

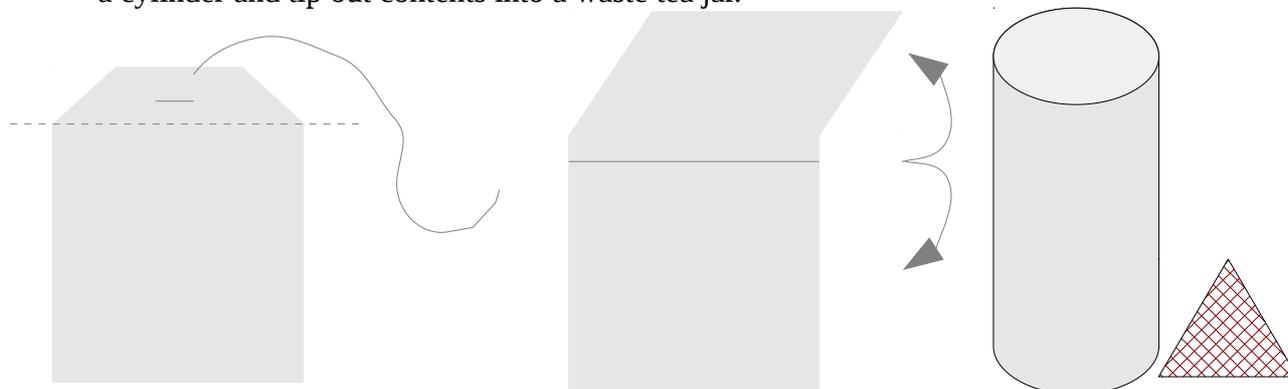


## Equipment (per group)

ceramic mat  
foil  
Twinings envelope tea bags (note: not all teabags are the same shape. Twinings works the best)  
long handled cooker lighter  
waste bin  
fire extinguisher  
waste tea jar

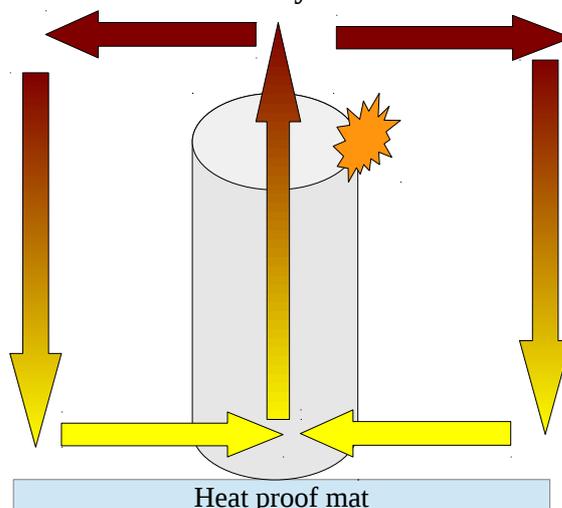
## Instructions for Flying Teabag Experiment

1. Wrap foil smoothly around a ceramic heat proof mat.
2. Cut the top of the tea bag along the dashed line, cut as straight as possible. Open teabag into a cylinder and tip out contents into a waste tea jar.



Set tea bag cylinder in the middle of the foil covered mat. [NB: If there are **no drafts** and the foil is smooth the teabag cylinder should stay upright]

3. Light the top of the cylinder on one side with the cooker lighter. Audience to stand at least 1m away. [NB: **Do not blow over** – if it does fall over leave to burn out. Ensure the cooker lighter flame is out and that the safety switch is on when not in use]



**The convection cell around the teabag is enough to lift it off the mat.**



This resource pack was created by Dr Rebecca Wilson  
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## Curriculum Links

### GCSE Physics – Heat Transfer

Heat is **thermal energy**. It can be transferred from one place to another by conduction, convection and radiation. Conduction and convection involve particles, but radiation involves electromagnetic waves.

I) *radiation* - All objects give out and take in **thermal radiation**, which is also called **infrared radiation**. The hotter an object is, the more infrared radiation it emits. The infrared is part of the **electromagnetic spectrum**. Example = the Sun radiates heat.

II) *conduction* - Heat energy moves through a substance. **Metals are good conductors of heat**, but non-metals and gases are usually poor conductors of heat. Poor conductors of heat are called **insulators**. Heat energy is conducted from the hot end of an object to the cold end. Metals have free moving electrons, metal atoms left behind are charged metal ions. These are packed close together, continuously vibrating. The hotter the metal, the increased kinetic energy these vibrations have. The free electrons transfer kinetic energy from hot parts of the metal to cold, colliding with ions as they move through the metal.

III) *convection* - Liquids and gases are fluids, their particles can move about. Convection occurs when particles with a lot of heat energy in a liquid or gas move and take the place of particles with less heat energy. Heat energy is transferred from hot places to cooler places. **Liquids and gases expand when they are heated**. Particles in liquids and gases move faster when they are heated than they do when they are cold, taking up more volume. The **liquid or gas in hot areas is less dense** than the liquid or gas in cold areas, so it rises into the cold areas. The denser cold liquid or gas falls into the warm areas.

### Context

Convection currents drive the Earth system in:

I) **LAND – convection cells in the mantle drive plate tectonics.** [IMAGE 1]

II) **OCEAN - convection cells in the ocean contribute to ocean currents.**  
[IMAGE 2]

III) **ATMOSPHERE - convection cells in the atmosphere drive our weather systems.** [IMAGE3]