**Objective 4.1.1 - Compare the structure and function of each of the listed organic molecules in organisms:**

* **Carbohydrates (glucose, cellulose, starch, glycogen)**
* **Proteins (insulin, enzymes, hemoglobin)**
* **Lipids (phospholipids, steroids)**
* **Nucleic acids (DNA and RNA)**

|  |  |  |
| --- | --- | --- |
| Macromolecules | Function | Subunits |
| Carbohydrates |  |  |
| Proteins |  |  |
| Lipids |  |  |
| Nucleic Acids |  |  |

|  |  |  |
| --- | --- | --- |
| Specific Molecule | Function | Subunits |
| Starch |  |  |
| Cellulose |  |  |
| Insulin |  |  |
| Glycogen |  |  |
| Glucose |  |  |
| Enzymes |  |  |
| Hemoglobin |  |  |
| Fats |  |  |
| DNA |  |  |
| RNA |  |  |

**Describe the following nutrient tests:**

|  |  |  |  |
| --- | --- | --- | --- |
| Nutrient | Type of Test | Negative Test | Positive Test |
| Starch |  |  |  |
| Lipids |  |  |  |
| Monosaccharides |  |  |  |
| Protein |  |  |  |

**Objective 4.1.3 Develop a cause and effect model for the specificity of enzymes.**

Explain the importance of shape to enzyme function.

Explain what determines the shape of an enzyme.

Explain why enzymes are specific.



Which substrate would fit into the enzyme in the picture above?

What do enzymes do to the rate of chemical reactions? How?

Look at the graph below and interpret it to determine which temperature range and pH range the enzyme works best in:



Common characteristics of enzymes:

* They usually end in - \_\_\_\_\_\_\_\_\_\_\_\_\_
* They are \_\_\_\_\_\_\_\_\_\_\_ - they can be used over, and over again because they are not destroyed and their shape does not change
* They are \_\_\_\_\_\_\_\_\_\_\_\_ - SHAPE MATTERS!!
* What is the function of enzymes in biological systems? Why are they necessary for all biochemical reactions?
* Explain why enzymes can be reused over and over again.
* How do extreme pH and extreme temperature affect enzymes?
* Explain the lock-and-key model of enzymes and substrates.

**Objective 1.1.1 Summarize the structure and function of organelles in eukaryotic cells & ways these organelles interact with each other to perform the function of the cell.**

**Fill in this chart. Also give the letter or number of the part as seen in the diagrams below.**

|  |  |  |
| --- | --- | --- |
| Cell Part and Letter | Structure Description | Function |
| Nucleus |  |  |
| Plasma Membrane |  |  |
| Cell wall |  |  |
| Mitochondria |  |  |
| Vacuoles |  |  |
| Chloroplasts |  |  |
| Ribosomes |  |  |

Which cell is the plant cell (left or right)?

Which structures are found only in the plant cell?

Which structures are found only in the animal cell?





**Microscope Use:**

How do you determine total magnification of a microscope? (Assume the eyepiece magnifies 10 x and the objective magnifies 40 x)

Draw how the letter “e” would look as view through a microscope?

Put the following in order from smallest to largest:

Organ systems Cells Organs Tissues

\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_

**Compare the following two types of cells:**

|  |  |  |
| --- | --- | --- |
|  | **Prokaryotic** | **Eukaryotic** |
| **Membrane-bound organelles** |  |  |
| **Ribosomes** |  |  |
| **Types of chromosomes** |  |  |
| **size** |  |  |

**1.2.1 Explain how homeostasis is maintained in a cell and within an organism in various environments (including temperature and pH)**

Explain what has happened in the diagram to the left.

Why did the large dark molecules NOT move to the left?

How is the semipermeable membrane like a cell membrane?

If the dark molecule is starch, where is the starch concentration greatest (left or right)?

If the white molecule is water, where is the water concentration greatest at first?

In osmosis, water moves from an area of \_\_\_\_\_\_\_\_\_\_ to an area of \_\_\_\_\_\_\_\_\_ concentration.

If the dark molecules could move, in what direction would they move? Why?

In diffusion, molecules move from an area of \_\_\_\_\_\_\_\_ to an area of \_\_\_\_\_\_\_\_ concentration.

What is osmotic pressure?

