

Introduction

Reproduction can be split into two divisions: ASEXUAL and sexual.

ASEXUAL: Involves just one parent.

Does not lead to genetic variation

Examples include: SPIRER PLANT and BINARY FISSA
→ RUNNERS (BACTERIA)

Sexual:

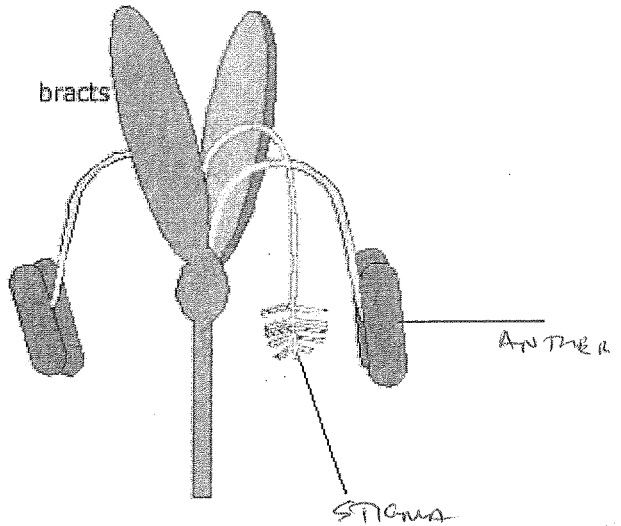
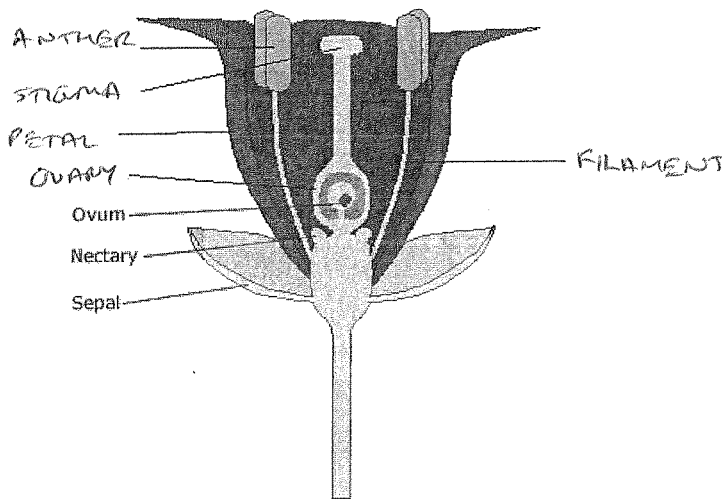
Involves 2 parents and PROMOTES genetic variation

Examples include: HUMAN and FLOWERING PLANTS

Involves the fusion of two GAMETES to produce a zygote (the process of FERTILISATION).

Plant reproduction

Label the diagrams below of an insect and wind pollinated flower:



Insect:

Wind:

Adaptations:

- SCENT
- ANTHER / STIGMA ENCLOSED
- COLOUR
- NECTAR

Advantages

- SPECIFIC INSECTS OFTEN FOR
- SPECIFIC PLANT → RELIABLE
- WIDE SPREAD POLLEN

Adaptations:

- ANTHER / STIGMA EXPOSED
- STIGMA LARGE / FEATHERY
- POLLEN LIGHT

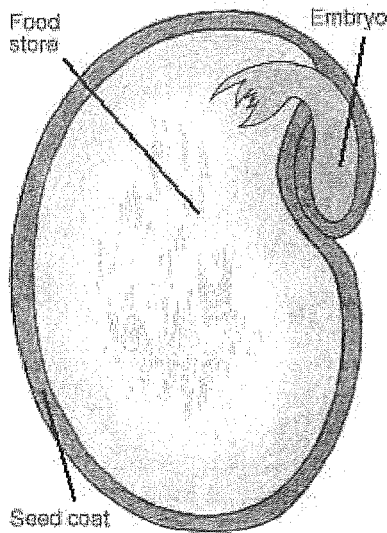
Advantages

- WIND ALWAYS PRESENT

After pollination (transfer of pollen from anther to stigma):

- It is necessary for the nucleus from the male gamete (the pollen) to meet and fuse with nucleus from the female gamete (the ovum)
- To do this the pollen grows a pollen TUBE.....which grows down the stigma and style and finds the ovum
- The male nucleus travels down this tube and ENTERS..... the ovum.
- The fertilised ovule forms the ZYGOTE, THEN SPORO.....
- The ovary wall often thickens and produces sugars to become the FRUIT.....

