~My Copy~

The Living Environment Regents Review Packet

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June 16' (Ecology)
#52, 65, 66, 67, 68-69
70-72

VOCAB LISTS

TOPIC 1

Active Transport
Amino Acids
Cell
Cell Membrane
Cell Respiration
Chloroplast
Circulation
Cytoplasm
Digestion
Diffusion
Enzymes
Excretion
Homeostasis
Hormone
Immunity
Inorganic
Metabolism
Mitochondria
Nucleus
Organ
Organ System
Organelle
Organic
Receptor Molecule
Respiration
Reproduction
Ribosome
Simple Sugars
Synthesis
Tissue
Vacuole

TOPIC 2

AIDS
Allergy
Antibodies
Antigen
ATP
Bacteria
Biochemical Processes
Catalyst
Cellular Respiration
Chloroplast
Disease
Dynamic Equilibrium
Enzyme
Feedback Mechanism
Fungi
Gas Exchange
Glucose
Guard Cells
Homeostasis
Immune System
Insulin
Microbe
Mitochondria
Pancreas
Parasite
Pathogen
pH
Photosynthesis
Respiration
Stimuli
Synthesis
Vaccine
Virus

TOPIC 3

Asexual Reproduction
Biotechnology
Bond
Chromosome
Clone
DNA
Egg
Expressed Genes
Genetic Engineering
Genetic Recombination
Heredity
Mutation
Replicate
Selective Breeding
Sexual Reproduction
Sperm
Subunit
Template
Traits

TOPIC 4

Asexual Reproduction
Cloning
Differentiation
Egg
Embryo
Estrogen
Expressed
Fertilization
Fetus
Gamete
Gene Expression
Meiosis
Mitosis
Ovaries
Placenta
Progesterone
Recombination
Sex Cell
Sexual Reproduction
Species
Sperm
Testes
Testosterone
Uterus
Zygote

TOPIC 5

Adaptive Value
Evolution
Extinction
Fossil Record
Genetic Variation
Geologic Time
Mutation
Natural Selection
Overproduction
Theory

TOPIC 6

Abiotic
Autotroph
Biodiversity
Biosphere
Biotic
Carnivore
Carrying Capacity
Community
Competition
Consumer
Decomposer
Ecology
Ecological Niche
Ecological
Succession
Ecosystem
Energy Pyramid
Environment
Food Chain
Food Web
Habitat
Herbivore
Heterotroph
Host
Limiting Factors
Parasite
Population
Predator
Prey
Producer
Scavenger

Deforestation
Direct Harvesting
Energy Flow
Fossil Fuel
Global Warming
Industrialization
Nonrenewable
Resource
Nuclear Fuel
Ozone Shield
Pollution
Renewable
Resource
Technology
Trade-off
Water Cycle

EXPERIMENTAL DESIGN TERMS

Assumption
Bias
Conclusion
Control
Controlled
Experiment
Data
Dependent Variable
Evidence
Experiment
Hypothesis
Independent
Variable
Inference
Model
Observation
Opinion
Peer Review
Research Plan
Scientific Literacy

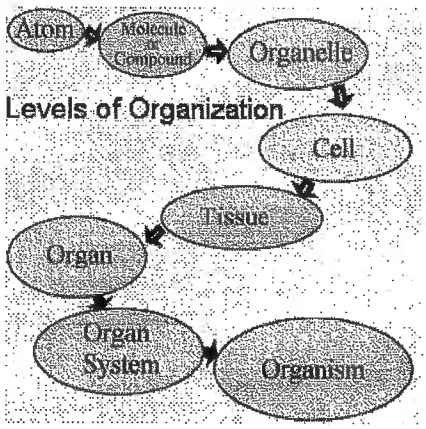
LAB TERMS

Balance
Chromatography
Compound Light
Microscope
Dichotomous Key
Dissection
Electronic Balance
Electrophoresis
Graduated Cylinder
Indicator
Magnification
Mass
Metric Ruler
Microscope
Stain
Stereoscope
Triple-Beam Balance
Volume

Study all of these terms for the Regents

Topic 1: Living Things

Organization of living things:



Cells are the smallest units of life.

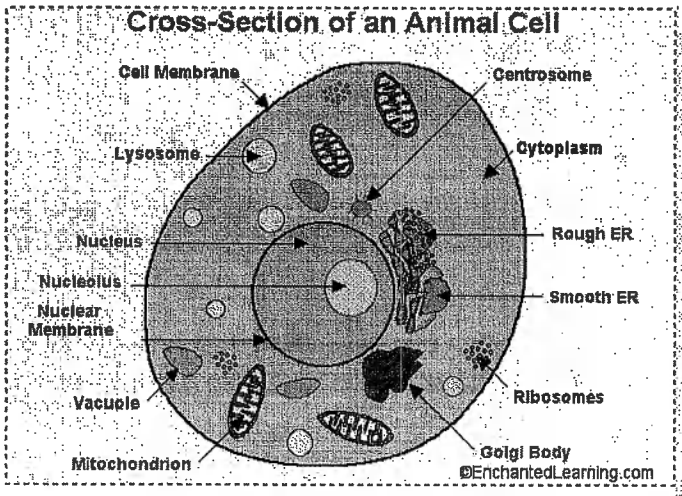
Organelles are the structures inside the cell.
Nucleus- Contains DNA (genetic information) that controls the production of proteins

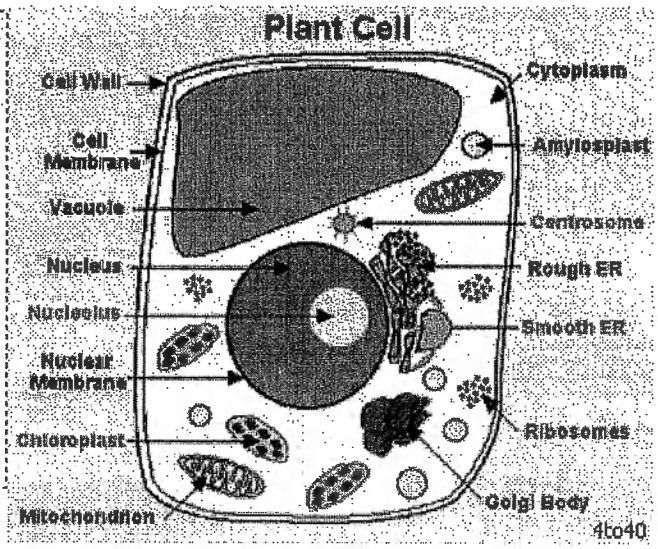
Ribosomes- Read the message sent from DNA and places AA in the correct order to form a protein. (order of AA determines SHAPE and Function of the protein)

Mitochondria- Site of Cellular Aerobic Respiration; makes ATP other metabolic activities needed to stay alive

Vacuoles- Store food (food vacuoles) or wastes

Cytoplasm- fluid (mostly water) where many chemical reactions take place.





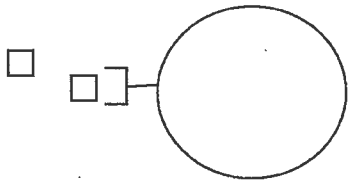
Cell Membrane-controls what goes in (nutrients and O_2)or out (CO_2 and wastes) of the cell.
Selectively permeable- only certain substances can pass through the membrane.

Diffusion- molecules move from a high concentration to a low concentration with no energy required. **Osmosis** is the diffusion of water.

Example) A cell has 95% water on the inside and 90% water on the outside. Water will move out of the cell (high to low).

Active Transport- molecules move from a low concentration to a high concentration ENERGY is REQUIRED. The energy used by cells is **ATP**.

Receptor Molecules- on the cell membrane; the shape determines what substances it can attach to and bring into the cell.



Plant Cells have all of this Plus....

Chloroplasts- Site of Photosynthesis

- contains a green pigment called Chlorophyll

Super Large Vacuole- Store water and sugar

Life Functions:

1. **Nutrition**- nutrients are needed for energy (ATP), repair and growth.
   Autotrophic Organisms- take in inorganic molecules (CO_2 and H_2O) to from complex organic compounds (like glucose $C_6 H_{12} O_6$) Ex.) Plants/Producers do photosynthesis
   Heterotrophic Organisms- cannot make their own food and rely on other organisms for food
   - Starches → simple sugars (glucose is an example)
   - Proteins → amino acids
   - Lipids → fatty acids and glycerol

2. **Transport**-materials must be distributed throughout the cell or body (nutrients, wastes, hormones, oxygen, antibodies...).

3. **Respiration** – Energy (ATP) is released from the bonds of glucose; happens in the mitochondria of the cells

4. **Metabolism**- all chemical reactions in an organism. **Synthesis** is the process of making materials in the body such as using nutrients to make proteins needed by the organism.

5. **Regulation and Coordination**- to maintain Homeostasis cells must be able to communicate (coordinate actions). Nerves and Hormones carry these messages to the

"target" cells. The target cell recognizes that the message because they have receptors on their membranes.

6. **Excretion**- gets rid of toxic waste products from cellular processes. This is different from elimination (digestive waste = feces)

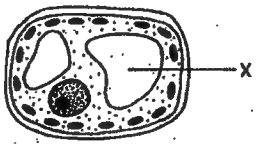
Topic 1
Homework Questions

Due 6/5 Monday 1-15

1 1. Which structures could most likely be observed in cells in the low-power field of a compound light microscope?
(1) cell walls and chloroplasts
(2) ribosomes and chromosomes
(3) vacuoles and oxygen
(4) carbon dioxide and mitochondria

2 2. Which organelles must be present within a cell of a geranium leaf for respiration and photosynthesis to occur?
(1) cell wall and cytoplasm
(2) mitochondrion and chloroplast
(3) cell membrane and nucleus
(4) vacuole and ribosome

2 3. In the diagram of a cell below, the structure labeled *X* enables the cell to



(1) release energy
(2) store waste products
(3) control cell activities
(4) manufacture proteins

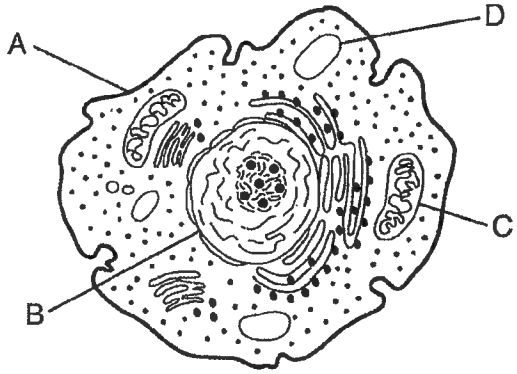
2 4. If the ribosomes of a cell were destroyed, what effect would this most likely have on the cell?
(1) It would stimulate mitotic cell division.
(2) The cell would be unable to synthesize proteins.
(3) Development of abnormal hereditary features would occur in the cell.
(4) Increased protein absorption would occur through the cell membrane.

3 5. Which structures carry out life functions within cells?
(1) tissues
(2) organ systems
(3) organelles
(4) organs

3 6. Certain poisons are toxic to organisms because they interfere with the function of enzymes in mitochondria. This results directly in the inability of the cell to
(1) store information
(2) build proteins
(3) release energy from nutrients
(4) dispose of metabolic wastes

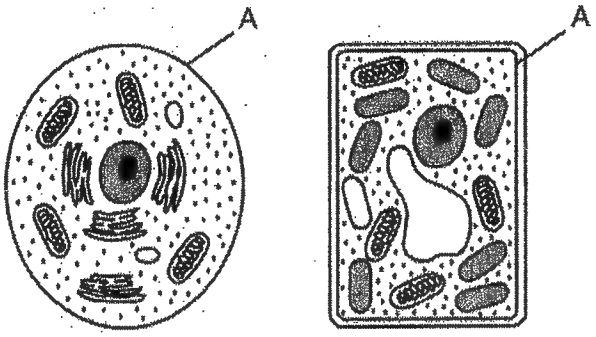
4 7. Which sequence shows a *decreasing* level of complexity?
(1) organs → organism → cells → tissues
(2) organism → cells → organs → tissues
(3) cells → tissues → organs → organism
(4) organism → organs → tissues → cells

3 8. The diagram below represents a cell.



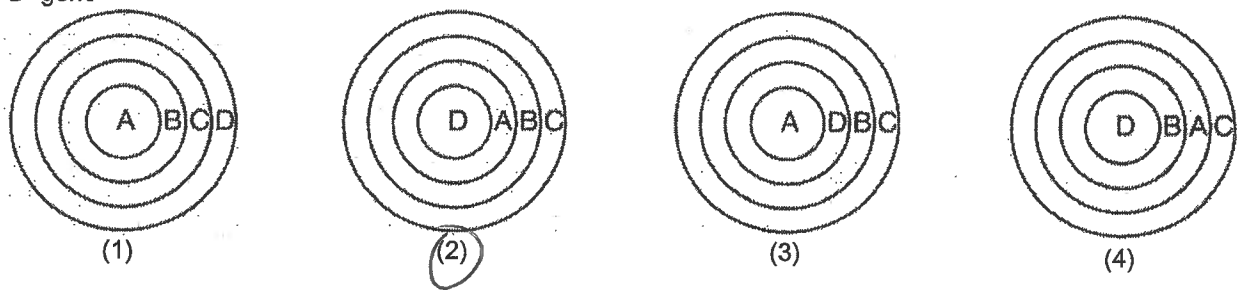
Which statement concerning ATP and activity within the cell is correct?
(1) The absorption of ATP occurs at structure *A*.
(2) The synthesis of ATP occurs within structure *B*.
(3) ATP is produced most efficiently by structure *C*.
(4) The template for ATP is found in structure *D*.

1 9. The diagram below represents two cells, *X* and *Y*.



Which statement is correct concerning the structure labeled A?
(1) It aids in the removal of metabolic wastes in both cell *X* and cell *Y*.
(2) It is involved in cell communication in cell *X*, but not in cell *Y*.
(3) It prevents the absorption of CO_2 in cell *X* and 0_2 in cell *Y*.
(4) It represents the cell wall in cell *X* and the cell membrane in cell *Y*.

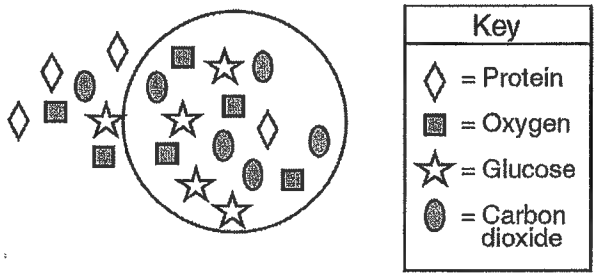
2 10. Which diagram best represents the relative locations of the structures in the list below?
A–chromosome
B–nucleus
C–cell
D–gene



3 11. Hereditary information is stored inside the
(1) ribosomes, which have chromosomes that contain many genes
(2) ribosomes, which have genes that contain many chromosomes
(3) nucleus, which has chromosomes that contain many genes
(4) nucleus, which has genes that contain many chromosomes

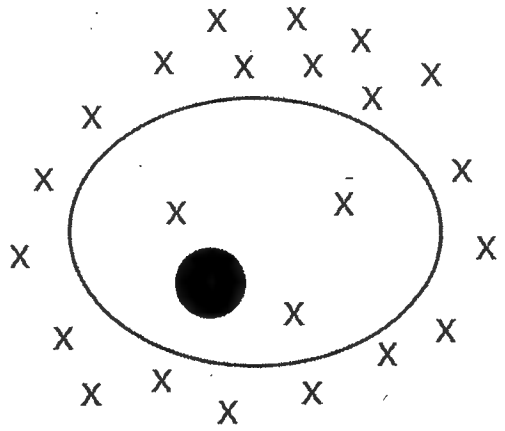
2 12. Which statement best explains why some cells in the reproductive system only respond to certain hormones?
(1) These cells have different DNA than the cells in other body systems.
(2) These cells have specific types of receptors on their membranes.
(3) Reproductive system cells could be harmed if they made contact with hormones from other body systems.
(4) Cells associated with the female reproductive system only respond to the hormone testosterone.

3 13. The diagram below shows the relative concentration of molecules inside and outside of a cell.



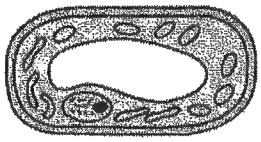
Which statement best describes the general direction of diffusion across the membrane of this cell?
(1) Glucose would diffuse into the cell.
(2) Protein would diffuse out of the cell.
(3) Carbon dioxide would diffuse out of the cell.
(4) Oxygen would diffuse into the cell.

2 14. The diagram below shows molecules represented by *X* both outside and inside of a cell.



