5. Calvin cycle: carbon fixation

CO_2 binds to RuBP with RuBisCo

6C molecule → 2 3C molecules
PGA

Reduction phase (light dependent stage)

G3P → sugars

G3P + ATP → RuBP

Calvin cycle requires ATP as input

4. Founder effect
Genetic drift

Gene flow: Individuals that enter or leave the population

Bottleneck effect: Drastic reduction in genetic diversity by pure chance

↳ Change in allele frequency (usually less genetic diversity)

9. Bacterial transformation

Humans/Eukaryotes in general: linear chromosomes

Bacteria: Circular pieces of DNA (plasmid)

Transformation → insert DNA into bacteria

Heat the bacteria → cold shock

opens up the membrane a bit
→ insert plasmids

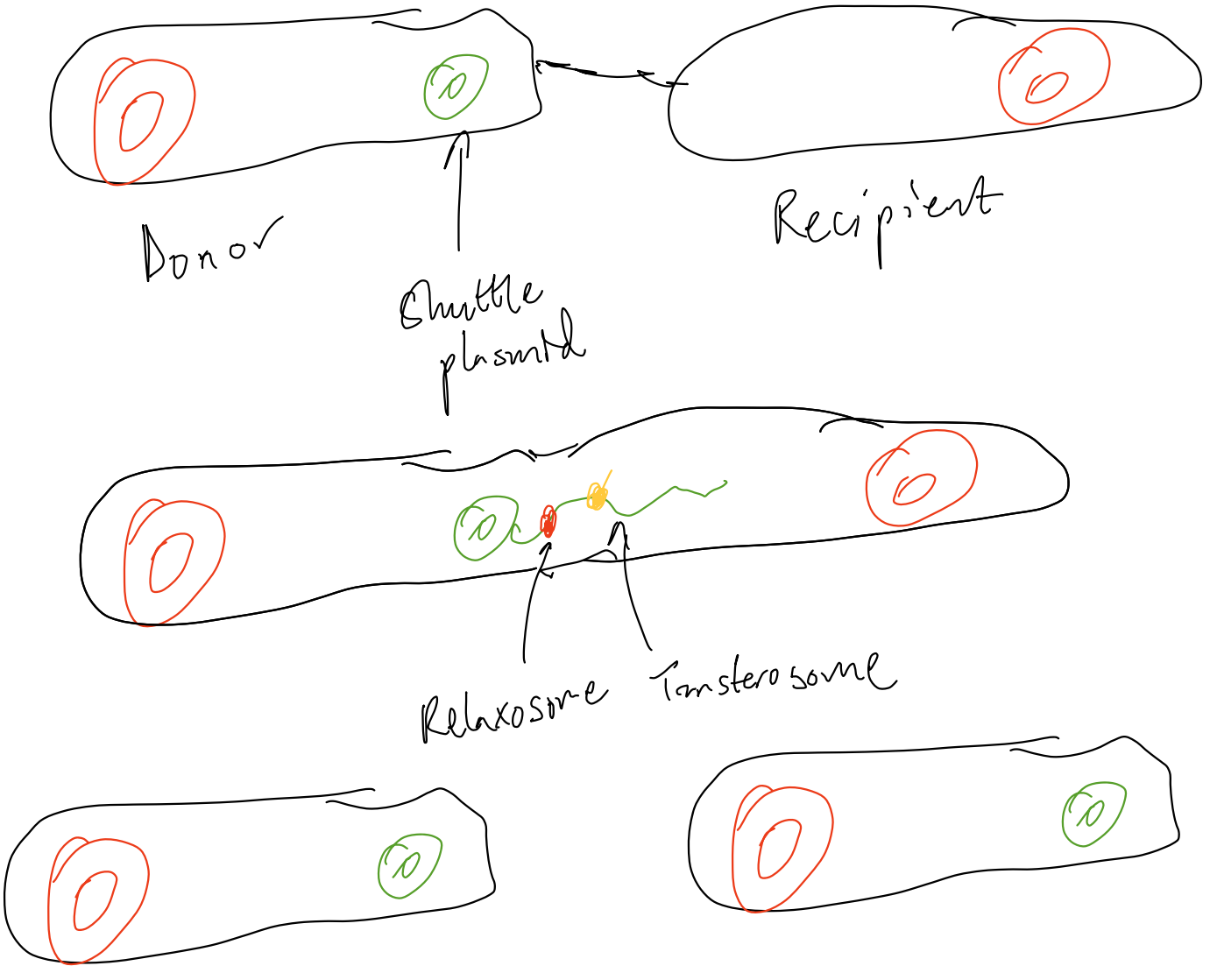
Enzymes: Biological catalysts "ase"

