

# **Revision Booklet 2022-2023** **Edexcel IGCSE(9-1) in Biology**

## **Part 2: Sections 3, 4 & 5 of the specification**

**3. Reproduction and inheritance**

**4. Ecology and the environment**

**5. Use of Biological resources**

*This revision booklet has been made to follow the specification point by point and it has questions based on each point.*

## Section 3: Reproduction and Inheritance

### 3.1 – 3.2 Reproduction in organisms

Compare the differences between sexual and asexual reproduction

	Sexual	Asexual
Number of parents		
Gametes involved		
Genetically identical to parents		
Genetic variation in the offspring		
Anything else?		
Anything else?		

What are gametes?

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What does fertilisation mean? Use the words **gamete**, **zygote**, **fuse**, **nucleus** in your answer

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What must happen for the zygote to develop into an embryo made of many cells?

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### 3.3 – 3.7 Reproduction in flowering plants

Complete the following table on parts of the flower

Part	Function	Adaptation for pollination (fill in if necessary)
Petal		
Anther		
Filament		
Stigma		
Ovary		
Ovule		
Pollen		
Nectary		
Sepal		

What is pollination?

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What is cross pollination?

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In the boxes describe, and explain how each type of plant is pollinated (insect or wind pollinated) (*hint – think about the positions of the stamen and carpel and each part is adapted for its function*)

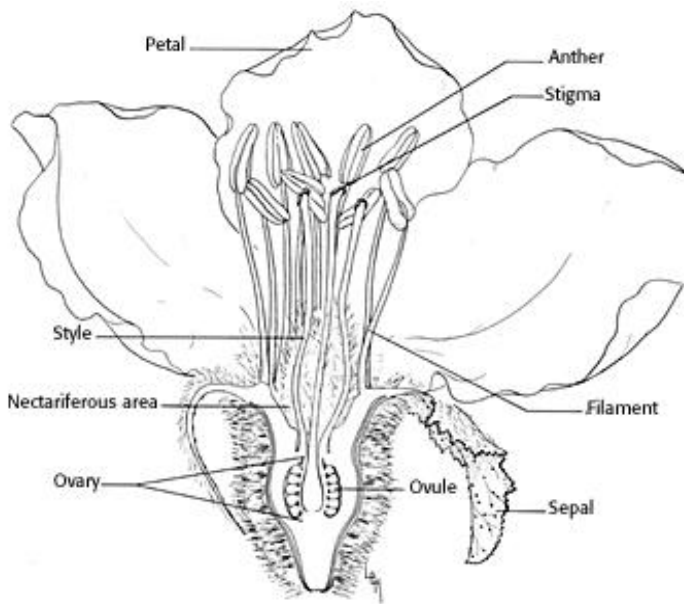


Figure 165. - Longitudinal section of 'Smyrna' quince flower, x4.

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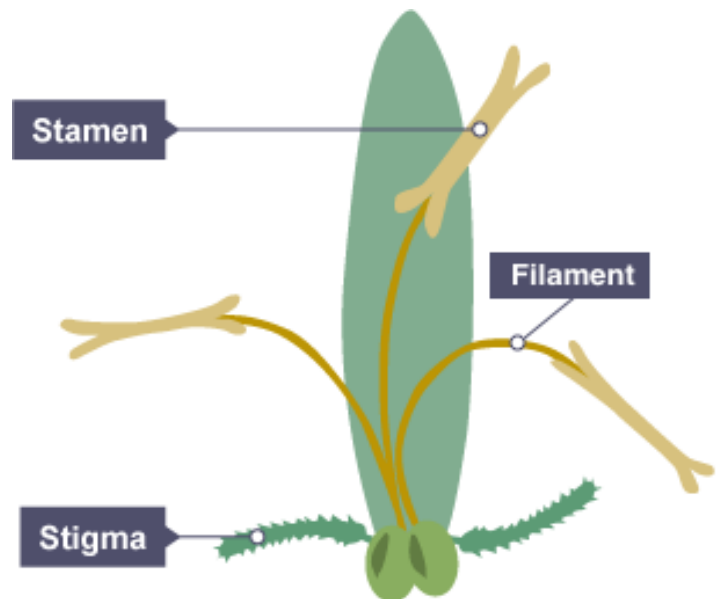
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What are the main differences between insect pollinated and wind pollinated flowers?

