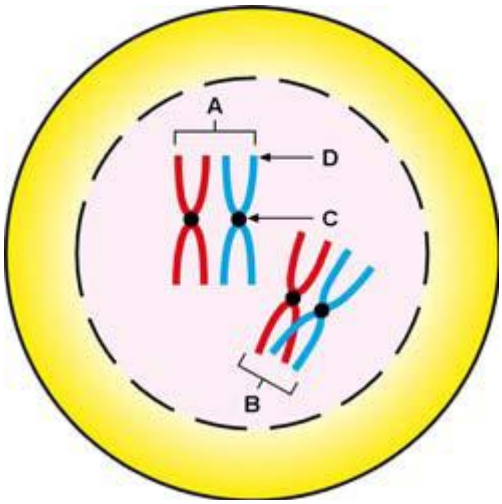
GENETICS: ADDITIONAL REVISION QUESTIONS

MEIOSIS

1 The diagram below represents a process that occurs during meiosis.



1.1 Provide labels for structures C and D.
1.2 In a living cell, would structures A and B be visible with a microscope or would you be able to see them with the unaided eye?
1.3 Name the process that is taking place at B.
1.4 Give ONE reason why the process mentioned in QUESTION 1.3 is important.
1.5 Draw a diagram of the structure labelled B to show its appearance immediately after the process in QUESTION 1.3 has occurred.

2. A Grade 12 learner planned an investigation to establish the attitudes and beliefs of high school learners about albinism.

She asked THREE questions in the survey:

1. Should mothers alone take the blame for children born with albinism?
2. Are people with albinism cursed and need to be hidden from public view?
3. Should people with albinism be employed?

The results of the survey are shown in the table below. Study the table and answer the questions that follow.

