14. Which insecticide has a more damaging effect on chromosomes? Support your answer with data. [1]

Methyl parathion has a more damaging effect because at every data point there were more than 2x the amount of damage to chromosomes.

15. What is missing from this experiment that would help improve the validity of the conclusions one might draw from the results? a control (without any insecticide)

16. Base your answer to the following question on the information below and on your knowledge of biology.

You are the head of the research division of the Leafy Lettuce Company. Your company is experimenting with growing lettuce using hydroponic technology. Hydroponic technology involves growing plants in containers of growth solution in a greenhouse. No soil is used. The growth solution that the company uses contains water, nitrogen, and phosphorus. The company wants to know if adding iron to this formula will improve lettuce growth.

Briefly describe how to test the effect of the formula with iron added. In your description, be sure to:

- State a hypothesis to be tested in the new experiment
- State how the control group will be treated differently from the experimental group
- Identify two factors that must be kept the same in both the experimental and control groups
- State what type of data should be collected to support or refute the hypothesis

- When iron is added to the growing solution, the lettuce grows taller
- The control group's growing solution will have no iron added
- The amount of growth solution, length of time, amount of sunlight, type of lettuce should all be kept the same.
- The length of the lettuce leaves should be collected

↑ dependent variable

The independent variable = amount of iron in growth solution

Scientific Inquiry and Skills

Complete the multiple choice found throughout the topic

Define the following terms:

1. Conclusion: A statement of the findings of an experiment
2. Control Group: The set up that does not have the independent variable applied.
3. Data: The information collected from the experiment, often numeric
4. Experiment: _____
5. Inference: An explanation of how something works.
6. Observation: Things that can be seen, measured, smelled, tasted, felt
7. Scientific Investigations involve what 6 steps:
   1. Defining a problem
   2. Researching information
   3. Create a hypothesis
   4. Design a procedure
   5. Conduct the experiment (collect data)
   6. Make a conclusion
8. Fill in the experimental design guide below with the appropriate definitions:

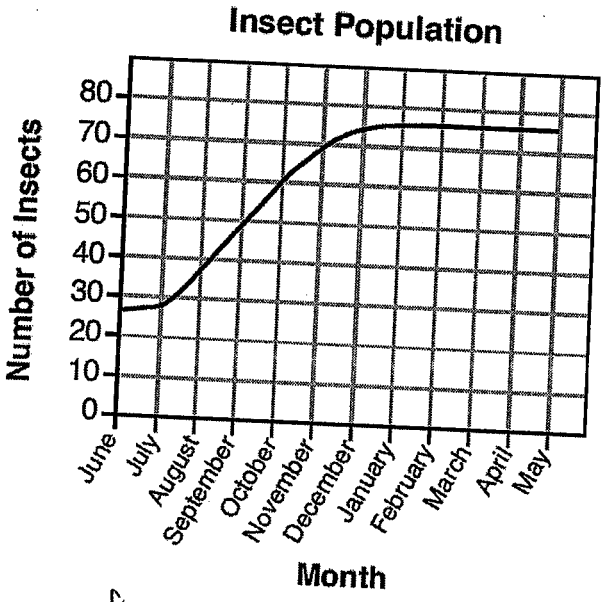
	Definition
Hypothesis	- A proposed explanation made on the basis of limited evidence as a starting point of further investigation
Dependent Variable	- the data collected that changed based upon the independent variable.
Independent Variable	- the one thing the experimentor makes different between the control + the experimental groups.
Controlled Variables	- All other factors in an experiment that must be the same for all setups.

12. Population Growth:

1. Carrying Capacity	The Largest population of any single species that an area can support
2. Limiting factor	Any factor in the environment that limits the size of a population
3. Examples of limiting factors	availability of food or water

