

Wkst 1.2: Activation Energy Worksheet

Energy diagram 1:

- i) $\Delta H = -40 \text{ kJ/mol}$
- ii) **Exothermic** reaction
- iii) $E_{af} = 60 \text{ kJ/mol}$
- iv) $E_{ar} = 100 \text{ kJ/mol}$
- v) Preferred reaction direction: **forward** (energetically favoured by minimum enthalpy)
- vi) Since only one step, it must be the rate-determining one!

Energy diagram 2:

- i) $\Delta H = 30 \text{ kJ/mol}$
- ii) **Endothermic** reaction
- iii) $E_{af} = 50 \text{ kJ/mol}$
- iv) $E_{ar} = 20 \text{ kJ/mol}$
- v) Preferred reaction direction: **reverse** (favoured by minimum enthalpy)
- vi) Since only one step, it must be the rate-determining one!

Energy diagram 3:

- i) $\Delta H = 10 \text{ kJ/mol}$
- ii) **Endothermic** reaction
- iii) E_{af} for each step = **30 kJ/mol, 20 kJ/mol, 80 kJ/mol**
- iv) E_{ar} for each step = **50 kJ/mol, 40 kJ/mol, 30 kJ/mol**
- v) Preferred reaction direction: **reverse** (favoured by minimum enthalpy)
- vi) Rate-determining step = **step 3** (for forward reaction)

Preferred reaction direction is favoured by minimum enthalpy (i.e. favours the direction of the **EXOTHERMIC REACTION** AND also favoured by Minimum E_a for the Rate Determining Step (the step with the largest E_a value)

Energy diagram 4:

- i) $\Delta H = -5 \text{ kJ/mol}$
- ii) **Exothermic** reaction
- iii) E_{af} for each step = **15 kJ/mol, 15 kJ/mol, 2.5 kJ/mol**
- iv) E_{ar} for each step = **12.5 kJ/mol, 5 kJ/mol, 20 kJ/mol**
- v) Preferred reaction direction: **forward** (favoured by minimum enthalpy)
- vi) Rate-determining step: **step 1** (for forward reaction)