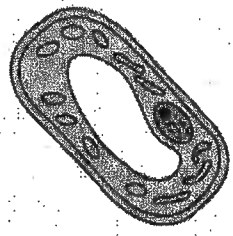
A process that would result in the movement of these molecules out of the cell requires the use of
(1) DNA
(2) ATP
(3) antigens
(4) antibodies

3 15. The diagram below represents a plant cell in tap water as seen with a compound light microscope.

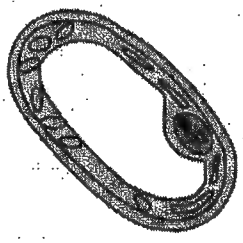


Which diagram best represents the appearance of the cell after it has been placed in a 15% salt solution for two minutes?

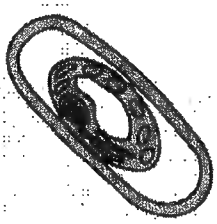
(1)



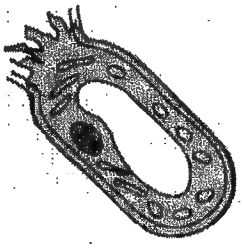
(2)



(3)



(4)



Topic 2: Homeostasis in Living Things

Homeostasis is the internal stability that all organisms maintain. Biochemical processes occur in living things and are essential for their survival.

Energy Storing Process- PHOTOSYNTHESIS

Equation in words: Water + Carbon Dioxide →Glucose + Oxygen

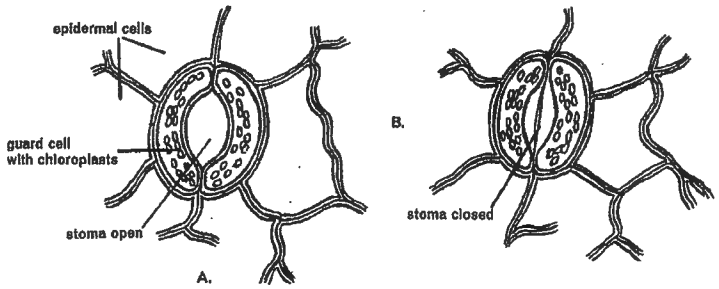
Equation in chemical symbols: $H_2O + CO_2 \rightarrow C_6H_{12}O_6 + O_2$

*Happens in the chloroplasts of plant cells (chlorophyll is the pigment needed)

*Light energy from the sun is converted into chemical energy

Stomates- holes on the bottoms of leaves that open and close

- let CO_2 in (when open)
- conserve water (when closed)
- special cells called **guard cells** control the opening or closing of the holes.



A. and B. SURFACE VIEW OF GUARD CELLS AND STOMA

Energy Releasing Process: CELLULAR RESPIRATION

Equation in words: Glucose + Oxygen →Water + Carbon Dioxide + ATP

Equation in chemical symbols: $C_6H_{12}O_6 + O_2 \rightarrow H_2O + CO_2 + ATP$

*Happens in the mitochondria of all cells

*Chemical energy from glucose is converted into ATP which is a form of energy used by cells.

Organism- All systems working together to maintain life and homeostasis

- **Digestive system**- digest and absorb nutrients

- **Respiratory System**- Gas exchange (oxygen & carbon dioxide)
- **Immune System**- protects the body from viruses and bacteria (pathogens/antigens)
    - Pathogens- disease causing organisms (virus, bacteria, fungus, microorganisms, protists)
    - Antigens are like protein name tags that have a special shape the white blood cells can recognize the name tags to
    - White Blood Cells- produce antibodies that have a special shape to fit into or recognize the bad pathogens/antigens and destroy them or label them for destruction. (immune response).
    - Vaccines- dead or weakened pathogen injected into your body so the WBC can "practice" making antibodies for it...makes a person IMMUNE to the pathogen.
    - Antibiotics- medications given to fight bacterial infections.
    - Allergy- body makes antibodies to harmless antigens (pollen, dust, peanut butter)
    - AIDS- H.I.V. destroys WBC...no immunity
- **Nervous System**- used for fast communication between cells to maintain homeostasis.
- **Endocrine System**- Hormones (chemical message) is sent through the blood to a target cell/organ that has the correct shaped receptors.
    - **Feedback Mechanisms**-maintain homeostasis by regulating the amount of sugar, water, calcium in your body/blood
    - Ex. If blood sugar is too high, insulin is released from the pancreas to bring it back to normal levels.
- **Excretory System**- removes wastes from the body (kidneys, skin, lungs)
- **Skeletal/muscular System**- Locomotion

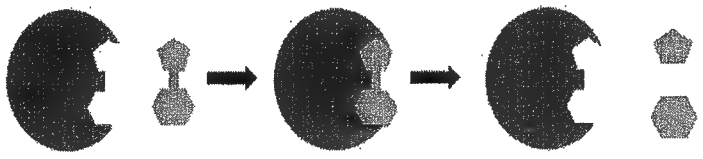
Dynamic Equilibrium- the constant small corrections that must occur to maintain homeostasis

Enzymes-Specially shaped proteins that digest or synthesize large molecules. They are needed for most metabolic activities (homeostasis/equilibrium)

- Enzymes are specific in their action and their substrate (what they digest or synthesize) Substrate "fits" into the enzyme

Ex.) protease digests proteins, Lactase digests lactose, Lipase digests lipids

- Enzymes are catalysts (increase the rate of the reaction)

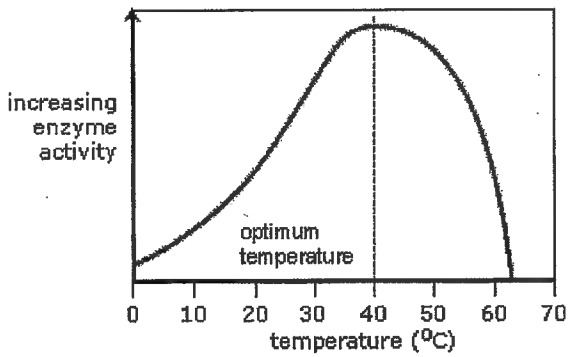


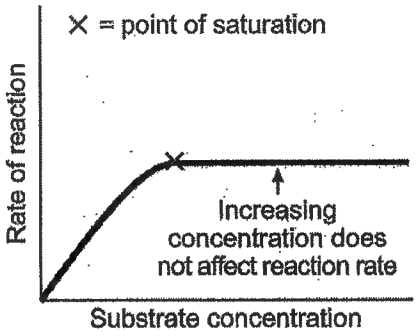
Enzyme + Substrate | Enzyme-Substrate Complex | Enzyme + Products

Ex. Starch will eventually breakdown into simple sugars but...Enzymes make the reaction happen 1000 times faster.

- if you change the shape of an enzyme (denature), you change the speed of it or make it stop functioning.

Factors affecting Enzyme Activity- Temperature, pH (acidic/basic) and amount of enzyme or substrate affect the rate at which enzymes work...Every enzyme has an optimal (best) temp and pH that it can work the fastest (highest rate). Temp & pH graphs look similar. Concentration of



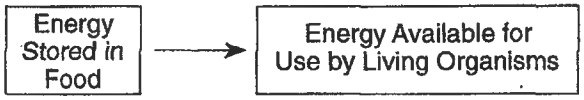


enzyme & substrate graphs look similar.

Homework Topic 2

Due 6/6 Tuesday 1-29

2 1. Which process is represented by the arrow in the diagram below?



1) growth
2) respiration
3) regulation
4) excretion

3 2. In photosynthesis, chlorophyll functions in changing

1) glucose molecules to starch
2) water and carbon dioxide to sugar
3) light energy to chemical bond energy
4) hydrogen bonds to water

3 3. The basic inorganic materials used during photosynthesis are

1) H_2O AND $C_6H_{12}O_6$
2) O_2 and CO_2
3) H_2O and CO_2
4) $C_6H_{12}O_6$ and CO_2

1 4. Bromthymol blue turns to bromthymol yellow in the presence of carbon dioxide. When the carbon dioxide is removed, the solution will return to a blue color. Two green water plants were placed in separate test tubes, each containing water and bromthymol yellow. Both test tubes were corked. One tube was placed in the light, the other in the dark. After several days, the liquid in the tube exposed to the light turned blue.

This demonstration illustrates that, during photosynthesis, green plants

1) take in carbon dioxide
2) need bromthymol blue
3) give off oxygen gas
4) form ATP molecules

2 5. Most of the oxygen in the atmosphere results from the process of

1) fermentation
2) photosynthesis
3) regulation
4) respiration

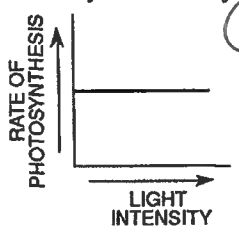
4 6. Most of the food and oxygen in the environment is produced by the action of

1) saprophytic bacteria
2) heterotrophic organisms
3) aerobic protozoans
4) autotrophic organisms

1 7. Photosynthesis transforms molecules of water and carbon dioxide into molecules of

1) carbohydrate and oxygen
2) carbohydrate and nitrogen
3) polypeptide and oxygen
4) polypeptide and nitrogen

3 8. If the leaves of a geranium plant receive an adequate supply of raw materials, which graph shows how the rate of photosynthesis is related to increasing light intensity received by the plant?

1)


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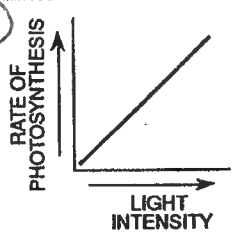

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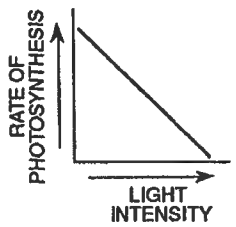

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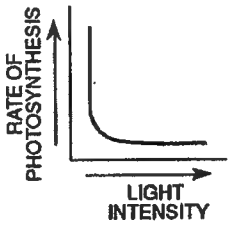
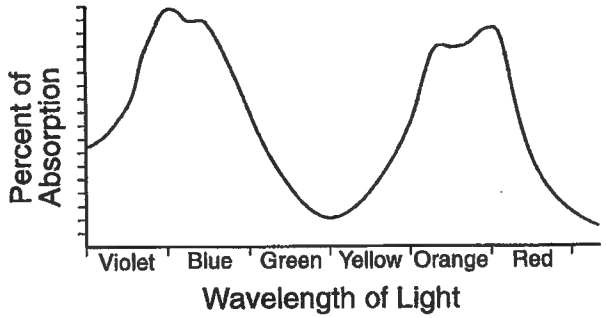


3 9. The graph below represents the absorption spectrum of chlorophyll.



The graph indicates that the energy used in photosynthesis is most likely obtained from which regions of the spectrum?

1) yellow and orange red
2) violet blue and green
3) orange red and violet blue
4) green and yellow

Homework Topic 2

3 10. Anaerobic respiration is considered to be less efficient than aerobic respiration because

1) less lactic acid is formed during anaerobic respiration than aerobic respiration
2) anaerobic respiration requires more oxygen than aerobic respiration
3) the net gain of ATP molecules is less in anaerobic respiration than in aerobic respiration
4) less energy is required during anaerobic respiration than aerobic respiration

1 11. Which word equation represents a type of fermentation?

1) glucose → lactic acid + energy
2) glucose + oxygen → carbon dioxide + water + energy
3) starch + water → simple sugars
4) carbon dioxide + water → glucose + oxygen + water

2 12. The products produced by yeast cells as a result of anaerobic respiration include ATP and

1) alcohol and oxygen
2) alcohol and carbon dioxide
3) water and oxygen
4) water and carbon dioxide

3 13. In a green plant cell, oxygen is used primarily for the process of

1) dehydration synthesis
2) photosynthesis
3) respiration
4) capillary action

4 14. In animals, the organelles in which aerobic cellular respiration occurs are known as

1) ribosomes
2) chloroplasts
3) nuclear membranes
4) mitochondria

3 15. Which substance is represented by *X* in the word equation below?

glucose + *X* →enzymes → water + carbon dioxide + ATP

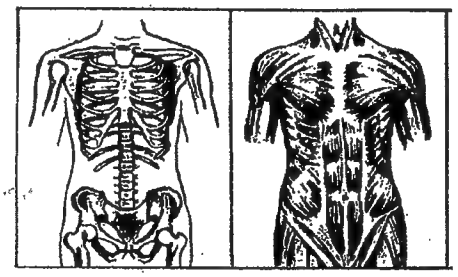
1) alcohol
2) chlorophyll
3) oxygen
4) lactic acid

1 16. In humans, what happens when the breathing rate increases?

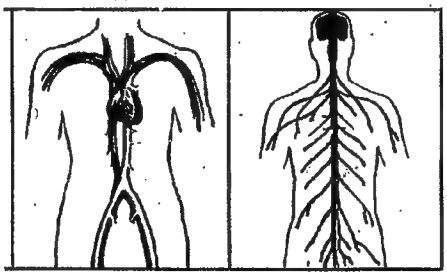
1) Additional oxygen will diffuse into the blood as carbon dioxide diffuses out of the blood in the lungs.
2) Additional carbon dioxide will diffuse into the blood as oxygen diffuses out of the blood in the lungs.
3) Oxygen from body cells will diffuse more rapidly into red blood cells.
4) Increased oxygen dissolved in the blood will stimulate the cerebrum to slow the breathing rate.

Homework Topic 2

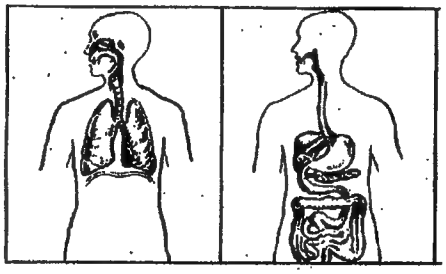
Base your answers to questions **17** through **20** on the diagrams below of organ systems and on your knowledge of biology.



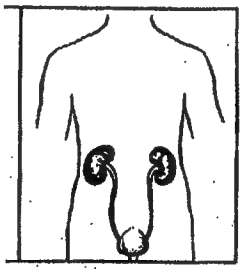
A B



C D



E F



G

2 17. Which disorder would most directly involve an organ in system *F*?

1) anemia
2) constipation
3) bronchitis
4) meningitis

1 18. Tendonitis is a condition that would most directly involve which two systems?

1) *A* and *B*
2) *C* and *D*
3) *E* and *F*
4) *A* and *G*

3 19. Cardiovascular diseases interfere most directly with the normal functioning of system

1) *E*
2) *G*
3) *C*
4) *D*

4 20. Polio is a disease caused by a virus that directly destroys cells in system

1) *A*
2) *B*
3) *C*
4) *D*

Homework Topic 2

1 21. Base your answer to the following question on the reading passage below and on your knowledge of biology.

Polio Vaccines

Polio is a disease that results in the destruction of nerve cells. The first vaccine against polio was developed by Jonas Salk and was made from polio viruses that were killed using the chemical formalin. In 1953, Salk tested the vaccine on himself, his wife, and his three sons. The vaccine was found to be safe and seemed to work. In 1954, more than 1.8 million schoolchildren were part of a trial to test the vaccine, and in April 1955, the vaccine was declared to be safe and effective.

Albert Sabin also developed a vaccine against polio. The vaccine developed by Sabin was made from weakened polio viruses. While the Salk vaccine had to be injected, the Sabin vaccine was administered orally on a cube of sugar.

Both vaccines were found to be effective in protecting people against polio because these vaccines stimulate immune responses involving antibody production. However, the Sabin vaccine is effective over a longer period of time and is easier to administer. Together, these vaccines have nearly eliminated polio in many parts of the world.

Which statement about the Salk vaccine is correct?

1) Dead viruses are injected.
2) Antibodies are injected.
3) Antibodies are administered orally.
4) Sugar cubes are administered orally.

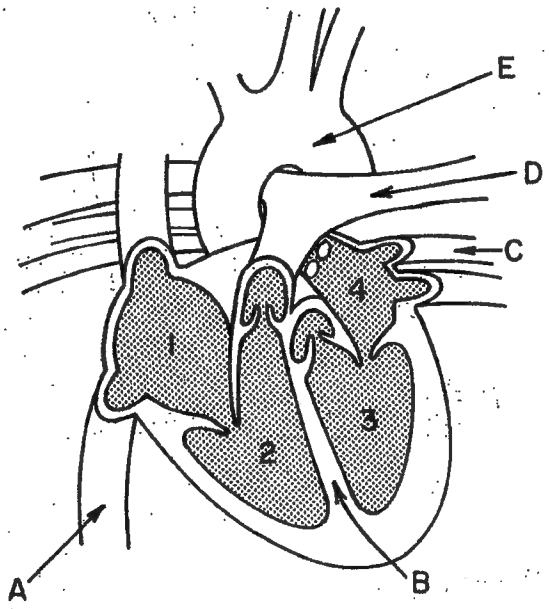
3 22. People who receive organ transplants sometimes produce antibodies in response to foreign proteins present in the organ of the donor. This reaction is an example of

1) regeneration
2) clotting
3) rejection
4) deamination

3 23. An individual who has had chicken pox rarely gets this disease again. This situation is an example of

1) biological control
2) negative feedback
3) active immunity
4) passive immunity

Base your answers to questions **24** through **26** on the diagram of the human heart below and on your knowledge of biology.