We only care about virulent bacteria as transformation factor

10. Look at graph/answer choices

15. Crossing over: Prophase I of Meiosis

Conjugation: Horizontal gene transfer



16. Apoptosis: Programmed cell death

Signaling → trigger apoptosis

Phagocytes do not destroy cells for nutrients

Apoptosis does not affect differentiation

Metamorphosis: egg → caterpillar → pupae → butterfly

Apoptosis → caterpillar cells/tissues die from apoptosis → butterfly tissue forms

21. Different species → not able to mate AND produce viable offspring

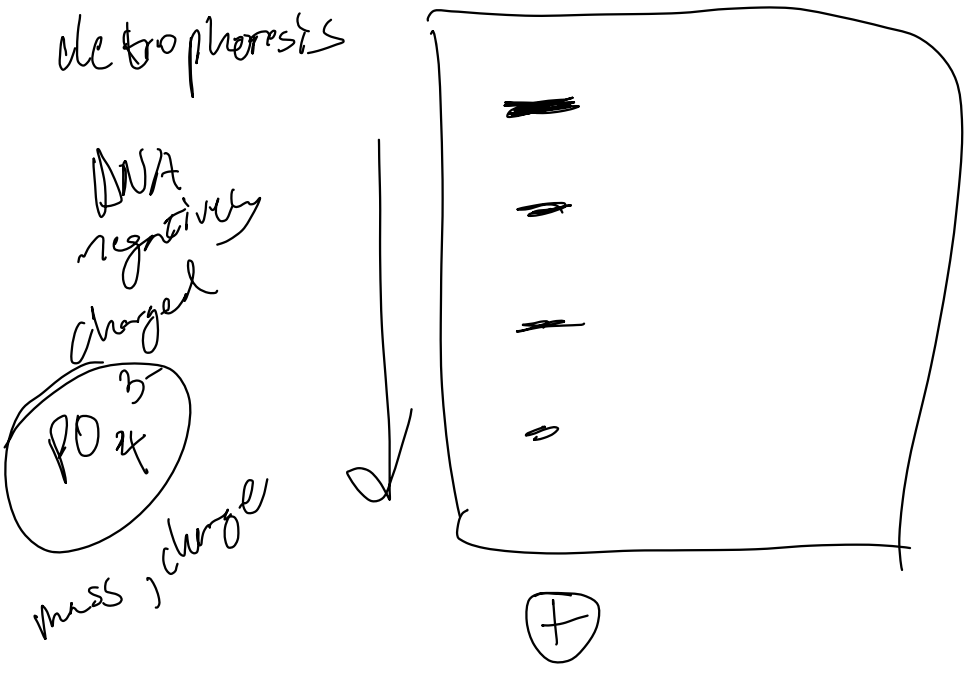
Temporal isolation → mate based on free cycle

