

# 8.2 More About Acids

## Question Paper

Course	DPIB 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  $0.001 \text{ mol dm}^{-3}$  has a pH value of 3. Suggest, giving a reason, the pH of the following solutions of acids:

i)

$0.01 \text{ mol dm}^{-3}$  hydrochloric acid

[2]

ii)

$0.01 \text{ mol dm}^{-3}$  ethanoic acid

[2]

**[4 marks]**

### Question 1b

b)

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

[1]

**[1 mark]**

### Question 1c

c)

Two separate titrations are carried out using  $25.00 \text{ cm}^3$  of  $0.01 \text{ mol dm}^{-3}$  solutions of hydrochloric acid followed by ethanoic acid, against  $0.01 \text{ mol dm}^{-3}$  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  $0.001 \text{ mol dm}^{-3}$  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  $\text{cm}^3$ , of  $2.25 \text{ mol dm}^{-3}$  ethanoic acid needed to completely react with 1.50 g of marble chips.

[3 marks]

**Question 4d**

d)

Determine the volume of  $\text{CO}_2$ , in  $\text{cm}^3$ , produced at 273 K and 101 kPa in part c).**[3 marks]**