3 24. Oxygenated blood from the left lung is returned to the heart through a structure labeled

1) *A*
2) *E*
3) *C*
4) *D*

4 25. Which sequence correctly represents the flow of blood through the heart?

1) 4 → 3 and 2 → 1
2) 2 → 1 and 3 → 4
3) 1 → 2 and 3 → 4
4) 1 → 2 and 4 → 3

Homework Topic 2

2 26. In the ventricles, deoxygenated blood is prevented from mixing with oxygenated blood by the structure labeled

1) *A*
2) *B*
3) *C*
4) *D*

4 27. Which statement best describes enzymes?

1) They slow down the rate of breathing.
2) They are the building blocks of polymers.
3) They speed up the conduction of impulses along a nerve cell.
4) They influence the rate of chemical reactions.

3 28. A similarity between the nervous system and the endocrine system in humans is that they both

1) are composed of neurons
2) are composed of glands
3) maintain homeostasis
4) secrete chemicals across synapses

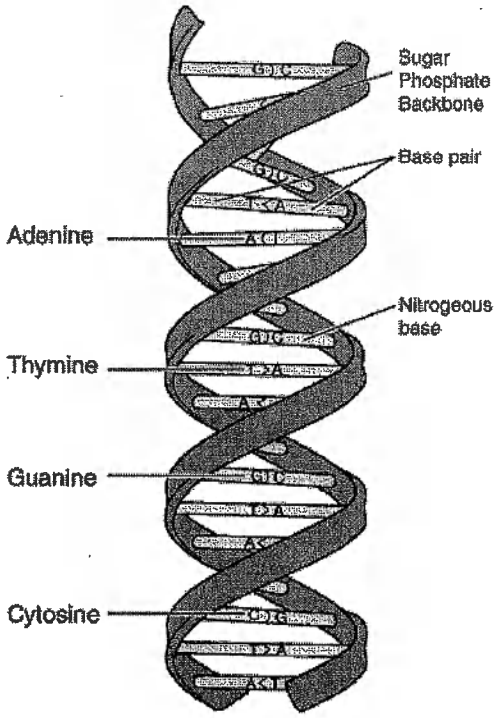
2 29. Some pituitary hormones cause the ovaries to secrete hormones. These ovarian hormones then influence the production of the pituitary hormones. This type of control mechanism is known as

1) ovulation
2) negative feedback
3) gametogenesis
4) a menstrual cycle

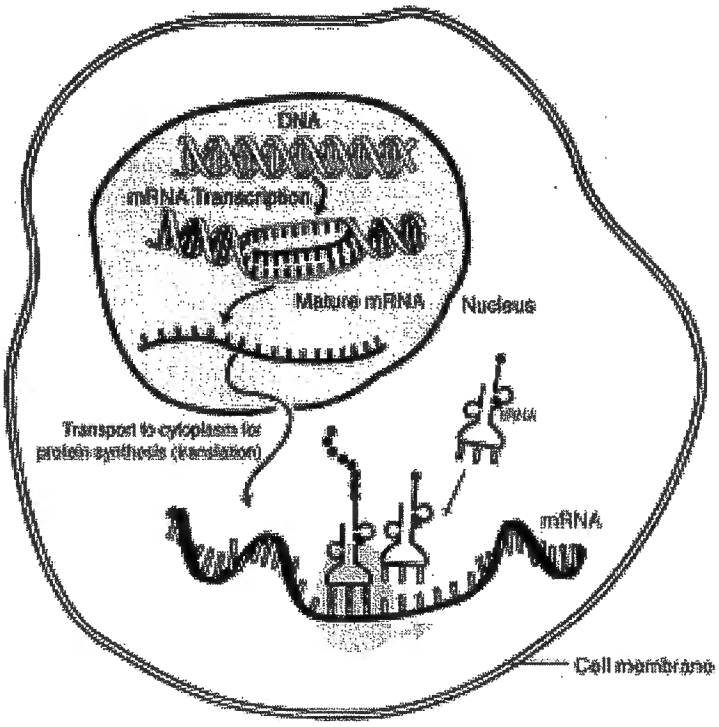
Topic 3: Genetics

DNA (deoxyribonucleic acid) is found in the nucleus and stays there

- carries the instructions for making proteins (put amino acids together in the correct sequence)
- has 4 different bases A, T, C, G
- has 2 strands(side by side) each base pairs with a complement (A=T and C=G)
- replicates before the cell divides (mitosis and meiosis) by untwisting and unzipping then copying each strand.
- Instructions are expressed in a code of three bases, on one strand, representing 1 of 20 different amino acids. (that is why proteins need the correct order to work)
  Ex.) T-A-C codes for Methionine



Since DNA stays in the nucleus, but the protein is assembled at the ribosome, DNA must copy its instructions (Base Sequence) onto a messenger that can leave the nucleus (mRNA).



Don't forget about Protein Synthesis!

mRNA takes the code from DNA out of the nucleus

At the ribosome, tRNA with its attached amino acid pairs up with the mRNA

The amino acids bond and break free of the tRNA

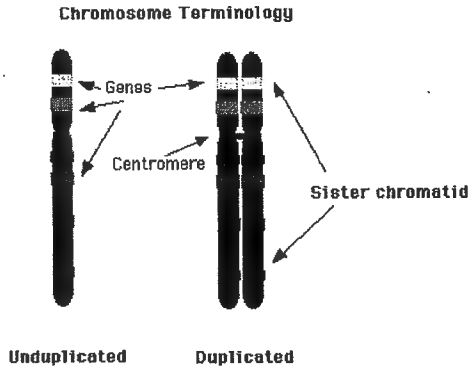
The amino acid chain is now called a protein (or a polypeptide).

Genes-DNA's sequence of bases that code for a protein. **Chromosomes** have 1000's of genes on them and chromosomes are made of DNA

- can be turned on(expressed) or off(not expressed) depending on the cell's environment.

Ex.) Hormones turn Reproductive cells on/off

- Cells specialize/differentiate because some genes are turned on or off.



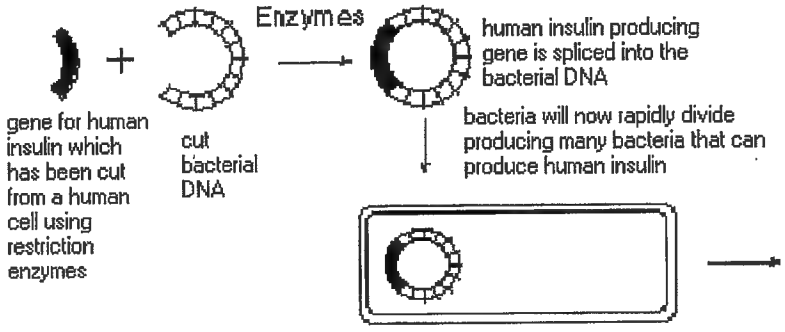
Mutation- Error in the DNA Sequence (inserting an extra base or deleting one) that causes a mistake in the order of amino acids in a protein (wrong shape = not work correctly)

- can be caused by chemicals or radiation, U.V. light, X-Rays (cause errors in DNA)
- can only be passed on to a baby(next generation)if it occurs in the gametes (sperm/egg/sex cell).
- may cause cancer (cells divide uncontrollably)
- cause genetic variation and may be good or bad changes

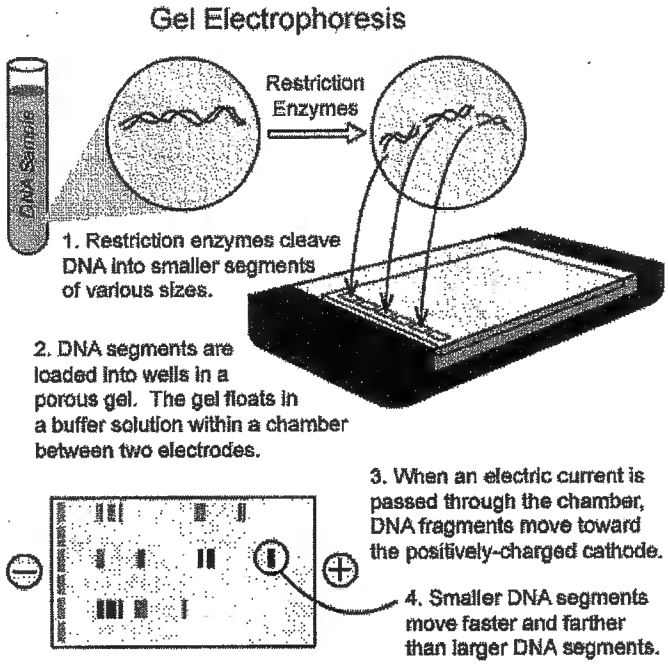
Selective Breeding- humans choosing organisms to mate in order to get the desired traits in offspring.

Recombinant DNA can be made by cutting DNA using special enzymes (restriction enzymes) and inserting genes into another organism's DNA.
*If an organism has the gene inserted into it, they can make the product

Ex.) Human insulin gene is pasted into a bacteria...bacteria can now make human insulin.



Gel electrophoresis- fragments of DNA can be separated by size (small ones go through the gel faster than the larger ones)



Topic 3
Homework Questions

2 1. The transfer of genes from parents to their offspring is known as
1) differentiation
2) heredity
3) immunity
4) evolution

1 2. Gregor Mendel developed some basic principles of heredity by
1) crossing pea plants
2) cutting off the tails of mice
3) breeding fruit flies
4) culturing bacteria in a laboratory

1 3. At warm temperatures, a certain bread mold can often be seen growing on bread as a dark-colored mass. The same bread mold growing on bread in a cooler environment is red in color. Which statement most accurately describes why this change in the color of the bread mold occurs?
1) Gene expression can be modified by interactions with the environment.
2) Every organism has a different set of coded instructions.
3) The DNA was altered in response to an environmental condition.
4) There is no replication of genetic material in the cooler environment.

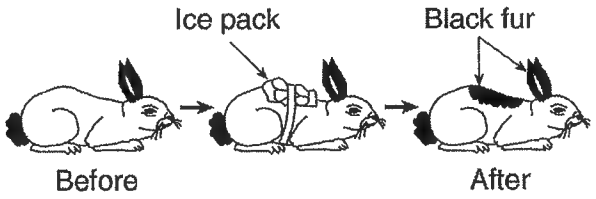
3 4. The chart below shows relationships between genes, the environment, and coloration of tomato plants.

Inherited Gene	Environmental Condition	Final Appearance
A	Light	Green
B	Light	White
A	Dark	White
B	Dark	White

Which statement best explains the final appearance of these tomato plants?
1) The expression of gene *A* is not affected by light.
2) The expression of gene *B* varies with the presence of light.
3) The expression of gene *A* varies with the environment.
4) Gene *B* is expressed only in darkness.

2 5. A boy inherits genes for tallness, but his growth is limited as a result of poor nutrition. This is an example of
1) an inherited disorder
2) environmental influence on gene expression
3) expression of a hidden trait
4) a characteristic controlled by more than one pair of genes

1 6. Which statement best explains the change shown in the diagram below?



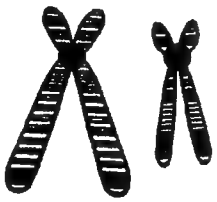
1) Gene expression in an organism can be modified by interactions with the environment.
2) Certain rabbits produce mutations that affect genes in specific areas of the body.
3) Sorting and recombination of genes can be influenced by very cold temperatures.
4) Molecular arrangement in existing proteins can be altered by environmental factors.

2 7. Which statement best describes a chromosome?
1) It is a gene that has thousands of different forms.
2) It has genetic information contained in DNA.
3) It is a reproductive cell that influences more than one trait.
4) It contains hundreds of genetically identical DNA molecules.

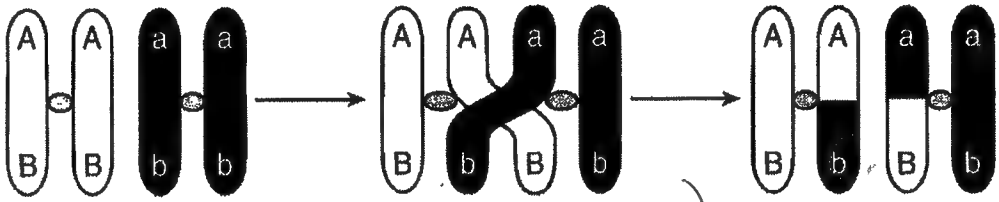
2 8. Changes in the genetic code of a human can be transmitted to offspring if they occur in
1) cancer cells
2) gametes
3) cell membranes
4) antibodies

3 9. Which statements best describe the relationship between the terms *chromosomes*, *genes*, and *nuclei*?
1) Chromosomes are found on genes. Genes are found in nuclei.
2) Chromosomes are found in nuclei. Nuclei are found in genes.
3) Genes are found on chromosomes. Chromosomes are found in nuclei.
4) Genes are found in nuclei. Nuclei are found in chromosomes.

4 10. The cells that make up the skin of an individual have some functions different from the cells that make up the liver because
1) all cells have a common ancestor
2) different cells have different genetic material
3) environment and past history have no influence on cell function
4) different parts of genetic instructions are used in different types of cells

2 11. Which diagram represents a pair of homologous (same) chromosomes?
1) 
3)
2)
4)

4 12. The diagram below shows a process that affects chromosomes during meiosis.



This process can be used to explain
1) why some offspring are genetically identical to their parents
2) the process of differentiation in offspring
3) why some offspring physically resemble their parents
4) the origin of new combinations of traits in offspring

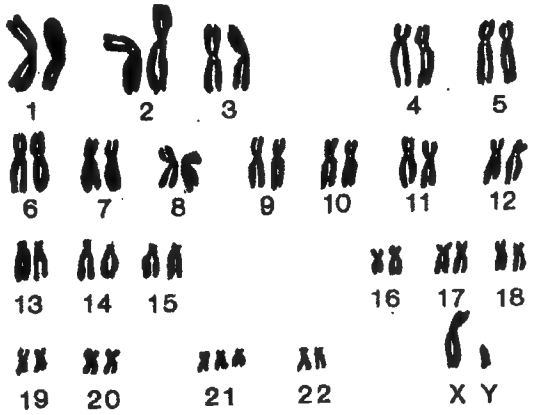
1 13. A single gene mutation results from
1) a change in a base sequence in DNA
2) recombination of traits
3) the failure of chromosomes to separate
4) blocked nerve messages

2 14. Some weed killers, insecticides, and food additives alter the DNA of certain cells. Because of this effect, these substances are known as
1) auxins
2) mutagens
3) meristems
4) autosomes

1 15. A photograph of human chromosomes that may be studied to determine possible genetic disorders is known as
1) a karyotype
2) amniocentesis
3) a screening
4) a pedigree

4 16. Oddly shaped red blood cells and severe pain are characteristics of a human genetic disorder known as
1) hemophilia
2) Tay-Sachs disease
3) phenylketonuria
4) sickle-cell anemia

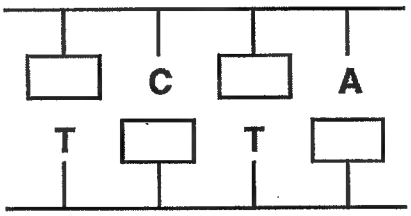
1 17. Base your answer to the following question on the diagram below and on your knowledge of biology. The diagram shows the number and structure of homologous pairs of chromosomes in a human body cell.



The chromosome abnormality represented in the diagram results in the disorder known as

1) Down syndrome
2) phenylketonuria
3) sickle-cell anemia
4) hemophilia

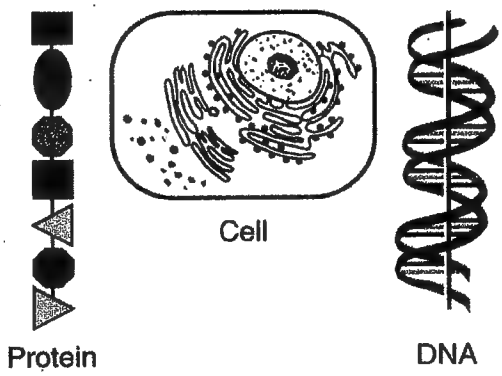
3 18. The diagram below represents an incomplete section of a DNA molecule. The boxes represent unidentified bases.



