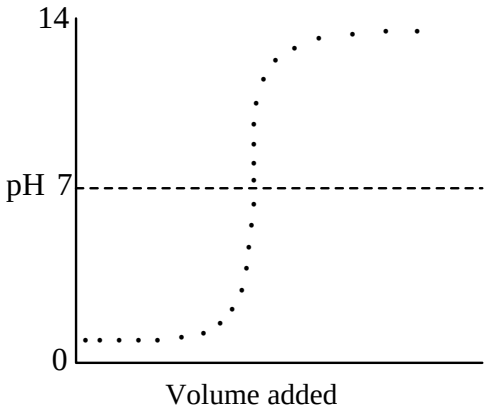
**Chem1102** **Sample Quiz 3 (i)** **Last update: 13/10/17**

1. A buffered solution is 0.0500 M $CH_3COOH$ and 0.0400 M $NaCH_3CO_2$. If 0.0100 mol of gaseous HCl is added to 1.00 L of the buffered solution, what is the final pH of the solution? For acetic acid, p$K_a$ = 4.76

a) 4.76 b) 4.46 c) 4.66 d) 4.86 e) 4.54

2. In each of the following titrations, the first solution is in the burette and the second solution is in the titration flask. For which titration would the curve illustrated be typical?




a) $Na_2CO_3$ (0.05 M) / HCl (0.1 M)

b) NaOH (0.1 M) / HI (0.1 M)

c) NaOH (0.1 M) / $CH_3COOH$ (0.1 M)

d) $NH_3$ (0.1 M) / $CH_3COOH$ (0.1 M)

e) $NH_3$ (0.1 M) / HCl (0.1 M)

3. What is the pH of a 0.045 M solution of KOBr? The p$K_a$ of HOBr is 8.63.

a) 4.74 b) 4.99 c) 8.25 d) 9.01 e) 10.64

4. Alongside $H_2O$, what are the major species present in a 1.0 M solution of HCl?

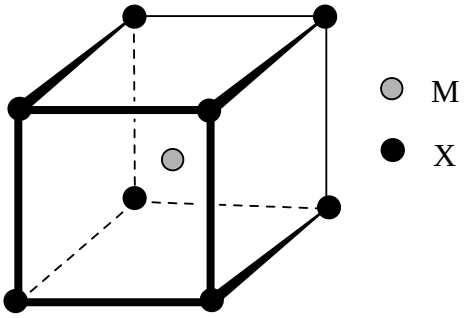
a) HCl(aq), $H_3O^+$(aq) and $Cl^-$(aq)
b) $H_3O^+$(aq) and $Cl^-$(aq)
c) HCl(aq)
d) HCl(aq), $H_3O^+$(aq), $OH^-$(aq) and Cl(aq)
e) $H_3O^+$(aq), $OH^-$(aq) and $Cl^-$(aq)

5. Which one of the following statements concerning crystal structures is correct?

a) The arrangement of layers in the hexagonal close-packed structure (hcp) is abcabcabc….
b) The packing efficiency of the face-centred cubic unit cell of aluminium is 52%.
c) The packing efficiency of zinc, which has hexagonal close-packed structure, is 68%.
d) The coordination number in a primitive cubic unit cell of polonium is 6.
e) The face-centred cubic unit cell of nickel contains 2 atoms per unit cell.

6. The unit cell below has anions (X) at the corners and cations (M) in the centre of the cell. What is the formula of the compound?

a) MX
b) $MX_2$
c) $M_2X_3$
d) $M_2X$
e) $MX_3$




7. The $K_{sp}$ for silver chloride is $1.8 \times 10^{-10}$ at 25 °C. What is the solubility of silver chloride (in mol $L^{-1}$) in 0.025 M tin(IV) chloride solution?

a) $8.5 \times 10^{-5}$ b) $6.7 \times 10^{-8}$ c) $7.2 \times 10^{-9}$ d) $1.8 \times 10^{-9}$ e) $1.3 \times 10^{-5}$