Draw arrows to show which way **wate**r will move in each of the following situations:

* 1. Salt inside the cell = 65% and outside the cell 40%.
	2. Sugar inside the cell 27% and outside 80%.

What is homeostasis?

How do cells maintain homeostasis: Consider pH, temperature, blood glucose, water balance

**Comparison of active and passive transport**

|  |  |  |
| --- | --- | --- |
|  | **PASSIVE TRANPORT** | **ACTIVE TRANSPORT** |
| **Requires energy?** |  |  |
| **Low to high concentration or high to low concentration?** |  |  |
| **Examples** |  |  |

**4.2.1 Analyze photosynthesis and cellular respiration in terms of how energy is stored, released, and transferred within and between these systems.**

Label the following molecules in these equations (water, glucose, oxygen, carbon dioxide, ethyl alcohol)

**A)** 



**B)**



**C)**

Which of the above reactions is photosynthesis?

Which of the above reactions is fermentation (anaerobic cellular respiration)?

Which of the above reactions is cellular respiration (aerobic)?

Which reaction(s) requires or stores energy?

Which reaction(s) release energy (ATP)?

Which reaction releases the most energy? Why?

Which reaction requires chlorophyll? What is the purpose of the chlorophyll?

Which organisms carry out process A?

Which organisms carry out process B?

Which organisms carry out process C?

Which process uses chloroplasts in eukaryotes?

Which process uses mitochondria in eukaryotes?

What factors could speed up (or slow down) process A?

What factors could speed up (or slow down) process B?

What factors could speed up (or slow down) process C?

**1.2.2 Analyze how cells grow and reproduce in terms of interphase, mitosis, and cytokinesis.**

Cell Cycle:



Look at the diagram of the cell cycle.

When does the duplication of DNA occur? What is this phase called?

What do GI and G2 represent?

Does mitosis include cytokinesis (division of the cytoplasm)?

Put the following stages of mitosis (cell division) in order.



**1.1.3 Explain how instructions in DNA lead to cell differentiation and result in cells specialized to perform specific functions in multicellular organisms.**

**Below are a variety of cells from the human body.**

Label these cells (red blood cell, sperm cell, white blood cell, muscle cell, nerve cell)

Which cell is adapted for movement? What structure makes this movement possible? What organelle is very plentiful in these cells in order to provide the energy for movement?

Which cell has no nucleus? What is the function of this cell?

Which cell is involved in the immune system?

Which cell helps in movement of bones? What happens in these cells to make that movement possible?

Which cell is adapted for transmitting messages? What is the direction of these messages? How do the messages get from one cell to the next?



**3.1.1 Explain the double-stranded, complementary nature of DNA as related to its function in the cell.**

Below is a strand of DNA. DNA in the cells exists as a double helix – what else needs to be added to this strand to make it a double helix? Give the nucleotide sequence.

What are the black pentagons? What are the nitrogen bases?



Compare RNA and DNA in the following table

|  |  |  |
| --- | --- | --- |
|  | RNA  | DNA |
| Sugars |  |  |
| Bases |  |  |
| Strands |  |  |
| WhereIn Cell |  |  |
| Function |  |  |

What kind of weak bonds hold the two strands of DNA together?

Why is it important that these bonds be weak?

**3.1.2 Explain how DNA and RNA code for proteins and determine traits.**

If the strand of DNA above undergoes transcription, what will the sequence of the mRNA be?

After translation, what would the amino acid sequence be for this section of mRNA? (read from right to left)

What is a codon?

What kind of bonds hold the amino acids together in the protein that is formed?

What are the three types of RNA and what are their functions?

 1)

 2)

 3)

Describe how proteins code for traits (remember the Snork activity and Alien DNA activity).

**3.1.3 Explain how mutations in DNA that result from interactions with the environment (i.e. radiation and chemicals) or new combinations in existing genes lead to changes in function and phenotype.**

What happens to DNA when a mutation occurs?

How do mutations affect the proteins that are formed?