Results of survey on people's attitudes and beliefs about albinism

	Number of people	
	Yes	**No**
Question 1	40	10
Question 2	30	20
Question 3	5	45

2.1 How many people participated in this survey?

2.2 Draw a bar graph of the results.

2.3 State conclusions from the results of each the THREE questions asked in the survey.

3 The following diagram represents a phase of meiosis.

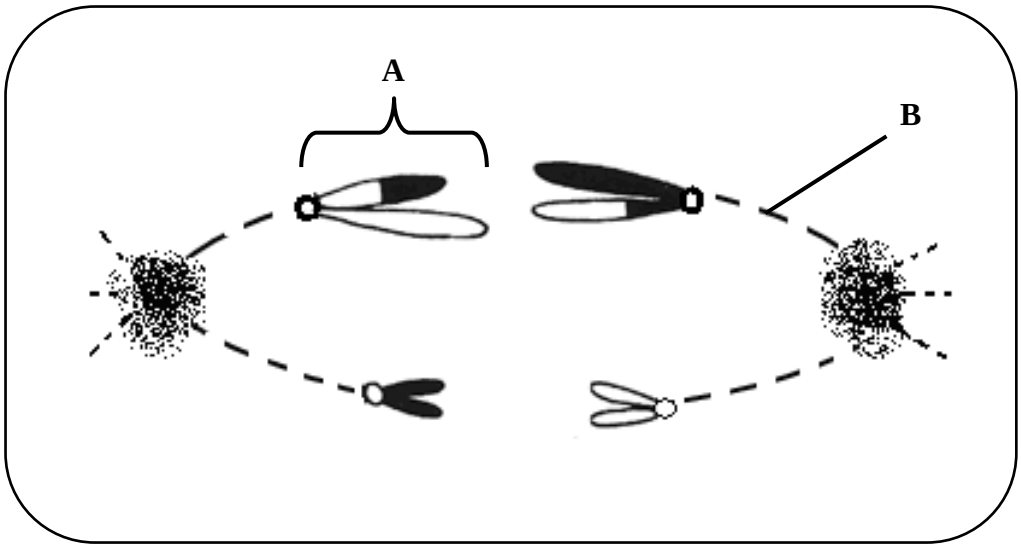


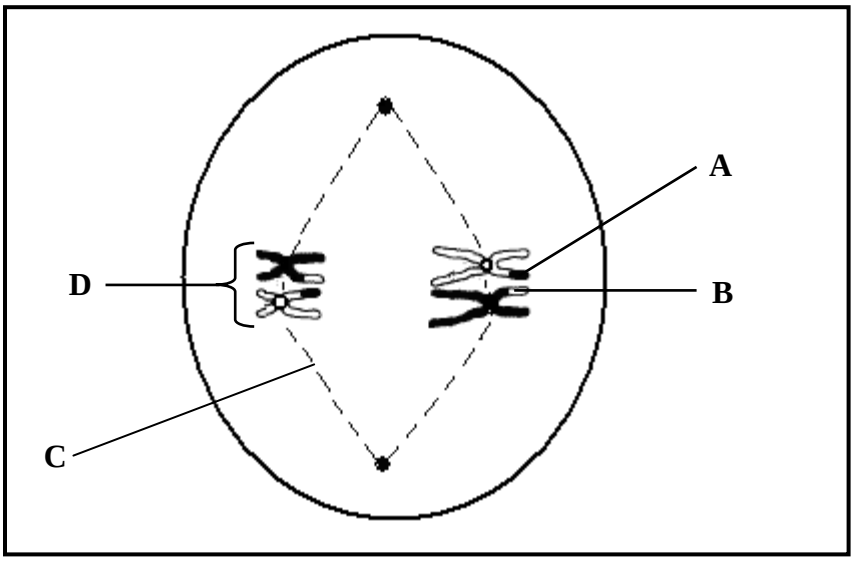
Diagram representing a phase of meiosis

3.1 Provide labels for parts A and B. (

3.2 How many chromosomes will there be in each cell formed from this cell at the end of meiosis?

3.3 How many chromosomes were present in the phase before the one represented in the diagram?

4 Study the diagram below and answer the questions which follow.



4.1 Label **C** and **D**.

4.2 Name the process which resulted in parts **A** and **B** being different from each other.

4.3 Describe how the process referred to in QUESTION 4.2 occurs.

4.4 State the importance of the process named in QUESTION 4.2.

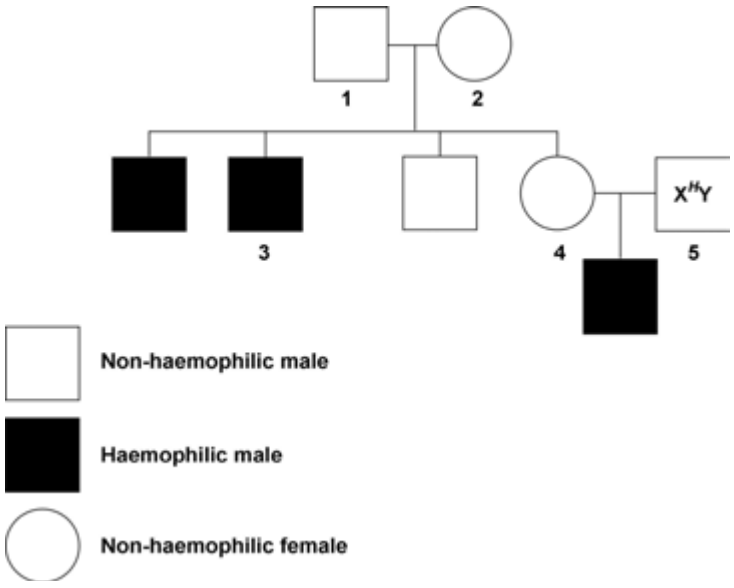
4.5 How many cells will be formed at the end of the first division of the cell drawn in the diagram above?

4.6 How many chromosomes will each daughter cell have when the cell, drawn in the diagram above, has completed meiosis?

MONOHYBRID CROSSINGS AND PEDIGREE DIAGRAMS

1 In humans the gene responsible for blood clotting is carried on the X chromosome. Males who carry the recessive allele bleed easily and are called haemophiliacs. A female will only display haemophilia if she has two recessive alleles. The pedigree diagram below shows the occurrence of haemophiliacs in a certain family after surveys were carried out. The genotype of individual 5 is indicated in the diagram below.

