Bill Packet

1. [x] Unit map
2. [x] Traffic light

   Traffic Light

Term	Pre-Assessment	Post-Assessment
-some	🟨	🟩
co-	🟩	🟩
hapl-	🟩	🟩
zyg-	🟨	🟩
chrom-	🟩	🟩
syn-	🟩	🟩
Positive Feedback	🟩	🟩
Protein Kinase	🟩	🟩
Sister Chromatids	🟩	🟩
MPF	🟥	🟩
Phosphorylation cascade	🟩	🟩
G_0 Phase	🟩	🟩
Haploid	🟩	🟩
G-protein	🟩	🟩
Ligand	🟩	🟩
Mitosis	🟩	🟩
Cyclin	🟩	🟩
cdk	🟩	🟩
Negative Feedback	🟩	🟩
cAMP	🟩	🟩
Quorum sensing	🟨	🟩
Cytokinesis	🟩	🟩
Diploid	🟩	🟩

3. [x] Test topics

   Test Topics

   1. Anabolic versus catabolic pathways

1. Definitions, examples

> did you just **Anabolic**
> Building stuff up or storing energy (photosynthesis)
>
> **Catabolic**
> Breaking stuff down or using energy (respiration)

2. Relationship between G, H, S – endergonic, exergonic – spontaneous, not spontaneous (see chart in notes)

> **G** - Gibb's free energy - the maximum availiable energy in a closed system
> **H** - Enthalpy - Energy needed or radiated from a reaction
> **S** - Entropy - Unuseful energy used or absorbed, often heat
> **Endergonic** - Net absorbtion of energy
> **Exergonic** - Net release of energy

2. First and second laws of thermodynamics and relationship to biology

> Energy cannot be created or destroyed, which is what the Gibbs' free energy formula states
> Energy dissipates, which means goes from high to low concentration, so heat cant move from a cold object to a hot object

3. ATP Cycle – understand the diagram

> ATP and ADP get recycled into each other, carrying energy around

4. Oxidation/reduction in terms of H

> Losing a hydrogen is oxidation, which releases energy, and gaining one is storing energy (reduction)

5. Respiration

1. 3 (or 4?) parts – study the summary chart!!!

> Consists of Glycolysis, formation of acetyl CoA, Krebs Cycle, then ETC

2. Proton-motive force

> When a high concentration of protons in a certain area has a tendency to move to a low concentration because of diffsion

3. Difference between hydrogen and proton

> hydrogen normally has a neutron with it as well, a hydrogen ion (positively charged) doesn't have an electron, which is just a proton

4. Main idea of fermentation

> Be able to produce energy even when there is air, the oxygen debt must be paid back later however

5. Lactic acid fermentation versus alcoholic fermentation

> Alcoholic fermentation's oxygen debt cannot be paid back, so when there are high concentrations of it undealt with, it is toxic

6. Facultative anaerobes, obligate anaerobes

> **Facultative anaerobes** can use either aerobic or anaerobic respiration when there is or is no oxygen
> **Obligate anaerobes** need to live in an oxygen free environment or they will die

6. Photosynthesis

   1. 2 parts

      1. Location

         > Chloroplasts and cytosol

      2. Function

         > Produce energy to use from light

      3. Products

         > Glucose, Oxygen

   2. 3 parts of Calvin Cycle

      > Carbon Fixation, Reduction, Regeneration

   3. Why is light needed? Why is water needed?

      > **Light**: As the source of energy
      > **Water**: To provide protons

   4. Where does the oxygen gas come from?

      > Breaking the Carbon Dioxide for its Carbon

   5. Pigments – wavelengths of light -- difference between absorption and reflection – relation to color and use

      > Chlorophyll reflects green and absorbs red and violet light

   6. Main idea of chemosynthesis

> Using inorganic carbon to produce organic material. In this case, using carbon dioxide to produce glucose

7. Respiration versus photosynthesis – similarities and differences

    1. Location of ETC, ATP synthase

    > Across the Thylakoid membrane vs mitochondrial membrane
    > Same, uses proton gradient to spin the thingy

    2. Chemiosmosis

    > Producing ATP from a proton gradient

    3. Reactants and products

    > Basically opposites, except the input energy for photosynthesis is light, when the output energy for respiration is ATP (chemical energy)

    4. Functions

    > Save energy, use stored energy

    5. Electron carriers

    > Carry electrons and energy to places to produce things. often NADH, NADPH, FADH

8. How do bacteria do these processes?

> Small-ly
> They don't they leech from other things

4. [x] Official AP Biology unit summary

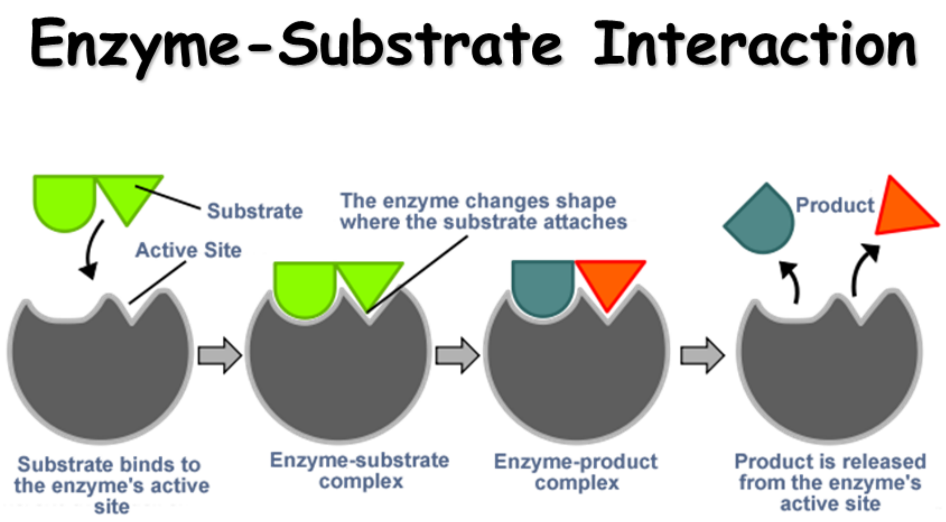
Unit Summary

Essential Questions

1. Breaking things down requires activation energy, which later releases more energy, which can be used to move muscles, grow, and even reproduce.
2. Photosynthesis and Respiration are two large ways of using and storing free energy. This often involves storing the energy in chemical bonds.