The seed will remain dormant until conditions become suitable for CERMINATION



Such conditions include:

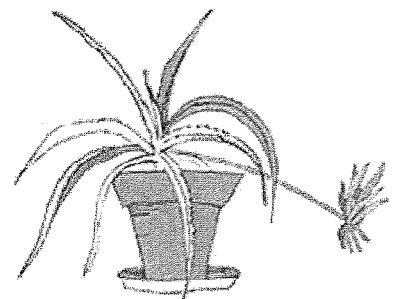
1. H₂O.....
2. O₂.....
3. SUITABLE TEMP......

During this process the embryo will develop a root (or radicle) and then a shoot (plumule). Before the young plant can photosynthesise it will rely on the FOOD STORE to provide the energy needed.

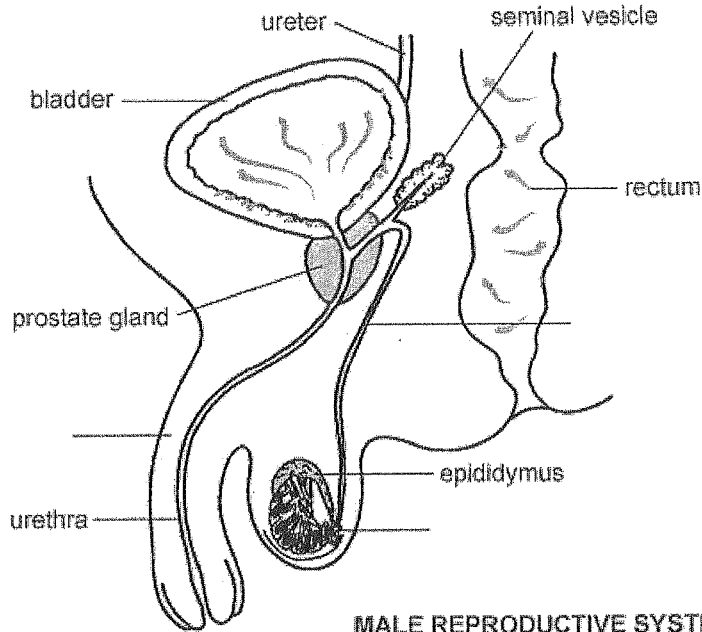
Asexual reproduction in plants

It is possible for plants to reproduce asexually (i.e. without flowers or fertilisation). Two of the most important methods of asexual reproduction are:

- RUNNERS..... - e.g. strawberry, spider plant
- TUBERS..... - e.g. potatoes, dahlias

