Chapter C11: Energy in Bonds

C11.2: Potential Energy Diagrams

The Force experienced by the small object is related to the slope of the potential energy graph:

$$F_x = -\frac{\Delta V}{\Delta x} \, . \tag{1}$$

(Remember that Force is defined as the rate of momentum transfer.)

This equation is important, because it helps us interpret these potential energy diagrams. We won't be directly using it in problems very often, if at all.

The main point of this, and the next section, is that a potential energy diagram tells us lots of qualitative information about how the object will move.

C11.3: Bonds

The key picture:

Key ideas:

- Turning points
- Forbidden regions
- Bonds

C11.4: Latent Heat

The latent of transformation is the extra internal energy that must be absorbed (or removed) for one kilogram of a substance to undergo the transformation.

$$\Delta U^{\text{th}} = |mL| \,, \tag{2}$$

where

C11.5: Chemical and Nuclear Energy

Useful info:

- Burning a kg of gasoline releases roughly 46 MJ of internal energy.
- Burning a kg of natural gas releases roughly 55 MJ of internal energy.
- For chemical reactions, the energy released per kg ranges between 10 and 100 MJ.
- For nuclear reactions, the energy released per kg ranges between 50 and 500 TJ. (1TJ = 1×10^9J.)

Examples

1. How much internal energy must be removed from 500 g of water at 0^0 in order to freeze it?
2. How much energy is needed to melt 3 kg of copper that is already at its melting point?
3. On a glacier research expedition you plan on drinking water obtained by melting the glacier. You'll melt this water with your gasoline camp stove. If you drink 2 kg of water a day, what is the minimum amount of fuel you should bring for each day?
4. How much fuel will be needed to bring your .5 kg iron kettle from 0°C to 100°C?