When the boxes are filled in, the total number of bases represented by the letter *A* (both inside and outside the boxes) will be

1) 1
2) 2
3) 3
4) 4

3 19. Three structures are represented in the diagram below.



What is the relationship between these three structures?

1) DNA is made up of proteins that are synthesized in the cell.
2) Protein is composed of DNA that is stored in the cell.
3) DNA controls the production of protein in the cell.
4) The cell is composed only of DNA and protein.

4 20. The genetic code of a DNA molecule is determined by a specific sequence of

1) ATP molecules
2) sugar molecules
3) chemical bonds
4) molecular bases

2 21. What determines the kind of genes an organism possesses?

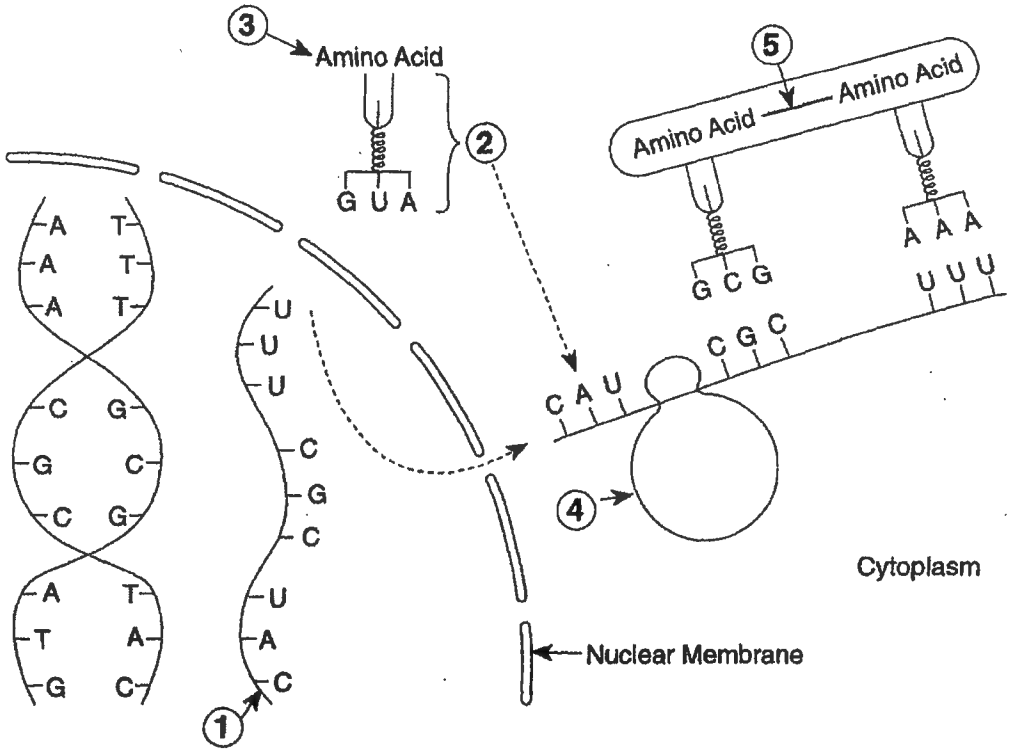
1) type of amino acids in the cells of the organism
2) sequence of the subunits A, T, C, and G in the DNA of the organism
3) size of simple sugar molecules in the organs of the organism
4) shape of the protein molecules in the organelles of the organism

3 22. Which nuclear process is represented below?

A DNA molecule untwists. → The two strands of DNA separate. → Molecular bases pair up. → Two identical DNA molecules are produced.

1) recombination 2) fertilization 3) replication 4) mutation

Base your answers to questions **23** through **25** on the diagram below, which represents some biochemical reactions involved in a cellular process.



1 23. The molecule coded directly from DNA is represented by number

1) 1 2) 2 3) 3 4) 4

4 24. What is an example of a molecule produced by this type of process?

1) glucose 2) glycogen 3) a fatty acid 4) a protein

1 25. The bond labeled 5, formed between two amino acids, is known as

1) a peptide bond 2) a hydrogen bond 3) an ionic bond 4) a carboxyl bond

2 26. Which statement indicates one difference between the gene that codes for insulin and the gene that codes for testosterone in humans?

1) The gene for insulin is replicated in vacuoles, while the gene for testosterone is replicated in mitochondria.
2) The gene for insulin has a different sequence of molecular bases than the gene for testosterone.
3) The gene for insulin is turned on in liver cells, but the gene for testosterone is not.
4) The gene for insulin is a sequence of five different molecular bases while the gene for testosterone is a sequence of only four different molecular bases.

3 27. The pedigree of Seattle Slew, a racehorse considered by some to be one of the fastest horses that ever lived, includes very fast horses on both his mother's side and his father's side. Seattle Slew most likely was a result of

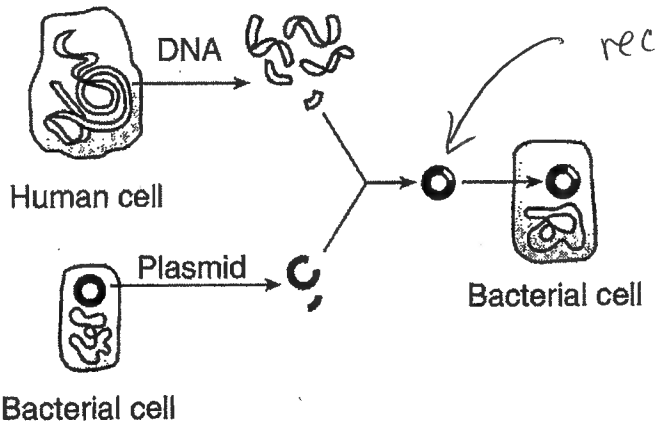
1) environmental selection
2) alteration of DNA molecules
3) selective breeding
4) a sudden mutation

Topic 3

3 28. Some farmers currently grow genetically engineered crops. An argument *against* the use of this technology is that

1) it increases crop production
2) it produces insect-resistant plants
3) its long-term effects on humans are still being investigated
4) it always results in crops that do not taste good

3 29. Which set of terms correctly identifies the procedure shown in the diagram below and a substance produced by this procedure?

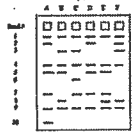


1) selective breeding-growth hormone
2) cloning-antibiotics
3) genetic engineering-insulin
4) replicating-glucose

2 30. Cloning an individual usually produces organisms that

1) contain dangerous mutations
2) contain identical genes
3) are identical in appearance and behavior
4) produce enzymes different from the parent

Base your answers to questions **31** and **32** on Use the diagram to answer the questions below.



gel electrophoresis

3 31. Which individuals are most closely related?

1) A and B
2) A and C
3) A and D
4) A and E

32. Which row contains the smallest DNA fragments

1) 1
2) 4
3) 9

the row furthest from the wells; small pieces travel further than big pieces (Biodiversity lab)

Topic 4: Reproduction and Development

Asexual Reproduction- one organism divides into two or more offspring

*Offspring are genetically identical to the parent

*Mitotic cell division (**mitosis**) is used to produce identical cells. A **clone** is genetically identical to the parent organism.

*Unicellular organisms (single celled) divide by mitosis to produce two identical cells.
Ex.) amoeba and bacteria

*Multi-cellular organisms- mitotic cell division produces a mass of cells or replaces/regenerates lost cells that later bud off to form the offspring)
Ex.) Hydra, Flatworm, starfish

Steps in mitosis:
1. Chromosomes and genes are copied (DNA Replicated)
2. Each copy goes into a new cell
3. Every cell has the same chromosomes as the original cell

*No Variation within the population

-Can't adapt to changes that happen in the environment (there may not be any survivors if the environment contains a factor that the original parent is not adapted to)
Ex.) No natural Selection/Evolution of population

*Fitness/High Adaptive Value/the genes that allow it to survive- are passed on to the next generation
Ex). Resistance genes(antibiotics, pesticides...) passes to the offspring

Sexual Reproduction- Two organisms donate 50% of their genes/DNA to form a new individual.
*Meiotic cell division(**meiosis**) produces sex cells - makes a cell with only half the DNA/Chromosomes/Genes as the original cell

***Gametes** (sex cells/Sperm/Egg) transfer half of the genetic materials/DNA/Chromosomes.
***Fertilization**- fusion of two gametes to form the zygote cell, maintaining the correct chromosome number from one generation to the next.

*New offspring is a combination of the genes from the parents (not identical to them)

***Increases variation** (genetic differences)- new offspring may inherit Fitness/High Adaptive Value/the genes that allow it to survive....From both of parents
EX. Inherits resistance from mom or dad or both....but, there's no guarantee that genes with high adaptive value will be inherited

Human Reproduction- regulated by hormones (estrogen & testosterone are two examples)

Female Structures:

1. **Ovary**-produces egg (released during ovulation) and secretes hormones (estrogen and progesterone to regulate the cycle)

2. **Oviduct/Fallopian tube**- connects ovary area to uterus; where fertilization happens.

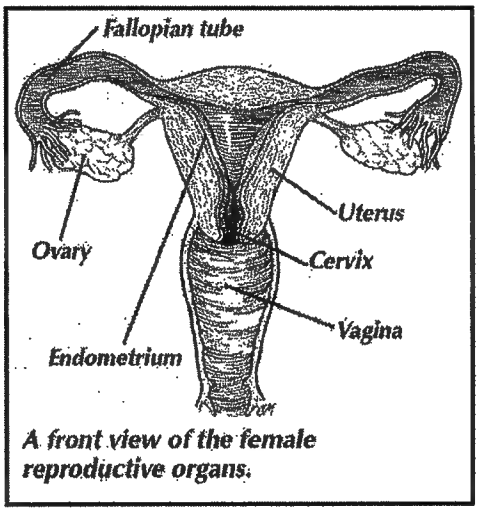
3. **Uterus**- protects fetus (where baby develops/grows)

***Placenta**- a temporary organ that provides nutrients, gas exchange and waste removal for the baby/fetus. Anything (good or bad) that is dissolved in the mother's blood will diffuse into the baby's blood through the placenta.

* **Umbilical cord**- carries baby blood to the placenta then back to baby

4. **Cervix**- the bottom of the uterus which opens into the vagina.

5. **Vagina**- also called the birth canal



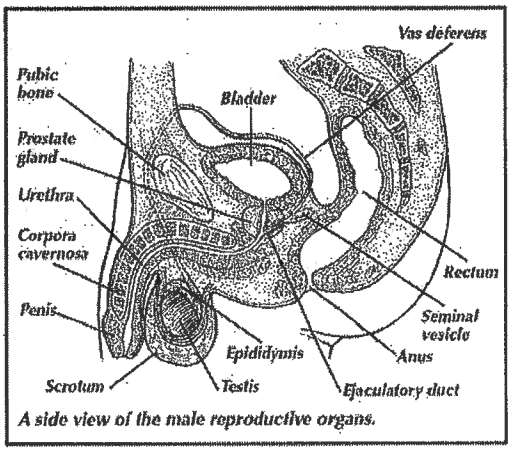
A front view of the female reproductive organs.

Male Structures:

1. **Testis**- Produces sperm and provides hormone (testosterone) for male traits (beard, voice, muscle mass)

2. **Epididymis**- where sperm mature

3. **Vas deferens**- carry sperm from testis/epididymis to urethra; "snipped" in a vasectomy



A side view of the male reproductive organs.

*Semen- mixture of sperm and fluids. Fluid is needed for sperm to swim.

4. **Urethra-** passageway leading out of the body for semen & urine

Embryonic Development: (one cell turns into two...then 100 billion)

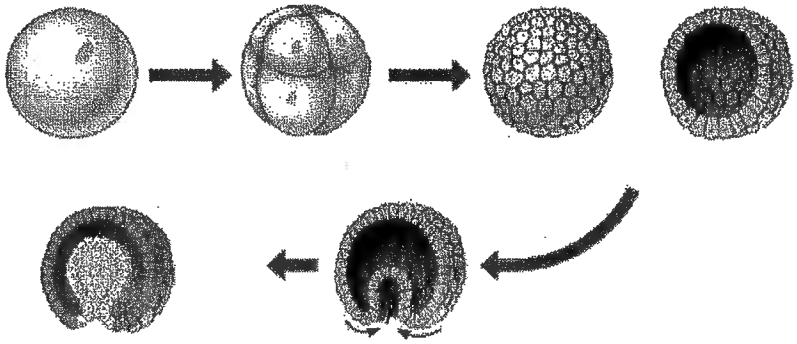
*Mitosis- every cell has identical DNA/Chromosome/Genes

***Differentiation**- cells become different/specialize depending on what genes are turned on or off. (Ex. nerve cell, skin cell, liver cell...)

*Environmental factors (hormones, cell location) can influence how genes are turned "on" or "off")

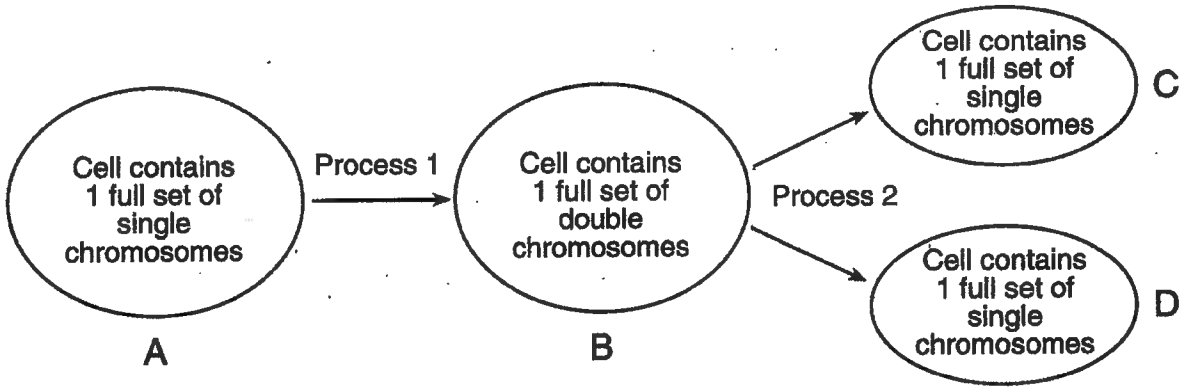
*If the mother is exposed to chemicals or drugs or disease during early pregnancy, the embryo development may be affected in a negative way. Ex.) Alcohol effects brain development

Embryonic Development (remember...this is cell division by mitosis)



Topic 4
Homework Questions

Base your answers to questions **1** through **4** on the diagram below and on your knowledge of biology. The diagram represents a single-celled organism, such as an ameba, undergoing the changes shown.



4 ___1. As a result of these processes, the single-celled organism accomplishes
1) gamete production 2) energy production 3) sexual reproduction 4) asexual reproduction

1 ___2. Process 1 is known as
1) replication 2) meiosis 3) differentiation 4) digestion

2 ___3. Process 1 and process 2 are directly involved in
1) meiotic cell division 2) mitotic cell division 3) fertilization 4) recombination

4 ___4. The genetic content of *C* is usually identical to the genetic content of
1) *B* but not *D* 2) both *B* and *D* 3) *D* but not *A* 4) both *A* and *D*

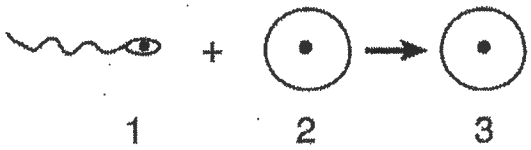
3 5. The diagram below shows two different cells undergoing mitotic cell division.

Which statement best describes these cells?
1) A and B are different types of animal cells.
2) A and B are different types of plant cells.
3) A is a plant cell and B is an animal cell.
4) A is an animal cell and B is a plant cell.

1 ___6. In animals, the process which results in haploid gametes is known as
1) meiosis 3) fertilization
2) mitosis 4) fission

2 ___7. A dogfish shark contains 24 chromosomes in each of its muscle cells. How many chromosomes are normally found in each of its gametes?
1) 6 3) 24
2) 12 4) 48

2 8. Some cells involved in the process of reproduction are represented in the diagram below

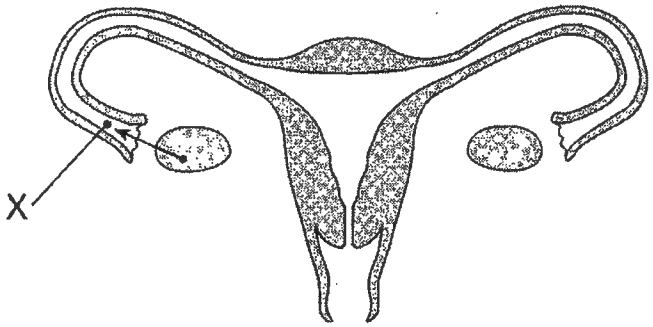


(sex cells only)
The process of meiosis formed
1) cell 1, only 3) cell 3, only
2) cells 1 and 2 4) cells 2 and 3

3 ___9. In an environment that undergoes frequent change, species that reproduce sexually may have an advantage over species that reproduce asexually because the sexually reproducing species produce
1) more offspring in each generation
2) identical offspring
3) offspring with more variety
4) new species of offspring in each generation

2 ___10. The greatest degree of genetic variation would be found in offspring that result from
1) binary fission 3) regeneration
2) fertilization 4) grafting

2 11. The diagram below represents structures found in a human female.