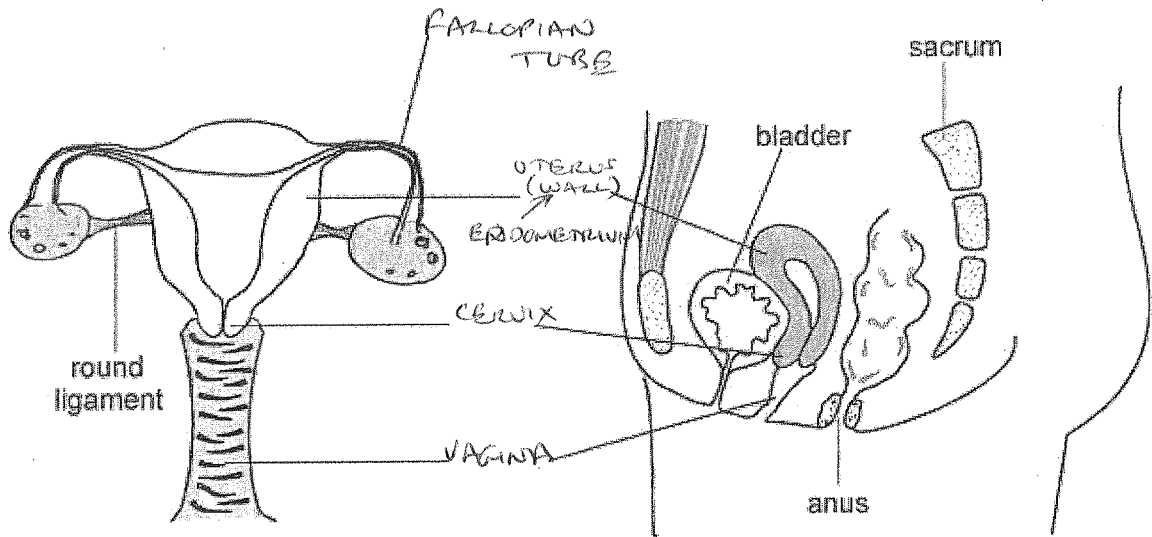


Human reproduction



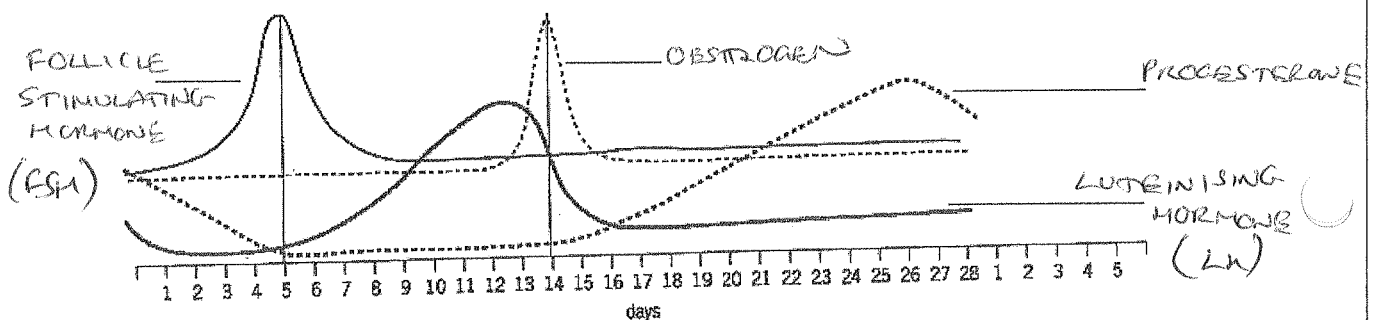
MALE REPRODUCTIVE SYSTEM

Sperm are produced in the testes under the influence of several hormones, including TESTOSTERONE. They pass along the sperm duct, combining with fluid from the SEMINAL vesicle before being ESACULATED.



FEMALE REPRODUCTIVE SYSTEM

Sperm are produced continuously in the male from PUBERTY. However, in the female all the immature eggs are already produced by birth. From puberty until the Menopause, the female releases (usually) one egg in a process known as Ovulation. This is part of the 28 day menstrual cycle which is under the influence of several hormones. Label the hormones on the following diagram.



Fill in the following table

Hormone	Site of production	Function
FSH	Pituitary gland	MATURATION OF FOLLICLE (EGG).
LH	PITUITARY GLAND	Involved in ovulation and the production of the 'corpus luteum'
OESTROGEN	Ovary	DEVELOPMENT OF UTERINE LINING
PROGESTERONE	OVARY	Maintain lining of uterus (ENDOMETRIUM)

Fertilisation:

If a sperm and egg do meet the resulting ZYGOTE..... then undergoes a series of cell DIVISIONS..... before it implants in the wall of the uterus, which is now referred to as a BLASTOCYST..... After several days the structure is called an EMBRYO.....which in turn develops into a foetus. During development the foetus is provided with nutrients from the mothers blood supply via the PLACENTA.....This structure allows very close contact between the foetuses and mothers circulations, although the two do not mix. In the space below list 4 substances which may exchange between the two (remember to think it is a two-way process):

1. CO₂.....
2. O₂.....
3. UREA.....
4. GLUCOSE / AMINO ACIDS etc......

In addition to being provided with nutrients the developing foetus is also protected by a sac which contains AMNIOTIC..... fluid.

Secondary sexual characteristics.

These develop at the time of puberty and caused by the release of TESTOSTERONE..... in males and OESTROGEN..... in females. Give some examples below:

Males:

1. INCREASED MUSCLE GROWTH.....
2. FACIAL HAIR.....
3. PUBIC ".....
4. VOICE DEEPENING.....
5. SPERM PRODUCTION.....

Females:

1. WIDENING OF HIPS.....
2. MENSTRUATION.....
3. BREAST DEVELOPMENT.....
4. PUBIC HAIR.....

Inheritance.

The genetic material in cells is made of the molecule DNA..... In human cells it is located in the NUCLEUS....., where it comprises 23.....pairs of CHROMOSOMES.. each of which contains many sections which are known as genes. Each Gene consists of alternative forms called ALLELES.....which cause differences in inherited characteristics.

Define each of the following terms to do with genes:

Dominant:

ONLY ONE COPY OF A DOMINANT ALLELE NEEDED TO BE EXPRESSED IN PHENOTYPE ; IF PRESENT ALWAYS EXPRESSED

Recessive:

NEED TWO COPIES OF A RECESSIVE ALLELE TO BE EXPRESSED IN PHENOTYPE

Homozygous:

BOTH ALLELES IN GENOTYPE ARE THE SAME

Heterozygous:

TWO DIFFERENT ALLELES IN GENOTYPE

Phenotype:

EXPRESSION OF GENOTYPE IN THE ENVIRONMENT - ACTUAL PHYSICAL CHARACTERISTIC/TRAIT

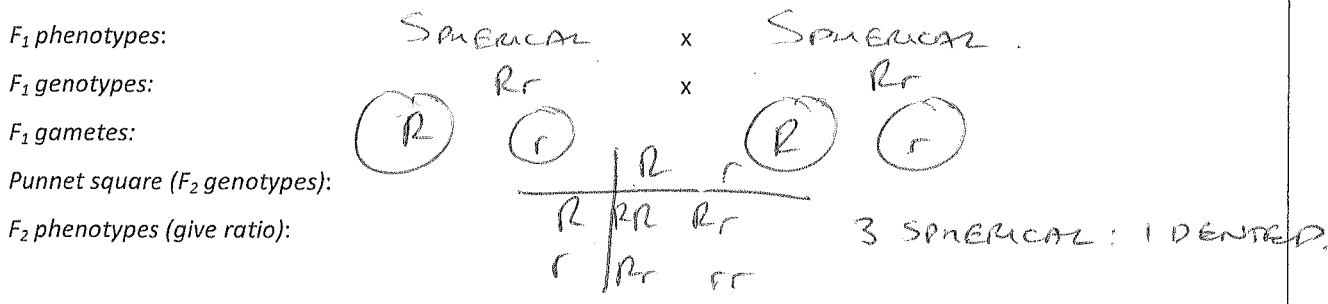
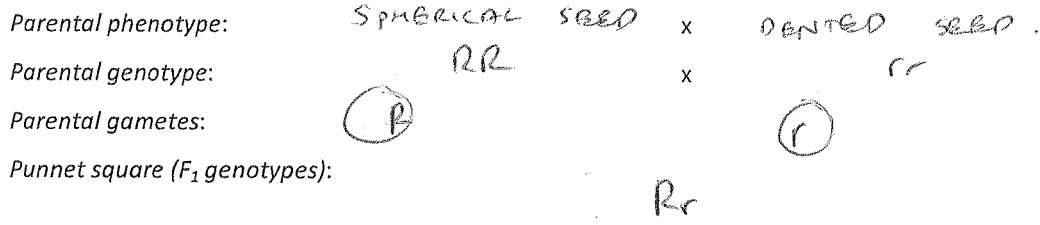
Genotype:

ALLELE COMBINATION FOR A SPECIFIC TRAIT

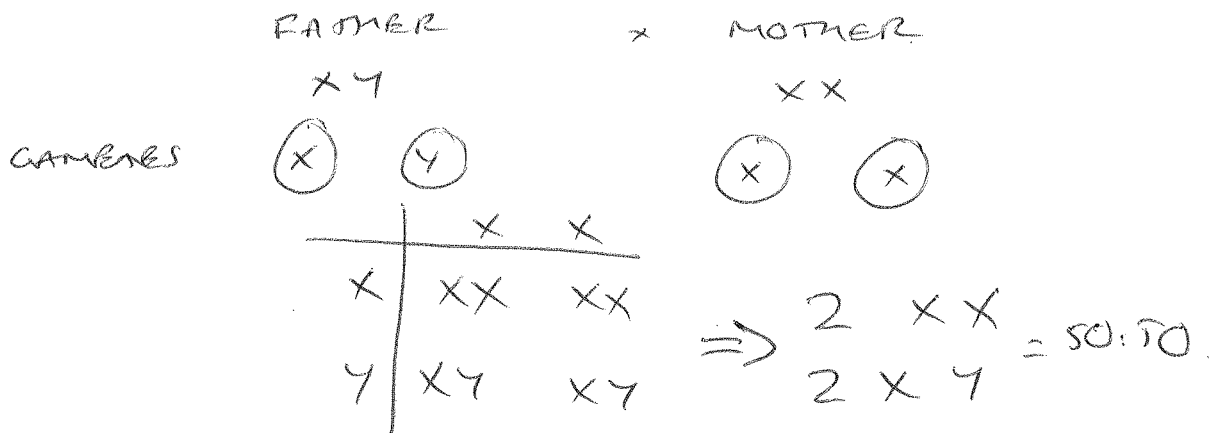
Co-dominance (also give an example):

BOTH ALLELES IN ^{HETEROZYGOUS} GENOTYPE AFFECT PHENOTYPE IN e.g. BLOOD GROUP: $I^A I^B$ GIVES AB

Complete the following diagram of a monohybrid (a single characteristic) cross: homozygous pea plants with spherical seeds were crossed with homozygous plants with dented seeds. (Spherical seeds are the dominant characteristic.) The seeds were collected and allowed to grow into the first generation (F₁). These were allowed to self-pollinate to form a second generation (F₂).

