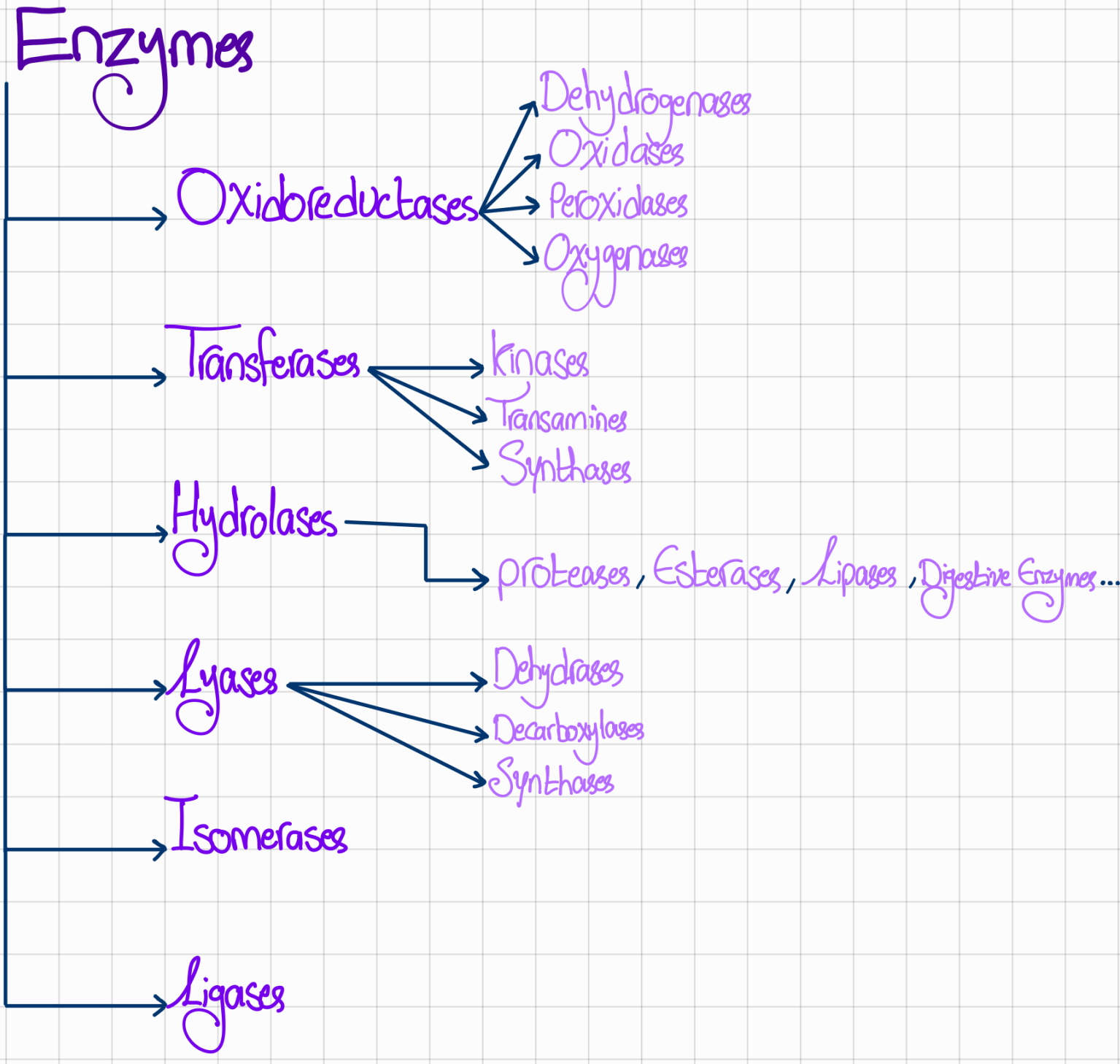
Summary for Enzymes Reactions



1. Oxidoreductases

a. Dehydrogenases

é transfer in the form of (H^-) or (H_2)

General formula : $H-A-H + NAD^+ \rightleftharpoons A + NADH + H^+$ (é transferring coenzyme)

How to distinguish ? presence of NAD^+/FAD in reactants

b. Oxidases

Hydrogen transfer from the substrate to oxygen producing H_2O_2

General Formula : $H-A-H + O_2 \longrightarrow A + H_2O_2$

How to distinguish ? O_2 in reactants, H_2O_2 in products

c. Oxygenases

Substrate oxidation by introducing O_2 into it.

