Video question script: Wax magnetic field and magnetic Earth

Question/Activity	Likely response	Rationale
In teaching about the Earth we use practical demonstrations to explore Earth properties. This example explores how the Earth's magnetism works and can be recorded through the Earthlearningideas 'Frozen magnetism', 'Magnetic Earth' and 'Magnetic Earth using a sponge ball globe'		Preparation for bridging from the model to real Earth processes

Frozen magnetism		
Show the class the petri dish with the magnetic field shown by iron filings 'frozen' in wax, explain what these different components are		Concrete preparation: familiarising them with the apparatus
Ask where the magnet was when the wax cooled.	• In the centre, aligned with the shape	Construction: using the pattern to spot the position of the magnet
Explain that once the wax cooled and 'froze' the iron filing magnetic field in position – that position was recorded. It doesn't matter how much the petri dish is moved, the position and alignment of the magnet can always be seen.		
Explain that, as hot rocks like igneous rocks cool down, they can also preserve evidence of the magnetic field		
If you have a magnetic igneous rock (i.e. an iron-rich rock, like gabbro or basalt) show that it can preserve its magnetisation by showing how a compass needle can be deflected.		
Explain that some igneous rocks can preserve signs of the Earth's magnetism when the rock was formed and cooled		Concrete preparation for the next activity

Magnetic Earth		
Show the class a Magnaprobe™. Then show that it doesn't matter how much you turn it, the magnet stays pointing in the same direction.		Concrete preparation: introduction to the instrument
Ask: What direction is the magnet pointing in? What is the magnet lined up with? What is it pointing downwards towards? Why is the pole not in a horizontal direction as shown by a compass, but deep in the Earth?	• Pointing downwards at a steep angle • Field lines of Earth's magnetism • One of the magnetic poles, N Pole in N hemisphere or S Pole in S Hemisphere • A compass has a mass on one side of the needle to keep it horizontal – the pole is actually deep in the Earth	Construction: helping them to construct the pattern of Earth's magnetism
Show them the clay (Plasticine™) ball containing a magnet. Use the Magnaprobe to show that it has a magnet inside. Explain that this is a model of our magnetic Earth.		Concrete preparation: introduction to the 'magnetic Earth'

Demonstrate the position of one of the poles – and stick a marker in. Repeat for the other pole. Then find the Equator and mark that. Repeat for different 'latitudes'		
Ask: How many degrees does the magnet on the Magnaprobe rotate through in moving from one pole to the other?	• Answers you may receive are 90º (unusual), 180º (most common), 360º or 0º. • Correct = 360º or 0º	Construction: they have to picture the pattern to be able to answer correctly
Demonstrate that the correct answer is 360º or 0º		
Ask: • If a volcano erupted at the North Pole, what angle (dip) would the magnetism recorded (the remanent magnetisation) have? • If a volcano erupted at the South Pole, what dip would the remanent magnetisation have? • If a volcano erupted at the Equator, what dip would the remanent magnetisation have? • Some lavas of Carboniferous age in the UK have horizontal magnetisation. Where was the UK when the lavas erupted?	• Vertical (90º) • Also vertical (90º) • Horizontal (0º) • On the Equator	Bridging: applying the pattern to the geological situation
Show the graph of magnetic inclination plotted against latitude		
Ask: What magnetic inclination would you expect for this latitude?	• They should work it out from the graph	
Check that the answer is correct using the Magnaprobe™ (this should give a reasonable answer, but not perfect as the magnet is not completely free to move)		

Magnetic Earth using a sponge ball globe		
Demonstrate the properties of the 'magnetic sponge ball Earth' using first the Magnaprobe™ then a magnetised needle		
Explain that the advantage of this model is that it is cheap to make and each group in the class can explore 'Earth's magnetism' for themselves		
Give each group a magnetic sponge ball Earth and ask them to explore it for themselves		Bridging: applying the pattern from the clay/ Plasticine™ magnetic Earth to a new magnetic Earth model

Note: We need to teach pupils that Earth's magnetism is **NOT** caused by a bar magnet inside the Earth – the evidence is that it is caused by currents in the core. This is just a model of how Earth's magnetism works.