



JENN

Training and Consultancy
The path to enlightened education

SUBJECT: AGRICULTURAL SCIENCES

GRADE 12

WINTER CLASSES

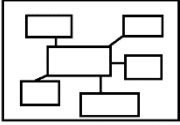
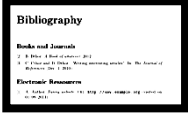
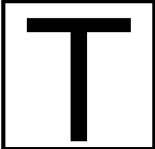
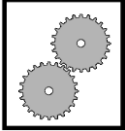
TEACHER AND LEARNER CONTENT MANUAL

Topic

1. GENETICS

**2. MARKETING, ENTREPRENEURSHIP
AND BUSINESS PLAN**

ICON DESCRIPTION

 MIND MAP	 EXAMINATION GUIDELINE	 CONTENTS	 ACTIVITIES
 BIBLIOGRAPHY	 TERMINOLOGY	 WORKED EXAMPLES	 STEPS



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TOPIC 1: Genetic concepts

EXAMINATION GUIDELINE AND OUTCOME

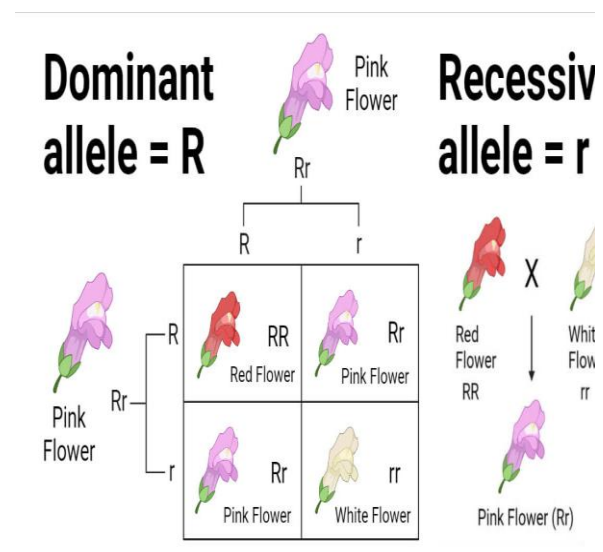
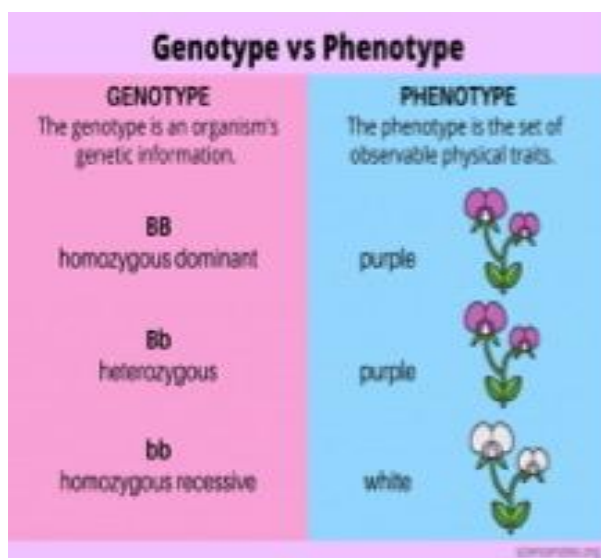
Basic agricultural genetics Monohybrid inheritance Dihybrid inheritance	Genetic concepts ● Define basic genetic terminology, like genetics/heredity, genes, chromosomes and alleles (homozygous and heterozygous) ● Distinguish between genotype and phenotype, dominant and recessive genes. ● Indicate a monohybrid inheritance/crosses (Mendel's first law: law of segregation) ● Indicate a dihybrid inheritance/dihybrid cross (Mendel's second law: law of independent assortment) ● Use various methods, such as a Punnett square, genetic diagrams and schematic representations to illustrate the crosses ● Describe Mendel's laws of segregation and independent recombination of characteristics ● Distinguish between qualitative and quantitative characteristics 
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IMPORTANT TERMS AND DEFINITIONS



Genetics is the study of heredity	Genetics
Heredity is the transfer of characteristics from parents to offspring.	Heredity
A section of DNA that contains the information for a specific genetic characteristic	Gene
A specific characteristic of an individual	Traits
A thread-like structure in the cell nucleus that contains DNA and protein	Chromosomes
Different forms of the same gene, one copy from each parent. (XX), it is homozygous for X and it is a female. (XY) it is heterozygous for sex, and it is a male.	Alleles

Having identical alleles for a particular gene e.g. BB or bb	Homozygous
Having different alleles of a gene e.g. Bb	Heterozygous
The set of genes an organism inherits from its parents	Genotype
The physical, behavioural, and biochemical traits that it expresses in an individual	Phenotype
The version of a gene that is expressed	Dominants
The version that is masked.	Recessive
Focuses on the inheritance of a single pair of alleles (one trait)	Monohybrid cross
Studies the inheritance of two different pairs of alleles (2 traits) simultaneously	Dihybrid cross



2 Monohybrid and dihybrid inheritance

Feature	Monohybrid Inheritance	Dihybrid inheritance
Definition	Inheritance of a single trait (one gene with two alleles)	Inheritance of two different traits (two genes, each with two alleles)
Mendel's Law	Follows the Law of Segregation , which state that alleles pairs separate during gamete formation	Follows the Law of Independent Assortment states that alleles of two different genes get sorted into gametes independently of one another during gamete formation
Cross Example	Tall (T) vs Short (t) pea plants	Seed shape (Round-R vs Wrinkled-r) and seed colour (yellow - Y vs Green - y)
Parental Cross (P)	TT x tt (pure tall x pure short)	RRYY x rryy (pure round-yellow x pure wrinkled-green)
Gametes (Meiosis)	T x t	RY x ry
Offsprings (F1)	Tt	RrYy
Self-crossed (P2) /Inbreeding	Tt x Tt (heterozygous tall x heterozygous tall)	RrYy x RrYy (heterozygous round and yellow x heterozygous round and yellow)
Gametes	T; t	RY; Ry; rY; ry
F1 generation phenotype ratio	3:1 (3 dominant: 1 recessive)	9:3:3:1 (9 double dominant, 3 dominant for one trait and recessive for the other, 3 recessives for one trait and dominant for the other, 1 double recessive)
Punnett square size	3 x 3 (9 boxes, including gametes)	5 x 5 (25 boxes, including gametes)
Example in Animals	Fur colour in mice (Black B dominant, white b recessive)	Fur colour and tail length in mice (Black B, White b; Long L, Short l)
Example in plants	Flower colour in pea plants (purple P, white p)	Seed shape and seed colour in pea plants

2.2 Punnett Square for Monohybrid and Dihybrid crosses

Monohybrid cross

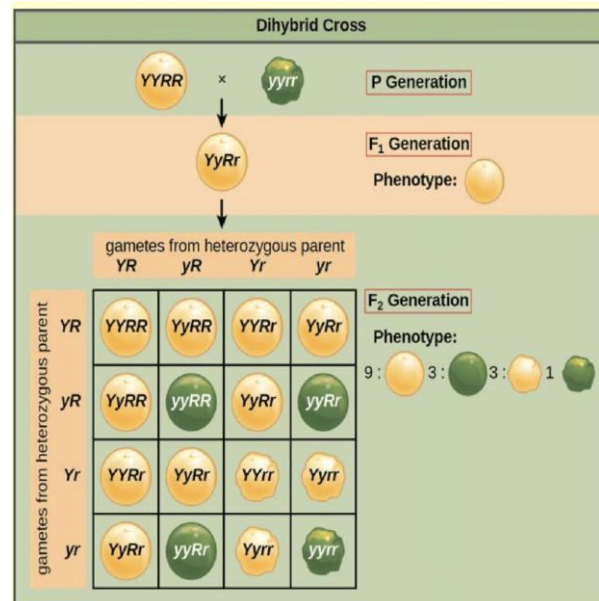
Parental generation: BB x bb

First filial generation, F₁:

Bb

Second filial generation, F₂:

Gametes	B	b
B	BB (purple)	Bb (purple)
b	Bb (purple)	bb (white)



2.3 Schematic representations to illustrate the crosses

Cross of parental generation

Parental phenotype

Parental genotype

Meiosis

Gamete

Fertilization

F₁ genotype

F₁ phenotype

Self-crossed F₁ generation

F₁ phenotype

F₁ genotype

Meiosis

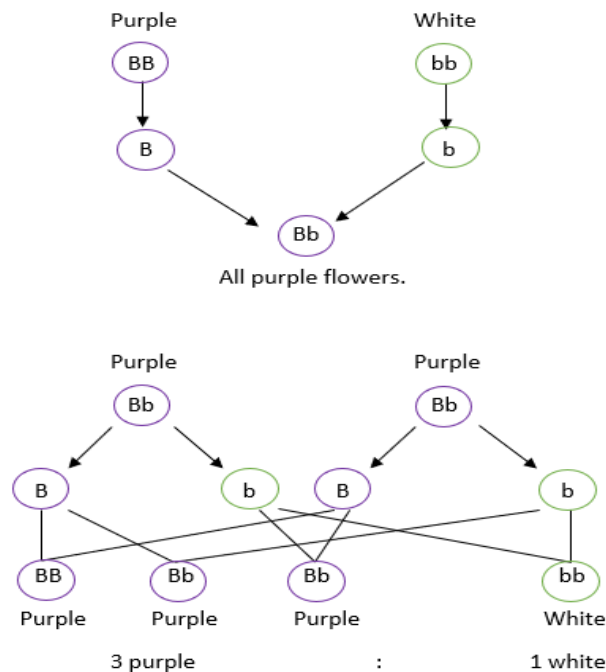
Gamete

Fertilization

F₂ genotype

F₂ phenotype

Ratio of F₂ genotype





ACTIVITIES

Activity 1

1.1 A farmer crosses two heterozygous red-coated cattle ($Rr \times Rr$), where **red (R)** is dominant over **white (r)**.

1.1.1 Use a Punnett square to show the possible genotypes of the offspring. (4)

1.1.2 Determine the **genotypic ratio** of the offspring. (2)

1.1.3 Calculate the **phenotypic ratio** of the offspring as a percentage. (2)

Activity 2

2.1 The gene for a brown coat in goats is dominant over that for a white coat. In the diagram below two brown-coated goats mated. (Use the symbol B for coat colour.) In goats, the gene for a **brown coat (B)** is dominant over the gene for a **white coat (b)**. Two brown-coated goats are crossed, and they produce offspring with both brown and white coats.

2.1 Determine the **genotypes of the parent goats**. (2)

2.2 Use a Punnett square to illustrate the cross between the two parent goats. (4)

2.3 Identify the **phenotypes of the offspring** produced from this cross. (2)

2.4 Calculate the **percentage of offspring that are heterozygous brown**. (2)

2.5 If one of the heterozygous offspring is crossed with another heterozygous individual, predict the **possible coat colours of the progeny** and give a reason for your answer. (2)

Activity 3

In pea plants, **seed colour** and **seed texture** are controlled by two different genes:

- **G** – Green (dominant), **g** – Yellow (recessive)
- **R** – Rough (dominant), **r** – Smooth (recessive)

A homozygous green, rough-seeded plant (**GGRR**) is crossed with a homozygous yellow, smooth-seeded plant (**ggrr**).

3.1 Name the type of genetic cross represented above. (1)

3.2 Give a reason for your answer in QUESTION 3.1. (1)

3.3 Determine the **genotype of all the F_1 offspring**. (2)

3.4 If two F_1 individuals are crossed, calculate the **percentage of offspring with yellow, smooth seeds** in the F_2 generation. Show ALL calculations. (3)

Activity 4

In sheep, **black coat colour (B)** is dominant over **white coat colour (b)**.

A homozygous black ram (**BB**) is crossed with a homozygous white ewe (**bb**). All the F_1 offspring are black. One of the F_1 individuals is then crossed with another sheep of unknown genotype. All the F_2 offspring produced are black.

4.1 Determine the **genotype of the unknown sheep**. Show your reasoning. (2)

4.2 Draw a **Punnett square** to illustrate the F_2 generation. (4)

4.3 State the **genotypic ratio** of the F_2 offspring. (1)

4.4 How many of the F_2 offspring are expected to be **white**? (1)

TOPIC 2: The pattern of inheritance

EXAMINATION GUIDELINE AND OUTCOME

The patterns of inheritance

- Identify and describe the pattern of inheritance that leads to different phenotypes: incomplete dominance, co-dominance, multiple alleles, polygenic inheritance and epistasis
- Define the concept of prepotency and atavism with relevant examples
- Describe the sex chromosomes and sex-linked characteristics (examples)



IMPORTANT TERMS AND DEFINITIONS

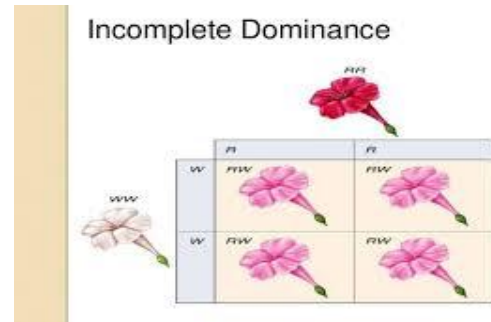


Atavism is the reappearance of ancestral traits in an organism, even if those traits have not been seen in recent generations	Atavism
Occurs when one gene mask the expression of another gene	Epistasis
Occurs when a trait is controlled by multiple genes	Polygenic inheritance
Prepotency refers to the ability of one parent to consistently pass on its traits to offspring, often overriding genetic contributions from the other parent.	Prepotency
Intermediate inheritance where neither of the two alleles for a particular trait is completely dominant over the other	Incomplete dominance
Both <u>alleles</u> of a gene pair in a <u>heterozygote</u> are fully expressed	Codominance

3. The pattern of inheritance

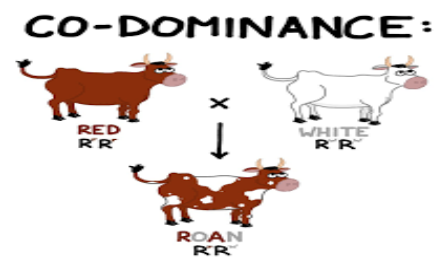
3.1 Incomplete dominance

This occurs when a heterozygous individual displays a phenotype that is intermediate between the two homozygous phenotypes, meaning neither allele is completely dominant, resulting in a "blended" appearance. Example: When a red-flowered plant (RR) is crossed with a white-flowered plant (WW), the offspring (RW) have pink flowers, showing a blend of red and white. In incomplete dominance, the heterozygous phenotype is a blend of the two homozygous phenotypes



3.2 Co-dominance

Both alleles of a gene are expressed equally in the phenotype of a heterozygous individual, showing distinct traits from both alleles simultaneously. For example: A cross between red and white animal will have offspring that is roan. In codominance, both alleles are fully expressed in the heterozygous phenotype



3.3 Multiple alleles

A situation where a gene has more than two different alleles present in a population, leading to a wider variety of possible phenotypes for a trait; example: the human ABO blood group system with A, B, and O alleles. Multiple alleles allow for more than two possible phenotypes for a single trait.

Trait = Blood Type		Alleles = I^A , I^B , i
Phenotypes		Genotypes
• Type A		• $I^A I^A$ or $I^A i$
• Type B		• $I^B I^B$ or $I^B i$
• Type AB		• $I^A I^B$ (co-dominance)
• Type O		

3.4 Polygenic inheritance

Occurs when a trait is controlled by multiple genes, each contributing a small effect, resulting in a continuous range of phenotypes within a population; examples include height and fur colour. Polygenic inheritance produces a continuous distribution of phenotypes due to the combined effects of many genes.

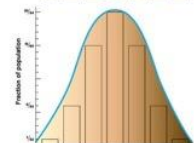
Polygenic inheritance

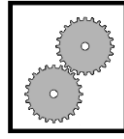
- Some phenotypes determined by additive effects of 2 or more genes on a single character

phenotypes on a continuum

human traits

- skin color
- height
- weight
- intelligence
- behaviors





Activity 5

Worked example

The mass of a certain plant fruit is controlled by two pairs of genes.
The base mass of a recessive plant (**aabb**) is **20 g**.
Each dominant (additive) allele contributes **5 g** to the base mass.