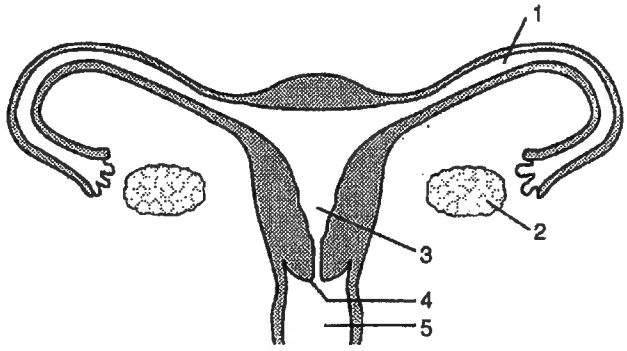


Which process results in the formation of structure X?
1) mitosis 2) meiosis 3) recombination 4) cloning

4 12. Which statement is true of both mitosis and meiosis?
1) Both are involved in asexual reproduction.
2) Both occur only in reproductive cells.
3) The number of chromosomes is reduced by half.
4) DNA replication occurs before the division of the nucleus.

3 13. Which characteristic of sexual reproduction has specifically favored the survival of animals that live on land?
1) fusion of gametes in the outside environment
2) male gametes that may be carried by the wind
3) fertilization within the body of the female
4) female gametes that develop within ovaries

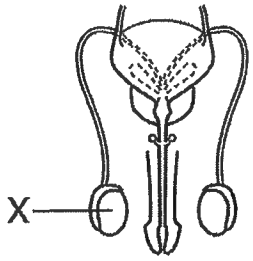
1 14. Base your answer to the following question on the diagram below. Select the part of the human female reproductive tract that is best described by that statement.



Fertilization normally occurs within this structure.
1) 1 3) 3
2) 2 4) 5

4 15. External fertilization occurs most often in
1) mammals and birds
2) reptiles and birds
3) amphibians and reptiles
4) fish and amphibians

4 16. The diagram below represents a system in the human body.

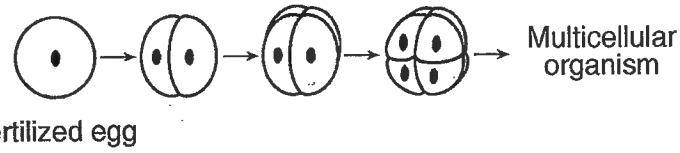


The primary function of structure X is to
1) produce energy needed for sperm to move
2) provide food for the sperm to carry to the egg
3) produce and store urine
4) form gametes that may be involved in fertilization

3 17. Which situation involves a risk to a fetus due to the mother smoking during pregnancy?
1) decreased digestive activity in the stomach of the fetus
2) a decrease in the amount of oxygen in the ovary of the mother
3) inhalation of secondhand smoke by the fetus
4) toxins in the bloodstream of the mother

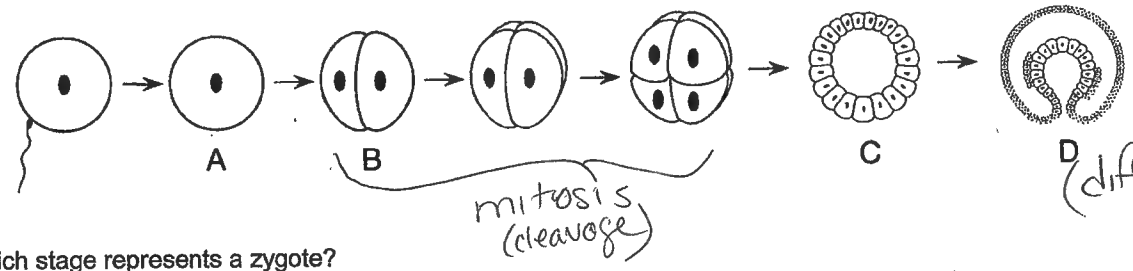
Topic 4

1 18. Which phrase best describes a process represented in the diagram below?



1) a zygote dividing by mitosis
2) a zygote dividing by meiosis
3) a gamete dividing by mitosis
4) a gamete dividing by meiosis

Base your answers to questions **19** and **20** on the diagram below, which represents some stages in the development of an embryo, and on your knowledge of biology.



1 19. Which stage represents a zygote?
1) A 2) B 3) C 4) D

3 20. Which stage represents a blastula? (hollow ball)
1) A 2) B 3) C 4) D

Topic 4

Base your answers to questions **21** and **22** on the information below and on your knowledge of biology.

Stem Cells

If skin is cut, the wound closes within days. If a leg is broken, the fracture will usually mend if the bone is set correctly. Almost all human tissue can repair itself to some extent. Much of this repair is due to the activity of stem cells. These cells resemble those of a developing embryo in their ability to reproduce repeatedly, forming exact copies of themselves. They may also form many other different kinds of cells. Stem cells in bone marrow offer a dramatic example. They can give rise to all of the structures in the blood: red blood cells, platelets, and various types of white blood cells. Other stem cells may produce the various components of the skin, liver, or intestinal lining.

The brain of an adult human can sometimes compensate for damage by making new connections among surviving nerve cells (neurons). For many years, most biologists believed that the brain could not repair itself because it lacked stem cells that would produce new neurons.

A recent discovery, however, indicates that a mature human brain does produce neurons routinely at one site, the hippocampus, an area important to memory and learning. This discovery raises the prospect that stem cells that make new neurons in one part of the brain might be found in other areas. If investigators can learn how to cause existing stem cells to produce useful numbers of functional nerve cells, it might be possible to correct a number of disorders involving damage to neurons such as Alzheimer's disease, Parkinson's disease, stroke, and brain injuries.

3 21. Stem cells may be similar to the cells of a developing embryo because both cell types can

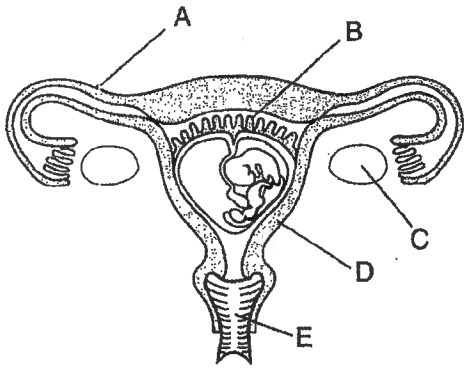
1) produce only one type of cell
2) help the brain to learn and remember things
3) divide and differentiate
4) cause Alzheimer's and Parkinson's diseases

1 22. What is the process by which stem cells produce exact copies of themselves?

1) cell division by mitosis 2) cell division by meiosis 3) sexual reproduction 4) glucose synthesis

Topic 4

23. The human female reproductive system is represented in the diagram below.



Complete boxes 1 through 4 in the chart below using the information from the diagram.

Name of Structure	Letter on Diagram	Function of Structure
1 Ovary	2 C	produces gametes
uterus	D	3 Place where fetus develops
4 Placenta	B	transports oxygen directly to the embryo

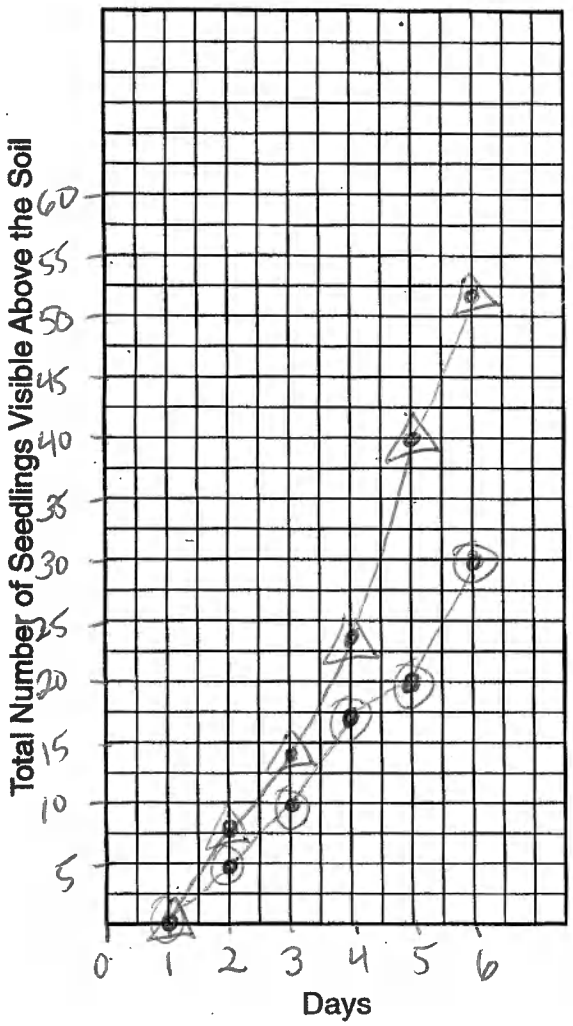
Topic 4

24. Base your answer to the following question on the information and data table below and on your knowledge of biology.

Three biology students wanted to find out if adding fertilizer to some potting soil would affect the germination of radish seeds. Each student added an equal amount of potting soil from the same bag to each of 10 cups. Student *A* added 1 gram of fertilizer to each cup of soil in group *A*. Student *B* added 2 grams of fertilizer to each cup of soil in group *B*. Student *C* added 3 grams of fertilizer to each cup of soil in group *C*. After stirring the mixture to obtain an even distribution of fertilizer, 8 radish seeds were placed in each cup and covered with 0.5 centimeter of soil. Over the next 6 days, all conditions, including the amounts of water and sunlight, were kept the same. The results are recorded in the data table below.

Data Table

Days After Planting	Total Number of Seedlings Visible Above the Soil		
	Group A	Group B	Group C
1	0	0	0
2	5	7	0
3	10	14	0
4	17	24	0
5	20	40	0
6	30	52	0



Key

Group A ⊙

Group B △

Example:

Example:

Plot the data for group *B* on the grid. Surround each point with a small triangle and connect the points.

Topic 5: Natural Selection And Evolution

Evolution- change over time; change in the frequency (how often they appear) of selected genes within a population of organisms.

*organisms tend to become more complex as organisms evolve (change) through time

*genes that have high adaptive value (allow an organism to survive) will increase in number as time goes on (from one generation to another)

* Evolution(change) happens faster if the environment is changing

*Evolution (change) occurs as a result of Natural Selection

Natural Selection- Theory proposed by Charles Darwin in 1859

*if an organism has the genes that let them survive (have Adaptive Value), then they reproduce passing the genes on to the next generation then gene becomes more common in the population.

*in a changing environment, favorable genes accumulate rapidly changing the appearance or behaviors of the population.

*If a species doesn't adapt/evolve in a changing environment, they may go extinct

Four Steps of Natural Selection

1. **Overproduction**- too many offspring are created (not all can survive because of limited resources in the environment)

2. **Competition**- because the species share common niches they will compete for food, space, mates...

3. **Variation**- Sexual reproduction (creates new combination of genes)

Mutations change the DNA/gene slightly

*Individuals in the population are not all the same. They contain different genetic information because of sexual reproduction and mutations.

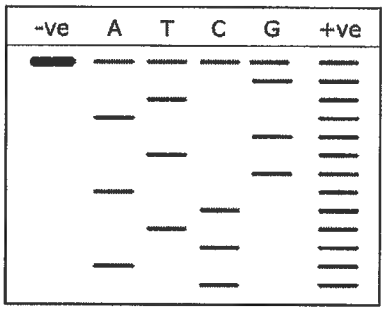
4. **Selection and Reproduction**- the genes that are not adapted to the environment are selected against (die)

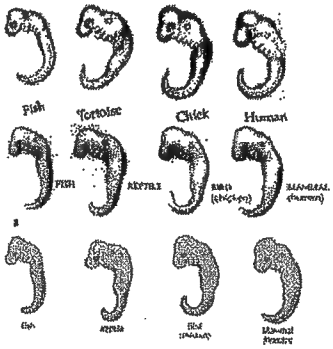
*Genes that have an adaptive value will survive and be passed on to the offspring.

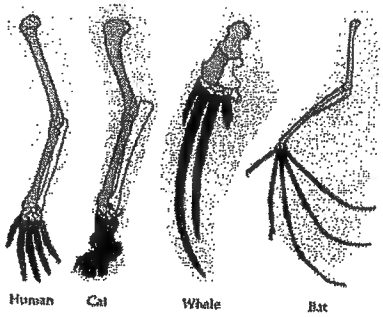
*If a population lacks **genetic variation** (asexual reproduction, no mutation,

inbreeding), they lose the ability to adapt (evolve) to a changing environment.

*If two species share a common ancestry (they are related), they will have similar DNA, proteins, embryonic development, bone structures.





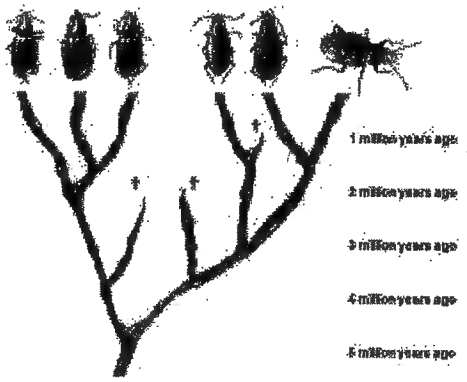


Evolutionary Tree (phylogenetic tree)- a diagram that illustrates the change of species over time.

*The very bottom is the common ancestor

*Lines that end before the top represent species that are now extinct

*Lines that reach the top are currently living species



*Branches that are drawn close to one another are more closely related that branches drawn farther apart.

Topic 5
Homework Questions

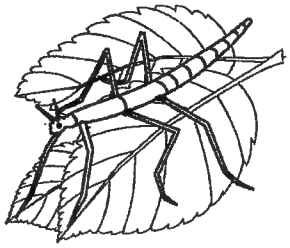
1. The females of certain species of turtles will sneak into a nest of alligator eggs to lay their own eggs and then leave, never to return. When the baby turtles hatch, they automatically hide from the mother alligator guarding the nest and go to the nearest body of water when it is safe to do so. Which statement best explains the behavior of these baby turtles?

1) More of the turtles' ancestors who acted in this way survived to reproduce, passing this behavioral trait to their offspring.
2) The baby turtles are genetically identical, so they behave the same way.
3) Turtles are not capable of evolving, so they repeat the same behaviors generation after generation.
4) The baby turtles' ancestors who learned to behave this way taught the behaviors to their offspring

2. Limited resource contribute to evolutionary change in animals by increasing

1) genetic variation within the population
2) competition between members of the species
3) the carrying capacity for the species
4) the rate of photosynthesis in the population

3. The illustration below shows an insect resting on some green leaves.



The size, shape, and green color of this insect are adaptations that would most likely help the insect to

1) compete successfully with all birds
2) make its own food
3) hide from predators
4) avoid toxic waste materials

4. Which factor is *least* likely to contribute to an increase in the rate of evolution?

1) presence of genetic variations in a population
2) environmental selection of organisms best adapted to survive
3) chromosomal recombinations
4) a long period of environmental stability

5. The Florida panther, a member of the cat family, has a population of fewer than 100 individuals and has limited genetic variation. Which inference based on this information is valid?

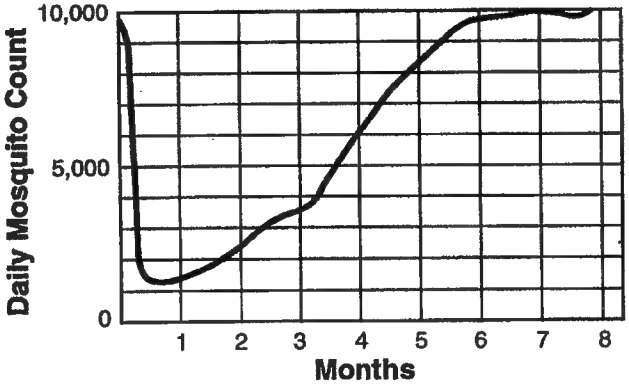
1) These animals will begin to evolve rapidly.
2) Over time, these animals will become less likely to survive in a changing environment.
3) These animals are easily able to adapt to the environment.
4) Over time, these animals will become more likely to be resistant to disease.