Let H = normal clotting (X^H); h = haemophilia (X^h)



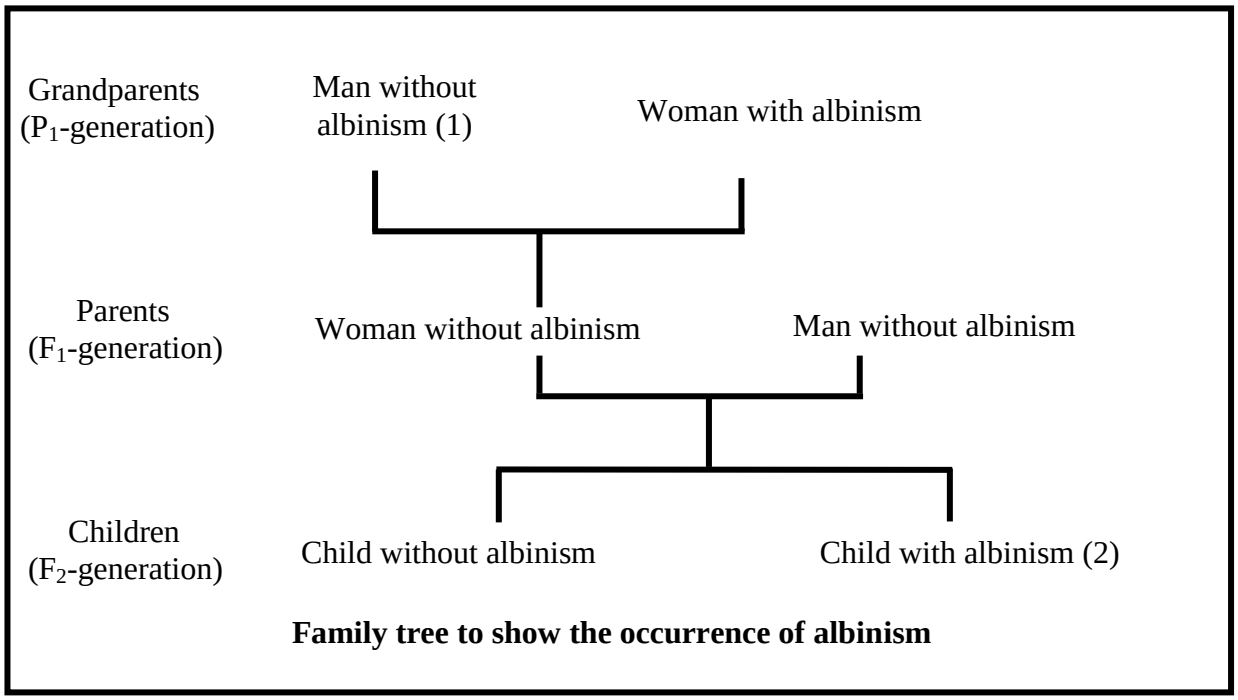
1.1 Write down the genotypes of individuals 1 to 4.

2 In another example, a haemophilic man is married to a non-haemophilic woman. They have three children: two sons, who are non-haemophilic, and a daughter who is a haemophiliac.

a) Construct a pedigree diagram to illustrate this example, clearly indicating the genotype of the three children.
b) The mother is expecting another boy. What are the chances that this third son will be a haemophiliac? Explain your answer. Use a Punnett square to obtain your answer.

3 People with albinism are unable to produce the dark pigment, melanin, in their skin. This condition is caused when an individual is homozygous recessive for this characteristic.

The family tree below shows the occurrence of albinism over three generations.