Question 1

Calculate the mass of a plant with genotype **AaBB**. (2)

Answer:

Count the number of dominant alleles in **AaBB**:

- A = 1 dominant
- B = 2 dominant
- Total dominant alleles = 3

Mass = Base mass + contributions
= 20 g + (5 g × 3)
= 20 g + 15 g
= **35 g ✓**

Question 2

Name **THREE genotypes** that will produce a plant with a mass of **30 g**. (3)

Answer:

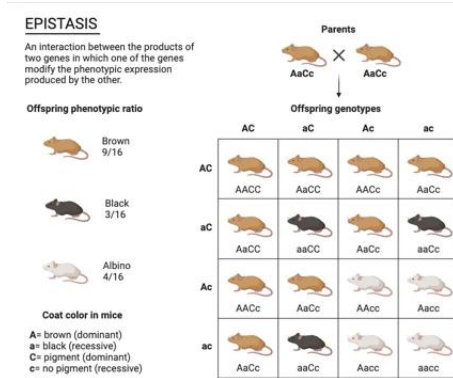
Step 1: Determine number of dominant alleles needed
 $30 \text{ g} = 20 \text{ g} + (5 \text{ g} \times 2)$
So, **2 dominant alleles** are required.

Step 2: Possible genotypes with 2 dominant alleles:

- **AAbb ✓**
- **aaBB ✓**
- **AaBb ✓**
- **AaBb ✓**

3.5 Epistasis

Occurs when one gene masks the expression of another gene, meaning the phenotype of one gene is dependent on the genotype of another gene. For example, a gene for albinism can mask the expression of other genes affecting skin colour, resulting in a completely white phenotype regardless of other pigment genes. Epistasis involves one gene influencing the expression of another gene.



3.6 Prepotency

Prepotency refers to the more than usual ability of one parent to pass on its traits to offspring, often overriding genetic contributions from the other parent. This is commonly seen in selective breeding, where certain individuals produce offspring that closely resemble them. Examples: A bull with strong prepotency for high milk production in cows will sire daughters that also produce large amounts of milk. A dominant tomato plant with high disease resistance consistently produces offspring with the same resistance, even when crossed with a weaker strain.

3.7 Atavism

Atavism is the reappearance of ancestral traits in an organism after several generations of absence. This occurs due to the expression of dormant genes that were previously suppressed. Example: Horses with extra toes, Modern horses typically have a single toe (hoof), but occasionally, a foal is born with small extra toes, resembling their multi-toed ancestors.

3.8 The sex chromosomes

Sex chromosomes determine an organism's biological sex. In most species, they come in pairs and vary between males and females. Example males have XY chromosomes and female XX chromosomes. The Y chromosome carries genes for male traits.

3.9 Sex-linked characteristics

Sex-linked characteristics are traits controlled by genes located on the sex chromosomes, usually the X chromosome. Since males (XY) have only one X chromosome, they express recessive X-linked traits more frequently than females (XX), who can be carriers. Example: streaked hairlessness is a disorder that results in streaks of missing hair in Holstein cattle caused by a dominant allele located on the X chromosome

Qualitative vs Quantitative Traits

- | | |
|---|---|
| <ul style="list-style-type: none">• Qualitative Traits<ul style="list-style-type: none">• Influenced by a single gene• Typically follow simple patterns of inheritance• Phenotypes fall into distinct categories (nominal scale)• Trait expression is typically unaffected by environment | <ul style="list-style-type: none">• Quantitative Traits<ul style="list-style-type: none">• Influenced by multiple genes, perhaps interacting genes• Do not follow simple patterns of inheritance• Phenotype is measured on continuous scale (interval scale)• Trait expression may be affected by environment |
|---|---|

Activity 6

In rabbits, **black fur colour (B)** is dominant over **brown fur (b)**. However, a separate gene **(D)** controls pigment deposition. Rabbits that are **dd** do not deposit pigment and appear **white (albino)** regardless of the allele present at the B locus.

1.1 Identify the **type of gene interaction** described above. (1)

1.2 Give a **reason** for your answer in QUESTION 1.1. (1)

1.3 Determine the **phenotypes** of rabbits with the following genotypes:

(a) **Bbdd**

(b) **BbDd** (2)

1.4 A rabbit with genotype **BbDd** is crossed with another rabbit of the same genotype (**BbDd**).

(a) Give **TWO possible genotypes of gametes** produced by one parent. (2)

(b) Determine the **phenotypic ratio** of the offspring. (1)

Activity 7

In snapdragon plants, **red flowers (R)** are crossed with **white flowers (W)**. The F_1 generation all have **pink flowers**.

7.1 Use a **Punnett square** to show the offspring of the **F_2 generation** when two F_1 plants are crossed. (4)

7.2 Name the **type of inheritance** illustrated in this cross. (1)

7.3 Give a **reason** for your answer in QUESTION 7.2. (1)

7.4 State the **genotypic ratio** of the F₂ generation. (1)

7.5 Calculate the **phenotypic ratio** of the F₂ generation. (1)

Activity 8

The mass of wheat grains is controlled by **two pairs of genes**. The base mass of a homozygous recessive plant (**aabb**) is **25 g**. Each dominant (additive) allele contributes **8 g** to the total mass.

8.1 Determine the **maximum number of dominant alleles** possible in this cross. (1)

8.2 Calculate the **mass of a plant with genotype AABB**. Show ALL calculations. (2)

8.3 Determine the **mass of a plant with genotype AaBb**. (2)

8.4 Name **TWO genotypes** that will produce a plant with a mass of **41 g**. (2)



Variation and Mutation

Define genetic terminology, like variation, mutation and selection
<i>Identify and describe the importance of variation and selection</i>
Discuss the external (environmental) and internal (genetic) causes of variation
Identify the types of mutagenic agents and their effects (changes in chromosome structures)



A change in the DNA sequence of an organism which is the main cause of diversity amongst organisms	Mutation
A change in a small quantity of the hereditary substance in the cell	Gene mutation
Visible changes in the structure or number of chromosomes.	Chromosome mutation
Change in chromosome number affecting part of the set — gain or loss of one or a few chromosomes (e.g., trisomy 21: 2n+1).	Aneuploidy
Change in whole set chromosome number — one or more extra complete sets of chromosomes (e.g., triploidy 3n, tetraploidy 4n).	Polyploidy
Involves the process of choosing individuals with wanted characteristics to breed offspring that may inherit their wanted characteristics	Selection
The process of choosing individual organisms with certain phenotypic trait values for breeding by humans	Artificial selection
The process by which populations of living organisms adapt and change	Natural selection

The differences in the phenotypes of plants and animals of the same species caused by genetic and environmental factors	Variation
The long-term weather pattern in a regions, typically averaged over thirty years.	Climate
A genetic characteristic giving rise to a range of phenotypes that seem to blend continuously from one extreme to the other and are usually influenced by multiple genes and environmental factors.	Quantitative characteristics
Refers to genetic characteristics that shows continuous variation	Qualitative characteristics
The degree to which a characteristic/trait is determined by genes	Heritability
This gives an estimate of how much better or worse than an average the offspring of an individual will be for a particular characteristic	Estimated breeding value(EBV)
The study of measurable biological characteristic by using computer technology	Biometrics

Importance of Variation & Selection

Selection and variation work together to drive genetic improvement, whether in natural evolution or controlled breeding programmes. Changes in the DNA of an organism occur because of spontaneous mutations, chromosome defects and sexual reproduction. These changes cause variation in individual organisms. Through a process of selection, variations can result in new breeds and varieties of plants and animals. Both are important for sustaining biodiversity, improving agriculture and ensuring the survival of species.

Variation

Causes of variation:

Variation is caused by: (a) external / environmental factors, and
(b) internal / genetic factors.

External causes of variation -This results from factors associated to the environment of an organism.

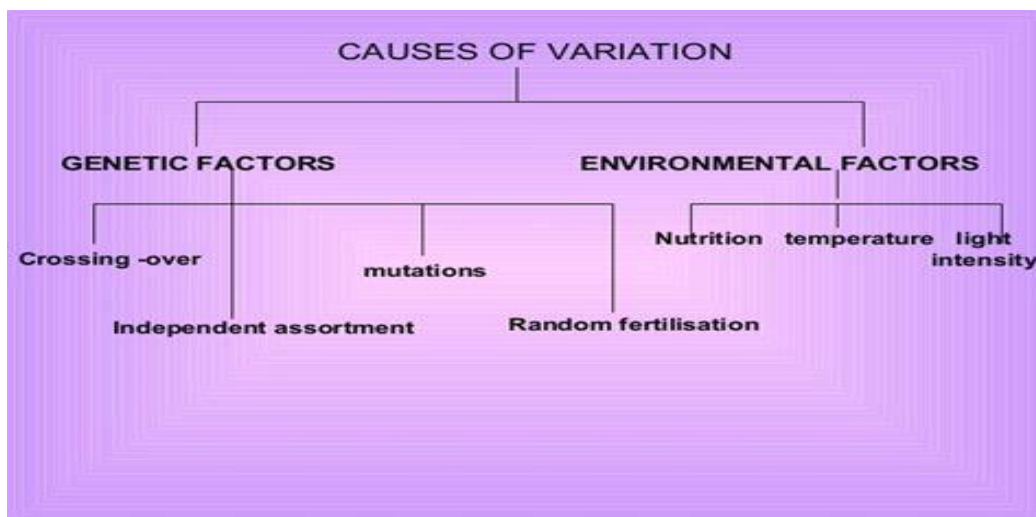
Diseases	Diseases cause variations in organisms by influencing genetic and environmental factors.
Climate/weather /temperature	Climate plays an important role in causing variations in living organisms by influencing genetic expressions, natural selection and adaptation.
Light Intensity	Animals living in areas at high altitude display colour differences amongst other things
Feeding	Variation will develop between two identically genetic composition that are fed food rations animals differing in quantity and quality.

Topography	Nguni cattle are exceptionally well adapted to cover great distances daily and to climb steep hill.
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Internal or Genetic causes of variation

Internal/genetic causes of variation are factors that are linked with the genes and heredity of an organism.

Mutations	It causes changes in the DNA or RNA of an organism which results in creation of new traits or alter existing ones.
Meiosis	Meiosis causes genetic variation through crossing over, independent assortment and random fertilisation.
Fertilization	During fertilisation, genetic variation is increased due to combination of unique genetic material from two parents.

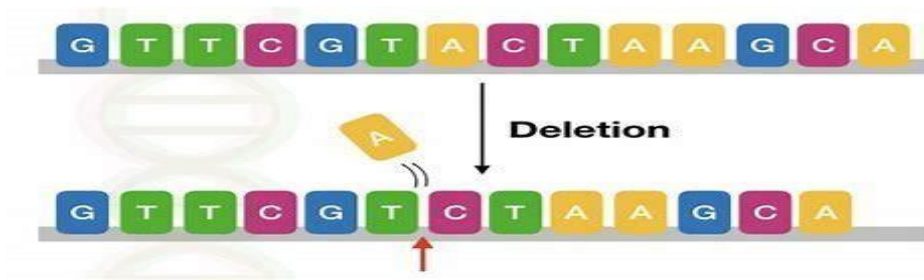


Types of mutations

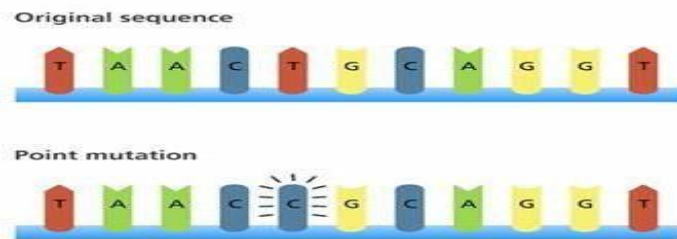
1. Gene OR Point mutations: They are the most common type of mutation affecting organisms.

- A. Deletion** : one or more nucleotide bases are removed from the gene sequence
- B. Insertion** : one or more nucleotide bases are added to the into the gene sequence.
- C. Substitution** : one nucleotide base is replaced by different nucleotide base.
- D. Inversion**: in this case, the order of two or more nucleotide bases is reverse.

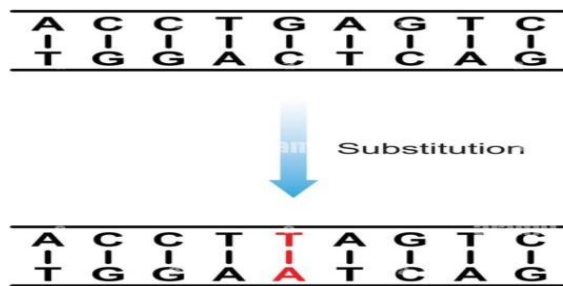
1. Deletion : one or more nucleotide bases are removed from the gene sequence



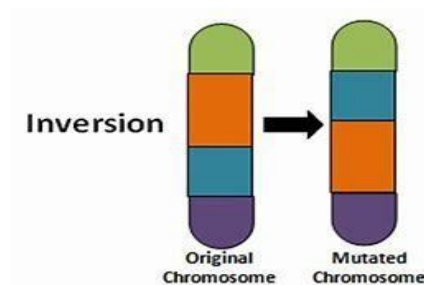
2. Insertion- one or more nucleotide bases are added into the gene sequence



3. Substitution – one nucleotide base is replaced with a different nucleotide base



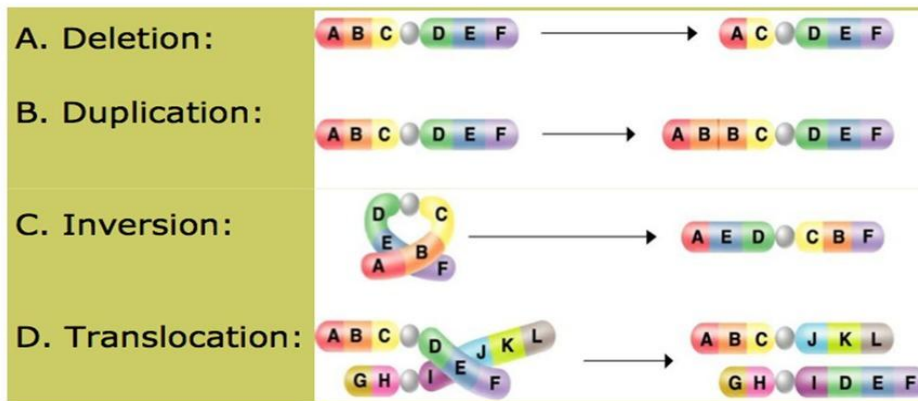
4. Inversion- the order of two or more nucleotide bases is reversed



2. Chromosome mutations

Chromosome mutations are usually detrimental to the individual organism.

Chromosomal Mutations



Causes of Mutations

Mutations may be caused by **induced /artificial and natural**

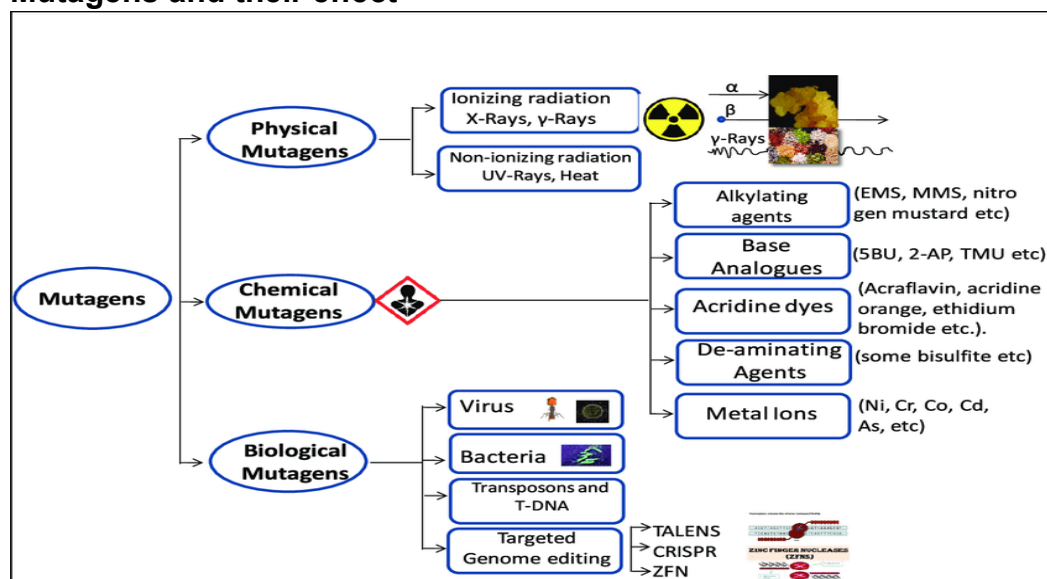
1. Induced/artificial mutations: these refer to mutations that are caused by artificial means. E.g. Mutagenic agents include physical, chemical and biological agents.

2. Natural mutations : mutations that occur spontaneously in nature due to the normal chemical processes in the cells of organisms.

Importance of mutation

Mutation is a crucial factors in the evolution and improvement of crops and animals by introducing genetic variation which can lead to desirable traits that enhance productivity, resilience and sustainability

Mutagens and their effect





ACTIVITIES

Activity 9

Variation refers to differences in characteristics among individuals of the same species. These differences can be influenced by environmental factors.