13. What is the difference between a biotic and an abiotic factor which limits the growth of a population?

biotic factors are living factors; abiotic factor are non-living

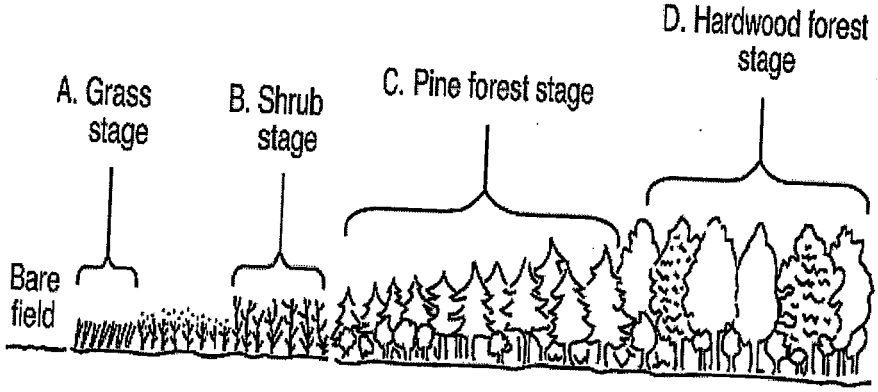


14. Analyze the graph and explain why the insect population doesn't keep increasing.

The population does not keep increasing because it has reached the carrying capacity. The resources are limited and that keeps the population from getting too big.

Succession: one community is replaced by another over time

- Pioneer organisms: first organisms to inhabit an area
  - Example: lichens + mosses
- Climax community: The fully developed ecosystem that remains stable unless the ecosystem changes.
  - Example hardwood forest



16. What is the difference between "natural selection" and "artificial selection"? In natural selection the environment chooses, in artificial selection, humans select.

17. A certain chemical destroys bacteria that have thin cell walls. Bacteria with thick cell walls are not affected. Describe how the introduction of this chemical into a bacteria culture contain both types of bacteria could be used to illustrate the theory of natural selection. Be sure to mention what the selecting agent is.
If the 2 types of bacteria are treated with this chemical (which is the selecting agent) then the thin walled bacteria will die and the thick walled bacteria survive. Nature thus selected the thick walled bacteria who pass their genes onto the next generation.

Ecology and Human Impact

1. Ecology is the study of the interaction of organisms in the ecosystem.

2. Levels of organization:

Biosphere : all of Earths ecosystems together

ecosystem : all the different populations that live and interact in the same environment along with the abiotic Factors

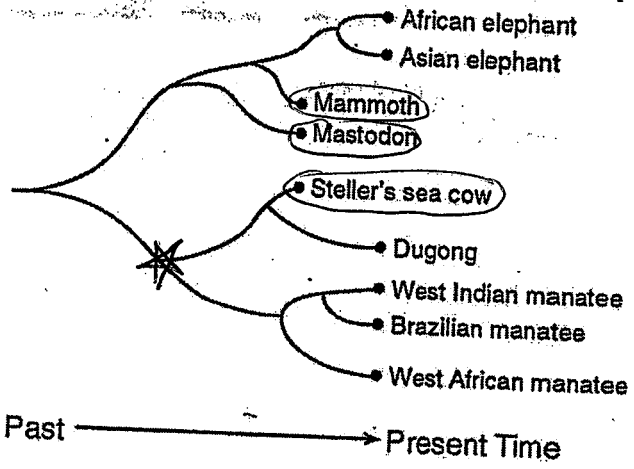
Community : all the populations that interact in a given area

Population : all the organism of a single species in a given area

3. Food Web Vocabulary

Organism	Description	Examples
Autotrophs (producers)	-make their own food most often by photosynthesis	-Flowering plants, grasses, trees
Heterotrophs (consumers)	-must consume food from the environment	-humans, elephants, fungi
Decomposers	Consumes dead organisms and organic wastes. Important in recycling materials	Bacteria + fungi
Scavengers	Carnivores that feed on the bodies of dead organisms	Vultures
Parasites	Lives and feeds on host organisms	Ringworm, tapeworm, ticks

3. The diagram below shows the current theory about the evolutionary relationships between some types of mammals.



4. Star the place on this diagram, which would represent the most recent shared ancestor between the Stellar's sea cow and West African manatee.

5. Circle the organisms, which have gone extinct.

6. Which 2 are more closely related – West Indian Manatee and the Brazilian Manatee OR the Brazilian Manatee and the West African Manatee? Explain.
West Indian manatee and Brazilian Manatee because they branched off of each other more recently

7. What type of evidence, amino acid sequence of proteins or structural comparisons gives the most accurate picture of evolutionary relationships? Explain. Amino acid sequences because it is more closely related to the DNA sequence.

