Acid-Base Properties:

-2006 I(2)

Which of the following is an acid salt where its aqueous solution shows alkaline?

1) $NaHSO_4$ 2) Na_2SO_4 3) $NaHCO_3$

4) Na_2CO_3 5) $Mg(OH)_2$ 6) $MgCl(OH)$

-2009 I(6)

(6) Which of the aqueous solutions of the compounds 1) to 5) is acid?

1) K_2CO_3 2) KCl 3) Na_2SO_4 4) NH_4Cl 5) $NaHCO_3$
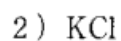
-2006 I(3)

When 100ml of 0.1mol/l hydrochloric acid is added into 200ml of 0.1mol/l sodium hydroxide, arrange the concentrations of H^+, OH^-, Na^+

ions in the resulting solution in a descending order.

1) $H^+ > OH^- > Na^+$ 2) $H^+ > Na^+ > OH^-$ 3) $OH^- > H^+ > Na^+$

4) $OH^- > Na^+ > H^+$ 5) $Na^+ > H^+ > OH^-$ 6) $Na^+ > OH^- > H^+$
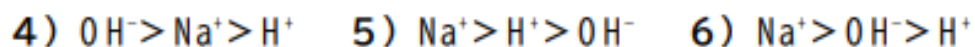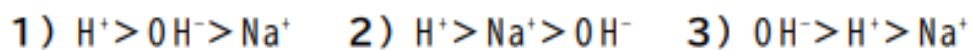
-2007 I(4)

(4) Heating a mixture of sodium chloride and concentrated sulfuric acid evolves

1) HCl   2) Cl_2 3) H_2

4) H_2S 5) SO_2
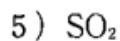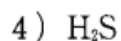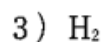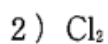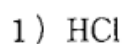
-2014 II

II Give the appropriate values for (a) and (b) in the sentences below to two significant figures. Use the following values for atomic weights: H=1.0, O=16.0, Na=23.0, S=32.0.

100 mL of 1.0 mol L^{-1} NaOH aq contains (a) g of NaOH. After mixing 100 mL of 1.0 mol L^{-1} H_2SO_4 aq with the first solution, the concentration of proton becomes (b) mol L^{-1}.

-2015 I(2)

(2) Which of acid aqueous solution 1) to 4) is non-volatile one?

1) CH_3COOH 2) H_2SO_4 3) HCl   4) HF
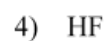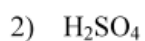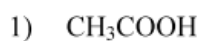
-2015 I(6)

(6) Which combination of the substances 1) to 4) will not produce ammonia under appropriate temperature and pressure conditions?

    1) copper and concentrated nitric acid

    2) nitrogen and hydrogen

    3) urea and water
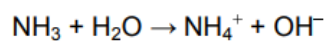
    4) calcium hydroxide and ammonium chloride

-2016 I(2)

(2) Which of aqueous solutions 1) to 4) is a weak base?

    1) CH_3COONa 2) C_6H_5OH (phenol)   3) NH_4Cl 4) KOH

-2016 II(1)

(1) When ammonia is dissolved in water, the reaction occurs as below. Here, ammonia works as (a) and water does as (b).

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

-2007 I(8)

(8) Which of the following descriptions 1) to 4) is correct?

1) The pH of the solution that results when 10ml of 1.0×10^{-5}mol/l HCl is diluted to 10l with distilled water is 8.

2) The pH of the solution that results when 10ml of 1.0×10^{-3}mol/l NaOH is diluted to 1.0l with distilled water is 9.

3) The pH of the solution that results when 10ml of 1.0×10^{-2}mol/l CH$_3$COOH is diluted to 1.0l with distilled water is 4.

4) The pH of the solution that results when 10ml of 1.0×10^{-3}mol/l H$_2$SO$_4$ is diluted to 1.0l with distilled water is 5.

-2008 I(5)

(5) Arrange the following mixed solutions A, B, and C in order of decreasing value of pH.

A : 15ml of 0.1mol/l H$_2$SO$_4$ and 10ml of 0.1mol/l NaOH

B : 15ml of 0.1mol/l HCl and 10ml of 0.1mol/l Na$_2$CO$_3$

C : 15ml of 0.1mol/l HCl and 10ml of 0.1mol/l NaOH

1) A > B > C 　　 2) A > C > B 　　 3) A > B = C 　　 4) B = C > A

5) B > A > C 　　 6) B > C > A 　　 7) B > A = C 　　 8) A = C > B

9) C > A > B 　　 10) C > B > A 　　 11) C > A = B 　　 12) A = B > C

-2009 II

II Calculate the pH of the solution that results upon mixing 10 ml of HCl solution with a pH of 1.0 with 40 ml of

(a) 0.15 mol/l HCl solution.

(b) 0.15 mol/l AgNO$_3$ solution.

(c) 0.15 mol/l NaOH solution.

If necessary, use log 2 =0.30, log 3 =0.48, and log 7 =0.85.

-2012 I(5)

(5) Which of the solutions 1) to 4) exhibits a pH value of 2?

1) 0.01 mol/L aqueous solution of acetic acid

2) 0.05 mol/L sulfuric acid

3) 0.01 mol/L hydrochloric acid

4) 1x10^{-12} mol/L aqueous solution of sodium hydroxide

-2014 I(2)

(2) When dissolved in water at the concentration of 1 mol L^{-1}, which of the substances 1) to 4) exhibits the lowest pH?

1) HCl   2) HF   3) CH$_3$COOH   4) H$_2$S

-2016 II(2)

(2) In titrating 1 M aqueous acetic acid with 1 M aqueous sodium hydroxide, the pH value of the solution becomes (c) than 7 at the equivalent point, and the appropriate pH indicator for this titration is (d).

-2018 IV(1)(b)

IV   Fill in (a) ~ (d) in the sentences below with the most appropriate values. Use the following values if necessary; the atomic weights of K, O, and H are 39, 16, and 1.0, respectively, and log 3 = 0.48. Calculate the values to two significant figures for (a) and (b), and one to three significant figures for (d).

(1)   Heat of 11.6 kJ was released when 11.2 g of KOH was completely dissolved in water. The heat of solution is (a) kJ mol^{-1}. Water was more added to adjust 2.0 L of KOH solution. Next, 5.0 mL of this KOH solution was added to 10.0 mL of 0.10 mol L^{-1} hydrochloric acid. The pH of the resultant solution is (b).