PEARSON EDEXCEL GCSE COMBINED SCIENCE (HIGHER) · 1SC0

BIOLOGY



EXAM QUESTION PACK

TOPIC 3: GENETICS (PAPER 1)

SCORE	PERCENTAGE
/81	%

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Q1.

Answer the questions with a cross in the boxes you think are correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Figure 1 shows part of a DNA molecule.

T	T	G	A	T	T	G	C	G	T	A	A

Figure 1

(i) Write the code for the complementary DNA strand in Figure 1.

(2)

(ii) Three bases code for each amino acid.

Which is the maximum number of amino acids coded for by this strand of DNA?

(1)

☒ **A** 3

☒ **B** 4

☒ **C** 6

☒ **D** 12

(iii) What is the shape of a DNA molecule?

(1)

☒ **A** triple stranded

☒ **B** single stranded

☒ **C** single helix

☒ **D** double helix

(Total for question = 4 marks)

Q2.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Birds are classified in the domain Eukarya.

(i) Why are the cells from birds described as eukaryotic?

(1)

☒ **A** they have membrane-bound organelles

☒ **B** they do not have nuclei

☒ **C** they have a rigid cell wall

☒ **D** they have a cell membrane

(ii) Give **one** reason why the three domain classification system was proposed.

(1)

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(Total for question = 2 marks)

Q3.

A student wanted to extract the DNA from fresh peas.

The student crushed the peas and added washing up liquid and water.

The enzyme protease was then added to this mixture.

(i) Explain why the enzyme protease was added to the mixture.

(2)

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(ii) The mixture was then heated and filtered.

Finally, the student poured the filtrate into a test tube and ice cold ethanol was poured down the side of the test tube into the filtrate.

State why ice cold ethanol was poured into the filtrate.

(1)

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(Total for question = 3 marks)

Q4.

(i) Figure 10 shows the percentages of bases for three organisms.

organism	percentage of each base in DNA (%)			
	adenine	thymine	cytosine	guanine
Human	30.8	30.8	19.2	19.2
Beetle	28.4	28.4		
Ebola virus	23.7	17.0	26.2	27.0

Figure 10

Calculate the percentage of cytosine for the beetle.

(2)

..... %

(ii) Explain why the information given about the Ebola virus indicates that this virus does not have a typical DNA structure.

(3)

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(Total for question = 5 marks)

Q5.

A scientist obtained a mass of 0.0062 nanograms of DNA from a diploid human cell.

Calculate the mass of DNA the scientist should obtain from a haploid human cell.

Give your answer in picograms.

(1 nanogram = 1000 picograms)

(2)

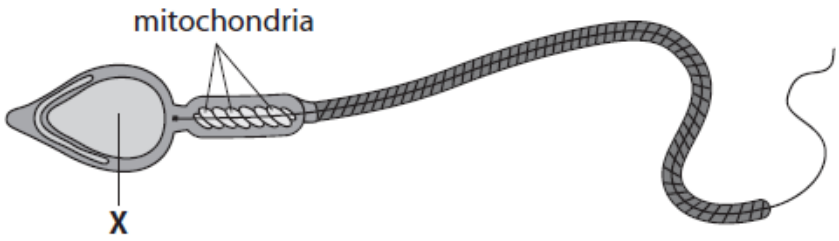
..... picograms

(Total for question = 2 marks)

Q6.

Cells

The diagram shows a human sperm cell.



(a) (i) Structure **X** on the diagram contains DNA.

Name structure **X**.

(1)

.....

(ii) Which statement is true for DNA?

Place a cross (☒) in the box next to your answer.

(1)

☒ **A** DNA is made up of amino acids and bases.

☒ **B** DNA is made up of amino acids which give instructions to make proteins.

☒ **C** In DNA, the bases A and T are complementary.

☒ **D** Every gene in a DNA molecule contains only three bases.

(b) Sperm cells are involved in fertilisation.

Define fertilisation.

(2)

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(c) (i) Describe the function of mitochondria.

(2)

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(ii) Gene mutations in DNA can produce abnormal mitochondria.

Explain how a gene mutation can produce a different protein.

(2)

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(Total for question = 8 marks)

Q7.

Mitosis and meiosis are processes that produce new cells.

Compare the outcomes of mitosis and meiosis.

(3)

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(Total for question = 3 marks)

Q8.

DNA is composed of four different DNA nucleotides.

(i) Which diagram represents the arrangement of the sugar, phosphate and the base in a DNA nucleotide?

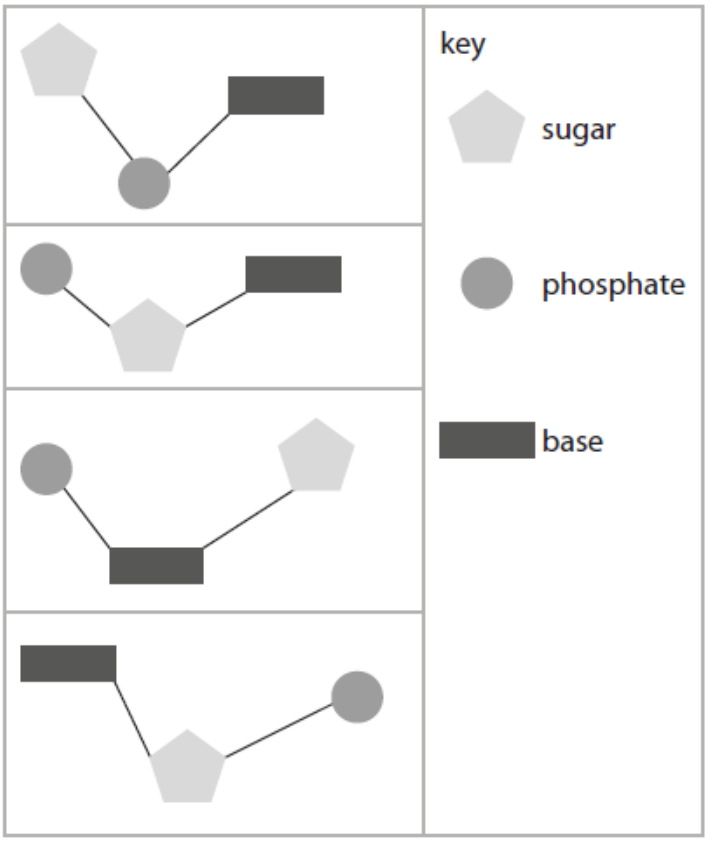
(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**



(ii) An allele starts with the DNA sequence ATGCATGTACCG.

Give the sequence of the complementary DNA sequence.

(1)

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(iii) The length of one DNA nucleotide was measured at 3.3×10^{-10} metres.

Calculate the approximate length of a gene containing 250 nucleotides in nanometres.

