8.2 More About Acids

Question Paper

Course	DP IB Chemistry
Section	8. Acids & Bases
Topic	8.2 More About Acids
Difficulty	Hard

Time allowed: 40

Score: /31

Percentage: /100

Question 1a

a)
A solution of hydrochloric acid of concentration 0.001 mol dm^{-3} has a pH value of 3. Suggest, giving a reason, the pH of the following solutions of acids:

i)
0.01 mol dm^{-3} hydrochloric acid

[2]

ii)
0.01 mol dm^{-3} ethanoic acid

[2]

[4 marks]

Question 1b

b)
A solution of 0.01 mol dm^{-3} ethanoic acid has a concentration of hydrogen ion of 1×10^{-4} mol dm^{-3}. Determine the percentage of ethanoic acid molecules that have dissociated.

[1]

[1 mark]

Question 1c

c)
Two separate titrations are carried out using 25.00 cm^3 of 0.01 mol dm^{-3} solutions of hydrochloric acid followed by ethanoic acid, against 0.01 mol dm^{-3} sodium hydroxide.
State what difference(s) would be observed in the two titrations.

[1]

[1 mark]

Question 1d

d)
Suggest a suitable indicator for the titration of hydrochloric acid and sodium hydroxide in part c), and state the colour changes observed.

[2]

[2 marks]

Question 2a

a)
Show how the ionic product for water is derived from the dissociation of water and give it units.

[3]

[3 marks]

Question 2b

b)
Determine the pH of 0.001 mol dm^{-3} sodium hydroxide.

[1]

[1 mark]

Question 2c

c)
Suggest, with a reason, how the magnitude of K_w changes with increasing temperature.

[4]

[4 marks]

Question 3a

a)
Malonic acid is a weak dibasic carboxylic acid with the formula $C_3H_4O_4$. Draw the displayed structure of malonic acid.

[1 mark]

Question 3b

b)
Suggest, with a reason, which of the two acids, ethanoic or malonic, has a higher pH?

[2]

[2 marks]

Question 3c

c)
Apart from testing the pH, suggest how equimolar solutions of malonic acid and ethanoic acid may be distinguished.

[1]

[1 mark]

Question 3d

d)
Write the formulas of two conjugate bases that can be formed from malonic acid.

[2]

[2 marks]

Question 4a

a)
Marble chips are added separately to solutions of the same concentration of ethanoic acid and hydrochloric acid. State **one** similarity and **one** difference you would expect to observe in the reactions.

[2]

[2 marks]

Question 4b

b)
Write an equation for the reaction between marble chips and ethanoic acid.

[1]

[1 mark]

Question 4c

c)
Determine the volume, in cm^3, of 2.25 mol dm^{-3} ethanoic acid needed to completely react with 1.50 g of marble chips.

[3 marks]

Question 4d

d)
Determine the volume of CO_2, in cm^3, produced at 273 K and 101 kPa in part c).

[3 marks]