Slime – Quantity for 2 Class Experiments

Order code: **06-8110**

This remarkable material opens up another route to Sc1 Investigations for KS4 Chemistry and provides an alternative to the rates of reaction investigations involving marble chips/ magnesium with acid etc.

Why use slime?

- Sc1 relating to Organic Chemistry
- Truly open ended
- Accessible by all levels of ability
- Cheap
- Safe
- Motivational

Poly(vinyl alcohol), PVA, is a polymer that most students will be familiar with as wood glue. It is commercially available in solution or dry form. By cross-linking the polymer using borax solution, 'slime' is formed in a rapid reaction and produces a material ready for investigation within minutes.

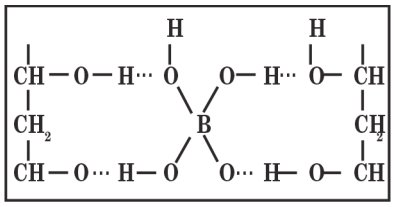
This starter pack contains:

- PVA - sufficient for 25 batches of slime
- Borax
- Dye - water soluble fluorescein
- Ideas for investigation
- Safety notes

Chemical details of slime

CH_2= CHOH > (-CH_2-CHOH-)$_n$

As supplied, the PVA solid has an average molar mass of about 115,000 g mol^{-1}. The borax dissolves in water to form a weakly alkaline solution and cross links alcoholic OH groups via hydrogen bonds forming a gel like structure. Typically 96% of the volume is trapped water. The hydrogen bonds are not permanent and this gives rise to the slime properties observed.



Making the solution

Typically students are provided with 25ml of 4% PVA and 5ml of 4% Borax solutions. The procedure below will produce sufficient quantities for 4 batches of slime.

PVA solution

- Heat 100ml of water to about 90°C. It is important that this temperature is not exceeded.
- Using a magnetic stirrer, slowly add 4g of PVA. If the PVA is added too quickly it will not disperse without difficulty. PVA solution can be made without the magnetic stirrer, but is much more time consuming.
- Maintain the temperature and keep stirring until the PVA dissolves.
- Pour into measuring cylinder and top up to 100ml to replace water lost by evaporation.
- Allow to cool

Borax solution

- Dissolve 0.8g of borax (sodium borate) in 20ml of water.
- A small amount of water soluble dye (e.g. fluorescein) or food colouring may be added at this stage. Only a very small amount of fluorescein is needed

Quantities should be increased/decreased as desired.

Making the slime

- The 'best' slime is made by mixing PVA and Borax in a 5:1 ratio
- Place PVA solution in a beaker and add the appropriate amount of borax
- Stir rapidly with a glass rod to ensure total mixing. Within seconds the slime forms
- Allow to stand for a few minutes whilst the cross-linking continues

Your slime is now ready for use.

Slime – Quantity for 2 Class Experiments

Order code: **06-8110**

Possible investigations.

The effect of various variables can be investigated quantitatively e.g. amount of stretch in given time period or time taken to stretch a given amount. Both measurements can be converted to rate of stretching in e.g. mm/s. Pupils need to spend time deciding how to measure the stretch in a fair and reproducible manner.

Possible variables to investigate:

- Ratio of PVA to borax - change volume of 4% borax solution added
- Concentration of Borax or PVA - dilute/ concentrate solutions as appropriate
- Temperature - slime can be placed in a beaker in a water bath until the desired temperature has been achieved
- Affect of pH - this will affect the degree of cross-linking and can be investigated by adding borax/borate buffered mixtures

Cleaning up

The beaker used to prepare the PVA solution should be washed up immediately after use. The apparatus used for the investigation should not be too dirty; the slime peels off glassware readily. Any residues can be removed easily by dissolving in 1M sulphuric acid (irritant) prior to normal washing routines.

Safety notes

- Borax - this is of minimal hazard unless large quantities of borax are ingested
- PVA - minimal hazard
- Fluorescein - minimal hazard

The slime produced is 96% water and as such the chemicals are present in low concentrations, but it is weakly alkaline.

However, the slime is not easily removed from clothing and may remove paint in some circumstances.

It is recommended that pupils wear disposable gloves (especially if they have sensitive skin, or there is to be prolonged handling) and eye protection. Although the slime can be stored in a sealed bag in a refrigerator, it can develop a mould if held for a long time.

It is the duty of the teacher to consult his/her employer's risk assessments before any of the procedures described are carried out. However, as the substances used present minimal hazards, there may well be no risk assessment for these activities.