(2)

..... nm

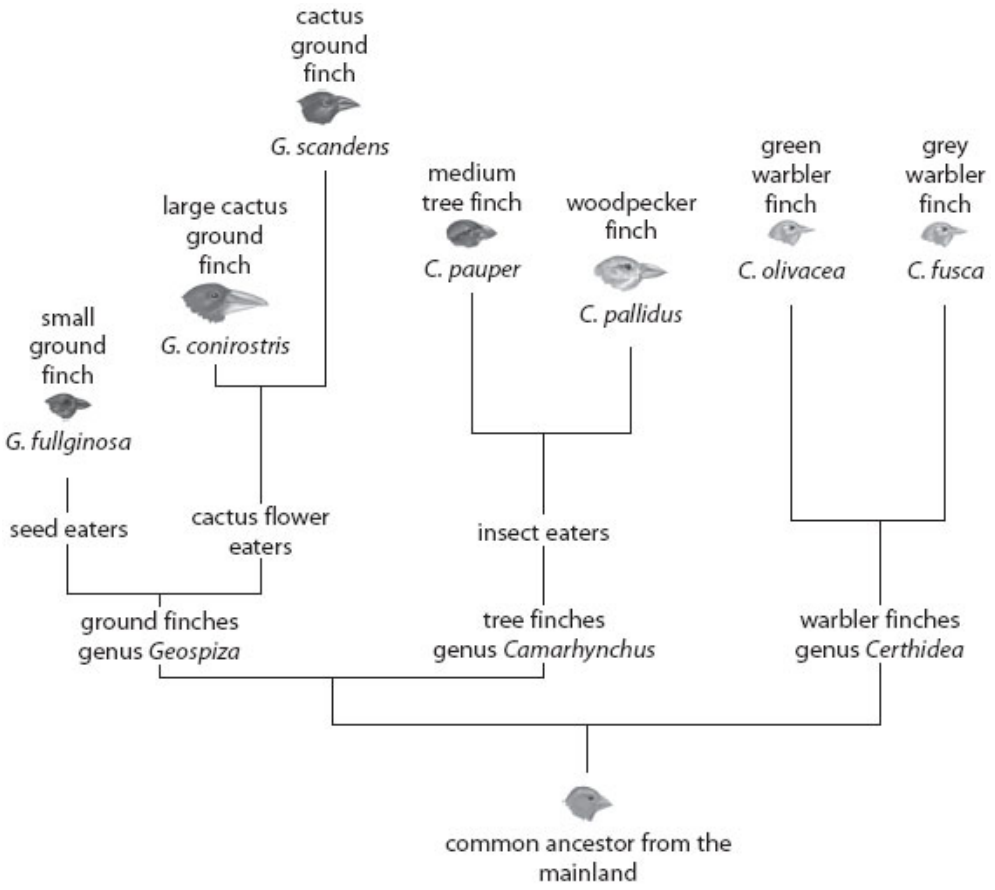
(Total for question = 4 marks)

Q9.

Charles Darwin studied the variety of finches on the Galapagos Islands.

He used this information to develop his theory of evolution.

Some of the finches are shown in the diagram.



(a) (i) State the genus and the species of the large cactus ground finch.

(2)

genus .....

species .....

(ii) Suggest how the size and shape of their beaks enabled all of these types of finches to survive.

(2)

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(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

Darwin's finches are an example of speciation due to

(1)

- ☒ **A** selective breeding
- ☒ **B** geographic isolation
- ☒ **C** hybridisation
- ☒ **D** the development of ring species

(b) Suggest how these species of finches could have evolved.

(3)

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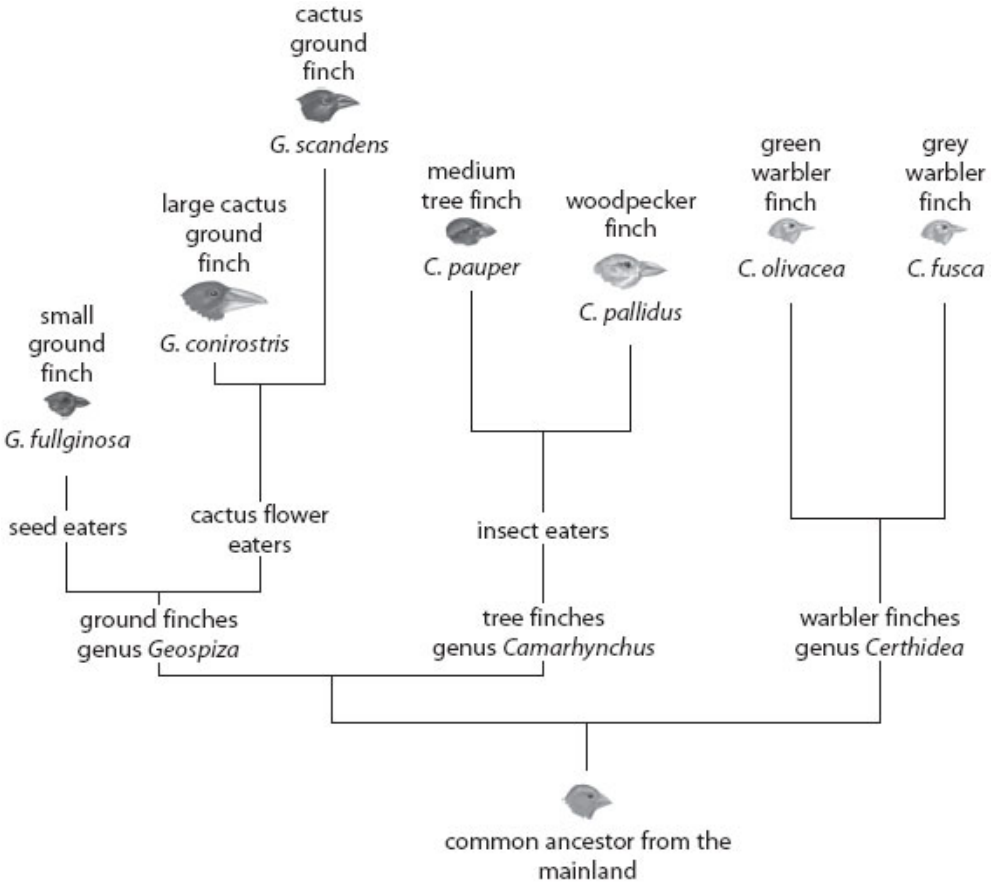
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Q10.

Charles Darwin studied the variety of finches on the Galapagos Islands.

He used this information to develop his theory of evolution.

Some of the finches are shown in the diagram.



(i) State the genus and the species of the large cactus ground finch.

(2)

genus .....

species .....

(ii) Suggest how the size and shape of their beaks enabled all of these types of finches to survive.

(2)

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(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

Darwin's finches are an example of speciation due to

(1)

☒ **A** selective breeding

☒ **B** geographic isolation

☒ **C** hybridisation

☒ **D** the development of ring species

Q11.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Figure 4 shows a great tit on a bird feeder.



© taviphoto/Shutterstock

Figure 4

Scientists have found that great tits living now have longer beaks than great tits living 50 years ago.

Genetic analysis shows changes in the sequence of the bird's DNA.

(i) Give the complementary strand sequence for this DNA template.

(1)

A	T	G	T	T	A	C	G	T
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮

(ii) Which statement correctly describes a DNA molecule?

