Test 3 Review

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Definition 1 (First Law of Thermodynamics)**.** *Energy cannot be creaed nor destroyed.*

Definition 2 (Second Law of Thermodynamics)**.** *When energy gets converted from one to another, the amount of useful energy decreases.*

An example would be that gasoline cars have only 20% efficiency.

Definition 3 (Entropy)**.** *Tendency towards the loss of orderliness and the loss of useful energy. An example would be something at equilibrium.*

1 ATP

Definition 4 (ATP)**.** *Nitrogen containing base adenine + sugar ribose base + 3 phospohate groups*

Why is breaking ATP exergonic overall? Shouldn't breaking bonds consume energy? Remember that we're breaking it through hydrolysis. It's true that breaking bonds take some energy, but the products that form when combined recombined with water (ADP and Pi) are much more stable, thus releasing a ton of energy.

Kinase P transfer enzyme. Just remember it.

1.1 3 ways ATP does work in cell

1. Coupled reaction: use the glutamic acid example (see beneath)
2. Active transport (such as protein pumps).
3. Movement: Motor protein, flagellum uses ATP. Phosphate group changes shit.

2 Coupled reaction

An example would be glutamic acid conversion to Glutamine. It is in and of itself a endogonic reaction. However, with ATP, glutamine acid forms an intermediate with ADP + Pi,

3 Enzymes

3.1 How does it work

1. Induced fit model. The active site is a pocket on the protein that has projecting R groups (from the amino acid backbone) that forms H bonds, ionic bonds, or temporary covalent bonds with the substrate. The enzyme slightly changes shape as the substrate enters the active site, putting strain of its bonds, therefore reducing the activation energy.
2. Orientation: The enzyme helps position the substrates in their right 3D orientations, increasing the number of productive collisions.

3.2 Specificity

The substrate must fit the active site in terms of size, shape, and charge compatibility.

3.3 5 ways cells regulate enzyme activity

1. Turn on/off genes that code enzymes.
2. Synthesized in inactive forms.
3. Competitive inhibition
4. Non-competitive inhibition (also known as allosteric regulation I think?)
5. Degradation

3.4 Environment

pH affects enzymes ince the h-bonds crucial to their 3D structure are stable in only narrow ranges of pH.

Moderatly high temperatures optimize rxns. If the temp is too low, molecular motion decreases. If temp too high, h-bonds might be broken due to excessive motion, causing denaturation.

4 Peroxisomes

They produce H_2O_2 as part of its natural metabolic reactions. However it also breaks them down instantly, to prevent harm to the cells.

5 Glycolysis

Glucose turns into 2 pyruvate, gaining 2 net ATP, 2 net NADH in the process.

6 Intermediate Step

2 pyruvate reacts with coenzyme A to form 2 acetyl coenzyme A. (It gets used in krebs cycle, and converts back into coenzyme A). Each pyruvate produces a CO_2 and NADH.

7 Krebs Cycle

Takes the acetyl coenzyme A and churns out a bunch of shit. The acetyl coA turns back into coA at the end. Releases 2 CO_2 and 3NADH and 1 $FADH_2$ and 1 ATP for each acetyl coA.

8 Fermentation

8.1 CH Bonds

Chisholm calls them "high energy bonds" not because they're hard to break. They are actually unstable; thus when broken they have the potential to form more stable bonds and release a lot of energy.

Without O_2, NAD^+ cannot naturally regenerate since the H^+ cannot be disposed of. Fermentation can help regenerate NAD^+ allowing us to re-enter glycolysis.

9 ETC

9.1 Coenzyme Q and cytochrome C

They are membrane bound and transports electrons between protein complexes. Diffusion is faster since they're membrane bound.

9.2 Proteins

Protein complex 1,3,4 pump protons, but protein complex 2 only picks up electrons.