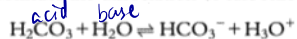
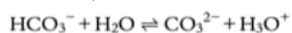


C 1.

Consider the dissociation of carbonic acid in aqueous solution:



reaction 1



reaction 2

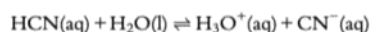
Which of the following is correct?

- ☒ A  $\text{HCO}_3^-$  acts as an acid in reaction 1 but as a base in reaction 2.
- ☐ B  $\text{HCO}_3^-$  is the conjugate base of  $\text{H}_2\text{O}$ .
- ☐ C  $\text{HCO}_3^-$  is the conjugate acid of  $\text{CO}_3^{2-}$ .
- ☒ D  $\text{H}_2\text{CO}_3$  and  $\text{CO}_3^{2-}$  are a conjugate acid–base pair.

2.

C

HCN is a weak acid and dissociates in water according to the following equilibrium:



Which of the following statements is correct?

- ☒ A HCN dissociates completely in solution.
- ☒ B The concentration of  $\text{CN}^-$  ions is greater than that of HCN.
- ☐ C  $\text{CN}^-$  is a stronger base than  $\text{H}_2\text{O}$ .
- ☒ D  $\text{H}_3\text{O}^+$  acts as a Brønsted–Lowry base.

3.

D

Which one of the following descriptions defines a strong acid?

- ☐ A It is concentrated.
- ☐ B It does dissociate in water.
- ☐ C It absorbs water from the air.
- ☐ D It almost completely dissociated in water.

4.

C

Which of the following represents the reaction between zinc powder and a dilute aqueous solution of sulfuric acid?

- ☐ A  $\text{Zn} + 2\text{H}_2\text{SO}_4 \rightarrow 2\text{ZnS} + 2\text{H}_2\text{O} + 3\text{O}_2$
- ☐ B  $4\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow 4\text{ZnO} + \text{H}_2\text{S}$
- ☐ C  $\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2$
- ☐ D  $\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnH}_2 + \text{SO}_2 + \text{O}_2$

D

5.

Which one of the following represents the reaction between calcium hydroxide and dilute hydrochloric acid?

- A**  $\text{Ca(OH)}_2 + \text{HCl} \rightarrow \text{CaOCl} + \text{H}_2\text{O}$   
**B**  $\text{CaOH} + \text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O}$   
**C**  $\text{CaOH} + 2\text{HCl} \rightarrow \text{Cl}_2 + \text{CaOH}_2$   
**D**  $\text{Ca(OH)}_2 + 2\text{HCl} \rightarrow \text{CaCl}_2 + 2\text{H}_2\text{O}$

A

6.

The amino acid alanine has the structure:



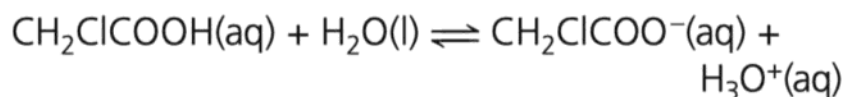
Which of the following species represents its conjugate acid?

- A**  $^+\text{NH}_3\text{CH}(\text{CH}_3)\text{COOH}$     **C**  $^+\text{NH}_3\text{CH}(\text{CH}_3)\text{COO}^-$   
**B**  $^+\text{NH}_3\text{CH}(\text{CH}_3)\text{COOH}_2^+$     **D**  $\text{NH}_2\text{CH}(\text{CH}_3)\text{COO}^-$

D

7.

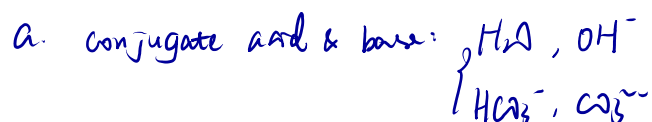
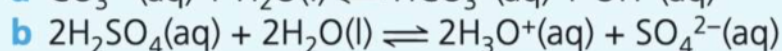
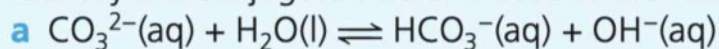
In the equilibrium below, which species represents a conjugate acid–base pair?



- A**  $\text{CH}_2\text{ClCOOH} / \text{H}_2\text{O}^-$   
**B**  $\text{CH}_2\text{ClCOO}^- / \text{H}_3\text{O}^+$   
**C**  $\text{H}_2\text{O} / \text{CH}_2\text{ClCOO}^-$   
**D**  $\text{H}_2\text{O} / \text{H}_3\text{O}^+$

8.

Identify the conjugate acid and base in the following reactions:



9.

Write equations, including state symbols, for the following reactions:

**a** sulfuric acid and copper(II) carbonate

**b** hydrobromic acid and calcium hydrogencarbonate

**c** phosphoric(V) acid and sodium carbonate

**d** ethanoic acid and calcium

**e** ammonium phosphate solution and aqueous barium hydroxide

