
03-231 Biochemistry SI
Thursday, October 13, 2005

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Academic Counseling

Nucleophilic Attack! (Theme: complementarity)

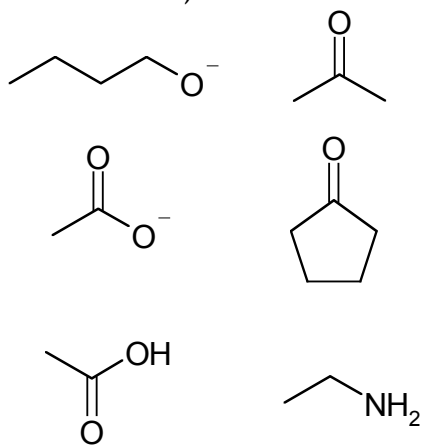
Nucleophile = nucleus loving. Therefore, a nucleophile must be at least partially _____ (+ or -) charged, because the nucleus of an atom is _____ (+ or -). The atom that the nucleophile attacks (a.k.a. electrophile - electron loving) is at least partially _____ (+ or -) because electron is _____ (+ or -).

Define a nucleophile: _____

List some functional groups that have the potential to be nucleophiles:

List some functional groups that have the potential to be electrophiles:

Identify and circle the nucleophile in each pair, then draw the arrows indicating the flow of electrons in a nucleophilic attack (hint: the intermediate is a tetrahedral intermediate)



Which is a better nucleophile? $\text{CH}_3\text{-CH}_2\text{-OH}$ or $\text{CH}_3\text{-CH}_2\text{-O}^-$

List the catalytic triad: _____, _____, and _____

How does the catalytic triad activate its nucleophile?

Serine Protease Mechanism

The big picture:

1. What's the overall chemical reaction? (Protease is an enzyme that...) What kind of reaction is it?
2. What's the first product? What's the nucleophile for the first reaction? How is it activated? What's the structure of the tetrahedral intermediate?
3. What's the second product? What's the nucleophile for the second reaction? How is it activated? What's the structure of the tetrahedral intermediate?

4. Complete the summary table below:

	1 st reaction	2 nd reaction
Starting material		
Nucleophile		
Activation (mechanism)		
Tetrahedral intermediate (structure)		
End product		

(Complete mechanism: board work)

How does an enzyme catalyze a reaction enthalpically? How does an enzyme catalyze a reaction entropically? Give an example for both in a serine protease.

Draw an energy diagram for a reaction with AND without the catalysis of an enzyme

Be sure to include the following states: (S, ES, intermediate, EP, P)
If in a serine protease the serine were mutated to a glycine. Which of the kinetic factor would be affected? K_m or V_{max} ? Why?

What alteration would you have to make on the enzyme to change the other kinetic factor?

Enzyme kinetics: Factory and workers analogy

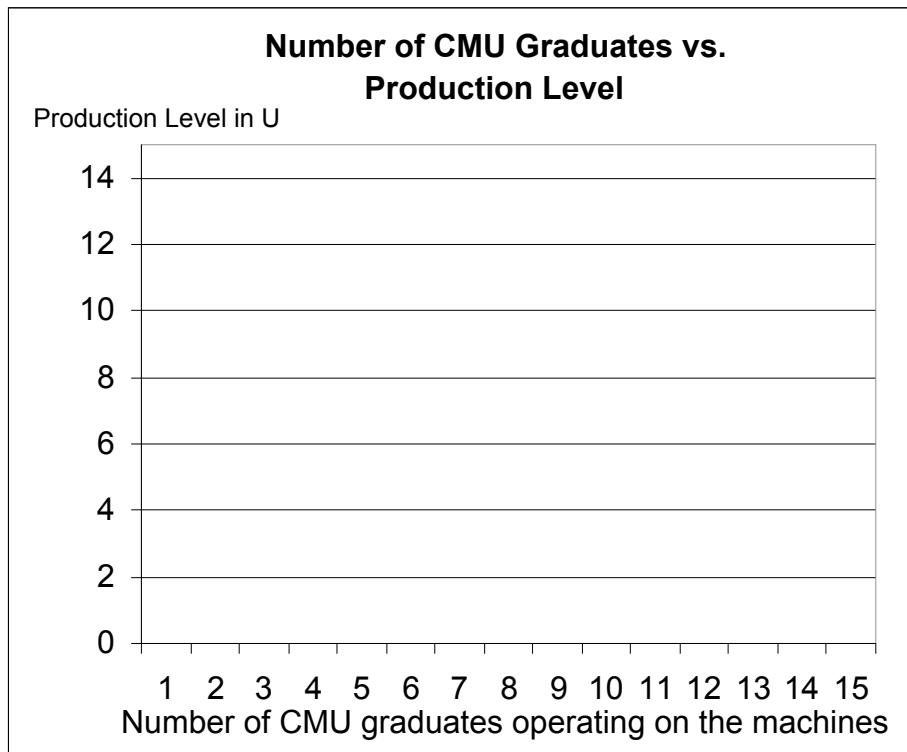
Imagine you have a factory with 10 machines; each has to be operated by a skillful CMU graduate. During the first week of the operation, you only have \$ (because CMU is a prestigious yet blood-sucking university) to hire one CMU graduate. During the 2nd week, due to your superior managing skills, you're able to hire 2. 3rd week → 3 graduates... The company size increases every week by 1, by the 15th week, you have

15 CMU
working for

graduates
you.

Graph the
relationship
between
level and
CMU graduates
(hint: the
production
from machine
graduate
gives 0 units
machine with
graduate
gives 1 unit per week)

relationship
production
number of
production
with no CMU
operating on it
per week; a
a CMU
operating on it



1. Predict how would the graph change if you use Pitt students instead? (lazy: only 50% of them are working at a particular time)

2. Predict how would the graph change if you use Carlow students instead? (clumsy: 5 machines were broken on the first day?)