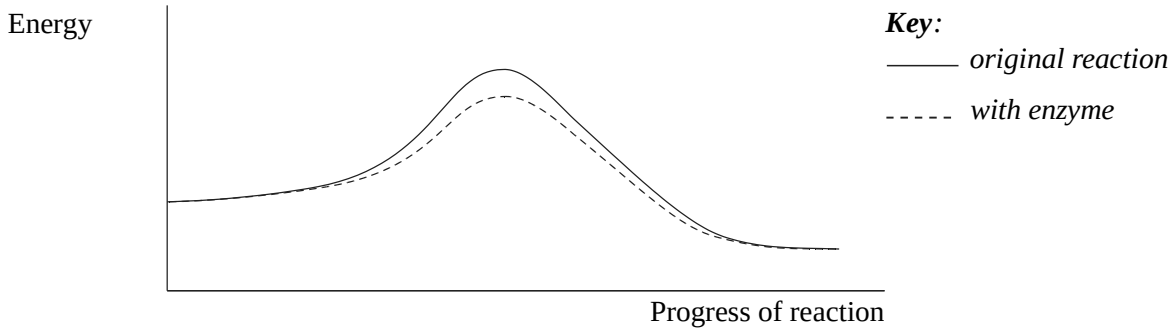
7.6 Enzymes – *summary of mark schemes*

7.6.1	State that metabolic pathways consist of chains and cycles of enzyme-catalysed reactions. Mark Scheme A. enzymes are specific for their substrate / lock and key model / energy requirements B. for reactions with substrates vary; C. each step of the pathway is unique / different substrate at each step; D. finer control of metabolic pathways;
7.6.2	Describe the induced-fit model. Mark Scheme A. change in shape of enzyme's active site; B. improves fit of enzyme and substrates; C. brought about when the substrate molecules bind with the enzyme; D. enzyme changes from inactive to active form; E. permits some enzymes to bind with several substrates; F. distorts / weakens bonds in substrates; G. lowers activation energy:
7.6.3	Explain that enzymes lower the activation energy of the chemical reactions that they catalyse. Mark Scheme  H. I. enzyme binds to substrate; J. lowers activation energy; K. by weakening bonds; L. making substrate more likely to react;
7.6.4	Explain the difference between competitive and non-competitive inhibition, with reference to one example of each. Mark Scheme *non-competitive:* A. inhibitor binds (to the enzyme) B. away from the active site / at allosteric site; C. shape / (intramolecular) bonding / conformation of the protein / enzyme is altered; D. shape / properties of active site altered; E. substrate no longer fits the active site / no enzyme-substrate / ES complex formed; F. no enzyme activity / works more slowly (until the inhibitor dissociates); G. eg CN inhibition of cytochrome oxidase by binding to SH groups / other valid example; H. allosteric inhibition is a form of non-competitive inhibition; I. most allosteric enzymes have multiple allosteric sites; J. metabolites can act as allosteric inhibitors of enzymes earlier in a metabolic pathway to regulate metabolism; K. binding (of end product) to an allosteric site changes shape of enzyme; *competitive*: L. a molecule structurally similar to the substrate binds to the active site; M. preventing substrate binding;

	N. eg inhibition of butanedioic acid (succinate) dehydrogenase by propanedioic acid (malonate) in the Krebs cycle / other valid example; O. competitive inhibition is reversible;
7.6.5	Explain the control of metabolic pathways by end-product inhibition, including the role of allosteric sites. Mark Scheme A. allosteric enzyme has binding site(s) away from / other than the active site; B. (shape of an) allosteric enzyme alternates between active and inactive (form); C. non-competitive inhibitor binds to allosteric site / away from active site; D. non-competitive inhibitor changes shape of active site; E. non-competitive inhibitors do not compete with substrate for the active site; F. end-product can inhibit enzyme needed for early / first step in metabolic pathway; G. negative feedback since increased level of product decreases rate of its own production; H. metabolic pathway regulated according to the requirement for its end-product; I. idea that inhibition is reversible;