(1)

☒ **A** two strands joined together by strong bonds to form a double helix

☒ **B** two complementary bases twisted into a double helix by strong bonds

☒ **C** a double helix with strands joined by hydrogen bonds between bases

☒ **D** four complementary strands joined together with hydrogen bonds

(iii) State the term used to describe a change in the sequence of DNA bases.

(1)

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(Total for question = 3 marks)

Q12.

The population of humans on Earth has increased significantly leading to food shortages.

The growth of drought-resistant crop plants could lead to an increase in food supply.

Describe how drought-resistant crop plants can be produced.

(3)

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(Total for question = 3 marks)

Q13.

DNA molecules contain base pairs.

Describe how the base pairs are bonded together in a DNA molecule.

(2)

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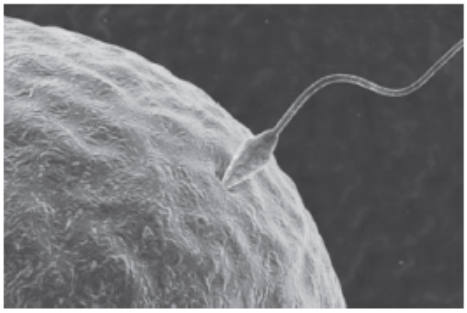
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(Total for question = 2 marks)

Q14.

The photograph shows a sperm cell and an egg cell just before fertilisation.



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Describe the structure of DNA.

(3)

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Q15.

(a) Describe how a section of DNA determines the structure of a protein.

(4)

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*(b) Describe the structure of DNA, including the roles of the scientists involved in its discovery.

(6)

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Human DNA was sequenced during the Human Genome Project.

(c) Explain how the Human Genome Project has contributed to advances in medicine.

(2)

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(Total for Question is 12 marks)

Q16.

Explain how two parents with a dominant phenotype can produce offspring expressing a recessive characteristic.

(2)

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(Total for question = 2 marks)

Q17.

The images show a normal red blood cell and a red blood cell from someone who has sickle cell disease. Sickle cell disease is a genetic disorder caused by two recessive alleles.



Normal red blood cell



Red blood cell from someone who has sickle cell disease

(a) (i) Complete the sentence by putting a cross (☒) in the box next to your answer.

An individual with sickle cell disease is said to be

(1)

☒ **A** a carrier for sickle cell disease

☒ **B** heterozygous

☒ **C** homozygous dominant

☒ **D** homozygous recessive

(ii) Describe the main symptoms of sickle cell disease.

(3)

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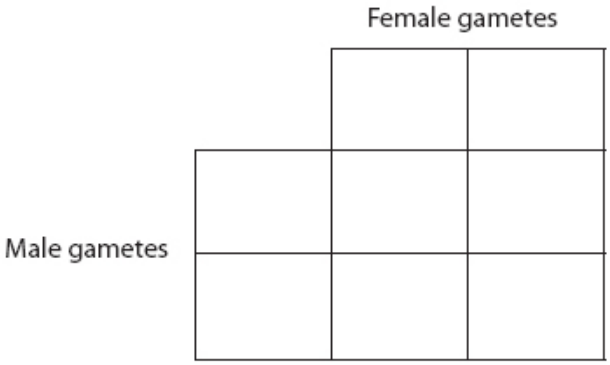
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(b) (i) A female with the genotype (**Dd**) and a male with the genotype (**DD**) for sickle cell disease are about to start a family.

Complete the Punnett square to show the possible genotypes of their offspring for sickle cell disease.

(2)



(ii) State the percentage chance that a child from these individuals will be

(2)

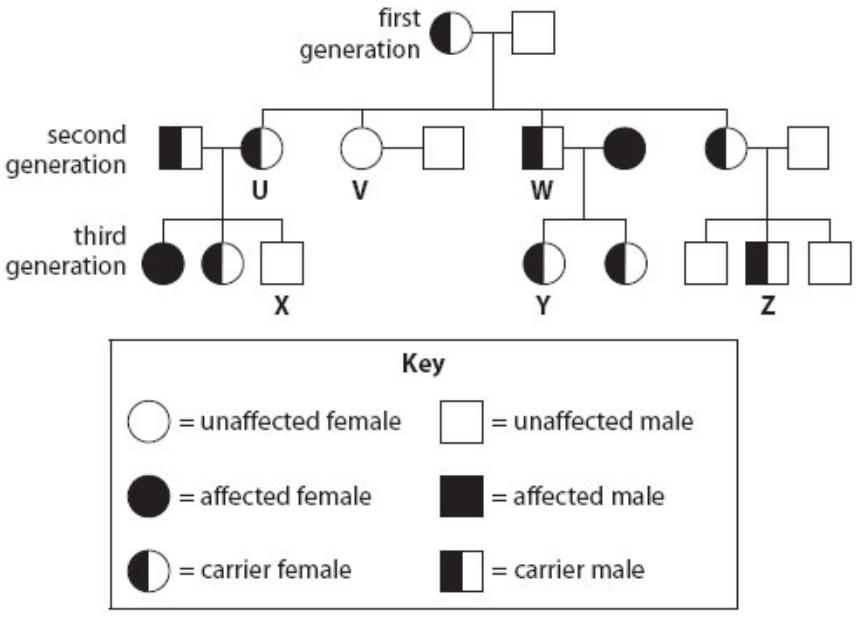
1. a carrier of sickle cell disease ..... %

2. an individual with sickle cell disease ..... %

(Total for Question = 8 marks)

Q18.

The family pedigree shows the inheritance of sickle cell disease through three generations.



(a) (i) Calculate the percentage of the offspring from the first generation who are heterozygous for sickle cell disease.

(1)

.....%

(ii) Explain why the offspring produced by the first generation parents are not the same as those predicted in a Punnett square.

(2)

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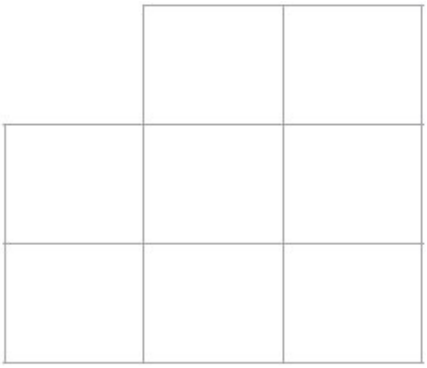
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(iii) Person **W** and his partner have a third child.

State the probability that this child will have sickle cell disease.

Complete the Punnett square to show this.

(2)



probability .....

(iv) Complete the sentence by putting a cross (☒) in the box next to your answer.

The genotype of person **V** is

(1)

☒ **A** homozygous dominant

☒ **B** homozygous recessive

☒ **C** heterozygous

☒ **D** carrier

*(b) Explain why it is important that individuals **X**, **Y** and **Z** have pedigree analysis completed before they consider having children.

You should use diagrams and mathematical calculations to illustrate your answer.

