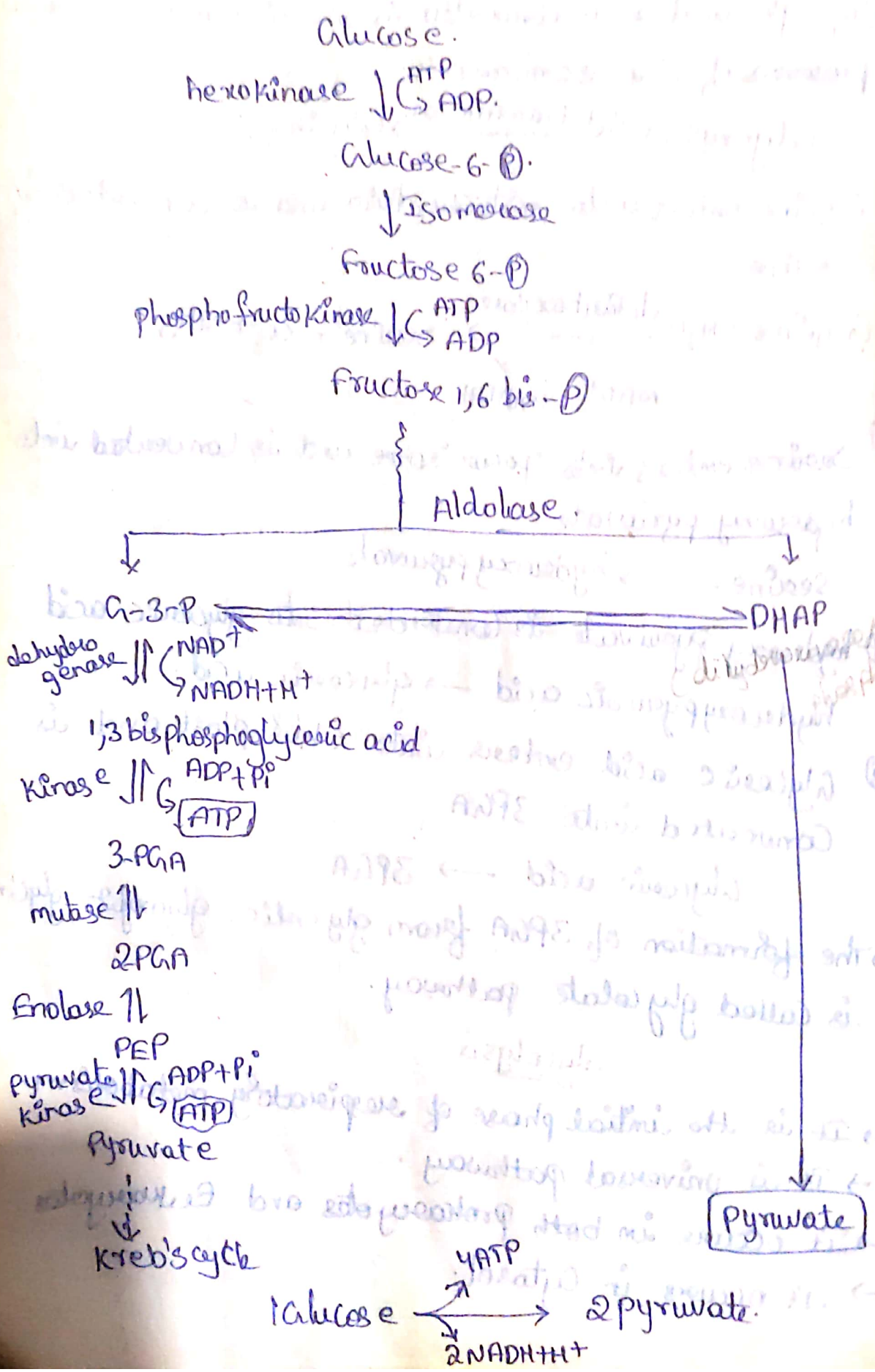
Glycolysis

→ It is the initial phase of respiratory metabolism.
→ It is universal pathway.
→ It occurs in both Prokaryotes and Eukaryotes.
→ It occurs in cytosol.

→ this pathway is called EMP pathway - Embden, Meyerhof, Parnas contributed that.



1. Phosphorylation:-

Glucose is converted to Glucose 6-Ⓟ in presence of enzyme hexokinase.

$$\text{Glucose} + \text{ATP} \xrightarrow[Mg^{2+}]{\text{Hexokinase}} \text{Glucose 6-Ⓟ} + \text{ATP}$$

2. Isomerisation:-

$$\text{Glucose 6-phosphate} \xrightarrow{\text{Isomerase}} \text{Fructose 6-Ⓟ}$$

Glucose 6-Ⓟ is converted into fructose 6Ⓟ in presence of isomerase.

3. phosphorylation:-

$$\text{Fructose 6-Ⓟ} \xrightarrow[\text{Kinase}]{\text{ATP} \rightarrow \text{ADP}} \text{Fructose 1,6 bis Ⓟ}$$

Fructose 6-Ⓟ is converted into fructose 1,6 bisⓅ in presence of kinase.

