

## Recipe for the perfect fracking fluid

### Make your own fluid to fracture hydraulically (frack) methane-bearing shale

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##### Ingredients

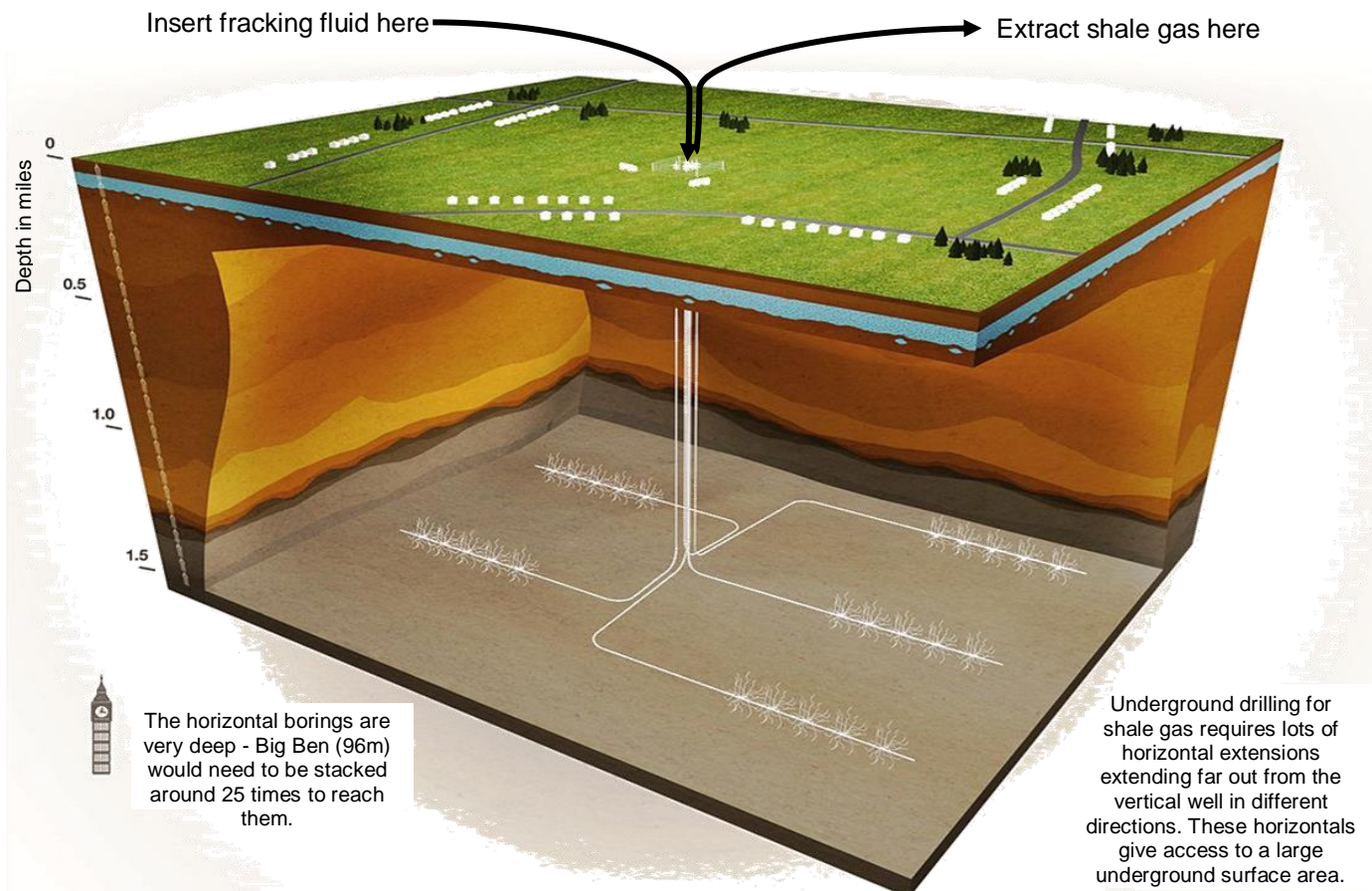
- 10 litres of water
- handful of sand
- squirt of washing up liquid
- squirt of lemon juice
- several drops of vinegar
- 10 x jelly babies

##### Instructions

- Take a suitable container, such as a bucket
  - Fill with water
  - Sprinkle in a handful of sand
  - Add a portion of washing up liquid
  - Squirt in some lemon juice
  - Add a dash of vinegar
  - Drop in ten jelly babies
  - Stir well
  - Pump under pressure into a borehole at least 1 km deep into methane-containing shale
  - Extract the methane
- (Note: it may not be possible to complete the last two stages of the recipe in the classroom!)**

Discuss with your class what each of the fracking fluid ingredients might be for.

Ingredient	Function
10 litres of water	incompressible fluid which can be greatly pressurised at 7,000,000 kgm <sup>-2</sup> or 70 Mpa (10,000 lbin <sup>-2</sup> , psi) to make it greater than the pressure of more than 1 km of overlying rock. This creates fractures in the shale which however, would close when the pressure was released, unless something was holding them open
handful of sand	grains go into the fractures to hold them open when the fluid pressure is released
squirt of washing up liquid	makes the fluid 'slippy' to help it to slide down the borehole and keep the well clean
squirt of lemon juice	these acidify the fluid to help to dissolve calcium carbonate deposits and stop iron compounds depositing
several drops of vinegar	
10 x jelly babies	like Guar Gum which thickens the fluid, helping it to pump better (thick when you want to pump it in, thin when you want to pump it out)



## The back up

**Title:** Recipe for the perfect fracking fluid.

**Subtitle:** Make your own fluid to fracture hydraulically (frack) methane-bearing shale.

**Topic:** Thinking through the purpose of the constituents of the fluid used for fracking, and the whole fracking concept.

**Age range of pupils:** 8 years upwards

**Time needed to complete activity:** 10 minutes

**Pupil learning outcomes:** Pupils can:

- describe the different constituents of fracking fluid;
- explain the purpose of each of the components;
- explain how the fluid is used in fracking.

### Context:

An activity to examine the hydraulic fracturing method and the purposes of the different constituents of the fracking fluid.

### Following up the activity:

Discuss why the methane contained in shale is not naturally released.

*A. Shale is a fine-grained sedimentary rock with tiny pore spaces between the grains. The spaces are so small that shale is impermeable to all fluids, including methane gas and water. It is only when the shale is cracked (fractured) that the methane can be released.*

Discuss where the methane in the shale originally came from.

*A. Shale is a sedimentary rock formed from mud. As the mud settled to the sea bed, microscopic dead plankton settled at the same time. During rock-formation, the plankton decayed to produce natural gas, mostly methane, as the mud became shale.*

### Underlying principles:

- Each of the constituents of fracking fluid has a part to play in fracking.
- An understanding of the role of the constituents provides the background necessary to understand the fracking process.

### Thinking skill development:

Thinking through the role of the fracking fluid constituents causes cognitive conflict allowing a picture of the fracking process to be constructed. This picture can be bridged to reality.

### Resource list:

- 10 litre (2 gallon) bucket
- water to fill bucket
- handful of sand
- bottle of washing up liquid
- lemon juice squirter
- bottle of vinegar
- 10 x jelly babies
- stirrer
- (optional) borehole at least 1 km deep into methane-containing shale

**Source:** The 'recipe' was kindly provided by Peter Styles from Keele University.

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