Name the **environmental factor** responsible for EACH of the following variations:

9.1.1 Plants growing in shaded areas have larger leaves than those growing in direct sunlight.

9.1.2 Cattle raised in areas with limited water supply show reduced growth compared to those in well-watered areas.

9.1.3 Sheep in windy regions develop thicker wool compared to those in calm environments.

9.1.4 Chickens exposed to longer daylight hours lay more eggs than those with shorter daylight exposure.

9.1.5 Fish living in polluted water bodies show slower growth than those in clean water. (5)

Activity 10

Genetically identical tomato plants were grown in three different locations under varying conditions. After two months, the following observations were recorded:

LOCATION	PLANT HEIGHT
X	Short
Y	Tall
Z	Medium

10.1.1 Identify the **genetic phenomenon** illustrated in the table above. (1)

10.1.2 Define the **genetic phenomenon** mentioned in QUESTION 10.1.1. (2)

10.1.3 Name **THREE environmental factors** that could have caused the differences in plant height. (3)

10.1.4 When two different tomato varieties are crossed, the offspring often show improved growth and higher yield.

10.1.5 Provide the **scientific term** for this improvement. (1)

Activity 11

An investigation was conducted to study the effects of **breed type** and **feeding regime** on the growth rate of pigs. Two different breeds of pigs were used. One group received a balanced diet, while the other group was given a limited diet. It was observed that pigs on the limited diet had a slower growth rate and lower final body mass.

11.1.1 Identify the following from the scenario above:

- (a) **Genetic** factor of variation (1)
- (b) **Environmental** factor of variation (1)

11.1.2 Explain the relationship between **diet and growth rate** in this investigation. (2)

11.1.3 Formulate a **hypothesis** for this investigation. (2)

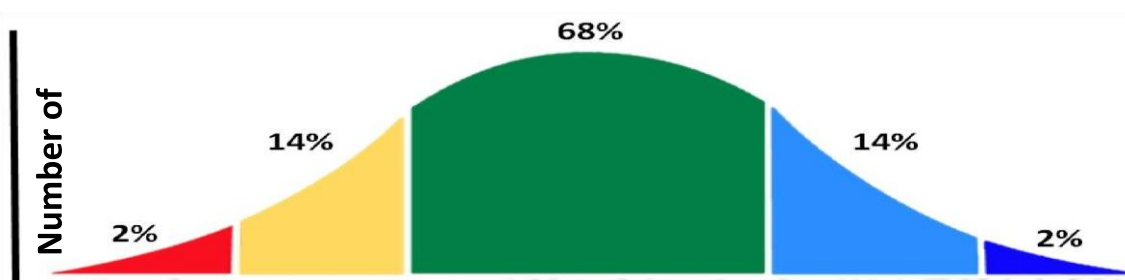
Selection and Breeding



Indicate the general principles of selection, like biometrics, heritability and estimated breeding values (EBVs), and compare natural and artificial selection	
Indicate the selection methods used by plants and animal breeders (mass, pedigree, family and progeny selection) and breeding values.	
Identify and describe inbreeding, linebreeding with relevant examples, cross breeding, upgrading, species crossing, out-crossing and the advantages and disadvantages of these different breeding systems	
The degree to which a characteristic/trait is determined by genes	Heritability
This gives an estimate of how much better or worse than an average the offspring of an individual will be for a particular characteristic	Estimated breeding value(EBV)
The study of measurable biological characteristic by using computer technology	Biometrics

Importance of variation in selection

Selection is based on the observable differences between individual of the same species. For example, if offsprings of two parents show a variation in characteristics such as growth rate, resistance to extreme weather condition and egg production, the variation of each of character will have a normal distribution curve(bell-shaped) curve



A greater number of the population falls in the average (individuals meeting the average) whilst lowest numbers are found in the extremes of the curve.

- Characteristics that are caused by genetic factors are passed from parents to offspring.
- Characteristics that are caused by the environment are not passed to offspring
- It is crucial that the farmer identifies characteristics that are **genetically** controlled when choosing individual plants or animals from breeding

Heritability

It refers to the degree to which a characteristic is determined by genetics as against environmental factors. It is calculated by comparing the similarity between connected individuals under similar environment conditions. Heritability is expressed on a scale of 1% to 100% or 0 to 1.

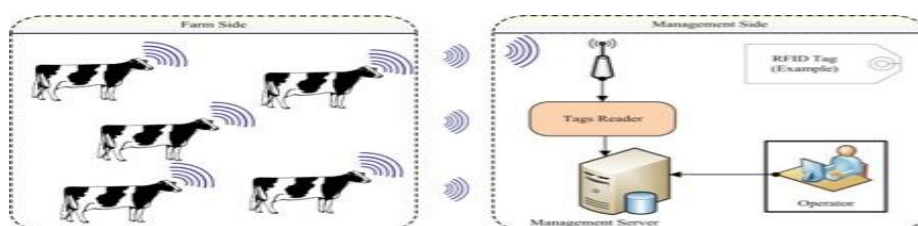
Heritability values of over 50% for a particular characteristic is considered high and more influenced by gene rather than by environment.

Estimated Breeding Values (EBVs)

EBV is used to predict the genetic potential of an animal as a parent. They help breeders make informed decisions to improve traits in livestock such as milk yield, growth rate, fertility and disease resistance.

Biometrics

In animal breeding, it refers to the application of statistical methods and mathematical models to analyse biological data related to animal traits, genetics and breeding performance. It plays a crucial role in selection breeding programmes, and genetic evaluation.



Factors to consider when selecting breeding stock.

1. Age	6. Quality of products
2. Level of performance	7. Mothering Ability
3. Physical Fitness	8. Adaptability
4. Health Body Conformation	10. Prolificacy
5. Temperament or Behaviour	

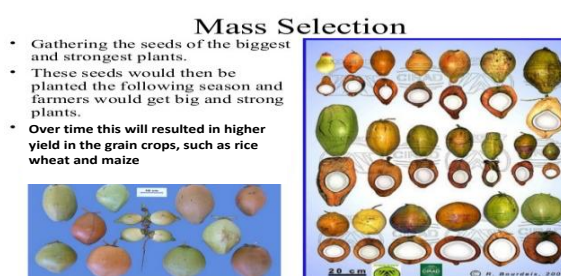
Selection: Types

- Natural Selection – as it happens in nature
- Artificial Selection – by human interference

Methods of Selection	
☐ Mass selection	- type of selection that is based on the individual's performance on the field
☐ Pedigree selection	- type of selection that is based on the quality of the ancestor
☐ Family selection	- type of selection that is based on the quality of the relatives of its generation (full/half siblings)
☐ Progeny selection	- type of selection that is based on the quality of the offspring

1. Mass selection

It refers to the practice of selecting individuals from a population based on their phenotype (desirable traits). The seeds from these selected plants are mixed and used to grow the next generation. Over successive generations, this process helps to improve the overall performance

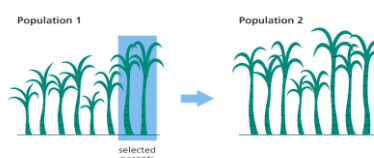


2. Pure line/ Progeny Selection

Plant and animal selection method where selection is based on the performance of the offspring (progeny). Examples include selecting wheat plants that produce offspring with higher grain yields. In animals, an example is selecting cattle whose offspring show superior milk production.

Progeny selection: based on the quality of the offspring.

- If the offspring are good.. Use the parents for breeding purposes!!!



3. Pedigree Selection

Individual plants and animals are selected based on their own performance and the known performance of their ancestors

Pedigree selection: based on the quality of the ancestors:

Determine all the possible modes of inheritance for the pedigrees.

Pedigree A

Pedigree B

Pedigree C

Answer Bank

- X-linked recessive
- autosomal dominant
- autosomal recessive

Family selection

A breeding method where entire families are selected based on the average performance of the family, rather selecting individual plants and animals. Selected individuals could be siblings or half siblings.

Family selection:

- Based on the quality of the relatives of the same generation (siblings). – Sugar Cane: Most often used in plants that use vegetative propagation



Using Heritability and Estimated Breeding Values(EBVs) in breeding.

- (EBV) is an estimate of how much better or less than average the offspring will be for a particular characteristic.
- Heritability refers to the proportion of variation in the population that is due to genetic influences.

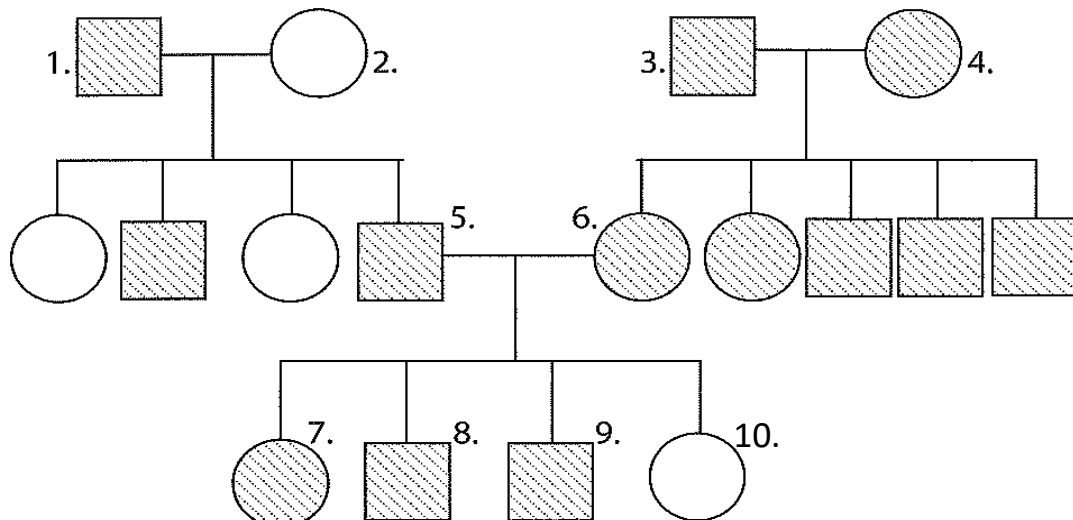
Farmers and animal breeders can use heritability and EBVs to predict and follow the progress of a breeding programme. The greater the EBV of the parents and the higher the heritability of the characteristics, the greater the chance of improving performance by selection and breeding



ACTIVITIES

Activity 13a

13.1 The diagram on the next page shows three generations of guinea pigs. The squares represent males and the circles represent females. Individuals represented by shaded symbols have black fur, those represented by non-



(FROM: BIOS STD 9, FISICHEM)

shaded symbols have white fur. Black fur (P) is dominant over white fur

13.1.1 Write down the genotypes of the individuals numbered 1, 2, 3 and 5. (5)

13.1.2 What percentage of the offspring numbered 7, 8, 9 and 10 do you expect to be heterozygous for fur colour? (2)

Activity 13b

"Two generations of mice are shown. Black fur (B) is dominant to white (bb).

In generation 1, a black male that produced some white offspring is mated with a white female.

Their black daughter (A) is mated with a white male.

Draw the possible genotypes for the parents and offspring, then:

- Give the genotypes of the original black male, the white female, and daughter A.
- What proportion of daughter A's offspring would be heterozygous for fur colour? (Show your crosses.)"

Assumptions: shaded = black (B, dominant), unshaded = white (bb, recessive).

a) Genotypes

- Original black male produced some white offspring → he must be heterozygous. Bb
 - White female → b b.
 - Their black daughter A (having a white sibling) must have inherited b from the father and B from the mother → B b.

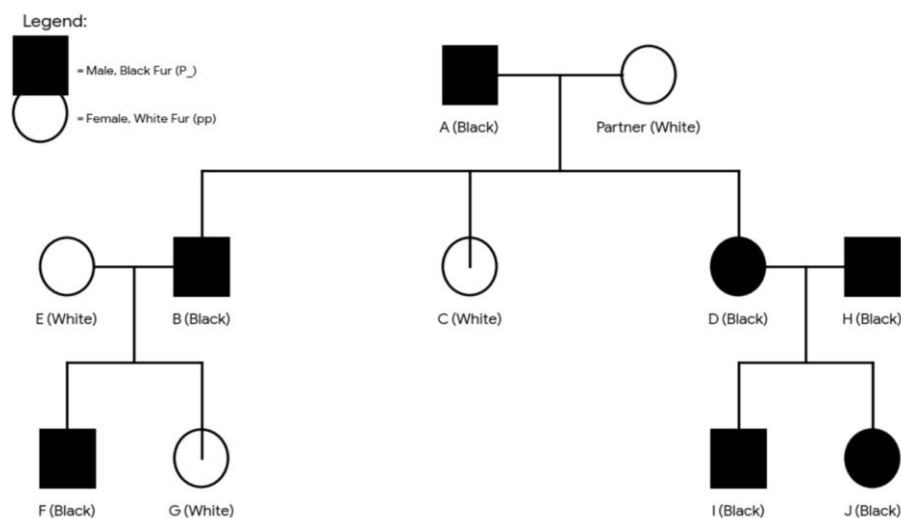
b) Cross and proportion heterozygous

- Cross daughter A (B b) × white male (b b).
- Punnett square:

	B	b
b	Bb	bb
b	Bb	bb

- Offspring genotypes: 50% B b (heterozygous black), 50% b b (white).
- Proportion heterozygous = 1/2 (50%).

Activity 13 c



1. Give possible genotypes for A, B, C, D, E and H (use P and p). (6 marks)
2. If B is heterozygous, what are the expected genotypes and phenotypes of B × E offspring? Show Punnett square. (4 marks)
3. What is the probability that the offspring of D × H is heterozygous? (2 marks)
4. If F (from B × E) mates with I (from D × H) and both are black but heterozygous, what proportion of their offspring will be white? (3 marks)

Generation 2: B = black, C = white, D = black. B mated with E = white. D mated with H = black.

Offspring: B × E → F = black, G = white. D × H → I = black, J = black.

Additional given: "If B is heterozygous" and later both F and I are heterozygous in question 4.

Possible genotypes for A, B, C, D, E and H

C is white → genotype = pp.

Any parent of a white child must carry p. Since A (black) and white partner produced C (white = pp), A must carry p → A = Pp.

B is black child of A × white; because A = Pp and other parent = pp, B could be Pp (black) or pp (only possibility) → B = Pp.

E is white given → E = pp.

D is black child of A × white → like B, D = Pp.

H is black and produced only black offspring (I, J) with D. D = Pp; if H were pp, some white offspring could result only if D contributed p and H p — but offspring shown are black only (I, J black). However from pedigree alone H can be either Pp or PP. Without additional white offspring, the conservative definite genotype is: H could be Pp or PP. (If question expects one choice, give H = Pp as a possible genotype consistent with others; but technically H is ambiguous.) Final list (consistent set):

- A = Pp
- B = Pp
- C = pp
- D = Pp
- E = pp
- H = Pp (possible) — note: H could also be PP.

2. B (Pp) × E (pp): expected genotypes and phenotypes; Punnett square

Punnett square:

- Parental gametes: B: P, p ; E: p, p Combinations:

Gametes	p	p
P	Pp	Pp
p	pp	pp

- Genotype ratio: 50% Pp : 50% pp.
 - Phenotype ratio: 50% black (Pp) : 50% white (pp).
3. Probability that a child of D × H is heterozygous
- D = Pp. Assume H = Pp (as above). Cross Pp × Pp → offspring genotypes: 25% PP, 50% Pp, 25% pp. Probability heterozygous = 50%.

(If H were PP, Pp × PP → 100% Pp heterozygous.)

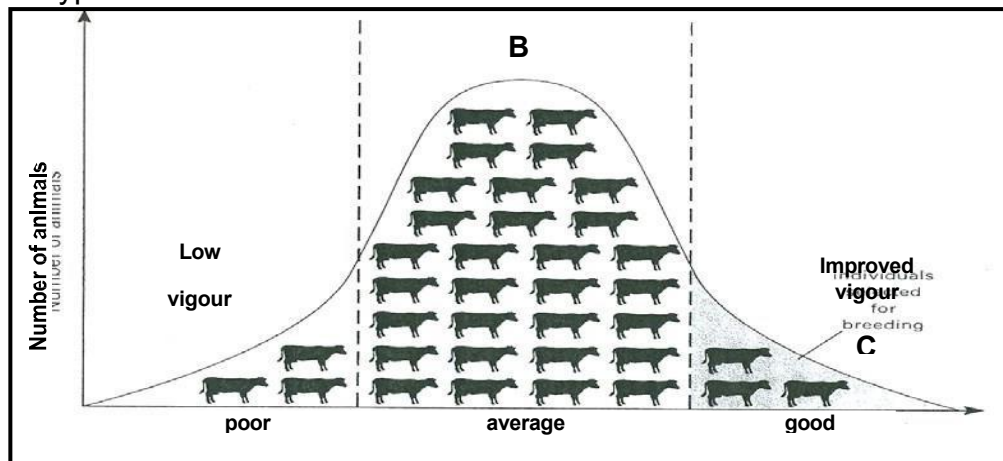
4. F (from B×E) mates with I (from D×H); both are black but heterozygous (Pp × Pp). What proportion of their offspring will be white? Cross Pp × Pp → genotype ratio 1 PP : 2 Pp : 1 pp. Proportion white (pp) = 1/4 = 25%.