(6)

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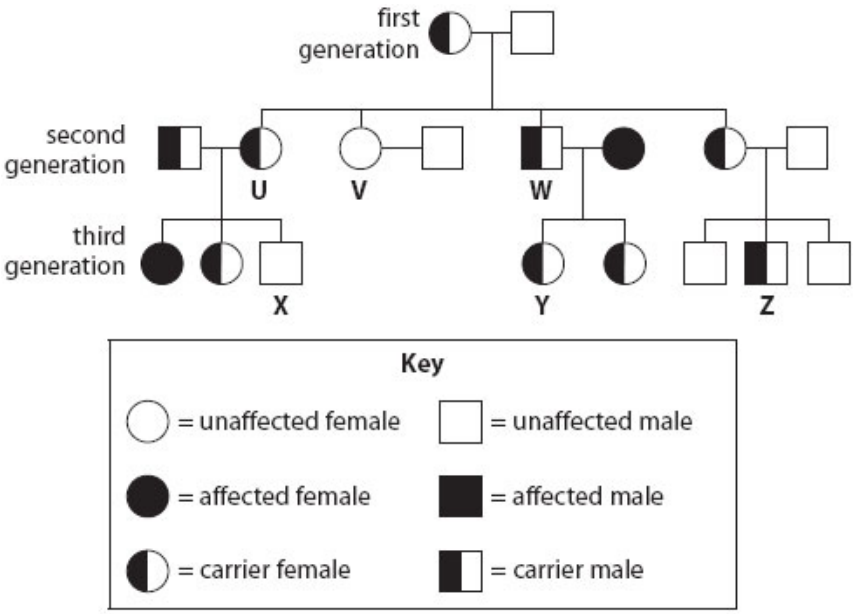
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(Total for Question is 12 marks)

Q19.

The family pedigree shows the inheritance of sickle cell disease through three generations.



(i) Calculate the percentage of the offspring from the first generation who are heterozygous for sickle cell disease.

(1)

.....%

(ii) Explain why the offspring produced by the first generation parents are not the same as those predicted in a Punnett square.

(2)

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(iii) Person **W**and his partner have a third child.

State the probability that this child will have sickle cell disease.

Complete the Punnett square to show this.

(2)

probability .....

(iv) Complete the sentence by putting a cross (☒) in the box next to your answer.

The genotype of person **V** is

(1)

☒ **A** homozygous dominant

☒ **B** homozygous recessive

☒ **C** heterozygous

☒ **D** carrier

Q20.

The images show a normal red blood cell and a red blood cell from someone who has sickle cell disease. Sickle cell disease is a genetic disorder caused by two recessive alleles.



Normal red blood cell

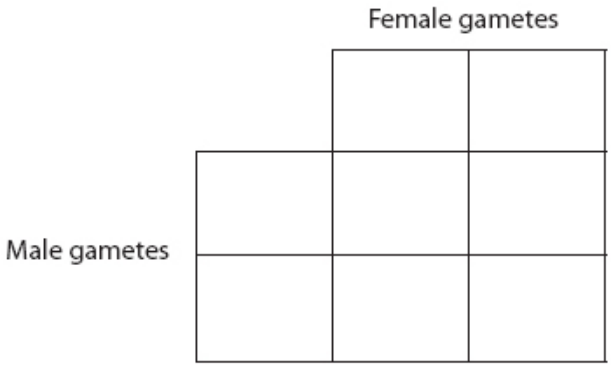


Red blood cell from someone who has sickle cell disease

(i) A female with the genotype (**Dd**) and a male with the genotype (**DD**) for sickle cell disease are about to start a family.

Complete the Punnett square to show the possible genotypes of their offspring for sickle cell disease.

(2)



(ii) State the percentage chance that a child from these individuals will be

(2)

1. a carrier of sickle cell disease ..... %

2. an individual with sickle cell disease ..... %

Q21.

Human DNA was sequenced during the Human Genome Project.

Explain how the Human Genome Project has contributed to advances in medicine.

(2)

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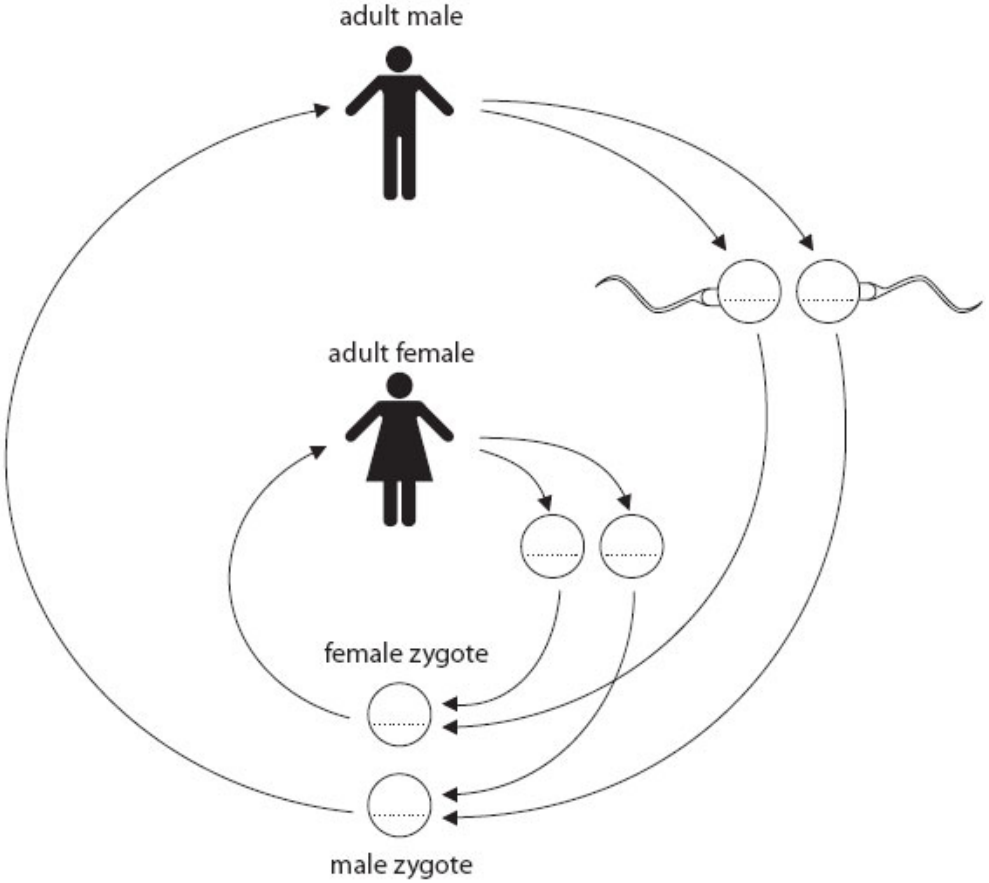
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Q22.

The diagram shows the human life cycle.

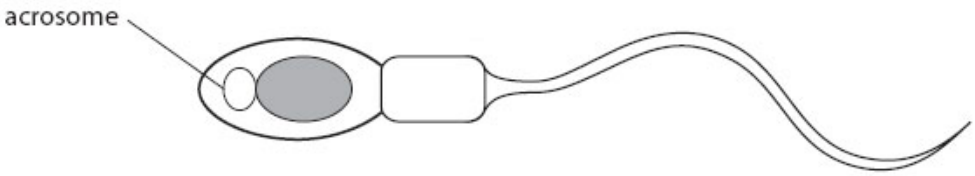
When a sperm cell fertilises an egg cell, a zygote is formed.



