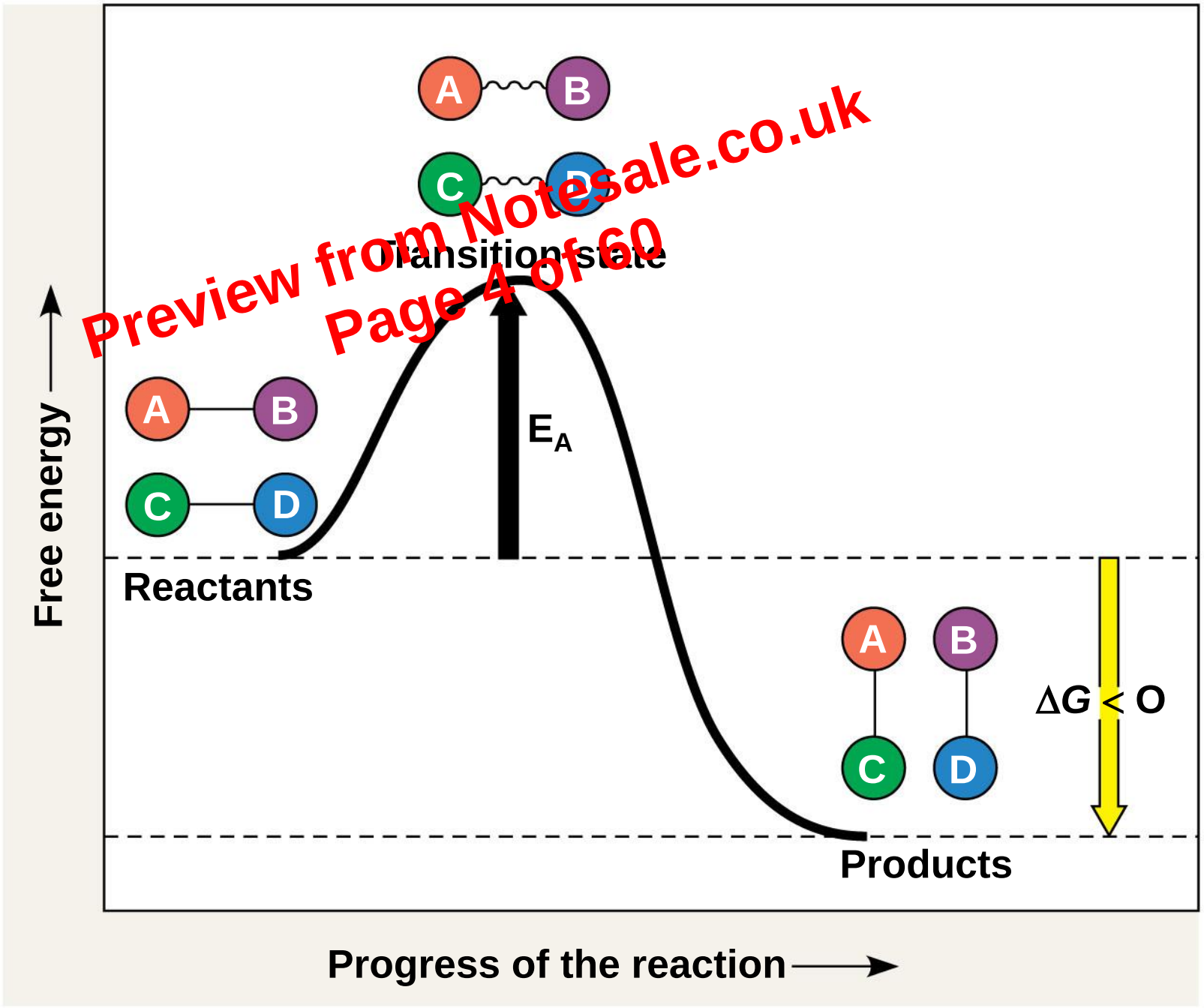
