without claiming that it prevents every pH change.

4. Calculate the initial ratio $n(A^-)/n(HA)$ for Buffer B.

5. Write the net ionic mole-model reaction when the Acid card is added.

6. Which buffer component is consumed by H^+ ? Which component increases?

7. After the Acid card, calculate moles of A^- .

8. After the Acid card, calculate moles of HA.

9. Calculate $n(\text{A}^-)/n(\text{HA})$ after the Acid card.

10. Predict the pH direction after the Acid card. State why your claim is limited.

11. Write the net ionic mole-model reaction when the Base card is added.

12. After the Base card, calculate moles of HA and A^- .

13. Calculate $n(\text{A}^-)/n(\text{HA})$ after the Base card.

14. Predict the pH direction after the Base card. Why is it not valid to say “no change”?

15. Compare 0.00100 mol added acid with the initial 0.0100 mol A^- inventory. What does this comparison say about capacity?

16. For the Capacity card, how many moles of H^+ remain after all A^- is consumed?

17. Explain why Buffer B cannot keep buffering added acid after its A^- inventory is exhausted.

18. Buffer C has 0.00100 mol each of HA and A^- at the same initial ratio as B. Which has greater acid-addition capacity, B or C? Cite quantities.

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19. A data-only card says “a conjugate pair reacts with some added acid or base.” What additional information is needed to judge whether a particular addition exceeds capacity?

20. Write a cautious CER statement that uses one reaction/mole result and one capacity limit.