6. Beak structures differ between individuals of one species of bird. These differences most likely indicate

1) the presence of a variety of food sources
2) a reduced rate of reproduction
3) a large supply of one kind of food
4) an abundance of predators

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

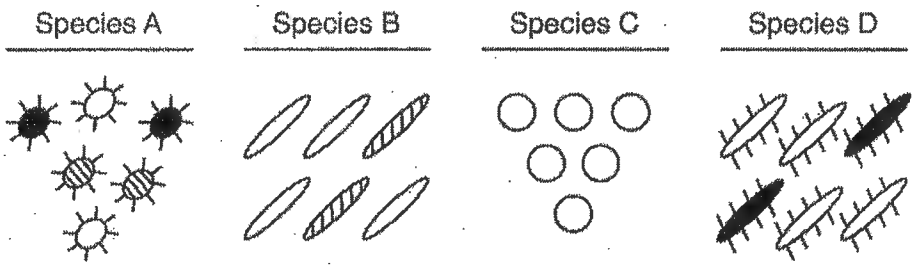
A small community that is heavily infested with mosquitoes was sprayed weekly with the insecticide DDT for several months. Daily counts providing information on mosquito population size are represented in the graph below.



What is the most probable reason for the decreased effectiveness of the DDT?

1) DDT caused mutations in
2) DDT was only sprayed once.
3) Mosquitoes resistant to DDT lived and produced offspring.
4) DDT chemically reacted with the DNA of the mosquitoes.

1 8. The diagram below represents four different species of bacteria



Which statement is correct concerning the chances of survival for these species if there is a change in the environment?
1) Species A has the best chance of survival because it has the most genetic diversity.
2) Species C has the best chance of survival because it has no gene mutations.
3) Neither species B nor species D will survive because they compete for the same resources.
4) None of the species will survive because bacteria reproduce asexually.

3 9. Which process can produce new inheritable characteristics within a multicellular species?
1) cloning of the zygote
2) mitosis in muscle cells
3) gene alterations in gametes
4) differentiation in nerve cells

3 10. Which process is *least* likely to add to the variety of traits in a population?
1) deletion of bases from DNA
2) genetic engineering
3) accurate replication of DNA
4) exchange of segments between chromosomes

4 11. In the early stages of development, the embryos of dogs, pigs, and humans resemble one another. This observation suggests that these animals may have
1) a similar number of chromosomes
2) similar habitat requirements
3) the same blood components
4) a common ancestry

2 12. A species that lacks the variation necessary to adapt to a changing environment is more likely to
1) develop many mutated cells
2) become extinct over time
3) begin to reproduce sexually
4) develop resistance to disease

___ 13. A researcher recently discovered a new species of bacteria in the body of a tubeworm living near a hydrothermal vent. He compared the DNA of this new bacterial species to the DNA of four other species of bacteria. The DNA sequences came from the same part of the bacterial chromosome of all four species.

Species	DNA Sequence
unknown species	ACT GCA CCC
species I	ACA GCA CCG
species II	ACT GCT GGA
species III	ACA GCA GGG
species IV	ACT GCA CCG

According to these data, the unknown bacterial species is most closely related to
1) species I
2) species II
3) species III
4) species IV

4

14. A classification system is shown in the table below.

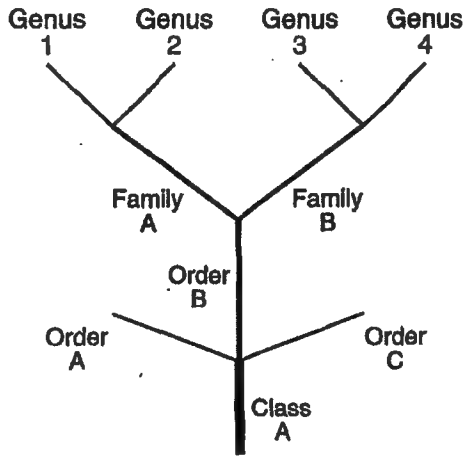
Classification	Examples
Kingdom — animal	△, ○, ▱, ☆, ▭, ◇, ℰ, ▽
Phylum — chordata	△, ▱, ℰ, ☆, ▭
Genus — *Felis*	▭, ℰ
Species — *domestica*	▭

This classification scheme indicates that ▭ is most closely related to

1) ☆
2) △
3) ▱
4) ℰ

3

15. The diagram below shows the evolutionary relationships between several groups of organisms.

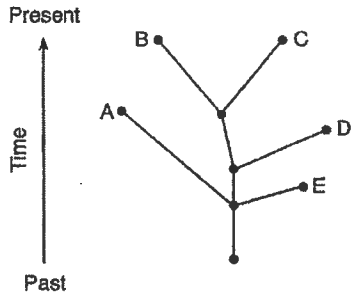


Organisms with the greatest biochemical similarities would most likely be found in which pair of genera?

1) 1 and 3
2) 2 and 3
3) 3 and 4
4) 1 and 4

1

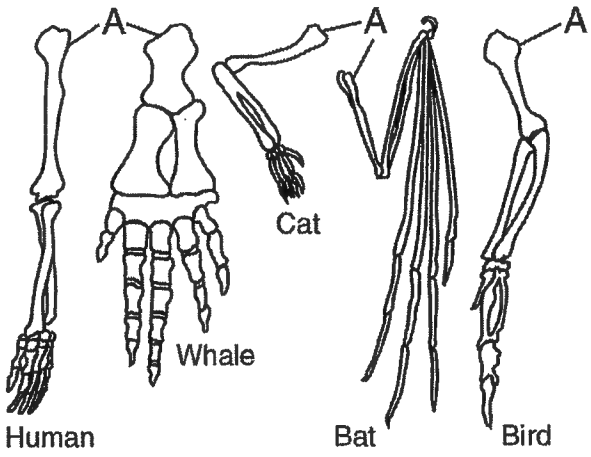
16. Which statement concerning the evolution of species *A*, *B*, *C*, *D*, and *E* is supported by the diagram below?



1) Species *B* and *C* can be found in today's environments.
2) Species *A* and *D* evolved from E.
3) Species *A* and *C* can still interbreed.
4) Species *A*, *B*, and *E* all evolved from a common ancestor and all are successful today.

1

17. Base your answer to the following question on the diagram below.



The similarities of the bones labeled *A* provide evidence that

1) the organisms may have evolved from a common ancestor
2) all species have one kind of bone structure
3) the cells of the bones contain the same type of mutations
4) all structural characteristics are the same in animals

Topic 5

Base your answers to questions **18** and **19** on the passage below and on your knowledge of biology.

Better Rice

The production of new types of food crops will help raise the quantity of food grown by farmers. Research papers released by the National Academy of Sciences announced the development of two new superior varieties of rice—one produced by selective breeding and the other by biotechnology.

One variety of rice, called Nerica (New Rice for Africa), is already helping farmers in Africa. Nerica combines the hardiness and weed resistance of rare African rice varieties with the productivity and faster maturity of common Asian varieties.

Another variety, called Stress-Tolerant Rice, was produced by inserting a pair of bacterial genes into rice plants for the production of trehalose (a sugar). Trehalose helps plants maintain, healthy cell membranes, proteins, and enzymes during environmental stress. The resulting plants survive drought, low temperatures, salty soils, and other stresses better than standard rice varieties.

___18. Which substance from bacteria was most likely inserted into rice plants in the development of the trehalose-producing rice?

1) sugar 2) enzymes 3) DNA 4) trehalose

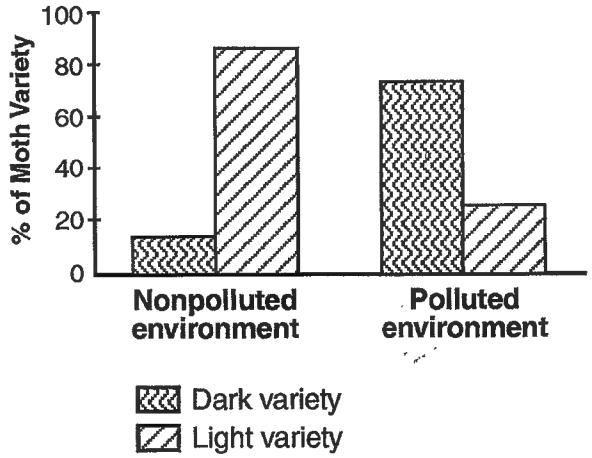
___19. Why is the production of new varieties of food crops necessary?

1) Essential food crops are rapidly becoming extinct.
2) Technology for producing fresh water for agriculture has improved.
3) Burning fossil fuels has decreased agricultural areas.
4) World population continues to increase.

___20. Base your answer to the following question on the information below and on your knowledge of biology.

Color in peppered moths is controlled by genes. A light-colored variety and a dark-colored variety of a peppered moth species exist in nature. The moths often rest on tree trunks, and several different species of birds are predators of this moth.

Before industrialization in England, the light-colored variety was much more abundant than the dark-colored variety and evidence indicates that many tree trunks at that time were covered with light-colored lichens. Later, industrialization developed and brought pollution, which killed the lichens, leaving the tree trunks covered with dark-colored soot. The results of a study made in England are shown below.



Which conclusion can best be drawn from the information given?

1) The trait for dark coloration better suits the peppered moth for survival in non-polluted environments.
2) The trait for light coloration better suits the peppered moth for survival in polluted environments.
3) The variation of color in the peppered moth has no influence on survival of the moth.
4) A given trait may be a favorable adaptation in one environment, but not in another environment.

Topic 6: Ecology and Human Impact on the Environment

Biosphere- areas on earth where we can find life

Species- interbreeding population of organisms

Community- all the different populations in the ecosystem

Ecology- the study of the interaction between the living and nonliving things

Ecosystem- the interaction between living (**biotic**) and nonliving (**abiotic**) in a given area.

*Abiotic factors influence what types of organisms can live in the habitat. Ex.)Temperature in Florida vs. Alaska; Amount of sunlight at the top of a lake Vs the bottom

*Biotic factors help recycle abiotic materials Ex.) Aerobic Respiration Breaks $C_6 H_{12} O_6$ down for ATP and releases the carbon dioxide (CO_2) and water (H_2O)

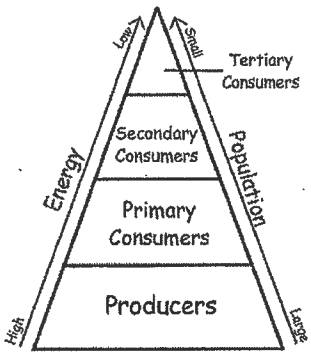
***To Remain Stable (self sustaining) Ecosystems must have:**

1. Constant Source of Energy. (Sun or Chemicals)

2. Organisms that can convert the energy into a usable form. Then pass that energy on to others. **Autotrophs** (plants) use sunlight and CO_2 to make sugar (organic). **Heterotrophs** (animals) consume that sugar for energy (respiration).

3. Diversity- Many different producers and consumers. If one plant species dies then another can pick up the slack.

4. Recycle Materials- organisms must break dead things down so the nutrients in them can be used again. Bacteria and Fungi decompose dead producers and consumers down to release nitrogen. The nitrogen is then used by other plants to grow.



Food chain- producer----> primary consumer-----> Secondary consumer

Ex. Aquatic plant------>Aquatic insect-------->Fish-------->Osprey

*Decomposers recycle and sunlight supplies the energy

Food Web- many food chains that are interconnected

Energy Pyramid- When a consumer eats another organism, the Energy is passed from one organism to the next.

*90% of the energy is lost to metabolic activities

Ex. You have to find the food (lose energy), you have to ingest and digest the food (lose energy), you have to transport the food to the cells (lose energy) you have to convert the food to ATP (lose energy)

*since energy is lost every time it's transferred from one consumer to the next, the amount of organisms decreases at each level.

*Producers are always the foundation of the food/energy pyramid

photosynthesis- use sun energy to put CO_2 and H_2O (inorganic materials) together to make $C_6 H_{12} O_6$ /sugar/glucose/carbs (organic compound)

Every organism has a job (**niche**) in the **habitat** (environment occupied)
Decomposers- break down dead plants and animals

Producers/Autotrophs- plants; can do photosynthesis to make food

Consumers/Heterotrophs- cannot make their own food; rely on other organisms for food

Herbivores- eat only plants

Carnivores- eat only other consumers

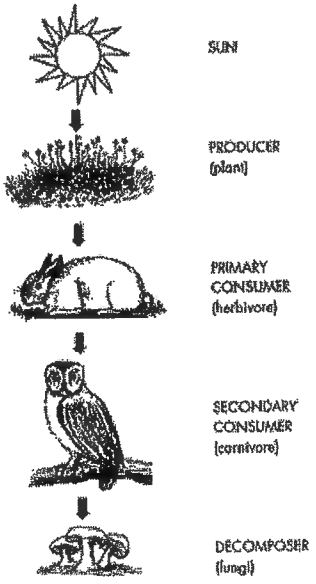
Scavengers- eat dead consumers

Predator-hunt and eat prey

Prey- try to escape the predator

Parasite- steals nutrients from a host

Host- what parasite steals from

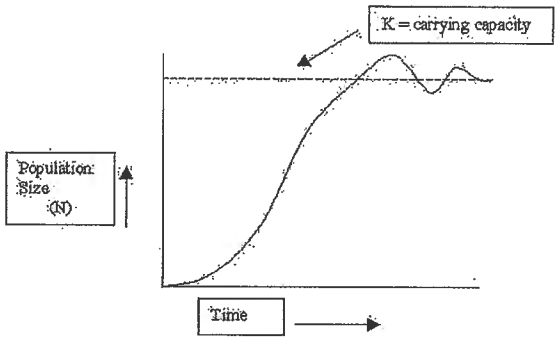


Carrying Capacity- amount of organisms that can be supported by the habitat.

*depends on the amount of food or space available

*amount of prey(rabbits) available keeps the predator(fox) population stable.

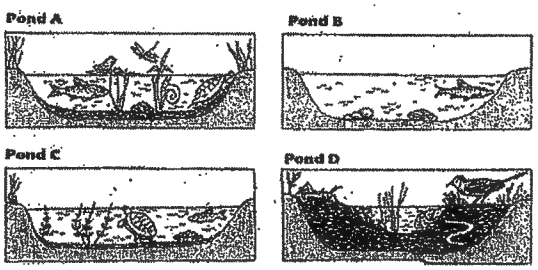
*Sharing a Niche causes Competition for food/resources

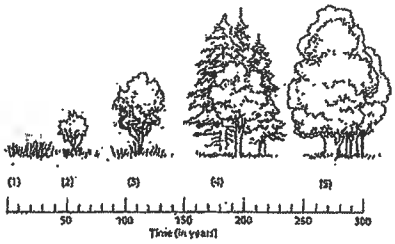


Ecological Succession- Ecosystems Change / evolve. Plants and animals change the environment then the new environment attracts new plants and animal

*lakes can fill in over time, fields turn into Mature/Stable forests

Fires and clearing the land starts the process all over again.





Humans influence the Environment in positive or negative ways

A **TRADE OFF** is a decision made by you weighing the good and bad influences our actions have on the environment.

Nature preserves- protect habitat and ecological diversity

Recycle non-renewables- decrease the amount of landfills (dumps) by using a non-renewable resource over again(aluminum cans/glass/metals/fossil fuels)

Use Renewable resources- sunlight, wood, foods, are constantly being replenished in the environment

Composts- decompose naturally then use as fertilizer

Limit pollution- Air(smog from cars), water (dumping or runoff from rain)

Regulation or Conservation- limit the amount of hunting

Biological mediation- use another organism to check the population of another(instead of using pesticides, use a natural predator)

Population growth- deforestation, using fossil fuels, more pollution like acid rain and smog

Hunting/harvesting/farming- decrease diversity of system

Non-native species- introduce new/strange organism to system...no natural predators to keep the population stable...exceed carrying capacity...depletes resources for the native species

CO_2 emmissions cause global warming changing the biosphere

CFC- breaks down the Ozone layer letting in more U.V.

Pesticides- kill all insects (not just the target) poison is passed on to other consumers that eat it. It becomes more concentrated in the next animal (**biomagnification**)

Chemical Pollution- air, water or food, may be carcinogen (cause mutations in the DNA) may affect diversity...

*All of the above decreases diversity. Anytime Diversity is decreased, the ecosystem is going to become less stable!!!!!