5. [x] Topic review guides
    1. [x] 3.1,3.2,3.3 Enzyme Structure, Catalysis and Environmental Impacts

    3.1-3.3



1.
2. The enzyme has an active site that fits the shape, polarity, and charge of a specific substrate. This specificity only allows specific molecules to bind to it, its substrates and blockers
3. Enzymes lower the activation energy for a specific chemical reaction, allowing them to happen faster
4. Denaturing is when a protein can no longer perform its function due to a misshaping caused by overheat, or inadequate pH levels
5. Denaturing an enzyme means that its active site will be the wrong shape, meaning that its substrates cannot bind to it
6. pH is defined by the inverse concentration of hydrogen ions in a specific solution, an increase of hydrogen ions leads to higher acidity and a positive charge in the solution, which could deform denature enzymes
7. Higher temperatures lead to faster moving molecules which leads to a higher chance that an enzyme will collide with its substrates over time, although at a certain temperature, the enzymes would be denatured from the temperature can will no longer function
8. Higher substrate concentration leads to a higher enzyme activity and reaction rate because more substrates will be bumping into enzymes over time, until the saturation of enzymes happens, when the reaction rate will significantly reduce because now increasing the substrate concentration will only minisculy increase the chances that substrates will bump into an unoccupied enzyme
9. Higher enzyme concentration positively linearly maps to an increase in enzyme activity
10. Increase in temperature can only increase the rate so much, until it kills the enzymes. Increase in the concentration of substates would only increase

the reaction rate until saturation of the enzymes. This would be the maximum speed of the enzyme

11. Both stop substrates from binding to the enzyme, although allosteric would permanently disable the enzyme from functioning, and is more effective at stopping a reaction, while competitive inhibitors are only as functional as the concentration of the inhibitor, and they don't stay permanently bound to the enzyme

2. - [x] 3.4 Cellular Energy

3.4

1. God, he created the universe and all the energy in it. The sun because it is what fuels all the autotrophs by light and heat, which fuels all the heterotrophs.
2. They need to grow and expend energy to maintain homeostasis and do work.
3. We can only decrease entropy in a place, but when you account for the entire system or environment, the entropy will always increase
4. Food, which is sugars, and ATP within cells, they contain a lot of stored chemical energy
5. In fats and sugars. They have a lot of chemical bonds which could be broken to create energy.

3. - [x] 3.5 Photosynthesis

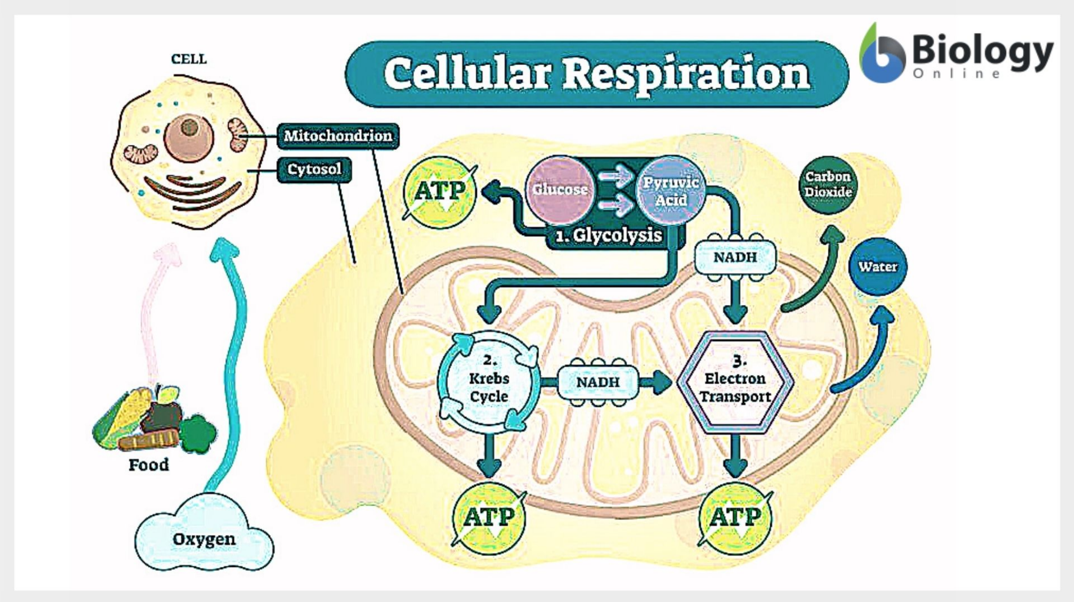
3.5

1. H_2O + CO_2 + light ⇒ $C_6H_{12}O_6$ + O_2
2. electrons get excited and used to pump hydrogen ions against the concentration gradient and bind to electron carriers
3. They absorb light to excite electrons, which is the energy harnessed to do work
4. An electron gets excited
5. The chlorophyll
6. 6
    1. Light hits the chlorophyll
    2. electron gets excited
    3. electron is replaced by hydrolysis
    4. ETC pumps proton into membrane
    5. ATP is produced from the gradient
    6. Light hits chlorophyll and excites electron
    7. Electron moves to the edge of the membrane
    8. Electron is used to bind to an electron carrier
7. 7
    1. Get made for use later
    2. Used as stored energy to perform functions in the light-independent cycle

8. Both functionally do the same thing, use the energy of an electron to pump hydrogen, but the source of the electron is different and where the electrons end up are different
9. From the light dependent reactions, in the form of ATP and NADPH

4. ☑ 3.6 Cellular Respiration

3.6

1. Growth, muscle contraction, storage of energy
2. 

3. Break down glucose into something the mitochondria can handle
4. Completely obliterated and turned into pure energy
5. NADH, FADH, ATP
6. Get attached to electron carriers and put down the ETC later
7. There is no oxygen, so aerobic respiration cannot happen, so fermentation takes place to produce energy when there is no oxygen
8. The last inorganic phosphate group (Pi) from ATP gets released, releasing energy
9. Convert other electron carriers into ATP
10. Carry electrons to the ETC when ATP cannot be made directly due to different available molecules
11. The krebs cycle needs the oxygen to bind to the released carbon, to create carbon dioxide
12. Convert other electron carriers into ATP by creating a proton gradient and using chemiosmosis (through the ATP synthase) to make ATP
13. Formation of ATP from ADP, after the krebs cycle
14. It uses a gradient of something to do something
15. I've never heard of decoupling in respiration

Activity Log

1. ☑ Activity: Enzyme POGIL
2. ☑ Activity: Enzyme Pathway Simulation

Enzyme Pathway Simulation

Post Lab Questions

1. Yes, the last corner to get folded clogged up because there was only one of that enzyme
2. The final product cannot be made because the pathway is broken. The body would not be able to produce certain things.

3. - [x] Activity: Enzyme Inquiry Diagrams & Questions

Enzyme Inquiry

1. The things that are the inputs to the reaction, they get acted upon
2. The chemical change or reaction
3. The Products
4. Substrates
5. Bind to the enzyme
6. Eject the products
7. The shape of the active site
8. Its what the reactants bind to, it matches the reactants it acts upon
9. The charges are the same, so they repel each other
10. The shapes don't match, so the reactant can't bind to the enzyme
11. Shape and charge
12. Enzymes increase the rate of chemical reaction
13. The chemical reaction won't happen
14. Lowers the activation energy
15. Protein, amino acids
16. polarity and charge
17. Interactions between different R groups
18. Hydrogen bonds, hydrophobic interactions, disulfide bridges, and ionic bonds
19. Increases steadily until optimum temperature then plummets down
20. The temperature of highest enzyme activity level
21. It plummets quickly
22. The active site is deformed
23. Enzymes get denatured when out of its operating temperature/pH
24. deform or die
25. Interactions between the R-groups of the amino acids no longer conform to its correct shape. This leads the protein structure to change completely
26. False, cold does not denature an enzyme, it just slows down the molecules
27. Denaturization is sometimes reversible
28. 0-7 are acidic
29. 7-14 are basic
30. 7, the pH of pure water
31. 3 pH
32. 9 pH

