FREE NOTES · NCERT + NEET LEVEL

Respiration in Plants

Kya paudhe saans lete, glycolysis, fermentation, aerobic respiration (link reaction, Krebs cycle, ETS, oxidative phosphorylation), respiratory balance sheet, amphibolic pathway aur respiratory quotient.

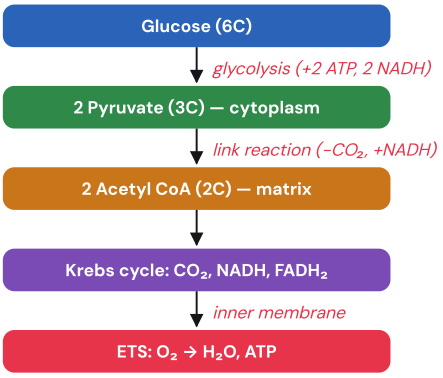
01 Kya paudhe saans lete?
02 Glycolysis (EMP pathway)
03 Fermentation
04 Link reaction aur Krebs cycle
05 ETS aur oxidative phosphorylation
06 Balance sheet, amphibolic pathway, RQ
07 Extra + tricks
08 Important Q&A
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10 Practice (NEET style)
11 Quick revision

01 Kya paudhe saans lete?

- Paudhon me saans ke khaas organs nahi; stomata aur lenticels se gas exchange. Har part apni gas khud sambhalta; transport kam.
- Cells surface ke paas (zinda cells patli layers me; lakdi wale stem ka andar mrit), isliye diffusion kaafi.
- Respiration: cells me khane ke C–C bonds todkar (oxidation) energy nikalna, **ATP** (energy currency) me. Substrates: zyada carbohydrates, fats aur proteins bhi.

02 Glycolysis (EMP pathway)

- Embden, Meyerhof, Parnas. Saare jeevon ke cytoplasm me; anaerobes me sirf yahi.
- Glucose → (hexokinase) glucose-6-P → fructose-6-P → fructose-1,6-bisP → DHAP + PGAL.
- PGAL → BPGA se **NADH**; BPGA → 3-PGA se ATP; PEP → pyruvate se ATP.
- Glucose pe net: **2 ATP** (4 bane - 2 lage) + **2 NADH** + 2 pyruvate.



Aerobic respiration ka overview

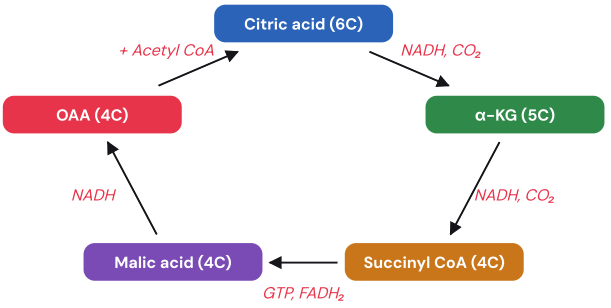
03 Fermentation

Type	Reaction	Kahan
Alcoholic	Pyruvate → acetaldehyde + CO_2 (pyruvic acid decarboxylase) → ethanol (alcohol dehydrogenase)	Yeast
Lactic acid	Pyruvate → lactic acid (lactate dehydrogenase), NADH wapas oxidise	Kuch bacteria, tez exercise me muscles (O_2 ki kami)

Glucose ki 7% se kam energy nikalti; sab ATP nahi banti. Alcohol ~13% hone pe yeast mar jaata. Dono me NADH → NAD^+ taaki glycolysis chalta rahe.

04 Link reaction aur Krebs cycle

- Mitochondrial matrix me. **Pyruvate dehydrogenase** (NAD^+, CoA, Mg^{2+} chahiye): pyruvate + CoA + NAD^+ → acetyl CoA + CO_2 + NADH + H^+.
- **Krebs / TCA / citric acid cycle** (Hans Krebs): acetyl CoA + OAA → citric acid (citrate synthase).
- Har acetyl CoA pe: 3 NADH, 1 $FADH_2$, 1 GTP (≈ATP), 2 CO_2. Glucose pe double.
- Succinate dehydrogenase Krebs ka akela enzyme jo inner membrane pe.



Krebs cycle (saral)

05 ETS aur oxidative phosphorylation

- Inner mitochondrial membrane. Complex I (NADH dehydrogenase) → ubiquinone → Complex III (cyt bc_1) → cytochrome c (mobile) → Complex IV (cyt a–a_3 oxidase, copper ke saath) → O_2 (aakhri H acceptor) → H_2O. $FADH_2$ Complex II se aata.
- 1 NADH ⇛ 3 ATP; 1 $FADH_2$ ⇛ 2 ATP (NCERT ke hisaab se).
- Complex V = **ATP synthase**: F_o (membrane me proton channel) + F_1 (headpiece, ATP banata). Har ATP ke liye ~2 H^+ F_o se (NCERT).
- Oxidative phosphorylation kyunki oxidation–reduction ki energy se ATP (photophosphorylation me roshni se).

