Acids and bases in daily life

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Acids and Bases

In every day life.

View the accompanying video on the website for answers and background information.

1. Give the balanced overall and ionic equations, states included, for the acid base reaction taking place with HCl in the stomach for the following ingredients found in antacids.

   a. **Magnesium hydroxide** ($Mg(OH)_2$)

      i. Overall _____

      ii. Ionic _____

   b. Aluminium hydroxide ($Al(OH)_3$)

      i. Overall _____

      ii. Ionic _____

   c. Calcium carbonate ($CaCO_3$)

      i. Overall _____

      ii. Ionic _____

   d. Sodium hydrogen carbonate ($NaHCO_3$)

      i. Overall _____

      ii. Ionic _____

2. Mylanta is a registered off-the -shelf antacid medication.

Figure 1 -Mylanta antacid medication.

a. The packaging clearly gives the amount of each active ingredient in mg.
Aluminium hydroxide = 400 mg
Magnesium hydroxide = 400 mg

i. Give the chemical formulae of each active ingredient.

_____

_____

ii. Find the percentage composition of OH^- in each of the two active ingredients.

- Aluminium hydroxide.

- Magnesium hydroxide

iii. Given that an average tablet of Mylanta has a mass of 2.00 g, give the combined concentration of, OH^- in %m/m, found in each tablet.

b. Using table 9 of the Data Booklet, suggest why excessive use of Mylanta can cause serious bone degeneration. Support your explanation by providing two ionic equations for the formation of phosphate precipitates.

c. A student places a finely crushed Mylanta tablet in a 100 mL conical flask filled with 50 mL of distilled water and stirs the mixture until the tablet is fully dissolved. The contents of the conical flask is the titrated against a standard, 1.00 M HCl. Calculate the average titre expected in mL.

d. Using table 1 comment on why aluminium hydroxide and magnesium hydroxide are both present in Mylanta when one will act as effective antacid?

Component	Active ingredient in antacid medications	Possible conditions from excess consumption	Notes / Mechanism
Sodium (Na^+)	Sodium bicarbonate ($NaHCO_3$).	Hypertension, fluid retention, edema, heart failure exacerbation	Excess sodium increases osmotic retention of water. Problematic in patients with cardiovascular disease
Calcium (Ca^{2+})	Calcium carbonate ($CaCO_3$) e.g. Tums	Hypercalcemia, kidney stones (CaC_2O_4), constipation, renal impairment	Too much Ca^{2+} can precipitat with oxalate in kidneys to for kidney stones
Aluminium (Al^{3+})	Aluminium hydroxide ($Al(OH)_3$) e.g. Mylanta	Constipation, hypophosphatemia, bone disorders (osteomalacia).	Al^{3+} and Mg^{2+} bind phosphate in the gut to produce insolubl solid salts and hence prevent absorption of PO_4^{3-} into the blood stream. Excess Al^{3+} can accumulate the blood and ultimately causes kidney damage.
Magnesium (Mg^{2+})	Magnesium hydroxide ($Mg(OH)_2$) e.g. Mylanta	Diarrhea, hypermagnesemia (in kidney disease), muscle weakness, cardiac disturbances	Poorly absorbed in healthy individuals; excess Mg^{2+} in renal patients can be toxic

Table 1 – side-effects of common antacids

A template for you to follow, if needed, when writing a scientific report. See the accompanying video on the website.

Scientific Investigation Report

Investigation: Determining the calcium carbonate content of antacid tablets

Student Name: _____

Class: _____

Date: _____

Figure 2 – Tums fruit antacid tablets

Title

The title of a quantitative research investigation should include the independent and dependent variables to clearly show the relationship being studied

Background

Provide scientific background information about the reaction between calcium carbonate and acids. Include balanced equations and any relevant chemical theory.

Hypothesis

State your hypothesis clearly written in the form If [cause], then [effect], because [scientific reason]

Safety

Hazard / Risk	Mitigation / Safety Measure	Action taken if hazard happens

Variables

Independent Variable 0ne only): _____

Dependent Variable (one only): _____

Controlled Variables (all possible variables):

_____

_____

_____

_____

_____

Materials

A detailed and comprehensive list of materials.

Procedure

Write numbered, step-by-step instructions for your titration. Include detail of apparatus (eg. 100mL beaker), volumes, and concentrations. Use repeat statements.

Results

Record all your titration readings and calculations in a properly formatted table for trial and average titres.

Discussion

Consider the following questions when discussing your results. Always refer to data you have collected.

- Were your titration results **consistent (precise)** between trials? Refer to your data.
- Were your measurements **close to the expected value (accurate)**?
- What **errors** may have affected your results, such as reading the burette incorrectly, incomplete reaction?
- Does your **calculated $CaCO_3$ content** agree with the manufacturer's claim?
- What **limitations** existed and what **improvements** could be made next time?

Conclusion

Restates the hypothesis in brief.

State whether the hypothesis was supported or not supported.

Summarises the main evidence from the data (e.g calculated mass of $CaCO_3$).