33. Completely useless, it cannot operate at all
34. 7, it is much lower than its optimum rate, but it still functions
35. It competes against the substrates of the enzyme, it competes for the active site, occupying it so that no reaction can take place
36. The normal reactants cannot bind, and so no reaction occurs
37. It does not compete for the active site, but just deforms it
38. It irreversibly deforms the active site of an enzyme, stopping production
39. 1
40. 3
41. 4
42. 4
43. All the enzymes are in maximum use, so adding more subtrates would not increase the speed
44. More enzyme
45. The enzyme concentration stays constant, but the substrate and products are inversely related. As the substrate decreases the product increases proportionally.
46. There is no more substrate to react with, so adding more enzyme wouldn't do anything

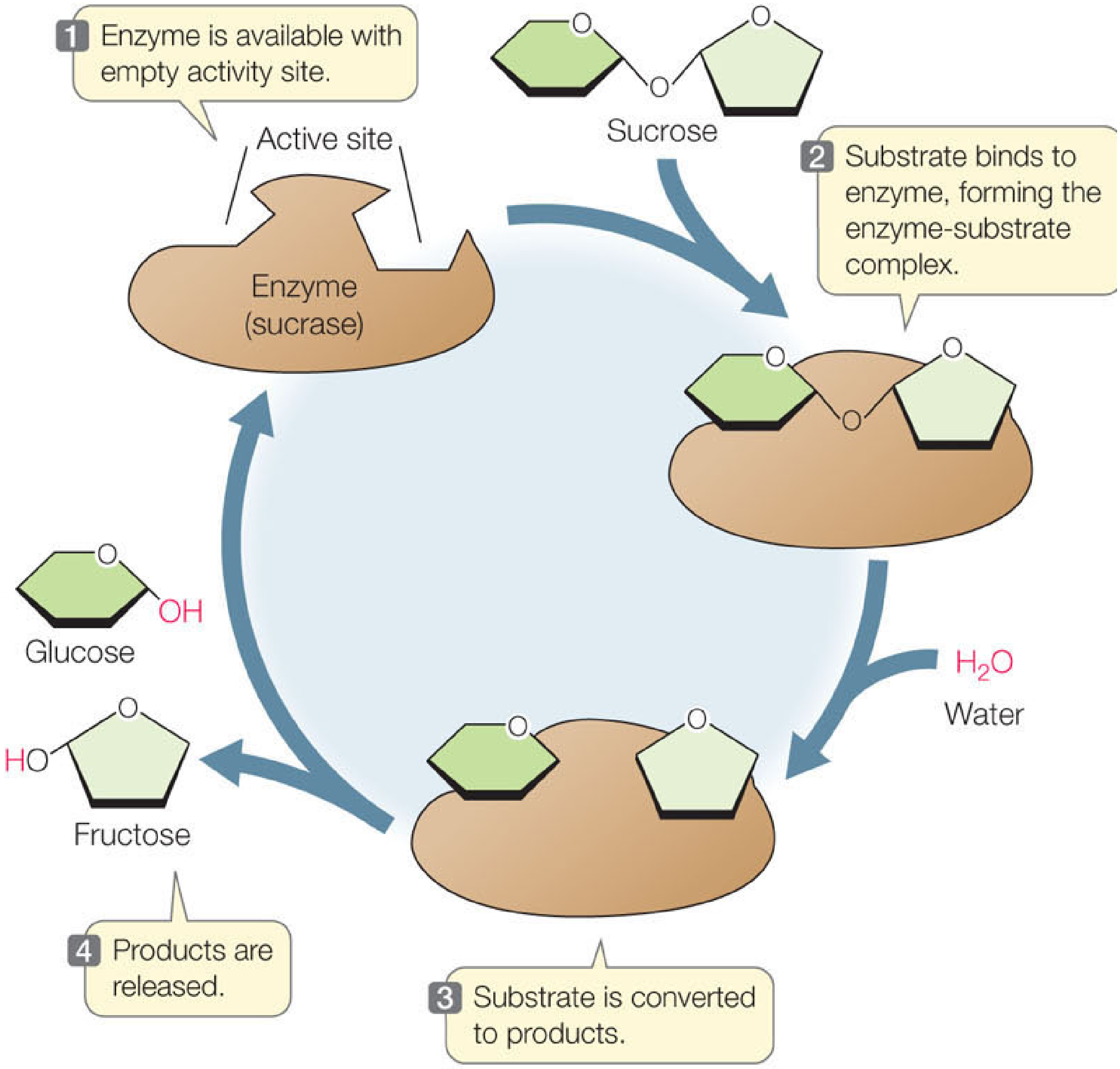
4. - [x] BR: Enzyme Activity

Enzymes

1. One combines the substrates together to form a product (often anabolic). The other takes a substrate and splits it into products (often catabolic).

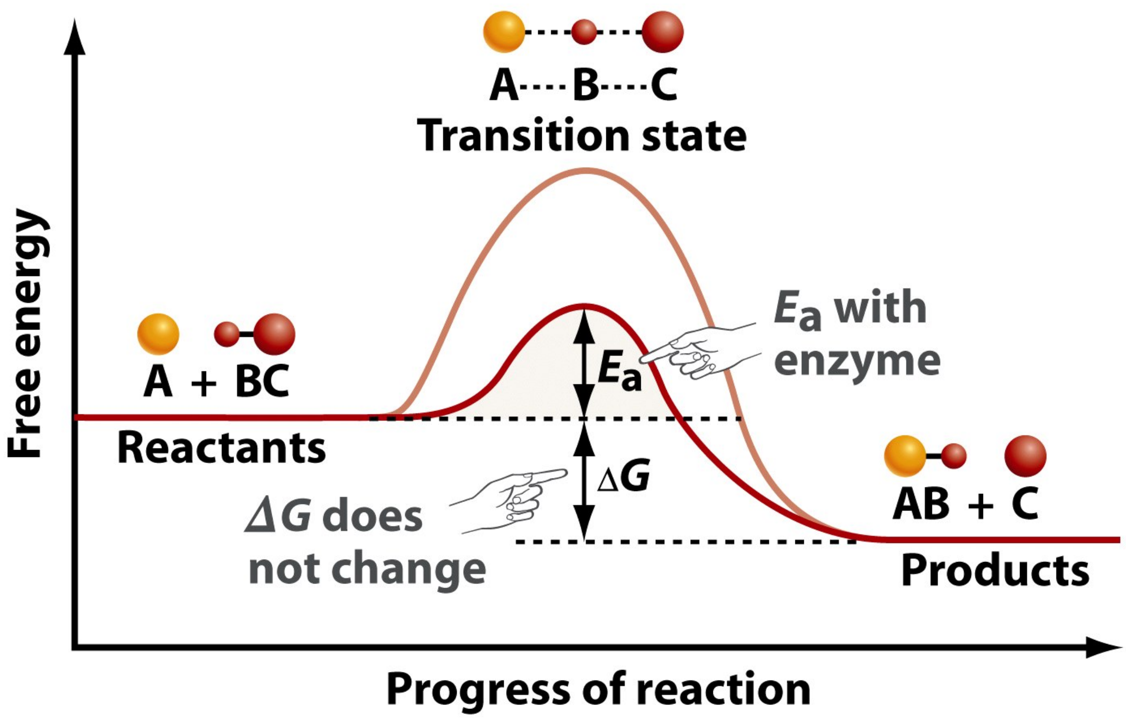
5. - [x] BR: Enzyme Inquiry and Their Activity

Enzymes and their Activity



1.

