**UNIT C1 – Cell Division**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *Identify the events labelled by number on left diagram* | | | | | | |
| Title  **1**    11  3  4  5  2  1  0  6  7  9  8 | | | | | **F16_5** | |
| **Area** |  | **Event** |  | **Description** | |  |
| **1** |  | **Cell Cycle** |  | **The life span of a cell** | |  |
| **2** |  | **Interphase** |  | **Phase that prepares the cell for mitosis and cell division** | |  |
| **3** |  | **Gap 1 or G1** |  | **Preparing cell by rapid growth** | |  |
| **4** |  | **Synthesis** |  | **DNA replication** | |  |
| **5** |  | **Gap 2 G2** |  | **Final cell preparation** | |  |
| **6** |  | **Prophase** |  | **Initial mitotic phase – 4 main events (see p. 3)** | |  |
| **7** |  | **Metaphase** |  | **Alignment on equator** | |  |
| **8** |  | **Anaphase** |  | **Division of chromatids to poles** | |  |
| **9** |  | **Telophase** |  | **Movement to end of cell, preparation for division** | |  |
| **10** |  | **Cytokinesis** |  | **Cell division** | |  |
| **11** |  | **Mitosis** |  | **Staged process which ends with cell division** | |  |
|  |  |  |  |  | |  |

***True or False***

|  |  |
| --- | --- |
| Interphase is the longest phase of mitosis? | FALSE – not part of mitosis |
| A cell can divide prior to copying its chromosomes? | FALSE – needs the chromosomes |
| There are 3 segments of interphase. | TRUE |
| Chromosomes are made up of DNA. | TRUE |
| A full complement of chromosomes is its haploid number. | FALSE – full is diploid (2n) |

|  |
| --- |
| ***Draw*** *a chromosome.* ***Label*** *2 sister chromatids and the centromere.* |
| Sister chromatids  Centromere |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Identify*** *the ploidy of the three cells below.* ***Label*** *the mother cell(s) and daughter cell(s).* | | | | | | | | | |
| **A Mitoitic Cell** | | | | | | | | | |
|
|
|  | **Autosomal/ somatic** | | | cells undergo mitosis. On a karyotype, mitotic cells are | | | | | |
| represented on which chromosome pair(s)? | | | | | | | **Pair 1 – 22** | | . A scientific |
| process similar to mitosis is known as | | | | | **Cloning** | | | so the daughter cells and | |
| mother cell are | | **identical** | | | |  | | | |
|  | | |  | | | | | | |

***Label*** *the squares below to identify the phases of mitosis and cytokinesis.* ***Identify*** *the appropriate number of events significant to each phase as identified.*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Prophase** |  | **Metaphase** |  | **Anaphase** |  | **Telophase** |  | **Cytokin** |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **4 Events** |  | **1 Event** |  | **2 Events** |  | **2 Events** |  | **1 Event** |
| **Chr. Short/thicken** |  | **Align on equator** |  | **Centromere divides** |  | **Nuc memb reforms** |  | **Cell Division** |
| **Centriole form pole** |  |  |  | **Chromatid separate** |  | **Mvmt complete** |  |  |
| **Spindles appear** |  |  |  |  |  |  |  |  |
| **Nuc memb fades** |  |  |  |  |  |  |  |  |

***Draw*** *the events of mitosis as accurately as possible in the rectangles above –* **Student generated**

***Identify*** *each mitotic phase.* ***Describe*** *what you see in each diagram that helped you to identify it.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | alliumtelophase | alliumanaphase | alliummetaphase | alliumprophase |
| **Description** | Movement to pole farther along, chromatin since indistinctive. Cell plate visible between chromatin | Chromatids moving from poles. Looks like 2 spiders | Alignment on equator | Nuclear membrane still formed, chromosomes short and thick (distinctive) |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***Identify*** *each mitotic phase.* | | | | |
| **m interphase** | **m anaphase** | **m prophase** | **m metaphase** | **m telophase** |
| **Interphase/Pro** | **Anaphase** | **Prophase** | **Metaphase** | **Telo/Cyto** |

***Match*** *the following terms*

|  |  |  |
| --- | --- | --- |
| **H** | DNA | A. regions on DNA that code for proteins |
| **A** | Genes | B. state of mother and daughter cells during mitosis |
| **L** | Chromosomes | C. general events that occur during the life of a cell |
| **E** | Chromatin | D. region that holds sister chromatids together |
| **K** | Sister Chromatids | E. DNA molecules uncoiled and tangled |
| **D** | Centromere | F. pinching-in of cell membrane, initiating division |
| **B** | Diploid | G. responsible for chromosomes movement |
| **G** | Spindle Fibres | H. the molecules that contain genes |
| **I** | Centrioles | I. separate and form the poles for cell division |
| **C** | Cell Cycle | J. process of cell division |
| **J** | Cytokinesis | K. two identical DNA molecules |
| **F** | Cleavage furrow | L. DNA molecule coiled very tightly around protein  molecules, visible under light microscope |

***Identify*** *when the phase where the events occur.*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Event** | **Interphase** | **Prophase** | **Metaphase** | **Anaphase** | **Telophase** |
| Chromosomes move to poles |  |  |  | **X** |  |
| Chromosomes shorten/thicken |  | **X** |  |  |  |
| Spindle fibres appear |  | **X** |  |  |  |
| Centrioles form the poles |  | **X** |  |  |  |
| Chromosomes align on equator |  |  | **X** |  |  |
| Chromosomes in form of chromatin |  |  |  |  | **X** |
| Cleavage furrow |  |  |  |  | **X** |
| Chromosomes duplicate | **X** |  |  |  |  |
| Cytokinesis begins |  |  |  |  | **X** |
| Centromere divides |  |  |  | **X** |  |
| Nuclear membrane disappears |  | **X** |  |  |  |
| Nuclear membrane reappears |  |  |  |  | **X** |

***Arrange*** *each of the following sets of statements in sequential order*

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1. | Metaphase |  |  |  |  |  |  |  |  |  |
| 2. | Prophase |  | **4** | **,** | **2** | **,** | **1** | **,** | **3** |  |
| 3. | Telophase |  |  |  |  |  |  |  |  |  |
| 4. | Interphase |  |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1. | cleavage furrow begins |  |  |  |  |  |  |  |  |  |
| 2. | chromosomes duplicate |  | **2** | **,** | **4** | **,** | **3** | **,** | **1** |  |
| 3. | centromere divides |  |  |  |  |  |  |  |  |  |
| 4. | chromosomes shorten and thicken |  |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1. | spindle fibres appear |  |  |  |  |  |  |  |  |  |
| 2. | chromosomes separate |  | **1** | **,** | **4** | **,** | **2** | **,** | **3** |  |
| 3. | cytokinesis occurs |  |  |  |  |  |  |  |  |  |
| 4. | chromosomes align of equator |  |  |  |  |  |  |  |  |  |

***Describe*** *the DNA content when comparing*

|  |  |
| --- | --- |
| Start of interphase and the beginning of prophase | **Double the chromosomes to begin prophase** |
| Beginning of metaphase and in late anaphase | **Chromosomes separate in anaphase** |

***Identify*** *the types of cells that mitosis occurs in with the types of cells that meiosis occurs in?*

|  |  |
| --- | --- |
| Mitosis | **Somatic/autosomal/diploid cells** |
| Meiosis | **Gamates/sex cells/haploid cells** |

*In what phase of the cell cycle does a cell spend most of its time? Why this phase takes the largest portion of time.*

**Interphase b/c the cell must duplicate everything prior to division**

|  |
| --- |
|  |

*During prophase, which two structures are visible and what structure starts to disappear. Explain why this occurs.*

**Visible – centrioles and spindles, Disappear – nuclear membrane**

|  |
| --- |
| **This occurs so the chromosomes can be pulled to opposite poles** |

***Compare*** *chromatin and chromosomes.* ***Identify*** *the phase of mitosis do we see chromatin and in which phase do the chromatids become visible?*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | **Comparison** |  | **Phase** |
| Chromatin |  | **Chromatids that are strung out and elongated** |  | **Telophase** |
| Chromosomes |  | **Short, thick visible** |  | **Prophase** |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Identify*** *the ploidy of the cells below.* ***Label*** *the mother cell(s) and daughter cell(s), Meiosis I, Meiosis II, and where chromosome reduction occurs* | | | | | | | | |
| **A Meioitic Cell**  Meiosis I - reduction  Meiosis II | | | | | | | | |
|
|
|  | **Gametes/sex cells** | | | cells undergo meioosis. On a karyotype, meiotic cells are | | | | |
| represented on which chromosome pair(s)? | | | | | | | **Pair 23 only** | . Meiotic cells |
| provide genetic | | | **Variability** | | | , therefore the mother and daughter cells | | |
| are | | **Similar** | | | but not identical. | | | |
|  | |  | | |  | | | |

***Label*** *the squares below to identify the phases of meiosis and cytokinesis.* ***Identify*** *the appropriate number of events significant to each phase as identified.*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Meiosis \_\_\_ | | | | | Meiosis \_\_\_ | | | | |
| **Pro**  **I** | **Meta**  **I** | **Ana**  **I** | **Telo**  **I** | **Cyto** | **Pro**  **II** | **Meta II** | **Ana**  **II** | **Telo**  **II** | **Cyto** |

***Define*** *the following terms and form a sentence using the words.*

|  |  |
| --- | --- |
| Synapsis | **A time period in the meiotic process** |
| Homologous Chromosomes | **2 similar chromosomes, eg. Chr. #1 from each parent AKA. homologues** |
| Tetrad | **2 homologues** |
| Crossing Over | **When 2 homologues exchange genetic information** |
| **During synapsis 2 homologous chromosome intertwine and become a tetrad and crossing over occurs** | |

