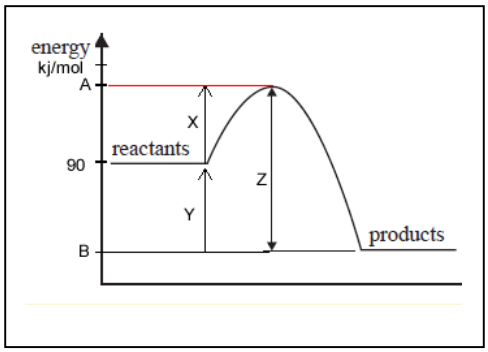
Thermochemical equations - energy profile diagrams.
Lesson 3

1) The energy profile diagram shown below is of the reaction $2A(g) + B(g) \rightarrow BA_2(g)$
Given that 80/kj/mol of energy is used in bond breaking while, during the process of bond formation, 150kJ/mol of energy is released label the following on the diagram.

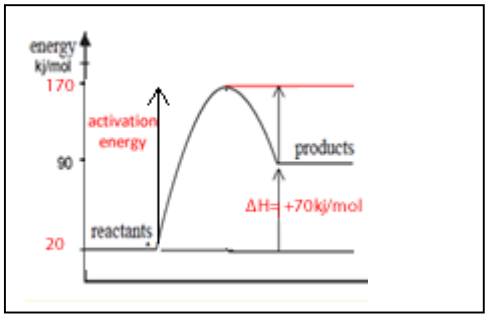
a) Give the value of:
- *A = 170 kJ/mol*
- *B = 20 kJ/mol*
- *X = 80 kJ/mol*
- *Y = 150 -80 = 70 kJ/mol*
- *Z = 150 kJ/mol*



b) Label the:
- Activation energy *=> X = 80 kJ/mol*
- ΔH and give its sign *=> Y = -70 kJ/mol*

c) On the set of axis, on the right, draw the energy profile of the reaction $BA_2(g) \rightarrow 2A(g) + B(g)$
ΔH *= +70 kJ/mol*

$\Delta H = H_{products} - H_{reactants}$

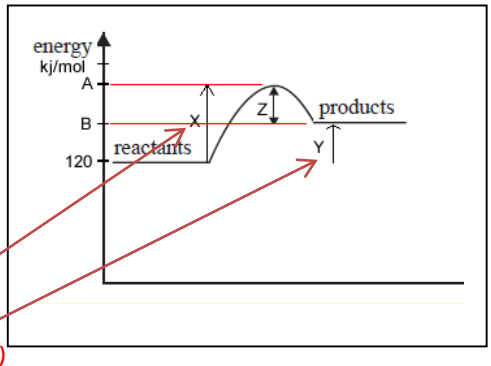


2) The energy profile diagram shown below is of the reaction

$$2Y_2(g) + 2ZX(g) \rightarrow 2ZY(g) + XY_2(l)$$

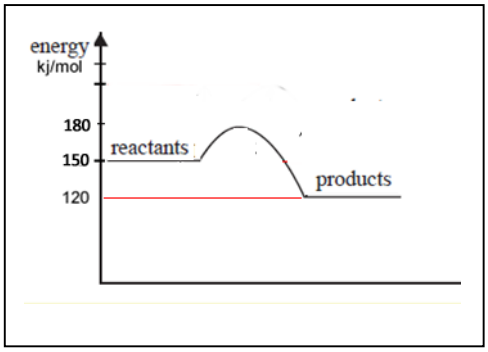
Given that 60/kj/mol of energy is used in bond breaking while, during the process of bond formation, 30kJ/mol of energy is released label the following on the diagram.

a) Give the value of:
- *A = 180 kJ/mol*
- *B = 150kJ/mol*
- *X = 60 kJ/mol*
- *Y = 30 kJ/mol*
- *Z = 30 kJ/mol*



b) Label the:
- Activation energy *60kJ mol⁻*
- ΔH and give its sign *(ΔH=+30kJmol⁻)*