  1. Quaternary



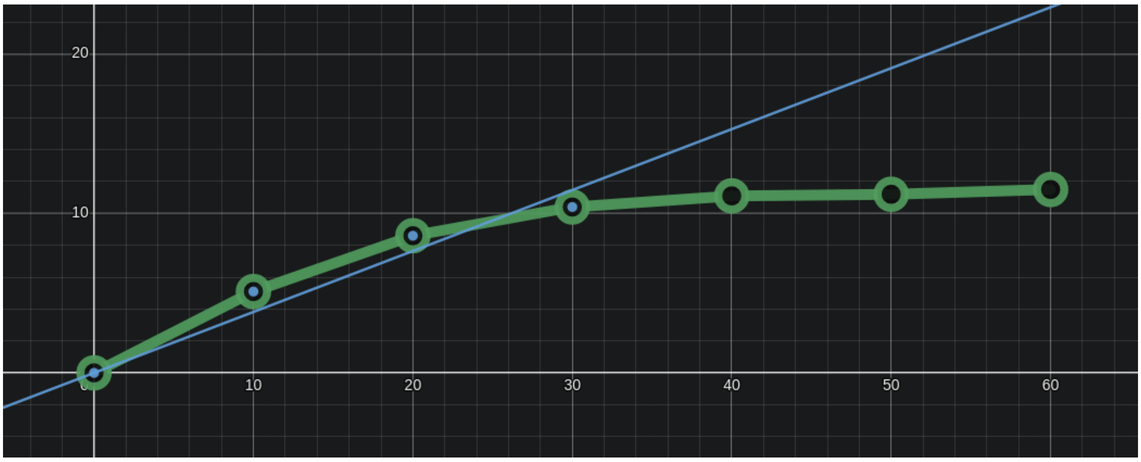
2. Figure 3-21 Biological Science, 2/e © 2005 Pearson Prentice Hall, Inc.

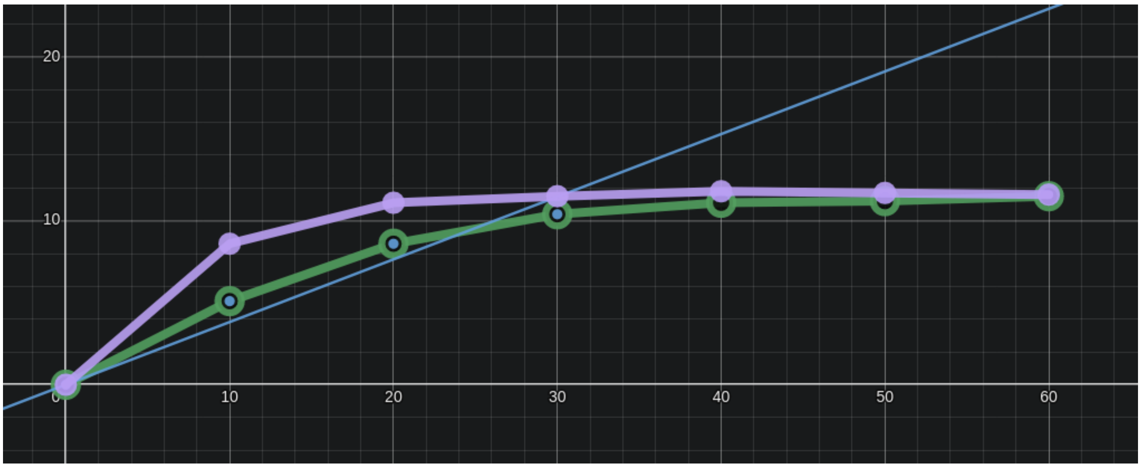
3. Competitive inhibitors tend to be reversible, so it only slows down the production of products in the enzyme, as the inhibitors can attach and go. Non-

competitive inhibitors tend to completely deactivate the enzyme, making it permanently unusable, which would stop reactions completely

6. - [x] BR: How to Write Free Response Questions (2010 FRQ #2 - Enzyme)

   Enzymes FRQ no2

   1. 

      rr = 0.3821 $\mu\text{M}/\text{min}$
   2. Because as the reaction goes on, the substrates get used up to create products, so at around 30 mins the substrates are running out so the probability that fewer substrates would bump into the same amount of enzymes is less, resulting in a lower reaction rate
   3. 

      Since the enzyme is doubled, the reaction time should be roughly halved, and since the amount of substrate (starch) remains constant, there cannot be a higher amount of resulting maltose concentration
   4. Temperature (higher is faster) and enzyme concentration (more is faster).
7. - [x] Activity: Free Energy POGIL
8. - [x] Activity: ATP-The Free Energy Carrier POGIL

   Free Energy

   # Free Energy

   1. 1
      1. Exothermic and Endothermic
      2. ΔH
      3.
         -
   2. 2

    1. Endothermic
    2. Endothermic
    3. Endothermic
3. No, water → ice above $0^{\circ}C$
4. 4
    1. ΔS
    2.
        -
5. No, they aren't correlated
6. 6
    1. Increasing
    2. Decreasing
    3. Increasing
7. 1, 1, 1, 1, 2, 2, 2, 1
8. Yes, Increasing → Reactants, Decreasing → Products
9. 9
    1. Increasing
    2. Decreasing
    3. Decreasing
    4. Increasing
10. Yes most of the time, but it also depends on temperature for cooling and heating
11. It heats up
12. Decreasing
13. Increasing
14. 14
    1. A, B, C, D
    2. H, below $60^{\circ}C$
    3. G, below $0^{\circ}C$
15. 15
    1.
        -
    2.
        -
16. because ΔH is negative and subtracting a positive $T\Delta S$ will always result in a negative (Exergonic)
17. $\Delta H > 0$ and $\Delta S < 0$ so $\Delta H - T\Delta S > 0$, meaning it is Endergonic (non-spontaneous)
    Issues QG17. Because even if $\Delta H = 0$, $T\Delta S > 0$, making $\Delta G < 0$
18. 18
    1. Decreasing
    2. Increasing

    3. System
19. 19
    1. The fire, because it produces heat
    2. The water because it absorbs the energy
20. 20
    1. The breaking of Glucose, it breaks bonds, making energy
    2. Production of ATP, it uses energy to make bonds
21. No, exothermic releases heat, but exergonic releases energy, but not heat
22. 22
    1. Entropy will continue to increase and more energy will be neeeded
    2. The sun.
23. No, spontaneous means that it increases the total entropy in the universe. If it doesnt, then its not spontaneous.