Family tree to show the occurrence of albinism

3.1 Indicate whether each of the individuals below could be homozygous dominant, homozygous recessive or heterozygous:

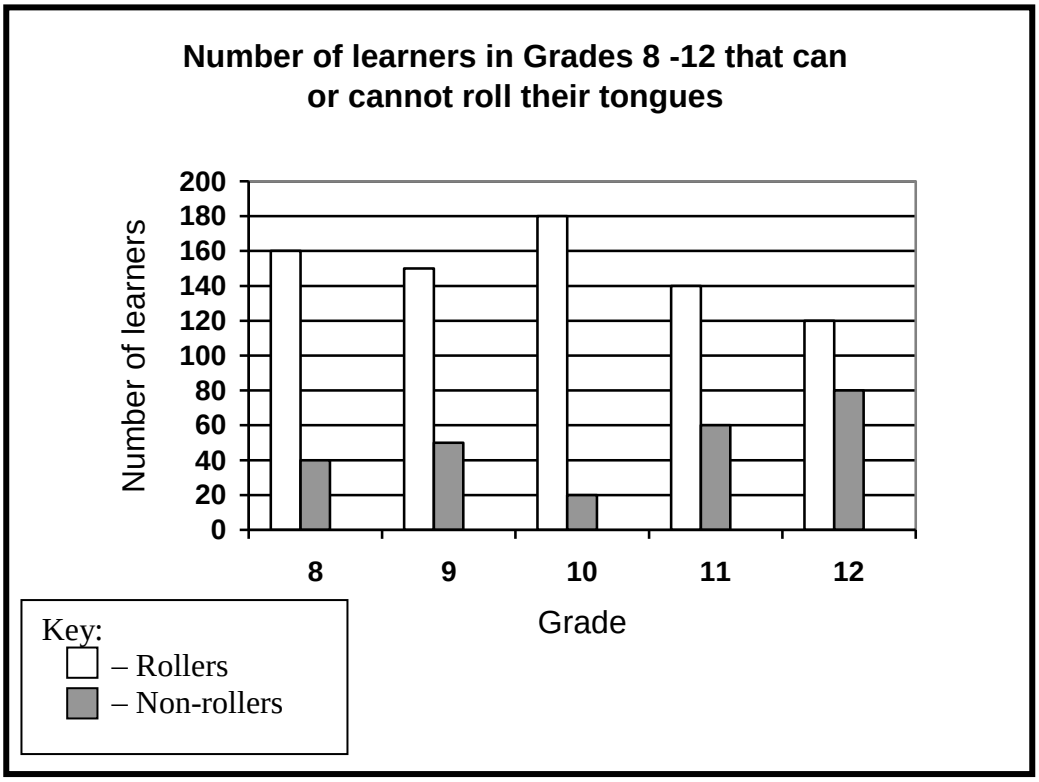
(a) 1
(b) 2

3.2 Explain your answer to QUESTION 3.1(a).

4 Some people have the ability to roll their tongue (rollers) while other people cannot roll their tongues (non-rollers).

A Grade 12 learner wanted to determine the frequency of learners in the school that could roll their tongues.

She went to each grade in the school and counted the number of rollers and non-rollers. She presented her results in the graph below.



4.1 State a hypothesis for this investigation.

4.2 Which grade had the most learners that could roll their tongues?

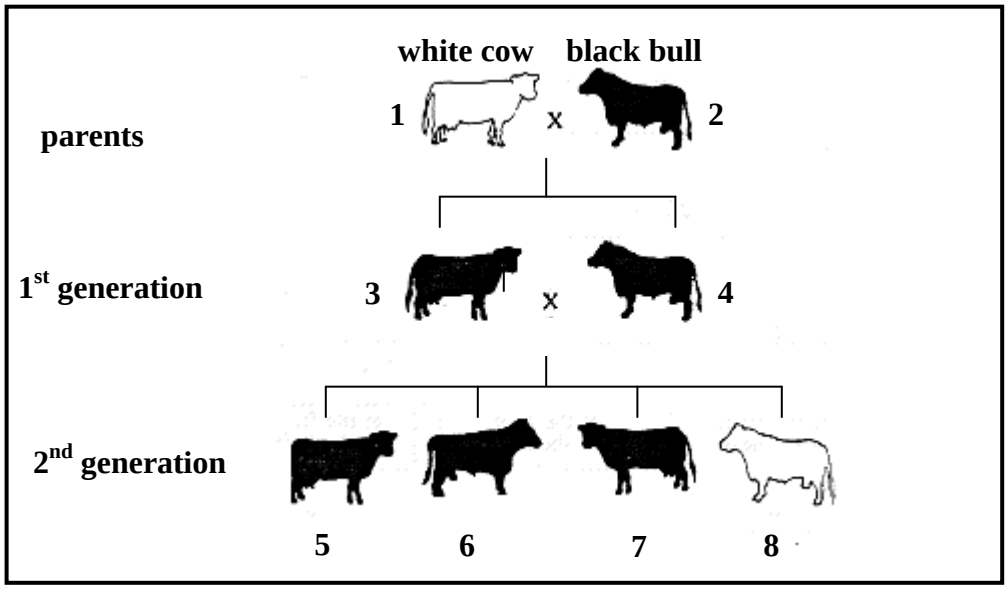
4.3 Use the data in the graph to draw a table that shows the results she obtained.