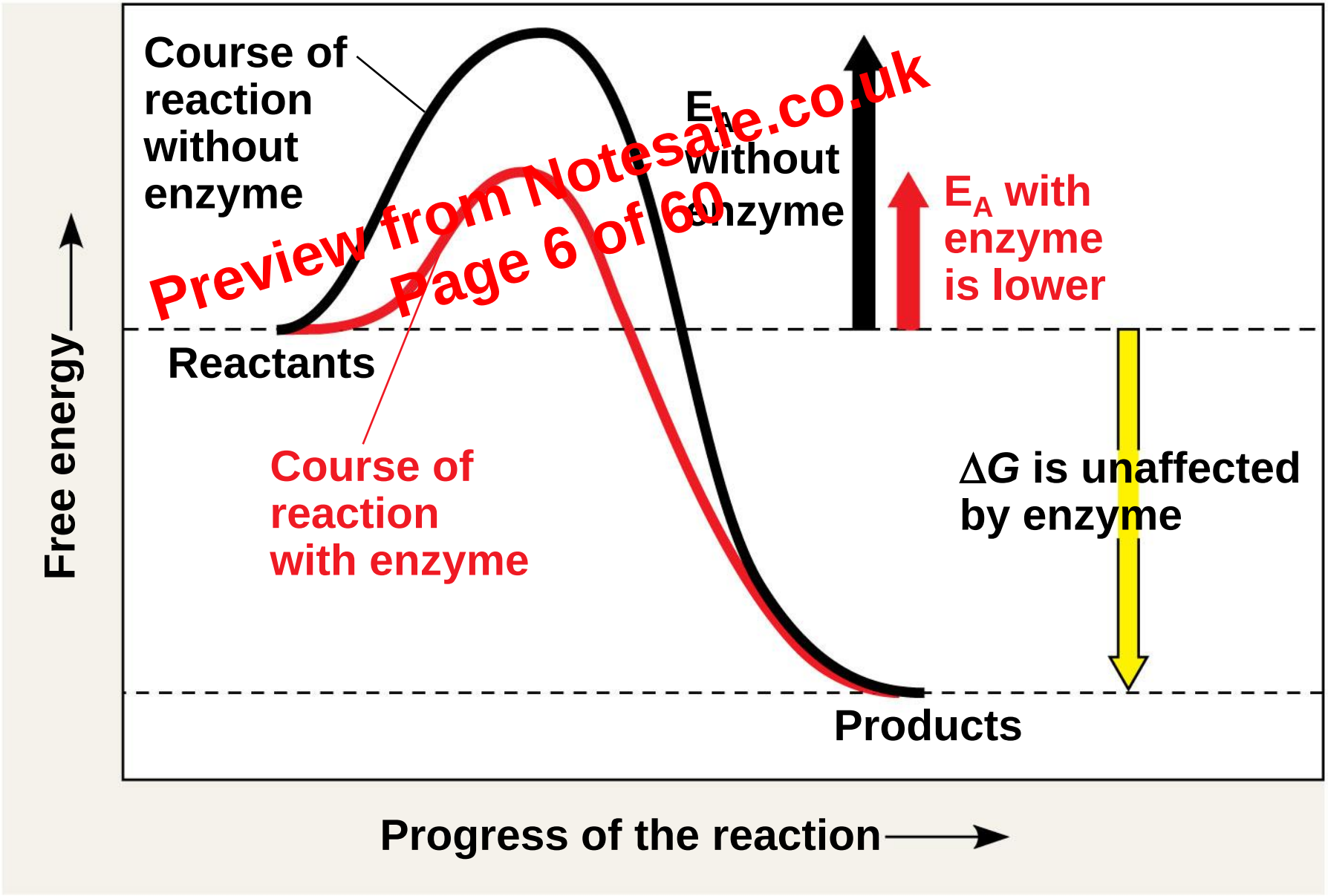
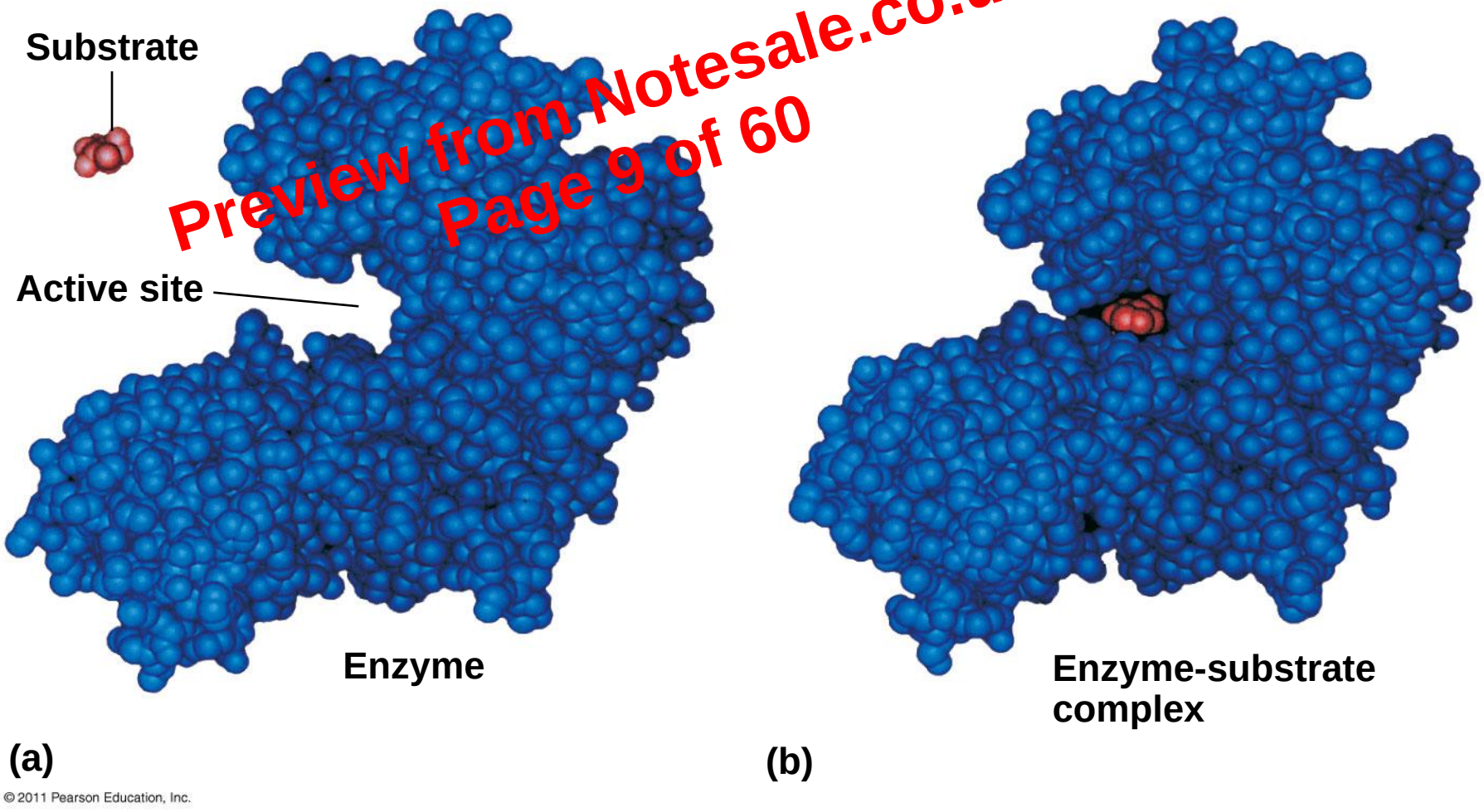
