Conduction, convection and radiation

SARA Hey Ada, how can I keep warm?

ADA Hello Sara, how are you?

SARA Oh you know, chilling out.

ADA Ha ha ha. Cool joke. I think I am warming up to you.

SARA Not that I don't like this banter but how can I warm up, Ada?

ADA First, vibrate your radiators. The easiest way to do this is by turning the radiator on. Heat energy will cause your radiator to vibrate on a molecular level. Heat will start to conduct through your radiator. This is when vibrating molecules start to hit and vibrate other molecules, making a knock-on, ripple effect - like dominoes or a Mexican wave. Metal also has free electrons which collide with the atoms making conduction super-efficient. Now, wait for the gas molecules in your room to bounce into your radiator and gain some of that heat energy.

Unfortunately, those pesky gas molecules are few and far between. To increase the chances that molecules hit your radiator, you could fill your house with liquid. A liquid's molecules are more densely packed together and so conduct heat quicker. Like the gas, liquid molecules will move around your house in convection currents. The vibrating molecules in the liquid start moving away from one another, leaving larger gaps between them. As density equals mass divided by volume, when the liquid's volume increases, it becomes less dense. As a result, the liquid becomes lighter, and starts to rise to the top. However, as it rises, it loses its heat energy to the environment. The molecules vibrate less, causing the molecules to bunch up again, making the liquid denser and heavier, causing it to sink. As it sinks and gets near the radiator, the liquid will heat up again, causing it to rise again. This is called convection.

To raise your radiator's efficiency even further, just make your house solid metal. You won't believe how low your bills are!

Ideally the next step would be to paint your house black to absorb heat radiation. All hot objects emit heat radiation, including the Sun. Heat from the Sun comes to Earth through empty space as electromagnetic radiation. Radiation travels as waves and not molecules. Matt black is best at emitting and absorbing heat radiation, shiny silver is worst.

SARA Thanks Ada! How would I keep warm without you?

ADA First, vibrate your radiators…

SARA Ahh, no. Ada, stop. Stop Ada. Hey Ada, stop. Sto-o-o-o-o-p!