There are two types of mutations we discussed – what are they? (use your guided notes if needed)

**3.2.1 Explain the role of meiosis in sexual reproduction and genetic variation.**

|  |  |  |
| --- | --- | --- |
|  | MITOSIS  | MEIOSIS |
| Type of reproduction(Asexual or sexual) |  |  |
| Chromosome number of mother cell (1N=haploid or 2N=diploid) |  |  |
| Chromosome number of daughter cells (1N=haploid or 2N=diploid) |  |  |
| Number of cell divisions |  |  |
| Number of cells produced |  |  |
| When does replication happen? |  |  |

Below is a table of sources of genetic variation.

|  |  |
| --- | --- |
| SOURCES OF VARIATION | Description |
| Crossing over |  |
| Random assortment of chromosomes |  |
| Gene mutations |  |
| Nondisjunction |  |
| fertilization |  |

**3.2.2 Predict offspring ratios based on a variety of inheritance patterns (Mendelian/dominance, incomplete dominance, co-dominance, sex-linked, and multiple alleles)**

In the Punnett square to the left, T = tall and t=short. Give the genotype for the parents.

Give the phenotype for the parents.

What are the genotypes and phenotypes of the offspring?

What is the genotypic ratio of the offspring?

What is the phenotypic ratio of the offspring?

What environmental factors might affect the expression of these genes for height? Explain.

Some genes produce intermediate phenotypes. Cross a pure breeding red flower (RR) with a pure breeding white flower (WW). Give the genotypes and phenotypes of the offspring.



Explain the inheritance of the following disorders:

(autosomal dominant? Autosomal recessive? Sex-linked dominant? Sex-linked recessive?)

Sickle cell anemia:

Cystic fibrosis:

Huntington Disease:

Blood type

If a woman with type A blood has a child with a man with type B blood and their first child has type O blood, give the genotypes of the woman and the man and do the cross. (Alleles are IA, IB, and i)

What are the odds that they will have a child with type O blood again?

What are the odds that they will have a child with homozygous type A blood?

What are the odds that they will have a child with type AB blood?

A blood test is done to see if one of three men is the father of a child. The child has type O blood, the mother has type A blood. Man #1 has type AB blood, Man #2 has type A blood, Man #3 has type O blood. Are there any men that can be ruled out as the father. Explain.

Polygenic traits

Some traits are considered to be polygenic. What does this mean?

Using 3 genes (A,a and B,b and C,c) explain hair color in terms of these genes. How many phenotypes are possible?

Sex Chromosomes

What are the male sex chromosomes in humans?

What are the female sex chromosomes in humans?

Colorblindness and hemophilia are sex-linked traits. What chromosome are these genes found on?

Cross a female who is a carrier for hemophilia with a normal male.



 What are the odds that they will have a child with hemophilia.

 What are the odds that they will have a daughter with hemophilia?

 What are the odds that they will have a daughter who is a carrier for hemophilia?

Why are males more likely to show a sex-linked disorder?

Karyotype



What is the gender of the person whose karyotype is shown to the left?

What is the disorder that this person has? What is your evidence?

What are some of the characteristics of this disorder?

Pedigrees



What is the inheritance pattern shown by this pedigree?

How do you know?



Using A,a, what is the genotype of person II4?

What is the genotype of person I3?

Test Cross

Describe the test cross that a farmer would use to determine the genotype of an animal that shows a dominant trait. Use the following Punnett squares and the letters A and a to explain your answer.



How does meiosis lead to segregation and independent assortment?

A problem to solve:

A brown mink crossed with a silverblue mink produced all brown offspring. When these F1 mink were crossed among themselves they produced 47 brown animals and 15 silverblue animals (F2 generation). Determine all the genotypes and phenotypes, and their relative ratios, in the F1 and F2 generations.

**3.2.3 Explain how the environment can influence the expression of genetic traits**

Below is a table including examples of disorders or diseases that are caused by a combination of genetics and the environment. For each effect, please check whether the disorder is caused by genetics, or the environment, or both. Please also include a description based on your notes.

|  |  |  |  |
| --- | --- | --- | --- |
| **“Effect”** | **Genetics?** | **Environment?** | **Description** |
| Lung/Mouth Cancer |  |  |  |
| Skin Cancer |  |  |  |
| Diabetes |  |  |  |
| PKU |  |  |  |
| Heart Disease |  |  |  |

**3.3.1 Interpret how DNA is used for comparison and identification of organisms.**

 To the left is an electrophoresis gel, showing evidence from a rape case.

 Could the defendant be the rapist? Explain your answer.

 Which fragments of DNA are the longest? Explain.

 What other ways can DNA fingerprinting be useful?

