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 ☒.

Read the passage below. Use the information in the passage and your own knowledge to answer the questions that follow.

Sweating is normal when we are hot. It is part of our natural cooling mechanism. If you sweat visibly when you do not need to cool down, it can be a problem.

The sweating process is controlled by the brain, which sends signals down the nerves to the sweat glands.

Sweating is crucial to survival. We sweat to control body temperature and the sweat glands in our armpits can produce several litres of sweat in 24 hours. How much we sweat varies hugely from individual to individual and even from day to day.

Hyperhidrosis occurs when some areas of the body start sweating excessively. This affects about 1% of the population. There are two main types. The most common type is primary focal hyperhidrosis, which affects many parts of the body. There is no known cause, but it usually begins in childhood and often runs in families. Another type is secondary hyperhidrosis, which often doesn't begin until after the teenage years, and usually has an underlying medical cause. These causes can include diabetes, menopause or chronic infection. It can also be a result of eating certain foods. Stress can play a major role too.

(a) Which part of the brain controls sweating (line 4)?

(1)

☒ **A** cerebellum

☒ **B** cerebral hemispheres

☒ **C** hypothalamus

☒ **D** pituitary gland

(b) Which type of nerve sends signals to the sweat glands (lines 4 and 5)?

(1)

☒ **A** connector

☒ **B** motor

☒ **C** relay

☒ **D** sensory

(c) Describe how sweating controls body temperature (lines 6 and 7).

(3)

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(d) Explain the evidence in the passage that indicates primary focal hyperhidrosis is a genetic condition.

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(e) Secondary hyperhidrosis can be caused by diabetes. Give one risk factor for diabetes (line 16).

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(f) The passage states that how much we sweat varies from individual to individual and from day to day. Explain why this is the case in people without hyperhidrosis (lines 8 and 9).

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(Total for question = 14 marks)

Q2.

Skin and hair contain a pigment called melanin.

(a) (i) Describe the function of the pigment melanin in the skin.

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(ii) State one other place, apart from hair and skin, where pigment is found in the body. **(1)**

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(b) A condition known as white forelock is caused by a dominant allele H.

People with this condition have a white patch in their hair.

The condition causes a deficiency of the skin pigment melanin.
A woman who is heterozygous for white forelock produces children with a father who does not have the condition.
(i) Draw a genetic diagram to show the possible offspring from this cross.
The condition is not sex-linked.

(4)

(ii) Calculate the probability that these parents will produce a boy with the condition.

(3)

probability = ...

(c) White forelock is a result of a mutation in a molecule of DNA.

Describe how this mutation causes the white forelock phenotype.

(4)

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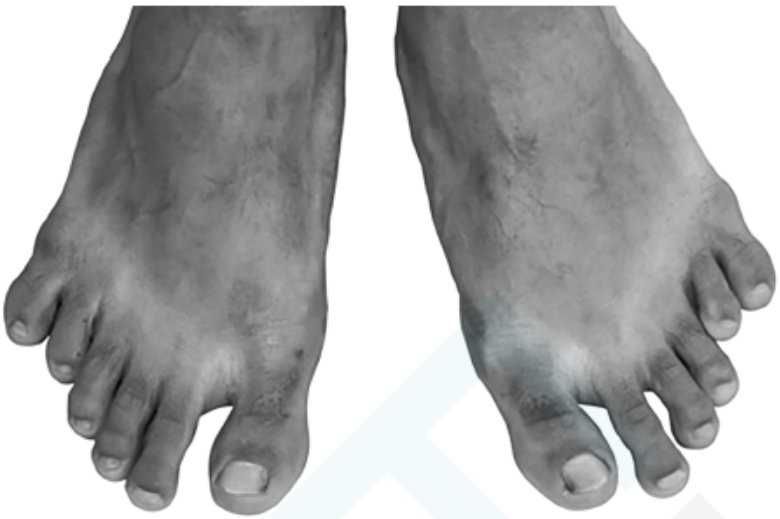
(Total for question = 14 marks)

Q3.
Polydactyly is a genetic condition caused by the presence of a dominant allele.
The photograph shows the feet of a person with polydactyly.



(Source: www.fotolia.com)

(a) State what is meant by the term **dominant allele**. **(2)**

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(b) A man with polydactyly has a son who has no symptoms of the disorder. The son and his wife produce two children. The first child, a boy, does not have polydactyly. The second child, a girl, is affected by the disorder. (i) Draw a family pedigree to show the genotypes of the man, his wife, his son, his son's wife and their children. Use the symbol D to represent the allele for polydactyly and d to represent the allele for normal hands.