Summary answers:

1. A = Pp; B = Pp; C = pp; D = Pp; E = pp; H = Pp (H could be PP).
2. Offspring of B×E: 50% Pp (black), 50% pp (white). (Punnett shown above.)
3. 50% heterozygous (assuming H = Pp). (If H = PP then 100%.)
4. 25% white offspring

Activity 14

14.1 The graph below represents a normal distribution curve used in the selection of animals for a breeding programme by taking only their phenotypic characteristics into account.



- 14.1.1 Deduce, from the graph, the most suitable group of animals (**A**, **B** or **C**) to be used in a breeding programme for the next generation. (1)
- 14.1.2 Give a reason for the answer to QUESTION 1.1. (1)
- 14.1.3. Identify the method of selection used in this breeding programme. (1)
- 14.1.4 Differentiate between *selection* and *variation*. (4)
- 14.1.5 Name the selection method used in each of the following situations in animal breeding:
 - (a) Selection based on the quality of relatives in the same generation (1)
 - (b) Selection based on the quality of offspring (1)

Breeding systems



Process of producing plants or animals by sexual reproduction	Breeding
The crossing of two plants or animals that are closely related	Inbreeding
The breeding of two plants or animals that are not closely related/Mating of two purebreds of different animals	Cross breeding
Breeding of animals that share common ancestors but not closely related	Line breeding
The mating of individual animals of different species	Species crossing
Increase in the performance of the hybrid	Hybrid vigour or Heterosis
Mating of unrelated animals or of animals that are not closely related	Outcrossing
The repeated mating of thoroughbred (purebred) male animals with inferior female animals.	Upgrading

A	_____
B	_____
C	_____
D	_____
E	_____
F	_____
G	_____
H	_____
I	_____
J	_____

Breeding types

A.RELATED BREEDING is when animals that are related are mated with each other. Examples are inbreeding and line breeding

1. Inbreeding

The crossing of two plants or animals that are closely related.

E.g. Father and daughter, mother and son, brother and sister.

2. Line Breeding

This is a form of selective breeding where animals that are related, but not as closely as inbreeding are mated to preserve desirable traits from a specific ancestor.

An example of line breeding is when a bull is selected to mate with a distant relative (granddaughters) rather than with a close relative (his daughters).

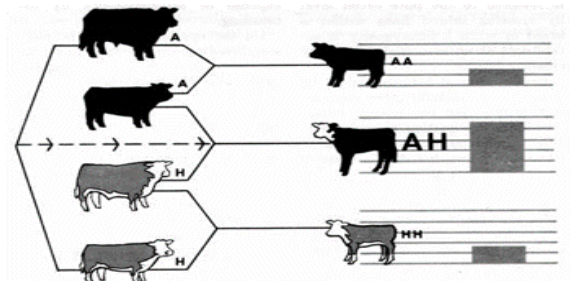
A **common ancestor** is an individual that appears on both the sire and dam sides of the pedigree.

B.UNRELATED BREEDING

1.Cross Breeding

Involves the crossing of two or more different animal breeds or plant varieties. The result is a hybrid animal/plant with enhanced traits from both parents, which is called hybrid vigour or heterosis.

E.g. Afrikaner bull X Aberdeen Angus cow.

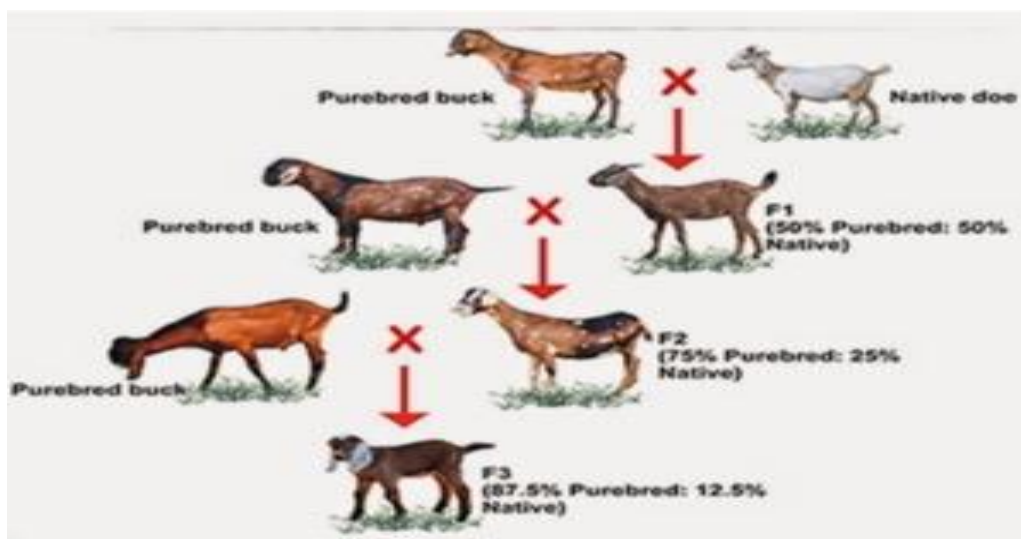


2. Outcrossing

This method introduces new characteristics to inbred animals. A distantly related relative of the same breed with desirable characteristics is brought in to cross breed with inbred animals.

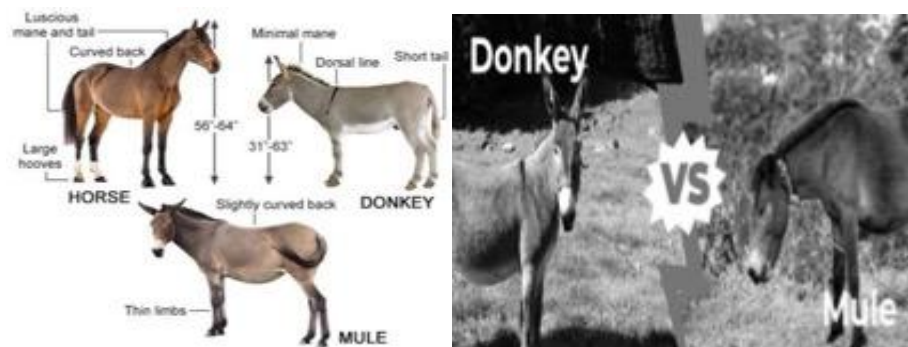
3.Upgrading/Grading up

It is the repeated mating of thoroughbred (purebred) male animals with inferior female animals to improve poor quality herd. Excellent pure-bred males of a specific breed are mated generation after generation with females of inferior quality. This is done by mating a good sire with females of inferior quality or using semen of good quality animals to inseminate these females.



4.Species-crossing

Is the mating of individuals of two different species/the crossing of two different animal species usually producing non-fertile offspring because each species is unique.



e.g. A horse mated with a donkey produces a mule.

or Donkey stallion X horse mare = mule

Uses of the mule

- Used as draught animals for pulling implements/ploughing/working.
- To carry loads/transport of goods

Advantages and disadvantages of breeding systems

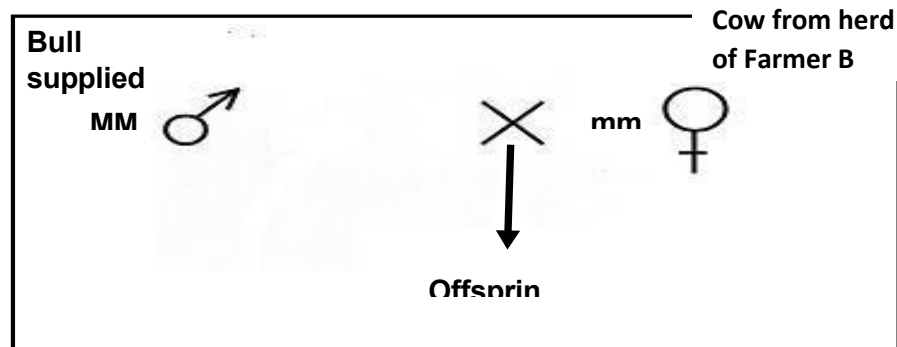
Breeding system	Advantages	Disadvantages
Inbreeding	• Produces uniform animals/plants • Used to create pure lines or strains • Helps in preservation of rare traits withing a population	• It lowers the variability of the gene • Reduction in vigour • May give rise to defective animals
Line-breeding	• Produces uniform animals and less defects than inbreeding	• Less hybrid vigour than cross breeding • May give rise to defective animals
Outcrossing	• Brings desired characteristics into pure breeds • Increases genetic diversity • Reduced inbreeding depression • Greater adaptability	• Less hybrid vigour than cross breeding • Leads to unpredictable offspring • Loss of desired traits
Cross breeding	• Gives rise to hybrid vigour/heterosis • Introduces new desirable traits • Offsprings are more fertile	• F1 hybrids have maximum effect after which hybrid vigour declines • Loss of pure-bred traits • May lead to Unpredictable traits
Upgrading	• Improves poor quality animals quickly • It improves productivity • It is cost effective	• Effect slows down after a few generations • Leads to loss of indigenous traits • It mainly dependent on exotic breeds
Species-crossing	Produces new plant/animal species	Animal species offspring are infertile



ACTIVITIES.

Activity 15

15.1 The illustration below shows an animal breeding method with cattle from two farmers (**A** and **B**). Farmer **A** has a commercial Hereford herd while Farmer **B** is a Sussex stud breeder



- 15.1.1 Identify the breeding method depicted above. (1)
- 15.1.2 State THREE benefits that this breeding method will have for Farmer B. (3)
- 15.1.3 Deduce a possible advantage that this breeding process can have for Farmer A. (1)

Activity 15.2

A dairy farmer crosses a high milk-producing Holstein Friesian cow with a hardy Nguni bull that is resistant to diseases and adapted to harsh conditions.

- 15.2.1 Identify the breeding method used. (1)
- 15.2.2 Give a reason for your answer. (1)
- 15.2.3 State TWO advantages of this breeding method for the farmer. (2)
- 15.2.4 Name the genetic principle responsible for improved performance in the offspring. (1)

Activity 15.3

A sheep farmer selects only the top 10% fastest-growing lambs from a flock and uses them for breeding in the next generation.

- 15.3.1 Identify the type of selection used. (1)
- 15.3.2 Give a reason for your answer. (1)
- 15.2.3 Explain how this method affects the normal distribution curve over time. (2)
- 15.3.4 State ONE disadvantage of this selection method. (1)

Activity 15.4

A commercial cattle farmer in Eastern Cape is experiencing low productivity due to poor pasture quality and recurring diseases. The farmer decides to introduce bulls from a hardy indigenous breed into the existing high-producing herd. Over time, the offspring show improved survival rate, moderate growth, and better adaptation to the environment.

15.4.1 Identify the breeding strategy used by the farmer. (1)

15.4.2 Explain how this strategy improves the performance of the offspring. (3)

15.4.3 Discuss TWO advantages and ONE disadvantage of this breeding strategy. (3)

15.4.4 Suggest ONE additional management practice (other than breeding) that the farmer can implement to improve productivity. (1)

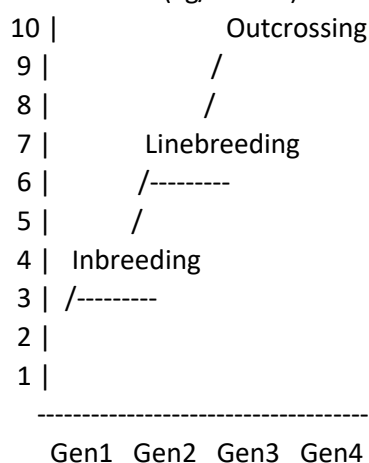
15.4.5 Explain how natural selection may also play a role in this scenario. (2)

Activity 15.5

15.5 A study was conducted to compare the effects of **inbreeding, linebreeding, and outcrossing** on the performance of cattle over several generations. The average growth rate (kg/month) was recorded.

Graph: Growth rate over generations

Growth rate (kg/month)



15.5.1 Identify the breeding method that shows a **decline in performance over generations**. 1

15.5.2 Explain the genetic reason for the trend observed in QUESTION 15.5.1. (2)

15.5.3 Describe how **linebreeding differs from inbreeding**. (2)

15.5.4 Which breeding method would be most suitable for improving productivity in a commercial herd? Give a reason. (2)

15.5.5 Predict what will happen to genetic variation in the population under:

(a) Inbreeding (1)

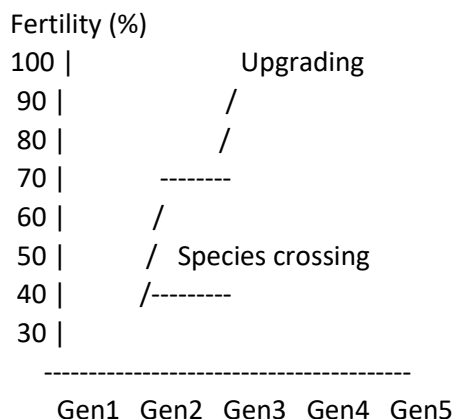
(b) Outcrossing (1)

15.5.6 Suggest ONE situation where a farmer might still choose to use linebreeding despite its risks. (1)

Activity 16

A second study compared the effects of **upgrading and species crossing** on fertility (%) and disease resistance in livestock populations over generations.

Graph 2: Fertility (%) over generations



16.1 Identify the breeding method that shows a **steady improvement in fertility over generations**. (1)

16.2 Explain why this method leads to improved fertility. (2)

16.3 Describe what is meant by **upgrading** in animal breeding. (2)

16.4 Explain why species crossing often results in reduced fertility. (2)

16.5 Give ONE example of species crossing in livestock. (1)

16.6 Evaluate which method (upgrading or species crossing) is more suitable for sustainable livestock production. Give a reason. (2)

GENETICALLY MODIFIED ORGANISMS



Define the concept of genetic modification/ engineering in plants with examples
List the aims of genetic modification of plant and animals
Identify and describe the current uses/ application of genetically modified plants
Describe the techniques used to genetically modify plants/ animals
Describe the potential benefits of genetically modified crops
Name the characteristics of GMOs
Indicate the potential risks of GMOs



TERMINOLOGY

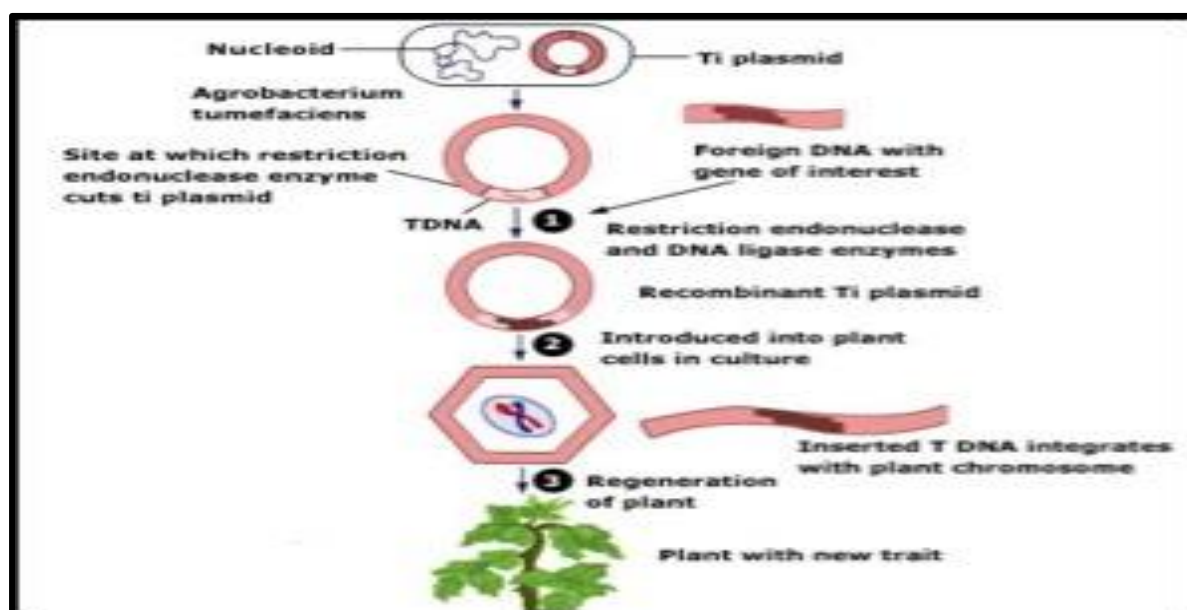
The use of organisms to produce useful substances	Biotechnology
The process of producing plants or animals by sexual reproduction	Breeding
A research activity that creates a copy of some biological entity (a gene/cell/organism)	Cloning
An organism whose genetic characteristics have been changed by inserting gene/s of another organism into its DNA	GMO
The manipulation of the genetic material of an organism to get desired changes.	Genetic modification



Genetic modification/engineering/manipulation

The process of altering the genetic material of an organism to achieve desired traits/characteristics. The process involves taking genes from one organism and inserting them into another organism. The inserted genes are incorporated into the recipient's DNA.