**3.3.2 Summarize how transgenic organisms are engineered to benefit society.**

Describe the process that is shown in the diagram to the left.

What is the value of this technology?

What are some other applications of this type of technology?

This process can be used to make GMO’s –genetically modified organisms. What are some of the ethical issues surrounding this technology?

**3.3.3 Evaluate some of the ethical issues surrounding the use of DNA technology (including cloning, genetically modified organisms, stem cell research, and Human Genome Project)**

What were the goals of the human genome project established?

How will the human genome project be useful in determining whether individuals may carry genes for genetic conditions?

How will the human genome project be useful in developing gene therapies?

Why might cloning be controversial?

Embryological stem cells are more controversial than adult stem cells. Where are embryonic stem cells obtained from?

**3.4.1 Explain how fossil, biochemical, and anatomical evidence support the theory of evolution.**

What did Louis Pasteur contribute to our understanding of the origins of life?



Explain Miller and Urey’s hypothesis.

Why did Miller and Urey put those particular gases into their experiment?

What type of organic molecules did they find?

What is the significance of their experiments?

Most hypotheses state that prokaryotic anaerobes probably evolved first. Why?

The hypotheses then suggest that prokaryotic autotrophs probably evolved? Why?

What would enter the atmosphere as a result of these autotrophs appearing?

Then prokaryotic aerobic heterotrophs could evolve. What can these cells do that others before them cannot?

What is the hypothesis explaining how eukaryotic cells evolved?

Describe what fossil evidence can tell us about organisms:

Compare the two types of fossil dating:

Relative dating:

Absolute dating:

How do the following pieces of evidence support the theory of evolution? What does it tell us about the organisms?

 Anatomical structures:



 Biochemical evidence:

**3.4.2 Explain how natural selection influences the changes in species over time.**

Discuss the steps in Darwin’s theory of evolution by natural selection.

1) populations of organisms have many genetic variations. Where do these come from?

2) organisms could reproduce exponentially but they don’t. Why not?

3) Genetic variations lead to different adaptations. What are adaptations?

4) Some adaptations have better survival value in certain environments. What does this mean?

5) Those organisms with adaptations that better fit them to an environment will survive, reproduce and pass on their genes. What does it mean to be “fit” to an environment?

6) The next population will have a high frequency of the genes that have been selected for. Why will the frequency of selected genes increase?

7) When this process continues over millions of years, it can lead to speciation. What is speciation?

**3.4.3 Explain how various disease agents (bacteria, viruses, chemicals) can influence natural selection.**

Describe how a population of bacteria can become resistant to an antibiotic (or an insect to a pesticide) using the steps listed above.

Explain the relationship between sickle cell anemia and malaria.

Explain the relationship between lung and mouth cancer and tobacco use.

Explain the relationship between skin cancer, vitamin D, folic acid and sun exposure.

Explain the relationship between diabetes, diet/exercise, and genetics.

Explain the relationship between PKU and diet.

Immune Response

Label each of the following letters: Disposal, Mobilization, Recognition, Immunity

What is the function of helper T-cells?

What is the function of killer T-cells?

What is the function of cytotoxic T-cells?

What do B cells produce?

What is happening at letter C?

What kind of cells are produced at letter D that keep you from becoming reinfected?

What is the difference between active immunity and passive immunity?

Explain what vaccines do to the immune system.



Health and Nutrition

What type of diet contributes to optimal health?

What type of diet contributes to obesity?

What type of diet contributes to malnutrition?

What happens when someone is deficient in Vitamin C? Vitamin D? Vitamin A?

Parasites (Malaria)

Describe the life cycle of the malarial parasite. What is the vector? What are the symptoms? What are the treatments?

Environmental Toxins

Explain the effects on human health of:

 Lead:

 Mercury:

**3.5.1 Explain the historical development and changing nature of the classification systems.**

Explain how the organization of the kingdoms and domains have changed over time.

What is the current accepted kingdom-domain system?

What is the current seven-level classification system?

What is binomial nomenclature?

How are DNA and biochemical analysis, embryology, and morphology used to classify organisms?

**3.5.2 Analyze the classification of organisms according to their evolutionary relationship (including dichotomous keys and phylogenetic trees)**

To the left is a phylogenetic tree of some organisms. According to this tree, which pairs of organisms are most closely related? 