(6)

(ii) The son and his wife have a third child.

Calculate the probability that this third child will be a boy affected by polydactyly.

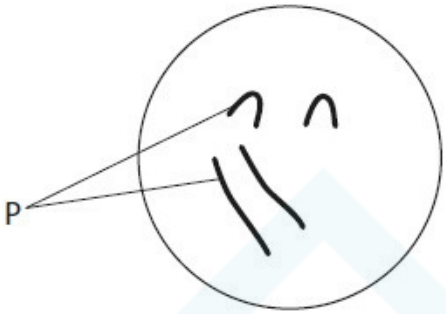
(3)

probability = ...

(Total for question = 11 marks)

Q4.

(a) The diagram shows the nucleus of a cell.



(i) Name the structures labelled P.

(1)

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(ii) The cell divides by mitosis and two nuclei are produced.

Draw the appearance of the two nuclei.

(2)

(b) Before mitosis can occur, the DNA of the cell must replicate.

The table lists stages of DNA replication.

Write the numbers 1, 2, 3 and 4 in the boxes to show these stages in the correct order.

(1)

Stage	Number
complementary bases pair up	
DNA double helix unwinds	
strands separate	
two DNA helices form	

(c) The DNA of the nucleus is analysed.

The table shows the results.

Base	X	adenine	Y	Z
Pecentage base in DNA (%)	30	20	30	20

(i) Identify base Z.

(1)

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(ii) Give the possible identities of base X.

(1)

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(d) Meiosis is another type of cell division.

Explain why meiosis is important in humans.

(4)

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(Total for question = 10 marks)

Q5.

(a) What type of microorganism causes gonorrhoea?

(1)

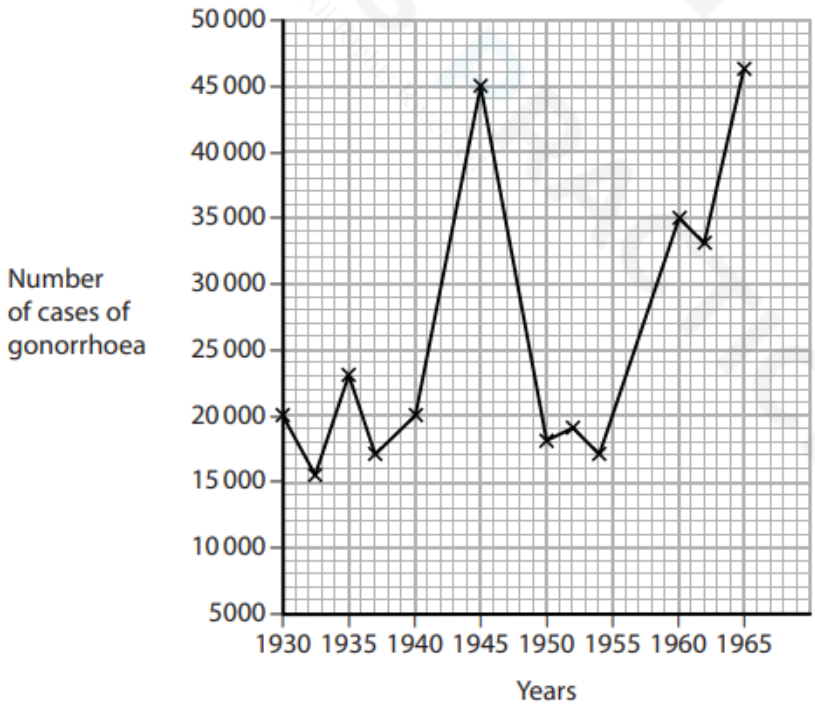
☒ **A** bacterium

☒ **B** fungus

☒ **C** protozoan

☒ **D** virus

(b) The graph shows the number of cases of gonorrhoea treated in UK clinics between 1930 and 1965.



(i) Find the number of cases of gonorrhoea in 1945.

(1)

number of cases = ...

(ii) Describe the trend in the number of cases of gonorrhoea between 1954 and 1965.

(2)

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(c) (i) State **two** ways to reduce the chances of catching gonorrhoea.

(2)

1 .....

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2 .....

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(ii) State **one** treatment for gonorrhoea.

(1)

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(d) Explain why oral contraceptives are ineffective in preventing the spread of sexually transmitted diseases.

(2)

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(Total for question = 9 marks)

Q6.

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 ☒.