4. Cleavage:-

Fructose 1,6- bisⓅ is converted into G3P and DHAP by the enzyme aldolase.

$$\text{Fructose 1,6 bisⓅ} \underset{}{\overset{\text{aldolase}}{\rightleftharpoons}} \text{G-3-P} + \text{DHAP}.$$

5. Isomerisation:-

Glyceraldehyde 3-Ⓟ is converted into DHAP in presence of Isomerase.

$$\text{G-3-Ⓟ} \overset{\text{Isomerase}}{\rightleftharpoons} \text{DHAP}.$$

6. Oxidation:-

G-3-Ⓟ is converted into 1,3 bisⓅ glycerate in presence of dehydrogenase.

$$\text{G-3-Ⓟ} \xrightarrow[NAD^+ \quad NADH+H^+]{\text{dehydrogenase}} \text{1,3 bisⓅ glycerate}.$$

7. Substrate level phosphorylation:

1, 3 bis(P) glycerate is converted into 3(P) glycerate in presence of Kinase. Here ATP is formed 1,3 bis(P) glycerate

$$\text{1,3 bis(P) glycerate} \xrightarrow[ADP+P_i \;;\; ATP]{\text{Kinase}} \text{3-(P)-glycerate}$$

8. Molecular Shift:

The phosphate molecule is shifted from 3 PGA to 2 PGA in presence of the enzyme mutase.

9. Dehydration:

2-PGA is converted into PEP in presence of Enolase enzyme.

$$\text{2PGA} \xrightarrow[\text{enolase}]{-H_2O} \text{PEP}$$

10. Substrate level phosphorylation:

PEP is converted into pyruvate in presence of Kinase. Here ATP is formed

$$\text{PEP} \xrightarrow[\text{Kinase}]{ADP+P_i \;;\; ATP} \text{pyruvate}$$

1 Glucose ⟶ 2 moles pyruvate

Total NADH + H$^+$ ⟶ 2.

Total ATP ⟶ 4.

Substrate level phosphorylation ⟶ 4.

Net ATP ⟶ 4 − 2 ⟶ (2)*

Cytosolic NADH + H$^+$ ⟶ 2 ATP

Total ATP from Glycolysis.

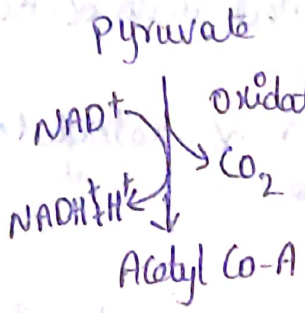
2 NADH + H$^+$ — 2 × 2 — 4 ATP

ATP — 4.

Total ATP → 8 ATP.
utilised ATP - 2 ATP
*6 ATP

Kreb's cycle

yruvate is formed from glycolysis undergoes oxidative
ph Decarboxylation and produces Acetyl - CoA.
Acetyl - Co-A enters into Kreb's cycle.
This linked reaction occurs in mitochondria.



1. Hydration :-
Acetyl Co-A is added with oxaloacetic acid and produces citrate by using citrate synthase. ~~Acetyl Co-A + OAA~~

Acetyl Co-A + OAA $\xrightarrow[\text{Synthase}]{\text{Citrate}}$ citrate

2. Dehydration :-
Water is removed citrate is converted into cis-aconitase.

Citrate $\xrightarrow[-H_2O]{\text{Aconitase}}$ Cisaconitase.

3. Hydration :-
Cisaconitase is converted into Isocitrate in presence of aconitase.

Cisaconitase $\xrightarrow[\text{Aconitase}]{H_2O}$ Isocitrate.

4. Oxidation-I :-

Isocitrate is converted into oxalosuccinate in presence of dehydrogenase.