Topic 6
Homework Questions

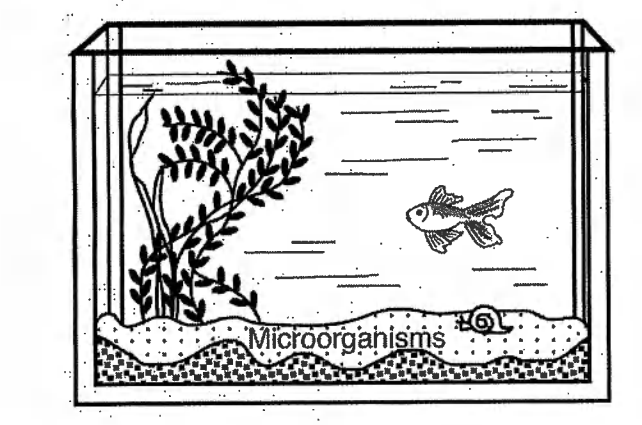
Due Wed 6/7
1-35

2 1. A stable ecosystem is characterized by having
1) predators that outnumber their prey
2) a continual input of energy
3) limited autotrophic nutrition
4) no competition between species

2 2. The portion of Earth in which all life exists is known as
1) the climax stage
2) the biosphere
3) a population
4) a biotic community

1 3. The study of the interactions between organisms and their interrelationships with the physical environment is known as
1) ecology
2) cytology
3) embryology
4) physiology

4 4. Which statement most accurately predicts what would happen in the aquarium shown below if it were tightly covered and maintained in natural light for one month?

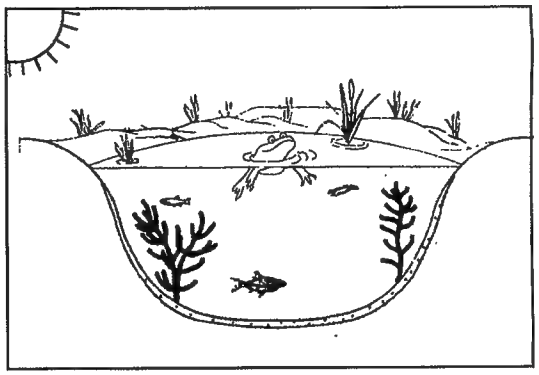


1) The water temperature would rapidly decrease.
2) The process of respiration in the snail would decrease.
3) The rate of reproduction of the fish would be affected.
4) The organisms would probably survive because materials would cycle.

2 5. Which statement describes all stable ecosystems?
1) Herbivores provide energy for the autotrophs,
2) The populations of predators are dependent on the populations of their prey.
3) The number of autotrophs equals the number of heterotrophs.
4) Consumers synthesize ATP from light energy.

4 6. A limiting factor unique to a field planted with corn year after year is most likely
1) temperature
2) sunlight
3) water
4) soil nutrients

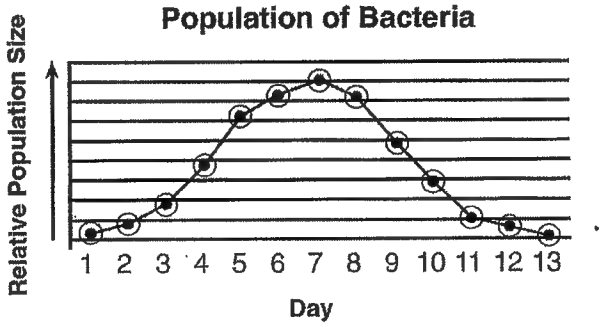
3 7. A pond ecosystem is represented in the diagram below.



Energy for this ecosystem originally comes from
1) water
2) consumers
3) sunlight
4) plants

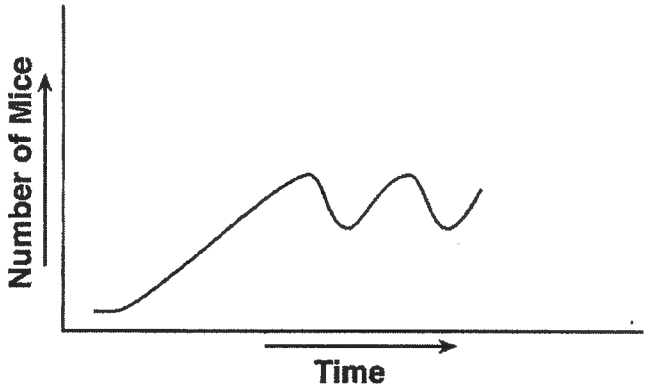
1 8. Which abiotic factor has the *least* effect on the ability of aerobic organisms to live and reproduce in a cave?
1) shape of rocks in the cave
2) amount of energy present in the cave
3) amount of oxygen in the cave
4) availability of moisture in the cave

2 9. A sample of bacteria was added to a culture dish containing a food supply. The dish was kept in an incubator for two weeks, where temperature and other conditions that favored bacterial growth were kept constant. The graph below shows changes that occurred in the bacterial population over the two weeks.



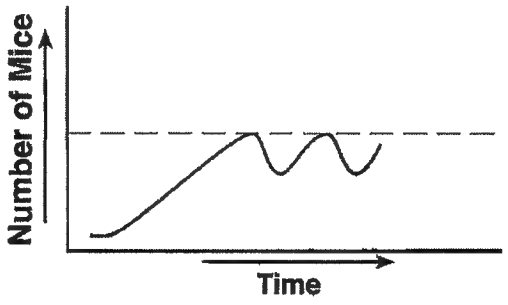
Which statement provides the best explanation for some of the changes observed?
1) The bacteria were unable to reproduce until day 8.
2) The bacteria consumed all of the available food.
3) The culture dish contained an antibiotic for the first five days.
4) The temperature increased and the bacteria died.

3 10. The graph below shows the growth of a field mouse population in an ecosystem over time.



The dashed line indicating the carrying capacity for the mouse population is correctly shown on which graph?

1)



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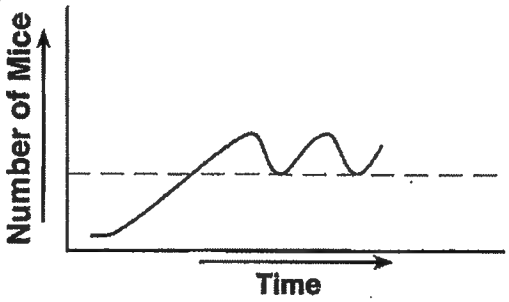
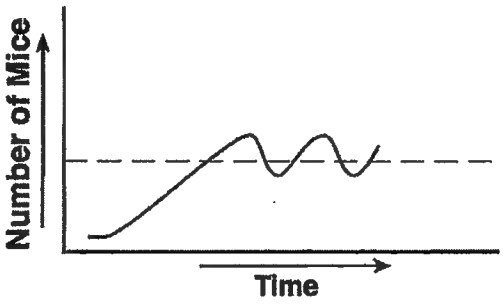
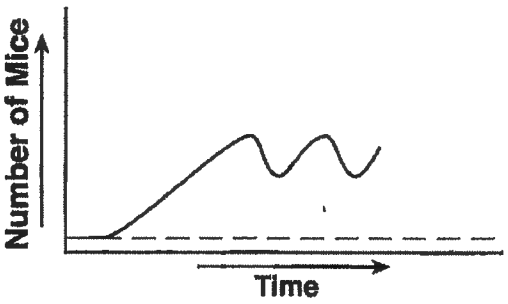


2)



4)



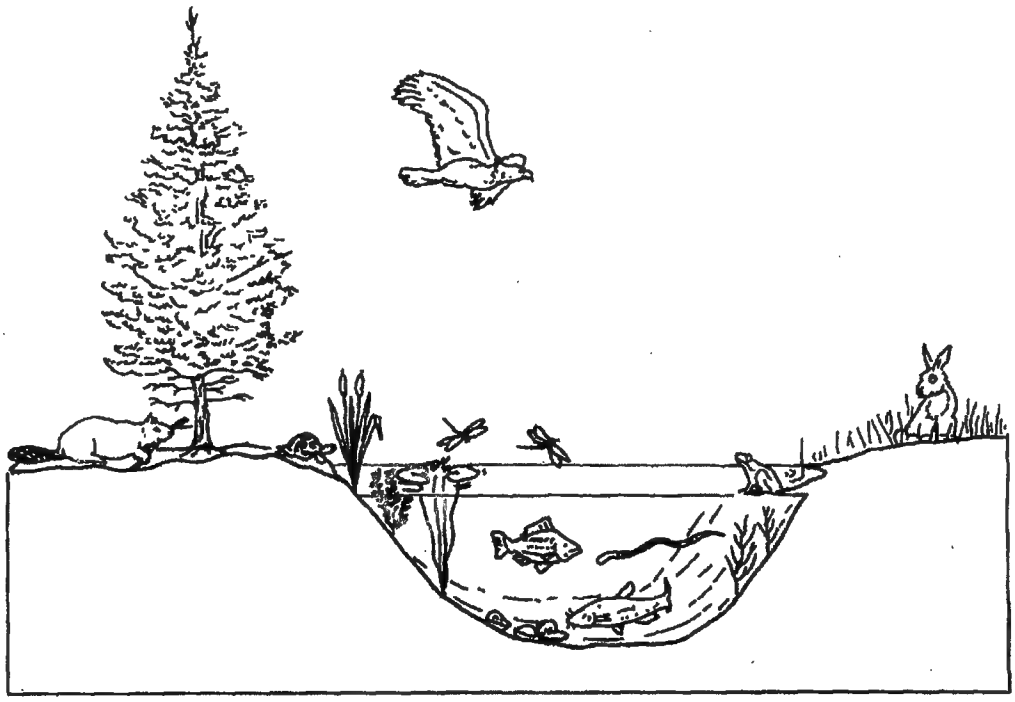
1 11. An example of a population is
1) all the *Zapus hudsonicus* in New York State
2) all the fish in Lake Erie
3) the number of different species of *Felis* in a geographic area
4) the number of maples, white oaks, spruce, gray squirrels, and owls in a forest

1 12. Which pair of organisms would most likely compete for the same ecological niche?
1) bacteria and fungi
2) deer and wolf
3) tree and fungi
4) deer and bacteria

3 13. What will most likely occur if two different plant species compete for the same requirements in an ecosystem?
1) They will usually develop different requirements.
2) One species may adapt to a different environment.
3) One species may be eliminated from that ecosystem.
4) They will alter the environment so that they can both survive in that ecosystem.

2 14. The first living things to grow successfully on a newly formed sand dune are known as
1) saprophytes
2) pioneer organisms
3) carnivorous plants
4) heterotrophs

2 15. The diagram below shows organisms in and around a pond.



Which ecological term refers to all the organisms shown in the diagram?

1) heterotroph 2) community 3) population 4) producer

4 16. One advantage of biodiversity in an ecosystem is that it

1) guarantees that the largest organisms will dominate the area
2) ensures a large amount of identical genetic material
3) develops relationships between organisms that are always positive over long periods of time
4) increases the chance that some organisms will survive a major change in the environment

4 17. A new island formed by volcanic action may eventually become populated with biotic communities as a result of

1) a decrease in the amount of organic material present
2) decreased levels of carbon dioxide in the area
3) the lack of abiotic factors in the area
4) the process of ecological succession

1 18. Abandoned railroad tracks are overgrown with weeds. Ten years later there are small aspen trees growing in the middle of the tracks. This change is an example of

1) ecological succession 3) genetic variation
2) biological evolution 4) heterotrophic nutrition

1 19. Carbon dioxide makes up less than 1 percent of Earth's atmosphere, and oxygen makes up about 20 percent. These percentages are maintained most directly by

1) respiration and photosynthesis
2) the ozone shield
3) synthesis and digestion
4) energy recycling in ecosystems

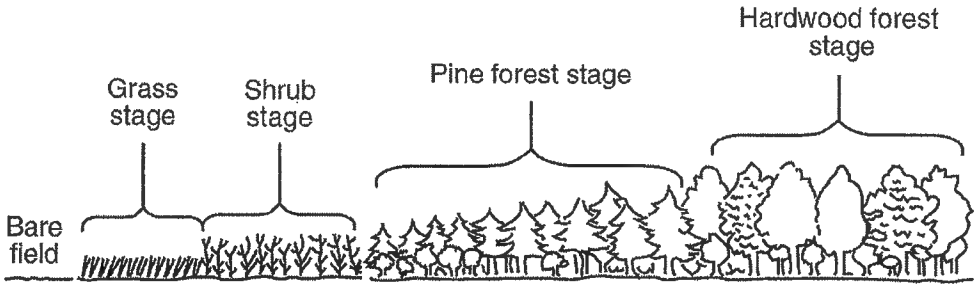
3 20. Which two life functions of animals help maintain the water cycle by recycling water back into the environment?

1) digestion and regulation
2) synthesis and locomotion
3) respiration and excretion
4) reproduction and growth

2 21. Which would be the most likely effect of a drastic reduction in all the producer organisms in a meadow environment?

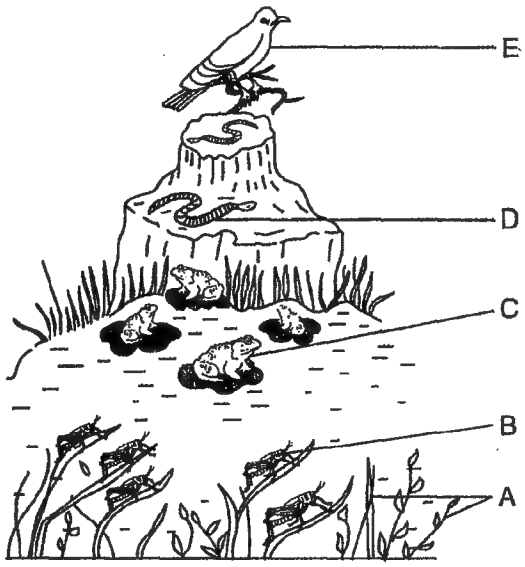
1) The grasshoppers would multiply rapidly.
2) The rabbit population would decrease.
3) All of the snake populations would increase.
4) All of the decomposers would die.

___22. The diagram below represents a biological process taking place in an area of New York State unaffected by natural disasters.



Which statement correctly describes a stage in this process?
1) The grass stage is the most stable stage and exists for thousands of years.
2) The shrub stage modifies the ecosystem, making it more suitable for the pine forest.
3) The pine forest stage has no biodiversity and the least competition.
4) The hardwood forest stage will be replaced by a pine forest.

Base your answers to questions **23** and **24** on the diagram below that represents an energy pyramid in a meadow ecosystem and on your knowledge of biology.



___23. Which two organisms are carnivores?
1) *A* and *B*
2) *A* and *E*
3) *B* and *D*
4) *C* and *E*

___24. Which species would have the largest amount of available energy in this ecosystem?
1) *A*
2) *B*
3) *C*
4) *E*

___25. In lakes that are exposed to acid rain, fish populations are declining. This is primarily due to changes in which lake condition?
1) size
2) temperature
3) pH
4) location

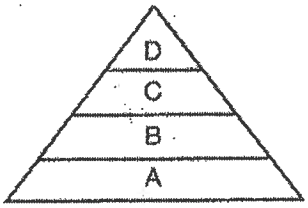
___26. Which human activity creates the *least* threat to global stability?
1) overuse of resources
2) pollution of water with heavy metals
3) pollution of air with sulfur gases
4) reuse of plastic bags

___27. Deforestation of areas considered to be rich sources of genetic material could limit future agricultural and medical advances due to
1) the improved quality of the atmosphere
2) the maintenance of dynamic equilibrium
3) an increase in the rate of evolutionary change
4) the loss of biodiversity

___28. In some areas, foresters plant one tree for every tree they cut. This activity is an example of
1) lack of management of nonrenewable natural resources
2) a good conservation practice for renewable natural resources
3) a good conservation practice for nonrenewable natural resources
4) lack of concern for renewable natural resources

___29. Global warming has been linked to a *decrease* in the
1) size of the polar ice caps
2) temperature of the Earth
3) rate of species extinction
4) rate of carbon dioxide production

4 30. The diagram below represents a food pyramid.



The concentration of the pesticide DDT in individual organisms at level D is higher than the concentration in individuals at level A because DDTis

1) synthesized by organisms at level D
2) excreted by organisms at level A as a toxic waste
3) produced by organisms at level C which are eaten by organisms at level D
4) passed through levels A, B, and C to organisms at level D

4 31. Communities have attempted to control the size of mosquito populations to prevent the spread of certain diseases such as malaria and encephalitis. Which control method is most likely to cause the *least* ecological damage?

1) draining the swamps where mosquitoes breed
2) spraying swamps with chemical pesticides to kill mosquitoes
3) spraying oil over swamps to suffocate mosquito larvae
4) increasing populations of native fish that feed on mosquito larvae in the swamps

3 32. Which human activity would most likely have a positive impact on the environment?