Inheritance of blood group involves codominant inheritance.

(a) (i) Which statement describes codominant inheritance in ABO blood groups?

(1)

☒ **A** the inheritance of two different alleles, both of which are expressed

☒ **B** the inheritance of two different alleles, only one of which is expressed

☒ **C** the inheritance of multiple alleles, only two of which are expressed

☒ **D** the inheritance of multiple alleles, only one of which is expressed

(ii) State the possible genotypes of a person with blood group A.

(1)

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(b) (i) A person's blood group is determined by antigens.
These antigens are carbohydrate and protein molecules on the surface of red blood cells.
In 2007, a team of scientists used enzymes to convert blood groups A, B and AB into blood group O for transfusions.
Suggest how enzymes can convert blood groups A, B and AB into blood group O.

(3)

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(ii) Suggest an advantage of producing blood group O using enzymes, compared

with other methods of obtaining blood group O. **(1)**

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(c) Haemophilia is a sex-linked blood disorder that reduces the ability of the blood to clot.

These are the genotypes of four offspring, P, Q, R and S.

P	Q	R	S
X^HX^h	X^hY	X^HX^H	X^HY

(i) Draw a genetic diagram to show how these offspring are produced from one set of parents.

(2)

(ii) These parents are expecting another baby.

Determine the probability that this baby will have haemophilia.

(1)

..... probability =

(Total for question = 9 marks)

Q7.

Haemophilia is a sex-linked condition caused by a recessive allele Xh instead of the usual XH.

Haemophilia is the result of a mutation.

(a) Explain what is meant by the term **mutation**.

(3)

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(b) (i) A man without haemophilia and a woman who is a carrier of haemophilia have a child.

Draw a genetic diagram to show the possible genotypes and phenotypes of this child.

(4)

(ii) The man and woman have a second child.

Calculate the probability that both children will have haemophilia.

(3)

(c) Explain why the man cannot be a carrier of haemophilia.

(5)

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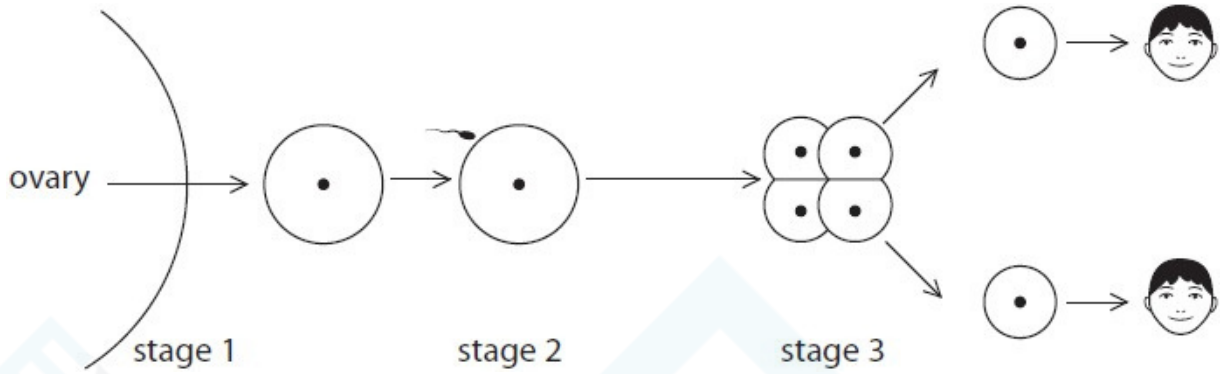
(Total for question = 15 marks)

Q8.

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 ☒.

(a) The diagram shows how genetically identical twins are produced.



(i) Name the process that occurs at stage 1.

(1)

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(ii) Name the process that occurs at stage 2.

(1)

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(iii) Use information from the diagram to explain how genetically identical twins are formed.

(2)

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(b) (i) In-vitro fertilisation (IVF) increases the chance of producing twins. Which hormones are given to a female at the start of IVF treatment?

(1)

☒ **A** FSH and LH

☒ **B** LH and oestrogen

☒ **C** oestrogen and progesterone

☒ **D** progesterone and FSH

(ii) Describe the procedures in IVF after hormone treatment.

(4)

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(Total for question = 9 marks)

Q9.

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 ☒.

(a) Genetic conditions are often caused by recessive alleles.

(i) Which of these describes an allele?

(1)

☒ **A** a chromosome that controls a characteristic

☒ **B** an alternative form of a gene

☒ **C** a pair of chromosomes that are the same size

☒ **D** one of a pair of chromosomes

(ii) State what is meant by the term **recessive**.

