

Strong and weak acids, bases and pH

AP Chemistry · Lab answers

The sample data give a K_a close to the accepted value. Your own results will differ a little with the probe, temperature and dilution accuracy. Show every substitution and keep two or three significant figures in the final value.

Level: AP Chemistry · **Curriculum:** AP Chem Unit 8

Question 1 Hydronium concentrations

$[\text{H}_3\text{O}^+] = 10^{-\text{pH}}$. For pH 2.88: **$1.32 \times 10^{-3} \text{ mol/dm}^3$** . The other rows give 3.89×10^{-4} and $1.23 \times 10^{-4} \text{ mol/dm}^3$.

Question 2 Percent ionised

Percent = $[\text{H}_3\text{O}^+]/c \times 100$: **1.3 %**, **3.9 %** and **12.3 %**. The percentage rises as the acid is diluted.

Question 3 K_a from each reading

$K_a = \mathbf{1.76 \times 10^{-5}}$, $\mathbf{1.57 \times 10^{-5}}$ and $\mathbf{1.73 \times 10^{-5}}$.

Question 4 Mean and comparison

Mean = **1.69×10^{-5}** . This differs from 1.8×10^{-5} by 6 %, so the results agree well.

Question 5 Predicting the next dilution

Solve $x^2 + 1.8 \times 10^{-5}x - 1.8 \times 10^{-9} = 0$: $x = 3.437 \times 10^{-5} \text{ mol/dm}^3$, so pH = **4.46**. The shortcut would be inaccurate here because x is about 34 % of c .

Question 6 Pipetting error

The real concentration is 0.0099 mol/dm^3 , 1 % lower than assumed. Using $c = 0.0100$ in the formula makes $c - [\text{H}_3\text{O}^+]$ slightly too big, so the calculated K_a is about **1 % too low**.

Question 7 Random error

Probe not at equilibrium: wait until the reading is steady for 30 seconds. Carbon dioxide dissolving in the dilute solutions: keep the beaker covered and measure quickly. **Repeat each reading three times** and average.