(a) Complete the diagram by writing the sex chromosomes in the egg cells, sperm cells, male zygote and female zygote.

(2)

(b) The diagram shows a sperm cell.



Complete the sentence by putting a cross (☒) in the box next to your answer.

The acrosome contains

(1)

☒ **A** enzymes to help get through the membrane of the egg cell

☒ **B** mitochondria to supply energy to swim

☒ **C** muscle fibres to swim

☒ **D** 23 chromosomes

(c) State why egg cells have a large amount of cytoplasm.

(1)

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(d) During ovulation an egg cell is released from the ovary.

Explain how changes in the levels of hormones result in ovulation.

(2)

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(e) Explain what happens to the uterus lining if the egg cell is fertilised.

(2)

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(Total for Question = 8 marks)

Q23.

Figure 17 shows the structure of a DNA nucleotide.

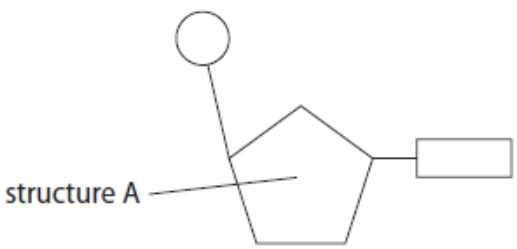


Figure 17

(i) Structure A is a

(1)

☒ **A** base

☒ **B** phosphate

☒ **C** sugar

☒ **D** polymer

* (ii) In 2003, the first complete human genome was sequenced.

The genomes of different people have small changes in the sequence of the DNA bases.

Describe how these changes in DNA sequence can affect the individuals and how sequencing a person's genome could influence their medical treatments.

(6)

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(Total for question = 7 marks)

Q24.

The bonds joining the two strands of a DNA molecule together are

(1)

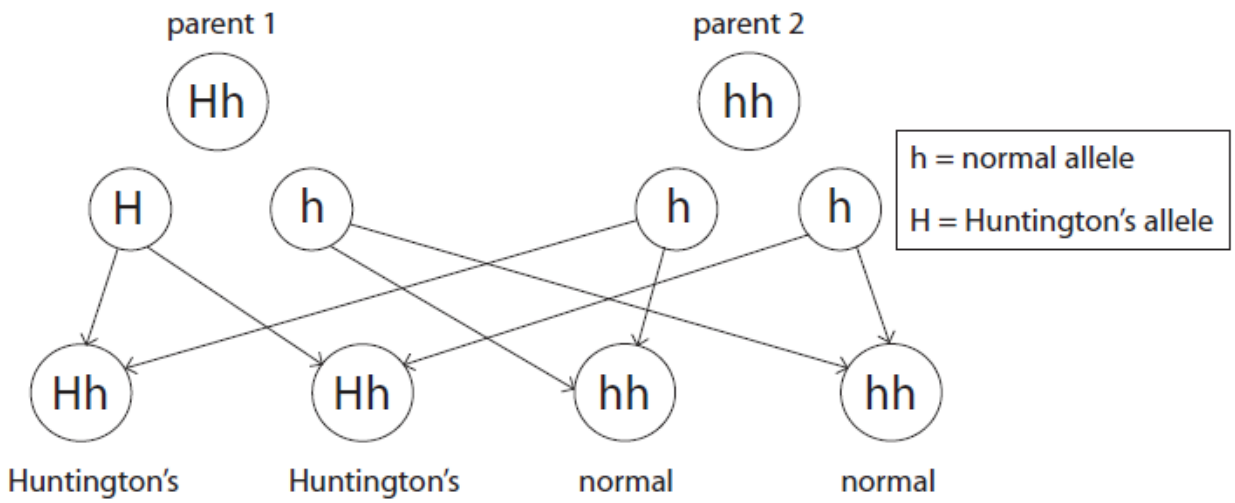
- ☒ **A** weak peptide bonds
- ☒ **B** strong peptide bonds
- ☒ **C** weak hydrogen bonds
- ☒ **D** strong hydrogen bonds

(Total for question = 1 mark)

Q25.

Huntington's disease is a genetic disorder.

The genetic diagram shows the inheritance of this disorder.



(a) (i) Use words or letters from the box to complete the following sentences.

(2)

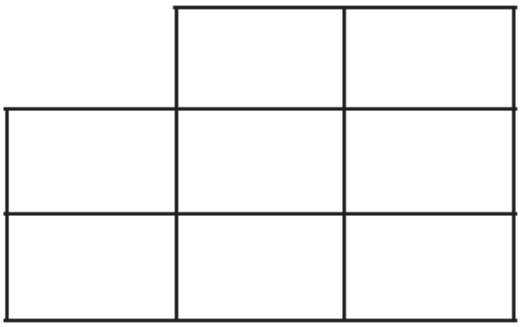
dominant	recessive	phenotype
h	HH	hh

Huntington's disease is caused by a ..... allele.

People with Huntington's disease can have the genotype Hh or ..... .

(ii) Complete the Punnett square to show the potential offspring of two parents heterozygous for Huntington's disease.

(2)

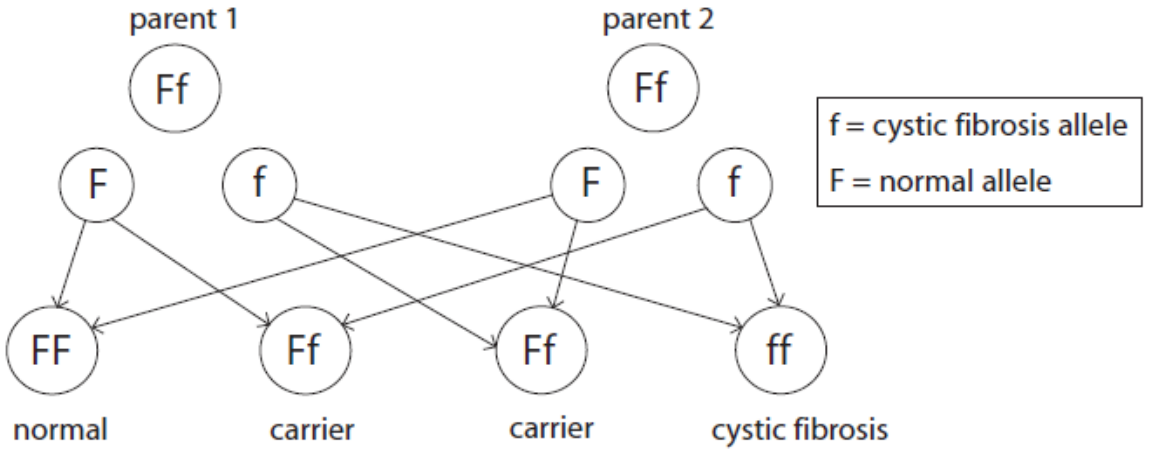


(iii) State the probability that a child of two parents, heterozygous for Huntington's disease, will have the disease.