27. Inject Rabbit mRNA

→ eggs hatch → tadpoles express rabbit hemoglobin

30. Thickness of bands → relative amounts

Recap gel electrophoresis

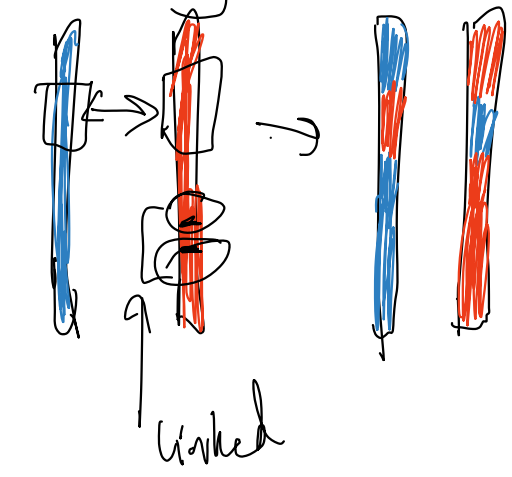


32. Amniotic egg → Yolk, food source
higher survival rate

33.

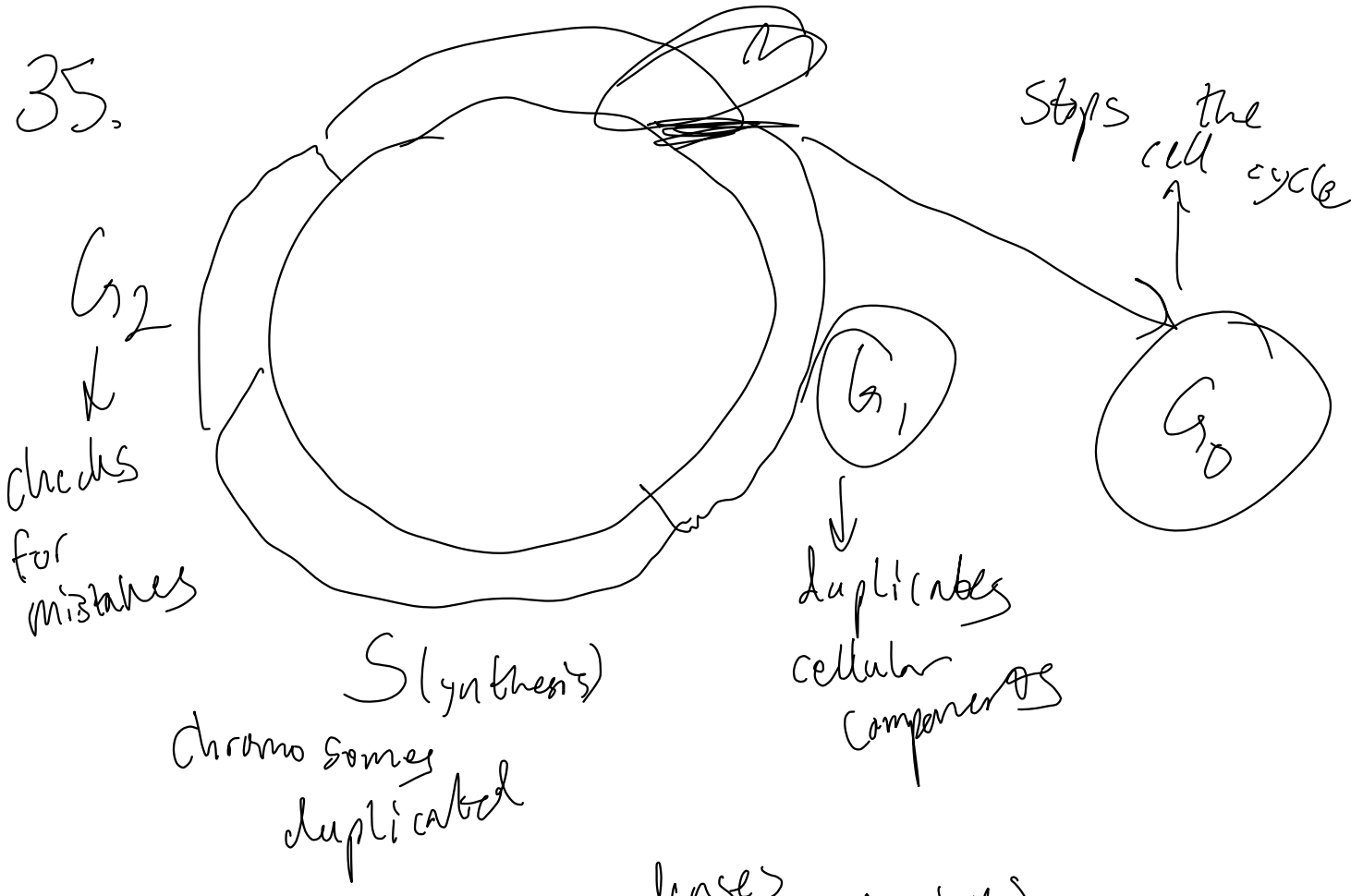
Male	Female
Grey, Long	Black, Apterous

Crossing over / Linked genes



Independent assortment
↳ 2 different chromosomes

35.



Prophase: Chromatin condenses, nuclear membrane dissolves

36. Binding receptors

B cells: Bind to virus, secrete antibodies

Cytotoxic T cell: Bind to cells infected by virus for destruction

Helper T cells: Bind to infected cells
↳ release of cytokines

Macrophage + big eater → consumes virus/affected cell, nonspecific

38. Central dogma of biology

DNA → preMRNA → mRNA → tRNA → proteins
(splicing) (codon) → amino acids