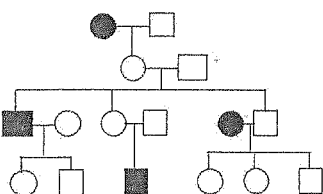


Complete a similar diagram below to show the chance of having a boy or girl is 50:50



In humans one of the best ways to interpret the inheritance of genetic characteristics is by using a pedigree chart. If, for example, the chart shows that the child of two healthy parents has a genetic disease where they have to be homozygous recessive, it shows that the parents must both have a heterozygous genotype.

Human inheritance is best studied using a pedigree chart. An example is seen below. In this chart the coloured squares/circles represent a particular trait e.g. a disease. Such charts are good as they show if a condition is more likely in a particular sex or whether it is dominant or recessive.

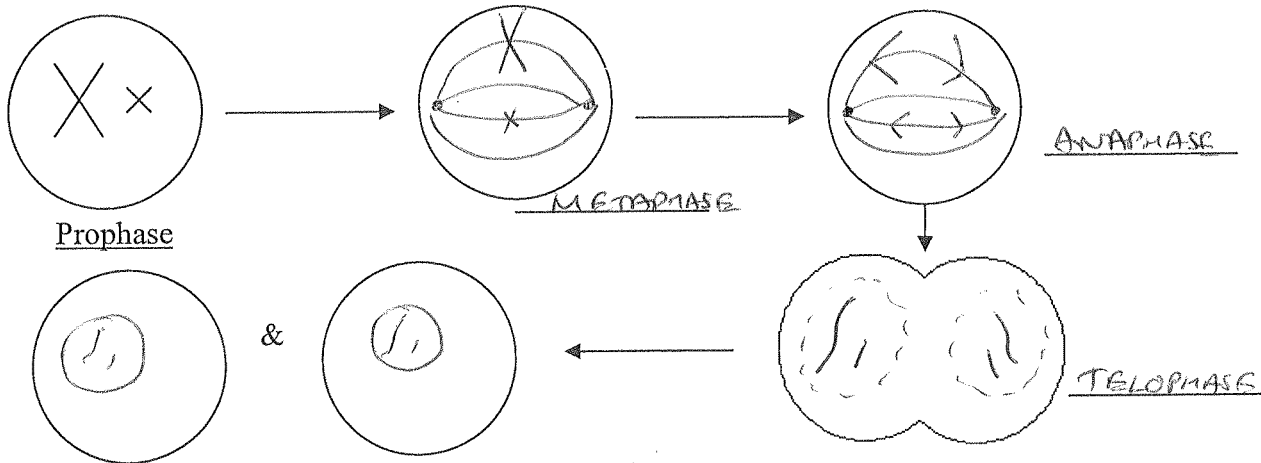


□ = male
 ○ = female

Cell division

To reproduce cells must divide. Therefore the nucleus and all the DNA must also divide. Nuclei can divide by either mitosis or meiosis.

Mitosis is used during, growth, repair, cloning and ASEXUAL reproduction and results in two IDENTICAL cells to the parent. Complete the following diagram of a cell containing two chromosomes (a DIPLOID number of two) as it goes through mitosis:



Meiosis differs from this in that it produces 4 cells with half the amount of genetic material (haploid). Each cell is also genetically DIFFERENT. This process is used in the production of GAMETES for sexual reproduction.

In humans the DIPLOID number is 46, whereas the HAPLOID number is 23.

Meiosis promotes VARIATION in a species. However, the original differences in the DNA of a species is caused by MUTATION. This leads to genetic variation, of course the RANDOM FERTILIZATION also promotes variation

Mutations are RARE and random changes in the DNA which can be passed on. They can be HARMFUL, neutral (i.e. cause no apparent effect, or even BENEFICIAL). The incidence of mutation is increased by exposure to:

X-RAYS, & UV RADIATION, CERTAIN CHEMICALS

Mutant organisms can increase in number by the process of NATURAL selection. This works simply by:

1. All species show variation
2. All species produce MORE offspring than can survive to adulthood.
3. Therefore there is COMPETITION for resources.
4. Only those best ADAPTED to their environment will survive.
5. These will pass on their GENES to the next generation.
6. This characteristic will therefore increase in number with time.