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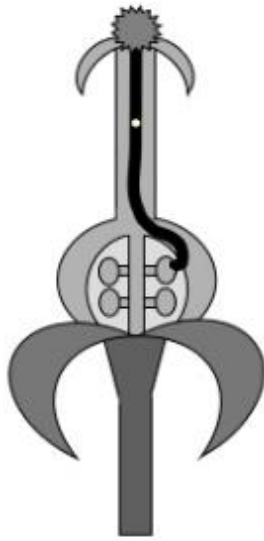


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What is happening in this picture? Use the words **pollen tube**, **style**, **ovule**, **fertilisation**, **nucleus**, **fuse**



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Describe what happens to the flower after fertilisation occurs:

- Petals: .....
- Fertilised ovule: .....
- Ovary: .....

What is Germination?

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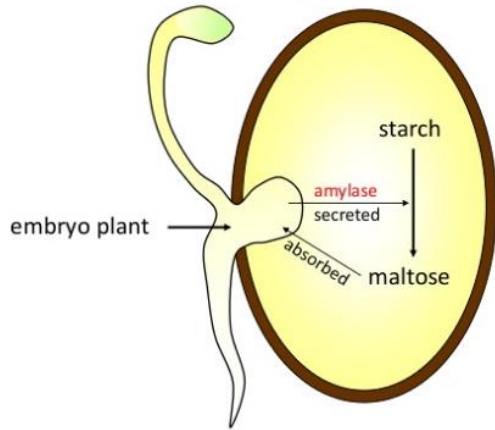
What are the conditions needed for a seed to germinate?

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Enzymes are used in seed germination



In the diagram label the **radicle**, **plumule**, **cotyledon**

What is the food store in the cotyledon mainly comprised of?

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Why do the radicle and plumule need a food source? (*hint: can photosynthesis happen yet?*)

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When is germination considered to be over?

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What life process do the cells in the seed undergo as it is germinating?

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Why doesn't the seed photosynthesis straight away?

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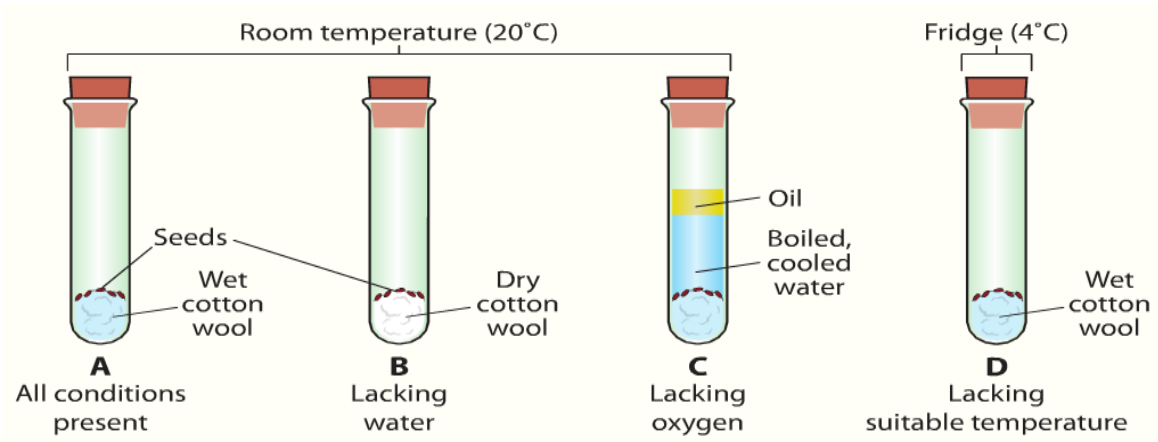
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What would happen if the seed was buried too deep?