8. Complete the table below to outline the four important parts that make up the theory of natural selection.

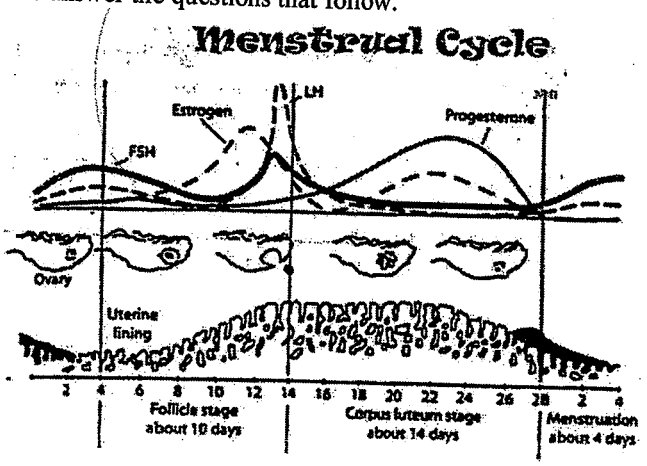
Theory of Natural, Selection	
overproduction	more off spring are made than can survive.
Variation	Due to variation exists within the population
Competition (Struggle for survival)	resources are limited + there is a struggle to survive
~~Mutation~~ Survival of the fittest	Some are better suited to survive

9. Explain why organisms always engage in a "struggle for survival". Give examples of different conditions which can cause this. **Include the word niche.** Ressources are limited and so any 2 organisms who occupy the same niche are going to compete to survive.

14. Fill in the table below.

Parts of the Human Female Reproductive System	
Structure	**Function**
Ovary	-allow for the production of an egg -makes estrogen + progesterone
Fallopian tubes (Oviduct)	-Site of fertilization
Uterus	-Site of implantation, growth + development of embryo, then fetus.
Birth Canal (vagina)	-Site of sperm deposition.

15. Use the diagram below to answer the questions that follow.



a. Overall this cycle occurs in human females each month in preparation for what? pregnancy

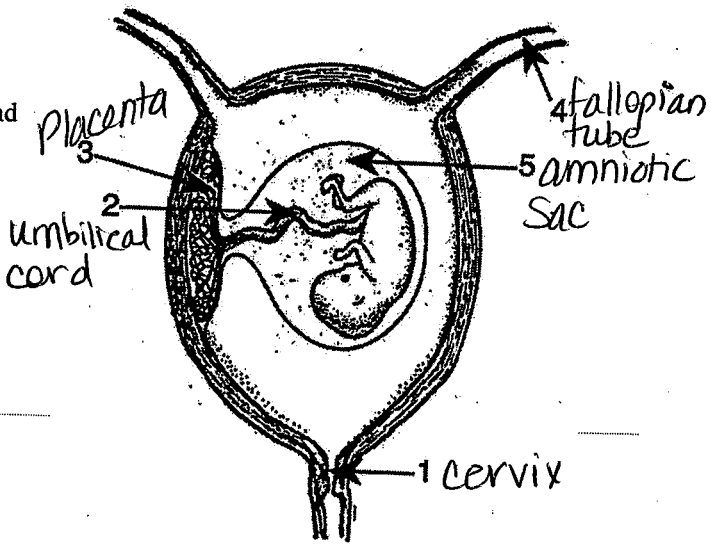
b. On or about which day is the egg released from the ovary? day 14

c. During what days of the cycle is the lining of the uterine shed and what is it called? 1-4

d. When wouldn't the lining be shed? if an embryo implanted in the uterus

e. Which hormones do the ovaries secrete? estrogen + progesterone

16. Label the parts of a fetus in prenatal development.



17. Where does the exchange of nutrients between the mother and the embryo take place? Placenta

18. What harmful environmental factors should women avoid during pregnancy? WHY?

alcohol → brain damage
drugs → brain damage

Regents Review - Reproduction and Development

1. Write the definitions for the following terms:

Cloning: making exact copies genetically of organisms

Differentiation: process of turning on specific genes in specific cells for specific structur + function

Gamete: haploid cells required for sexual reproduction (eggs + sperm)