The process includes adding, removing, or changing specific genes within the organism's genome. The genes used in DNA technology are commonly obtained from host cells or organisms called gene laboratories.



The process of genetic modification in maize/corn



Aims of genetic modification in plants animals

Aims of genetic manipulation in plants	Aims of genetic manipulation in animals
• Certain crops such as maize and soya beans are genetically modified to be pesticide and herbicide resistant. • Improves crop yields • improving commercial properties such as flavour and shelf life • producing pharmaceutical crops that produce proteins, drugs and vaccines for humans	• Increase the nutritional quality of animal products • Increases yield of animal products such as milk • Production characteristics such as growth rate, disease resistance and milk production. • Improving food quality • Producing medicine producing industrial or consumer products, such as fibre • Breeds more fertile animals to increase production for the growing world population.

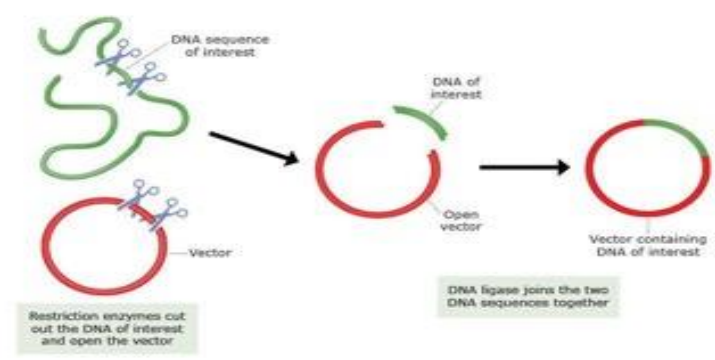
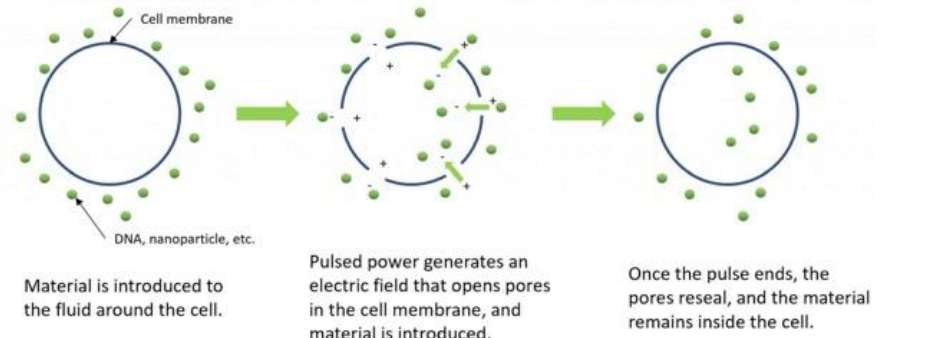
Characteristics of GMOs

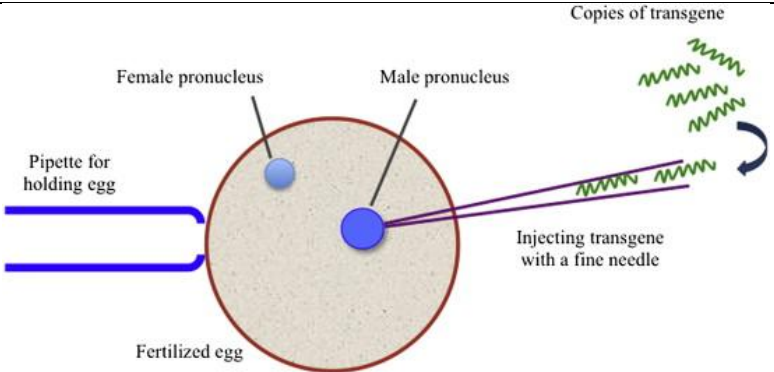
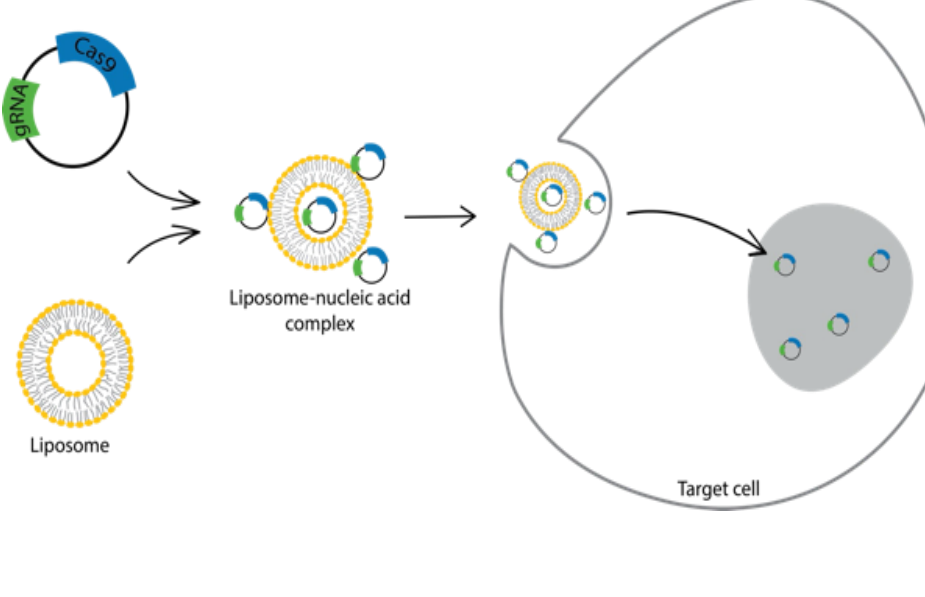
- Crops like Bt corn and Bt cotton are modified to produce *Bacillus thuringiensis* toxin which **protects them from insect pests ,reducing the need for chemical pesticide.**
- GM crops like drought -tolerant maize and rice are designed to **withstand harsh environmental conditions, including salinity, drought** and extreme temperatures.
- Improvements such as **nutrient enrichment, yield and shelf life.** Crops like Golden Rice are enriched with vitamins (e.g. Vitamin A) to combat nutrient deficiencies in populations ying heavily on staple foods.
- **Increase resistance to viral diseases** such as in the cassava plant.
- Special abilities such as **helping to clear pollution** and store vaccines
- May be so expensive to acquire that poorer farmers may not be able to afford the seed/material

Advantages of Genetic modification crops over traditional methods

<i>Genetic modification</i>	<i>Traditional methods</i>
• Fast because it requires only one generation to complete	• Slow and can take many generations to reach a target
• It is very precise	• Not very precise
• Not limited to crossing species that can interbreed	• Limited to crossing cultivars or breeds of the same species

TECHNIQUES USED IN GENETIC MODIFICATION IN PLANTS

TECHNIQUE	ILLUSTRATION
Bacterial carriers(vectors) transfer foreign genetic material into host cells. Plasmids for example are engineered to carry desired genes and replicate within bacterial cells	 The diagram illustrates the process of bacterial transformation. It starts with a linear DNA sequence of interest (green) and a circular plasmid vector (red). Restriction enzymes are used to cut out the DNA of interest and open the vector. DNA ligase then joins the two DNA sequences together, creating a recombinant vector containing the DNA of interest. © Copyright, 2014, University of Illinois. All rights reserved. www.bioteklearn.org.nz
Biolistic s/Gene gun. The selected DNA is attached to microscopic particles of the metal gold or tungsten. The DNA particles are shot into the target cells using a burst of gas under pressure, in a similar way to firing a bullet from a gun	 The diagram shows the Gene Gun technique. A gene gun barrel is used to shoot DNA-coated gold particles into a target plant cell. The particles enter the cell through the cell wall and membrane. The DNA is then released into the cytoplasm, where it can be integrated into the host genome. The process is shown in three stages: 1. DNA-coated gold particles are loaded into the gene gun barrel. 2. The particles are shot into the target plant cell. 3. The DNA is released into the cytoplasm and integrated into the host genome.
Electroporation. An electric field is used to temporary increase permeability of the cell membrane , allowing genetic material to enter the cell.	 The diagram illustrates the process of electroporation. It shows a cell membrane with DNA, nanoparticle, etc. being introduced to the fluid around the cell. Pulsed power generates an electric field that opens pores in the cell membrane, and material is introduced. Once the pulse ends, the pores reseal, and the material remains inside the cell.

Microinjection. A precise technique used to directly introduce foreign DNA, RNA, or other molecule into a cell using a fine glass micropipette.	
Lipofection. It involves using small bubbles of fat called liposomes as carriers of selected DNA. The target cells and liposomes are placed into a special solution. The liposomes mix with phospholipids in the cell membrane allowing the DNA entry cells for inclusion into the chromosomes	

Potential benefits and risks of GMOs

Potential benefits	Potential risks
Health benefits. Farmers use fewer pesticides on insect resistant plants , which result in healthier food	Health risks. Allergic reactions. Introducing new genes into an organism could potentially create new allergens. It could also lead to the cause of cancer
Environmental benefit. Crops can be engineered to resist pests, diseases and environmental conditions leading to higher productivity.	Environmental risks Overuse of pest resistant GM crops (like Bt cotton) or herbicide resistant crops can lead to evolution of pests and weeds(super weeds) that are resistant to these controls. The toxic effects of insect resistant crops could potentially also kill beneficial insects such as bees
Improved nutritional content. GM technology can enhance the nutritional profile of crops	Economic concerns GM crops are patented and farmers may not afford it. GM seeds have the same genetic composition which makes them vulnerable to infection, which can destroy the entire crop

Benefits and risks of Genetic manipulation

Benefits	Risks
- It may become possible to grow crops in previously non-arable areas. - GM crops may be more productive (produce higher yields), and therefore feed a growing world population at lower cost. - Some GM crops are resistant to pests and diseases and therefore reduce the use of chemicals. This is better for the environment. - Some GM crops have a longer shelf life and improved properties such as . Better flavour, colour, texture and nutritional value. - Use of GM crops can have a positive effect on the economy, especially in less-developed countries. Already, implementation of GM cotton crops has led to economic gains in S.Africa.	Environmental hazards. Unintended harm to other organisms Reduced biodiversity Reduced effectiveness of pesticides Gene transfer to non-target species The toxic effects of insect-resistant plants could potentially also kill beneficial insects such as bees Human health risks Unknown effects on human life Increased allergies: Be a possible cause of cancer and the loss of an effective immune system GM crops contain genes that offer resistance to antibiotics Economic concerns GM crops are patented and farmers may not retain seed for breeding purposes, which means that they have to buy new seed each year. GM seeds for a particular variety all have the same genetic composition.
GM crops can allow people to receive medicines and vaccines that are difficult to distribute.	This makes them vulnerable to infection, which can destroy the entire crop



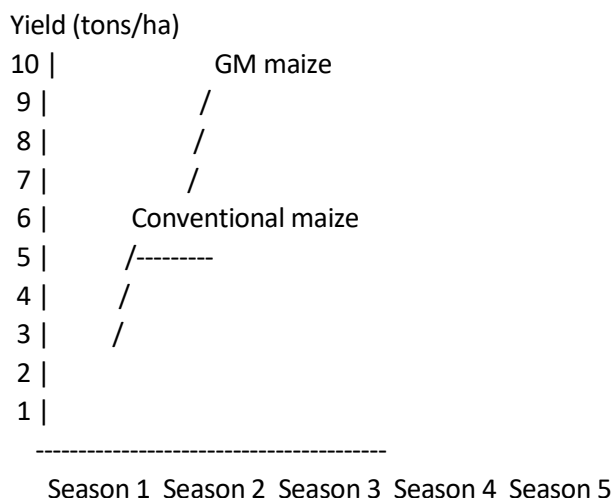
ACTIVITY 17 (30 Marks; 45 Minutes)

GENETIC ENGINEERING, BIOTECHNOLOGY & GM CROPS (DATA RESPONSE)

A group of scientists developed a genetically modified (GM) maize variety resistant to stem borers using a gene from the bacterium *Bacillus thuringiensis*. The performance of the GM maize was compared with conventional maize over five growing seasons.

The results for **average yield (tons/ha)** are shown below:

GRAPH: Yield of maize over 5 seasons



- 17.1.1** Identify the type of genetic technique used to produce the GM maize. (1)
- 17.1.2** Describe how the Bt gene is transferred into the maize plant. (2)
- 17.1.3** State TWO advantages of the GM maize shown in the graph. (2)
- 17.1.4** Explain why the yield of conventional maize remains lower than GM maize over time. (2)
- 17.1.5** State TWO possible environmental risks of using GM maize. (2)
- 17.1.6** Suggest ONE reason why some farmers may still prefer conventional maize despite lower yields. (1)

Activity 18

(Genetic Engineering & Biotechnology)

A group of scientists developed a genetically modified cotton plant that produces a toxin from *Bacillus thuringiensis* to protect it from insect pests. In another development, farmers use a laboratory technique to produce large numbers of identical banana plants that are disease-free.

- 18.1.1** Identify the type of biotechnology used to produce the pest-resistant cotton. (1)
- 18.1.2** State TWO advantages of the genetically modified cotton for farmers. (2)
- 18.1.3** Give TWO possible negative environmental impacts of using genetically modified crops. (2)
- 18.1.4** Briefly describe how the gene from the bacterium is transferred into the cotton plant. (2)

18.2 The production of identical banana plants is shown in a laboratory setup.

- 18.2.1** Identify the technique used to produce these plants. (1)
- 18.2.2** Explain how this technique works. (2)
- 18.2.3** State TWO advantages of this technique for farmers. (2)
- 18.2.4** Suggest TWO socio-economic implications of using this technique. (2)

AGRICULTURAL MARKETING:



EXAMINATION GUIDELINES

- Define market/marketing.
- Distinguish between marketing and selling.
- List, identify and describe the main functions of agricultural marketing
- Terminology: demand and supply
- The Law of demand and the law of supply
- Interpretation of demand and supply curves
- Factors influencing demand and supply of goods
- Price elasticity demand/supply and price inelasticity of demand/supply
- Price determination with and supply and demand
- Explanation of demand/supply schedule/curves/graphs
- Interpretation of Price elasticity of demand and supply
- Free Market(Concept of free marketing, the general advantages and disadvantages)
Farm gate market, fresh produce market, Internet sales, Direct marketing, and internet marketing.
- Co-operative marketing (The concept of agricultural cooperatives, types of agricultural co-operatives, principles, benefits/advantages.

IMPORTANT TERMS AND DEFINITIONS



Market	An entire number of buyers and sellers in an area being considered .
Marketing	All the processes involved including planning promotion, and distribution of goods or ideas to the customers/consumers.
Market equilibrium	A market situation where demand and supply of goods are the same.
Selling	The exchange of goods and services for money
Bartering	Exchange of goods for goods
Buying	Obtain a product or service in exchange for payment.
Processing	The conversion and modification of raw product in order to add value.
Demand	Refers to quantity of goods that consumers are willing and able to buy at different prices and times.
Supply	Quantities of goods that producers are willing and able to sell or produce at different prices and time.
Price Elasticity	Refers to the quantity response to a change in price.
Law of demand	As the price of a good increases, demand for the good or service will decrease./ As the price of a good decrease, more of the good will be bought by consumers.

Law of supply	The law of supply states that as the price of a product increases, the quantity supplied also increases, and as the price decreases, the quantity supplied decreases.
Hedging	A market price risk management strategy where the market price is kept constant.
Free marketing	A form of marketing where producers market their produce as they wish
Cooperative marketing	It is when producers pool their products and market them through the cooperative society.
Controlled marketing	It refers to the regulation of goods and services by government/State
A cartel	Refers to a group of producers who join together to control prices.
Price fixing	When group of producers collaborate/collude and set prices artificially.