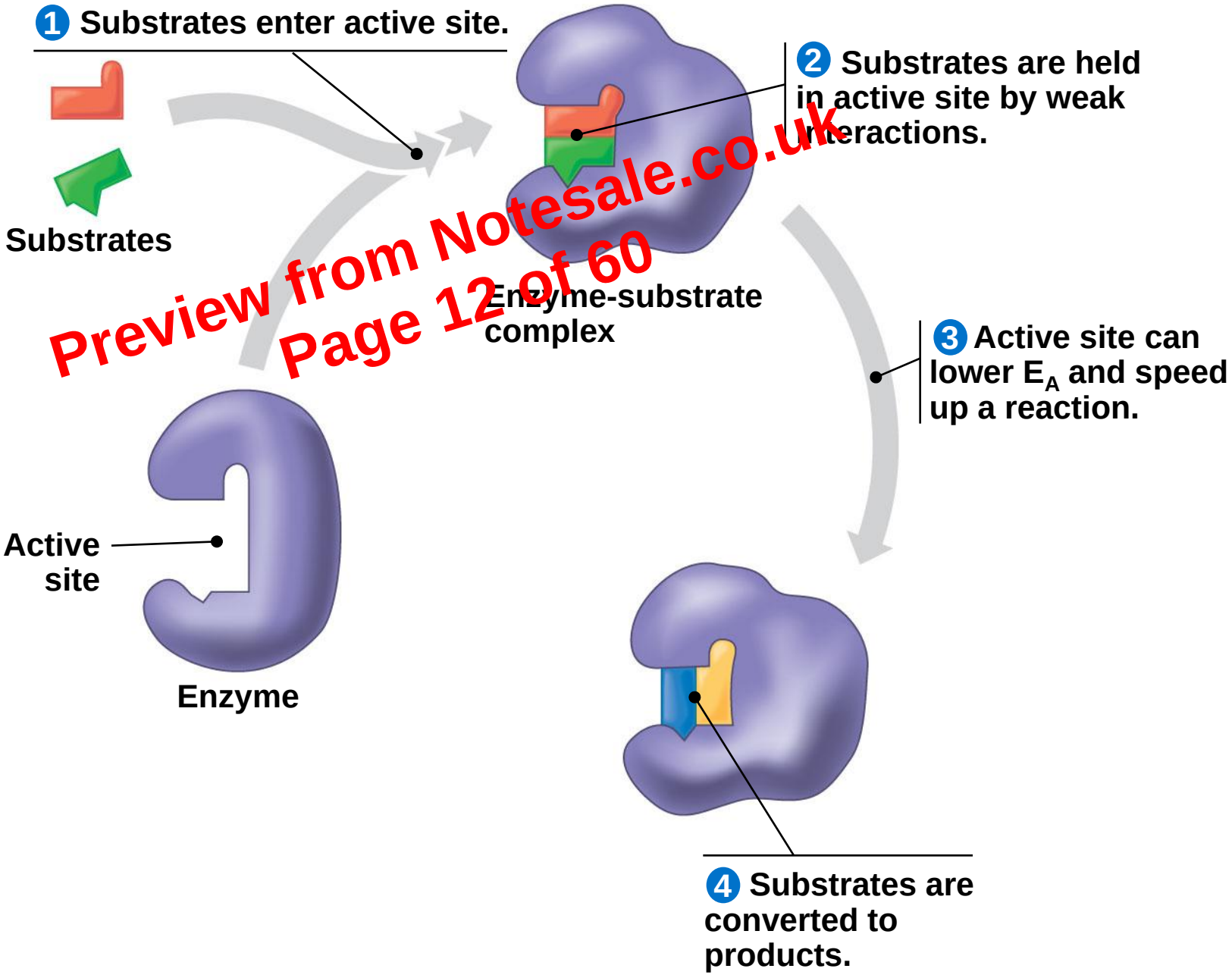








