SCOPE FOR TEST ON GENETICS AND INHERITANCE

CONTENT	ELABORATION
Introduction	Mendel as father of Genetics
Concepts in Inheritance (must know)	Chromatin and Chromosomes Genes and Alleles Dominant and RecessivePhenotype and Genotype Homozygous and Heterozygous (very important to know these terms) Mendels Law of Segregation
Monohybrid Crossing	Know the following:The format representing a genetic crossing (P1; Phenotype, Genotype, Meiosis. Gametes, Fertilization, F1, Genotype, Phenotype, Ratio (crucial to know layout) HOMOZYGOUS X HOMOZYGOUS = 100% HETEROZYGOUS (the same) HETEROZYGOUS X HETEROZYGOUS = Genotype(1:2:1) Phenotype (3:1) HOMOZYGOUS X HETEROZYGOUS) = Genotype (50%:50%) eg. sex of baby Indicating Homozygous or heterozygous Complete dominance, Incomplete dominance and Co-dominance Genetic Problems
Dihybrid Crossing	Same as Monohybrid format but working with two characteristics Mendels Law of Independent Assortment Ratio of Genotypes and Phenotypes Genetic Problems
Sex Determination	Heterozygous x Homozygous 22 pairs of chromosomes autosomes and 1 pair (number 23) gonosomes (sex chromosomes) Able to show a crossing determining inheritance of sex
Sex-linked Inheritance	Sex-linked alleles and sex-linked Disorders like haemophilia and Colour-blindness The mother is normally the carrier unless both X-chromosomes have the allele for the disease. Mother must have the recessive allele displayed on both X-chromes to be affected by disease. Disease is always recessive If on male X-chromosome, males will always be affected. If child is female and affected, the mother and father must have the recessive gene. If only one parent transfer the gene, daughter can be carrier but not affected. Boy child will always be affected if he picks up the gene from the parent because he has only 1 X-chromosome whereas girls have 2 chromosomes. **Sex linkage** describes the sex-specific patterns of inheritance and presentation when a gene mutation (allele) is present on a sex chromosome (gonosome) rather than a non-sex chromosome (autosome). In humans, these are termed X-linked recessive, X-linked dominant and Y-linked. The inheritance and presentation of all three differ depending on the sex of both the parent and the child. In X-linked dominant inheritance, a son or daughter born to an affected mother and an unaffected father both have a 50% chance of being affected (though a few X-linked dominant conditions are embryonic lethal for the son, making them appear to only occur in females). If the father is affected, the son will always be unaffected, but the daughter will always be affected. A Y-linked condition will only be inherited from father to son and will always affect every generation.

<table>
<tr><td>Blood Grouping</td><td>There are different blood groups influenced by the multiple alleles; Blood group A; Blood group B; Blood Group AB and Blood group O

<table>
<tr><th>Phenotype (Blood type)</th><th>Genotype</th></tr>
<tr><td>Type A</td><td>I^AI^A or I^Ai</td></tr>
<tr><td>Type B</td><td>I^BI^B or I^Bi</td></tr>
<tr><td>Type AB</td><td>I^AI^B</td></tr>
<tr><td>Type O</td><td>ii</td></tr>
</table>
<table>
<tr><th>Blood Type</th><th colspan="2">Genotype</th><th>Can Receive Blood From:</th></tr>
<tr><td>A</td><td>i^Ai
i^Ai^A</td><td>AA
AO</td><td>A or O</td></tr>
<tr><td>B</td><td>i^Bi
i^Bi^B</td><td>BB
BO</td><td>B or O</td></tr>
<tr><td>AB</td><td>i^Ai^B</td><td>AB</td><td>A, B, AB, O</td></tr>
<tr><td>O</td><td>ii</td><td>OO</td><td>O</td></tr>
</table>
Inheritance of the ABO Blood System in Humans
<table>
<tr><th></th><th>I^A</th><th>I^B</th><th>i</th></tr>
<tr><td>I^A</td><td>I^AI^A
A</td><td>I^AI^B
AB</td><td>I^Ai
A</td></tr>
<tr><td>I^B</td><td>I^BI^A
AB</td><td>I^BI^B
B</td><td>I^Bi
B</td></tr>
<tr><td>i</td><td>iI^A
A</td><td>iI^B
B</td><td>ii
O</td></tr>
</table>
Genetic problems involving inheritance of blood type. Must be able to ascertain parenthood to correct child

Blood Type Problem
Three children recently born in a hospital were accidently mixed up. The blood types of the parents involved are given along with the blood types of the infants. Determine which baby belongs with which parents, and explain your reasoning for the decisions you made.

<table>
<tr><th colspan="2">Mother and Father</th><th colspan="2">Babies</th></tr>
<tr><td>Parents #1</td><td>Type A & Type B</td><td>Child x</td><td>Type A</td></tr>
<tr><td>Parents #2</td><td>Type O & Type AB</td><td>Child y</td><td>Type O</td></tr>
<tr><td>Parents #3</td><td>Type B & Type O</td><td>Child z</td><td>Type AB</td></tr>
</table>
Paternity testing through blood grouping and DNA profiling</td></tr>
<tr><td>Genetic / Pedigree Lineages</td><td>Able to do genetic / pedigree traces of inheritance of characteristics over many generations
Interpretation of pedigree diagrams</td></tr>
<tr><td>Genetic Links</td><td>Mutations in mitochondrial DNA used in tracing female a ncestry (Evolution)</td></tr>
</table>

TERMINOLOGY – Term and meaning

Term	Meaning/Definition
chromatin	Tangled network of chromosomes located within the nucleus
chromatid	The individual threads that form a chromosome
centromere	Structure joining two threads of a chromosome
nucleolus	Structure in the nucleus responsible for forming ribosomal RNA
nucleoplasm	That part of the protoplasm within the nucleus
cytoplasm	That part of the protoplasm outside the nucleus.
ribosome	Structure that is the site of protein synthesis
Gene	Segment of a chromosome that controls each characteristic
hereditary	Characteristics that are passed from parents to offspring
DNA	Nucleic acid that is a constituent of chromosomes
Helix	Natural shape of a DNA molecule
RNA	Type of nucleic acid that occurs as a single strand / nucleic acid that contains uracil
nucleotide	Building blocks of nucleic acids consisting of a sugar, a base and a phosphate
replication	The formation of an exact copy of the DNA in a cell
template	The original strand upon which a new strand is developed
complementary strand	The new strand that is made based on the sequence of nucleotides on the template
cytosine	The base that pairs off with guanine
thymine	The base that pairs off with adenine
uracil	The base found in RNA and not DNA
Hydrogen bonds	The chemical bonds which link base pairs in the DNA molecule
enzyme	A protein that speeds up a chemical reaction / a catalyst
codon	The three adjacent bases found on a DNA or m-RNA molecule
anticodon	The three adjacent bases found on a t-RNA molecule that will determine which amino acid will be brought to the ribosome
transcription	The synthesis of m-RNA from a DNA template
translation	The process of converting the information carried by m-RNA to the correct sequence of amino acids to form a particular protein
synthesis	Building up of separate parts into a whole
Condensation reaction	When large molecules are made from simple molecules with the release of water
Amino acid	The basic building block of a protein molecule

Peptide link	A link between two adjacent amino acids
monomer	A single unit that makes up a larger molecule

polymer	A large molecule which is formed from many small molecules (monomers)
mutation	A sudden and relatively permanent gene / chromosomal change
Mitochondrial DNA	The type of DNA found only in the mitochondrion
genome	All the genes present in an organism