A	_____
B	_____
C	_____
D	_____
E	_____

CONCEPTS OF MARKET & SELLING

Market refers to the physical or virtual meeting of buyers and sellers to exchange goods.

Marketing refers to all the processes involved including planning promotion, and distribution of goods or ideas to the customers/consumers.

DIFFERENCES BETWEEN SELLING AND MARKETING

The main difference between selling and marketing is that selling involves the procedure where goods or services are traded for money whilst marketing involves in activities and plans that businesses use to promote the selling or buying of a product or service.

Attributes	Selling	Marketing
Orientation	Generating high sales volumes	High profits
Focus	Needs of seller	Needs of buyer
Planning	Short term	Long term
Emphasis	Product	Customer wants.
Price	The cost determines the price	Consumers determine the price

Marketing mix

The approach that a company takes to marketing its products is called the marketing mix. The marketing mix consists of the four Ps

Product

Prices

Place

Promotion

AGRICULTURAL MARKETING FUNCTIONS

Agricultural produce must undergo a series of transfers or trade from one hand to another before it eventually reaches the consumer. This is achieved through four important marketing functions which are :

- 1 Transport,
- 2 Storage,
- 3 Packaging, and
- 4 Processing/value adding.

1.Transport

Agricultural produce must be transported from production point to assembly point and finally to the consumer or market. Different modes of transport can be used based on the nature of produce. These include rail, road, air and sea.

Fresh produce such as vegetables, fresh fruit, meat, and milk may be transported by road and will require refrigerated transport to avoid spoilage in transit. Air transport may be required for cut flower and other highly perishable produce.



A truck transporting agricultural produce

Storage

Some agricultural produce like grapes must be stored before packaging and processing soon after harvesting to prevent spoilage. Farmers may use on -farm storage facilities or use another party such as a processor to keep his produce until ready for the market.



Picture of silos being used to store grains.

Advantages of Storage

- Ensures fresh produce.
- Helps to keep PRICES constant.
- Creates jobs.
- Reduces the time between production and purchasing.
- Helps maintain the supply and demand of products.

Packaging

Most agricultural produce is packaged before transporting. The purpose of packaging is to help farmers and packers of fruits and vegetables to choose the optimum packaging for their produce to improve shelf life and quality of the product and reduce loss in the supply chain.

Maize meal



A box of apples



Advantages of packaging

- It improves shelf life.
- It gives the product strong market appeal.
- It promotes the trademark/brand.

Important aspects/Guidelines of packaging produce

1 Protection

The package must protect produce from mechanical damage and poor environmental conditions during handling and transportation.

2 Identification

Packaging must identify and provide useful information about the produce such as product name, size, quantity producer and brand.

3 Containment

- Containers must be **clean, dry**
- **Relevant** for the type of product
- There should be **no odour**, or importation of foreign objects.
- It must be **rigid** and be able to support the product.

Processing/value adding.

Processing includes changing a product from its raw form into a new type that is easier for the consumer to use. Examples of processing include milling maize, preparing sausage, canning tomatoes and making orange juice and drying fruits.



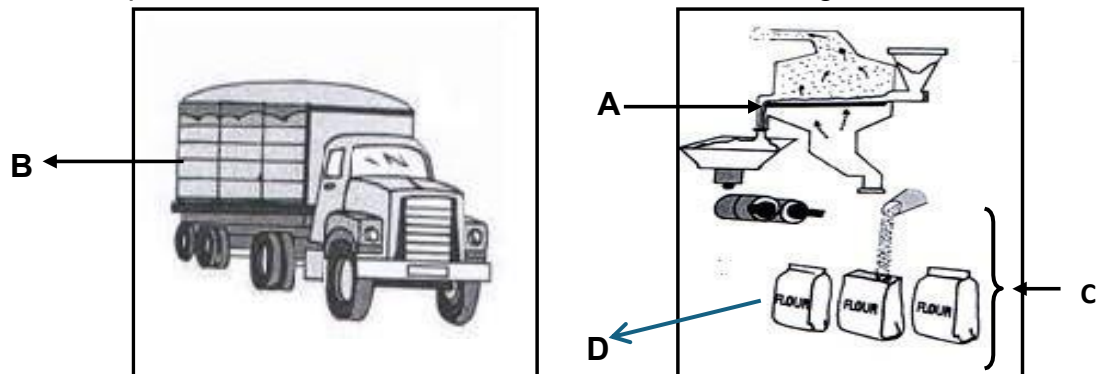
Advantages of processing

- Avoids over supply/spoilage/reduce wastage of excess produce
- Improves food safety
- Increases shelf life
- Provides job opportunities
- Enables easy packaging/handling
- Ensures food security/availability of products all year round
- Adds value to the product
- Product can be transported over longer distances
- Increases the demand of the product
- Increases profitability/revenue

ACTIVITIES. (30 Marks; 45 Minutes)

Activity 1

1.1 The pictures below illustrate the functions of marketing



1.1.1 Identify the marketing functions illustrated in:

- (a) B (1)
- (b) C (1)

1.1.2 State TWO guidelines for the marketing function in C. (2)

1.1.3 Name TWO advantages of the marketing function in A. (2)

1.1.4 Suggest TWO aspects to consider when choosing packaging in D. (2)

1.2 Give a marketing function that matches EACH of the following statements:

- 1.2.1 Products are placed in boxes. (1)
- 1.2.2 Products are kept in cool place giving them a longer shelf-life (1)
- 1.2.3 Changing a product from its raw form (1)
- 1.2.4 Produce is moved from the farm to consumers. (1) (1)

ACTIVITY 2: MARKETING VS SELLING (DATA RESPONSE)

2.1 A poultry farmer is planning how to sell eggs in a local community. The farmer considers customer needs, pricing strategies, storage, and long-term profitability before making decisions.

2.1.1 Define the concept **marketing**. (2)

2.1.2 Indicate whether EACH of the statements below refers to **marketing or selling**.

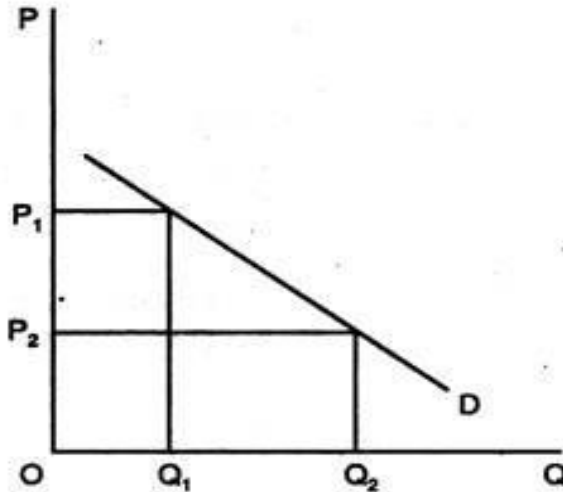
- (a) Conducting interviews with customers to determine preferred egg sizes and prices.
- (b) Focus is on quickly selling all eggs produced to avoid spoilage. (1)
- (c) Planning production based on customer demand and future trends. (1)
- (d) Focus is mainly on immediate income from egg sales. (1)
- (e) Includes advertising, packaging, and customer satisfaction strategies. (1)
- (f) Short-term orientation aimed at maximizing sales volume. (1)
- (g) Long-term planning to ensure continuous customer satisfaction. (1)

DETERMINATION OF PRICE USING DEMAND AND SUPPLY

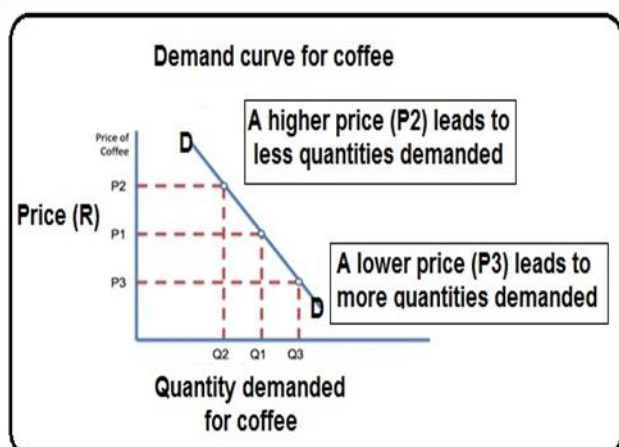
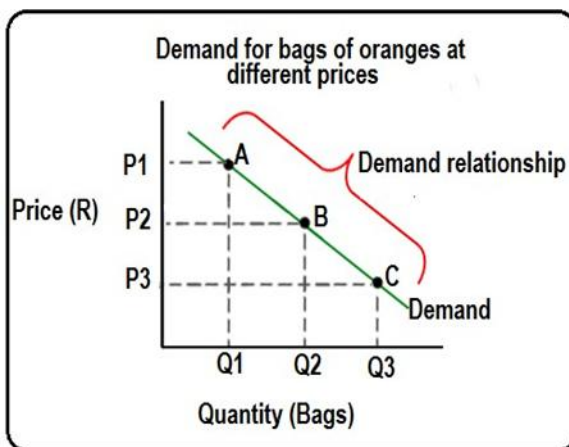
1.Demand

Definition of demand: Quantity of a product consumers bought or willing to pay at a particular price and time.

- **Demand curve:** is a graph of the relationship between the price of a good and the quantity demanded.



A graph showing demand curve.



Demand curves

Interpretation of the demand curve

At point A, the quantity of oranges demanded will be Q_1 and the corresponding price will be P_1 . At point C, the quantity of oranges demanded will be Q_3 and the corresponding price will be P_3 .

Law of demand: The higher the price, the lower the quantity demanded and vice versa

The demand relationship illustrates the negative relationship between price & demand.

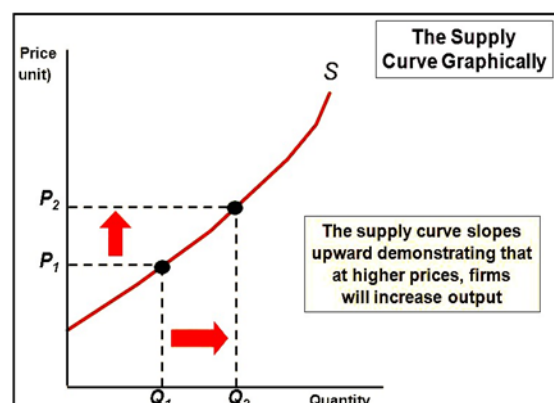
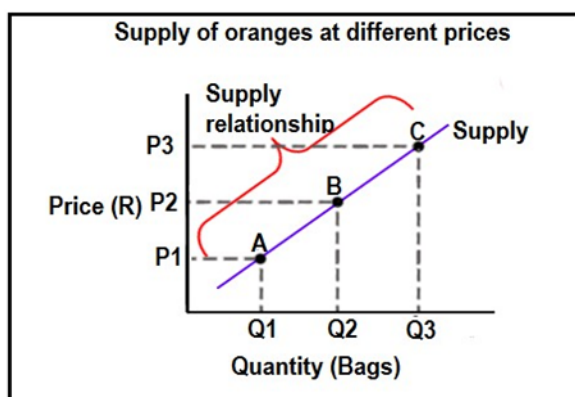
Factors influencing demand of a product.

- 1 **Price.** An increase in the price of a product will lead to low demand for that product.
- 2 **Compliments.** If the price of a produce that competes with other products is noticeably high, the demand for the product will be lower as consumers prefer to buy cheaper products.
- 3 **Taste and preferences/quality.** When consumers prefer a product such as chicken to a competing product such as beef, the demand for chicken will increase.
- 4 **Fashion.** Changes in fashion can lead to a change in demand for certain products. For example, if the demand for Nguni cattle skins is in fashion, the demand for skins will increase.
- 5 **Festive seasons.** At certain times of the year such Christmas, the demand for meat and vegetables increase.
- 6 **The number.** Higher number of consumers increase demand for a product. Conversely, lower number of consumers decrease demand.
- 7 **Income/buying power of consumers-** Increase in income will increase demand. Lower income lead to lower demand.

2. Supply

Definition of Supply: Quantity of a product producers are will to offer for sale at a particular price and time.

Supply curves



Supply curves

Interpretation of the supply curve

A, B and C are points on the supply curve. Each point on the curve reflects a direct correlation between the quantity supplied (Q) and price(P) . At point B, the quantity of goods supplied will be Q2 and the price at P2 and so on.

Law of supply : The higher the price, the higher the supply and vice versa

The supply relationship illustrates the positive relationship between price & demand.

FACTORS AFFECTING SUPPLY OF A PRODUCT

- 1 **Price.** The higher the price of a produce, the higher the quantity sold by farmers because they get extra income from selling the produce.
- 2 **Production cost.** High cost of producing a product leads to farmers producing less. Low input cost will lead to high production of produce.
- 3 **Technological changes.** Improvements in technology in the production processes lead to increased production.
- 4 **Government subsidy and taxation.** Government subsidies such as paying part of the cost of fertilizer for farmers will reduce farmers' production costs which in turn will lead to increased production.
- 5 **Political instability.** Conflicts can disrupt and decrease the supply.
- 6 **Number of suppliers and /producers.** Production of the same product, for example, maize by many farmers at the same time and to the same market will lead to high supplies of the product.
- 7 **Environmental conditions/climate.** Agriculture is highly dependent on the weather. Increase in temperature and carbon dioxide levels can increase some crop yields in some places. Very cold conditions may lead to lower supply of summer crops in South Africa.

PRICE ELASTICITY AND INELASTICITY OF DEMAND AND SUPPLY

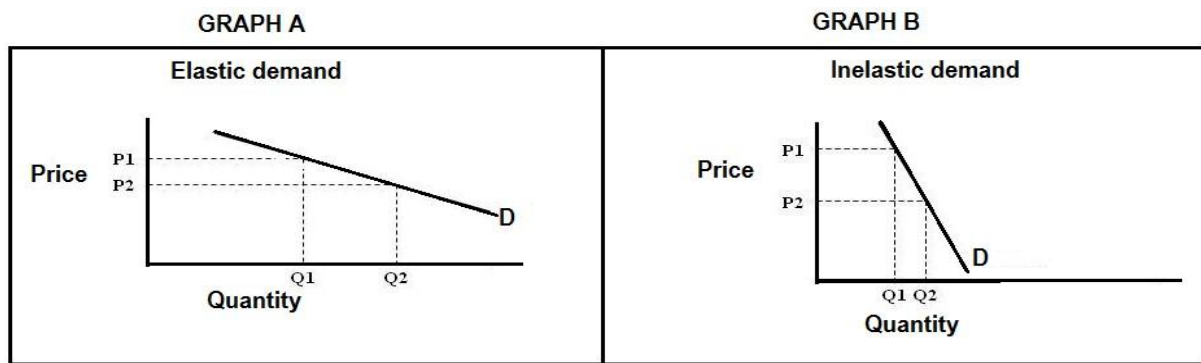
Elasticity – This refers to the response of a demand or supply curve to price change

Price elasticity of Demand- This is a measurement of the change in demand for a good or service in relation to a change in its price.

Elastic demand - a slight change in price will cause a big decrease in the quantity demanded. An example could be a *chocolate bar or cavella shoes*.

Inelastic demand - a change in price will cause a small/no change in the quantity demanded.

The price of *maize meal* or *fuel* and most agricultural products is inelastic as people will still buy the product regardless of price change.



Price elasticity of demand

Price inelasticity of demand

Factors that affect the elasticity of demand

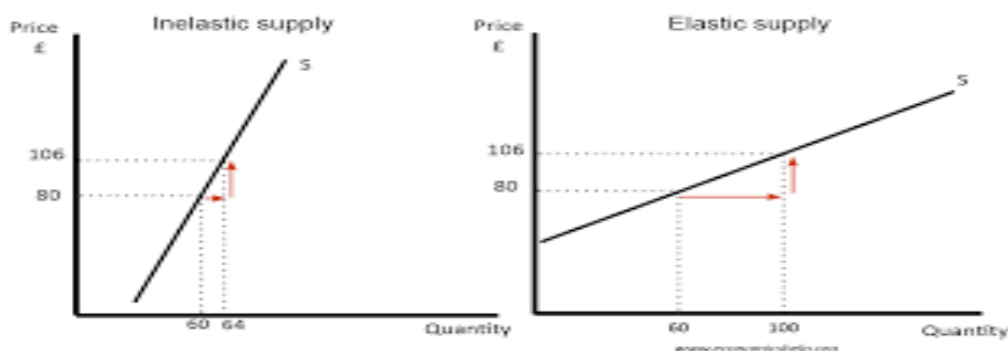
Nature of the product . Luxury items such as cheese show more elastic demand than necessities such as maize meal and cabbage.