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**3.5 Practical:** This diagram shows an experiment to investigate the conditions needed for seeds to germinate.



Describe what would happen to the seeds in test tube A

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Describe what would happen to the seeds in test tube B

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Describe what would happen to the seeds in test tube C

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Describe what would happen to the seeds in test tube D

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Explain why you would expect the results you described for the seeds in the different test tubes

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Some plants can reproduce asexually via natural methods or artificial methods. Describe these two methods of asexual reproduction in plants:

<b>Natural</b> methods	<b>Artificial</b> methods
Runners –	Cuttings –

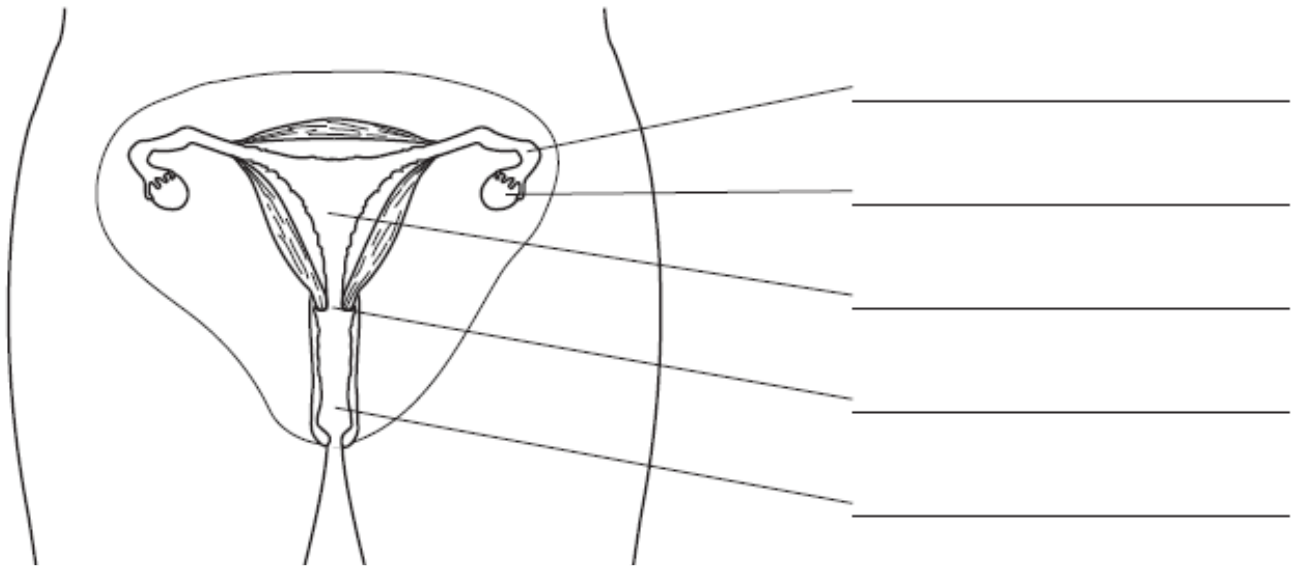
What are two other ways that some plants can reproduce asexually?

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### 3.8 – 3.13 Reproduction in Humans

Label these parts of the female reproductive system.



How is each part of the female reproductive system adapted for its function?

Ovary: .....

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Oviduct (*include the ciliated cells in your description*): .....

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Uterus: .....

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Cervix: .....