Gene Expression: turning on of genes to make specific proteins

Meiosis: type of cell division to make haploid cells specifically eggs + sperm

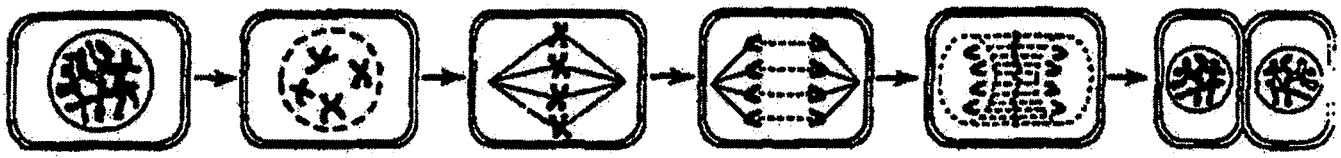
Mitosis: regular cell division for growth + repair

2. Fill in the table below.

	Definition	Genetic Makeup of offspring
Sexual Reproduction	making of offspring with 2 parents	Variety, all offspring different from parent
Asexual Reproduction	making of offspring with 1 parent	all offspring are genetically identical

3. Is cloning asexual or sexual reproduction? Explain. Asexual, offspring are identical to the parent

4. What kind of division is shown below? Asexual, mitosis



5. What are the different reasons organisms (single and multicellular) carry out this this type of division.

Asexual reproduction, growth, repair

6. Fill in the table below.

	# of cell divisions	Exchange of genetic material between chromosomes	# of functioning cells produced from original	Function of cells produced in multicellular organisms	Genetic makeup of final cells produced
Meiosis	2	Yes, crossing over	4	Sexual reproduction	unique
Mitosis	1	no	2	growth, repair	identical to original

15. Summarize what is occurring in numbered steps.

① DNA is opened up so that RNA polymerase can copy the code onto mRNA this process is called TRANSCRIPTION. A→U T→A C→G G→C

② The mRNA leaves the nucleus through a nuclear pore + goes to the ribosome

③ In the ribosome 3 bases are read at a time. (called a codon)

④ Each codon specifies for a unique amino acid. The tRNA brings the specific amino acid to join the polypeptide chain (Protein) this process is called translation

16. If parents want to find out if their baby has a disease a genetic test can be done. Prepare the sequences below for genetic testing by "cutting" between every GC (not CG) pair. "Cut" by drawing lines. How are these DNA fragments cut in the lab?

Baby's DNA sequence

AATG|CTTGGG|CT (4, 6, 2)

Normal DNA sequence

GAAG|CTTGGG|CC (4, 6, 2)

Mutated disease DNA sequence

GAAATCTGAG|CT (10, 2)

Create the pattern which would result from running these fragments. Shade the bands.

STD	Baby	Healthy	Disease
11			
10			■
9			
8			
7			
6	■	■	
5			
4	■	■	
3			
2	■	■	■
1			

17. What is this test called? Why do bands move through gel? The test is called a gel electrophoresis and the DNA moves through the gel because of an electric current.

18. What messenger RNA strand would the baby's DNA sequence transcribe? UUA, CGA ACC, CGA

- Where in the cell does this take place? in the nucleus
- What is the amino acid sequence would from as a result of this mRNA? Leu - Arg - Thr - Arg

Second Position

First Position (5' end)	U	C	A	G	Third Position (3' end)
U	UUU, UUC Phe; UUA, UUG Leu	UCU, UCC, UCA, UCG Ser	UAU, UAC Tyr; UAA Stop; UAG Stop	UGU, UGC Cys; UGA Stop; UGG Trp	U C A G
C	CUU, CUC, CUA, CUG Leu	CCU, CCC, CCA, CCG Pro	CAU, CAC His; CAA, CAG Gln	CGU, CGC, CGA, CGG Arg	U C A G
A	AUU, AUC, AUA Ile; AUG Met	ACU, ACC, ACA, ACG Thr	AAU, AAC Asn; AAA, AAG Lys	AGU, AGC Ser; AGA, AGG Arg	U C A G
G	GUU, GUC, GUA, GUG Val	GCU, GCC, GCA, GCG Ala	GAU, GAC Asp; GAA, GAG Glu	GGU, GGC, GGA, GGG Gly	U C A G

d. Where in the cell does this take place? Ribosome

Compare this sequence to the healthy amino acid sequence. Is it likely that the baby has genetic disorder?