Enhancers are a 50-1500 bp sequence that can increase the likelihood of gene expression

42. chloroplasts, next to lamp that emits white light

Lower absorbance → higher photosynthetic activity

(Prediction)

1. a) Higher distribution in glucose soaked chamber

(Justification)

↳ Flies more inclined to go to the chamber upon detecting the smell of a food source

b) wet cotton ball with no glucose

why? → glucose as attracting factor

change → conc. glucose, temperature, light levels, choice chamber shape/size, duration, time of day

↳ Ensuring that only glucose preference matters

c) Most at ripe banana end

60 flies H_0: All be the same

E of 20

$$\sum\left(\frac{(O-E)^2}{E}\right) = 48,7$$

3 groups, 2 df groups - 1

Critical value $p = 0.05$ or 0.01

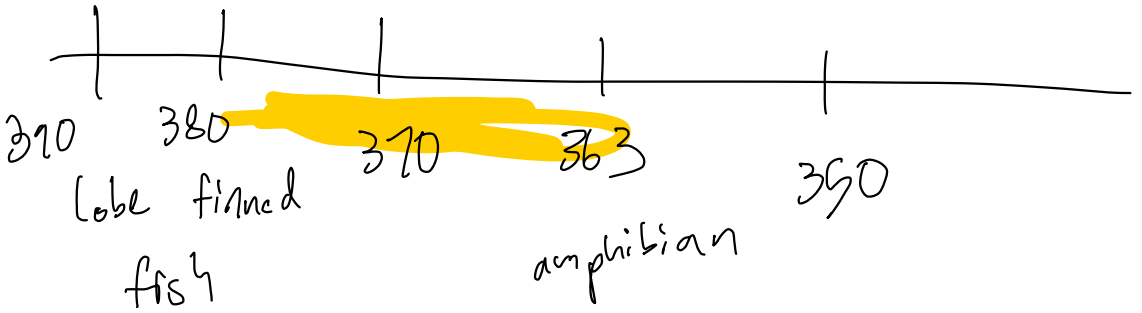
for exceeds crit value

↳ reject H_0

e) Stimulus (presence of glucose/sugars)

↳ Response (fly goes to that chamber).