8. In which of the following are the atoms arranged in order of INCREASING first ionisation energy?

a) Ne, F, O, C
b) Te, Se, S, O
c) Ca, K, Cl, Ar
d) He, Ne, Ar, Kr
e) N, P, K, Rb

Questions 9 & 10 refer to the solubility of cadmium hydroxide, $Cd(OH)_2$:

$$Cd(OH)_2(s) \rightleftharpoons Cd^{2+}(aq) + 2OH^-(aq)$$

9. The $K_{sp}$ for $Cd(OH)_2$ is $5.9 \times 10^{-15}$ at 25 °C. What is the solubility of $Cd(OH)_2$ in mol $L^{-1}$?

a) $7.7 \times 10^{-8}$ b) $5.4 \times 10^{-8}$ c) $1.1 \times 10^{-5}$ d) $5.9 \times 10^{-15}$ e) $1.8 \times 10^{-5}$

10. If 100. mL of $2.0 \times 10^{-5}$ M $Cd(NO_3)_2$ is added to 100. mL of a solution of $2.0 \times 10^{-5}$ M KOH, which statement is correct?

a) The ionic product is $1.0 \times 10^{-15}$ and $Cd(OH)_2(s)$ does not precipitate.
b) The ionic product is $1.0 \times 10^{-15}$ and $Cd(OH)_2(s)$ precipitates.
c) The ionic product is $1.0 \times 10^{-10}$ and $Cd(OH)_2(s)$ precipitates.
d) The ionic product is $1.0 \times 10^{-10}$ and $Cd(OH)_2(s)$ does not precipitate.
e) none of the above

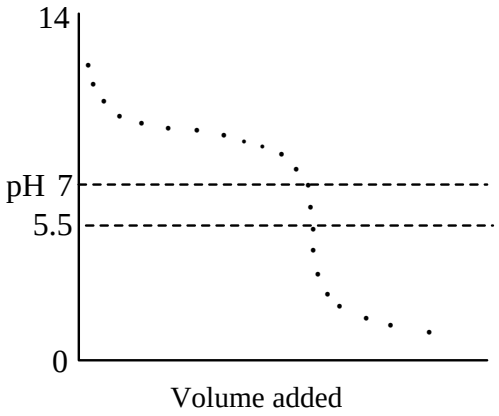
Correct answers: 1B, 2B, 3E, 4B, 5D, 6A, 7D, 8B, 9C, 10A

**Chem1102** **Sample Quiz 3 (ii)** **Last update: 13/10/17**

1. A buffered solution is 0.450 M $CH_3CO_2H$ and 0.450 M $NaCH_3CO_2$. If 0.0800 mol of solid NaOH is added to 1.00 L of the buffered solution, what is the final pH of the solution? For acetic acid, p$K_a$ = 4.76 (*Hint*: Use the Henderson-Hasselbalch Equation)

a) 4.58 b) 4.60 c) 4.76 d) 4.90 e) 4.92

2. In each of the following titrations, the first solution is in the titration flask and the second solution is in the burette. For which titration would the curve illustrated be typical?




a) $Na_2CO_3$ (0.05 M) / HCl (0.1 M)

b) NaOH (0.1 M) / HI (0.1 M)

c) NaOH (0.1 M) / $CH_3COOH$ (0.1 M)

d) $NH_3$ (0.1 M) / $CH_3COOH$ (0.1 M)

e) $NH_3$ (0.1 M) / HCl (0.1 M)

