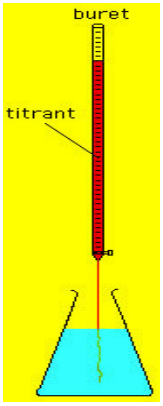
Test: Acid-Base

SCH4UE_2012-2013_V1 NAME: _____

Multiple Choice (22)



1. Water will act as an acid with which of the following?

I. H_2CO_3
II. HCO_3^{-1}
III. CO_3^{-2}

A. I only B. II only C. I and II only D. II and III

2. Which of the following 1.0 mol dm^{-3} solution will have the greatest electrical conductivity?

A. $HI_{(aq)}$ B. $H_2S_{(aq)}$ C. $HCN_{(aq)}$ D. $H_3PO_{4(aq)}$

3. An acid is added to water and a new equilibrium is established. The new equilibrium can be described by:

A. pH < pOH and $K_W = 1 \times 10^{-14}$
B. pH < pOH and $K_W < 1 \times 10^{-14}$
C. pH > pOH and $K_W = 1 \times 10^{-14}$
D. pH > pOH and $K_W > 1 \times 10^{-14}$

4. Consider the following equilibrium:

$$2H_2O_{(l)} + \text{energy} \rightleftharpoons H_3O^{+1}_{(aq)} + OH^{-1}_{(aq)}$$

The $[H_3O^{+1}]$ will decrease and the K_W will remain constant when:

A. A strong acid is added
B. A strong base is added
C. The temperature is increased
D. The temperature is decreased.

5. Which of the following graphs describes the relationship between $[H_3O^{+1}]$ and pH?

A. B.

C. D.

6. When the $[H_3O^{+1}]$ in a solution is increased to twice the original concentration, the change in pH could be from:

A. 1.7 to 1.4 B. 2.0 to 4.0 C. 5 to 2.5 D. 8.5 to 6.5

7. Which of the following 1.0 mol dm^{-3} solution would have a pH greater than 7.00?

A. HCN B. KNO_3 C. NH_4Cl D. CH_3COONa

8. What is the pH at the mid-point, (transition point), for an indicator with a $K_a = 2.5 \times 10^{-4}$?

A. 2.5×10^{-4} B. 3.60 C. 7.00 D. 10.40

9. What volume of 0.100 mol dm^{-3} sodium hydroxide is required to completely neutralize 15.00 cm^3 of 0.100 mol dm^{-3} $H_3PO_{4(aq)}$?

A. 5.00 cm^3 B. 15.00 cm^3 C. 30.00 cm^3 D. 45.00 cm^3

10. What is the pH of the solution formed when 0.060 moles of $NaOH_{(aq)}$ is added to 1.00 dm^3 of 0.050 mol dm^{-3} $HCl_{(aq)}$?

A. 2.00 B. 7.00 C. 12.00 D. 12.78

11. The relationship: $\dfrac{[H_3BO_3]\,[OH^{-1}]}{[H_2BO_3^{-1}]}$

is the expression for:

A. K_a for H_3BO_3 B. K_b for H_3BO_3

C. K_a for $H_2BO_3^{-1}$ D. K_b for $H_2BO_3^{-1}$

12. A buffer solution may contain equal moles of :

A. Weak acid and strong base

B. Strong acid and strong base

C. weak acid and its conjugate base

D. Strong acid and its conjugate base

13. What is the concentration of a solution of $Sr(OH)_{2(aq)}$ with a pH = 11.00?

A. 2.0×10^{-11} mol dm^{-3} B. 1.0×10^{-11} mol dm^{-3}

C. 5.0×10^{-4} mol dm^{-3} D. 1.0×10^{-3} mol dm^{-3}

14. When comparing 1.0 mol dm^{-3} solutions of bases, the base with the lowest $[OH^{-1}]$ is the:

A. Weakest base and it has the largest K_b value

B. Strongest base and it has the largest K_b value

C. Weakest base and it has the smallest K_b value

D. Strongest base and it has the largest K_b value

15. Oxalic acid, $H_2C_2O_{4(aq)}$, has a $K_a = 5.9 \times 10^{-2}$. The value of K_b for $HC_2O_4^{-1}$ is:

A. 1.7×10^{-13} B. 1.6×10^{-10} C. 6.4×10^{-5} D. 5.9×10^{-2}

16. Which of the following applies at the mid-point, i.e. the transition point for all indicators, HI_{nd}?

A. $[HI_{nd}] = [I_{nd}^{-1}]$ B. $[H_3O^{+1}] = [I_{nd}^{-1}]$

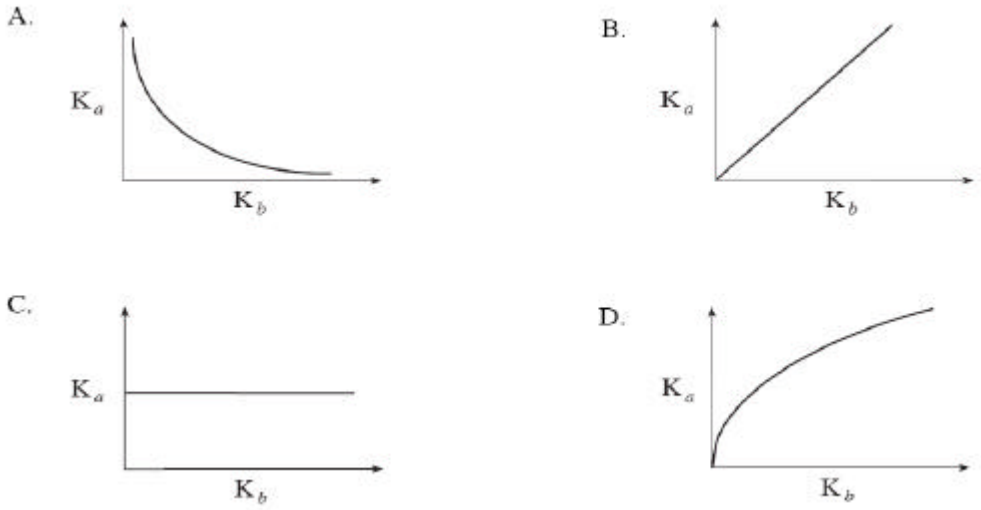
C. $[H_3O^{+1}] = [OH^{-1}]$ D. $[HI_{nd}] = [H_3O^{+1}]$