***Classify*** *each event according to the phase it belongs by placing the letter I (interphase), P (prophase), M (metaphase), A (anaphase), and T (telophase)*

|  |  |
| --- | --- |
| **MEIOSIS I** | |
| **PRO I** | 1. Spindle forms |
| **ANA I** | 2. Homologous chromosomes separate (one to each pole) |
| **PRO I** | 3. Synapsis |
| **TEL I** | 4. Cytoplasm divides by cytokinesis |
| **MET I** | 5. Tetrads become aligned along the equator |
| **TEL I** | 6. Nuclear membrane forms |
| **PRO I** | 7. Chromosomes become visible |
| **PRO I** | 8. Nuclear membrane disappears |
| **PRO I** | 9. Homologous chromosomes form a tetrad |
| **INT** | 10. DNA material is replicated |
| **MEIOSIS II** | |
| **A II** | 1. Chromatids separate (one to each pole) |
| **T II** | 2. Cytokinesis completes the second division |
| **T II** | 3. Nuclear membrane forms |
| **P II** | 4. Nuclear membrane disappears |
| **A II** | 5. Centromeres divide |

***Explain*** *the difference between the terms haploid and diploid*

|  |
| --- |
| **Haploid – half complement of chromosomes (n), Diploid – full complement (2n)** |

*What process is responsible for restoring the diploid chromosome number in the human life cycle?*

|  |
| --- |
| **Fertilization (n + n = 2n, sperm + egg = zygote)** |

***Identify*** *each meiotic phase.* ***Describe*** *what you see in each diagram that helped you to identify it.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Meiosis I** | | | | |
|  | lilytelo1 | lilyana1 | lilypro1 | lilymeta1 |
| **Description** | 2 poles – Meiosis I, later on because of movement  Telophase I | 2 poles – Meiosis I, still moving  Anaphase I | Chromosomes short thick and within nucleus  Prophase I | Chromosomes on equator  Metaphase I |
| **Meiosis II** | | | | |
|  | lilytelo2 | lilyana2 | lilypro2 | lilymeta2 |
| **Description** | 4 Normal looking cells  Telophase II | 4 cells having moved  Telo or Ana II | 2 cells with short/thick chrom  Prophase II | 2 cells on equator  Meetaphase II |

*In the space below* ***draw*** *a diagram showing the chromosome arrangement of metaphase I and metaphase II?*

|  |  |  |
| --- | --- | --- |
| **Metaphase I** |  | **Metaphase II** |
| **X X X X X X X X X**  **X X X X X X X X X** |  | **X X X X X X X X X** |

*During which meiotic phase do*

|  |  |
| --- | --- |
| Chromatids separate? | **Anaphase II** |
| Homologous chromosomes separate? | **Anaphase I** |

***Comparing Mitosis and Meiosis*** *Place a check mark on the chart below to classify the different statements as events that occur in Mitosis, Meiosis or both*

|  |  |  |
| --- | --- | --- |
| **Event** | **Mitosis** | **Meiosis** |
| 1 cell division | **X** |  |
| 2 cell divisions |  | **X** |
| Interphase occurs once | **X** |  |
| Interphase occurs twice | **Neither** | **Neither** |
| 2 daughter cells formed | **X** |  |
| 4 daughter cells formed |  | **X** |
| Parent cell is diploid | **X** |  |
| Daughter cells are diploid | **X** |  |
| Daughter cells are haploid |  | **X** |
| Parent (2n = 46) Daughter (n = 23) |  | **X** |
| Parent (2n = 46) Daughter (2n = 46) | **X** |  |
| Occurs in gametes (sex cells) |  | **X** |
| Occurs in somatic cells (autosomes) | **X** |  |

*Why is Meiosis II more similar to Mitosis than Meiosis I?*

**Both involve chromatid separation not separation of a homologous pair**

|  |
| --- |
|  |

***Complete*** *the following about nondisjunction*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Define the term nondisjunction | | **Improper separation of genetic material** | | |
| During which phase does it occur? | | **Metaphase when spindles are attached** | | |
| Does it affect mitosis or meiosis? | | **Meiosis** | | |
| n – 1 is | **Monosomic** | A human with this condition would have | **45** | chromosomes |
| n + 1 is | **Trisomic** | A human with this condition would have | **47** | chromosomes |

*Compare gamete interaction for identical and fraternal twins*

|  |  |
| --- | --- |
| **Twin Type** | **Gamete Interaction (eg. # sperm w/ # egg)** |
| Identical Twins | **1 egg + 1 sperm that separates after fertilization** |
| Fraternal Twins | **2 diff eggs with 2 diff sperm that divide properly** |

*For* ***each*** *Karyotype identify*

1. *Male or female, and “Normal” or Nondisjunction (if nondisjunction, circle the affected pair)*
2. *Chromosome pair affected and type of disorder – ie. Trisomy 5 or Monosomy 23, etc.*

|  |  |
| --- | --- |
| tri18k | Typical Normal Karyotype |
| **Male – Trisomy 18** | **Male - Normal** |
|  | |
| trisomy-21 karyotype | xok |
| **Male – Trisomy 21** | **Female – Monosomy 23** |
|  | |
| xxyk | [female](http://www.pathology.washington.edu/galleries/Cytogallery/cytogallery.html) |
| **Male – Trisomy 23** | **Female – Normal** |

*For each phase of life in the life cycles below, identify whether the phase is haploid (n) or diploid (2n), and* ***circle*** *where* ***fertilization*** *is shown in the cycle.*

|  |  |  |
| --- | --- | --- |
|  | **Male** | **Diploid** |
| **Spores** | **Haploid** |
| **Zygote** | **Diploid** |
| **Female** | **Diploid** |
| **Gametes** | **Haploid** |

|  |  |  |
| --- | --- | --- |
|  | |  |
| **Zygote** | **Diploid** |
| **Zoospores** | **Haploid** |
| **Gametes** | **Haploid** |
| **Gametophyte** | **Haploid** |
| **Mature Sporophyte** | **Diploid** |
|  |  |
|  | |

|  |  |  |
| --- | --- | --- |
|  |  |  |
| **Plasmodium** | **Diploid** |
| **Zygote** | **Diploid** |
| **Gametes** | **Haploid** |
|  |  |
| **Process 1** | **Mitosis** |
| **Process 2** | **Meiosis** |
|  |  |

**UNIT C2 – Genetics**

***Identify*** *Mendel’s two principals and provide a* ***description*** *of each. Which principal can be applied to describe genetic variability?*

|  |  |
| --- | --- |
| Mendel’s 2 Laws | **Law of Segregation, Law of Independent Assortment** |
| Description | **Segregation – splitting of gametes so only 1 is passed on by parent** |
|  | **Assortment – genes are individual of each other and don’t morph together** |

***Match*** *the terms on the left with the correct description on the right.*

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Term** | **Description** | |
| **F** | Genotype | A. | an alternate form of a gene |
| **A** | Allele | B. | plants first studied for inheritance of characteristics |
| **I** | Monohybrid | C. | how gene pairs are assorted |
| **D** | Homozygous | D. | when both alleles are the same |
| **J** | Mendel | E. | the gene that is expressed only when homozygous |
| **B** | Peas | F. | the genes present in an organisms cells |
| **H** | Phenotype | G. | stamen & pistel are on different flowers |
| **C** | Independently | H. | the appearance of an organism |
| **G** | Cross Pollination | I. | a cross involving only one pair of traits |
| **L** | Dominant | J. | discovered the principles of heredity |
| **E** | Recessive | K. | the stamen & pistel are on the same flower |
| **K** | Self Fertilization | L. | the gene that masks the effects of other genes |

**True or False?**

|  |  |
| --- | --- |
| Two alleles of Gg are G and g | **True** |
| Yy is a heterozygous genotype | **True** |
| rr is homozygous dominant | **False – homozygous recessive** |
| Gametes contain 2 alleles of each gene | **False – 1 allele per gamete** |
| The phenotype Tt is heterozygous | **True** |
| UU is a homozygous dominant genotype | **True** |
| The genes T and t both code for the same trait of the individual | **True** |
| The phenotype is the appearance of the individual | **True** |
| Dominant genes are only expressed when in a homozygous individual | **False – also heterozygous** |
| r is dominant over R | **False – r is recessive** |

***Invent*** *appropriate allele symbols for the following pairs of dominant and recessive traits. Assume the trait listed first is the dominant trait.*

|  |  |
| --- | --- |
| **Trait Colors** | **Allele** |
| yellow and white flowers | **Y – yellow, y - white** |
| brown and silver fur | **B – Brown, b - silver** |
| spotted and solid coat | **S – spotted, s - solid** |
| brown and blue eyes | **B – brown, b - blue** |

***Classify*** *the following traits as examples of a genotype, phenotype or both?*

|  |  |
| --- | --- |
| **Trait** | **Classification** |
| curly hair | **Phenotype** |
| Rr | **Genotype** |
| A person with blue eyes | **Phenotype** |
| A person with an allele for blue eyes and one for brown | **Genotype** |
| A person who is homozygous for green eyes | **Genotype** |

***State*** *the genotypes of the following traits****.***

|  |  |
| --- | --- |
| **Trait** | **Genotype** |
| Homozygous green pod pea plant (green is dominant) | **GG (G – Green)** |
| Homozygous short-haired hamster (short is recessive) | **TT (T – tall)** |
| Homozygous six-fingered man (5 fingers is dominant) | **ff (F – 5 Fingers)** |
| Heterozygous striped tiger (no stripes is recessive) | **Ss** |
| Homozygous sickle blood cells (normal cells are dominant) | **nn (N – normal)** |

