

Acids, Bases & Redox 1

- Practice Problems for Assignment 8

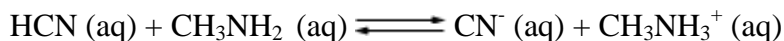
1. A substance which produces OH^- ions in solution is a definition for which of the following?

- (a) an Arrhenius acid
- (b) an Arrhenius base
- (c) a Bronsted-Lowry acid
- (d) a Bronsted-Lowry base

2. In which of the following is HSO_3^- acting as a Bronsted-Lowry acid?

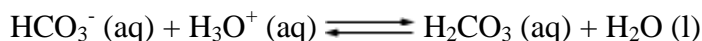
- (a) $\text{HSO}_3^- (\text{aq}) + \text{H}_2\text{O} (\text{l}) \rightarrow \text{H}_2\text{SO}_3 (\text{aq}) + \text{OH}^- (\text{aq})$
- (b) $\text{NH}_3 (\text{aq}) + \text{HSO}_3^- (\text{aq}) \rightarrow \text{NH}_4^+ (\text{aq}) + \text{SO}_3^{2-} (\text{aq})$
- (c) $\text{HSO}_3^- (\text{aq}) + \text{HPO}_4^{2-} (\text{aq}) \rightarrow \text{H}_2\text{SO}_3 (\text{aq}) + \text{PO}_4^{3-} (\text{aq})$
- (d) $\text{H}_2\text{C}_2\text{O}_4 (\text{aq}) + \text{HSO}_3^- (\text{aq}) \rightarrow \text{HC}_2\text{O}_4^- (\text{aq}) + \text{H}_2\text{SO}_3 (\text{aq})$

3. Which of the following describes a conjugate acid-base pair for the following equilibrium?



- (a) CN^- , HCN
- (b) CH_3NH_3^+ , CN^-
- (c) HCN , CH_3NH_3^+
- (d) CH_3NH_3^+ , CH_3NH_2

4. Consider the following equilibrium:



Which statement is true?

- (a) Products are favoured because H_2O is a stronger acid than H_2CO_3 .
- (b) Products are favoured because H_3O^+ is a stronger acid than H_2CO_3 .
- (c) Reactants are favoured because HCO_3^- is a stronger base than H_2O .
- (d) Reactants are favoured because H_3O^+ is a stronger base than H_2CO_3 .

5. Consider the following equilibrium:



Reactants are favoured in this equilibrium. Which of the following describes the relative strengths of the acids and the bases?

- (a) Stronger acid: HF
Stronger base: F⁻
- (b) Stronger acid: HF
Stronger base: OI⁻
- (c) Stronger acid: HOI
Stronger base: F⁻
- (d) Stronger acid: HOI
Stronger base: OI⁻

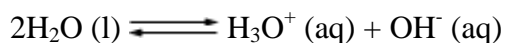
6. Which of the following is the strongest acid that can exist in an aqueous solution?

- (a) O²⁻
- (b) NH₂⁻
- (c) H₃O⁺
- (d) HClO₄

7. Which of the following relationships is used to calculate K_w at 30°C?

- (a) K_w = pH + pOH
- (b) pK_w = -log [H₃O⁺]
- (c) K_w = [H₃O⁺][OH⁻]
- (d) K_w = [H₃O⁺] + [OH⁻]

8. Consider the following equilibrium:



What changes occur to [H₃O⁺] and pH when NaOH is added?

- (a) [H₃O⁺] increases and pH increases.
- (b) [H₃O⁺] increases and pH decreases.
- (c) [H₃O⁺] decreases and pH increases.
- (d) [H₃O⁺] decreases and pH decreases.

9. Which of the following is a definition of pK_w ?

- (a) pK_w = -logK_w
- (b) pK_w = pH - pOH
- (c) pK_w = 7.0 at 25°C
- (d) pK_w = [H₃O⁺][OH⁻]

10. What is the pH of a 0.050M KOH solution?

- (a) 0.30
- (b) 1.30
- (c) 12.70

(d) 13.70

11. Which of the following K_a values represents the acid with the strongest conjugate base?

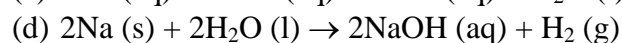
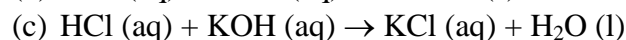
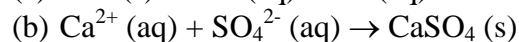
(a) $K_a = 4.2 \times 10^{-12}$

(b) $K_a = 9.5 \times 10^{-9}$

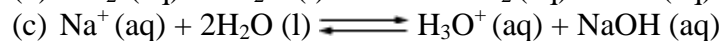
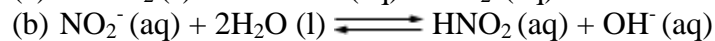
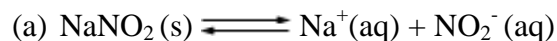
(c) $K_a = 2.0 \times 10^{-5}$

(d) $K_a = 7.8 \times 10^{-3}$

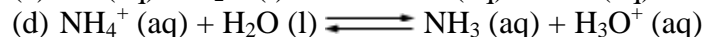
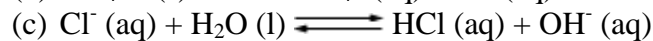
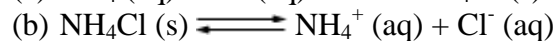
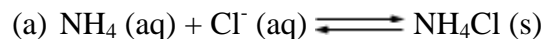
12. Which of the following represents the dissociation equation of a salt in water?



