Biochemistry kinetics and ATP yield sheet

Amino acids: charge and pI

- Below a group's pKa, the group holds its proton. Above it, the proton is lost.
- Protonated amino group: +1. Deprotonated carboxyl group: -1.
- pI: average the two pKa values on either side of the neutral form.
- Basic amino acids: use the two highest pKa values. Acidic amino acids: use the two lowest.

Michaelis-Menten kinetics

- v = Vmax[S] ÷ (Km + [S])
- Km is the substrate concentration that gives half of Vmax (units of concentration, such as mM).
- Lineweaver-Burk: 1/v = (Km/Vmax)(1/[S]) + 1/Vmax
- y-intercept = 1/Vmax. x-intercept = -1/Km. Slope = Km/Vmax.
- Competitive inhibitor: apparent Km = × Km, where = 1 + [I]/Ki.
- Keep [I] and Ki in the same units, and Km and [S] in the same units.

Reversible inhibition

Inhibitor	Apparent Km	Apparent Vmax	Lineweaver-Burk lines
Competitive	Increases	No change	Meet on the y-axis
Uncompetitive	Decreases	Decreases	Parallel
Noncompetitive	No change	Decreases	Meet on the x-axis
Mixed	Rises or falls	Decreases	Meet off both axes

ATP yield per glucose

Stage	Made per glucose	ATP
Glycolysis	2 ATP (net)	2
Glycolysis	2 NADH (cytosol)	3 or 5
Pyruvate to acetyl-CoA	2 NADH	5
TCA cycle	2 GTP	2
TCA cycle	6 NADH	15
TCA cycle	2 FADH	3
Total		30 or 32

- 1 NADH = about 2.5 ATP. 1 FADH = about 1.5 ATP.
- 1 acetyl-CoA through the TCA cycle = 3 NADH + 1 FADH + 1 GTP = 10 ATP.

- 30 ATP uses the glycerol 3-phosphate shuttle. 32 ATP uses the malate-aspartate shuttle.
- Use the values your professor teaches, and say which ones you used.

Beta-oxidation (saturated, even number of carbons, n)

- Rounds = (n ÷ 2) - 1. Each round gives 1 NADH and 1 FADH.
- Acetyl-CoA = n ÷ 2.
- Activation costs the equivalent of 2 ATP (ATP is split to AMP).
- Net ATP = 10(n ÷ 2) + 4((n ÷ 2) - 1) - 2.
- Palmitate (16:0): 80 + 28 - 2 = 106 ATP.

PFK-1 regulation

- Activators: AMP, fructose 2,6-bisphosphate.
- Inhibitors: ATP, citrate, H.

Nucleic acids

- Double-stranded DNA: %A = %T and %G = %C.
- Purines make up half the bases.