This amino acid sequence is the same as the babies. The baby is not going to have the genetic disorder

Normal Sequence Leu. - arg - thr - arg

Topic 3 – Genetics and Reproduction and Development

1. Define the following terms:

Heredity - the study of the inheritance of genes

Genes - instructions for making proteins

Gene Expression - the turning on of genes to initiate the production of a specific protein

Chromosome - DNA wrapped around histones. Human cells have 46 chromosomes/cell

Genetic Engineering - manipulation of genes

Restriction Enzymes - enzymes used to cut DNA at known sites (restriction sites)

Gel Electrophoresis - a test that compares DNA samples cut by restriction enzymes

Selective Breeding - When humans choose which individuals to mate

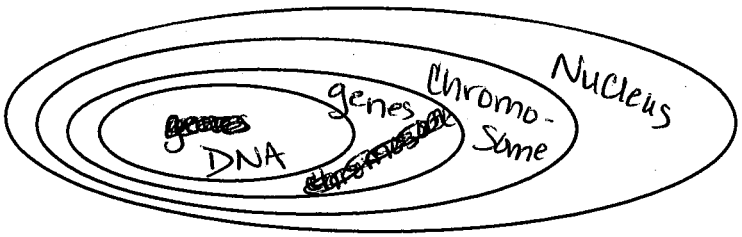
DNA Replication- When DNA makes a copy of itself prior to mitosis or meiosis

Asexual Reproduction - 1 parent makes a copy of its DNA + passes it to offspring (clone)

Sexual Reproduction - 2 parents, each parent gives the offspring 1/2 the DNA

Cloning - exact copies of each other, genetically identical DNA

2. Complete the Venn diagram to show the relationship between **genes, chromosomes, DNA,** and the **nucleus.**



3. How does sexual reproduction bring about new combination of genes and therefore variation?
   ① Crossing over creates new combinations of genes.
   ② Sexual recombinations of genes

4. Mutations can cause variation, What are some causes of mutation?
   ① Random mistakes during replication
   ② Mutagenic agents (ex. X-rays, certain toxins, UV radiation)

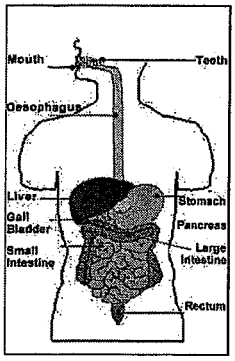
5. What is the main advantage of sexual reproduction over asexual reproduction?
   Sexual reproduction creates more variation which increases the chances of survival of the species in the event of environmental change.

Circle the following - terms that can be associated with sexual reproduction:

One parent, (two parents,) mitosis, (meiosis) (gamete) cloning, (fertilization) identical offspring, (variation)

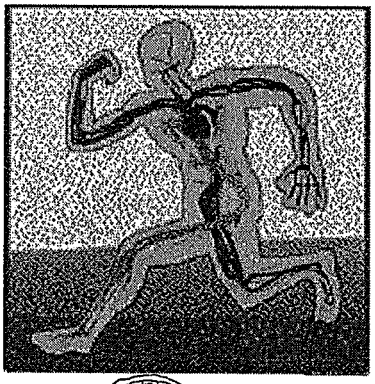
Human Body Systems

1. Name the Body Systems below.



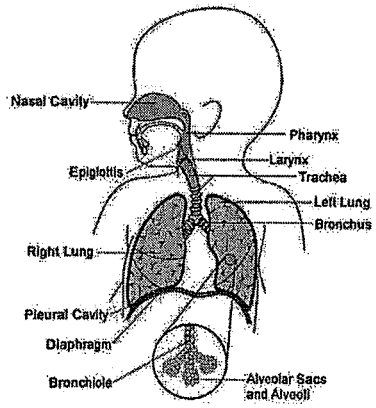
System - Digestive

Facts: takes large food molecules and breaks them down into absorbable molecules.
- Mechanical Digestion
- Chemical Digestion