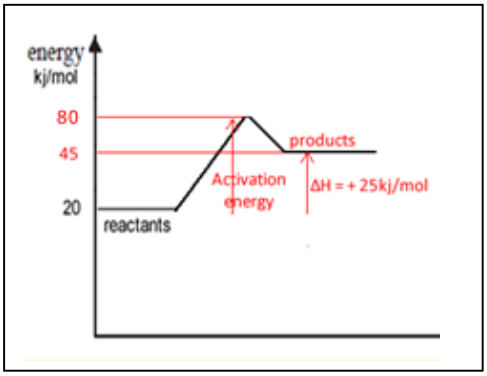
c) On the set of axis, on the right, draw the energy profile of the reaction $2ZY(g) + XY_2(l) \rightarrow 2Y_2(g) + 2ZX(g)$



3) Ammonium nitrate is used in "Ice Packs" to treat sports injuries. The dissolving of ammonium nitrate is given by the equation $NH_4NO_3(s) \rightarrow NH_4NO_3(aq)$ $\Delta H = +25kJ/mol$
If the activation energy for the reaction $NH_4NO_3(aq) \rightarrow NH_4NO_3(s)$ is 35 kJ/mol
draw the changes in chemical energy that occur during the dissolving of ammonium nitrate powder.

On the set of axis, shown on the right

indicate and give the value of the:
- activation energy *= 60 kJ/mol*
- ΔH = *+25kJ/mol*
- the enthalpy of the products *45 kJ/mol*

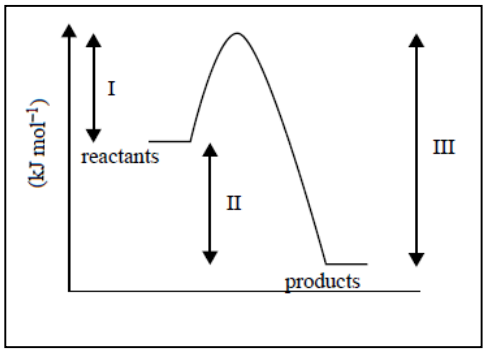


4) Consider the energy profile diagram of a particular reaction shown below. Labelled are certain enthalpy changes that occur as the reaction proceeds.

What label/s best represent the :

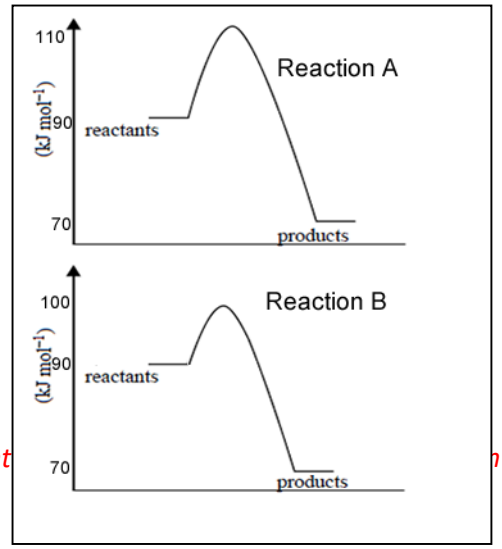
- Energy released during bond formation
III
- Energy required to break reactant bonds
I
- Net energy change for the forward reaction
II

- The activation energy for the reverse reaction
III



5) Consider the energy profiles of two reactions shown on the right.
Indicate true or false for the comments below.
Give a reason for your selection.

a) Reaction A is faster than reaction B
False – greater activation energy is needed for reaction A than reaction B. Hence less reactant particles of reaction A are likely to have this amount the reaction particles of reaction B



b) Reaction A releases more energy than reaction B

False – the ΔH is the same for both reactions at -20 kJ/mol

c) The reverse reactions of both A and B are harder to initiate than the forward reaction.

True – the activation energy for the reverse reaction A is 40 kJ/mol whereas the activation energy for the forward reaction is 20 kJ/mol. The reverse reaction B is 30 kJ/mol whereas the forward reaction has an activation energy of only 10 kJ/mol.