(1)

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(b) The genetic diagram shows the inheritance of cystic fibrosis.



(i) Explain why, if both sets of parents are heterozygous, the chance of inheriting Huntington's disease is greater than the chance of inheriting cystic fibrosis.

(2)

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(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

A symptom of cystic fibrosis is the overproduction of

(1)

☒ **A** mucus

☒ **B** red blood cells

☒ **C** stomach acid

☒ **D** white blood cells

(iii) Explain why a man with cystic fibrosis may be infertile.

(2)

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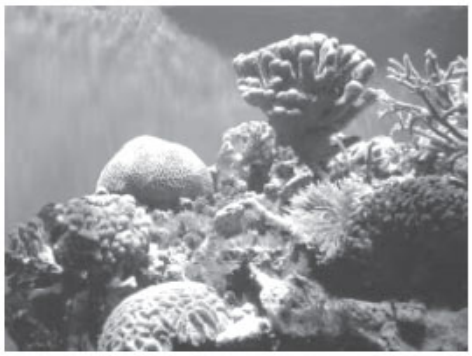
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Q26.

Corals are animals that live on the sea bed.

The photograph shows some species of coral.



After fertilisation, mitosis takes place to form an embryo.

The embryo develops into new coral.

(i) Describe mitosis.

(3)

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(ii) Describe how the embryo develops into new coral.

(3)

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Q27.

Haemochromatosis is a disease that occurs when iron accumulates in the liver.

A person with haemochromatosis is treated by having 0.5 dm^3 of their blood removed each week.

This lowers the level of iron in their blood.

(i) Give **two** safety precautions needed when blood is removed from this person.

(2)

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(ii) Haemochromatosis can be inherited.

Haemochromatosis occurs when a person inherits two copies of a recessive allele.

Figure 6 shows the inheritance of haemochromatosis in a family.

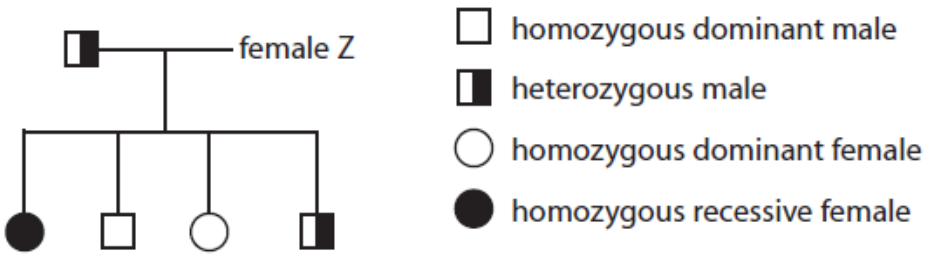


Figure 6

State and explain the genotype of female Z.

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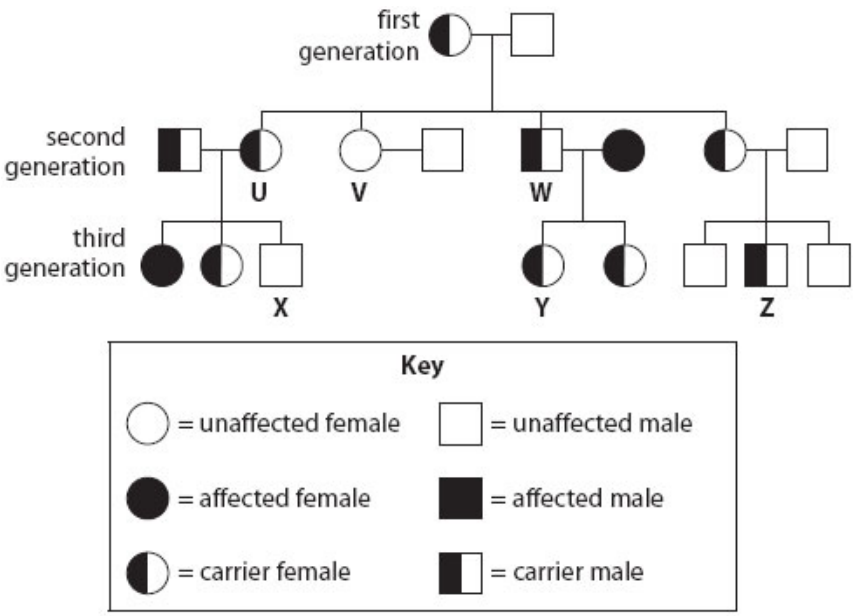
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(Total for question = 5 marks)

Q28.

The family pedigree shows the inheritance of sickle cell disease through three generations.



* Explain why it is important that individuals **X**, **Y**and **Z**have pedigree analysis completed before they consider having children.

You should use diagrams and mathematical calculations to illustrate your answer.

(6)

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Q29.

Resistant organisms

(a) The photograph shows the common rat *Rattus norvegicus*.



State the level of classification for both parts of the binomial name *Rattus norvegicus*.

(2)

Rattus

.....

norvegicus

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(b) Some rats have a mutation which enables them to eat the rat poison Warfarin and survive.

Suggest how the use of Warfarin could lead to an increase in the number of rats with this mutation.

(2)

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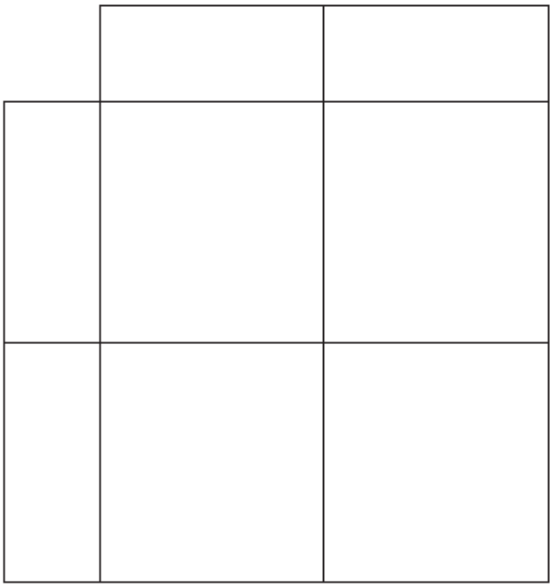
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(c) The allele for Warfarin resistance is recessive.

Complete the Punnett square to show how two rats, both heterozygous for Warfarin resistance, could produce Warfarin resistant offspring.