Which organism is most closely related to the rayfinned fish?

Which organisms are the mammals most closely related to?

Use the following key to identify the tree branch to the left.

1. a. leaf is needle-like….go to 2

 b. leaf is broad……… go to 5

2. a. needles are short ....go to 3

 b. needles are long…...go to 4

3. a. underside of needles green…Hemlock

 b. underside of needles silver ..Balsam

4. a. 3 needles in bundle….Pitch Pine

 b. 5 needles in bundle….White Pine

5. a. edge of leaf round…go to 6

 b. edge of leaf serrated…go to 7

6. a. minty odor…… Wintergreen

 b. no minty odor…..Laurel

**2.1.2 Analyze the survival and reproductive success of organisms in terms of behavioral, structural, and reproductive adaptations.**

Fill in the charts below showing how various groups of organisms accomplish the life functions listed.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Protists** | **Annelids** | **Insects** |
| Transport of materials |  |  |  |
| Excretion |  |  |  |
| Respiration |  |  |  |
| Regulation |  |  |  |
| Nutrition |  |  |  |
| Reproduction |  |  |  |
| Growth and development |  |  |  |

|  |  |  |
| --- | --- | --- |
|  | **Amphibians** | **Mammals** |
| Transport of materials |  |  |
| Excretion |  |  |
| Respiration |  |  |
| Regulation |  |  |
| Nutrition |  |  |
| Reproduction |  |  |
| Growth and development |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Non-vascular Plants** | **Gymnosperms**  | **Angiosperms**  |
| Transport of materials |  |  |  |
| Excretion |  |  |  |
| Respiration |  |  |  |
| Regulation |  |  |  |
| Nutrition |  |  |  |
| Reproduction |  |  |  |
| Growth and development |  |  |  |

**Explain what the following systems do: Compare the following two types of cells.**

|  |  |
| --- | --- |
|  | Function of system |
| Transport of materials |  |
| Excretion |  |
| Respiration |  |
| Regulation |  |
| Nutrition |  |
| Reproduction |  |
| Growth and development |  |
| Synthesis |  |

Complete the chart comparing the examples of behavior, including how it helps the organisms survive in their environment.

|  |  |  |
| --- | --- | --- |
| **Type of Behavior** | **Explanation of Behavior**  | **Survival Value of Behavior**  |
| Suckling  |  |  |
| Insects moving away or toward light |  |  |
| Migration |  |  |
| Estivation |  |  |
| Hibernation |  |  |
| Habituation |  |  |
| Imprinting |  |  |
| Classical conditioning |  |  |
| Trial and error |  |  |
| Communication using pheromones |  |  |
| Courtship dances |  |  |
| Territoriality |  |  |

Which of the above behaviors are innate (or instinct)?

Which of the above behaviors are learned?

Which of the above behaviors are social?

**2.1.1 Analyze the flow of energy and cycling of matter (such as water, carbon, nitrogen, and oxygen) through ecosystems relating them to the health and stability of an ecosystem.**

|  |  |
| --- | --- |
| Carbon cycle Diagram |  |

Which process(es) put carbon dioxide into the atmosphere?

Which process(es) take carbon dioxide out of the atmosphere?

Explain the Greenhouse Effect in relationship to carbon dioxide in the atmosphere.

What effect might increased atmospheric carbon dioxide have on the environment?

Food Webs



What are the producers in this food web?

What are the primary consumers (herbivores) in this food web?

What are the secondary consumers in this food web?

What are the highest level consumers in this food web?

Create an energy pyramid from the food chain: leavesinsectsbirdsredfoxbear



Where is the most energy in this pyramid? Where is the least energy?

What happens to energy as it moves through the food chain/web?

Assume there are 10,000 kcal of energy in the leaves? Estimate the amount of energy in each of the other levels of the energy pyramid.

What happens to matter as it moves through the food chain/web?

What is the ultimate source of energy for this food web?

**2.1.3 Explain various ways organisms interact with each other (including predation, competition, parasitism, mutualism) and with their environments resulting in stability within ecosystems.**

**In the following chart, explain the symbiotic relationships**

|  |  |  |
| --- | --- | --- |
| **Relationship** | **Definition**  | **Example**  |
| **Mutualism** |  |  |
| **Commensalism** |  |  |
| **Parasitism** |  |  |

Predator-Prey

In the graph below, which organism is the prey? Which is the predator?

