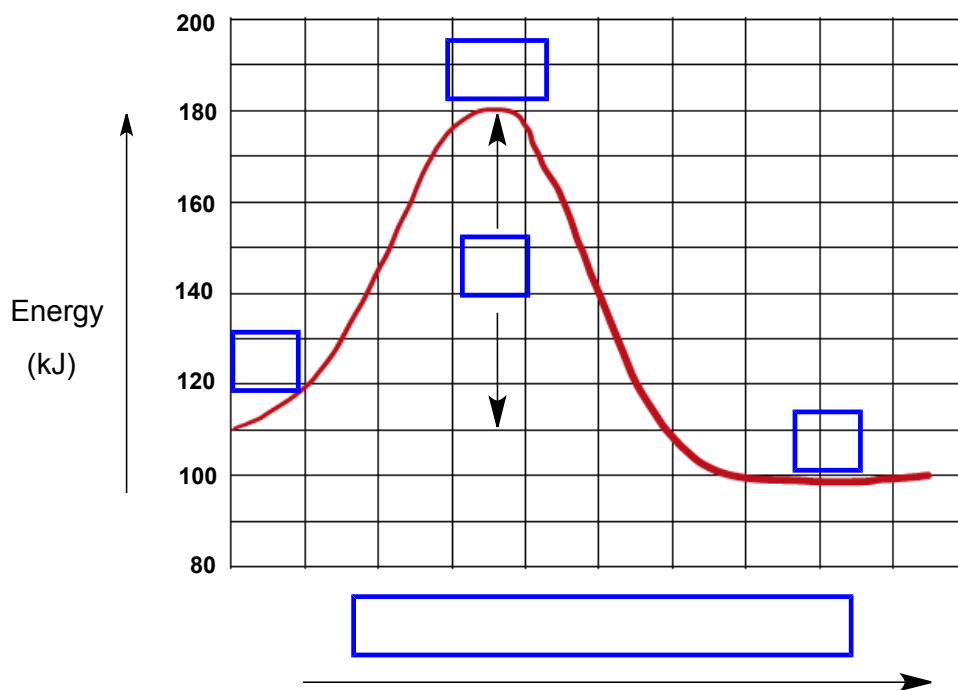
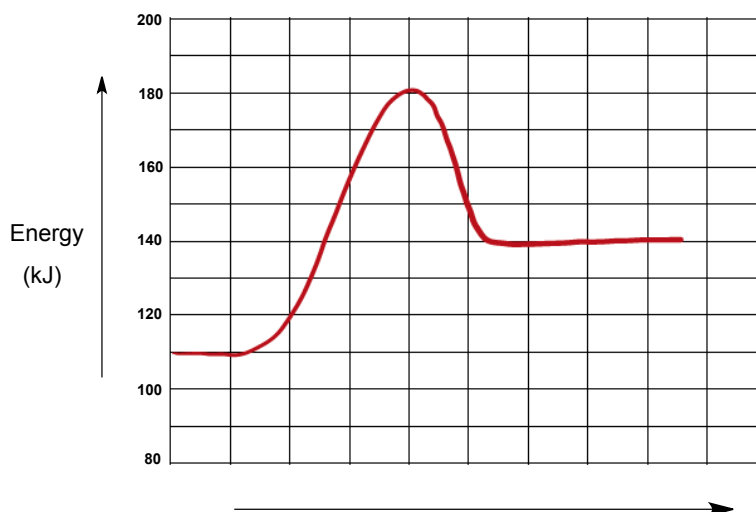


## CONCEPT: ENERGY DIAGRAMS

- A curved plot on a graph that illustrates the energies of reactants, products and *transition state* as a reaction occurs.
  - **Reactants ( \_ )**: Found \_\_\_\_\_ in the beginning.
  - **Products ( \_ )**: Found \_\_\_\_\_ at the end.
  - **Transition State ( \_ )**: The \_\_\_\_\_ energy structure along a *reaction coordinate* between reactants and products.
    - Sometimes referred to as the \_\_\_\_\_ complex.
  - **Reaction Coordinate**: The progress of a reaction pathway that lies along the \_\_\_\_\_ axis.
  - **Activation Energy (Energy Barrier) ( \_ )**: The \_\_\_\_\_ energy required for a reaction to occur.



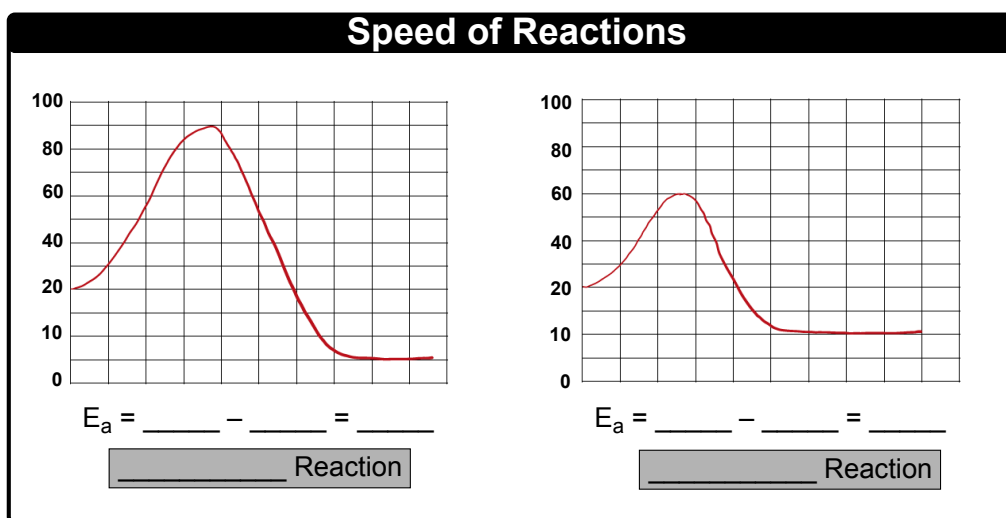
**EXAMPLE:** What is the energy value for the product within the following energy diagram?