Availability of substitute products. Products having varieties of substitutes tend to have much more tended to be more elastic than those that do not have substitutes. For example, if the price of orange juice increase, many people will look for other types of drinks such as apple, mango, and pear drinks so the demand for orange juice is elastic.

Time period . Demands for products become more elastic with passage of time. For example, if the price for fertilizer is increased by say 40%, a farmer's demand might not change immediately but as time passed, the farmer might change for compost or farmyard manure.

Price Elasticity of supply

This refers to the measure of how sensitive the quantity supplied of a good is to changes in price.

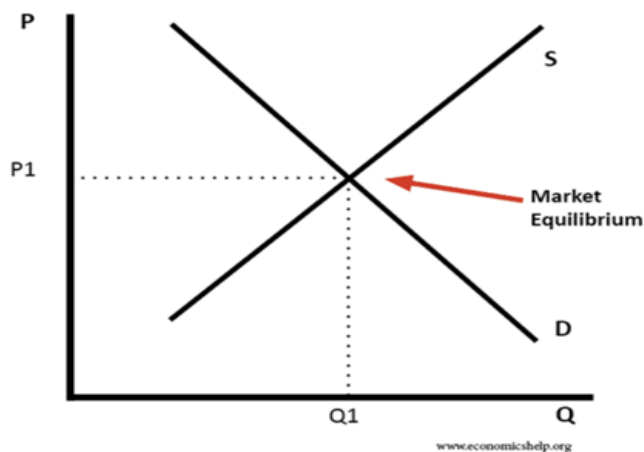


- **Inelastic supply** - When the change in supply is relatively less when compared to the change in price.
- **Elastic supply** - When the change in supply is relatively more when compared to the change in price.

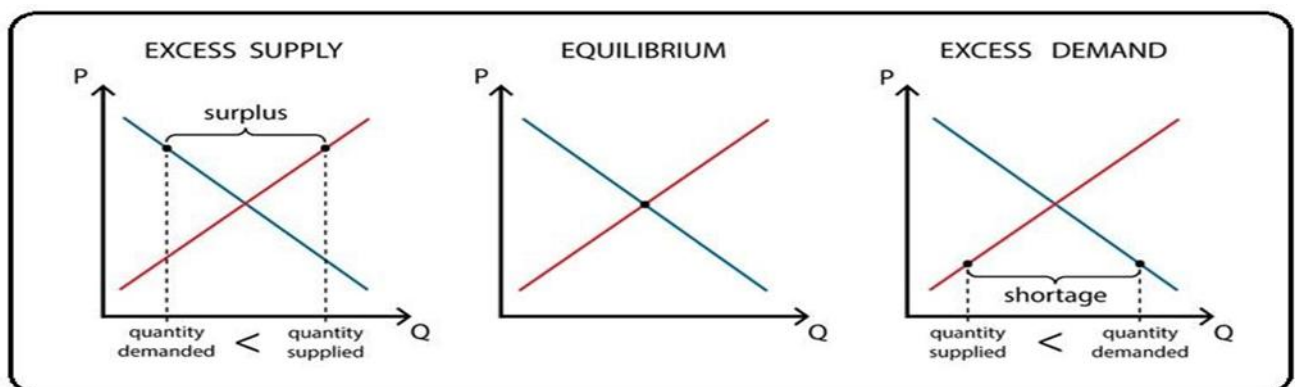
MARKETING EQUILIBRIUM

The market equilibrium is the point where the amount of product supplied by the producer is equal to the amount bought by buyers; i.e. supply is equal to demand.

Equilibrium price: the price at which the demand is equal to supply, and the market is cleared of all goods. If a market is in equilibrium, the price will not change unless an external factor changes the supply and demand, which results in a disruption of the equilibrium.



A graph showing market equilibrium.



Market equilibrium graphs showing surpluses and shortages.

Surplus occurs when production is above the equilibrium point. This often occurs if the floor price is set above equilibrium price.

Shortage occurs when production is below the equilibrium price. This normally occurs if the ceiling price is set below the equilibrium price.

Approaches to Marketing

Niche marketing

- Focuses on a specific group of consumers in a market place.
- Is usually a small section of the market, comprising consumers who share a preference and who are willing to pay a premium for a product or service that satisfies that specific preference?

There are three rules for niche marketing:

- Meet the unique needs of the segment of the market
- Focus on the interest and motivations for the segment when you develop promotional materials

Test the market by starting small, but with focus.

Mass marketing (undifferentiated marketing)

- In this form of marketing the farming business ignores market segment differences and addresses the whole market.
- Mass marketing attempts to reach every consumer rather than targeting a particular market segment.
- It targets the whole market with a single offer.
- Such a strategy is effective only for products such as maize and fruit that appeal to a broad cross-section of consumers.

Traditionally, Mass marketing is done through radio. Television and newspaper

Multi-segment marketing:

- This type of marketing involves marketing to two or more segments of the market.
- A unique marketing strategy is then developed to suit those segments.
- Multi-segment marketing is when the same product is offered to different groups or segments in a market.
- This is typically done by offering different levels of quality to different levels of income, for example offering Class 1 fruit to consumers with high income and Class 3 fruit to consumers with low income

Sustainable agricultural marketing

Involves the application of an environmental educative approach to marketing

- Sustainability is about maintaining or even improving something over the long term
- This form of marketing ensures that with all the intensive production and marketing taking place, that the environment retains the potential to support future generations
- It entails adapting activities on every level of operation to be more ecologically friendly and safe, as well as socially acceptable and healthy,
- Examples:
- Developing a product that is naturally healthy, instead of genetically modified crops,
- Packaging: using recycled or recyclable materials in packaging instead of materials such as plastic.
- Advertising: aiming to better communicate the sustainable agricultural 'practices employed in production is called eco-labelling.

Green markets	Eco-labelling
A green market distributes used, refurbished, reconditioned, repaired and recycled products that are in working condition through brokers and resellers	Eco-labelling is a method of labelling that communicates information, educates and increases consumer awareness on the impact of a product on the environment. It encourages consumers to buy products with a low environmental impact.



ACTIVITIES. (30 Marks; 45 Minutes).

Activity 3

3.1 Define the terms below:

3.1.1 Demand (2)

3.1.2 Supply (2)

3.1.3 The Law of supply (2)

3.1.4 Market equilibrium (2)

3.1.5 The Law of Demand. (2)

Activity 4

4.2 Various options are provided as possible answers to the following questions. Select the appropriate answer and write only the corresponding letter (A–D) beside each question number (1.1 to 1.5) in your answer book.

4.2.1 One of the following is not a characteristic of the term selling?

- A A long- term plan
- B Personal communication of information
- C Exchange of goods for cash
- D Convincing people to buy a product.

4.2.2 An advantage of processing raw agricultural produce is:

- A Reduces oversupply and wastage
- B A decrease in job opportunities
- C A decrease in the value of the product
- D. A shorter shelf life

4.2.3 The Law of demand states that:

- A The higher the price, the higher the quantity of goods bought.
- B The higher the number of consumers, the lower the quality of good bought.

- C The lower the price, the higher the quantity of goods bought.
- D The lower the price, the lower the quantity of goods bought.

4.2.4... occurs at the point where the market demand and supply curves meet.

- A Shortage
- B Market development
- C Surplus
- D Market equilibrium

4.2.5 One of the following factors influences the supply of a product.

- A Increases in the number of consumers
- B Taste and preference of the consumers in the short term
- C Government subsidies and taxation policies
- D. The range of the product.

(10)

Activity 5.1

5.1 The diagram below shows the demand for maize meal at different prices within a period of two months



5.1.1 Identify the marketing concept illustrated by demand **A** and **B** above.

5.1.2 Give a reason for the answer to QUESTION 2. (2)

5.1.3 Explain the reason why consumers responded in such a way to price change. (2)

5.1.4 Suggest TWO other products that could have caused consumers to respond in the same way as in Q 2.1.1. (2)

5.1.5 Suggest ONE product that would have caused a different response to Q 2.1.1. (1)

ACTIVITY 5.2: DEMAND CURVE & PRICE RESPONSIVENESS (data response)

A farmer sells bags of potatoes in a local market. The table below shows the relationship between price and quantity demanded over a period of time.

TABLE: DEMAND FOR POTATOES

Price (R per bag)	Quantity Demanded (bags)
80	20
60	35
40	55
20	80

5.2.1 Present the information in the table above in a line graph. (6)

5.2.2 Identify the relationship between price and quantity demanded shown in the table. (1)

5.2.3 Describe the shape of the demand curve shown in the graph. (1)

5.2.4 Explain why the quantity demanded increases when price decreases. (2)

5.2.5 Calculate the change in demand quantity when price drops from R80 to R40. (2)

5.2.6 Determine whether demand is **elastic or inelastic** between R80 and R60. Substantiate using values from the table. (3)

5.2.7 Suggest TWO factors (other than price) that could influence demand for potatoes. (2)

AGRICULTURAL MARKETING SYSTEMS

Free marketing

- **Free Market:** goods are exchanged freely no restrictions or controls.



A vendor selling farm produce

- **Advantages of a free market system**

No transport costs

Sales are usually in cash which is more convenient

The producer can show initiative and drive

Cheaper because there are no intermediaries/middlemen/ marketing costs

Producers are motivated to work harder

Farmers/ Producers receive cash on the spot

Producers sell where they want

Sell at their own price

Disadvantages of Free Marketing system

- There is risk to the producer.
- Price fixing may occur.
- There is greater fluctuation of prices.

CHANNELS /OPTIONS OF A FREE MARKET SYSTEM

1.Farm gate marketing/Bakkie sale /Truck sale

It is a form of marketing done by the farmer at the site of production. Examples include the sale of vegetables ,broilers and animals.



Advantages and disadvantages of farm gate marketing.

Advantages	Disadvantages
Low marketing costs	The farmer will have to accept the local price
Produce is sold at low prices	Farm may not be well located to reach customers
There is no transport cost	Buyers must be present at farm to purchase produce
Consumers get fresh produce with minimal loss of quality	There may be limited supply of produce

2.Fresh Produce market

The farmer sends his produce to the **agent** at the market who negotiates for a good price on behalf of the farmer.



Advantages	Disadvantages
The market is able to sell produce in high volumes	Markets are often far from production centres
Farmer can take advantage of above average prices in times of supply shortages.	Farmers pay agreed commission to market agents
Produce is sent to agents at the municipal fresh produce markets	There can be price fluctuations in the market.

3.Stock Sales/Livestock Auction Sale

Livestock are sold on auction near to a farm to the **highest bidder**. The auction is mostly run by livestock auction specialist.



Advantages	Disadvantages
The auctioneer advertises the event.	The seller may not be offered the expected price
Payment by the buyer is guaranteed	Lower prices than that of the market is a reality
Small scale farmers have access to these auctions	Small scale farmers may not be financially sound to transport their animals to the auction site

4.Direct /contract marketing

Farmer sells directly to the retailer/supermarket who in turn sells to others under a contract arrangement.

Advantages	Disadvantages
It saves time, money and labour	There should be always quality products
Many customers can be attracted very quickly	Customers do not know what they are buying
Middlemen are cut out	The farmer must have enough produce to meet client's requirements

5.Internet marketing

This is also known as web marketing or e-marketing .In this case, goods are sold on the internet through a computer or smart cell phone. It is a type of direct sales which includes marketing done via emails and wireless media.



Advantages	Disadvantages
Produce can reach global audience in a short space of time	It only helps consumers with internet/ smart phone network access
It has relatively low cost	Attracting customers may not be easy
Products can be delivered directly to the clients	Not all consumers shop online
Low capital-intensive business	The possibility of fraud/scamming is a big risk
Money can be transferred before goods are delivered	

AGRICULTURAL COOPERATIVES

A cooperative is a voluntary organisation formed by a group of people who have a common need that they want to address.



Types of Agricultural Cooperatives

- 1 Agricultural cooperatives sell products with higher profits and provide for their members' production requirements as cheaply as possible.
- 2 Commercial or consumer cooperatives. Their aim is to supply the consumer requirements as cheaply as possible.

Principles of Agricultural Cooperatives

- Democratic member control
- The highest authority of a co-operative is in the hands of members during a general meeting.
- Members of cooperatives have the democratic right to vote for their directors.
- Members get a bonus depending on how much capital they have contributed.
- Open and voluntary membership
- Discrimination is not allowed in cooperatives.
- Autonomy and independence of a co-operative

Advantages of cooperative marketing

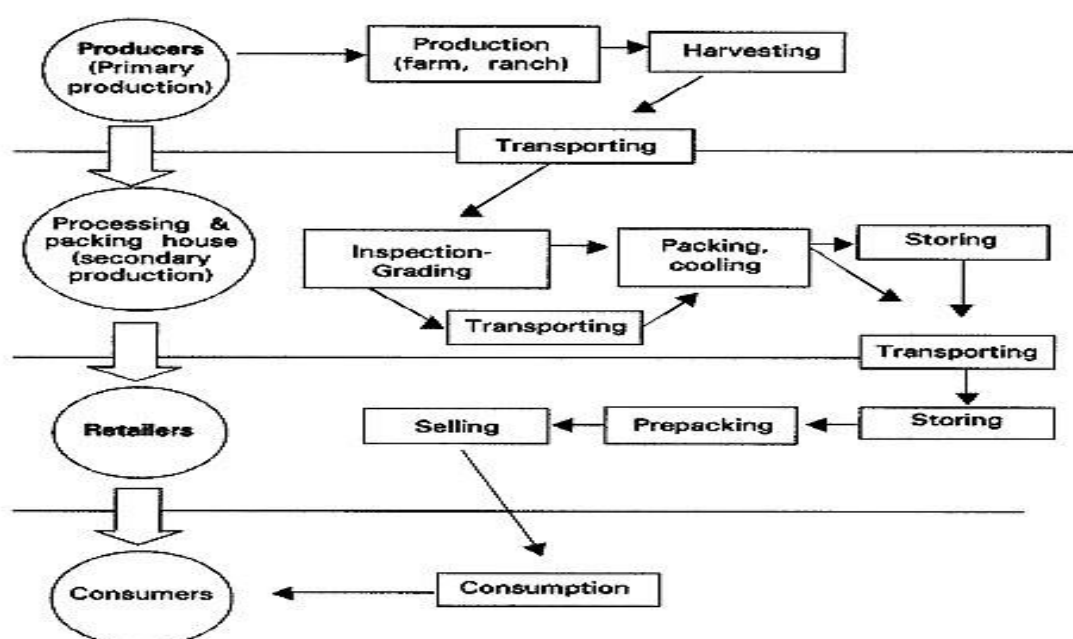
- . Lower marketing costs/cost distribution
- . Services are supplied cheaper/bulk purchasing
- . More bargaining power
- . Access to funding/credit to producers
- . Higher prices are obtained
- . Elimination of the intermediaries
- . Potential for growth
- . Access to better infrastructure
- . Branding

MARKETING CHAIN

An agricultural marketing chain is the path an agricultural product follows from the farm to the consumer.

The first link in the chain is the production on the farm.

Marketing chains are also called agri-business chains or supply chains.