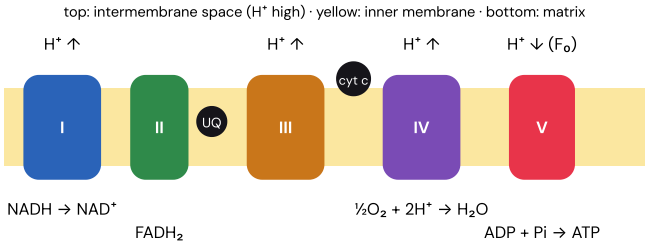
06 Balance sheet, amphibolic pathway, RQ

Net gain: 38 ATP har glucose pe aerobic respiration me (maanyataayein: kram se pathway, glycolysis ka NADH mitochondria me, beech ka koi product doosre kaam me nahi, sirf glucose; asli value kam).

Fermentation	Aerobic
Aadha todna	Poora CO_2 + H_2O tak
Net 2 ATP	Net 38 ATP
NADH dheere oxidise	NADH tezi se oxidise

- **Amphibolic pathway**: respiration catabolic aur anabolic dono (acetyl CoA se fatty acids; intermediates se amino acids).
- **RQ = CO_2 nikla / O_2 laga**: carbohydrates 1; fats <1 (tripalmitin 102/145 = 0.7); proteins ~0.9; anaerobic: infinity.

07 Extra + tricks



Inner mitochondrial membrane pe electron transport chain

- Glycolysis enzymes kram se: hexokinase → phosphoglucoisomerase → **phosphofructokinase** (mukhya control) → aldolase → triose phosphate isomerase → G3P dehydrogenase (NADH) → phosphoglycerate kinase (ATP) → phosphoglyceromutase → enolase → **pyruvate kinase** (ATP).
- **Shuttles**: glycolysis ka NADH seedha mitochondria me nahi jaata. Malate–aspartate shuttle (heart, liver, kidney): har NADH = 3 ATP ⇒ 38 ATP. Glycerol-phosphate shuttle (skeletal muscle, brain): 2 ATP ⇒ 36 ATP.
- Substrate-level phosphorylation: glycolysis (2 steps) aur Krebs (succinyl CoA → succinate, GTP).
- Krebs intermediates ka trick: "**C**an **I** **K**eep **S**ome **S**ucrose **F**or **M**y **O**wn" = Citrate, Isocitrate, α-Ketoglutarate, Succinyl CoA, Succinate, Fumarate, Malate, OAA.

08 Important Q&A

Q1. Respiration ko amphibolic pathway kyun kehte?

Kyunki todna (catabolism) aur banana (anabolism) dono: acetyl CoA jaise intermediates se fatty acids aur amino acids bante.

Q2. Tripalmitin ka RQ: $2C_{51}H_{98}O_6 + 145\ O_2 \rightarrow 102\ CO_2 + 98\ H_2O$.

RQ = 102/145 = 0.7.

Q3. ETS me electrons ka aakhri acceptor?

Oxygen; H^+ ke saath paani banata.

09 Common mistakes

- Kehna ki glycolysis mitochondria me (cytoplasm me hota).
- Glycolysis ka net 4 ATP likhna (net 2).
- Bhoolna ki succinate dehydrogenase membrane pe hai.
- Fats ka RQ 1 se zyada likhna.

10 Practice (NEET style)

1. 1 glucose se aerobic me net ATP?
2. Pyruvate se acetyl CoA ka enzyme?
3. Krebs cycle ka pehla product?
4. Carbohydrates ka RQ?
5. III aur IV ke beech mobile carrier?

ANSWERS

1) 38 · 2) Pyruvate dehydrogenase · 3) Citric acid · 4) 1 · 5) Cytochrome c

11 Quick revision: exam se 5 minute pehle

GLYCOLYSIS

- Cytoplasm
- Net 2 ATP + 2 NADH
- Glucose → 2 pyruvate

KREBS

- Matrix; OAA + acetyl CoA
- Har chakkar: 3 NADH, 1 $FADH_2$, 1 GTP

ETS

- Inner membrane
- NADH 3, $FADH_2$ 2 ATP
- O_2 aakhri acceptor

RQ

- Carb 1, fat 0.7
- Protein 0.9
- Anaerobic ∞

Koi doubt? padhaiadda.netlify.app pe AI Doubt Solver se poocho, ya is chapter ka mock test do.