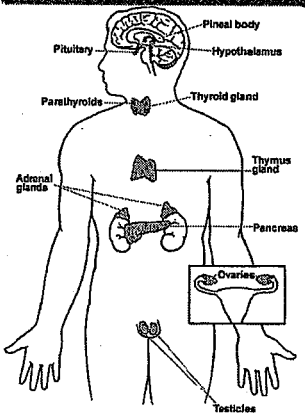
System - Circulatory

Facts: Carries O_2, molecules, waste, hormones, CO_2
Capillaries - diffusion
Arteries - away from ♡
Veins - towards ♡



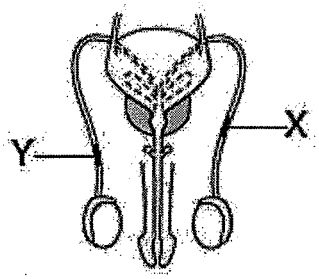
System - Respiratory

Facts: Site of gas exchange
O_2 in
CO_2 out



System - Endocrine

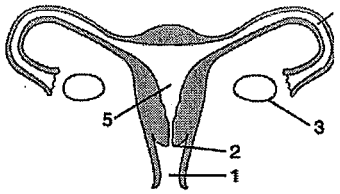
Facts: produce hormones which regulate Chemistry of the blood.



Male

System - Reproduction

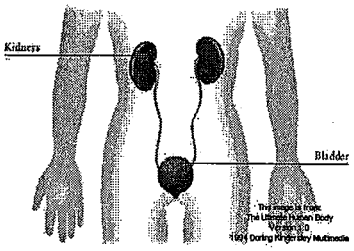
Facts: produces sperm and deposits them into the female



.4 Female

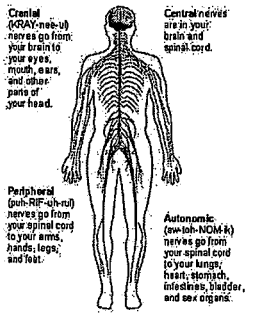
System - Reproductive

Facts: produces egg, receives semen, sperm swim into the fallopian tube where fertilization occurs.



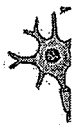
System - Excretory

Facts: Filters the blood by removing wastes, water and salts



Dei
c

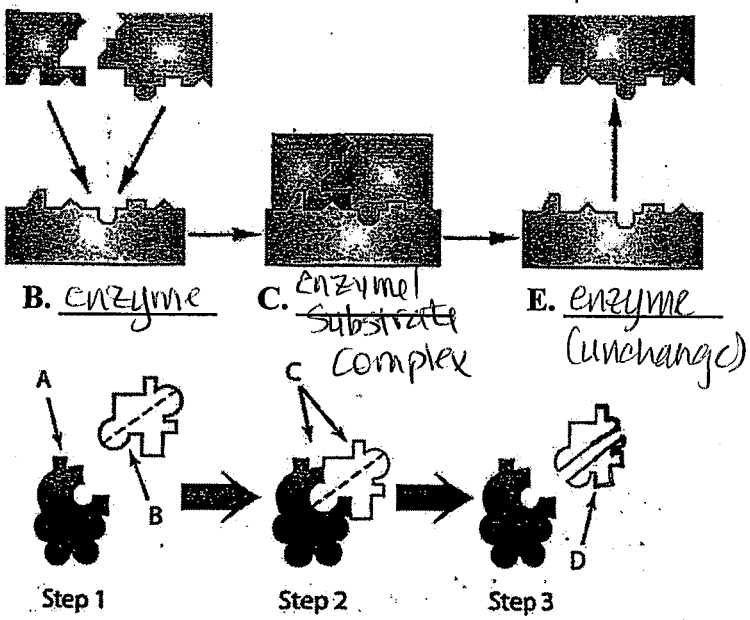
Myelin



System - Nervous

Facts: Controls all of the body systems via nervous impulses.