## CONCEPT: ENERGY DIAGRAMS

### Speed of Reactions

- The speed of a chemical reaction is based on the \_\_\_\_\_ of the activation energy.
  - Activation Energy ( $E_a$ ) = \_\_\_\_\_ - \_\_\_\_\_
  - The \_\_\_\_\_ the activation energy then fewer reactant molecules have enough energy to convert into products.
  - \_\_\_\_\_  $E_a$  = slower the reaction.                      \_\_\_\_\_  $E_a$  = faster the reaction.



**EXAMPLE:** Which reaction will occur in the shortest amount of time?

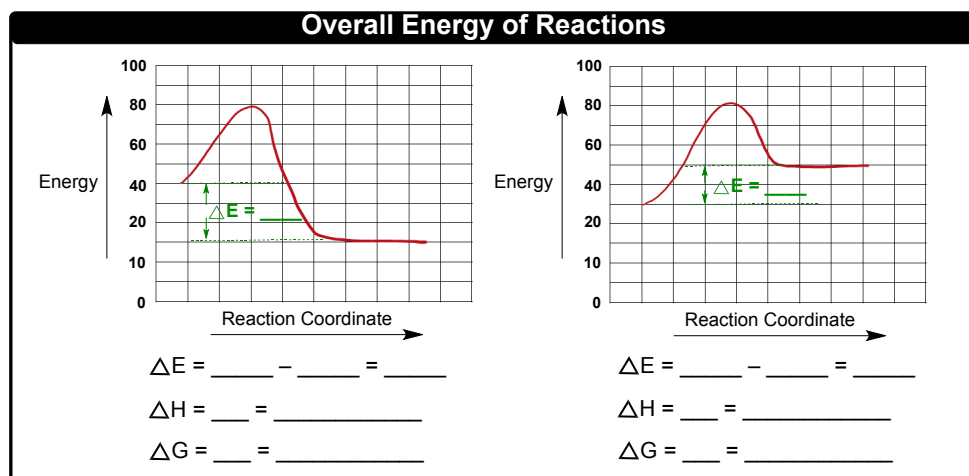
a) Reaction A ( $E_a = 143$  kJ)

b) Reaction B ( $E_a = 80$  kJ)

c) Reaction C ( $E_a = 215$  kJ)

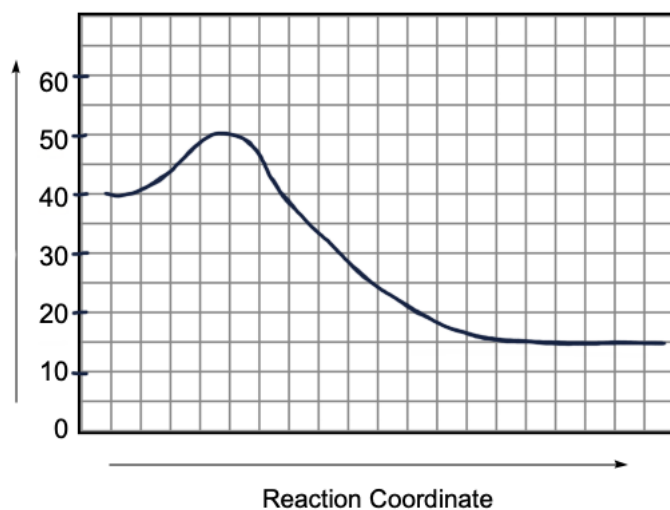
### Stability

- The difference in overall energy between the reactants and products can determine the favorability of a reaction.
  - Overall Energy ( \_\_\_\_\_ ) = \_\_\_\_\_ - \_\_\_\_\_
    - Enthalpy ( \_\_\_\_\_ ): when the overall energy is classified as \_\_\_\_\_ energy.
    - Gibbs Free Energy ( \_\_\_\_\_ ): when the overall energy is connected to favorability of \_\_\_\_\_ formation.



### CONCEPT: ENERGY DIAGRAMS

**PRACTICE:** Which of the following statements is true regarding the energy diagram provided?



- i. The reaction is endothermic.
- ii. The activation energy is + 10 kJ.
- iii. The reaction releases energy.
- iv. The enthalpy of the reaction is – 25 kJ.

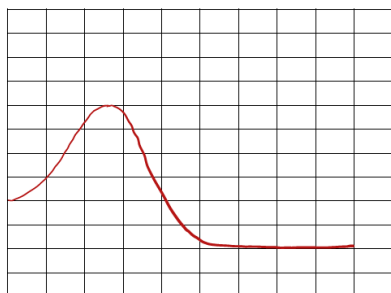
a) I only

b) II and IV

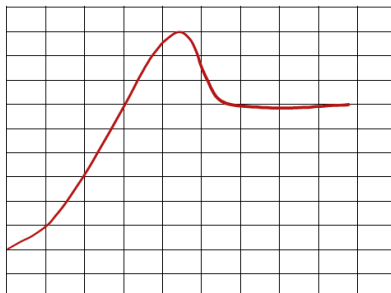
c) I and III

d) II, III and IV

**PRACTICE:** Which of the following reactions proceeds the slowest?



**Reaction 1**



**Reaction 2**



**Reaction 3**