*Define the term test cross. Describe the conditions when a test cross may be beneficial.*

|  |  |
| --- | --- |
| Definition | **A cross between a dominant BUT UNKNOWN genotype and a recessive trait** |
| Description | **Often used by breeders to ensure that they are breeding pure bred animals and** |
|  | **Reduce the likelihood of hybrids or recessive offspring** |

***MONOHYBRID CROSSES - Dominant and Recessive Crosses***

1. In summer squash, white fruit color is dominant over yellow.
2. If a squash plant homozygous for white is crossed with one homozygous for yellow, what will be the genotypes and phenotypes of the F1 offspring?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| WW x ww | = | (F1) | 100% Ww | 100% white |

1. Use a punnett square to diagram a cross between two F1 individuals. What are the genotypic and phenotypic ratios for the offspring?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| (F1) Ww x Ww | = | (F2) | 1 WW: 2 Ww: 1 ww | 3 White: 1 Yellow |

1. What are the possible genotypes and phenotypes if we cross 2 heterozygous tall pea plants?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Tt x Tt | = | (F1) | 1 TT: 2 Tt: 1 tt | 3 Tall: 1 Short |

1. If two pea plants are crossed and the F1 offspring includes one homozygous tall pea plant, what are the phenotypes and genotypes of the parents?

|  |
| --- |
| Given (F1) 1 TT = both parents must have been tall |

1. The following problems are based on Wyandotte poultry in which rose comb is dependent upon a dominant gene, and single comb upon its recessive allele. To be included in the Wyandotte flock, a bird must have a rose comb.
2. What would be the genotypic and phenotypic ratios for F1 offspring of a cross between the two heterozygous birds?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Rr x Rr | = | (F1) | 1 RR: 2 Rr: 1 rr | 3 Rose: 1 Single |

1. A rose-combed male is mated with two rose-combed females. Female A produces 14 chicks, all of which are rose-combed. Female B produces 9 chicks, seven of which are rose-combed and two which are single-combed. What are the genotypes of the three parent birds?

|  |  |
| --- | --- |
| R\_ x R \_ = (F1) Rose (R\_) | R\_ x R \_ = (F1) 7 Rose (R\_), 2 Single (rr) |
| Male and Female B must be Rr to produce rr offspring, Female A could be either RR or Rr based on info | |

1. Albinism is a failure to produce the enzyme needed to make melanin. It is recessive to normal pigmentation. An albino woman whose father is albino and mother normal, marries a normal man, one of whose parents is normal and the other albino. He has an albino sister. The couple have a normal daughter. Identify all genotypes and phenotypes.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | nn (father) | N\_ (mother) |  | N\_ (parent 1) | nn (parent 2) |  |
|  |  | nn (woman) | **X** | N\_ (man) | nn (sister) |  |
|  |  | (F1) N\_ | | |  |  |
| Mother – Nn (bc of albino woman), Parent 1 – Nn (bc of albino sister), F1 – Nn (because of mother) | | | | | | |

1. What is the probability of a heterozygous dominant parent and a recessive parent having an affected boy if a particular trait is autosomal recessive?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Nn x nn | = | (F1) | 2 Nn: 2 nn | 2 Normal: 2 Affected |
| Probabilty = ½ being affected x ½ being a boy = ¼ probability | | | | |

1. ***MONOHYBRID CROSSES - Incomplete and Co-Dominant Crosses***
2. In snap dragons, yellow flower color is not completely dominant over white. The heterozygous condition produces pale-yellow flowers.
3. What will be the result of a cross between two pale-yellow flowered plants?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| (P) CwCy x CwCy | = | (F1) | 1 CwCw: 2 CwCy: 1 CyCy | 1 White : 2 Pale : 1 Yellow |

1. What will be the result of a cross between a pale-yellow flower and a white flowered plant?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| (P) CwCy x CwCw | = | (F1) | 1 CwCy: 1 CwCw | 1 Pale: 1 White |

1. Yellow coat color in guinea pigs is produced by the homozygous genotype CyCy, cream color by the heterozygous genotype CwCy, and white by the homozygous genotype CwCw.
2. What genotypic ratio are matings between cream-colored individuals likely to produce?

|  |  |  |  |
| --- | --- | --- | --- |
| (P) CwCy x CwCy | = | (F1) | 1 CwCw: 2 CwCy: 1 CyCy |

1. What phenotypic ratio are matings between cream-colored individuals likely to produce?

|  |  |  |  |
| --- | --- | --- | --- |
| (P) CwCy x CwCy | = | (F1) | 1 White : 2 Cream : 1 Yellow |

1. In the four o'clock, a flower rather like a petunia, the allele for red flower color is incompletely dominant over the allele for white flower color. When a red flower is crossed with a white one, an intermediate pink flower is produced.
2. Show the genotypes of the parents and the F1 generation of a cross between a red and a white four o'clock flower.

|  |  |  |  |
| --- | --- | --- | --- |
| (P) CrCr x CwCw | = | (F1) | 4 CrCw |

1. What would be the anticipated offspring if the F1 plant from above were crossed back with the red parent? ……. With the white parent?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CrCw x CrCr | = | (F1) | 1 CrCw: 1 CrCr | 1 pink : 1 red |

1. Lethal alleles have such a detrimental effect on an organism that the organism cannot survive. Some lethal dominant alleles exhibit incomplete dominance, in which only the homozygous individual succumbs to the allele and dies. An example is the creeper chicken who has a heterozygous (Cc) who is damaged, a normal chicken is (cc), and death occurs in genotype (CC).
2. A creeper chicken (Cc), heterozygous for a lethal allele, mated with a normal chicken (cc). What is the expected genotypic ratio of the F1 generation?

|  |  |  |  |
| --- | --- | --- | --- |
| (P) Cc x cc | = | (F1) | 1 Cc : 1 cc |

1. Why didn't the lethal allele (C) cause death in any of the embryos of this cross?

|  |
| --- |
| Because the normal parent must give a “c” so can’t be lethal “CC” |

1. A mating of an albino (white) guinea pig and a black one gave 3 white, 3 black, and 6 brown offspring in the F2 generation.
2. What were the genotypes for the albino (Cw) and the black (Cb) parent guinea pigs respectively?

|  |
| --- |
| If F2 is a 1:2:1 ration, the F1 must be heterozygous, parents must be homozygous |

1. What kinds of offspring, and in what proportions, would result from the mating of the black parent above with another animal of the same genotype?

|  |
| --- |
| If black is crossed with same parent (ie. Black) then expect all black offspring |

***MONOHYBRID CROSSES - Multiple Allele Crosses***

1. IA and IB are considered to be co dominant while IO is recessive to both IA and IB. Develop a key to show all possible genotypes?

|  |
| --- |
| Type A – IAIA or IAio, Type B – IBIB or IBio, Type AB – IAIB , Type o– ioio |

1. A parent has type O blood. Which blood type could not be found in any of the children in this family? Explain

|  |
| --- |
| Cannot find AB – other are possible since A and B can form in a heterozygous form |

1. The children of a man with type A blood and a woman with type B blood were tested for blood type. Of the four children, one had type A, one had type B, and one had type O blood. What were the genotypes of the parents?

|  |
| --- |
| If F1 are A, B and O – parents must both be heterozygous to produce O |

1. Two babies get mixed up in a hospital. Baby 1 has type AB blood and baby 2 has type A blood. Mr. Jones has type A blood and Mrs. Jones has type O blood. Mr. Smith has type AB blood and Mrs. Smith has type B blood. Which baby belongs to the Jones and which baby belongs to the Smiths?

|  |
| --- |
| Mrs Jones is type O – she cannot have an AB Baby so Baby 2 is theirs |

1. Multiple Alleles control the intensity of pigment in mice. The gene D1 designates full color, D2 designates dilute color and D3 is deadly when homozygous. The order of dominance is D1>D2>D3. When a full-color male is mated to a dilute color female, the offspring are produced in the following ratio: two full color to one dilute to one dead. What are the genotypes of the parents?

|  |
| --- |
| Parents are D1 \_\_ x D2 \_\_ and produce a D3D3 offspring, they must be heterozygous |

1. Plumage color in mallard ducks is dependent upon a set of three alleles: MR for restricted mallard pattern, M for mallard, and m for dusky mallard. The dominance hierarchy is MR>M>m.
2. What genotypic ratio is expected in the F1 generation when crossing MRMR with MRM?

|  |  |  |  |
| --- | --- | --- | --- |
| (P) MRMR x MRM | = | (F1) | 1 MRMR : 1 MRM |

1. What phenotypic ratio is expected in the F1 generation when crossing MRMR with MRM?

|  |  |  |  |
| --- | --- | --- | --- |
| (P) MRMR x MRM | = | (F1) | All Restricted |

1. What percentage of the F1 generation are expected to be restricted mallard pattern when crossing MRM with MRm?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| (P) MRM x MRm | = | (F1) | 1 MRMR : 1 MRM : 1 MRm : 1 Mm | 50% Restricted |

***DIHYBRID CROSSES***

1. Short hair (L) is dominant over long hair (l) in rabbits. In addition, the gene for spotted coat color (S) is dominant over the allele for solid color (s). two dihybrid rabbits (heterozygous for both alleles) are mated. What phenotypes are expected, and in what ratios, among the bunnies produced?

|  |  |  |  |
| --- | --- | --- | --- |
| (P) LlSs x LlSs | = | (F1) | 9 Short/Spotted : 3 Short/Solid : 3 Long/Spotted : 1 Long/Solid |