4.4 Calculate the ratio of rollers to non-rollers. Show ALL working.

5 A pregnant woman was told by a genetic counsellor that her baby had equal chances of having blood type A or blood type AB. This means that the genotypes of the woman and her husband must have been …

A $I^A\ I^A$ and $I^B\ i$
B $I^A\ I^B$ and $I^B\ i$
C $I^A\ i$ and $I^B\ I^B$
D $I^A\ I^B$ and $I^A\ i$

7 The diagram below shows the offspring of crosses between a pure-bred black coat bull and a pure-bred white coat cow. The coat colours of the offspring of the first and second generations are also shown. Coat colour is controlled by two alleles, one for black and one for white coat colour.



7.1 Use the letters **B** and **b** and state which gene is responsible for the following:

7.1.1 Black coat colour and White coat colour

7.1.2 Which animal(s) (**1** to **8**) in the diagram **must be** homozygous for coat colour?

8 The table below shows the results obtained by first crossing a pure-bred black furred mouse with a brown furred mouse. The gene for black fur is dominant over the gene for brown fur. The F_1 generation was used as parents (consisting of 4 breeding pairs) of the F_2 generation.

	Number of black mice	**Number of brown mice**
Parents	1	1
F_1 generation	8	0
F_2 generation		
Offspring of 1st breeding pair	8	0
Offspring of 2nd breeding pair	7	1
Offspring of 3rd breeding pair	5	3
Offspring of 4th breeding pair	4	4

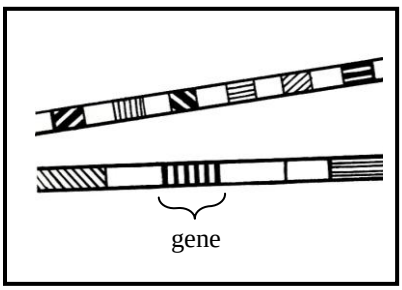
8.1 From the data, calculate the phenotypic ratio of the mice with black fur and the mice with brown fur in the F_2 generation. Show ALL your workings.

8.2 Suggest why it is better to use the four sets of offspring to calculate the ratio rather than using only one set.

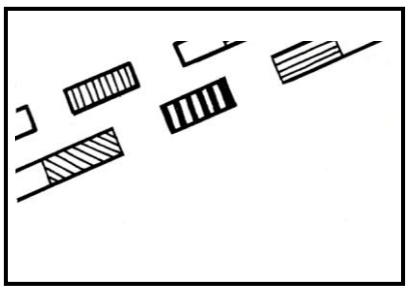
8.3 Draw bar graphs on the same system of axes to represent the phenotypic results of the F_2 generation offspring of each breeding pair shown in the table above.

Biotechnology

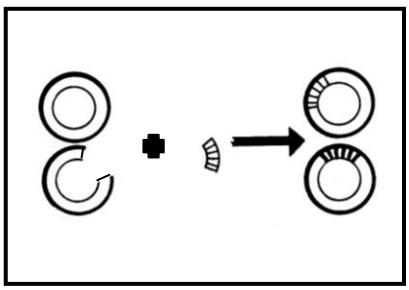
1 The following diagrams illustrate some stages in the manufacturing of insulin. Study the diagrams and answer the questions that follow.
NOTE: The diagrams are <u>not</u> drawn to scale.