Which population increases (or falls) first and why?

Which population increases (or falls) second and why?



**2.1.4 Explain why ecosystems can be relatively stable over hundreds or thousands of years, even though populations fluctuate.**

Sampling techniques



Assume that the diagram to the left shows populations of pine trees in an area. The area is too large for a scientist to count every tree.

How can the scientist use sampling to get a good estimate of the number of pine trees per 10,000 square meters.

Assume that each small plot (square) is 10 m x 10 m. Estimate the population size of the whole area.

How could the same process (above) be used to estimate species diversity?

How could the same process be used to discover changes in the environment over time?

Biotic and Abiotic Factors

List at least 3 biotic factors in an environment.

List at least 3 abiotic factors in an environment.

Give an example of how biotic and abiotic factors act together to limit population growth and affect carrying capacity.

|  |  |
| --- | --- |
| Graph 1: Rabbits Over TimeWhat kind of growth curve is shown by the graph to the right?What is the carrying capacity for rabbits?During what month were rabbits in exponential growth?  |  |
|  |  |
| Graph 2: Mexico and USIn Mexico, what percentage of the population is between 0-4 years of age? In the US? Which population is growing the fastest? Which age group has the smallest number in both countries?   |  |

Chart 3: Trapping Geese

|  |  |  |  |
| --- | --- | --- | --- |
| Year | Geese Trapped | Number with Mark |  |
|  1980 | 10 | 1 |  |
| 1981 | 15 | 1 |  |
| 1982 | 12 | 1 |  |
| 1983 | 8 | 0 |  |
| 1984 | 5 | 2 |  |
| 1985 | 10 | 1 |  |

In order to estimate the population of geese in Northern Wisconsin, ecologists marked 10 geese and then released them back into the population. Over a 6 year period, geese were trapped and their numbers recorded.

Use the formula to calculate the estimated number of geese in the area studied?
This technique is called \_\_\_\_\_\_\_\_\_\_\_\_ & \_\_\_\_\_\_\_\_\_\_\_\_\_\_

Supposing more of the geese found in the trap had the mark, would the estimated number of geese in the area be greater or lesser?

|  |  |
| --- | --- |
| The graph to the left shows the growth of the human population from 1 A.D. to 2000 A.D. Describe what you see has happened.Predict what will happen to population growth in the future and explain your reasoning.What factors influence birth and death rates? |  |

**2.2.1 Infer how human activities (including population growth, technology, consumption and production of waste, habitat destruction and introduction of non-native species) may impact the environment**

**Explain the effect each of the following may have on the environment.**

|  |  |
| --- | --- |
| **Factor** | **Effect on Environment** |
| **Population Size** |  |
| **Population Density** |  |
| **Resource Use** |  |
| **Acid Rain** |  |
| **Habitat Destruction** |  |
| **Introduced non-native species** |  |
| **Pesticide use** |  |
| **Deforestation** |  |

How do changes in human populations affect populations of other organisms?

What effect do volcanoes have on the atmosphere?

**2.2.2 Explain how the use, protection and conservation of natural resources by human impact the environment from one generation to the next.**

What are some examples of sustainable practices and stewardship that can protect the environment?

**2nd Tier Vocabulary -**

**Non-Science Words YOU Should Know:**

* accumulate
* accumulation
* adjacent
* alkaline = basic
* alter
* aquatic
* archaic
* assemble
* burrow
* capability
* coastal
* complex
* complexity
* continuous
* desirable
* discard (s) (ed)
* distilled H2O = 100% H2O
* effective
* effectiveness
* effectvity
* efficacy
* essential
* estimate
* exemplify (ied)
* expend (s) (ed)
* exterior
* extreme
* flexible
* fundamental
* global
* impact
* ineffective
* infer
* interior
* marine
* moderate
* modify / modification
* morbidity
* mortality
* mutagen
* non-essential
* optimal
* phenomenon
* potential
* primary
* primitive
* productive
* productivity
* progressive
* propel
* rapid
* represent (s) (ed)
* seldom
* sequence
* significant (ly) / significance
* source
* stability
* stimulate
* stimulation
* submerge
* susceptible
* template
* vestigial
* viable
* yield (s) (ed)