(1)

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(b) A student investigates a genetic condition found in his family.

- he is male and has the condition
- his mother does not have the condition
- his father and his father's brother have the condition
- his father's sister does not have the condition
- his father's mother (grandmother) does not have the condition but his father's father (grandfather) does have the condition

(i) Construct a family pedigree showing which members of the family have the condition and which do not.

(3)

(ii) Discuss the conclusions the student can make about the inheritance of the condition.

(3)

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(Total for question = 8 marks)

Q10.

There are many factors that affect the height of a human.

(a) The heights of a group of students are measured.

The table shows the results.

Height in cm	150–151	152–153	154–155	156–157	158–159	> 160
Number of students	4	14	25	20	10	4

(i) Plot a bar chart of the results.

(5)

(ii) Describe the trend shown in this bar chart.

(2)

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(b) State three factors that could affect the heights of the students.

(3)

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2 .....

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3 .....

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(Total for question = 10 marks)

Q11.

Haemophilia is a condition in which blood does not clot. It is caused by a sex-linked allele.

(a) (i) Explain why the process of blood clotting is important.

(3)

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(ii) State what is meant by the term **sex-linked**.

(2)

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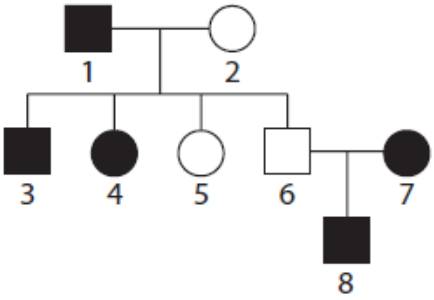
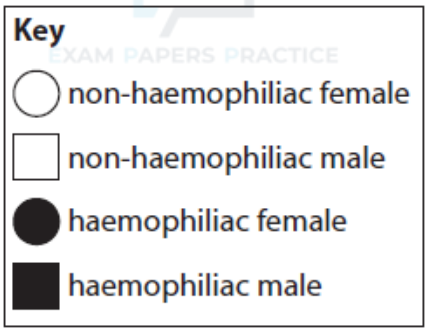
(b) The pedigree shows the pattern of inheritance of haemophilia in a family.





Xh is the allele for haemophilia and XH is the allele for clotting.

(i) What is the genotype of person 3?

(1)

☒ **A** Xh

☒ **B** Xh

☒ **C** XH

☒ **D** Xh

XHY

(ii) What is the genotype of person 5?

XhY

(1)

☒ **A** Xh

☒ **B** Xh

☒ **C** XH

☒ **D** Xh

XHY

(iii) Parents 6 and 7 have another child.

XhY

Determine the probability that the child will be male with haemophilia.

(2)

probability = ...

(iv) Explain why people with genotypes shown by persons 4 and 7 are less likely to be present in a population.

(3)

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(Total for question = 12 marks)

Q12.
(a) CFTR is a protein that is found in cell membranes.
This protein is responsible for transporting sodium ions across cell membranes using active transport.
(i) Describe the process of active transport.

(2)

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(ii) In some people a DNA mutation causes the production of a faulty CFTR protein. This results in cystic fibrosis. Explain how an individual can inherit cystic fibrosis from their parents.

(2)

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(iii) The faulty CFTR protein is unable to bind to the endoplasmic reticulum in the cell following protein synthesis. Suggest how this might affect the CFTR protein.

(2)

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(iv) The CFTR protein is made up of 1408 amino acids.

Calculate the number of nucleotides found in one strand of the CFTR gene.

(2)

number of nucleotides = ...

(v) Describe the structure of a nucleotide found in a DNA molecule.

(3)

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(b) There are 20 different amino acids that can be joined to form a polypeptide chain. The table gives some base sequences that code for five of these amino acids.

Code	Name of amino acid
AAT or AAC	asparagine
TAT or TAC	tyrosine
TTT or TTC	phenylalanine
CGT or CGG	arginine
CAT or CAC	histidine

Diagram 1 shows part of the gene that codes for a CFTR protein that functions normally.

Diagram 2 shows the same part of the gene with a mutation that causes cystic fibrosis.

AATATCATCTTTGGTGTTTCCTATGAT

Diagram 1

AATATCATCGGTGTTTCCTATGAT

Diagram 2

(3)

Describe the changes that occur in the gene and the protein that cause cystic fibrosis.

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(Total for question = 14 marks)