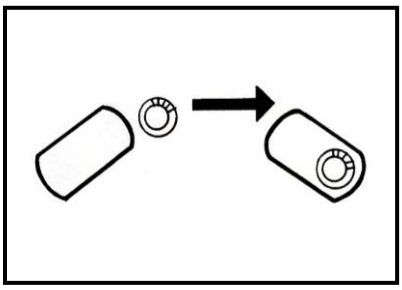
A. Choose the gene for insulin



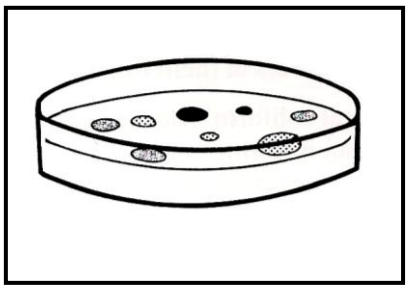
B. 'Cut' the insulin gene



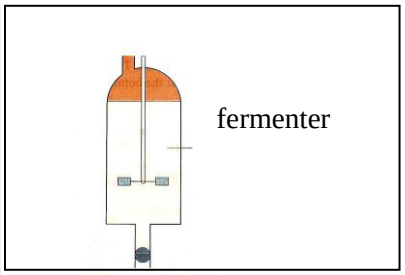
C. Insert the insulin-gene in plasmids



D. Mix plasmids with *Esherichia coli* bacteria



E. Select bacteria with the insulin gene



F. Bacteria in fermenter

Some stages in changing a bacterium so that it will make human insulin

1.1 What is the function of each of the following in the manufacturing of insulin?

a) Enzymes

b) Plasmids

c) Fermenter

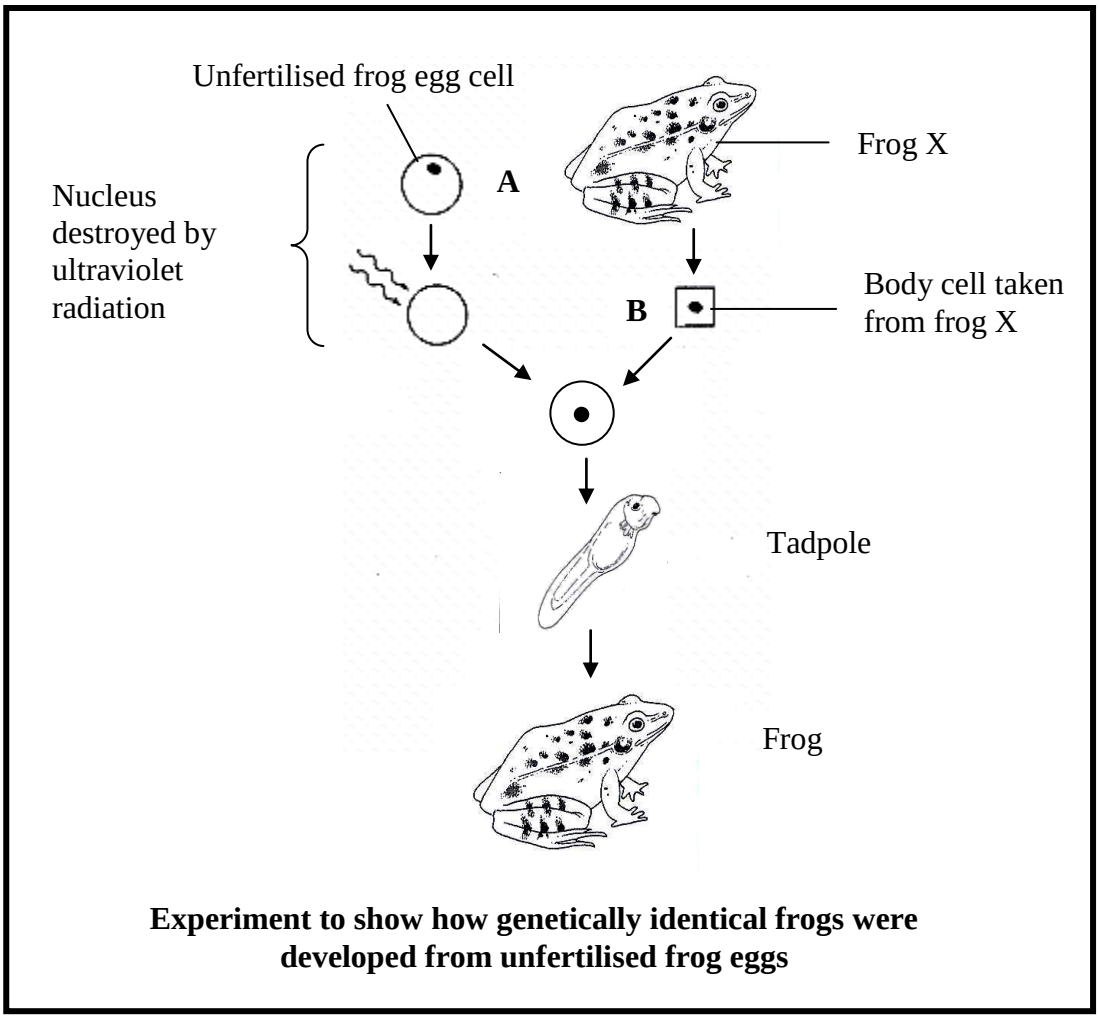
1.2 By which biological process is insulin (protein) manufactured by using the human gene?