Isocitrate $\xrightarrow[NAD^+ \; NADH_2]{\text{dehydrogenase}}$ Oxalosuccinate

5. Decarboxilation :-

Oxalosuccinate is converted into α-Ketoglutarate

Oxalosuccinate $\xrightarrow[\text{decarboxylase}]{CO_2}$ α-Ketoglutarate

6. Oxidation-II :-

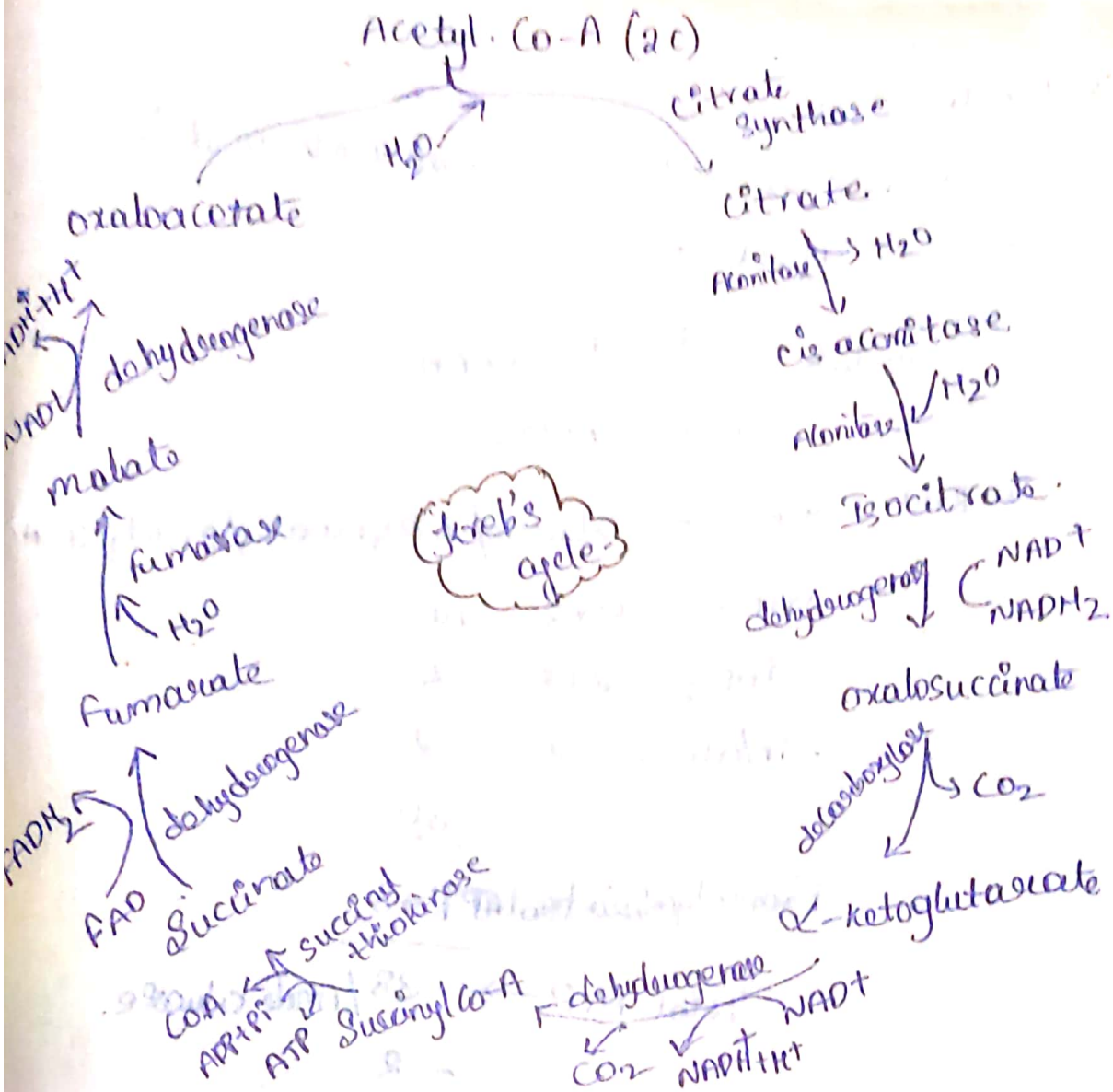
α-Ketoglutarate is converted into Succinyl Co-A in presence of dehydrogenase.

α-Ketoglutarate $\xrightarrow[NAD^+ \; NADH_2 \; CO_2]{\text{dehydrogenase}}$ Succinyl Co-A.

7. Substrate level phosphorylation :-

Succinyl Co-A is converted into succinate in presence of kinase.

Succinyl Co-A $\xrightarrow[GDP+P_i \; GTP]{\text{kinase}}$ Succinate.



8. Oxidation - III :-

Succinate is converted into fumerate in presence of enzyme dehydrogenase.

$$\text{Succinate} \xrightarrow[NAD^+ \quad NADH_2]{\text{dehydrogenase}} \text{fumerate}$$

9. Hydration :-

Fumerate is converted into malate in presence of fumerase, here water molecule is added.

$$\text{Fumerate} \xrightarrow{\text{Fumerase}} \text{malate}$$

10. Oxidation - IV

Malate is converted into oxaloacetic acid in presence of dehydrogenase.

$$\text{Malate} \xrightarrow[NAD \rightarrow NADH_2]{\text{dehydrogenase}} OAA$$

In kreb's cycle for 1 Glucose / 2 pyruvate / 2 Acetyl Co-A

$NADH_2 - 8 \times 3 = 24$

$FADH_2 - 2 \times 2 = 4$

GTP/ATP $- 2 = 2$

30

From glycolysis total ATP → 8

Total ATP → 38 / 1 mole glucose.

$- 2$

Net ATP 36

Respiration

Oxidation of Carbohydrates - Co_2 and H_2O

$$C_6H_{12}O_6 + 6O_2 \xrightarrow[ATP]{} 6CO_2 + 12H_2O$$

1. Glycolysis - Cytoplasm - EMP
2. Kreb's cycle - matrix of mitochondria → TCA / citric acid cycle
3. ETC - cristae of mitochondria
4. Oxidative phosphorylation - Cristae of mitochondria.