Heat and Work

Apparatus

There are three sets of apparatus for this activity:

1 – an insulated container, for example a cheap thermos, with a piston that can be slid up and down in it keeping the air inside sealed in. This can be cut from cork or polystyrene with a handle attached.

2 – a thin, non-insulated tin, for example a milo tin with the lid firmly on, placed on a stand so it can be heated. Some matches or a Bunsen burner to heat the tin.

3 – a thin, non-insulated tin with a sliding lid, for example a tall narrow 1 litre fruit juice tin with a cork piston (not polystyrene or something that melts at low temperature), which fits snugly into the tin but can slide. Greasing the inside of the tin may help. A load such as a rock or large bunch of keys placed on top. This is all placed atop a stand so it can be heated from beneath with a Bunsen burner or matches.

Action

1 - The students push the piston down into the container.

2 – the students heat the container with the lid on.

3 – the students heat the container with the load in place.

The students determine which process is adiabatic, which is isochoric and which is isobaric.

They should determine the sign of the heat, work and change in internal energy for each process.

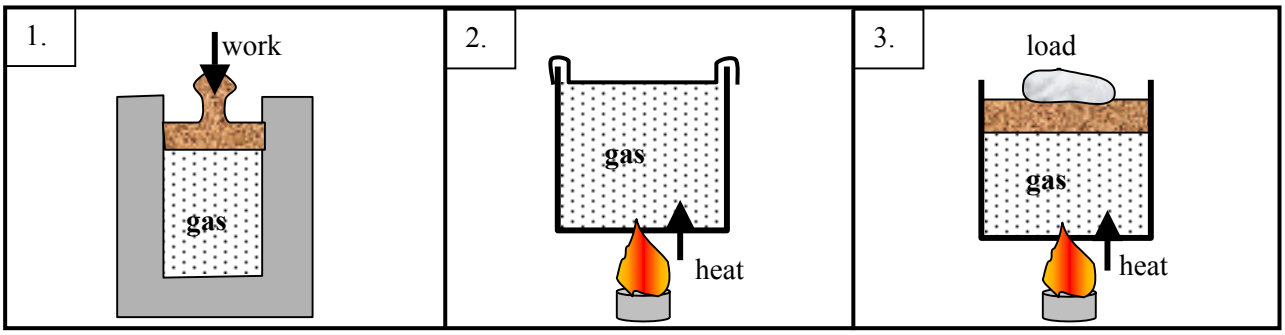
The Physics

1 - the piston is pushed into the insulated cylinder. This is adiabatic, the insulation prevents heat transfer.

2 - the gas inside the tin is heated with the lid on. This is isochoric – the volume is kept constant.

3 - the gas is heated with the sliding lid on, and a load on top – this is isobaric as the weight on top of the lid keeps the pressure constant.

	process 1	process 2	process 3
Heat (+ is in)	0	+	+
Work (+ is out)	-	0	+
ΔU	+	+	+



Accompanying sheet

Heat and Work

There are three processes to perform.
In each case, consider what happens to the gas inside.

1. Push the piston down into the insulated cylinder.
2. Heat the gas inside the tin with the lid on.
3. Heat the gas with the sliding lid on, and a load on top.

Which, if any, of these processes is adiabatic, isochoric or isobaric?
Draw a table showing heat, work and change in internal energy for each process.