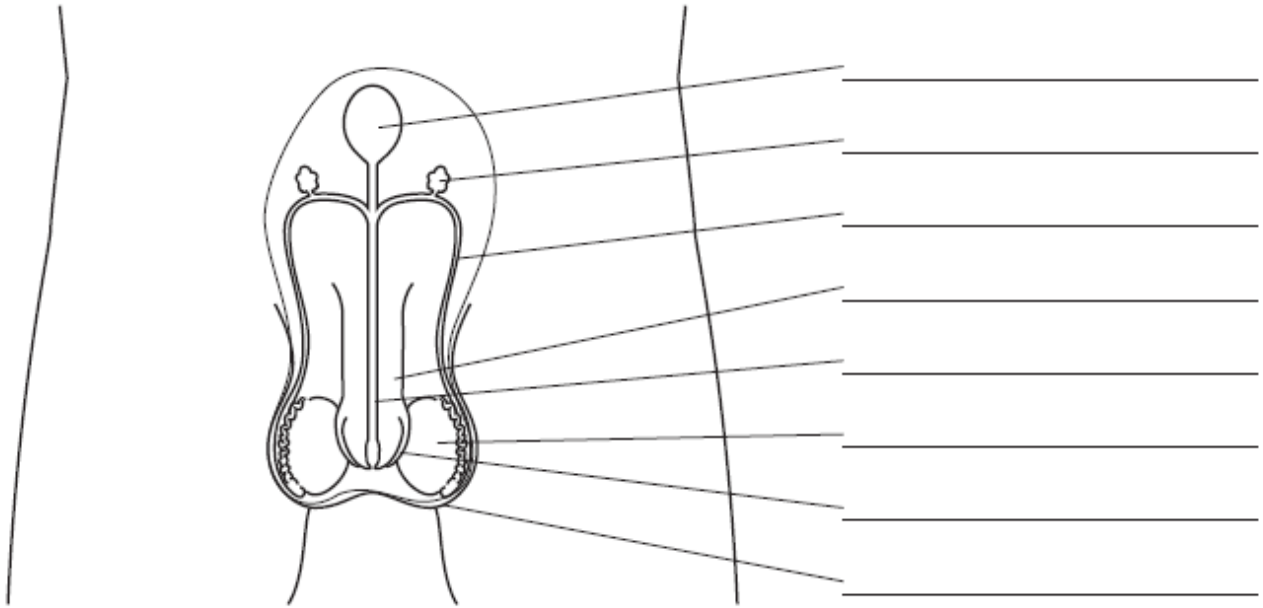
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Vagina: .....

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Label the male reproductive system.



What does each part of the male reproductive system do?

Testes: .....

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Sperm duct: .....

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Seminal glands: .....

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Scrotum: .....

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Erectile tissue: .....

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Urethra: .....

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Penis: .....

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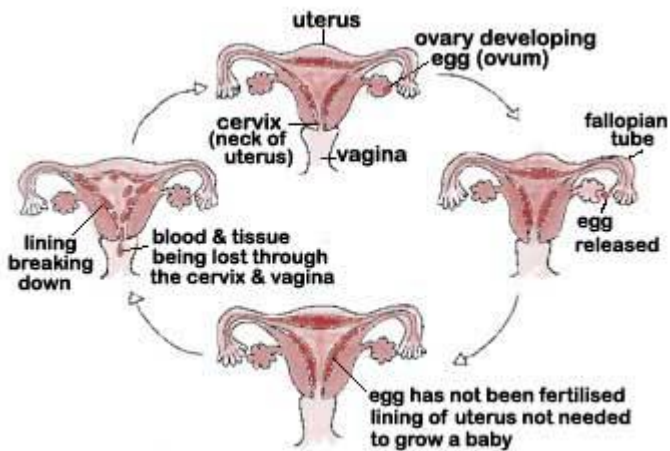
Where is oestrogen produced?

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Where is progesterone produced?

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Describe what happens to the lining of the uterus during the menstrual cycle



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What role does oestrogen have in the menstrual cycle?

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What role does progesterone have in the menstrual cycle?