Factors that hamper the marketing chain	Way to streamline and improve agri-business chain
• Perishability/spoilage • Seasonal fluctuation • Poor/insufficient infrastructure • Lack of control over production • Wide distribution of production areas/high transportation costs • Bulkiness in relation to the value/low value in relation to volume • Lack of capital • Standardisation/variation in the quality of products • Risks/accidents/theft/strikes • Intermediaries/agents	• Use cold storage and refrigerated • Provide storage facilities • Improve road infrastructure • Improve access to market information • Combining loads with other producers • Processing products close to where they are produced • Provide access to finance • Grading/standardisation of products to facilitate marketing/pricing • Insurance

Roles of legislation in the marketing of agricultural products

- Promotes a fair, accessible and sustainable marketplace
- Prevents unfair marketing and business practices
- Ensures that product information is given in simple language
- Increases market access to participants
- Controls the sales of certain agricultural products
- Ensures that products comply with set standards in terms of produce itself and packaging
- Sets and maintains national standards at processing sites
- Promotes agricultural products safety
- Regulates market agents and improve their functioning

AGRICULTURAL ENTREPRENEURSHIP

Difference between Entrepreneur and Entrepreneurship

Entrepreneur: A person who exercise initiative by taking advantage of a business opportunity

Entrepreneurship: The process of discovering, evaluating and exploiting new business opportunities

Phases of the entrepreneurial process

- Identification of the opportunity
- Evaluate the opportunity
- Determining resources required
- Developing the business plan
- Starting and managing the enterprise
- Growing the business

Personal characteristics/Success factors of Entrepreneurs

- Confidence/courage
- Risk taker
- Innovative/creative
- Self-motivated/drive
- Hard working/energetic
- Commitment
- Foresight
- Passion and positive attitude
- Responsible
- Strong leadership

BUSINESS PLAN

Format or components of a business plan

- Title page
- Table of content/index
- An executive business profile/general overview of the business □
- A marketing plan
- Production/operational plan
- Human resource plan
- Financial plan
- SWOT analysis
- Supporting documentation

Reasons for developing a business plan

- Test the feasibility and economic viability of the business idea
- Determine the financial needs
- Repositioning the business to deal with changes in the market
- Gain knowledge about marketing opportunities and competitors
- Foresee problems which reduces risk
- Guide daily operations/roles and responsibilities
- Secure funding
- Ensure effective business management
- Mapping out objectives and goals
- Provide guidelines for decision making
- Provide timeframes for completion of projects
- Provide information about the business

Problems when drawing up a business plan

- Insufficient technical details
- Unrealistic assumptions and projections/overambitious
- Leaving gaps/being vague/errors/not authentic/too generic/
provision of too much unnecessary information
- Hiding weaknesses and risks
- Incomplete financials/forgetting to include the cash flow
- Insufficient research
- Using incorrect format
- Not including information about suppliers of the business
- Not highlighting potential competition

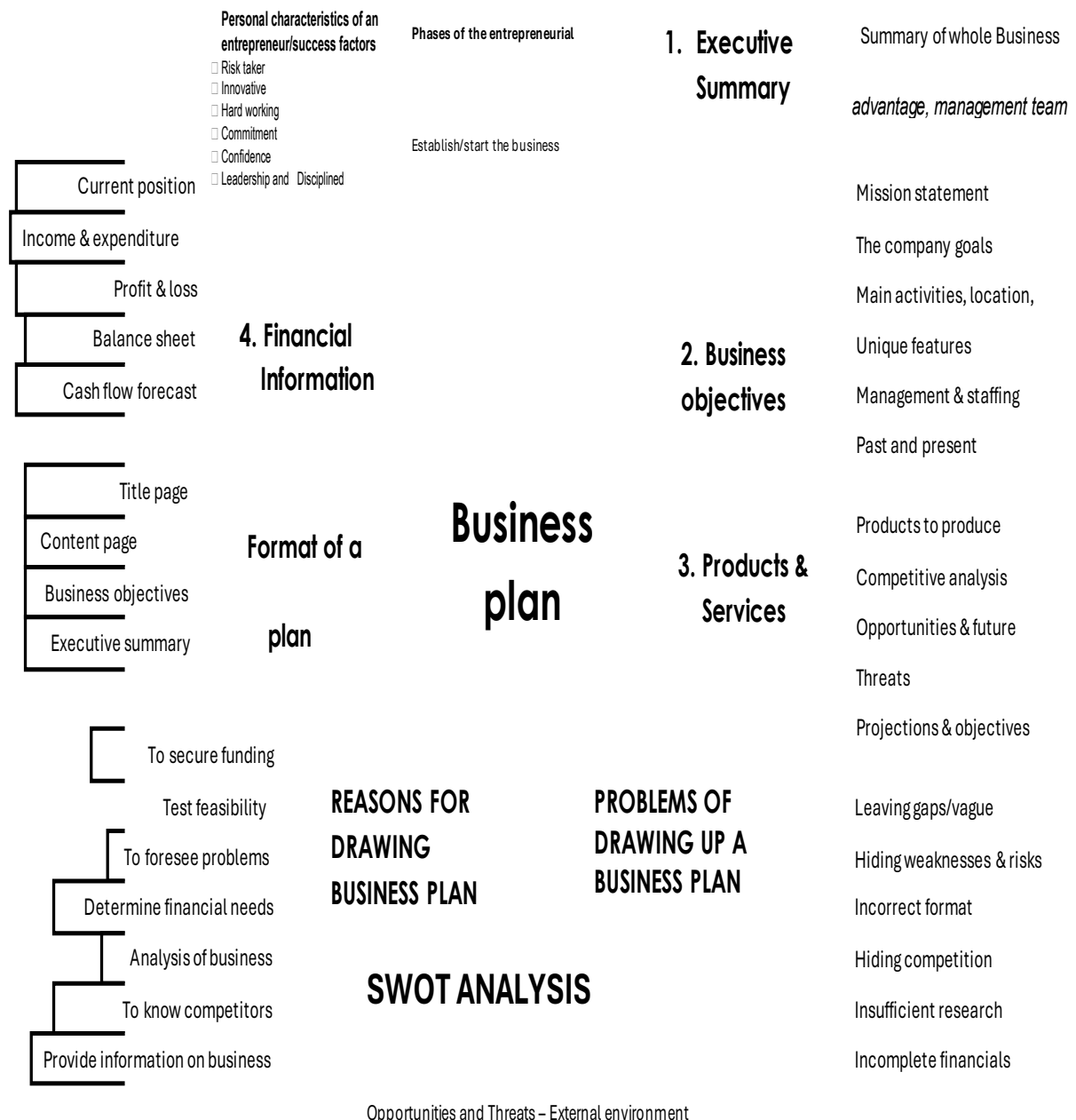
SWOT ANALYSIS

SWOT stands for Strengths, Weaknesses, Opportunities and Threats.

The evaluation of the Strengths and Weaknesses of the internal environment and Opportunities and Threats of the external environment of a business is called the SWOT analysis.

Purpose of SWOT analysis

It helps to evaluate the business





ACTIVITY 6

(30 Marks; 45 Minutes)

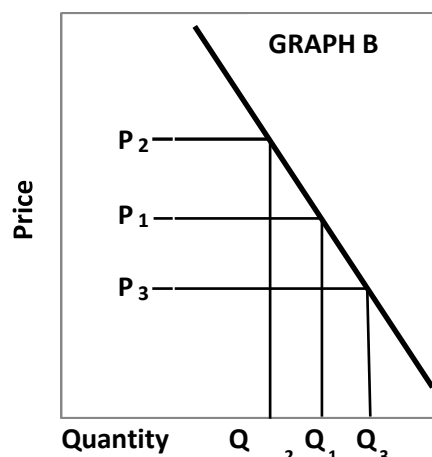
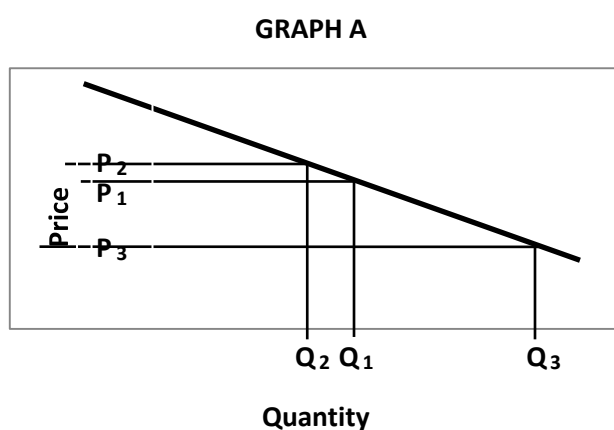
6.1 . Change the underlined words in each of the following statements to make them TRUE . Write only the answer next to the to the question 1.3.1-1.3.6 in the ANSWER BOOK.

- 6.1.1 The benefit for Controlled marketing system to the producer is that the producer is not burdened with marketing and have more time for farming activities.
- 6.1.2 Entrepreneur is the process of discovering, evaluating and exploiting new business opportunities
- 6.1.3 Production and marketing plans are are some of the components of a good SWOT plan.
- 6.1.4 The change in price has little influence on the quantity of product demanded describes elasticity.
- 6.1.5 Management is the process of planning and executing the conception, pricing, promotion and distribution of ideas, goods and services to consumers.

(5)

ACTIVITY 6.2

6.2 The graphs below show the change in the demand for products in relation to the change in price.



- 6.2.1 Identify the graph (A or B) that represents EACH of the following:
 - (a) Price inelasticity of demand (1)
 - (b) Price elasticity of demand (1)
- 6.2.2 Give a reason for your answers to QUESTION 2.2.1(a) and (b). (2)
- 6.2.3 State THREE other factors that may cause elasticity of demand. (3)

6.3 Define the following concepts

- 6.3.1 Price elasticity of demand (2)
- 6.3.2 Controlled marketing (2)
- 6.3.3 Pool system (2)
- 6.3.4 Entrepreneurship (2)
- 6.3.5 Hedging (2)

6.4 High-order question: Elasticity

A farmer in Eastern Cape produces maize. Due to a drought, the price of maize increases significantly, but the quantity demanded by consumers decreases only slightly.

- 6.4.1 Identify the type of price elasticity of demand illustrated. (2)
- 6.4.2 Explain why consumers respond in this way despite the price increase. (4)
- 6.4.3 Analyse how this situation will affect the farmer's total revenue. (4)
- 6.4.4 Advise the farmer on TWO strategies to improve profitability under these conditions. (4). [14]

Activity 7 & 8

(30 Marks; 45 Minutes)

7.1 The marketing channels below are related to free marketing system.

7.1.1 Give one marketing channel for EACH of the statements from the list below: Write only the channel next to the question numbers (.1.3.1 (a) – (d).

Internet marketing; stock sales; fresh produce market; farm gate marketing; contract marketing.

- (a) A farmer sells spinach direct from the farm. (1)
- (b) Goat, sheep and cattle are sold to the highest bidder. (1)
- (c) Products are electronically advertised and sold (1)
- (d) Mangoes and apples are delivered to markets immediately (1)

7.1.2 Name and explain any TWO disadvantages of a free marketing system (2)

Activity 8

8.1 Two groups of learners used different strategies to promote and market their produce from the school garden.

GROUP 1	GROUP 2
Sold vegetables to the local supermarket	Sold vegetables from door to door at their own price
Vegetables from each individual in the group were combined into one stockpile for marketing	Each individual in the group was responsible for selling their own produce

8.1.1 Identify the marketing system used by GROUP 2 (1)

8.1.2 Refer to the table above and justify with TWO reasons why the marketing system identified in QUESTION 2.1.1 was chosen. (2)

8.2 Avocado pear farmers grouped themselves to produce and sell their produce together.

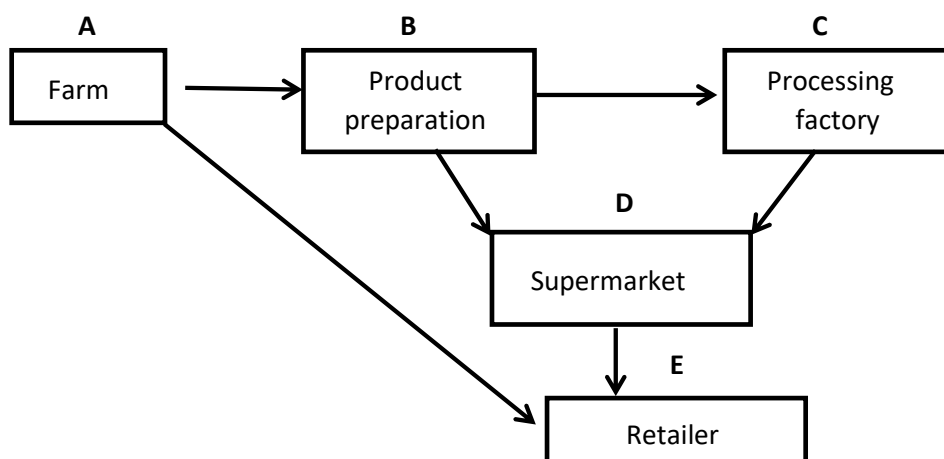
8.2.1 Identify the agricultural marketing system used by the farmers (1)

8.2.2 Indicate the role of the marketing system in QUESTION 2.2.1 (1)

8.2.3 Name TWO benefits of the marketing system in QUESTION 2.2.1 (2)

8.2.4 State TWO factors that may hamper the marketing of avocado pears (2)

Activity 9 The flow chart represents a marketing chain



9.1.1 Identify the marketing chain illustrated above (1)

9.1.2 Name the factor that may hamper the marketing at stage E if low consumer demand of agricultural products. (1)

9.1.3 Indicate TWO ways to improve the agribusiness chain between stage A and stage E.

Activity 10 (Business plan)

10.1 A business plan is a plan of action that an entrepreneur should have for a business.

10.1.1 Give TWO reasons for drawing up a business plan. (2)

10.1.2 List THREE items that should be included in the format of a good business plan. (3)

10.1.3 State TWO problems that may be encountered when drawing up a business plan. (2)

Higher-Order Question 1

Scenario-Based Strategy Evaluation

A livestock farmer in the Eastern Cape is currently experiencing overcapitalisation after purchasing several high-end delivery vehicles to sell meat directly to local retailers. To cover these costs, the farmer took out a loan with a variable high interest rate. Recently, a severe drought has reduced the quality of the grazing land (fixed capital), leading to a drop in the slaughtering mass of the lambs.

Analyze this scenario and provide a strategic intervention plan by addressing the following:

1. Evaluate the Risk: Explain how the combination of the farmer's debt and the perishability of the product at the retail stage creates a "financial trap" for this specific business. (4)
 2. Propose a Solution: Suggest how the farmer could use a pool system or diversification to mitigate the current capital loss caused by the drought. (4)
 3. Marketing Adjustment: Recommend one way the farmer can use market research to adjust their marketing chain and recover the costs of the underutilized delivery vehicles. (2).
- (10)**

Higher-Order Application Question 2

Scenario: An emerging farmer has drafted a business plan to start a large-scale hydroponic vegetable farm. To impress the bank for a loan, he projected high income but failed to include a cash flow budget or a risk management plan. Six months in, he is facing undercapitalization because his electricity costs are higher than expected, and a sudden pest outbreak has destroyed 40% of his crop.

Critical Thinking Task:

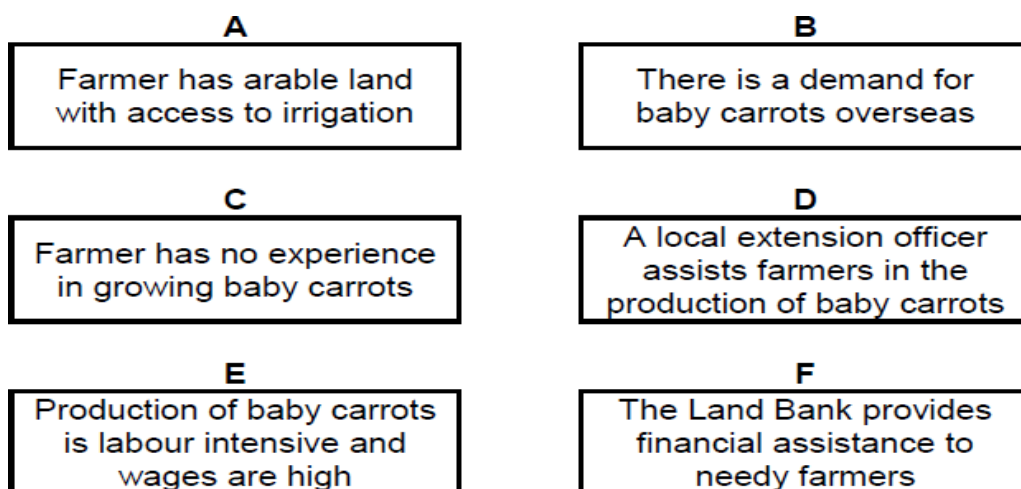
1. Evaluate the Planning Failure: Explain why the absence of a cash flow budget in the original business plan led to the farmer's current state of undercapitalization. (4)
2. Strategic Intervention: Propose TWO specific items the farmer should now add to the "Production/Operations" section of his revised business plan to prevent future crop losses from pests. (4)
3. Financial Justification: Justify why a bank would be more likely to grant a second loan if the farmer includes a Balance Sheet showing high fixed assets (like greenhouses and land) despite his current low cash reserves. (2)

[Total: 10 Marks]

10.2 Read through the following terms, and decide whether they are Threats, Opportunities, Weaknesses or Strengths for a grain producing enterprise.

- 10.2.1 Untrained labour force
- 10.2.2 Low grain prices
- 10.2.3 Drought
- 10.2.4 Imports from other countries
- 10.2.5 Changes in legislation
- 10.2.6 Consumers moving away from eating bread
- 10.2.7 Good soil
- 10.2.8 Favourable climate
- 10.2.9 Insecticide-resistant pests
- 10.2.10 Increase in diesel price
- 10.2.11 Decrease in water costs
- 10.2.12 Lack of management knowledge(1X12) = 12

10.3 The schematic representation below shows the aspects of a SWOT analysis done by an emerging farmer.



10.3.1 Link statement A, B, C and E in the schematic representation with the elements of a SWOT analysis. (4)

10.3.2 Explain how the farmer may use the strengths and opportunities in the schematic representation above to improve the farming enterprise. (2)

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