1. In the reaction

$$NH_3 + H_2O \leftrightarrow NH_4^+ + OH^-$$

A conjugate acid-base pair is

A) H_2O and OH^- B) H_2O and NH_4^+
C) NH_3 and H_2O D) NH_3 and OH^-

2. Which is the conjugate acid of HSO_4^-?

A) H_3O^+ B) HSO_3^-
C) SO_4^{2-} D) H_2SO_4

3. What are the bases that accept protons in the reaction?

$$H_2S + H_2O \leftrightarrow H_3O^+ + HS^-$$

A) HS^- and H_3O^+ B) H_2S and H_3O^+
C) HS^- and H_2O D) H_2S and H_2O

4. In the reaction:

$$HBr + H_2O \leftrightarrow H_3O^+ + Br^-$$

Which is a conjugate acid-base pair?

A) HBr and H_2O B) H_3O^+ and HBr
C) H_3O^+ and Br^- D) HBr and Br^-

5. Given the reaction:

$$CH_3COOH(aq) + H_2O(\ell) \leftrightarrow CH_3COO^-(aq) + H_3O^+(aq)$$

In this reaction, which substances are accepting protons?

A) $H_2O(\ell)$ and $H_3O^+(ag)$
B) $H_2O(\ell)$ and $CH_3COO^-(aq)$
C) $CH_3COOH(ag)$ and $CH_3COO^-(ag)$
D) $CH_3COOH(ag)$ and $H_2O(\ell)$

6. In the reaction:

$$H_2PO_4 + H_2O \leftrightarrow H_3PO_4 + OH$$

Which pair represents an acid and its conjugate base?

A) H_2O and H_2PO_4
B) H_3PO_4 and OH^-
C) H_2O and H_3PO_4
D) H_3PO_4 and $H_2PO_4^-$

7. Given the reaction at equilibrium:

$$HSO_4^- + NH_3 \leftrightarrow SO_4^{2-} + NH_4^+$$

What are the two species that are acids?

A) NH_3 and SO_4^{2-} B) NH_3 and NH_4^+
C) HSO_4^- and SO_4^{2-} D) HSO_4^- and NH_4^+

8. In the reaction:

$$H_2O + H_2O \leftrightarrow H_3O^+ + OH^-$$

The water is

A) a proton donor, only
B) a proton acceptor, only
C) both a proton donor and a proton acceptor
D) neither a proton donor nor a proton acceptor

9. The compound HNO_3 can be described as an

A) Arrhenius base and a nonelectrolyte
B) Arrhenius acid and a nonelectrolyte
C) Arrhenius acid and an electrolyte
D) Arrhenius base and an electrolyte

10. Which compound releases hydroxide ions in an aqueous solution?

A) KOH B) CH_3OH
C) HCl D) CH_3COOH

14) $H_2O + NH_3 \rightleftarrows NH_4^+ + OH^-$

15) $H_2O + H_2O \rightleftarrows H_3O^+ \ OH^-$

16) $NH_3 + NH_3 \rightleftarrows NH_4^+ + NH_2^-$

17) $H_2SO_4 + Ca(OH)_2 \rightleftarrows CaSO_4 + 2H_2O$

18) $O_3ClOH + H_2O \rightleftarrows H_3O^+ + O_3ClO^-$

19) $H_2O + HI \rightarrow H_3O^+ + I^-$

20) $CH_3COOH + H_2O \rightarrow CH_3COO^- + H_3O^+$

21) $NH_4^+ + OH^- \rightleftarrows NH_3 + H_2O$

22) $H_2SO_4 + OH^- \rightarrow HSO_4^- + H_2O$

23) $HSO_4^- + H_2O \rightarrow SO_4^{-2} + H_3O^+$