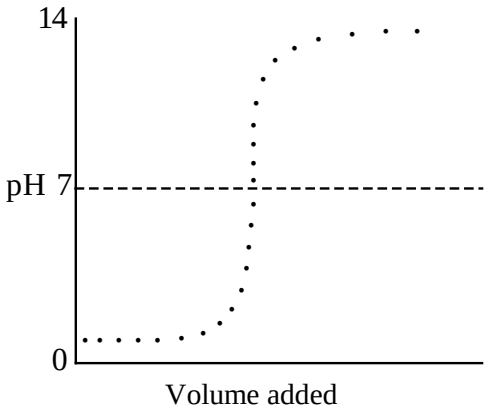
Chem1902/1904 Sample Quiz 3 (i) Last update: 12/10/15

1. A buffered solution is 0.0500 M CH_3CO_2H 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, pK_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. 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

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

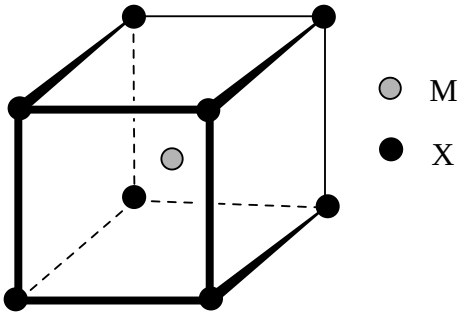
a) HCl(aq), H_3O^+(aq) and Cl^-(aq)
b) H_3O^+(aq) and Cl^-(aq)
c) HCl(aq)
d) HCl(aq), H_3O^+(aq), OH^-(aq) and Cl(aq)
e) H_3O^+(aq), OH^-(aq) and Cl^-(aq)

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 coordination number in a body-centred cubic unit cell of iron is 8.
c) The packing efficiency of the face-centred cubic unit cell of calcium is 68%.
d) The packing efficiency of strontium, which has hexagonal close-packed structure, is 52%.
e) The body-centred cubic unit cell of tungsten contains 4 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 1.8×10^{-10} at 25 °C. What is the solubility of silver chloride (in mol L^{-1}) in 0.025 M tin(IV) chloride solution?

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

Questions 8 & 9 refer to the solubility of lead chromate, $PbCrO_4$:

$$PbCrO_4(s) \rightleftharpoons Pb^{2+}(aq) + CrO_4^{2-}(aq)$$

8. The K_{sp} for $PbCrO_4$ is 2.0×10^{-16} at 25 °C. What is the solubility of $PbCrO_4$ in mol L^{-1}?

a) 1.4×10^{-8} b) 2.8×10^{-8} c) 2.0×10^{-16} d) 7.1×10^{7} e) 5.0×10^{15}

9. If 5.0 mL of 1.0×10^{-5} M $Pb(NO_3)_2$ is added to 5.0 mL of a solution of 1.0×10^{-10} M K_2CrO_4, which statement is correct?

a) The ionic product is 1.0×10^{-15} and $PbCrO_4(s)$ precipitates.
b) The ionic product is 2.5×10^{-16} and $PbCrO_4(s)$ does not precipitate.
c) The ionic product is 1.0×10^{-15} and $PbCrO_4(s)$ does not precipitate.
d) The ionic product is 2.5×10^{-16} and $PbCrO_4(s)$ precipitates.
e) none of the above

10. How many different stereoisomers (*i.e.* geometrical and optical isomers) of the complex $[Co(en)_3]^{3+}$ are possible? en = ethane-1,2-diamine = ethylenediamine = $NH_2CH_2CH_2NH_2$

a) 1 b) 2 c) 3 d) 4 e) 5

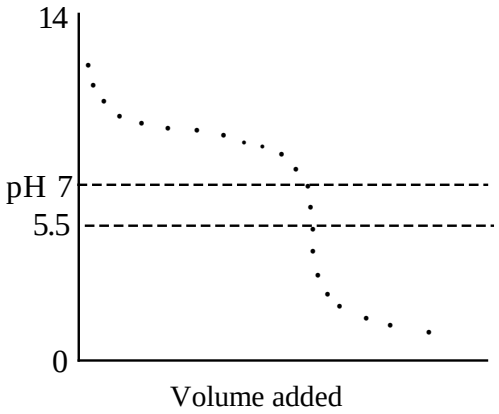
Correct answers: 1B, 2B, 3B, 4B, 5B, 6A, 7D, 8A, 9D, 10B

Chem1902/1904 Sample Quiz 3 (ii) Last update: 12/10/15

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, pK_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. 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^{-}

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)

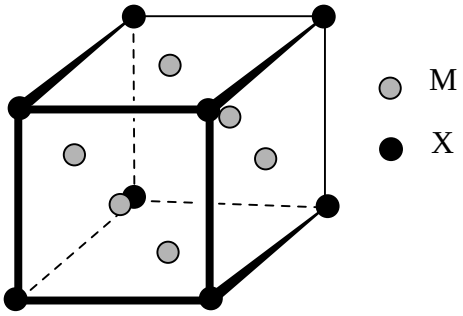
e) CN^{-}(aq), H_3O^{+}(aq), OH^{-}(aq) and Na^{+}(aq)

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

a) The arrangement of layers in the cubic close-packed structure (ccp) is abcabcabc….
b) The coordination number in a body-centred cubic unit cell of iron is 6.
c) The primitive cubic unit cell of polonium contains 2 atoms per unit cell.
d) The packing efficiency of the primitive cubic unit cell of polonium is 68%.
e) The packing efficiency of magnesium, 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 barium sulfate is 1.1×10^{-10} at 25 °C. What is the solubility of barium sulfate (in mol L^{-1}) in 0.1 M iron(III) sulfate solution?

a) 1.1×10^{-10} b) 2.2×10^{-10} c) 3.7×10^{-10} d) 5.5×10^{-10} e) 1.0×10^{-5}

Questions 8 & 9 refer to the solubility of iron(II) phosphate, $Fe_3(PO_4)_2$:

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

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

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

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

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

10. How many different stereoisomers (*i.e.* geometrical and optical isomers) of the complex $[Co(en)BrCl(CN)F]^-$ are possible? en = ethylenediamine = $NH_2CH_2CH_2NH_2$

a) 4 b) 6 c) 8 d) 12 e) 16

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