3. What is the pH of a 0.24 M solution of sodium fluoride? The p$K_a$ of HF is 3.17.

a) 5.72 b) 8.28 c) 9.26 d) 11.45 e) 13.38

4. Alongside $H_2O$, what are the major species present in a 1.0 M solution of NaCN?

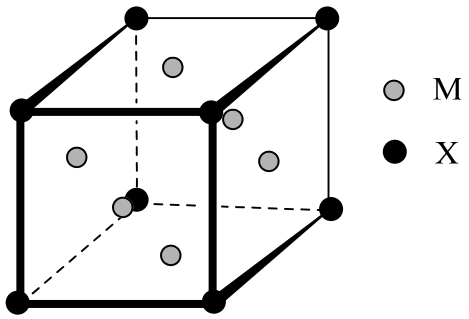
a) NaCN(aq)
b) HCN(aq), $Na^+$(aq) and $CN^-$(aq)
c) HCN(aq), $OH^-$(aq), $Na^+$(aq) and $CN^-$(aq)
d) $Na^+$(aq) and $CN^-$(aq)
e) $CN^-$(aq), $H_3O^+$(aq), $OH^-$(aq) and $Na^+$(aq)

5. Which one of the following statements concerning crystal structures is correct?

a) The packing efficiency of the body-centred cubic unit cell of iron is 68%.
b) The coordination number in a face-centred cubic unit cell of polonium is 8.
c) The body-centred cubic unit cell of iron contains 1 atom per unit cell.
d) The arrangement of layers in the cubic close-packed structure (hcp) is abababab….
e) The packing efficiency of cobalt, which has hexagonal close-packed structure, is 68%.

6. The unit cell below has anions (X) at the corners and cations (M) in the centre of each face. What is the formula of the compound?

a) MX
b) $MX_2$
c) $M_3X$
d) $M_2X$
e) $M_2X_3$




7. The $K_{sp}$ for lead(II) chloride is $1.7 \times 10^{-5}$ at 25 °C. What is the solubility of lead(II) chloride (in mol $L^{-1}$) in 1.00 M magnesium chloride solution?

a) $1.2 \times 10^{-6}$ b) $4.3 \times 10^{-6}$ c) $5.7 \times 10^{-7}$ d) $6.2 \times 10^{-8}$ e) $1.4 \times 10^{-9}$

8. In which of the following are the ions arranged in order of DECREASING ionic radius?

a) $Sn^{4+}$, $In^{3+}$, $Sr^{2+}$, $Rb^{+}$
b) $Na^{+}$, $Mg^{2+}$, $O^{2-}$, $F^{-}$
c) $I^{-}$, $Cl^{-}$, $Br^{-}$, $F^{-}$
d) $Cs^{+}$, $Ba^{2+}$, $Tl^{3+}$, $Pb^{4+}$
e) $Mg^{2+}$, $Al^{3+}$, $S^{2-}$, $Cl^{-}$

Questions 9 & 10 refer to the solubility of iron(II) phosphate, $Fe_3(PO_4)_2$:

$$Fe_3(PO_4)_2(s) \rightleftharpoons 3Fe^{2+}(aq) + 2PO_4^{3-}(aq)$$

9. The $K_{sp}$ for $Fe_3(PO_4)_2(s)$ is $1.0 \times 10^{-36}$ at 25 °C. What is the solubility of $Fe_3(PO_4)_2$ in mol $L^{-1}$?

a) $2.5 \times 10^{-8}$ b) $3.1 \times 10^{-8}$ c) $6.3 \times 10^{-8}$ d) $1.0 \times 10^{-7}$ e) $4.0 \times 10^{-7}$

10. If 25.0 mL of $2.0 \times 10^{-5}$ M $FeSO_4$ is added to 25.0 mL of a solution of $1.0 \times 10^{-10}$ M $K_3PO_4$, which statement is correct?

a) The ionic product is $8.0 \times 10^{-35}$ and $Fe_3(PO_4)_2(s)$ precipitates.
b) The ionic product is $2.5 \times 10^{-36}$ and $Fe_3(PO_4)_2(s)$ precipitates.
c) The ionic product is $8.0 \times 10^{-35}$ and $Fe_3(PO_4)_2(s)$ does not precipitate.
d) The ionic product is $2.5 \times 10^{-36}$ and $Fe_3(PO_4)_2(s)$ does not precipitate.
e) none of the above

Correct answers: 1E, 2E, 3B, 4D, 5A, 6C, 7B, 8D, 9A, 10B