



irritant !



corrosive !

What precautions should you take when working with acids?

Acid names	Formulae	Concentration mol/dm ³	Colour of universal indicator	pH	Strong or Weak acid?
Hydrochloric acid	HCl	1.0			
Sulfuric acid	H ₂ SO ₄	1.0			
Nitric acid	HNO ₃	1.0			
Ethanoic acid	CH ₃ COOH	1.0			

Conclusions

- ethanoic acid is a _____ acid
- hydrochloric, nitric and sulfuric acids are _____ acids
- strong acids have a _____ pH than weak acids of the same concentration

Why are some acids stronger than others?

- Acids are chemicals that _____ (dissociate) in water to produce _____ ions
- An acid is strong if it _____ ionises in water (100% of molecules ionise):

Higher
LEARN

e.g.

100% →

- Weak acids only _____ ionise in water **note that there is an** _____

Higher
LEARN

e.g.

less than

1% ⇌

you can see from the previous equation that the ionisation of a weak acid is an example of a _____ reaction and produces an equilibrium mixture

- _____ is a measurement of the number of moles of hydrogen ions, H⁺ in solution
the _____ the hydrogen ion concentration, the _____ the pH number

- So, the pH of a weak acid is much _____ than the pH of a strong acid of the _____ concentration.

Higher Only

You must be able to explain the difference between acid strength and acid concentration:

CONCENTRATION: the concentration of an acid is a measure of

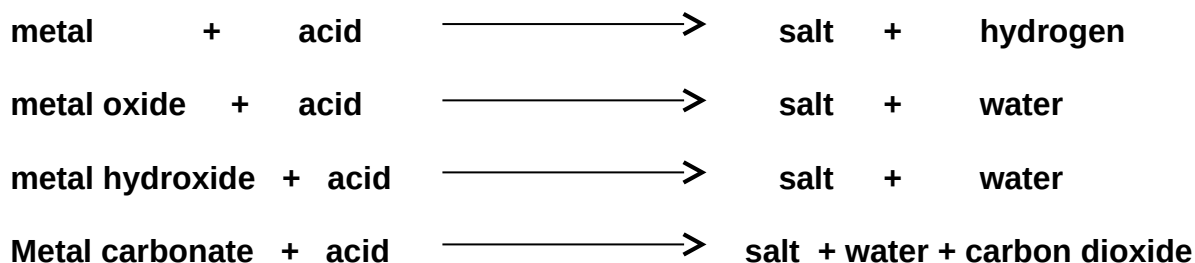
STRENGTH: How strong or weak an acid is i.e. its strength, is a measure of

strong =

weak =

Comparing the Reactions of Strong and Weak Acids

Both Strong and weak acids will perform these reactions:



Experiment 1 – Compare the reaction of *magnesium* with HCl and CH_3COOH (ethanoic acid)

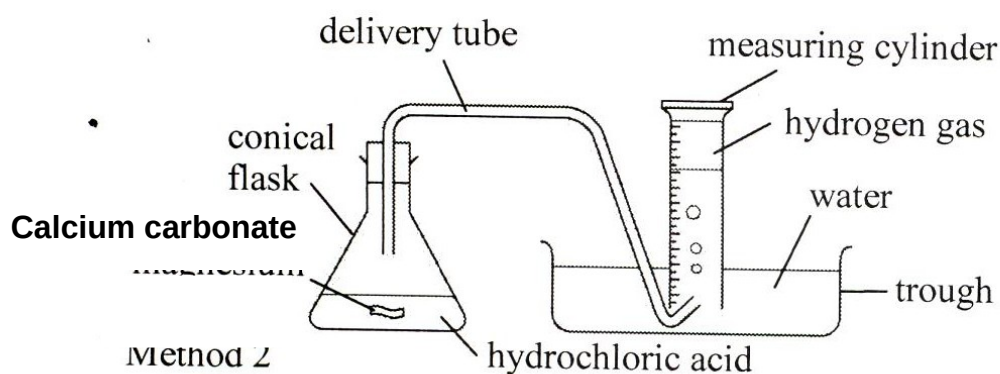
Observations

1. The magnesium fizzes _____ with HCl
2. The magnesium disappears _____ with HCl
3. The test tube with HCl gets _____ (more exothermic)
4. Gas makes a _____ with a lighted splint

Conclusion

- Both ethanoic acid and hydrochloric acid react with magnesium to give _____
- Ethanoic acid reacts _____ than hydrochloric acid because there are fewer _____ (H^+). Fewer H^+ means fewer _____ with Mg so the rate of reaction will be _____.

Experiment 2 – Compare the reaction of calcium carbonate, CaCO_3 with HCl and CH_3COOH (ethanoic acid)



$$\text{Rate} = \frac{1}{\text{time}}$$

Results

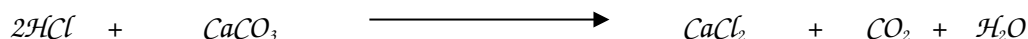
<i>Acid</i>	<i>1.0 mol/dm³</i>	<i>Time to collect 10cm³ of gas (s)</i>	<i>Rate (s⁻¹)</i>
<i>Hydrochloric Acid</i>	<i>HCl</i>		
<i>Ethanoic acid</i>	<i>CH₃COOH</i>		

TOTAL volume produced by both gases = 24cm³

Conclusions

- Both ethanoic acid and hydrochloric acid react with calcium carbonate to give

_____.



- Magnesium and calcium carbonate react slower with ethanoic acid than with hydrochloric acid of the same