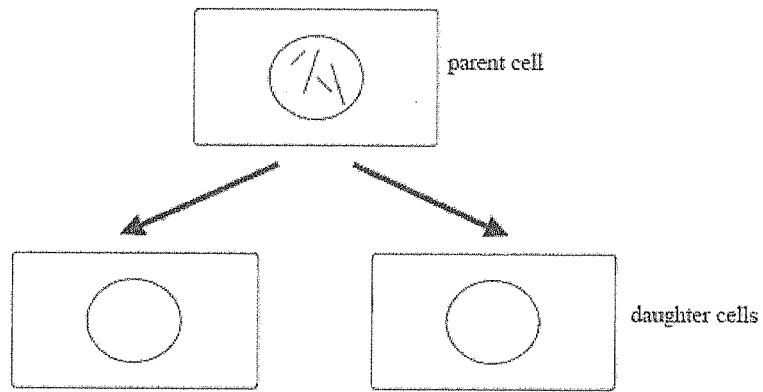
An example of this, in bacteria, is:

..... EXPLANATION OF ANTIBIOTIC RESISTANCE
..... IN BACTERIA

IGCSE Questions

1. (a) Cells can divide by mitosis. The diagram below shows the chromosomes in a parent cell before mitosis takes place.

(i) Complete the diagram to show the chromosomes in each daughter cell.

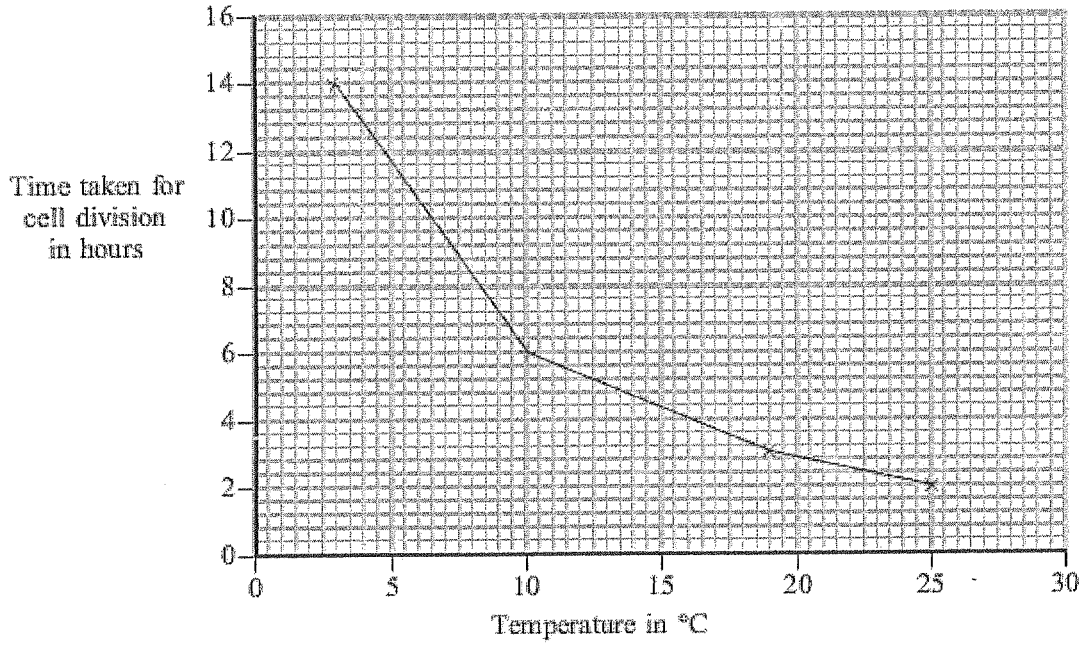


(1)

(ii) What is the diploid number of the parent cell?

.....(1)

(b) The graph below shows the time taken for cells to divide by mitosis at different temperatures.



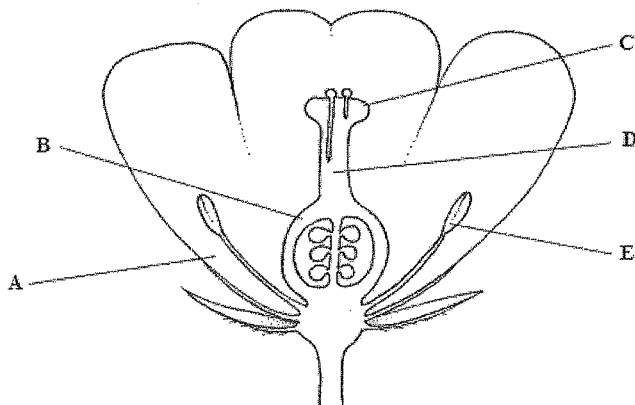
(i) How does the increase in temperature affect the time taken for cell division to occur?
(1)

(ii) Starting with one cell, at 25 °C, how many cells would there be after
 2 hours
 8 hours(2)

Total 5 marks

2. The diagram shows a section through a flower.

(a) Name the parts labelled A, B, C and D.

