Video question script: Extrusion – see how they run

Question/Activity	Likely response	Rationale
In teaching about the Earth we can use investigations to explore Earth processes. This example investigates how magma erupts through the Earthlearningidea, 'See how they run'		Preparation for bridging from the model to real Earth processes
We have here …	Some treacle – which we are going to use to mimic lava	
We first need to think how we can change the runniness (viscosity) of the treacle by: • making it more runny or • making it less runny Discuss this with your group	Some might say; • more runny – heat it up • more runny – add liquid – like water • less runny cool it down • less runny add solid material – like sand	Construction = applying previous patterns to this problem Metacognition = explaining reasoning
Now, we need to devise tests to see how these work. It is best if we test each of the variables (heat, water and sand) separately Let's start with the heating investigation, by putting some treacle into a boiling tube Which investigation option is best? Discuss these with your group	We could warm one boiling tube in a hand while leaving the other at room temperature We could heat the boiling tube in a water bath while recording the temperature and: • pour it onto a sloping tile and time it • pour it onto a sloping petri dish and time it • time how long it takes a drop to fall from the tube to the table • time how long it takes to flow to the mouth of the tube	Cognitive conflict = which tests will work best? Metacognition = explaining reasoning
Now consider the addition of sand and water. Which investigations are best for these? Discuss these with your group	Test the sand and water in separate petri dishes; keep a dish of unaltered treacle as a control: • mix treacle with water and time how long it takes to flow down the sloping dish • mix it with sand - ditto	Cognitive conflict = which tests will work best? Metacognition = explaining reasoning
Carry out the tests	• hotter = more runny • with water = more runny • with sand = less runny	
Ask how we could improve these investigations and use the results to plot graphs	By measuring carefully – the temperature and amounts of treacle, water and sand, and plotting these	
Ask: • if we have magma that is hot, contains water and no solid material (no crystals) will it flow quickly or slowly? • If we have magma that is cooler, contains little water but a lot of crystals, will it flow quickly or slowly?	• Hot magma with water and no solid flows quickly • Cooler magma with no water and crystals flows slowly	Bridging = from the investigation to reality
Show them the diagrams of two volcanoes, ask which of these was formed by the quick-flowing, runny magma that was extruded as lava Which was formed by the slow-flowing lava?	• Volcano X = quick-flowing • Volcano Y = slow-flowing	Cognitive conflict = applying flow rate ideas to the diagrams
Explain that in volcano Y, some of the magma could have trickled out as slow-flowing lava, but probably, the magma solidified in the vent. Then		Bridging = from the investigation to reality

pressure built up and built up until there was a catastrophic eruption.		
Ask which of these sorts of eruption you would like to watch	Volcano X = it is fairly safe – like Hawaiian volcanoes – I have been within 5m of flowing Hawaiian lava – and survived! You don't want to see Volcano Y erupt – 57 people died in the Mt. St Helens eruption.	

Scientific accuracy:

- Whilst the treacle model of magma correctly shows that the temperature of the magma, the amount of crystals it contains and its water/gas content (as well as its composition), all play key roles in how explosive eruptions are …
- … water content has the opposite effect than that shown by the treacle model.
- For complex reasons, the more water a volcanic magma contains, the more explosive it becomes.