_____.

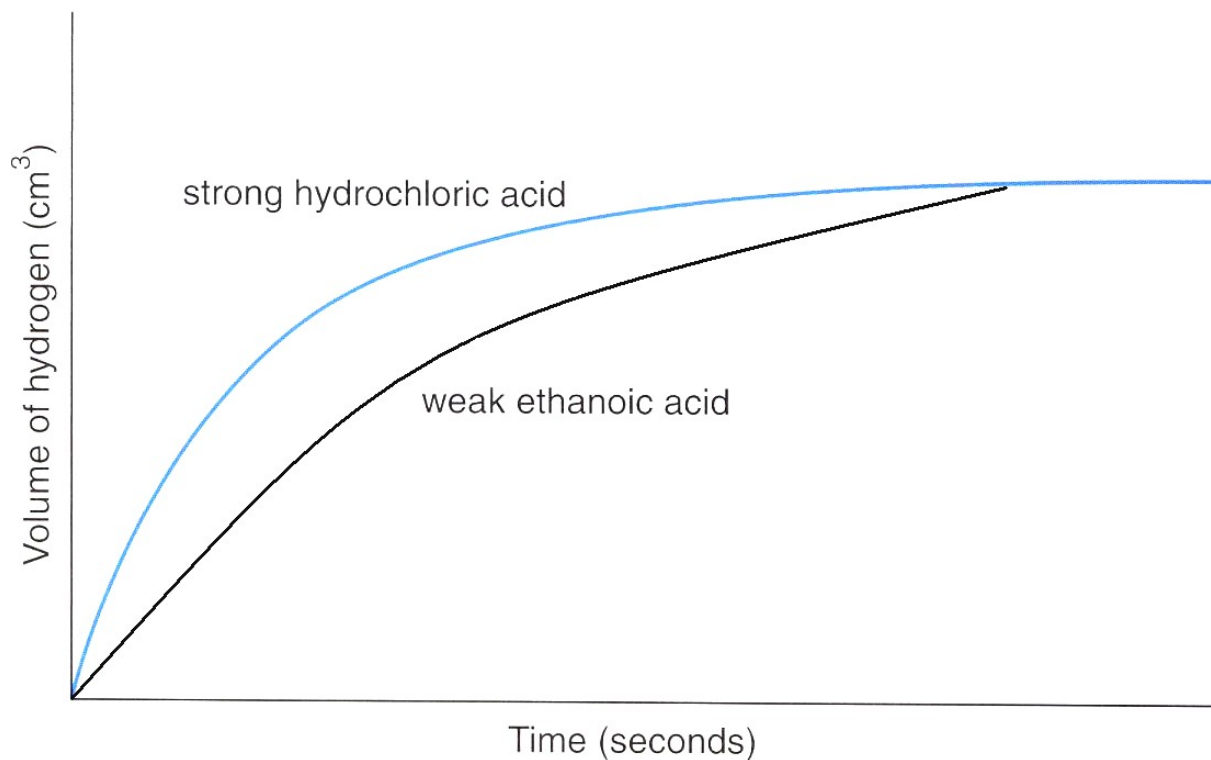
Explanation: the weak acid, CH_3COOH ionises less so fewer H^+ means that there are fewer collisions with CaCO_3 which results in a slower rate of reaction

Summary (HIGH LEVEL)

Strong acid means almost _____ % ionisation therefore there is a greater _____ of hydrogen ions, H^+ . This leads to a greater _____ frequency between reactant molecules and H^+ so the rate of reaction is faster.

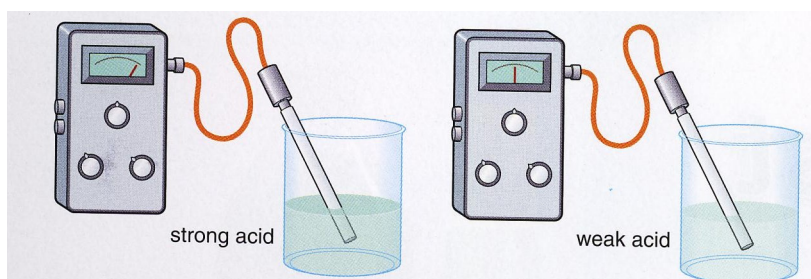
IMPORTANT

If the _____ **mass** of solid is used and the _____ **volume** and **concentration** of acid, then the _____ **total volume of gas** is produced in experiment 1 and 2 but the weak acid produces it more _____ than the strong acid.



▲ Same amount of acid – different rate
So, the volume of gas produced depends on the _____ of acid and NOT on the strength.

Comparing the electrical conductivity of strong and weak acids



Results

Acid	1.0 mol/dm ³	Electrical conductivity
Hydrochloric Acid	HCl	
Ethanoic acid	CH ₃ COOH	

Conclusion

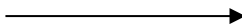
- ethanoic acid has a _____ electrical conductivity than hydrochloric acid of the same concentration

Why?

- electrolysis of both ethanoic acid and hydrochloric acid makes hydrogen at the negative electrode

Why?

+



reduction

Higher Only

Ethanoic acid is _____ conductive than hydrochloric acid of the same concentration

because:

- ethanoic acid is _____ and hydrochloric acid is _____
- HCl has a _____ concentration of hydrogen ions to carry the charge

Weak acids can be really useful



One use for weak acids is as **descalers** – removing limestone from metal surfaces e.g. sinks and washing machines

Weak acids can be more useful than dilute strong acids

1.

2.



Higher Only

You must also be able to explain why a weak acid may be more useful than the more dilute strong acid but you must refer to the “hydrogen ion concentration” in your answer.

concentration” in