ATP

1. In order of left to right: Adenine, ribose sugar, phosphate group
2. 2
    1. There are three phosphate groups
    2. Take away the third phosphate group
3. ATP + H_2O ⇒ ADP + Phosphate group
4. Split into OH and O
5. Hydro = water, lysis = break / cut, it breaks the H_2O into OH and O
6. 6
    1. Net output, as it breaks bonds
    2. ATP, it has more bonds
7. 7
    1. Exothermic, it releases energy
    2. Its the breaking of water that releases energy
8. 8
    1. ADP + Phosphate group + Energy ⇒ ATP + Water
    2. It adds the phosphate group back to the ADP
    3. Endergonic, it absorbs energy
9. Left: Phosphorylation, Right: Hydrolysis
10. 10
    1. Cellular processes
    2. Formation of glucose or fats
11. Respiration
12. 12
    1. Forming ATP through phosphorelation
    2. Spending ATP to make ADP
    3. Saving ATP (energy) for later
13. $\text{Adenosine} - \text{Nitrogenous Base} - \text{Phosphate Group}$

14. Exergonic, it releases energy
15. It prevents the body from producing new ATP through electron transfer so that it would break down sugars (weight) to produce energyPhotosynthesis

9. ☑ BR: Interpreting Action Spectrum/Absorption

Action and Absorption Spectra for Photosynthesis

1. 430, 680
2. Accessory Pigments, they absorb light at a different range of chlorophyll

10. ☑ Activity: Photosynthesis Guided Inquiry POGIL

Photosynthesis

1. 1
    1. Chloroplast
    2. Plants, animals dont do photosynthesis normally
2. Chlorophyll
3. 3
    1. Carbon Dioxide (CO_2), Water (H_2O), Sunlight
    2. Inside the inner membrane
    3. Endergonic, it takes energy from the sun to produce higher energy molecules
    4. Sunlight (electromagnetic energy as light)
4. 4
    1. Calvin cycle
    2. In the Thylakoid
    3. In the Stroma
5. Chlorophyll
6. Glucose ($C_6H_{12}O_6$), Water (O_2), Water (H_2O)
7. To get the carbons from them to produce glucose
8. A black dot
9. 9
    1. Photosystem II and I
    2. In the Inner thylakoid at Photosystem II
    3. Oxygen
10. 10
    1. Outside Photosystem II
    2. In the ETC
    3. Inside side of the ETC

11. It uses energy to pump protons into an area to create a gradient
12. 12
    1. Photosystem II
    2. Photosystem I
    3. ATP Synthase
13. 13
    1. Water
    2. ETC
14. No
15. 15
    1. $2H_2O$ + Light + $2NADP^+$ + $3ADP$ ⇒ $2NADPH$ + O_2 + $3ATP$
    2. No, they are reactants
    3. 6 Oxygen, 12 NADPH, 18 ATP
16. Light independent reactions
17. Carbon Fixation, Reduction, Regeneration
18. 18
    1. 3
    2. 5
    3. 15
19. 19
    1. 3
    2. 6
    3. 3
    4. 18
20. Exited the cycle in PGAL
21. Adds the carbon from carbon dioxide to the cycle
22. 22
    1. PGAL
    2. The Oxygen on the end is swapped for Hydrogen
    3. 6 ATP and 6 NADPH
    4. No, 6 PGA and 6 PGAL both have 3 carbons each
23. 23
    1. 6
    2. PGA, NADPH, ATP

24. 24

    1. 5
    2. 3 ATP
    3. 15
    4. RuBP
    5. 3
    6. Goes off to produce Glucose and other biomolecules
25. 25

    1. Two, one PGAL has 3 Carbons and Glucose has 6
    2. Two or Six depending on how you count it
    3. 18 ATP and 12 NADPH
26. Back to be reused in other cellular processes, such as photosynthesis again

27. Light depenent creates ATP and other electron carriers essential to the light indepenent reactions, which produce glucose and and recycle the electron carriers

28. 28

$6CO_2$	$12H_2O$	→	$C_6H_{12}O_6$	$6O_2$	$6H_2O$
LD (used)	LD (used)		LID (produced)	LD (produced)	LD (produced)

29. Sunlight → Electrons → ATP → Glucose

30. Cellular Respiration

31. 31

    1. Over time, the carbon dioxide will get used up and turned into oxygen as photosynthesis happens, as the carbon will be taken from the molecule
    2. Oxygen will steadily increase over time as it is the direct product of taking the carbon from the carbon dioxide
    3. RuBP gets used and reused throughout the Calvin cycle, so its concentration will vary throughout the cycle
32. 32

    1. It fails to mention that some water is needed to start the reaction
    2. There are so many intermediary steps to get from light to glucose, such as the production of ATP and the entire Calvin cycle