3. a)



370

b) Homologous features

limbs, bone structure

scales

DNA evidence (molecular clock)

↳ mutations happen at a steady rate

count mutations to determine time of divergence

8. Ligand binding

 → cell signal requires ligand binding

step 1

step 2: Inscade → amplifies signal to nucleus

step 3: start transcription / translation

T4:

4. viral load related with % mRNA, wil involved in viral infection

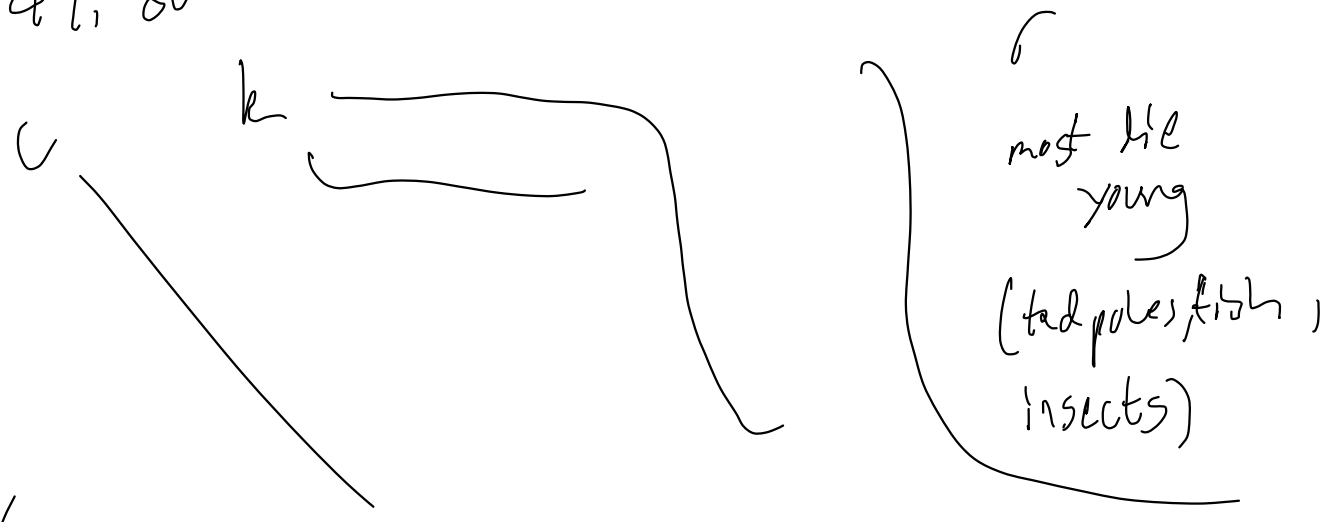
13. Dark-colored poisonous fish ↑ mimicry

35.

40. Resources/nutrients present

43,

47, Survival curves



6. a) Present, unpackaged
| relative amount of transcription

b) $\frac{.74 - .07}{.74}$ 90.54%

c) DNA packaging vs. transcription factor

d) DNA methylation
↳ deactivates/silences genes
(environmental factors)

Unit 1: Chemistry

H_2O, hydrogen bonding, properties of water

melting/boiling points, density, heat capacity

Elements of life CHNOPS

Carbohydrates, lipids, nucleic acids → functions

↓

DNA

phos, sugar Deoxyribose, base pair → Purines GA

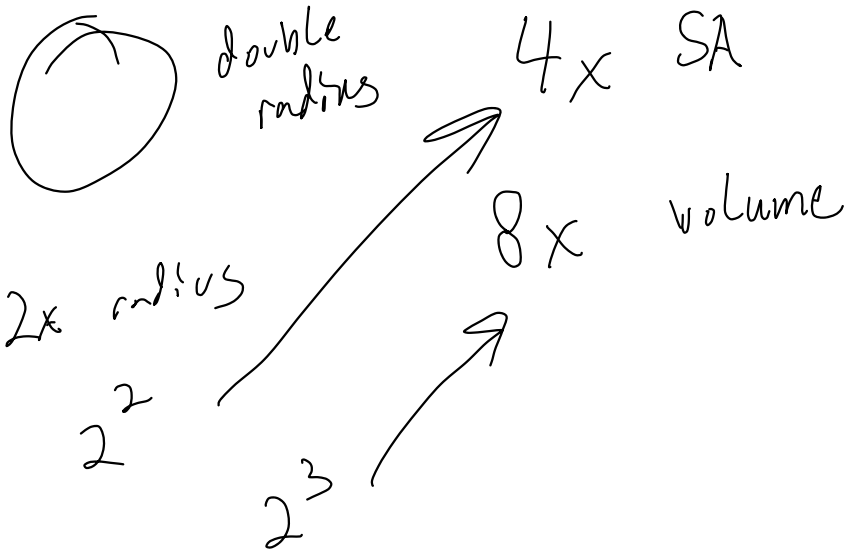
Pyrimidines TC, U

Unit 2: Cell structure/function

Organelles of cell (functions, shape)