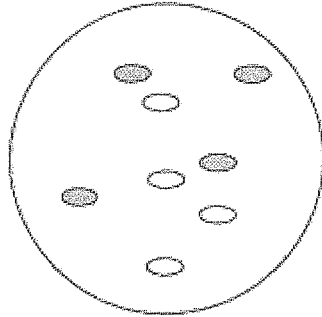


A
 B
 C
 D

(4)

(b) Part E produces pollen. In some flowers the pollen grains contain starch. The gene for making starch in the pollen grains has two alleles. The allele B for making starch is dominant and the allele b is recessive.

Some pollen grains were collected from one flower and tested to see if they contained starch. The diagram below shows the results seen using a light microscope.



Key  pollen grain containing starch

 pollen grain not containing starch

(i) Name the substance used to test for starch.
(1)

(ii) If the pollen grains contain starch, what colour will they be after this test?
(1)

(c) Pollen grains are haploid, so contain only one allele for a character. Look at the diagram in (b) showing the pollen grains.

(i) What is the genotype of the flower that produced these pollen grains? Tick the correct answer.

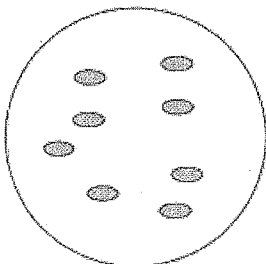
BB (homozygous dominant)

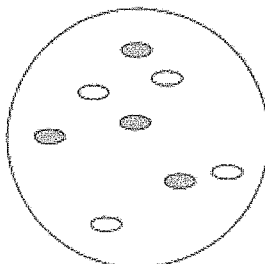
Bb (heterozygous)

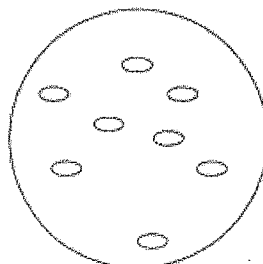
bb (homozygous recessive)

(1)

(ii) Pollen is collected from a flower that is homozygous recessive and tested for starch. Which of the following shows the results you would expect to see? Tick the box under the correct answer.







Total 8
Marks

(1)

3. Cystic fibrosis is an inherited condition. The allele for cystic fibrosis is recessive. The condition develops when a person is homozygous recessive.

(a) How many copies of the allele need to be present for someone to have cystic fibrosis?
.....(1)

(b) The letter **N** is used for the normal allele, and the letter **n** is used for the allele for cystic fibrosis. A mother and father both have the genotype **Nn** and do not have cystic fibrosis. In the space below, complete the genetic diagram to show the genotypes of the gametes of the mother and father and the possible genotypes of their children. You should also state which of the children would develop cystic fibrosis.

	Mother	Father
Genotype of parents	Nn	Nn
Gametes		
Genotype of children		
Does the child develop cystic fibrosis? (yes or no)		

(3)

(c) Scientists can test people to find out if they carry the allele **n**. The test is done on genetic material from inside cells.

(i) Which part of a cell contains genetic material?
.....(1)

(ii) Name the molecule that genetic material is made from.
.....(1)

Total 6 marks

4. Clover is a small plant that is often eaten by snails. Scientists have found two types of clover plant growing on a mountain. They differ in their ability to make a poisonous substance called cyanide. The clover plants that grow at the bottom of the mountain can produce cyanide. They have alleles that make their cells produce small bags of an enzyme in the cytoplasm. If a snail starts to eat the plant the bags are broken and the enzyme is released. The enzyme produces cyanide and so the snails stop eating the clover.

The clover plants that grow at the top of the mountain cannot make cyanide. Their cells have different alleles and do not produce small bags of enzyme. If they did, ice crystals that sometimes

appear in the cytoplasm would burst the bags and kill the plants. It is too cold for snails to survive at the top of the mountain.

(a) Explain why clover plants that make cyanide are found growing at the bottom of the mountain and not at the top of the mountain. Use your understanding of natural selection in your answer.

.....

.....

.....

.....

.....

.....

.....

(5)

(b) All clover plants have swellings called nodules on their roots. These nodules contain nitrogen fixing bacteria. These are one type of bacteria that play an important part in the nitrogen cycle.

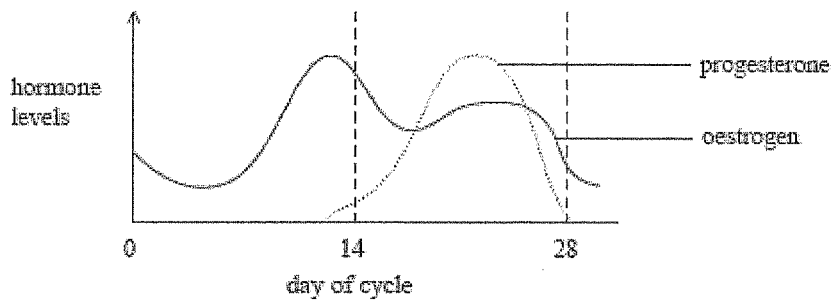
The table shows events that occur in the nitrogen cycle. Complete the table by naming the type of bacteria involved with each event.