1. In watermelons, the genes for green color and for short shape are dominant over their alleles for striped color and for long shape. Suppose a plant with long striped fruit is crossed with a plant that is heterozygous for green color and homozygous for short shape. What are the phenotypes and their respective ratios?

|  |  |  |  |
| --- | --- | --- | --- |
| (P) ggss x GgSs | = | (F1) | 1 Green/Short : 1 Green/Long : 1 Striped/Short : 1 Striped/Long |

1. Some dogs bark while others are silent when trailing. The barking characteristics (B) is dominant. Erect ears (E) are dominant to drooping ears. List the genotypes, genotypic ratio, phenotypes and phenotypic ratio expected in pups when a heterozygous erect-eared barker crosses with a droopy-eared, silent-trailer.

|  |  |  |  |
| --- | --- | --- | --- |
| (P) EeBb x eebb | = | (F1) | 1 EeBb (erect/barker) : 1 Eebb(erect/silent) : 1 eeBb (droopy/barker) : 1 eebb (droopy/silent |

1. If one individual is homozygous for two dominant traits and another is homozygous for two recessive traits, and if the two individuals are crossed, what proportion of the F1 offspring from this cross will resemble each parent in appearance? The F2 offspring?

|  |  |  |  |
| --- | --- | --- | --- |
| (P) AABB x aabb | = | (F1) | All AaBb – dominant for both traits |
| (F1) AaBb x AaBb | = | (F2) | 9 Dom A/Dom B : 3 Dom A/Rec B : 3 Rec A/Dom B : 1 Rec A/Rec B |

1. In the garden pea plant, round seed shape (R) is dominant over wrinkled (r), and yellow seed color (Y) is dominant over green (y).
2. What phenotypes would be expected, and in what ratios, in the F2 from the cross of a homozygous wrinkled, yellow plant to a round, green one?

|  |  |  |  |
| --- | --- | --- | --- |
| (P) rrYY x RRyy | = | (F1) | All RrYy – Round/Yellos |
| (F1) RrYy x RrYy | = | (F2) | 9 Round/Yellow : 3 Round/Green : 3 Wrinkled/Yellow : 1 Wrinkled/Green |

1. In the F2, what is the ratio of round to wrinkled? What is the ratio of yellow to green?

|  |
| --- |
| 3 Round : 1 Wrinkled (reduced from 12 : 4), 3 Yellow : 1 Green (reduced from 12 : 4) |

***SEX LINKED CROSSES***

1. Human color blindness is a sex-linked trait due to a recessive gene.
2. If a woman with normal vision (but a carrier) whose husband is color blind have children what percentage of the **boys** **would be color blind**?

|  |  |  |  |
| --- | --- | --- | --- |
| (P) XNXn x XnY | = | (F1) | 50% of the boys XnY |

1. What is the probability that a woman with normal color vision whose father was color blind, and whose husband has normal vision will have a **color blind child**?

|  |  |  |  |
| --- | --- | --- | --- |
| (P) XNXn x XNY | = | (F1) | 25% chance of a CB child (XnY) |

1. An X-linked gene (c) produces red-green color blindness. A normal woman whose father was color blind marries a color blind man.
2. What are the chances that the **first child will be a boy** who is **color blind**?

|  |  |  |  |
| --- | --- | --- | --- |
| (P) XNXn x XnY | = | (F1) | ½ being a boy x ½ that boy will be CB = ¼ chance |

1. Of all the phenotypes produced from this marriage, what **percent of the girls** are expected to be color blind?

|  |  |  |  |
| --- | --- | --- | --- |
| (P) XNXn x XnY | = | (F1) | 50% of the girls XnXn |

1. Of all the children, sex unspecified, from this marriage, what proportion are expected to be normal?

|  |  |  |  |
| --- | --- | --- | --- |
| (P) XNXn x XnY | = | (F1) | 50% of the offspring XnY, XnXn |

1. In cats which are XX (female) and XY (male), the X-linked allele (B) determines black coat color when homozygous, yellow when homozygous recessive (b), and tortoise shell (calico), a mixture of black and yellow, when heterozygous. The Y chromosome lacks the gene for hair color.
2. A yellow mother has a litter consisting of two yellows and three calico offpsring. What is the genotype of the father?

|  |
| --- |
| Mother is XbXb – F1 has 2 yellow and 1 calico – Father must be XBY |

1. A calico mother has a litter of six: one yellow male, two black males, one yellow female and two calico females. What is the genotype of the father?

|  |
| --- |
| Mother is XBXb – F1 a yellow female – Father must be XbY |

1. A calico mother has a litter of three black females. If the father was black, how often would you expect the same results to happen?

|  |
| --- |
| Mother is XBXb father is XBY – F1 3 black females – 50% of the time bc F1 could be XBXB or XBXb for females |

1. In cats the genotype BB is black. Bb is tortoise shell and bb is yellow. The gene is on the X chromosome. A tortoise shell female is crossed with a black male.
2. What offspring would be expected?

|  |  |  |  |
| --- | --- | --- | --- |
| (P) XBXb x XBY | = | (F1) | 1 XBXB : 1 XBXb : 1 XBY : XbY |

1. Would you expect to find any tortoise shell males?

|  |
| --- |
| No because they only have a single X chromosome |

1. In men color blindness is due to a sex-linked recessive allele while blue eyes are due to an autosomal recessive allele. Two brown-eyed persons with normal vision produced a blue-eyed color blind son. What are the genotypes of the parents?

|  |
| --- |
| Some unknowns exist here – Parents are known to be - B\_ XNX\_ B\_XBY and they produce bbXnY, based on the offspring being blue eyed, both parents must be Bb x Bb, being CB means mom was XNXn since mom passes on the Xn and dad is passing on the Y |

***CHROMOSOME MAPPING***

1. Map the chromosome based on the information below (crossover frequency).

R - T = 16% O - R = 16%

O - T = 32% Z - O = 3%

R - Z = 19%

Sequence – Z, O, R, T or T, R, O, Z

1. Map the chromosome based on the information below (crossover frequency).

Gene Marker to Purple Eyes 4% Straight Wings to White Eyes 18%

White Eyes to Purple Eyes 12% Gene Marker to White Eyes 16%

Straight Wings to Purple Eyes 6%

|  |
| --- |
| Straight – Gene Marker – Purple – White  Or  White – Purple – Gene Marker - Straight |

1. The data below show the rates at which crossovers occur for certain genes in Drosophila. Use this information to determine a gene order for the chromosome on which these genes are located.

Curved wings/vestigial wings 8.5 lobe eyes/reduced bristles 21

Curved wings/reduced bristles 24.5 vestigial wings/purple eyes 12.5

Reduced bristles/purple eyes 3.5 vestigial wings/black body 18.5

Black body/lobe eyes 23.5 purple eyes/curved wings 21

Curved Wings – Lobe Eyes – Vestigial Wings – Purple Eyes – Reducued Bristles – Black Body

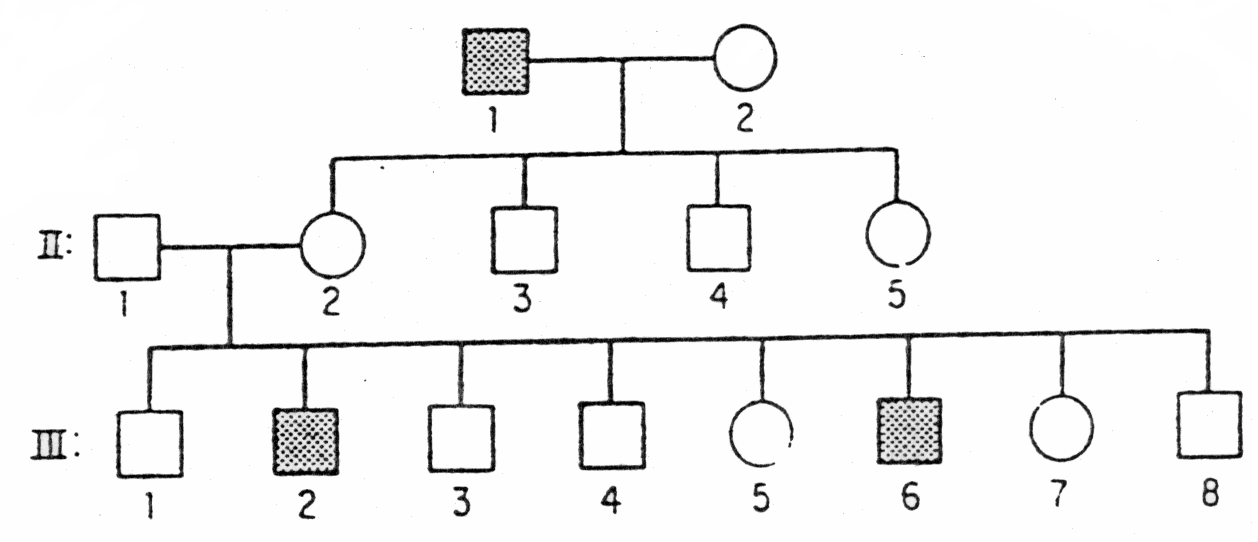
Or\

Black Body – Reduced Bristles – Purple Eyes – Vestigial Wings – Lobe Eyes – Curved Wings