11. ☑ BR: Photosynthetic Activity Data Analysis

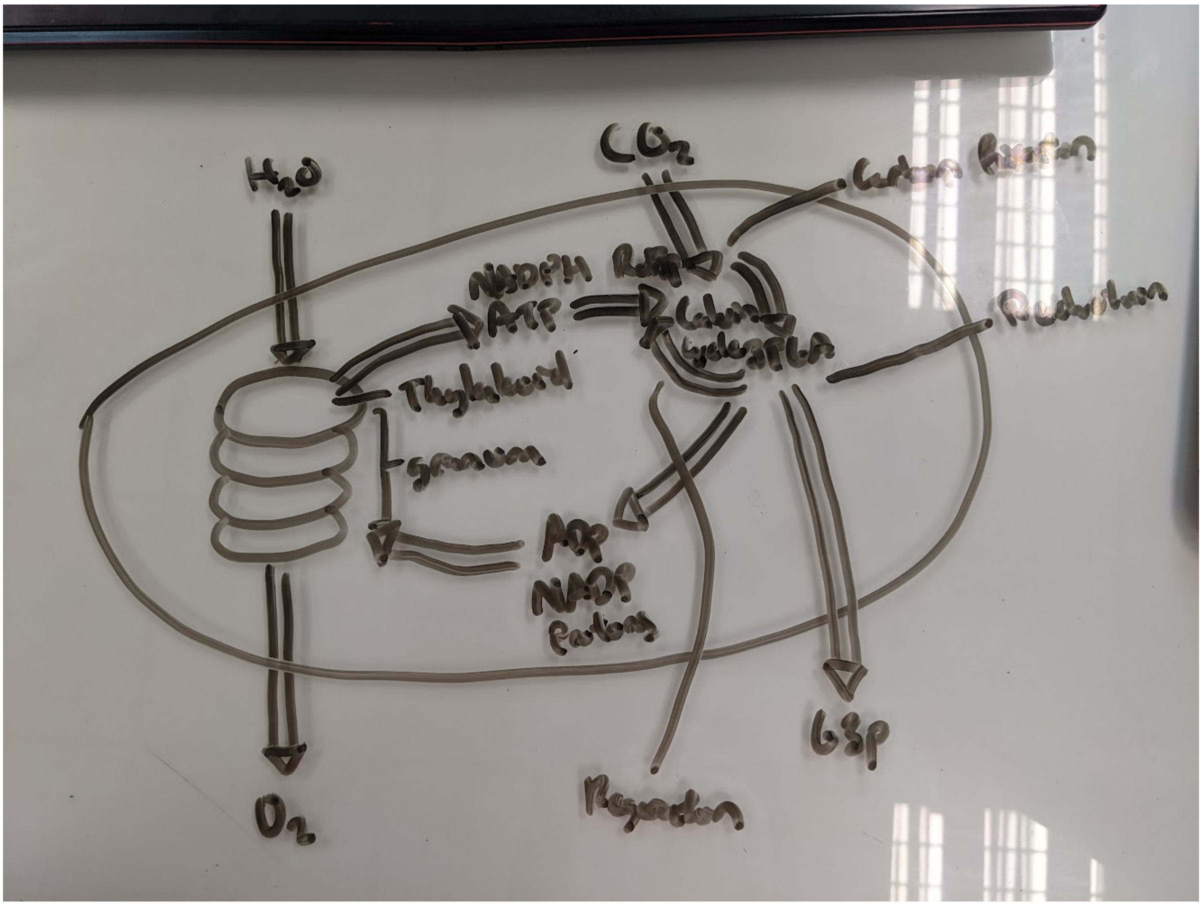
    Photosynthetic Activity

    1. $40^{\circ}C$
    2. 40: $4^{\circ}C$, 50: $10^{\circ}C$

3. It increases as the gap between gross and net increase. Its because the temperature is higher so the molecules move faster and react faster.
4. It begins low, then increases until $40^{\circ}C$ and goes down after that
5. Photosynthesis seems to have an optimum temperature at $40^{\circ}C$ while respiration seems to keep getting faster as the temperature increases.

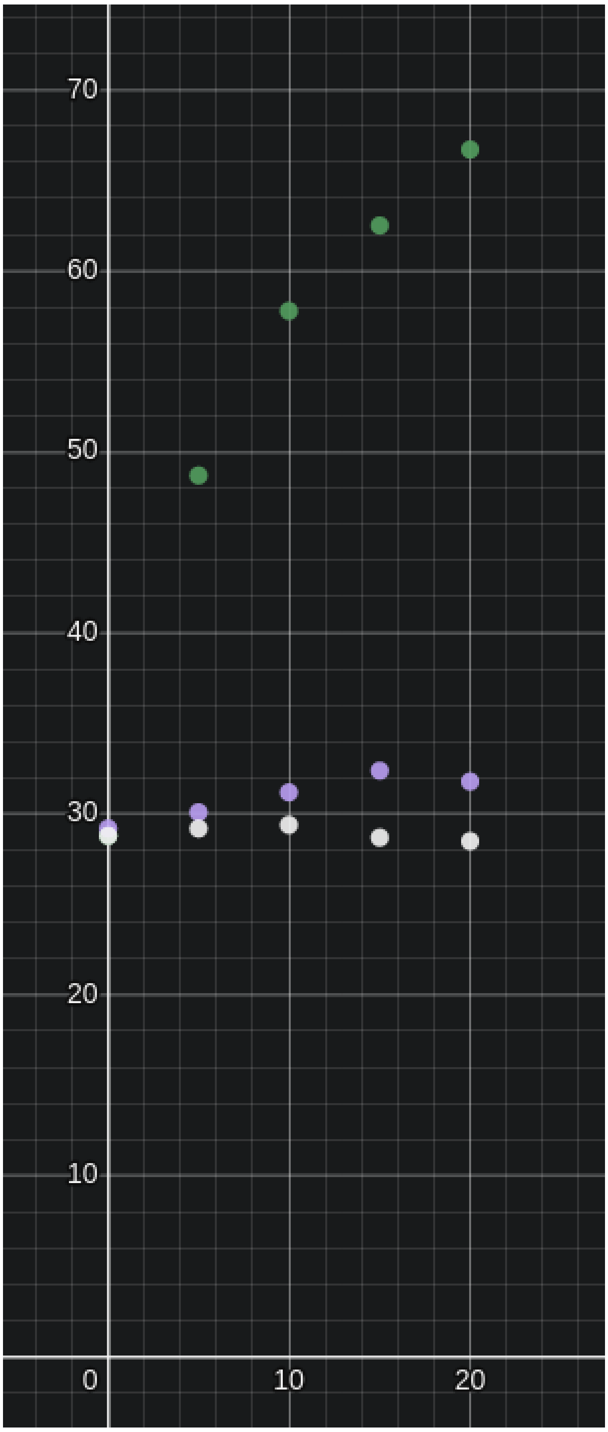
12. ☑ Chalk Talk: Photosynthesis

Photosynthesis



13. ☑ BR: DPIP & Photosynthesis Practice FRQ

DPIP and Photosynthesis

1. 

   x (time in minutes)
   y (%transmittance)
   1. Green: Light, unboiled
   2. Purple: Dark, unboiled
   3. White: Light, boiled
2. Light, unboiled for each time as it is the default without changing anything in its default environment
3. When it is dark, there is less light that the environment, the choloplasts are less active, meaning there is less electrons, which means there is less reduction going on.
   When it is boiled, some of the enzymes needed for photosynthesis are destroyed, which decreases the effectivity of the photosynthetic process

14. ☑ Investigation: Photosynthesis Leaf Disk Lab (Handout only)

Leaf Disc

Leaf Disc Lab

Data

Time (min)	Dark, Bicarb	Dark, Soap	Half, Bicarb	Half, Soap	Light, Bicarb	Light, Soap
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	2	0
5	0	0	0	0	2	0
6	0	1	0	0	2	0
7	0	1	0	0	2	0
8	0	1	0	0	2	0
9	0	1	0	0	2	0
10	0	1	0	0	2	0
11	0	1	0	0	2	0
12	0	1	0	0	2	0
13	0	1	0	0	2	0
14	0	1	0	0	2	0
15	0	2	0	0	2	0

Meta-info

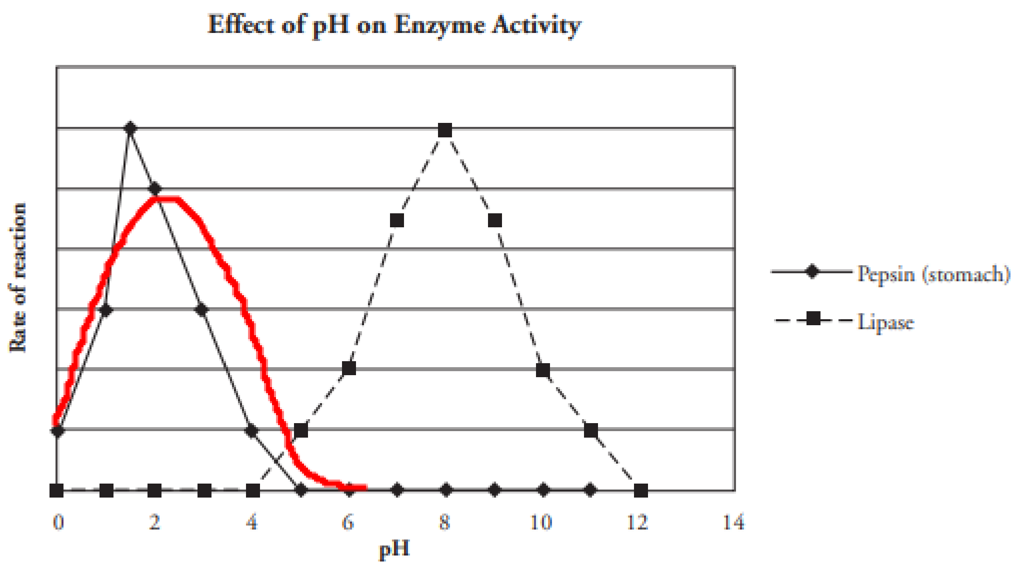
1. Our team sought to see how the intensity of light would effect the photosynthetic rate
2. We predicted that the higher the intensity of light, the faster photosynthesis would occur
3. Our results show that in the non-control groups (bicarb) the higher the intensity, the faster photosynthesis happens