Event in the nitrogen cycle	Type of bacteria
Convert nitrite into nitrate	
Convert nitrate into nitrogen gas	
Convert nitrogen gas into ammonium compounds	
Break down dead organic tissue into ammonium compounds	

(4)

Total 9 marks

5. The diagram shows how the levels of oestrogen and progesterone vary in the menstrual cycle.



(a) On the diagram, show how the line for progesterone would change if the woman became pregnant. (1)

(b) Fill in the missing words in the sentences below.

The fusion of a male and female gamete is known as fertilisation, which produces a single cell called a This cell divides and develops into an, which is protected by fluid in the uterus. (3)

(c) Which type of reproduction involves gametes?
.....(1)

Total 5 marks

6. Huntington's disease is a genetic condition that affects the nervous system. Huntington's disease is caused by a dominant allele, **H**. The condition does not develop until middle age (around 40 years old).

(a) A couple plan to have children. The father is heterozygous for Huntington's disease and the mother is homozygous recessive.

(i) Draw a genetic diagram to show the genotypes of the parents, the gametes and the possible genotypes and phenotypes of their children. Use **H** to represent the allele for Huntington's disease and **h** to represent the normal allele.

(4)

(ii) What is the probability of this couple producing a child who will not develop the disease?

.....(1)

(b) The symptoms of the disease do not appear until middle age. Suggest why this makes it unlikely that Huntington's disease will disappear from the population.

.....
.....

(2)

(c) Huntington's disease affects the brain. The brain is part of the central nervous system.

(i) Name the **other** part of the central nervous system.

.....(1)

(ii) Some reflex actions, such as withdrawal of a finger from a hot object, do not involve the brain.

Explain how a reflex arc helps in the withdrawal of a finger from a hot object.

.....
.....
.....
.....
.....
.....
.....(5)

Total 13 marks



- 1.
- (a) (i) both with four chromosomes; (1)
 - (ii) 4; (1)
 - (b) (i) takes less time / quicker / eq; (1)
 - (ii) 2 hours: 2; (1)
 - 8 hours: 16; (2)

Total 5 marks

- 2.
- (a) petal / corolla / perianth / tepals; (4)
 - ovary / carpel / pistil;
 - stigma;
 - style;
 - (b) (i) iodine; (1)
 - (ii) blue / black / blue-black; (1)
 - (c) (i) Bb (heterozygous); (1)
 - (ii) third box along; (1)

Total 8 marks

- 3.
- (a) two; (1)
 - (b) N n N n;
 - Nn Nn NN nn;
 - no no no yes; (3)
 - (c) (i) nucleus / chromosome;
 - (ii) DNA; (2)

Total 6 marks

4.

(a) bottom: plants make cyanide;
 snails leave plants / do not eat plants;
 plants survive;
 (advantage to have) gene / allele for cyanide/
 enzyme;
 reproduce; (ONCE)
 pass on ability / gene / allele to make cyanide;
 (ONCE)

top: plants do not make cyanide;
 no snails;
 cold;
 cyanide would kill plants;
 (disadvantage to have) allele gene / allele for
 cyanide/enzyme;
 ice bursts bags / enzymes would be released;
 reproduce; max
 pass on ability / gene / allele not to make cyanide; (5)

(b) nitrifying;
 denitrifying;
 nitrogen fixing;
 decomposing / decomposers; (4)

Total 9 marks

5.

Question Number	Question		
	(a)		
	Acceptable Answers	Reject	Mark
	dotted line remains high after the peak;		(1)

Question Number	Question		
	(b)		
	Acceptable Answers	Reject	Mark
	zygote; embryo; amniotic;		(3)

Question Number	Question		
	(c)		
	Acceptable Answers	Reject	Mark
	sexual;		(1)

Total 5 marks

6. (a) (i) parent genotypes: male + Hh female + hh;
gametes: H h (h) h;
offspring genotypes: Hh and hh;
offspring phenotypes: Huntington's disease, normal; 4
- (ii) 50% / 0.5 / ½ / 1:1 / 1 in 2; 1
- (b) would have children already / gene already passed on;
didn't know they had Huntington's; 2
- (c) (i) spinal cord; 1
(ii) receptors;
sensory / afferent neurones;
relay neurones / spinal cord;
motor / efferent neurones;
muscles / effector;
contracts;
synapse;
no brain involved; max
quicker; 5

Total 13 marks