13. Which of the following describes the net ionic equation for the hydrolysis of a NaNO_2 solution?



14. Which of the following describes the net ionic reaction for the hydrolysis of $\text{NH}_4\text{Cl (s)}$?



15. Which of the following solutions has the highest pH?

(a) 0.1M HCl

(b) 0.1M NaF

(c) 0.1M NaHS

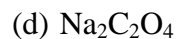
(d) 0.1M NH_4Cl

16. Which of the following salt solutions will be acidic?

(a) KClO_4

(b) NH_4Br

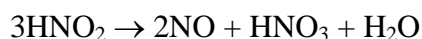
(c) NaHCO_3



17. Which of the following represents an oxidation?

- (a) $2\text{H}^+ + \text{S} \rightarrow \text{H}_2\text{S}$
- (b) $2\text{SO}_4^{2-} \rightarrow \text{S}_2\text{O}_8^{2-}$
- (c) $\text{Na}^+ + \text{Cl}^- \rightarrow \text{NaCl}$
- (d) $\text{SO}_2 + \text{H}_2\text{O} \rightarrow 2\text{H}^+ + \text{SO}_3^{2-}$

18. The equation for the decomposition of nitrous acid is



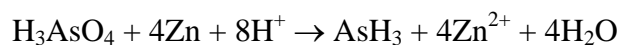
Which of the following is correct?

- (a) This is a redox reaction.
- (b) This is an acid-base reaction.
- (c) This is a reduction half equation.
- (d) This is an oxidation half equation.

19. What is a typical characteristic of a strong oxidizing agent?

- (a) It is readily oxidized.
- (b) It easily loses electrons.
- (c) It has a negative oxidation number.
- (d) It has a positive reduction potential.

20. Consider the following equation:



Which of the following is correct?

- (a) Oxygen is reduced.
- (b) Arsenic is oxidized.
- (c) Zinc is the oxidizing agent.
- (d) The reaction is a redox reaction.

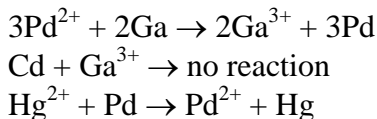
21. Which of the following is more difficult to reduce than the H^+ (aq) ion?

- (a) I_2
- (b) Ag^+
- (c) Zn^{2+}
- (d) Cu^{2+}

22. In which of the following chemical changes will there be an oxidation number change of +3?

- (a) $\text{Cr}^{3+} \rightarrow \text{Cr}^{2+}$
- (b) $\text{ClO}^- \rightarrow \text{ClO}_2^-$
- (c) $\text{Cr}^{3+} \rightarrow \text{Cr}_2\text{O}_7^{2-}$
- (d) $\text{Mn}^{2+} \rightarrow \text{MnO}_4^-$

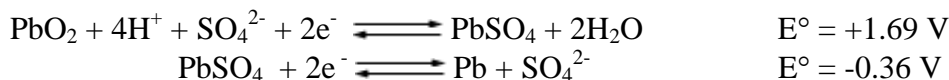
23. The metals Hg, Cd, Ga and Pd react as follows:



Which of the following metals is the strongest reducing agent?

- (a) Pd
- (b) Ga
- (c) Cd
- (d) Hg

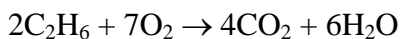
24. Given the following half-cell reactions:



Which of the following best describes the overall reaction and the standard cell voltage in a lead acid storage battery?

- (a) $\text{Pb} + 2\text{H}_2\text{O} \rightarrow \text{PbO}_2 + 4\text{H}^+ + 4\text{e}^-$ $E^\circ_{\text{cell}} = +1.33$
- (b) $\text{PbO}_2 + 4\text{H}^+ + 4\text{e}^- \rightarrow \text{Pb} + 2\text{H}_2\text{O}$ $E^\circ_{\text{cell}} = +1.33$
- (c) $\text{Pb} + \text{PbO}_2 + 2\text{SO}_4^{2-} + 4\text{H}^+ \rightarrow 2\text{PbSO}_4 + 2\text{H}_2\text{O}$ $E^\circ_{\text{cell}} = +2.05$
- (d) $2\text{PbSO}_4 + 2\text{H}_2\text{O} \rightarrow \text{Pb} + \text{PbO}_2 + 2\text{SO}_4^{2-} + 4\text{H}^+$ $E^\circ_{\text{cell}} = +2.05$

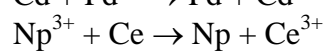
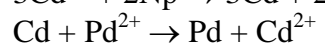
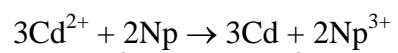
25. Consider the following equation for the combustion of ethane:



The change in oxidation number for carbon is equivalent to

- (a) 1 electron lost.
- (b) 7 electrons lost.
- (c) 1 electron gained.
- (d) 7 electrons gained.

26. Consider the following spontaneous reactions:



Which is the strongest oxidizing agent?

- (a) Cd^{2+}
- (b) Ce^{3+}
- (c) Np^{3+}
- (d) Pd^{2+}

Answers:

1. B
2. B
3. D
4. B
5. B
6. C
7. C
8. C
9. A
10. C
11. A
12. A
13. B
14. D
15. C
16. B
17. B
18. A
19. D
20. D
21. C
22. C
23. B
24. C
25. B
26. D