15. [x] Activity: Cellular Respiration--An Overview POGIL

Cellular Respiration

1. Pepsin and Lipase
2. 2
    1. The stomach
    2. Small Intestine
3. 3

Pepsin	1.5
Lipase	8

4. No Lipase, but maximum Pepsin
5. No Pepsin, but maximum Lipase
6. It becomes denatured and malshaped
7. 8, because it is the highest reaction rate
8. 1.5, because it is its peak reaction rate
9. No, since the pH levels are vastly different, the overall shape of the protein will also be vastly different
10. 

11. Decreases its effectivity as Pepsin works best at lower pH levels, and at 6-7 there is very little effectivity
12. 12
    1. Amylase is most effective at 40 degrees, and decreases when moved away from 40 degrees
    2. More enzyme concentration leads to more r.r. in a linear manner
    3. More substrate concentration leads to higher reaction in a logarithmic pattern
13. 13
    1. 40 degrees
    2. In order for it to function well, you'll need to maintain homeostasis at this temperature to maximise effectivity, too high and itll damage the enzyme, too little and the molecules will move too slowly

14. The molecules move slower, so they interact with the enzymes less frequently, slowing down the reaction
15. Since his temperature is closer to the peak rate of reaction for amylase, he will digest carbs faster since the carbs are interacting with the amylase more often due to the faster speeds of the molecules.
16. 16
    1. Linearly increasing, directly related
    2. More enzyme means more faster
17. Respiration produces around 32 to 42 ATP, while fermentation only produces 2 ATP
18. No NAD would be reproduced, and eventually there would not be any NAD to carry any electrons, stopping other functions like glycolysis. Converting the NADH to NAD is important for reusing the NAD, otherwise new NAD would have to be created, which would use more energy than it produces.
19. Since strenuous exercise happens faster than you can supply oxygen for, this forces your muscle cells to break down glucose via fermentation instead of full respiration. The lack of oxygen leads to fermentation which leads to a lactic acid buildup.
20. Oxygen enabled organisms are able to respirate, which is multiple times better at breaking down energy from glucose (about 18x better), this allows them to be more efficient, needing less sugar as food.
21. 21
    1. Fermentation is happening
    2. The cytoplasm breaks down the glucose, but cannot perform respiration without the mitochondrial matrix, this leads to a buildup of lactic acid. The mitochondria would not need to and cannot perform fermentation, so it only breaks down the pyruvate via respiration
    3. The cytoplasm does not have the ability to use oxygen to break down molecules, so it did not have the oxygen part of carbon dioxide. The cytoplasm only does the oxygen independent reactions.
    4. First it converts all the glucose into pyruvate through glycolysis, then all the pyruvate is converted into lactic acid by recycling the NADP, this leads to a buildup of lactic acid
    5. The Mitochondria cannot break down glucose, only the cytoplasm can, so the mitochondria would do nothing with the glucose and the pyruvate would be the proper input, so CO2 would be produced.

16. ☑ Activity: Glycolysis and the Krebs Cycle POGIL

Glycolysis

1. 1

    1. Glucose
    2. 6
2. 2
    1. 3
    2. 2
3. Yes, it takes two ATP, but produces 4 ATP and 2 NADH
4. It has the most potential energy (has the most bonds)
5. Less, it has less bonds and the process to get from glucose to pyruvate produces usable chemical energy
6. 2ATP
7. NAD+
8. From the previous molecule, which got the Pi from the first two ATP
9. Mitochondrion
10. 10
    1. No, pyruvate is a large polar molecule, meaning it probably would not fit through the membrane
    2. With a facilitated transport protein it could be diffused across the membrane
11. A carbon dioxide molecule
12. 12
    1. Pyrivate Oxydase
    2. 2
    3. Acetyl CoA
    4. Has a single bond with the Carbon backbone
13. 0
14. 1 NADH
15. 2 Acetyl CoA, 2 CO_2, 2 NADH
16. Inside the mitochondrial matrix
17. Acetyl-CoA
18. Not directly
19. 19
    1. 4
    2. 6
    3. The acetyl-CoA
20. 20
    1. 5
    2. The creation of a CO_2
21. 21
    1. 4
    2. The creation of a CO_2
22. 3 NADH, 1 ATP, 1 FADH

23. Citrate, it has the most bonds and releases a lot of energy without needing to bond with something else
24. Oxaloacetate, it cannot release any high energy molecules without getting bonds from the Acetyl CoA
25. The Acetyl CoA carries an acetyl group, which is high energy because it fuels the Krebs cycle to produce all the higher energy molecules
26. 2
27. 4 CO_2, 2 ATP, 6 NADH, 2 $FADH_2$
28. No
29. Citrate to α-Ketoglutenase, the main molecule loses free energy, but going from NAD to NADH increases free enrgy
30. 30
    1. Pyruvate, Glucose, and Acetyl CoA
    2. A fat molecule would be able to store many times more energy as it has more bonds and could possibly break down into multiple glucose molecules
    3. Muscles, Heart, Brain

17. Activity: Oxidative Phosphorylation POGIL

    Oxidative Phophorylation

    1. The Edge
    2. 2
        1. The Intermembrane Space
        2. Active pumping out from the Mitochondrial Matrix
    3. It is going against the concentration gradient
    4. 4
        1. NADH, FADH
        2. Krebs Cycle
        3. Water
        4. Oxidation
    5. 5
        1. Oxygen
        2. Water
    6. No
    7. No
    8. Along with the concentration gradient, facilitated diffusion
    9. No, it is going with the gradient so it is lowering its potential energy
    10. ATP Synthase

11. The production of ATP with ATP Synthase
12. ADP
13. 13

-	Number of ATP produced	Number of NADH produced	Number of FADH produced
-	-	NADH	FADH
Glycolysis	2 ATP	2 NADH	0 FADH
Krebs Cycle	2 ATP	8 NADH	2 FADH
Electron Transport Chain	-	x3	x2
Total ATP produced	4ATP	30 ATP	4 ATP
Grand Total			38 ATP

