

## PHY2201 Summary Sheet 1

1<sup>st</sup> law  $dU = d'Q + d'W$  expresses energy conservation.

$U$  is internal energy. Since  $U$  is a variable of state,  $dU$  is an “exact differential” meaning that

$\int_{\text{initial state}}^{\text{final state}} dU$  depends ONLY on the initial and final states, NOT on the process involved in moving from the initial to the final state.

$d'Q$  and  $d'W$  (N.B  $d'$  is usually rendered as “d-bar” in the course notes and textbooks; formatting restrictions in Word require the use of  $d'$ ) represent heat flow and mechanical work done. These are NOT exact differentials as the total heat flow and work done in moving from an initial to a final state DO depend on the process involved.

1<sup>st</sup> law does not explain

- Ease of converting work to heat but not vice versa.
- Systems naturally tend to a state of disorder not order.
- Heat only flows DOWN a temperature gradient.

### Reversible vs irreversible processes.

A process is irreversible if

1. The variables-of-state change abruptly
2. Dissipative forces (e.g friction) exist.

A process is reversible if

1. Variables of state change infinitely slowly, so system is ALWAYS in an equilibrium state
2. All mechanical work is quasi-static and frictionless
3. The system follows a well-defined locus on the  $p$ - $V$  (or equivalent) diagram.
4. This locus can be exactly retraced, leaving both the system AND its surroundings in their original state.

**NO REAL PROCESS IS TRULY REVERSIBLE.**