Question 1: **Discuss the different types of variation**

Variations as the word may suggest refers to differences among organisms of the same species due to the differences in the genes they inherit and the environment they survive in. Variation may be shown in physical appearance, metabolism, fertility, mode of reproduction, behavior, learning and mental ability, and other obvious or measurable characters. Variations come with their own package of advantages and disadvantages. While variation may promote survival of organisms in different environments, it all leads to extinction of some traits in populations of organisms. This assignment will discuss the types of variations, what they are and will end with giving the advantages and disadvantages of variations.

There are generally two types of variations which are environmental variation and genetic variations. It is however, important to note that under these two general categories there are other more types of variations.

Environmental variation is the differences among organisms of the same species due to the different factors of the environment they are exposed to, for example, exposure of organism to different temperatures, light, humidity, nutrients, loss of body parts via accidents, dehorning of cattle by man, lightening of the skin using cosmetics. Environmental variations are never passed from parent to offspring because they are not genetically acquired but environmentally acquired.

Genetic variation on the other hand refers to differences amongst organisms of the same species due to the differences in the genes they inherit from their parents, for example, some individuals are tall and others are short. This is because they inherited different genes from their parents. Such variations can be inherited because they are genetically determined.

As such, there are types of genetic variation. These are continuous variation and Discontinuous variation.

Continuous variation

This is the type of variation of a given character/trait where by differences among organisms of the same species are slight and grade into each other.

These characters can be measured and mean, mode and median can be obtained. Examples of this type include; Height, weight, intelligence, waist line, length and width of structures, skin colour, yield of milk, fertility, number of grains on a maize cob.

When the above are measured for any group of organisms, the biggest percentage of the measurement are intermediates, a few are of low grade and a few are of long grades. Continuous variation gives a normal distribution curve/bell shaped curve,/Gaussian curve when we compare many organisms referring to one continuous character.

It is important to note that no remarkable differences in value but continuous transmission from low to intermediate to high as shown by the normal distribution graph below. Though genetically determined can be influenced by the environment. Such features can be used in the dichotomous key.

Discontinuous variation

This is a type of variation which shows clear-cut and sharp differences amongst organisms over a given trait. In discontinuous variation differences do not merge into each other and therefore there are no intermediate grades. Features cannot be measured but can be observed and therefore we cannot obtain a normal distribution curve.

Features persist throughout the life time of an organism. They show distinct differences. Examples include sex, finger print, tongue rollers and non-tongue roller, colour blindness, taster and non-tasters to PTC (phenyl thio carbamide) blood groups, sickle cell anemia, hemophilia, skin pigmentation (normal skin colour/albinism) eye colour etc. They are not affected by environmental condition. The traits of discontinuous variation can also be used when constructing a dichotomous key.

Causes of variation

1. Environmental factors such as;

a) Diet,

b) Altitude,

c) Light intensity,

d) Temperature,

e) Pathogens and diseases,

f) Social function and

g) Age.

2. Genetic factors such as;

a) Crossing over between homologous chromosomes during prophase I of meiosis,

b) Mutations (which bring about mainly discontinuous variation in a population)

Advantage of Variations

The advantages of variations include the points that variations provide the basis for evolution and helps in maintaining life even in harsh conditions because having variations can help organisms survive in adverse conditions. Hence, natural selection will result in survival of the species having variation which is better than others.

Disadvantages of Variations

Variations can also be disadvantageous when they happen at an individual level. For example, the variation that arises from mutation can be lethal for the organisms. As the result, the organism with such kind of variation will not survive some environmental changes.

Other types of variations which can be classified as either continuous or discontinuous include; somatogenic and blastogenic. These two are classifications of variation based on their origin. Somatogenic variations are another category under continuous variations. Somatogenic variations are the result of influence of the environment upon the somatic cells. Their examples include; skin darkening in humans, strong and well developed muscles, and small feet due to wearing tight shoes. What is important to note about somatogenic variations is that they are not heritable. This is because they do not cause any alterations in the genotype of the organism.

Blastogenic variations are unlike somatogenic variations in that they heritable due to alterations in the genes of the organism. The changes may be due to assortment of genes during meiosis in sexual reproduction or due to some sudden change in the composition of genes or chromosome number. An example of change due to meiosis is the difference in height of a population. An example of change in the number of chromosomes is Down's syndrome where there is an extra 21^{st} chromosome. The individual is mentally retarded, has moon face, thick lips and generally does not live to the reproductive age. An example of change in the gene structure is sickle-celled anemia. In this, one of the genes undergoes a change in its composition. This will result in the red blood cells being sickle shaped. It is a fatal disease.

In conclusion, variation is simply the difference that occurs in organisms. It carries with it both advantages and disadvantages depending on its occurrence, whether it is in the species or in the individual organism. Variations have helped further the studies in evolution and other subjects in biology.