17. Which of the following titration will have an equivalence point with a pH less than 7.00?

A. H_2SO_4 with NH_3 B. HNO_3 with LiOH

C. H_3PO_4 with KOH D. HCOOH with NaOH

18. Which of the following graphs describes the relationship between acid ionization constant, K_a and K_b for all conjugate pairs?



19. What is the pH of a solution of 0.10 mol dm^{-3} HOCl and 0.10 mol dm^{-3} NaOCl ? (pK_a (HOCl) = 7.45).

A. 7.45 B. 4.23 C. 6.54 D. 10.22

20. Dilution of a weak acid will:

A. Increase the percent of acid ionized

B. Decrease the percent of acid ionized

C. Increase the percent of acid ionized if K_a is > 10^{-5}

D. Decrease the percent of acid ionized if K_a is < 10^{-5}

21. The indicator methyl orange has a pK_a of about 3.5. Its acid form is red, its basic form is yellow. What colour is the indicator at pH = 7

A. Red B. Yellow C. Orange D. Green

22. If ammonia, NH_3, is titrated with $HCl_{(aq)}$, the pH at halfway to the equivalence point is: (K_a (NH_4^{+1}) = 5.6 x 10^{-10})

A. 2.00 B. 4.74 C. 7.00 D. 9.25

Multiple Choice Answers

1	2	3	4	5	6	7	8	9	10	11
12	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**

Problems (35)

1. The value of $K_W = 5.48 \times 10^{-14}$ at 50 ^{O}C.

a. Calculate the pH of pure water at 50 ^{O}C. 2

pH of pure water at 50 ^{O}C = _____

b. Suggest why the pH of pure water is not acidic. 1

c. Calculate the pH of a solution formed when 25.0 cm^3 of 0.150 mol dm^{-3} sulphuric acid are added to 30.0 cm^3 of 0.200 mol dm^{-3} potassium hydroxide at 25 ^{O}C. (Assume that the sulphuric acid is fully ionized.) 3

pH of solution: _____

2. The hydrogen phthalate ion, $C_8H_5O_4^{-1}$, is a weak acid with $K_a = 2.9 \times 10^{-7}$.

a. Write an equation to represent the ionization of the weak acid, the phthalate ion, $C_8H_5O_4^{-1}$. 1

ionization equation: _____

b. If you dissolve 2.55 g of potassium hydrogen phthalate, $KC_8H_5O_4$ to make a 250 cm^3 solution, what is the pH of the solution? 3

pH of solution: _____

3. Consider the salt ammonium acetate, CH_3COONH_4.

a. Write the equation for the dissociation of ammonium acetate. 1

dissociation equation: _____

b. Draw the Lewis structure, state the shape and the expected bond angle of the ammonium ion, NH_4^{+1} and the acetate ion, CH_3COO^{-1}. 3

Molecule	Lewis structure	Shape	Bond Angle
NH_4^{+1}			
CH_3COO^{-1}			

c. Write equations for the hydrolysis reactions which occur. 2

d. K_a for the ammonium ion, NH_4^{+1} = 5.6×10^{-10}, and K_a for acetic acid = 1.8×10^{-5}. Explain why a solution of ammonium acetate has a pH = 7. Support your answer with calculations. 2

4. A student pipetted 50.0 cm^3 of 0.100 mol dm^{-3} of methanoic acid, $HCOOH_{(aq)}$ into a conical flask. He then slowly added 0.100 mol dm^{-3} of potassium hydroxide, $KOH_{(aq)}$ from a burette. In total 50.0 cm^3 of the alkali were added. The pH of the resulting solution was measured throughout the experiment with a pH meter.

a. Fill in the following table: 2

Molecule	Lewis structure	Shape	Bond angle
$HCOO^{-1}$			

b. What is the pH of the resulting solution at the equivalence point, if pKa (HCOOH) = 3.75. 4

pH of solution: _____

c. This titration could be carried out using an indicator. The pH ranges for the colour changes of four indicators re shown in the table below:

Indicator	pH range
Clayton yellow	12.2 – 13.2
Thymol blue	8.0 –9.6
Brilliant yellow	6.6 – 7.8
Resazurin	3.8 – 6.4

Explain which of these indicators is the most suitable for this titration. 2

d. Sketch the pH curve for this titration. (Use all the information from (a), (b), and (c) above to sketch your pH curve.) 3

5. A mixture of benzoic acid, C_6H_5COOH, and sodium benzoate, C_6H_5COONa, can act as a buffer solution.

a. Define what is meant by a buffer solution. 1

b. Describe what happens to this buffer solution when acid is added. 2

c. Calculate the pH of a solution containing 7.20 g of sodium benzoate, C_6H_5COONa in 1.0 dm^3 of 0.020 mol dm^{-3} of benzoic acid, C_6H_5COOH, (K_a (C_6H_5COOH) = 6.3×10^{-5}). 3