

8.10 Buffer Capacity

Name: _____ Class: _____ Date: _____

Total: 9 marks

Objective

Build the skills to answer exam questions on **buffer capacity**.

You must be able to:

- define **buffer capacity** 缓冲容量 (how much acid/base a buffer absorbs)
- link capacity to the **amounts** of the buffer components
- compare two buffers' capacities

1 Worked examples

Study these first. Each one shows the method for a question type used later —follow the steps and you can do the Practice and Exam-style questions yourself.

■ Buffer capacity

Buffer capacity is how much added acid or base a buffer can neutralize before its pH changes significantly. It depends on the **amounts** (moles) of the weak acid and its conjugate base.

■ More moles, more capacity

A **concentrated** buffer (more moles of both components) has a **larger** capacity than a dilute one with the same ratio —same pH, but it can absorb more.

■ Ratio vs capacity

The **ratio** sets the **pH**; the **amounts** set the **capacity**. Two buffers can have the same pH but very different capacities.

■ Best capacity near 1:1

Capacity is greatest when $[A^-] \approx [HA]$ (near $\text{pH} = \text{p}K_a$), because there is plenty of both to react with either added acid or base.

2 Practice

Now apply the methods above.

2.1 What does buffer capacity measure?

[1]

2.2 Which sets the pH: the ratio or the amounts? [1]

2.3 Two buffers have the same ratio but one is more concentrated. Which has the greater capacity? [1]

3 Exam-style questions

3.1 Buffer capacity depends mainly on the [1]

- **A** ratio of base to acid
 - **B** amounts (moles) of the components
 - **C** temperature only
 - **D** color
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3.2 Buffer P is 1.0 M acid + 1.0 M base; buffer Q is 0.10 M acid + 0.10 M base (same pK_a).

(a) Compare their pH. [1]

(b) Compare their buffer capacities, with a reason. [2]

3.3 Explain why a buffer has its greatest capacity when $[A^-] \approx [HA]$. [2]

4 Go further

You are now ready for the real exam questions on this subtopic:

- work through the **8.10 Buffer Capacity** lesson on the **Learn** page;
- read the **Buffer Capacity** section of the AP Chemistry handout on the **Know** page.

Solutions

2.1 How much added acid or base it can neutralize before the pH changes much.

2.2 The ratio sets the pH.

2.3 The more concentrated one.

3.1 B —the amounts (moles) of the components.

3.2 (a) Same pH (same ratio and pK_a). (b) Buffer P has the greater capacity —more moles of both components, so it can absorb more added acid or base.

3.3 With comparable amounts of both, there is plenty of conjugate base to neutralize added acid **and** plenty of weak acid to neutralize added base, so it resists change in either direction most effectively.