***PEDIGREES Classify*** *the pedigrees as being recessive/dominant and autosomal/X-Linked.* ***Develop*** *a key to represent the possible genotypes on the pedigree.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| pedigree X dom.JPG |  | **Classification** | Dom, X-Linked |  |
|  | **Key** |  |  |
| XNXN – Affected female  XNXn – Affected female  XnXn- Unaffected female  XNY – Affected male  XnY – Unaffected male | | | |
| pedigree auto rec.JPG | |  |  | | --- | --- | | **Classification** | Rec, Autosomal | | **Key** |  |   AA – Unaffected male or female  Aa - Unaffected male or female  Aa - Affected male or female | | | |
| pedigree x rec.JPG | |  |  | | --- | --- | | **Classification** | Rec, X Linked | | **Key** |  |   XNXN – Unaffected female  XNXn – Unaffected female  XnXn- Affected female  XNY – Unaffected male  XnY – Affected male | | | |

Look at the following pedigree for the trait that has the dominant allele “A” and recessive allele “a”. State the genotypes of the individuals and state whether this trait is dominant-recessive (autosomal inheritance) or sex-linked inheritance. – **Recessive, X-Linked**



1 Crosses involving a single trait M\_ O\_ N\_ O\_ H\_ Y\_ B\_ R\_ I\_ D\_

2 Crosses involving two traits D\_ I\_ H\_ Y\_ B\_ R\_ I\_ D\_

3 Type of square used to illustrate a particular cross P\_ U\_ N\_ N\_ E\_ T\_ T\_

4 Type of chart used to illustrate a trait within a family P\_ E\_ D\_ I\_ G\_ R\_ E\_ E\_

5 Generations produced through crosses F\_ I\_ L\_ I\_ A\_ L\_

6 This trait masks another trait D\_ O\_ M\_ I\_ N\_ A\_ N\_ T\_

7 Lower case letters illustrate these alleles R\_ E\_ C\_ E\_ S\_ S\_ I\_ V\_ E\_

8 Genotype with two identical alleles H\_ O\_ M\_ O\_ Z\_ Y\_ G\_ O\_ U\_ S\_

9 Crosses used by breeders to identify heterozygous dominant animals T\_ E\_ S\_ T\_ C\_ R\_ O\_ S\_ S\_ **(2)**

10 The 2 letters representing an individual’s genes G\_ E\_ N\_ O\_ T\_ Y\_ P\_ E\_

11 How a trait appears when viewed P\_ H\_ E\_ N\_ O\_ T\_ Y\_ P\_ E\_

12 When two different alleles each appear in a new phenotype C\_ O\_\_ D\_ O\_ M\_ I\_ N\_ A\_ N\_ T\_ **(2)**

13 Father of Modern Genetics G\_ R\_ E\_ G\_ O\_ R\_ M\_ E\_ N\_ D\_ E\_ L\_ **(2)**

14 Profession of 13 above M\_ O\_ N\_ K\_

15 Types of plants used in Mendel’s experiments P\_ E\_ A\_

16 Showed that chromosomes carried genes T\_ H\_ O\_ M\_ A\_ S\_ M\_ O\_ R\_ G\_ A\_ N\_ **(2)**

17 Type of animal used by 16 above D\_ R\_ O\_ S\_ O\_ P\_ H\_ I\_ L\_ A\_

18 Type of crosses identified by Morgan S\_ E\_ X\_ L\_ I\_ N\_ K\_ E\_ D\_ **(2)**

19 AKA…Non-sex chromosomes A\_ U\_ T\_ O\_ S\_ O\_ M\_ E\_ S\_

20 Genetic information is carried on these C\_ H\_ R\_ O\_ M\_ O\_ S\_ O\_ M\_ E\_ S\_

21 Organizing the sequence of traits on a gene C\_ H\_ R\_ O\_ M\_ O\_ S\_ O\_ M\_ E\_ M\_ A\_ P\_ **(2)**

22 A person with a heterozygous genotype may be called a C\_ A\_ R\_ R\_ I\_ E\_ R\_

23 Science involved in the study of heredity G\_ E\_ N\_ E\_ T\_ I\_ C\_ S\_

24 A gene carries these T\_ R\_ A\_ I\_ T\_

25 On a pedigree, a triangle illustrates this T\_ W\_ I\_ N\_ S\_

FRATERNAL AND IDENTICAL TWINS

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

5 13 6 24 4 1 12 21 17 16 14 2 23 13 9 11 3 7 20 15 18 19 25 22 10 8

**UNIT C3 – Molecular Biology**

***Complete*** *the chart explaining the contributions of scientists in the discover and explanation of DNA*

|  |  |  |
| --- | --- | --- |
| **Scientist(s)** | **Time Frame** | **Contributions** |
| **Franklin** | 1950s | Used X-Ray diffraction to discover the design of DNA double helix. Her data was “used” by Watson and Crick to formulate their hypothesis |
| **Watson and Crick** | 1950s | Developed the molecular structure of DNA called the double helix. |

***Complete*** *the chart about enzymes.*

|  |  |  |
| --- | --- | --- |
| **Enzyme** |  | **Function** |
| Restriction Enzyme |  | Cuts open DNA |
| DNA Ligase |  | Used to glue DNA together |

***Define*** *the terms.*

|  |  |  |
| --- | --- | --- |
| **Term** |  | **Description (point form)** |
| Transgenic |  | Inserted into living organism to transmit to next generation |
| Plasmid |  | DNA molecule, often circular |

***Mutations*** *Use the phrase: THE FAT CAT ATE THE HOT DOG to illustrate types of mutations by defining each type of mutation and perform that mutation on the sentence.*

|  |  |  |
| --- | --- | --- |
| **Mutation** |  | **Description** |
| Insertion |  | Adding one or more extra nucleotides into DNA  Ex. THE **BIG** FAT CAT ATE THE HOT DOG |
| Deletion |  | THE CAT ATE THE HOT DOG (FAT was deleted) |
| Point Mutation |  | THE **M**AT CAT ATE THE HOT DOG (F mutated to be M) |
| Base Substitution |  | THE FAT CAT AT**A** THE HOT DOG (A was substituted for E) |

***Concept Map*** *Fill in the appropriate descriptions from the word list*

**Word List**

A, U, G, C Semi-Conservative Translation Replication

A, T, G, C Transcription Recombinant DNA Protein Synthesis

Protein Synthesis

**DNA**

Replication

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| What are nucleotides comprised of? | | | | **Sugar, Phosphate, Nitrogen Bae** | | | | | |
| Compare the amount of DNA found inside one of your muscle cells with the DNA found in one of your | | | | | | | | | |
| brain cells. | **Should be the same** | | | |  | | | | |
| Why are organ transplants more successful between identical twins than between other individuals? | | | | | | | | | |
| **Because they have identical DNA (less mutations) so less chance of rejection** | | | | | | | | | |
| Why are the opposing sides of the DNA molecule never identical, but always complementary? | | | | | | | | | |
| **Because nitrogen bases bind in complements, not to identical bases** | | | | | | | | | |
| During which part of the cell cyles does DNA replication take place? | | | | | | **Interphase** | | | |
| A drug holds the complementary nitrogen bases with such strength that the DNA molecule is | | | | | | | | | |
| permanently fused in the shape of a double helix. Predict whether or not this drug might prove harmful. | | | | | | | | | |
| Provide your reasons. | | **Harmful, if it is fused DNA cannot unwind and replicate** | | | | | | | |
| Provide the base sequence for the complementary strand of DNA that would match the DNA strand | | | | | | | | | |
| TAG TCT AAG CCG TAA TCA | | | **ATC AGA TTC GGC ATT AGT** | | | | |  | |
| How do your cells reduce the chances of mutations occurring during DNA replication. | | | | | | | | |  |
| **There are proof reading molecules that reduce the errors** | | | | | | | | | |
| What is recombinant DNA, how is it created, and what can it be used for? | | | | | | | **A system by which DNA** | | |
| **can be added or removed from a DNA strand. Allows for genetic manipulation or change** | | | | | | | | | |

***Compare*** *DNA and RNA*

|  |  |  |  |
| --- | --- | --- | --- |
|  | **DNA** |  | **RNA** |
| 1. | **Single stranded** |  | **Double stranded** |
| 2. | **ATGC** |  | **AUGC** |
| 3. | **In nucleus only** |  | **In nucleus, cytoplasm, ribosome** |
| 4. | **Deoxyribose sugar** |  | **Ribose sugar** |
| 5. | **One type** |  | **3 types – m, t, r** |

***Match*** *the terms on the left with the correct descriptions on the right.*

|  |  |  |  |
| --- | --- | --- | --- |
| **F** | Uracil | A. | the sugar found in RNA |
| **M** | tRNA | B. | made of proteins |
| **G** | Deoxyribose | C. | copying of the DNA code by mRNA |
| **J** | mRNA | D. | the forming of a protein from the code found on mRNA |
| **L** | Double helix | E. | a 3 base code for an amino acid |
| **B** | Enzymes | F. | a base found in RNA only |
| **C** | Transcription | G. | the sugar found in DNA |
| **N** | Anticodon | H. | duplication of the DNA code |
| **I** | Nucleotide | I. | made of sugar, phosphate, and a base |
| **K** | Adenine | J. | carries information out into the cytoplasm |
| **E** | Codon | K. | bonds with thymine |
| **H** | Replication | L. | shape of the DNA molecule |
| **D** | Translation | M. | brings amino acids to the ribosome to form a protein |
| **A** | Ribose | N. | the 3 base code found on tRNA |