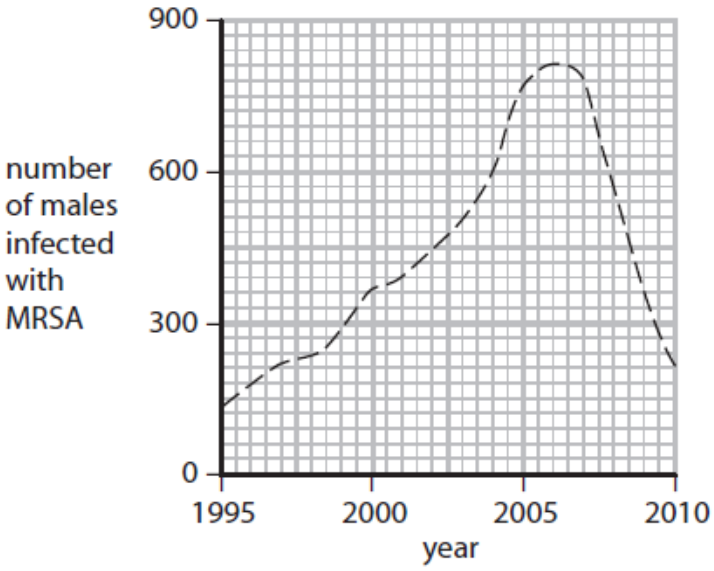
Use **R** and **r** to show the dominant and recessive alleles.

(2)



*(d) Hospitals have introduced programmes to reduce MRSA infections in patients because antibiotics have become less effective.

The graph shows the number of males infected with MRSA during their stay in hospital.



A programme of intensive use of antiseptics in hospitals has been used since 2005.

Use the information given and your own scientific knowledge to explain the trends shown in the graph.

(6)

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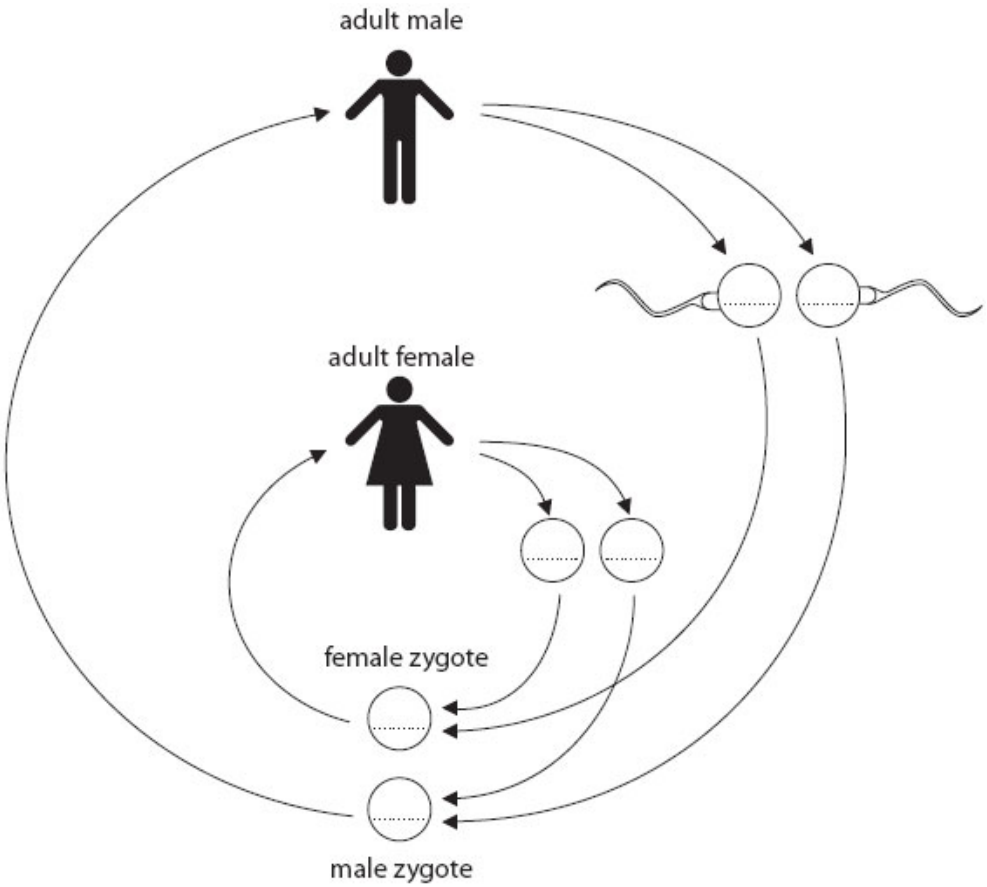
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(Total for question = 12 marks)

Q30.

The diagram shows the human life cycle.

When a sperm cell fertilises an egg cell, a zygote is formed.



Complete the diagram by writing the sex chromosomes in the egg cells, sperm cells, male zygote and female zygote.

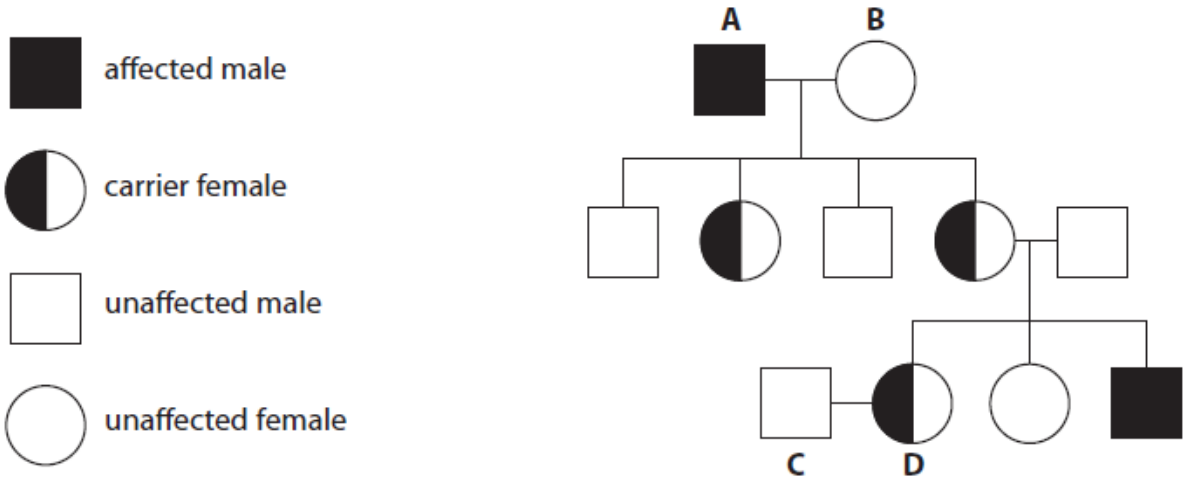
(2)

Q31.

Sex-linked genetic disorders

Haemophilia is a recessive sex-linked disorder.

This family pedigree shows the inheritance of haemophilia.



(a) (i) State the sex chromosomes of person **B**.

(1)

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(ii) Explain why the male offspring from **A** and **B** do not have haemophilia.

(2)

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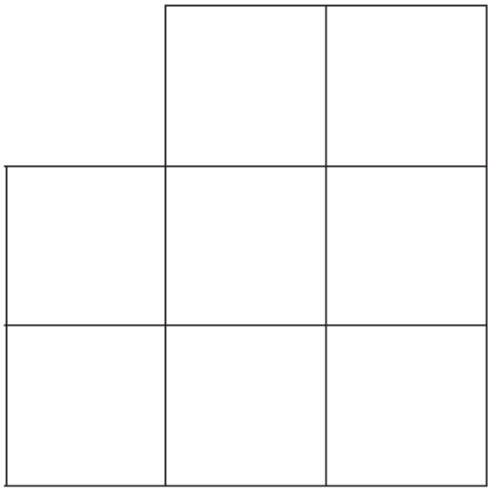
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(iii) Using the Punnett square, calculate the probability that individuals **C** and **D** could have a child with haemophilia.

