This lesson is **designed to be run in an ICT room**. It revises what students should know about modes of heat transfer and then applies these concepts to heat transfer within the Earth, particularly focussing on convection within the solid mantle and the slow time-scales this happens over. Students can then explore online resources demonstrating convection and thinking about current cutting edge scientific research that looks at imaging deep Earth structure, and what a job as a research scientist is like. An accompanying powerpoint presentation, ICT room pupil instructions and a time-scale print out are included in the lesson 4 resource pack.

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| **Cycle** | **Aims** | **Teacher instructions** | **Pupil focus** | **Timing/ mins** |
| Starter – silly putty | - Getting the idea that something which behaves like a solid on a shorter timescale can flow like a liquid on a much longer timescale | Show the video and get the students to think about the question on the slide. | Generating ideas from observations | 5 |
| Information: Heat transfer in the Earth | - Recapping heat transfer  - Thinking about heat transfer in the Earth | Show the video of convection. The left side of the tank is being heated at the bottom; the right side is being cooled at the bottom. Brief refresher slide for heat transfer. Students discuss how the different layers of the Earth might transfer heat. On the next slide with the Earth cross section, you can give them the real answers. After this, students are asked to think about how the mantle can convect and allow S waves to travel through it. The resolution to this is that the mantle is solid but (similarly to the silly putty), over a long timescale it can flow. There is an explanation of solid state flow, and a slide with pictures of convection. | Recapping, taking in new ideas, brainstorming new ideas | 15 |
| Activity, using the computers | - Final interactive resources bring the students up to the cutting edge.  - Imagining themselves in the role of a researcher | Instructions for the students are provided, with links to look at. They should be given access to these instructions on their computers. The logarithmic ‘timescales timeline’ which is provided could be printed or students could be given access to a copy on their computers. Students explore the online links themselves (you might need to limit this to a certain time, depending on how much time you still have and whether you want the last task to be homework). The final task is explained in the instructions: they must imagine they are a scientist studying the deep Earth and produce an A4 fact-file poster or an A4 magazine interview page answering questions about their role. | Exploring online resources, thinking about rates, convection and the current cutting-edge science relating to the deep Earth. Putting themselves in a researcher’s shoes. | 30 (finish at home if you run out of time) |

The websites students will be visiting:

* <https://ian-r-rose.github.io/interactive_earth/thermal_hires.html>

An interactive simulation of thermal convection in the mantle. Instructions on the website tell you how you can create hot spots and cold spots in the mantle, adjust the temperature difference, and even create earthquakes.

* <https://deepearth.esc.cam.ac.uk/?page_id=294>

An online exhibition by the ‘Deep Earth Explorers’ who are researchers in the Earth Sciences department of the University of Cambridge that use Earthquakes to image deep Earth structure.