5. Label the following diagrams and explain whether it is digestion or synthesis. Explain your answer.



A. Substrate

B. enzyme

C. Enzyme/ ~~Substrate~~ Complex

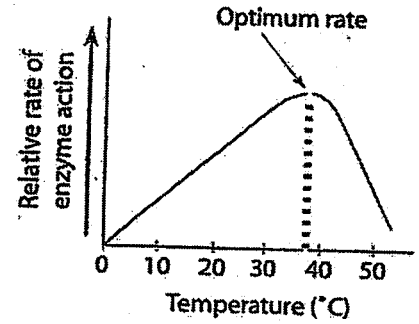
D. Product

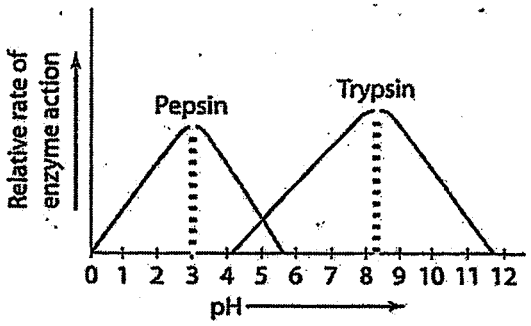
E. enzyme (unchanged)

Synthesis - 2 smaller molecules are joining to make 1 larger molecule. ex. 2 amino acids join to make a dipeptide.

Digestion - 1 large substrate goes in... 2 small molecules leave as end products.

6. Study the graphs below and explain how temperature and pH can either quicken or slow the rate of enzyme action.





An increase in temperature from 0→37°C causes an increase in enzyme activity. Above 37°C it slows down + enzyme can denature.

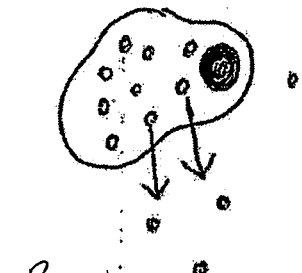
Pepsin works best at a pH of 3 which is perfect b/c it is in the stomach.
Trypsin works best at a pH of about 8.2.

7. Define Dynamic Equilibrium- _____

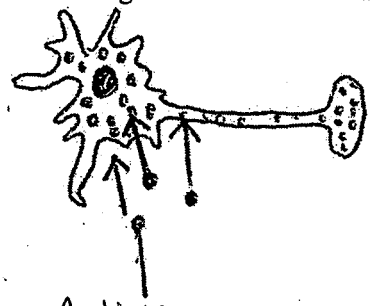
8. Define Feedback Mechanism - feedback mechanisms work by _____

10. What is the name of the transport that requires energy? Name some examples of this type of transport. - Active Transport - phagocytosis, endocytosis, exocytosis

11. Identify the following diagrams as showing either diffusion or active transport.



Passive



Active

Passive

12. Describe the process by which the red onion in Diagram A can be made to appear like Diagram B without raising the cover slip on the slide. [1]

Diagram A

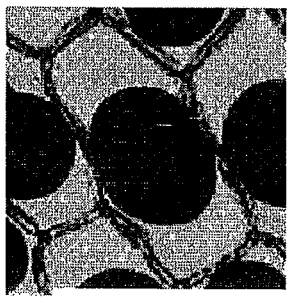


Diagram B

using a dropper (pipette) filled with saltwater on one side of the coverslip and paper towel slightly under the coverslip on the opposite side, begin dropping salt water. The paper towel on the opposite side will pull the saltwater across

13. What process is responsible for the change from Diagram A to Diagram B? [1] _____

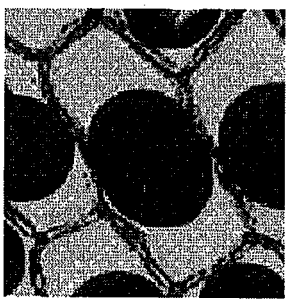


Diagram C

Diagram D

14. Describe the technique in which the onion in Diagram C can be made to look like the one in Diagram D without raising the cover slip on the slide. [1]

This time drop distilled water on one side of coverslip while paper towel is on the other side.

4.

Big Three Organic Compounds	Made of what building blocks?	Big Structural Characteristic	Job in organism
Carbs	- glucose - monosaccharides		- used for cellular respiration to make ATP.
Lipids	- glycerol + 3 fatty acids		- stored energy
Proteins	- Amino Acids		- building blocks of human proteins

5.

Levels of Organization from SMALLEST to LARGEST	Example from each level
Atom	Carbon (C)
molecules	$C_6H_{12}O_6$ (glucose)
organelle	mitochondria
Cell	muscle cell
tissue	muscle tissue
organ	muscle
organ systems	musculoskeletal system
Organism	human being