Effects of Temperature and pH

- Each enzyme has an optimal temperature in which it can function
- Each enzyme has an optimal pH in which it can function
- Optimal conditions favor the most active shape for the enzyme molecule

Sources of food enzymes (plant, animal, microbial, and recombinant). Cont.

Industrial enzymes have traditionally been derived from:

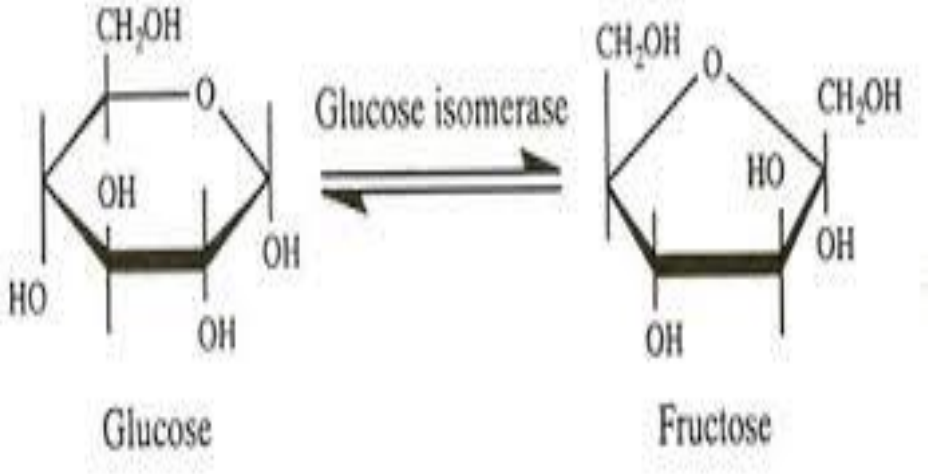
Plants: *α*-amylase, *β*-amylase, bromelain, *β*-glucanase, ficin, papain, chymopapain, and lipoxygenase

Animals: trypsins, pepsins, chymotrypsins, catalase, pancreatic amylase, pancreatic lipase, and rennin (chymosin)

Microorganisms: *α*-amylase, *β*-amylase, glucose isomerase, pullulanase, cellulase, catalase, lactase, pectinases, pectin lyase, invertase, raffinose, microbial lipases, and proteases.