Cell size: square-cube law (metabolism, heat diffusion)

surface area: volume



Plasma membranes: Permeability

Phospholipid bilayer → semi permeable membrane

small nonpolar molecules passively diffuse

lager / charged / polar molecules need active transport

Passive: no energy diffusion → facilitated diffusion

Active: Requires ATP

Osmoregulation / tonicity

hypo

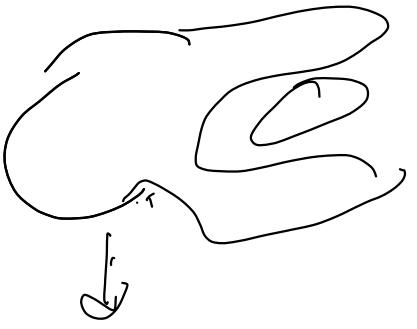
iso

hyper

Cell compartmentalization

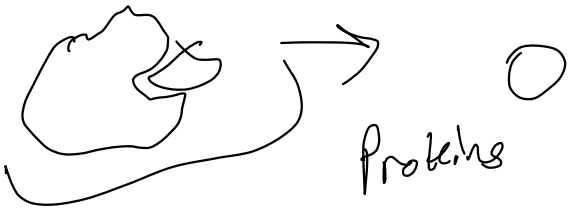
Endosymbiosis theory

↳ mitochondria



Unit 3: Energy

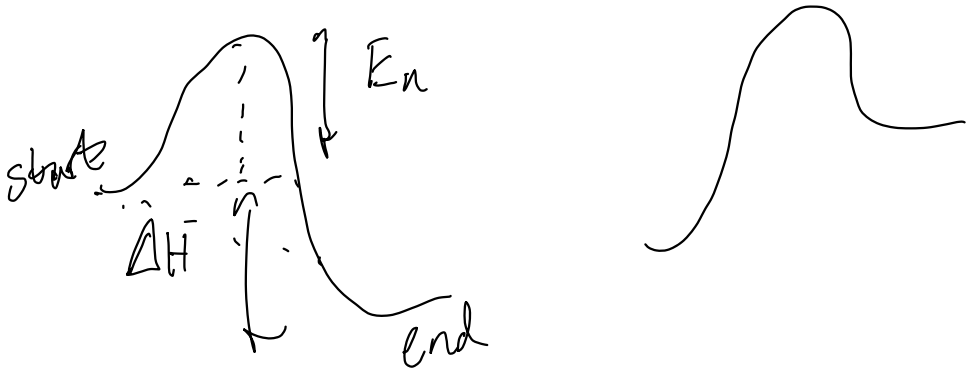
Enzymes:



Proteins catalyze reactions

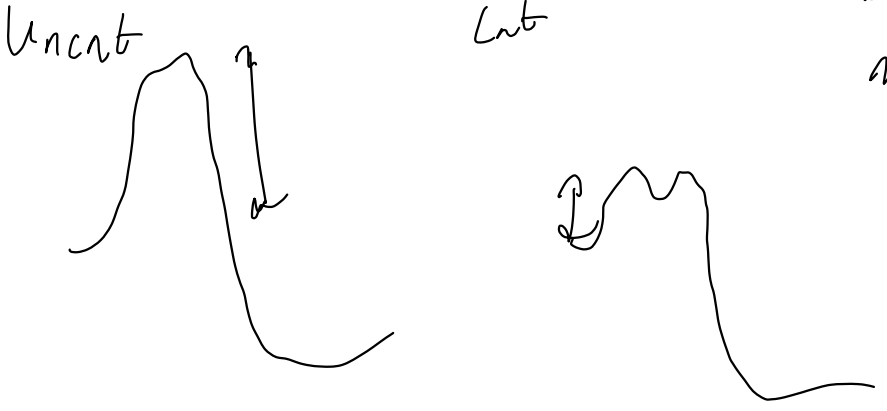
Very specific to conditions

temperature, pH



Enzymes lower E_a, speeding up reaction by providing pathway / mechanism

Enzymes CANNOT make an unfavorable reaction favorable



Glycolysis → net 2ATP per glucose

↓ Anaerobic → Lactic acid fermentation

→ Aerobic → Krebs cycle → $NADH$, $FADH_2$ → ETC, proton gradient drives ATP synthase → makes ~30-32 ATP per glucose molecule

Obligate vs. facultative

↓ aerobe → must have oxygen

↓ anaerobe → must not have oxygen

Plant → photosynthesis

chloroplasts → Calvin cycle

light dependent + independent cycle

Unit 4: Cell Cycle / Communication

Signal transduction

Ligands bind → signal amplification → cell response
(cascade)

Feedback → (cycles, A affects B affects C)

Cell cycle G1, S, G2, M

cell can't leave by going into G_0

Mitosis → I, P, M, A, T, Cytokinesis

Regulations of cell cycle (telomeres, apoptosis)

Unit 5: Heredity

Meiosis → genetic diversity meiosis 1 vs. meiosis 2
crossing over

Mendelian genetics → punnet squares, predict phenotypes
↑
sex-linked vs autosomal

Non mendelian genetics
↳ incomplete, codominance, multiple alleles → mitochondrial inheritance

Determine inheritance pattern → Pedigrees

Environmental effects: Phenotypic plasticity

change in environment → change in phenotypes

flower → Hydrangeas affected by soil pH

Unit 6: Gene Expression / Regulation

Structure of DNA / RNA

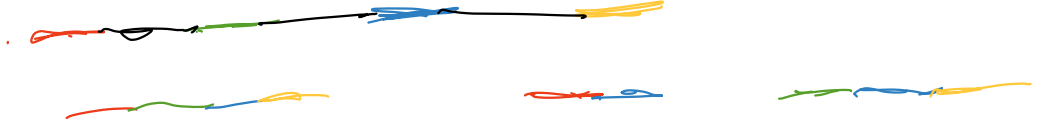
DNA replication — 5' 3' Leading Lagging strand Okazaki fragments

RNA synthesis — RNA polymerase
↳ RNA → translate it

Central dogma of biology

Gene expression — immature mRNA → introns, exons
Immature mRNA
splice out introns, keep exons

Alternative splicing: Different expressions of a single gene



Mutations: changes to base sequence
Point mutations: change to single BP
silent: no change ← fine
missense: change in amino acid ← pretty bad
nonsense: change leads to stop codon ← worst

PCR → replicates DNA
gel electrophoresis
Transformation
Restriction enzymes

Unit 7: Natural Selection:

"Survival of the fittest"

Fitness → Ability to survive and then reproduce

Population genetics

↳ Hardy-Weinberg equilibrium $p^2+2pq+q^2=1$

5 assumptions $p+q=1$

Evidence of evolution → homologous features

↳ Analogous features

Common ancestry/relatedness

↓

Phylogeny trees / cladograms

Speciation → Allopatric vs. Sympatric

Extinction

Variations in population (genetic composition)

Genetic drift, bottleneck effect

Origin of life

Unit 8: Ecology

Biotic vs. abiotic factors

↳ energy flow through ecosystems

10% rule

carrying capacities

Density dependent vs. Independent factors
disease, predation, competition, food
water / temperature

Food web / food chain

Ecosystem → Keystone species

↘ Indicator species

↓

Biodiversity

(index)

Final tips: Get rest (sleep) before the exam

Eat breakfast, don't do last minute cramming

Formula sheet / how to apply

Breathe. You got this!