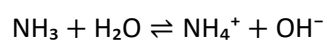


# Acid/Base terminology

1. Which species is the **conjugate base** of  $\text{H}_2\text{CO}_3$ ?

- A.  $\text{CO}_3^{2-}$
- B.  $\text{HCO}_3^-$
- C.  $\text{H}_3\text{O}^+$
- D.  $\text{OH}^-$
- E.  $\text{H}_3\text{CO}_4$

2. In the reaction



Which is a conjugate acid–base pair?

- A.  $\text{NH}_3 / \text{NH}_4^+$
- B.  $\text{NH}_3 / \text{OH}^-$
- C.  $\text{H}_2\text{O} / \text{OH}^-$
- D.  $\text{NH}_4^+ / \text{OH}^-$
- E.  $\text{H}_2\text{O} / \text{NH}_4^+$

3. Which base is **strongest** in water?

- A.  $\text{NO}_3^-$
- B.  $\text{Cl}^-$
- C.  $\text{CH}_3\text{COO}^-$
- D.  $\text{SO}_4^{2-}$

4. Which acid is **diprotic**?

- A.  $\text{HNO}_3$
- B.  $\text{HCl}$
- C.  $\text{CH}_3\text{COOH}$
- D.  $\text{H}_3\text{PO}_4$
- E.  $\text{H}_2\text{SO}_4$

5. Which species can donate **three protons** in aqueous solution?

- A.  $\text{CH}_3\text{COOH}$
- B.  $\text{H}_3\text{PO}_4$
- C.  $\text{CH}_3\text{CH}_2\text{COOH}$
- D.  $\text{NH}_4^+$
- E.  $\text{NH}_3$

6. Which reaction represents the **second ionisation** of sulfuric acid?

- A.  $\text{H}_2\text{SO}_4 \rightarrow \text{H}^+ + \text{SO}_4^{2-}$
- B.  $\text{H}_2\text{SO}_4 \rightarrow \text{H}^+ + \text{HSO}_4^-$
- C.  $\text{H}_2\text{O} \rightarrow \text{H}^+ + \text{OH}^-$
- D.  $\text{SO}_4^{2-} \rightarrow \text{H}^+ + \text{SO}_4^{3-}$
- E.  $\text{HSO}_4^- \rightarrow \text{H}^+ + \text{SO}_4^{2-}$

7. Which species is **amphiprotic**?

- A.  $\text{CO}_3^{2-}$
- B.  $\text{H}_3\text{O}^+$
- C.  $\text{NO}_3^-$
- D.  $\text{Na}^+$
- E.  $\text{HCO}_3^-$

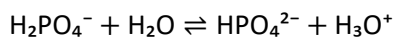
8. Which statement is **correct**?

- A. All amphoteric substances are amphiprotic
- B. Amphoteric substances react only with acids
- C. Amphiprotic substances donate and accept protons
- D. Amphoteric means only proton transfer
- E. Amphiprotic substances react only with bases

9. Which statement is correct?

- A. Strong acids have weak conjugate bases
- B. Weak acids have weak conjugate bases
- C. Strong acids have strong conjugate bases
- D. Acid strength does not affect conjugate strength
- E. Conjugate acids and bases have equal strength

10. In the reaction



$\text{H}_2\text{PO}_4^-$  is acting as a:

- A. Base only
- B. Acid only
- C. Spectator ion
- D. Salt
- E. Both an acid and a base

### Short-answer questions

1. Define the term **conjugate acid–base pair**.

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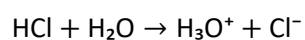
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2. Identify the conjugate acid and conjugate base in the reaction:



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3. Explain why  $\text{CH}_3\text{COO}^-$  is a stronger base than  $\text{NO}_3^-$ .

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4. A student described the species  $\text{HCO}_3^-$  as amphoteric. Is the student correct? Explain your answer.

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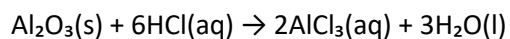
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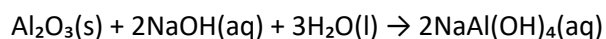
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5.  $\text{Al}_2\text{O}_3$  undergoes two reactions as shown below.



and



- i. Compare and contrast an amphoteric substance and an amphoteric substance.

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ii. Using aluminium oxide as an example classify this substance as an amphiprotic or amphoteric substance. Explain why.

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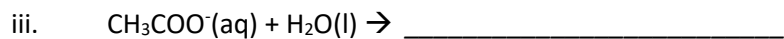
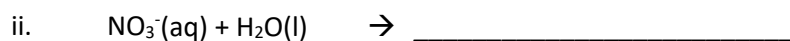
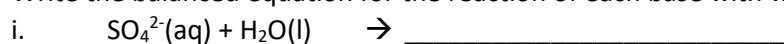
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6. Consider the following species,  $\text{SO}_4^{2-}$ ,  $\text{NO}_3^-$  and  $\text{CH}_3\text{COO}^-$ .

a. Write the balanced equation for the reaction of each base with water.



b. Which reaction produces the most amount of  $\text{OH}^-$ ? Explain why.

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