***Arrange*** *these events in sequential order*

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Transcription** | | | | | | |  |  |  |
| 1. | mRNA molecule detaches from the DNA strand |  |  |  |  |  |  |  |  |  |
| 2. | DNA molecule in the nucleus unwinds/unzips |  | **2** | **,** | **4** | **,** | **1** | **,** | **3** |  |
| 3. | DNA strand rejoins and coils. |  |  |  |  |  |  |  |  |  |
| 4. | mRNA nucleotides attach themselves to exposed DNA nitrogen bases |  |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Translation** | | | | | | |  |  |  |
| 1. | polypeptide breaks away to be used by the cell. |  |  |  |  |  |  |  |  |  |
| 2. | mRNA leaves nucleus and attaches to ribosome |  | **2** | **,** | **4** | **,** | **3** | **,** | **1** |  |
| 3. | mRNA terminator codon is reached |  |  |  |  |  |  |  |  |  |
| 4. | tRNA anticodon (carrying an amino acid) attach appropriately to the mRNA |  |  |  |  |  |  |  |  |  |

|  |  |
| --- | --- |
| ***Calculate*** *which of the following would be the longest* | |
| **90 (30 x 3)** | mRNA strand 30 codons in length |
| **40 (20 x 2)** | 2 DNA strands of 20 nitrogen bases each |
| **75 (25 x 3)** | 25 tRNA anticondons |

***Scrambles -*** *Unscramble the following words into a logical sequence*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Position new gene, Ligase, Restriction Enzyme | **Restriction** |  | **Position** |  | **Ligase** |
| Translation, DNA Unzips, Transcription | **DNA Unzips** |  | **Transcription** |  | **Translation** |

*Fill in the following table based on the original DNA codons provided*.

|  |  |  |  |
| --- | --- | --- | --- |
| **DNA codon** | **Complementary DNA strand**  (use DNA codon) |  | **Complementary mRNA codon**  (use DNA codon) |
| Ex. 1 AAG | Ex. 1 TTC |  | Ex. 1 UUC |
| GAG | **CTC** |  | **CUC** |
| TCT | **AGA** |  | **AGA** |
| TAA | **ATT** |  | **AUU** |
| GGA | **CCT** |  | **CCU** |
| CCA | **GGT** |  | **GGU** |
| CGC | **GCG** |  | **GCG** |
| AAA | **TTT** |  | **UUU** |
| TGG | **ACC** |  | **ACC** |
| ATT | **TAA** |  | **UAA** |

***Match*** *the following* mRNA codons *with their amino acids using the mRNA chart for amino acids.*

|  |  |  |  |
| --- | --- | --- | --- |
| **3** | CUU | 1. | Stop |
| **1** | UAG | 2. | Glutamine |
| **9** | ACA | 3. | Leucine |
| **5** | UGG | 4. | Isoleucine |
| **6** | AGC | 5. | Tryptophan |
| **7** | AUG | 6. | Serine |
| **10** | GAG | 7. | Start |
| **8** | AAU | 8. | Asparagine |
| **4** | AUA | 9. | Threonine |
| **2** | CAG | 10. | Glutamate |

***Match*** *the following* DNA triplets/codons *with their amino acids using the mRNA chart for amino acids.*

|  |  |  |  |
| --- | --- | --- | --- |
| **5** | AAA 🡪 **UUU** | 1. | Isoleucine |
| **10** | GAA 🡪 **CUU** | 2. | Lysine |
| **1** | TAA 🡪 **AUU** | 3. | Serine |
| **7** | CAC 🡪 **GUG** | 4. | Stop |
| **3** | AGC 🡪 **UCG** | 5. | Phenylalanine |
| **9** | CGT 🡪 **GCA** | 6. | Start |
| **6** | TAC 🡪 **AUG** | 7. | Valine |
| **8** | TTA 🡪 **AAU** | 8. | Asparagine |
| **2** | TTC 🡪 **AAG** | 9. | Alanine |
| **4** | ACT 🡪 **UGA** | 10. | Leucine |

***Fill in the Blanks***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| What is the amino acid coded by the triplet TAT? | | | **AUA 🡪 isoleucine** | |  | | |
| Name, in order, of the amino acids coded in the DNA: GGTGGGCTAACA | | | | **Pro-Pro-Aspartate-Cystein** | | | |
| What codon is carried by the mRNA if the tRNA anti-codon loop reads CAG? | | | | | | **GUC** | |
| What is the dipeptide formed from the DNA sequence TCAGGA? | | | | **Serine - Proline** | | | |
| Which amino acids connect to the tRNA molecules that have the anti-codon sequences: | | | | | | | |
| AGC – CUU – ACU - AUA | | **Serine – Glutamate – Tyrosine - Stop** | | | | |  |
| Explain why DNA strands are coded using triplet codons and not just the 4 nitrogenous bases alone. | | | | | | | |
| **More combinations are possible** | | | | | | | |
| Some amino acids have more than one codon, but each codon can only have one particular amino acid. | | | | | | | |
| **True** |  | | | | | | |

***Describe*** *or* ***define*** *the significance of the following terms?*

|  |  |
| --- | --- |
| **Term** | **Description** |
| Deoxyribose | **Sugar in DNA** |
| Phosphate | **Part of DNA backbone** |
| S – P Backbone | **Alternating pattern of DNA backbone** |
| DNA Nitrogen Bases (4) | **ATGC, form complementary base pairs** |
| Nucleotide | **A sugar, phosphate and nitrogen base, base structure of DNA** |
| Complementary Base Pairs | **A – T, G – C or A – U, G – C** |
| Hydrogen Bond | **Holds nitrogen bases together** |
| Covalent Bond | **Holds nucleotides together** |
| Double Stranded | **2 sides of DNA** |
| Double Helix | **3D design of DNA** |
| Ribose | **Sugar in RNA** |
| RNA Nitrogen Bases (4) | **AUGC** |
| Uracil | **uracil replace thymine in RNA** |
| Single Strand | **Only one string of nucleotides** |
| Transcription | **mRNA strand formation from DNA code** |
| Triplet | **3 letter sequence of DNA** |
| mRNA | **A strand that forms from individual nucleotides attaching to DNA** |
| Codon | **3 letter sequence of mRNA** |
| Translation | **Using the mRNA strand to form protein** |
| tRNA | **Carriers of amino acids** |
| Anticodon | **3 letter sequence of tRNA** |

***Cryptic Puzzle -*** *Use the clues to fill in the blanks below, the place the appropriate letter (ie. double underlined letter) from the word into the puzzle at the bottom of the page*

1 Asexual reproduction M\_ I\_ T\_ O\_ S\_ I\_ S\_

2 First true phase of mitosis/meiosis P\_ R\_ O\_ P\_ H\_ A\_ S\_ E\_

3 Phase when genetic material aligns on the equator M\_ E\_ T\_ A\_ P\_ H\_ A\_ S\_ E\_

4 Phase chromatids separate A\_ N\_ A\_ P\_ H\_ A\_ S\_ E\_

5 Final phase of mitosis/meiosis T\_ E\_ L\_ O\_ P\_ H\_ A\_ S\_ E\_

6 Largest percentage of a cell’s life cycle is spent in this phase I\_ N\_ T\_ E\_ R\_ P\_ H\_ A\_ S\_ E\_

7 AKA…genes, genetic material C\_ H\_ R\_ O\_ M\_ O\_ S\_ O\_ M\_ E\_ S\_

8 Time period when crossing over occurs S\_ Y\_ N\_ A\_ P\_ S\_ I\_ S\_

9 Occurs during Prophase I of meiosis C\_ R\_ O\_ S\_ S\_ I\_ N\_ G\_ O\_ V\_ E\_ R\_ **(2)**

10 AKA…4 sister chromatids T\_ E\_ T\_ R\_ A\_ D\_

11 Contains genetic code D\_ N\_ A\_

12 Binds with Uracil or Thymine A\_ D\_ E\_ N\_ I\_ N\_ E\_

13 Found in DNA but not RNA T\_ H\_ Y\_ M\_ I\_ N\_ E\_

14 Sugar found in DNA D\_ E\_ O\_ X\_ Y\_ R\_ I\_ B\_ O\_ S\_ E\_

15 Always binds with Guanine C\_ Y\_ T\_ O\_ S\_ I\_ N\_ E\_

16 Always binds with Cytosine G\_ U\_ A\_ N\_ I\_ N\_ E\_

17 Found in RNA but not DNA U\_ R\_ A\_ C\_ I\_ L\_

18 Area within a cell where chromosomes can be found N\_ U\_ C\_ L\_ E\_ U\_ S\_

19 Area within a cell where proteins are synthesized R\_ I\_ B\_ O\_ S\_ O\_ M\_ E\_

20 Type of RNA that forms within the nucleus M\_ E\_ S\_ S\_ E\_ N\_ G\_ E\_ R\_

21 Process of proteins synthesis that occurs in the nucleus T\_ R\_ A\_ N\_ S\_ C\_ R\_ I\_ P\_ T\_ I\_ O\_ N\_

22 Process of proteins synthesis that occurs in the cytoplasm T\_ R\_ A\_ N\_ S\_ L\_ A\_ T\_ I\_ O\_ N\_

23 Enzyme used in gene therapy, to cut a section of DNA R\_ E\_ S\_ T\_ R\_ I\_ C\_ T\_ I\_ O\_ N\_

24 Enzyme used in gene therapy, to glue a section of DNA back together L\_ I\_ G\_ A\_ S\_ E\_

25 Single stranded material used to synthesize proteins R\_ N\_ A\_

26 What a cell does during cytokinesis D\_ I\_ V\_ I\_ D\_ E\_ S\_

27 Sexual Reproduction M\_ E\_ I\_ O\_ S\_ I\_ S\_

SEMI CONSERVATIVE REPLICATION

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

1 16 27 17 21 15 11 3 20 19 26 10 22 14 9 4 23 24 2 5 8 18 25 13 6 7 12

**UNIT D – Populations and Communities**

***Identify*** *the 5 conditions upon which the Hardy-Weinberg principle is based.* ***Explain*** *its relationship to gene pool stability*

|  |  |
| --- | --- |
| 5 Conditions | **Large population, no migration, no mutations, equal viability, random mating** |
| Explanation | **If these conditions are met, their equilibrium will allow the population to reamin** |
| **stable or balanced** | |