1.3 In the past ,the pancreas of animals were used to extract insulin to treat diabetes

(a) State ONE disadvantage of using animal pancreas to treat diabetes.

(b) State ONE advantage of insulin that is produced by genetic engineering.

2 The diagram below shows the steps of an experiment in which a large number of genetically identical frogs were developed from unfertilised frog eggs. The nucleus of each unfertilised egg was destroyed and replaced by a nucleus obtained from a body cell from frog X.



Experiment to show how genetically identical frogs were developed from unfertilised frog eggs

2.1 The diploid number of chromosomes in the above frogs is 26. How many chromosomes are present in the nucleus of the following

cells?

(a) Cell A

(b) Cell B

2.2 Why can an egg containing a nucleus from the body cell of a frog develop into a tadpole?

2.3 Explain why all the frogs produced from the treated eggs are genetically identical.

2.4 Name the method of producing genetically identical offspring as shown in the diagram.

2.5 State ONE reason why some people might:

(a) Favour the process shown in the diagram

(b) Be against the process shown in the diagram

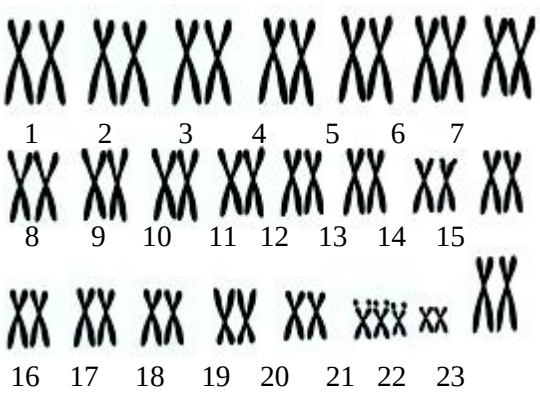
3 Since the 1980s, human insulin has been produced using genetically modified bacteria and yeast.

3.1 State THREE advantages of producing human insulin by genetic modification.

3.2 Give TWO reasons why some people might be against genetic modification.

KAROTYPES

1. Study the diagram below and answer the questions that follow.



Karyotype of a person

1.1 Is this the karyotype of a male or a female?

1. 2 Give a reason for your answer to QUESTION 1.5.1.

1. 3 How many chromosomes does this person have?

1.4 Name the genetic disorder that this person has.