General formula : $A + O_2 \longrightarrow O-A-O$ (can be monooxygenase too)

How to distinguish ? Transferring one or two O_2 to the substrate.

d. Peroxidases

Oxidation of the substrate by H_2O_2

General formula : $2\,(A-SH) + H_2O_2 \longrightarrow A-S-S-A + 2H_2O$ (like glutathione)

How to distinguish ? H_2O_2 is in the reactants.

2. Transferases

Transferring a functional group (C, N, O, P)

a. Kinases

Catalyzes the transfer of a phosphate group from ATp usually (not always ATP)

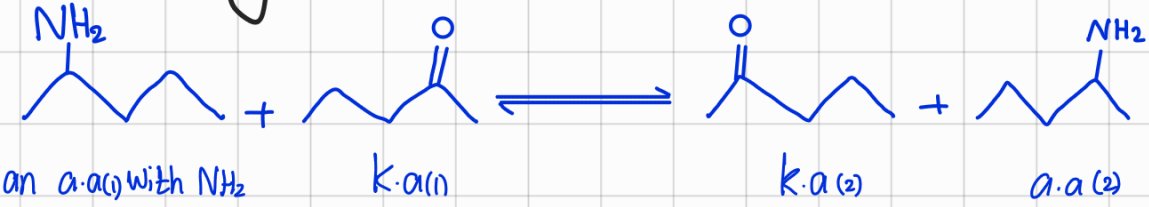
General formula: $A + B\text{-}\textcircled{P} \longrightarrow A\text{-}\textcircled{P}$ ...

How to distinguish ? The addition of a phosphate group to the substrate.

b. Transaminases

Transferring an amino functional group from one amino acid to a keto acid.

General formula:



How to distinguish ? Transferring an NH_2 from one molecule to another.

*The rxn is reversible

An example: Aspartate transaminase.

c. Synthases

When the synthesized enzyme is physiologically imp., the transferase may be called "Synthase"

An example: Glycogen synthase transfer a glycosyl residue (glucose) from UDP-glucose to the end of a glycogen (phys. imp.) molecule elongating it.

How to distinguish ? Transferring a molecule functional group and the product is physiologically imp.

3. Hydrolases

They catalyze cleavage reactions using water.

They're named depending on the name of bond cleaved.

General formula: $A-B + H_2O \longrightarrow A-H + B-OH$

Examples: proteases, Esterases, lipases, phosphatases, Digestive Enzymes like trypsin, ...
How to distinguish? H_2O is a substrate + cleavage reaction

4. Lyases

making double bonds or rings by dehydration

*They're reversible

cleavage of double bonds without hydrolysis
(by adding small molecule to the double bond or removing this molecule)

a. Dehydrases

Removing H_2O to give a double bond
Example: Enolase

b. Decarboxylases

Replacement of a carboxyl group by a hydrogen.
Example: pyruvate decarboxylase.

c. Synthases

Addition of a small molecule to the double bond
Example: Citrate synthase.

How to distinguish lyases in general?

No H_2O / H_2O_2 / O_2
No NAD^+ / FAD
NO isomers

حمّل على سيدنا مُحمّد
وادعُ لإخوانك في غزّة
والزم ثغرك.

Another example on lyases is Aldolase

it breaks down glucose-1,6-bisphosphate into dihydroxyacetone phosphate & glyceraldehyde-3-phosphate and the reaction is reversible.

5. Isomerases

They catalyze intramolecular rearrangement.

Example: Mutases.

Catalyze the movement of phosphate from one atom to another.

6. Ligasis

They connect 2 molecules together (→ Must be a C-atom at least in one of them.) using energy derived from ATP

Example: pyruvate carboxylase binds pyruvate with CO_2 molecule using ATP producing oxaloacetate.

How to distinguish? connects 2 molecules, 1 product, energy is used