***Record*** *a mathematical formula to represent (1) allele frequency and (2) genotypic frequency*

|  |  |
| --- | --- |
| **Allele Frequency**  **p + q = 1** | **Genotypic Frequency**  **p2 + 2pq + q2 = 1** |

***Match*** *the following mathematic representations and genotypic descriptions.*

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Mathematical Representation** |  | **Genotypic Description** |
| **B** | p2 | A. | Heterozygous dominant |
| **A** | 2pq | B. | Homozygous dominant |
| **C** | q2 | C. | Homozygous recessive |

***Calculate*** *the following*

1. What would be the frequency of the genotypes if the alleles have a frequency of exactly half and half?

|  |  |  |
| --- | --- | --- |
| q = 0.50 | p + q = 1 so p = 0.5 | p2 = 0.25, 2pq = 0.50, q2 = 0.25 |

1. In Tanzania, 4% (0.04) of the population are homozygous sickle-cell anemics (ss) and 32% (0.32) are heterozygous (Ss). From these data, calculate the proportion of alleles that are s and S.

|  |  |  |
| --- | --- | --- |
| q2 = 0.04, q = 0.2 | p + q = 1 so p = 0.8 | p2 = 0.64, 2pq = 0.32, q2 = 0.04 |

1. A particular recessive trait was found in 300 out of 1200 people observed.
2. What are the allele frequencies for the recessive and dominant alleles?

|  |  |
| --- | --- |
| q2 = 300/1200 q2 = 0.25, q = 0.5 | p + q = 1 so p = 0.5 |

1. What percentage of the students would be carriers of the allele for the recessive trait?

|  |  |  |
| --- | --- | --- |
| q2 = 300/1200 q2 = 0.25, q = 0.5 | p + q = 1 so p = 0.5 | p2 = 0.25, 2pq = 0.50, q2 = 0.25 |

1. How many of the 1200 students have the homozygous dominant genotype?

|  |  |
| --- | --- |
| p2 = 0.25, 2pq = 0.50, q2 = 0.25 | 1200 x 0.25 = 300 students |

1. The recessive frequency for attached earlobes is 25% in a group of 2200 people.
2. What are the allele frequencies for the dominant and recessive alleles?

|  |  |
| --- | --- |
| q2 = 25% q2 = 0.25, q = 0.5 | p + q = 1 so p = 0.5 |

1. What are the genotypic frequencies?

|  |
| --- |
| p2 = 0.25, 2pq = 0.50, q2 = 0.25 |

1. How many people in the group have (unattached) earlobes?

|  |  |
| --- | --- |
| 2200 x (p2 + 2pq) = 2200 x 0.75 | 1,650 people |

1. In the town of High River, 245 individuals had dimples in their cheeks (recessive) while 255 did not have dimples (dominant). What is the frequency of the alleles in this population?

|  |  |
| --- | --- |
| q2 = 245/500 q2 = 0.49, q = 0.7 | p + q = 1 so p = 0.3 |

1. White wool is dependent upon a dominant allele B and black wool is dependent on the recessive allele b. Suppose that a sample of 900 sheep in Manitoba gave the following data: 891 white and 9 black. What is the frequency of the genes in this population?

|  |  |
| --- | --- |
| q2 = 9/900 q2 = 0.01, q = 0.1 | p + q = 1 so p = 0.9 |

1. In peppered moths, the white allele is dominant to the black allele. In October of 1994, an ecologist observed the peppered moths in Baker's Wood: White moths: 1025 Black moths: 125

Determine the percentage of the homozygous recessive, homozygous dominant, and heterozygous genotypes.

|  |  |  |
| --- | --- | --- |
| q2 = 125/1150 q2 = 0.11, q = 0.33 | p + q = 1 so p = 0.67 | p2 = 0.45, 2pq = 0.44, q2 = 0.11 |

1. In a given population of 610 individuals, the allele frequencies of the L and l alleles were found to be 0.62 and 0.38 respectively. Calculate the number of individuals with the L, Ll, and l genotypes.

|  |
| --- |
| p2 = 0.38, 2pq = 0.47, q2 = 0.14 |

1. A group of students were invited to taste phenylthiocarbamide (PTC). The ability to taste PTC is inherited by a single pair of genes and tasting (T) is dominant to non-tasting (t). Among 798 students, 60.4% were tasters.

|  |  |
| --- | --- |
| 1. Calculate the allele frequencies for T and t. | q2 = 0.396, q = 0.63, p + q = 1, p = 0.37 |
| 1. How many of the students were TT, Tt, and tt? | TT = 109, Tt = 372, tt = 316 |

1. If a recessive allele occurs in 65% of the population, find each of the genotypic frequencies for this characteristic.

|  |  |
| --- | --- |
| q = 0.65, p + q = 1, p = 0.35 | p2 = 12%, 2pq = 46%, q2 = 42% |

1. In 1000 tobacco seeds you will find a 3:1 ratio of green to albino plants. Find the allele and genotypic frequencies for this characteristic.

|  |  |  |
| --- | --- | --- |
| q2 = ¼, q2 = 0.25, q = 0.5 | p + q = 1 so p = 0.5 | p2 = 0.25, 2pq = 0.50, q2 = 0.25 |

1. In a large population of randomly breeding *Drosophila*, 1% of the population exhibits

burgundy eye colour, an autosomal recessive trait. According to the Hardy-Weinberg equilibrium,

what percentage of the population is expected to be heterozygous? (provide an answer between

zero and 1, rounded to 2 decimal places)

|  |
| --- |
| q2 = 0.01, so q = 0.1, p = 0.9, 2pq = 0.18 |

1. If this pedigree represented a distinct population, calculate how many of the 21 people could be expected to be heterozygous for the trait?

|  |
| --- |
| q2 = 4/21, so q2 = 0.44, p = 0.56, 2pq = 0.49 |

|  |
| --- |
|  |

***Define*** *the following terms.* ***Provide*** *an appropriate abbreviation and record its mathematical equation.*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Term** |  | **Abbr** |  | **Equation** |  | **Definition** |
| Growth rate |  | **gr** |  | **See Data Sheet** |  | **Change in number over change in time** |
| Per capita Growth Rate |  | **cgr** |  | **See Data Sheet** |  | **Change in number over original pop** |
| Population Density |  | **Dp** |  | **See Data Sheet** |  | **Number over area** |
| Change in Population |  | **N** |  | **See Data Sheet** |  | **Factors that increase - decrease** |

***Calculate*** *the following*

|  |
| --- |
| A sheep farm in central Alberta is located on a plot of land 3.00 km by 2.00 km. There are 858 female sheep and 42 male sheep on the farm. The farmer has constructed shelters for the sheep and provides them with food and water to supplement the graze that is naturally available. |

|  |  |  |
| --- | --- | --- |
| Calculate the population density (sheep/km2) of the sheep on this farm. | **Answer** | **150/km2** |
| *Record your answer rounded to three significant digits* |  |  |

|  |
| --- |
| A population of rattlesnakes contained 1 000 individuals at the beginning of a year. During the year, the population changed in the following ways  Births 106  Deaths 53  Immigration 42  Emigration 15  The population occupied an area of 160 hectares |

|  |  |  |
| --- | --- | --- |
| Calculate the rattlesnake population density at the beginning of the year. | **Answer** | **6.25** |
| *Record your answer rounded to two decimal places* |  |  |

|  |  |  |
| --- | --- | --- |
| Calculate the per capita growth rate for the rattlesnake population in the year | **Answer** | **0.08** |
| *Record your answer rounded to two decimal places* |  |  |

|  |
| --- |
|  |

|  |  |  |
| --- | --- | --- |
| What is the per capita growth rate of the snow goose population between 1968-1990? | **Answer** | **10.3** |
| *Record your answer rounded to one decimal place* |  |  |

|  |
| --- |
|  |

|  |  |  |
| --- | --- | --- |
| What is the population density of Komodo dragons in Komodo Island National Park? | **Answer** | **6.73** |
| *Record your answer rounded to two decimal places* |  |  |

What was the per capita growth rate of each population of fruit fly during the time frame of the study?

