

Question 27**(12 marks)**

Phosphoric acid, $\text{H}_3\text{PO}_4(\text{aq})$, is a weak, triprotic acid.

- (a) Write the ionisation equation for phosphoric acid in water which shows the **second** proton of the acid being released into solution. (2 marks)

Magnesium carbonate, $\text{MgCO}_3(\text{s})$, is an ingredient of a commonly-used antacid.

- (b) Other than water, list **three** species (elements, compounds, ions) that would be found in the reacting vessel open to the atmosphere at the completion of the reaction between excess solid magnesium carbonate and an aqueous solution of phosphoric acid. (3 marks)

One: _____

Two: _____

Three: _____

Sodium hydroxide solution, NaOH(aq) , was used in a titration to determine the concentration of phosphoric acid.

- (c) Other than it having too low a molar mass, state **two** reasons why the concentration of the sodium hydroxide solution cannot be reliably determined by weighing out an amount of solid sodium hydroxide and dissolving it in a known volume of distilled water. (2 marks)

One: _____

Two: _____

The table below lists some acid-base indicators and the colour that each appears over a pH range.

Indicator	Colour		pH range
	Acid	Base	
Universal indicator	red	violet	1.0 – 14.0
Methyl orange	red	yellow	3.2 – 4.4
Bromocresol green	yellow	blue	3.8 – 5.4
Litmus	red	blue	4.5 – 8.3
Methyl red	yellow	red	4.8 – 6.0
Bromothymol blue	yellow	blue	6.0 – 7.6
Phenol red	yellow	red	6.8 – 8.4
Phenolphthalein	colourless	magenta	8.2 – 10.0

- (d) Select the acid-base indicator from the table above that would be most suitable for the titration between phosphoric acid, $\text{H}_3\text{PO}_4(\text{aq})$, and sodium hydroxide solution, $\text{NaOH}(\text{aq})$. Justify your choice of indicator, including **one** relevant equation. (5 marks)
