8.2 More About Acids

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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

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The correct answer is **D** because:

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

A is incorrect as this solution is pH 2, since pH = -log[H^+] and -log[1.0×10^{-2}] = 2

B is incorrect as this solution is also pH 2. This is because $[H^+] \times [OH^-] = Kw = 1 \times 10^{-14}$, so $[H^+] = \frac{Kw}{[OH^-]} = 1 \times 10^{-2}$ 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 1×10^{-3} mol dm^{-3}
- This means the concentration of hydrogen ions would be 1×10^{-11} mol dm^{-3} since

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

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

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

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

Extra info:

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

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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

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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

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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

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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^3 to 500 cm^3
- The pH scale is log_{10} 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

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The correct answer is **B** because:

- Carboxylic acids, RCOOH, and amines, RNH_2, are weak acids and bases

A is incorrect as $Ba(OH)_2$ is classified as a strong base. It is the only hydroxide in Group 2 that is a strong base - this is because $Ba(OH)_2$ is very soluble in water, so fully ionises and produces many OH- ions

C is incorrect as HNO_3 is a strong acid

D is incorrect as KOH is a strong base

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The correct answer is **B** because:

- Converting the concentrations into pH

X. 0.100 mol dm^{-3} = 1.00 x 10^{-1} mol dm^{-3} = pH 1

Y. 0.001 mol dm^{-3} = 1.00 x 10^{-3} mol dm^{-3} = pH 3

Z. 0.010 mol dm^{-3} = 1.00 x 10^{-2} mol dm^{-3} = 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

	endo	
H_2O (l)	⇌	H^+ (aq) + OH^- (aq)
	exo	

- 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 $[H^+]$, 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 H^+ ions and OH^- ion is always equal

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The correct answer is **B** because:

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

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

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

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

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

- 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

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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