The contact process

MAGS — Hi, we're Mags and Cal.

CAL — Today we're looking at how to produce sulfuric acid through the contact process.

MAGS — Sulfuric acid is great at absorbing water, which makes it a useful dehydrating agent. See, when it's added to glucose or sugar like this, it removes hydrogen and oxygen, aka water, leaving us with a black solid of carbon.

CAL — Now I'm off to Uncle Alun's factory to see the contact process in action.

Sulfuric acid is the world's most commonly used chemical. It's used in car batteries and to make paints, dyes, fibres, plastics, detergents and loads more.

Factories produce sulfuric acid on an industrial scale using the contact process.

CAL — Uncle Alun, how does the process work?

ALUN — Well, there are three steps, and we need three things – sulfur, oxygen and water.

First step – making sulfur dioxide which is an acidic gas.

We burn liquid sulfur in excess oxygen. This reaction is irreversible.

Step two – making sulfur trioxide. We do this by reacting the sulfur dioxide gas with more oxygen.

CAL — Ah, now the arrows go both ways, so that reaction's reversible?

ALUN — And tricky. It needs controlled conditions. Want sulfuric acid quicker? Increase pressure and temperature.

CAL — To speed up reaction rates.

ALUN: — Yeah, but we don't use a really high pressure because it could cause an explosion, and also increases the energy cost with only a small increase in reaction. And

	increasing temperature too much reverses the reaction.
CAL	Turning the sulfur trioxide back into sulfur dioxide and oxygen.
ALUN	Less sulfur trioxide. So it's all about compromise. Our compromise temperature is around 450°C. And we use a pressure of 1 atmosphere along with a vanadium(V) oxide catalyst to increase the reaction rate without reversing it.
CAL	But still no sulfuric acid?
ALUN	Ah well, in step three, we need to add water to the sulfur trioxide to finally get sulfuric acid. But adding water directly to sulfur trioxide creates an uncontrollable reaction. So for safety reasons, we first dissolve the sulfur trioxide in concentrated sulfuric acid to create oleum. Add water to oleum, and finally you've got sulfuric acid.
CAL	Cheers, Uncle Alun. So that's the contact process. I can see myself working here – I'll be in 'contact' when I leave uni.