Produced by the use of the enzyme glucose isomerase.

Glucose can reversibly be isomerized to fructose. The equilibrium conversion for glucose to fructose is 50% under industrial conditions.



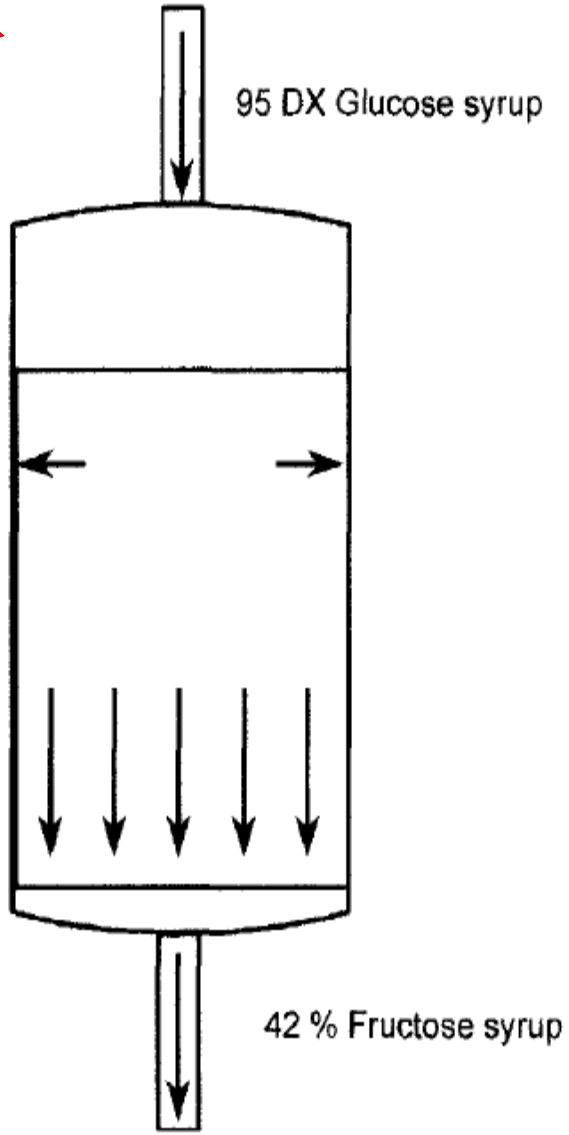
The isomerization reaction can only be economically efficient by using immobilized enzyme.

This is done by using an immobilized isomerase in a fixed-bed reactor process in a column through wh glucose flows continuously.

The enzyme granules must be rigid enough prevent compaction during the operation.

Sweetzyme IT (Novozymes A/S) is produced by mutant of a selected *Streptomyces murinus* stra The immobilization procedure consists of disruption of a cell concentrate through with homogenizer. The cells are then cross-linked w glutaraldehyde. The concentrated aggregate extruded and finally fluid-bed dried and sieved.

Depending on parameters such as temperature, p feed purity, and so on, the operating lifetime of t isomerase will typically be 200–360 days.



Lipases

Lipases are used to break down milk fats and give characteristic flavors to cheeses. Stronger flavored cheeses, for example, the Italian cheese, Romano, are prepared using exogenous lipases.

The flavor comes from the free fatty acids produced when milk fats are hydrolyzed.

Animal lipases are obtained from kid, calf and lamb.
Microbial lipase is derived by fermentation with the fungal species *Mucor meihei*.

Microbial lipases are readily available for cheese-making, but less preferred, since they are less specific in what fats they hydrolyze.

Animal enzymes are more partial to short and medium-length fats. Hydrolysis of the shorter fats is preferred because it results in the desirable taste of many cheeses. Hydrolysis of the longer chain fatty acids can result in either soapiness, or no flavor at all.

Use of enzymes in meat and seafood products manufacturing

Proteases- heat stable forms preferred , e.g., papain, ficin, and bromelain (mixture of enzymes found in pineapples)

- To modify texture and induce tenderness in meats and squid,
- To improve chewability and digestibility,
- To reduce bitterness and improve flavor as well as nutritive value,
- Produce hydrolysates from meat scraps, underutilized fish species and fish processing discards;
- Enhanced flavors in fermented herring (fish).