1) using pesticides to decrease populations of birds of prey
2) increasing emissions into the atmosphere to decrease the pH of lakes
3) using parasites for biological control of pests to increase crop yields
4) engaging in uncontrolled hunting and trapping to reduce populations of carnivores

4 33. The increasing demands for fossil fuels has led government and businesses to consider several possibilities to solve the energy crisis. Which solution will reduce the impact of this crisis on the environment and future generations?

1) increase the number of drilling sites for crude oil in North America
2) build more power plants away from population centers
3) limit the number of people in each vehicle
4) develop alternative fuel sources that can be produced from renewable resources

3 34. One possible reason for the rise in the average air temperature at Earth's surface is that

1) decomposers are being destroyed
2) deforestation has increased the levels of oxygen in the atmosphere
3) industrialization has increased the amount of carbon dioxide in the air
4) growing crops is depleting the ozone shield

1 35. Continued depletion of the ozone layer will most likely result in

1) an increase in skin cancer among humans
2) a decrease in atmospheric pollutants
3) an increase in marine ecosystem stability
4) a decrease in climatic changes

LAB REVIEW

Part D of the Living Environment Regents Exam covers information from the four required labs.

Question format varies from multiple choice to short answer or longer answers. There will be diagrams or graphs to interpret and possibly a simple diagram to sketch/label

NYS Required Labs

- Diffusion Through a Membrane
- Making Connections
- Relationships and Biodiversity
- The Beaks of Finches

NYS Regents Lab Review The Beaks of Finches

Important Terms

Variation
Struggle for Survival
Environment
Migration
Competition
Adaptation
Selecting Agent

Key Points

1. Species evolve over time. Evolution is a result of the interactions between:
    a. The potential for a species to increase its population
    b. Genetic variation of offspring due to mutation and genetic recombination.
    c. A limited amount of resources in the environment (ex. food, space, mates, etc.)
    d. Selection by the environment of those individuals that are better able to survive and produce viable offspring ("survival of the fittest")

2. Some characteristics / variations give individuals an advantage over others in surviving and reproducing. The offspring of these "better adapted" individuals will be more likely to survive and reproduce than those of other individuals. The proportion / frequency of individuals with favorable characteristics will increase.

3. Variation in a population increases the likelihood that at least some individuals will survive the changing environmental conditions.

Procedure

1. In teams of two, students will simulate competition for food by finches in an island environment.

2. The beak variations of finches will be represented by a variety of tools (tweezers, spoons, pliers, etc.)

3. In Round One, students simulate feeding on small seeds. Each student will remove seeds alone, without competition from other students.

4. The winners of Round One stay on their original island while the losers migrate to a new island with a different food source (large seeds). In Round Two, the same procedure will be followed with one exception. Competition between species will be simulated by having a member from each opposing team feed from the tray at the same time. The winning teams proceed to Round Three and the losing teams are eliminated.

5. In Round Three, all surviving teams feeding on large seeds will feed from the same tray of large seeds at the same time. All surviving teams feeding on small seeds will feed on the same tray of small seeds at the same time.

6. The winning teams of from Round Three will possess the beak variation that is best fit for feeding on that particular type of seed.

7. All trials in each round run for the same length of time. Only those seeds that are successfully removed are counted.

Analysis

1. Those individuals with beaks best adapted for feeding on small seeds remained on the island at the end of Round One while those with "less adapted" beaks migrated to a new island.

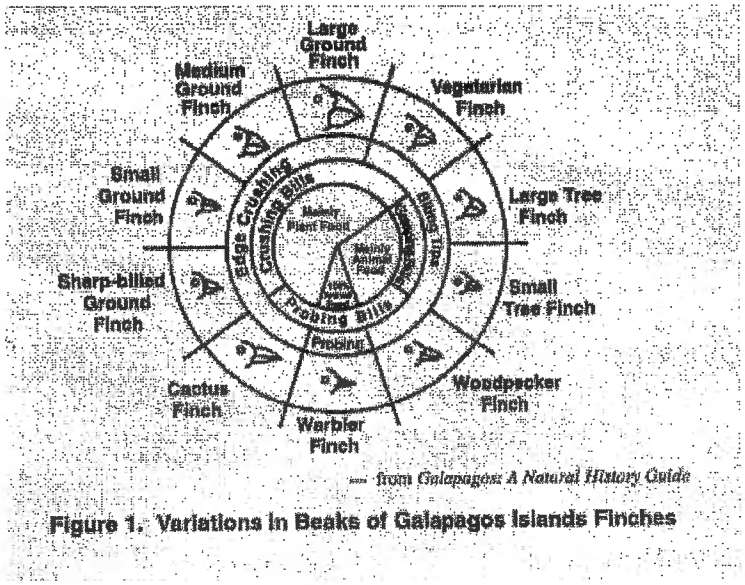
2. Competition for food in Round Two should have had an adverse effect on feeding success.

3. There were fewer survivors at the end of Round Three due to increased competition.

4. The following four components of Natural Selection were simulated:

    a. Variation: different beaks, different size seeds
    b. Competition: more than one bird feeding at one bowl
    c. Struggle for survival: each bird trying to get enough food to survive
    d. Adaptation: particular characteristics of "beaks"
    e. Environment: students, seeds, dishes are part of environment
    f. Selecting agent: type of "beak" and / or type of seed available

Review Sheet



— from *Galapagos: A Natural History Guide*

Figure 1. Variations in Beaks of Galapagos Islands Finches

* Be sure you study the diagram to the left that shows the variations in beaks of Galapagos Island finches. The diagram represents the types of beaks, the function of the beaks, and the type of food the finches eat.

NYS Regents Lab Review: Relationships and Biodiversity

Important Terms

Biodiversity
Gel Electrophoresis
Molecular Evidence
Habitat Destruction
Structural Evidence
Chromatography
Human Impact
DNA
Extinct
Amino Acids
Enzymes

Key Points

1. The diversity of life on the planet has been created through the process of evolution by means of natural selection.
2. Through natural selection, organisms have evolved to lessen competition, and therefore fill a wide array of niches. This *biodiversity* increases the stability of ecosystems.
3. Biodiversity has important benefits to mankind, including development of new food sources and medicines; as well as beneficial, free, ecosystem services. Ecosystem degradation and destruction lead to the loss of genetic biodiversity and increases the chance that an ecosystem will become less stable and collapse.

Procedures

*Safety precautions are moronic for this lab. Goggles in step 4 & 5 are for a vinegar and baking soda reaction and paper chromatography using food coloring, vinegar, and water.

1. Seven tests are conducted to determine the relatedness of Samples X,Y, and Z to *Botana curus*. They are as follows:
    a. Structural Characteristics of Plants
        - Compare the characteristics of the bagged samples
    b. Structural Characteristics of Seeds
        - Compare the characteristics of the bagged samples
    c. Structural Characteristics of Stems (Internal Microscopic Structures)
        - Use low power on the microscope to examine cross sections of the stems. Look for a scattered arrangement of bundles or a circular arrangement of bundles.
    d. Paper Chromatography to Separate Plant Pigments
        - Using clean, separate pipettes for each sample, transfer two drops of each plant extract to a piece of chromatography paper, two cm above the bottom. Label the top of the paper with the proper sample names.
        - Place the paper into a cup of water, 1 cm deep. The water should NOT touch the spots of plant extract.
        - Keep checking the sample to make sure the water does not reach the labeled top part of the paper. When the water is done rising, check the color and relative amounts of pigments and record this in the data table.

    e. Indicator Test for Enzyme M

- Placing a scoop of the indicator powder into 4 depressions of the well tray, check the extracts for the presence of Enzyme M. A fizzing reaction indicates that Enzyme M is present in the extract.

f. Gel Electrophoresis (simulated) to Compare DNA
   - Obtain colored paper strips representing portions of DNA molecules. The sequence of bases are representative of molecules isolated from *Botana curus* and Species X,Y, and Z. An enzyme will be used to cut between C and G of the sequences to produce different sized portions of the DNA. These will be placed on a simulated gel plate to compare the relatedness of *B. curus* to X, Y, and Z.

g. Translating the DNA Code to Make a Protein
   - Using the DNA codons, create the complementary messenger RNA, remembering that the DNA base A specifies the RNA base U (*T is replaced with U in RNA). Using the Universal Genetic Code table, translate the mRNA base sequences into the correct amino acid sequences of the protein.

Analysis

1. This lab has 7 tests used to determine the relatedness of 4 plant samples. Remember that scientists use a variety of evidence to determine evolutionary relationships, including cell types, structural morphology, DNA, behavior, embryology, and fossils. The more criteria that are shared between organisms, the more likely they are closely related.
2. Relatedness can be shown using a "branching tree diagram", or cladogram. Organisms that are closely related are next to each other on the same branch. More distant relations are further apart on the branch.
3. *Botana curus* shares the most characteristics with Sample Z, making this sample the most closely related. These characteristics included the presence of Enzyme M, the same pigments blue, yellow, and pink, scattered bundles, no difference in the amino acid sequences, and the same DNA banding pattern.
4. The evidence that should receive the most emphasis when determining the relatedness would be the genetic sequence, as many things can look similar structurally (convergent evolution), but would be unlikely to share the same DNA sequence if they are not truly closely related.
5. The loss of even a single species (extinction) can have major implications for mankind and natural ecosystems.
6. Scientists use gel electrophoresis to separate DNA fragments. Negatively charged DNA molecules migrate through the gel like material towards the positively charged pole. The smaller molecules migrate more rapidly through the gel than the larger ones do.

NYS Regents Lab Review: Diffusion Through a Membrane

Important Terms

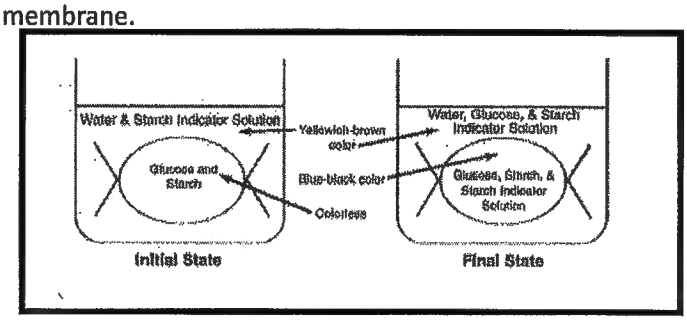
Diffusion
Selectively permeable
Indicators
Dialysis tubing
Starch
Glucose
Starch indicator
Glucose indicator
Controls
Cytoplasm
Cell membrane
Cell wall
Osmosis
Wet mount
Cover slip

Key Points I

1. Molecules tend to move from high to low concentration without the use of energy (*diffusion*).
2. Membranes may allow some molecules to pass through while not allowing others (*selectively permeable*).
3. *Indicators* are used to show the presence of certain kinds of molecules.

Procedure I

1. A model cell is made using a plastic membrane (usually *dialysis tubing*) containing *starch* and *glucose*. The bag is sealed with string.
2. *Starch indicator* (iodine) is placed in solution outside the 'cell'.
3. Because of the differences in concentration, starch indicator diffuses in and glucose diffuses out. Starch 'wants' to diffuse out, but cannot because the molecule is too large to pass through the membrane.



4. Starch (milky white) + starch indicator (brown) = blue-black color
5. The inside of the bag turns blue-black while the outside stays brown, proving that indicator went in, but starch did not leave.
6. *Glucose indicator* (blue) + glucose (clear) + HEAT = green, brown, red, or orange
7. Testing the fluid outside the 'cell' shows glucose has left. This is tested by placing fluid from outside into a test tube, adding indicator solution, and heating the mixture.
8. You may prove that #6 is true by testing (heating) indicator alone and also testing indicator + starch. Both of these *controls* result in a blue color (no change).

Analysis I

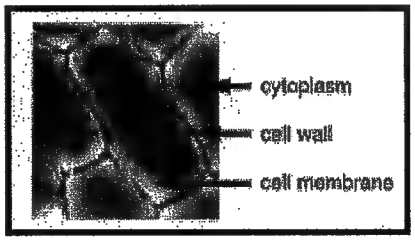
1. Glucose and starch indicator may pass through the membrane. Starch may not. This is because starch is a much larger molecule than glucose or starch indicator.
2. This shows the importance of breaking down large molecules inside the digestive system in order for nutrients to enter the bloodstream.

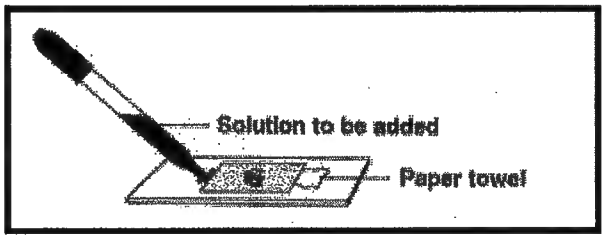
Key Points II

1. Basic parts of the cell that are easily seen under the microscope are the *cytoplasm*, *cell membrane*, and *cell wall* (in plants).
2. Molecules tend to move from high to low concentration without the use of energy (*diffusion*).
3. Diffusion of water molecules is particularly important and has the special name of *osmosis*.
4. The balance of water molecules inside and outside the cell is extremely important for the survival of all organisms, including humans.

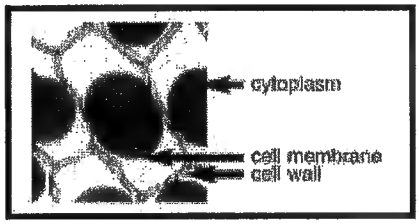
Procedure II

1. Make a *wet mount* slide of a thin section of red onion cells. The cells are taken from the outer 'skin' of the onion bulb and a small piece is placed in a drop of water on a microscope slide. A *cover slip* is placed on top by touching it to the water at an angle, and then carefully placing it on the specimen, trying not to get air bubbles underneath.
2. The cells are examined under the light (compound) microscope. You should be able to identify the cytoplasm, cell membrane, and cell wall.
3. It is important to see that the cell membrane and cytoplasm completely fill the space within the cell wall.





4. Place a 10% salt solution under the cover slip. This is done by putting a drop of salt solution next to one edge of the cover slip, then absorbing water from the <u>opposite</u> side of the slip using a paper towel.
5. Observe the cells in the salt solution. It is important to see that the cytoplasm and cell membrane have shriveled up inside the cell wall. This is due to water molecules leaving the cell and entering the salty (low water) solution.



6. Place distilled water under the cover slip using the technique described in #4 above.
7. Observe the cells in distilled water. It is important to see that the cytoplasm and cell membrane have swollen back to fill the entire space available within the cell wall.

Analysis II

1. Cells placed in very salty solutions will lose water, causing them to collapse and possibly lose the ability to complete life functions.
2. Cells placed in very watery solutions will tend to gain water, which causes them to swell and might cause them to burst/break open, destroying the cell. Note that this did not happen in the plant cells because the cell wall prevents the cell membrane from easily expanding.
3. Freshwater creatures, particularly single-celled organisms, must cope with too much water entering the cells. Saltwater organisms tend to have the opposite problem and must try to reclaim lost water.

NYS Regents Lab Review: Making Connections

Important Terms

Pulse Rate
Muscle fatigue
Homeostasis
Hypothesis
Independent variable
Dependent variable
Control variable
Control group
Trial
Sample size
Histogram

Key Points I

1. In order to find a hypothesis, one looks for patterns. For example, we did not see a connection between pulse rate and height, but we did see a connection between pulse rate and exercise.
2. Graphs and data tables present data in a clear, organized way that is easy to understand.
3. Pulse rate increases during exercise because the cells need to be provided with more food and oxygen and more wastes are produced which need to be transported to the lungs (CO_2) and the kidneys (urea).
4. Muscles become fatigued, tired, due to waste products building up in them.
5. Organ systems interact in order to maintain homeostasis.

Procedure I

1. Students found their average pulse rates after three trials.
2. Class results were graphed in a histogram, bar graph.
3. Pulse rates were found to increase after exercising.
4. A clothespin was squeezed rapidly for one minute. The number of times that it was squeezed was recorded.
5. The clothespin was squeezed the same way for another minute.

Analysis:

1. Organ systems interacted to maintain homeostasis during exercise. For example:
    a. The respiratory system takes in oxygen, which is transported to cells by the circulatory system. As cells use oxygen at a higher rate, an increased heart rate would get the oxygen to the cells more quickly
    b. As muscle cells increase their activity, they produce waste products at a higher rate. These wastes are carried to the excretory system by the blood (circulatory system) more efficiently when the heart rate increases.
2. A reliable way to test a hypothesis or a claim is to do an experiment.