(3)



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(b) Haemophilia can be treated using a blood clotting factor produced in a fermenter.

The conditions inside a fermenter have to be carefully controlled.

Explain why **one** named condition must be controlled in a fermenter.

(2)

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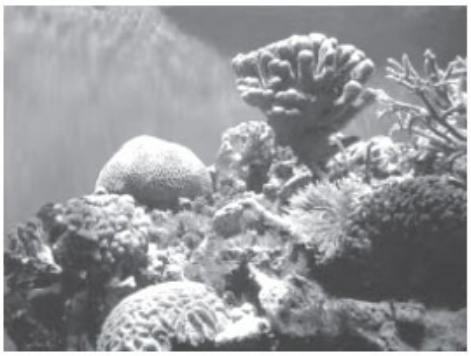
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(Total for question = 8 marks)

Q32.

Corals are animals that live on the sea bed.

The photograph shows some species of coral.



(a) Corals can reproduce sexually, releasing sperm cells into the water.

The mass of DNA in one sperm cell from a species of coral is 0.5 picogram.

(i) Suggest the mass of DNA that would be present in an unfertilised egg cell of the same species.

(1)

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(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

The term used to describe the number of chromosomes in an egg or sperm cell is

(1)

☒ **A** diploid

☒ **B** gamete

☒ **C** haploid

☒ **D** zygote

(iii) Complete the sentence by putting a cross (☒) in the box next to your answer.

The base pairs in DNA are

(1)

☒ **A** thymine with adenine, cytosine with guanine

☒ **B** thymine with guanine, adenine with cytosine

☒ **C** uracil with adenine, guanine with cytosine

☒ **D** uracil with thymine, guanine with cytosine

(iv) Name the bond that joins the base pairs together.

(1)

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(b) After fertilisation, mitosis takes place to form an embryo.

The embryo develops into new coral.

(i) Describe mitosis.

(3)

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(ii) Describe how the embryo develops into new coral.

(3)

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(Total for Question = 10 marks)

Q33.

The images show a normal red blood cell and a red blood cell from someone who has sickle cell disease. Sickle cell disease is a genetic disorder caused by two recessive alleles.



Normal red blood cell



Red blood cell from someone who has sickle cell disease

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

An individual with sickle cell disease is said to be

(1)

- ☒ **A** a carrier for sickle cell disease
- ☒ **B** heterozygous
- ☒ **C** homozygous dominant
- ☒ **D** homozygous recessive

(ii) Describe the main symptoms of sickle cell disease.

(3)

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Q34.

* Describe the structure of DNA, including the roles of the scientists involved in its discovery.

(6)

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Q35.

The DNA of an organism determines its phenotype.

White tigers are produced because of a mutation of a single allele which usually produces the normal orange and yellow fur pigmentation.

The mutated allele is recessive.

Samba, a male white tiger, was bred with Rani. They had three offspring; two offspring have white fur and one has a normal fur pigmentation.

(i) State the genotype of Rani.

(1)

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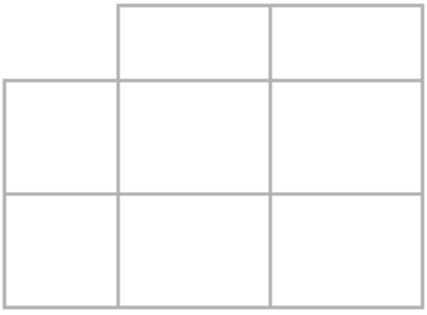
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(ii) The offspring with normal fur pigmentation was bred with a tiger that was heterozygous.

Use A/a to represent the alleles for fur pigmentation.

Predict, using the Punnett square, the percentage probability of the offspring from this cross having normal fur pigmentation.

(2)



percentage probability = ... %

(Total for question = 3 marks)

Q36.

A student used the method shown in Figure 1 to compare the mass of DNA extracted from strawberry fruit cells and from kiwi fruit cells.

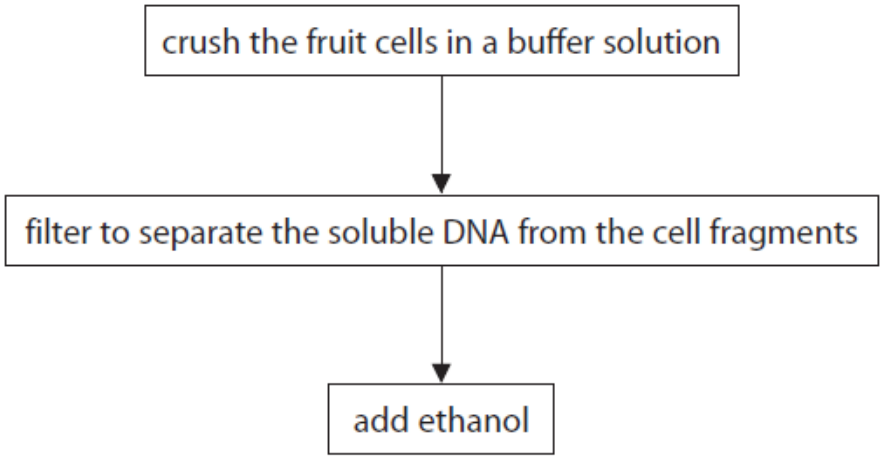


Figure 1

(i) State why ethanol is used.

(1)

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(ii) State **two** variables the student needs to control when using this method to compare the mass of DNA from these two fruits.

(2)

1 .....

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2 .....

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(iii) The student repeated the experiment.

Give **one** reason why.

(1)

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(Total for question = 4 marks)

Q37.

The dodo was a flightless bird which is now extinct.

The photograph shows the skeleton of a dodo.



(a) (i) Explain why the dodo was placed in the kingdom Animalia.

(2)

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(ii) The dodo was classified as a chordate.

Using the information in the photograph, explain why scientists classified the dodo into the phylum Chordata.

(1)

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(iii) The binomial name for the dodo is *Raphus cucullatus*.

Complete the sentence by putting a cross (☒) in the box next to your answer.

The name *Raphus*refers to the dodo's

(1)

- ☒ **A** family
- ☒ **B** genus
- ☒ **C** order
- ☒ **D** phylum

(b) The dodo lived on the small island of Mauritius. It became extinct in 1681.

Using your knowledge of natural selection, suggest why the dodo may have become extinct.

(3)

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(c) Complete the sentence by putting a cross (☒) in the box next to your answer.

The formation of a new species due to geographical isolation is called

(1)

- ☒ **A** adaptation
- ☒ **B** competition
- ☒ **C** hybridisation
- ☒ **D** speciation

(d) Describe the causes of variation in a population.

(2)

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