**Topic 10.2: Inheritance**

**Essential Idea: Genes may be linked or unlinked and are inherited accordingly.**

**Statements & Objectives:**

**10.2.U1 Unlinked genes segregate independently as a result of meiosis.**

State the difference between independent assortment of genes and segregation of alleles.

(**State** Give a specific name, value or other brief answer without explanation or calculation.)

Describe segregation of alleles and independent assortment of unlinked genes in meiosis.

(**Describe** Give a detailed account or picture of a situation, event, pattern or process.)

**10.2.U2 Gene loci are said to be linked if on the same chromosome.**

Define autosome and sex chromosome.

(**Define:** Give the precise meaning of a word, phrase, or physical quantity.)

Describe what makes genes “linked.”

(**Describe** Give a detailed account or picture of a situation, event, pattern or process.)

**10.2.U3 Variations can be discrete or continuous.​**

Contrast discrete with continuous variation.

(**Contrast** Give an account of the differences between two (or more) items or situations, referring to

both (all) of them throughout.)

State an example of a discrete variation,

(**State** Give a specific name, value or other brief answer without explanation or calculation.)

State an example of a continuous variation.

(**State** Give a specific name, value or other brief answer without explanation or calculation.)

**10.2.U4 The phenotypes of polygenic characteristics tend to show continuous variation.**

Explain polygenetic inheritance using an example of a two gene cross with codominant alleles.

(**Explain**: Give a detailed account including reasons or causes)

Outline the use of Pascal’s triangle to determine phenotype frequencies that results from polygenic crosses.

(**Outline** Give a brief account or summary.)

State that a normal distribution of variation is often the result of polygenic inheritance.

(**State** Give a specific name, value or other brief answer without explanation or calculation.)

State example human characteristics that are associated with polygenic inheritance.

(**State** Give a specific name, value or other brief answer without explanation or calculation.)

**10.2.U5 Chi-squared tests are used to determine whether the difference between an observed and expected frequency distribution is statistically significant.**

State the two possible hypotheses of a statistical test.

(**State** Give a specific name, value or other brief answer without explanation or calculation.)

Calculate the chi square value to determine the significance of differences between the observed and expected results of a genetic cross.

**(Calculate** Obtain a numerical answer showing the relevant stages in the working.)

Determine the degrees of freedom and critical value for the chi-square test.

(**Determine** Obtain the only possible answer.)

Draw a conclusion of significance by comparing the calculated and critical chi-square values.

**(Draw**: Represent by means of a labeled, accurate diagram or graph, using a pencil. A ruler(straight edge) should be used for straight lines. Diagrams should be drawn to scale. Graphs should have points correctly plotted (if appropriate) and joined in a smooth curve. )

**10.2.A1 Completion and analysis of Punnett squares for dihybrid traits.**

Determine possible allele combinations in gametes for crosses involving two genes.

(**Determine** Obtain the only possible answer.)

Use correct notation to depict a dihybrid cross between two unlinked genes.

**(Use** Apply knowledge or rules to put theory into practice.)

Construct a Punnett square to show the possible genotype and phenotype outcomes in a dihybrid cross.

(**Construct** Display information in a diagrammatic or logical form.)

**10.2.A2 Morgans’s discovery of non-Mendellian ratios in Drosophilia.**

Describe how Morgan discovered relationship between eye color and sex in Drosophila.

(**Describe** Give a detailed account or picture of a situation, event, pattern or process.)

**10.2.A3 Polygenic traits such as human height may be influenced by environmental factors.**

Outline two example environmental factors that can influence phenotypes.

(**Outline** Give a brief account or summary.)

Compare continuous to discrete variation.

(**Compare** Give an account of the similarities and differences between two (or more) items or situations, referring to both (all) of them throughout.)

**10.2.S1 Calculation of the predicted genotypic and phenotypic ratio of offspring of dihybrid crosses involving unlinked autosomal genes.**

Determine the predicted genotype and phenotype ratios of F1 and F2 offspring of dihybrid crosses.

(**Determine** Obtain the only possible answer.)

**10.2.S2 Identification of recombinants in crosses involving two linked genes.**

Use correct notation to show alleles of linked genes.

**(Use** Apply knowledge or rules to put theory into practice.)

Construct a Punnett square to show the possible genotype and phenotype outcomes in a dihybrid cross involving linked genes.

(**Construct** Display information in a diagrammatic or logical form.)

Explain how crossing over between linked genes can lead to genetic recombinants.

(**Explain**: Give a detailed account including reasons or causes)

**10.2.S3 Use of chi-squared test on data from dihybrid crosses.**

Calculate a chi-square value to compare observed and expected results of a dihybrid genetic cross.

(**Calculate** Obtain a numerical answer showing the relevant stages in the working.)

Using the df and critical chi-square value, determine if there is a significant difference between observed and expected results of a dihybrid cross.

(**Determine** Obtain the only possible answer.)

**10.2.NOS Looking for patterns, trends and discrepancies- Mendel used observations of the natural world to find and explain patterns and tends, Since then, scientists have looked for discrepancies and asked questions based on further observations to show exceptions to the rules. For example, Morgan discovered non-Mendellian ratios in his experiments with Drosophilia.**

Describe the trends and discrepancies that led Morgan to propose the idea of linked genes.

(**Describe** Give a detailed account or picture of a situation, event, pattern or process.)

**Key Terms**

Genotypes

​F1 generation

​linkage group

​discontinuous

​degrees of freedom

meiosis

​codominant

​polygenic crosses

Drosophila

gene loci

autosome

​gametes

​F2 generation

​Mendelian ratios

​sex-linked

variation

​Chi-square

​genotype

haploid

​Mendel

​linkage genotype

​polygenes

​un-linked genes

​sex chromosome

Pascal’s triangle

​Punnett Square

​df

dihybrid cross

​chromosome

​monohybrid

​independent assortment

discrete variation

​continuous variation

polygenic inheritance

​distribution frequency

​genetic recombinants

parental generation

​linked

​discrete

​chi-square

segregation

​phenotype

​allele

​Morgan

​segregation