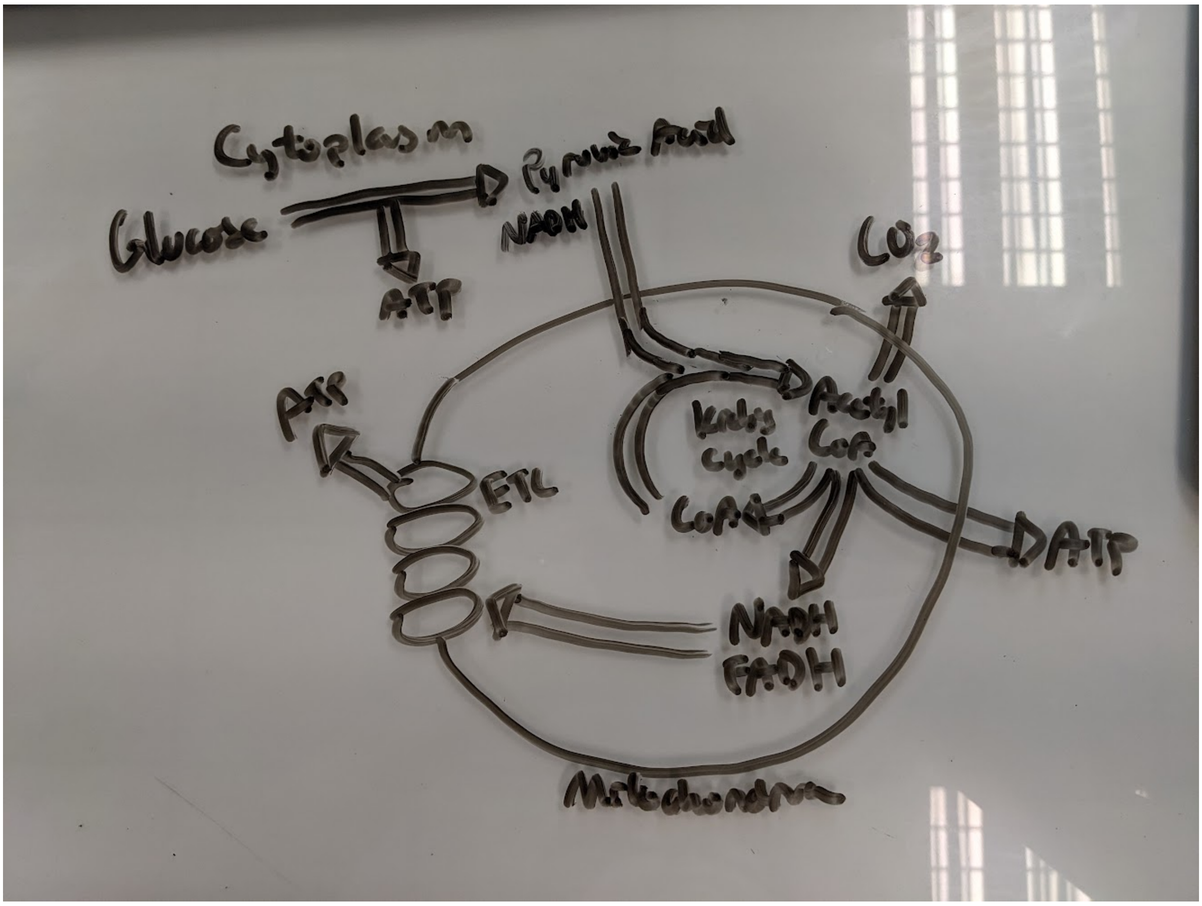
14. 14 ^^
15. It is the final electron acceptor in the electron transport chain, allowing the conversion of NADH and FADH into a proton gradient
16. 16

	Reactants		Products		
	$C_6H_{12}O_6$	$6O_2$	$6CO_2$	$6H_2O$	38 ATP
Phases used	Glycolysis	ETC	Krebs Cycle	ETC	Chemiosmosis
Location	Cytoplasm	Mito. Membrane	Mito. Matrix	Mito. Membrane	Mito. Membrane

17. Oxidative phosphorylation is used to produce ATP from ADP in chemiosmosis. Substrate level phosphorylation is used in glycolysis and krebs cycle.
18. The intermembrane space, as it has a high concentration of protons
19. No energy will be able to be produced and the cell will die
20. 20
    1. Glycolysis and fermentation
    2. The cell membrane

18. ☑ Chalk Talk: Cellular Respiration & Fermentation

Cellular Respiration



19. POGIL: Enzymes

Enzymes

1. Pepsin and Lipase
2. 2
    1. Stomach
    2. Small Intestine
3. 3
    1. 1.5
    2. 8
4. Pepsin is at its maximum reaction rate while Lipase is completely ineffective
5. Lipase is at its maximum reaction rate while Pepsin is completely ineffective
6. Their shape becomes malformed and their active site no longer binds to their matching molecules
7. 4 and 12, they have no function at all
8. 5, it has no function above this pH level
9. No, the pH levels are vastly different leading to different looking enzymes
10. It would look similar to that of Pepsin, high functionality at low pH levels
11. The digestion ability would be greatly hindered as it would change the pH level to a level that isn't suitable for the enzymes in the stomach, greatly lowering its reaction rates
12. 12
    1. The most suitable temperature for Amylase is $40^\circ C$, anything above would destroy the protein and anything below would reduce the speed of reaction

by slowing the molecules
    2. Enzyme concentration is linearly related to reaction rate
    3. Higher Substrate concentration leads to a higher rate of reaction until you reach the saturation of enzymes, at which increasing the substrate concentration would only increase the chances of intersection with an enzyme
13. 13
    1. $40^{\circ}C$
    2. It is its maximum operating temperature before it explodes
14. The proteins begin getting heat sterilized and completely irreversibly dysfuctional
15. It could kill stomach enzymes, but also speed up the reaction rate of those that survive. After long periods of time, its likely that the stomach enzymes would be irreversibly denatured leading to a broken, slow, and ineffective digestion
16. 16
    1. Linearly related, more enzyme means more reaction
    2. If you have one car carrying 5kg, when you have two cars, now you can carry 10kg over the same time (linearly related)
17. Increasing and gently approaching a limit (the saturation of the enzymes) It will never reach the limit because you will never have a substrate perfectly take the place of the previous product immediately, however increasing the substrate concentration leads to less time between production in the enzymes
18. Say you have 10 cars (enzymes) and you need to drive one lap then switch drivers and repeat this indefinitely. If you have more cars, more laps will be driven. If all the drivers (randomly distributed at the end zone) rush for the car after a lap is completed, if there are more people around, the chance that someone will be standing close to the car increases, leading to less down time before another lap can be driven (reducing wasted parked time)
19. Yes, but since it is a limit, it will never be practically reached unless your concentration is infinite, because attaching to an enzyme perfectly immediately after the product has been ejected is practically impossible to consistently reproduce even with a large concentration
20. (shift it $30^{\circ}C$ to the right)
21. 21
    1. The bacteria already lives in a hot environment, so raising its temperature to $95^{\circ}C$ wouldn't likely kill everything in the bacteria and would only delaminate the DNA. If this was done on human polymerase, other damage would likely happen, killing basically all working enzymes
    2. A lot of the rest of the human enzymes and proteins would be destroyed, including primers and other DNA effective machines
22. Linear, more enzyme means more coenzyme
23. Divide everything by like 4