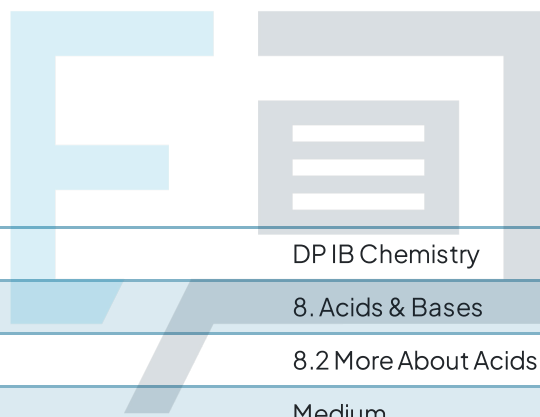




## 8.2 More About Acids

### Mark Schemes



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

# Exam Papers Practice

To be used by all students preparing for DP IB Chemistry HL  
Students of other boards may also find this useful

1

The correct answer is **D** because:

- Basic solutions have a pH greater than 7 and the hydrogen ion concentration lies between  $1.0 \times 10^{-7}$  and  $1.0 \times 10^{-14} \text{ mol dm}^{-3}$

**A** is incorrect as this solution is pH 2, since  $\text{pH} = -\log[\text{H}^+]$  and  $-\log[1.0 \times 10^{-2}] = 2$

**B** is incorrect as this solution is also pH 2. This is because  $[\text{H}^+] \times [\text{OH}^-] = K_w = 1 \times 10^{-14}$ , so  $[\text{H}^+] = \frac{K_w}{[\text{OH}^-]} = 1 \times 10^{-2}$  or pH 2

**C** is incorrect as the pH is below 7.00 so is acidic

2

The correct answer is **C** because:

- The concentration of hydroxide ions in NaOH would be  $1 \times 10^{-3} \text{ mol dm}^{-3}$
- This means the concentration of hydrogen ions would be  $1 \times 10^{-11} \text{ mol dm}^{-3}$  since

$$K_w = [\text{H}^+] \times [\text{OH}^-] = 1 \times 10^{-14}$$

$$[\text{H}^+] = \frac{K_w}{[\text{OH}^-]}$$

$$= \frac{1 \times 10^{-14}}{1 \times 10^{-3}} = 1 \times 10^{-11} \text{ mol dm}^{-3}$$

$$\text{pH} = -\log [\text{H}^+] = -\log(1 \times 10^{-11}) = 11$$

**Extra info:**

It's handy to remember that  $[\text{H}^+] = 1 \times 10^{-\text{pH}}$



3

The correct answer is **B** because:

- According to **Le Chatelier's Principle** raising the pressure will cause an equilibrium to shift to the side with the fewer gas molecules
- In this case, the shift would be to the right since the only gas molecule is on the left
- The concentration of hydrogen ions would increase, so the pH would decrease

**Exam tip:**

You are not required to quote **Le Chatelier's Principle** in an exam, but you are required to apply it to solve problems

4

The correct answer is **C** because:

- The amount of hydrogen produced is determined by the number of moles of the acid
- Since the volume and concentration of the acids are the same, the number of moles of acid are equal, and so will be the moles and volume of gas produced

**A** is incorrect as although the hydrochloric acid will react faster, its pH will be lower than ethanoic acid

**B** is incorrect as the total volume of gas produced is determined by the moles of acid, not by whether the acid is strong or weak

**D** is incorrect as ethanoic acid will react more slowly but its pH will be higher than an equal volume and concentration of hydrochloric acid

5

The correct answer is **C** because:

- When the solution is diluted, the concentration of hydrogen ions decreases by a factor of 10 since the volume has changed from 50 cm<sup>3</sup> to 500 cm<sup>3</sup>
- The pH scale is log<sub>10</sub> scale so a tenfold change in the hydrogen ion concentration corresponds to a change in one pH number
- The pH must change from 11 to 10

6

The correct answer is **B** because:

- Carboxylic acids, RCOOH, and amines, RNH<sub>2</sub>, are weak acids and bases

**A** is incorrect as Ba(OH)<sub>2</sub> is classified as a strong base. It is the only hydroxide in Group 2 that is a strong base – this is because Ba(OH)<sub>2</sub> is very soluble in water, so fully ionises and produces many OH<sup>-</sup> ions

**C** is incorrect as HNO<sub>3</sub> is a strong acid

**D** is incorrect as KOH is a strong base

7

The correct answer is **B** because:

- Converting the concentrations into pH

X.  $0.100 \text{ mol dm}^{-3} = 1.00 \times 10^{-1} \text{ mol dm}^{-3} = \text{pH } 1$

Y.  $0.001 \text{ mol dm}^{-3} = 1.00 \times 10^{-3} \text{ mol dm}^{-3} = \text{pH } 3$

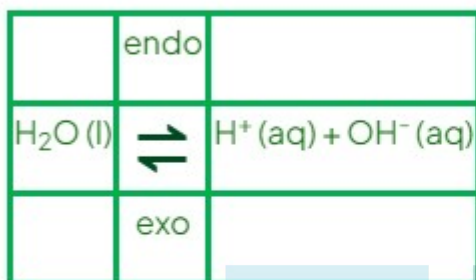
Z.  $0.010 \text{ mol dm}^{-3} = 1.00 \times 10^{-2} \text{ mol dm}^{-3} = \text{pH } 2$

- This gives the correct order as  $X < Z < Y$

8

The correct answer is **A** because:

- The ionisation of water is a reversible process and therefore **Le Chatelier's** principle applies



- If the temperature of the water increases, then the equilibrium will move to oppose the change in temperature
  - Therefore, the forward reaction will be favoured
  - This produces more hydrogen ions and hydroxide ions
  - The higher the value for  $[\text{H}^+]$ , the lower the pH value

**B** is incorrect as a decrease in temperature will increase the pH of water

**C** is incorrect as pH of water is affected by temperature. An increase in temperature will decrease pH (becomes more acidic) and a decrease in temperature will increase pH (becomes more alkaline)

**D** is incorrect as despite the fact that pH will change with temperature, the concentration of  $\text{H}^+$  ions and  $\text{OH}^-$  ion is always equal

9

The correct answer is **B** because:

- The pH can be found without a calculator using simple maths:

$$K_w = [H^+] \times [OH^-] = 1 \times 10^{-14}$$

$$[H^+] = \frac{K_w}{[OH^-]}$$

$$[H^+] = \frac{1 \times 10^{-14}}{1 \times 10^{-1}} = 1 \times 10^{-13} \text{ mol dm}^{-3}$$

$$[H^+] = 10^{-\text{pH}}, \therefore \text{pH} = 13$$

- LiOH is a strong base so will contain lots of ions and be a good conductor
- A strong base of pH 13 will turn universal indicator purple

**A** is incorrect as the pH, conductivity and indicator colour are incorrect

**C** is incorrect as the pH, conductivity and indicator colour are incorrect

**D** is incorrect as the conductivity and indicator colour are incorrect

10

The correct answer is **A** because:

- The same volume and concentration of sodium hydroxide would neutralise the same number of moles of hydrochloric acid
- The most concentrated acid would be the beaker that has the lowest pH after addition of the sodium hydroxide
- This beaker has the most moles of acid left after neutralisation

**B, C & D** are incorrect as they are not the beaker with the lowest pH