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Using long-winged fruit flies and vestigial-winged fruit flies, a group of biology students performed an investigation of population dynamics and selection pressure. Vestigial-winged fruit flies are homozygous for a mutant allele that causes their wings to be small and non-functional. The students established an initial population of 100 purebred flies of the two phenotypes for wing length. The population was maintained for four months and monitored for changes in size and phenotypic ratios. The results of the investigation are shown below. | | | | | | | |
|  | Time of Study | Long-winged females | Long-winged males | Vestigial-winged females | Vestigial-winged males | Total number of flies |  |
|  | Start | 5 | 5 | 45 | 45 | 100 |  |
|  | 1 month | 135 | 121 | 36 | 29 | 321 |  |
|  | 2 months | 263 | 272 | 32 | 30 | 597 |  |
|  | 3 months | 350 | 351 | 23 | 20 | 744 |  |
|  | 4 months | 407 | 397 | 12 | 15 | 831 |  |
|  |  |  |  |  |  |  |  |

|  |  |  |
| --- | --- | --- |
| What was the per capita growth rate of the total fruit fly population over the entire study? | **Answer** | **7.31** |
| *Record your answer rounded to two decimal places* |  |  |

alleles biotic potential carrying capacity climax community exponential growth locus

closed population commensalisms succession Hardy-Weinberg environmental resistance mimicry

gene homozygous immigrate population density k-selected populations symbiosis

heterozygous predator-prey pioneer community interspecific competition intraspecific competition natality

mortality mutualism open populations r-selected population primary succession emigrate

parasitism secondary succession

|  |  |
| --- | --- |
| The proportions of alleles in a population where no evolution is taking place | **Hardy-Weinberg** |
| Number of a particular species living in a set area | **population density** |
| Birth rate | **natality** |
| Alternate forms of the same gene | **alleles** |
| Growth of a population equal to number of offspring to exponent of the number of generations | **exponential growth** |
| Death rate | **mortality** |
| Maximum population that an area can sustain | **carrying capacity** |
| One organism benefits and the other organism is neither harmed nor helped | **commensalisms** |
| Two alleles that are different | **heterozygous** |
| Movement of an individual out of a population | **emigrate** |
| A population that is only affected by mortality and natality | **closed population** |
| Describes two alleles that are the same | **homozygous** |
| Movement of an individual into a population | **immigrate** |
| Both organisms benefit from interacting with one another | **mutualism** |
| A community after it has been disturbed by a fire, flood, etc | **secondary succession** |
| Position of a gene in a chromosome | **locus** |
| First species to survive in a bare rock succession (eg: lichen) | **pioneer community** |
| One organism benefits at the expense of another organism | **parasitism** |
| Building a community from scratch or from where none existed before | **primary succession** |
| Portion of a chromosome that determines a hereditary trait of the offspring | **gene** |
| Species most suited to an area that settles into an area as its final community | **climax community** |
| Relationship between organisms of the same species which involves competition | **intraspecific competition** |
| Sequence of communities replace one another through time | **succession** |
| A population that is affected by natality, mortality, immigration, and emigration | **open populations** |
| Species has the color patterns that closely resemble those of another species | **mimicry** |
| Relationship between organisms of different species in which in competiton | **interspecific competition** |
| Relationship in which members of one species hunt and kill the other species for food | **predator-prey** |
| Close, long-term relationship between two individuals of different species | **symbiosis** |
| Stable population with a long life-span and low birth rate | **k-selected populations** |
| Maximum number of offspring produced under ideal conditions | **biotic potential** |
| All of the factors that tend to reduce population numbers | **environmental resistance** |
| An unstable population with a short life-span and high birth rate | **r-selected population** |

***Explain*** *the relationship between biotic potential, limiting factors, and environmental resistance.*

**Biotic potential is limited by both limiting factors and environmental resistance**

|  |
| --- |
|  |

***Describe*** *how are carrying capacity related to space and populations?*

**An area’s space limitations will control the population size in the area**

|  |
| --- |
|  |

***Explain*** *what a J-shaped curve and S-shaped curve illustrate. Match each curve to either a K-selected or r-selected population.*

**J-curve shows exponential growth (r-selected population)**

|  |
| --- |
| **S-curve show growth limited by carrying capacity (K-selected population)** |

***Compare*** *the terms density-dependent and density-independent factors as they apply to populations.*

**Density independent – abiotic factors (flood, tornado)**

|  |
| --- |
| **Density dependent – biotic factors (competition, disease)** |

***Classify*** *each description to its appropriate relationship: commensalism, mutualism, parasitism, or predation.*

|  |  |
| --- | --- |
| **Description** | **Relationship** |
| A bird builds its nest in the branches of a tree. | **Commensalism** |
| A remora attaches itself to a shark without harming the shark and feeds on the scraps of food the shark eats. | **Commensalism** |
| A shrimp cleans the external parasites, debris, and ectocommensals off the skin of a large fish. | **Mutualism** |
| An anaerobic bacterium infects a cut, grows, and reproduces, causing lockjaw in a human. | **Parasitism** |
| A wolf hunts and kills a deer. | **Predator-Prey** |
| Certain algae and fungi live together as lichens. | **Competition** |

***Explain*** *the difference between Shelford's Law of Tolerance and Gause's principle.*

**Shelford – the distribution of a species depends on the areas tolerance (environmental factors**

|  |
| --- |
| **Gause – No 2 organisms can occupy the same role, competition will reduce one** |

**Draw** a J-shaped and S-shaped population growth curve and label the following areas of the graph: carrying capacity, lag phase, stationary phase, death phase, growth phase, environmental resistance.

|  |  |
| --- | --- |
| **J- Curve**  **Student derived** | **S-Curve**  **Student derived** |

***Classify*** *the following as either a K-selected or r-selected population strategy.*

|  |  |
| --- | --- |
| **Strategy** | **Description** |
| **r-selected** | life span two weeks |
| **K-selected** | life span seventy years |
| **K-selected** | litter size is 2 per year |
| **K-selected** | adult weights 400-500 kg |
| **K-selected** | number of eggs released equals 5 |
| **r-selected** | number of eggs laid equals 150 000 |
| **K-selected** | adult weight less than a gram |
| **K-selected (close to r)** | sexual maturity in 3 months |
| **K-selected** | females breed every third year |
| **r-selected** | population doubling rate every 20 minutes |
| **K-selected** | young stay with the mother for three years |
| **r-selected** | female often dies during the hatching time |

***Classify*** *the descriptions as either density-dependent or density independent*

|  |  |
| --- | --- |
| **Density Dependent** | decreased vegetation |
| **Density Dependent** | decreased inflammatory and antibody response |
| **Density Independent** | drought |
| **Density Dependent** | emigration |
| **Density Independent** | forest fire |
| **Density Independent** | heavy rain |

***Match*** *each name of a relationship between organisms with its correct description.*

|  |  |  |  |
| --- | --- | --- | --- |
| **D** | Predation | A. | organisms are rivals for resources |
| **E** | Mutualism | B. | one organism benefits, the other is unaffected |
| **B** | Commensalism | C. | one organism benefits at the other's expense |
| **C** | Parasitism | D. | one organism preys on another |
| **A** | Competition | E. | both organisms gain some advantage from the interaction |

**Cryptic Puzzle *Use the clues to fill in the blanks below, the place the appropriate letter (ie. double underlined letter) from the word into the puzzle at the bottom of the page***

1 An alternate form of a gene A\_ L\_ L\_ E\_ L\_ E\_

2 Formula for calculating population equilibrium H\_ A\_ R\_ D\_ Y\_ W\_ E\_ I\_ N\_ B\_ E\_ R\_ G\_ **(2)**

3 A population in balance is in E\_ Q\_ U\_ I\_ L\_ I\_ B\_ R\_ I\_ U\_ M\_

4 Relationship where both organisms benefit M\_ U\_ T\_ U\_ A\_ L\_ I\_ S\_ M\_

5 Relationship where one organism benefit the other is unaffected C\_ O\_ M\_ M\_ E\_ N\_ S\_ A\_ L\_ I\_ S\_ M\_

6 Relationship where one organism benefit the other is harmed P\_ A\_ R\_ A\_ S\_ I\_ T\_ I\_ S\_ M\_

7 Relationship where one species hunts another P\_ R\_ E\_ D\_ A\_ T\_ I\_ O\_ N\_

8 Maximum number of offspring under ideal conditionsB\_ I\_ O\_ T\_ I\_ C\_ P\_ O\_ T\_ E\_ N\_ T\_ I\_ A\_ L\_ **(2)**

9 The type of relationship between two organisms S\_\_ Y\_ M\_ B\_ I\_ O\_ S\_ I\_ S\_

10 Reproductive strategy – large mass, parental care, slow reproduction K\_ - S\_ E\_ L\_ E\_ C\_ T\_ E\_ D\_

11 Reproductive strategy – short life, no parental care, exponential reproduction r\_ - S\_ E\_ L\_ E\_ C\_ T\_ E\_ D\_

12 To resemble another organism M\_ I\_ M\_ I\_ C\_ R\_ Y\_

13 Number of organisms that an area can support C\_ A\_ R\_ R\_ Y\_ I\_ N\_ G\_ C\_ A\_ P\_ A\_ C\_ I\_ T\_ Y\_ **(2)**

14 Competition between a wolf and a coyote I\_ N\_ T\_ E\_ R\_ S\_ P\_ E\_ C\_ I\_ F\_ I\_ C\_

15 Competition between two wolves I\_ N\_ T\_ R\_ A\_ S\_ P\_ E\_ C\_ I\_ F\_ I\_ C\_

16 Number of organism with a certain area P\_ O\_ P\_ U\_ L\_ A\_ T\_ I\_ O\_ N\_ D\_ E\_ N\_ S\_ I\_ T\_ Y\_ **(2)**

17 Total genes within a population G\_ E\_ N\_ E\_ P\_ O\_ O\_ L\_ **(2)**

18 To disguise ones self to avoid predation C\_ A\_ M\_ O\_ F\_ L\_ A\_ U\_ G\_ E\_

19 Progressive replacement of one community with another S\_ U\_ C\_ C\_ E\_ S\_ S\_ I\_ O\_ N\_

20 Type of population only controlled by natality and mortality C\_ L\_ O\_ S\_ E\_ D\_

21 Graph that represents a K-selected population S\_ - C\_ U\_ R\_ V\_ E\_

22 Graph that represents an r-selected population J\_ - C\_ U\_ R\_ V\_ E\_

23 Initial population in an area P\_ I\_ O\_ N\_ E\_ E\_ R\_

24 Final, dominant community in an area C\_ L\_ I\_ M\_ A\_ X\_

GENE AND ALLELE FREQUENCIES

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

17 15 5 1 6 16 10 4 11 8 1 24 7 14 21 2 3 22 23 19 12 9 18 20