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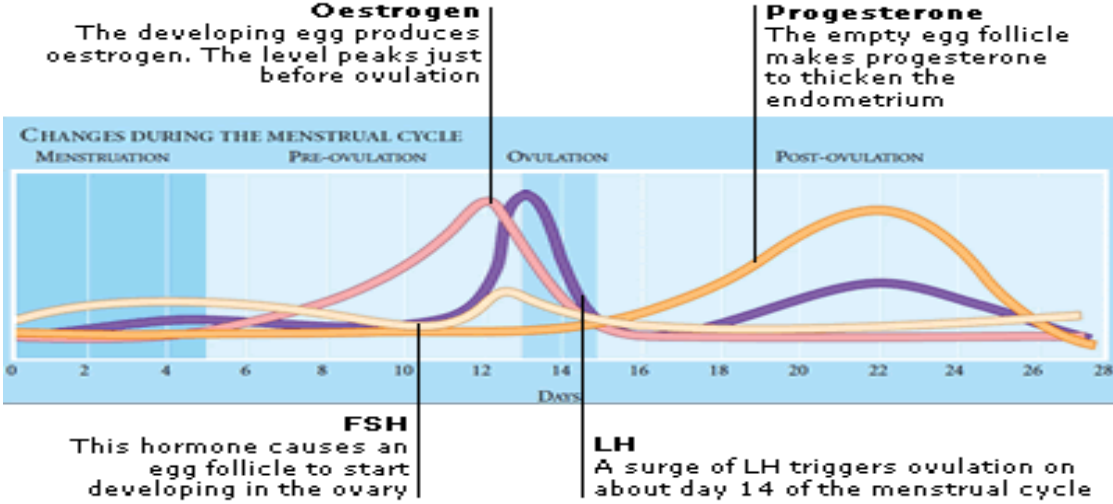
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What does FSH stand for? .....

What does LH stand for? .....

Where are FSH and LH produced? .....

Look at this graph



What is the role of FSH in the menstrual cycle?

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What is the role of LH in the menstrual cycle?

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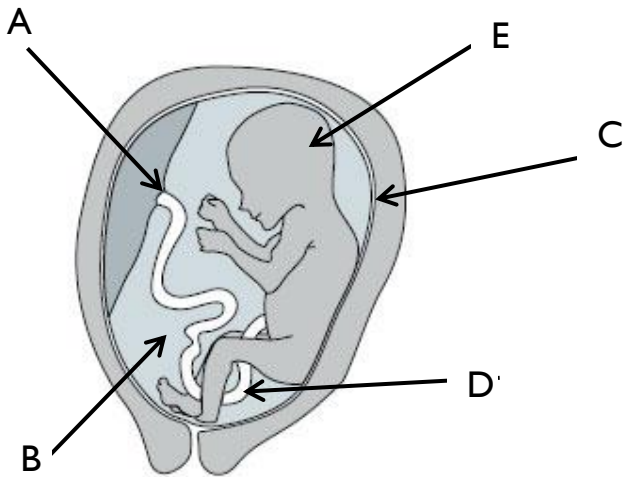
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What day in the menstrual cycle does ovulation occur on? .....

Which days does menstruation occur on? .....

The next few questions will be about the placenta and the role of the amniotic fluid in embryonic development

Label the diagram



- A .....
- B .....
- C .....
- D .....
- E .....

The placenta develops from foetal tissues and allows the ..... of materials between mother and foetus. It has a large number of blood vessels that do not touch. This ensures there is no ..... of the maternal and foetal blood.

Give three reasons why it is important that the maternal and foetal blood do not mix.

- 1.....
2. ....
3. ....

Which substances diffuse from the mother's blood into the foetus? (nutrients as well as 'protective proteins')

Explain why the embryo needs each of the above.

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Which substances diffuse from the foetus' blood into the mother's blood and why is it important that they are removed?

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What is the role of the amniotic fluid?

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What would happen to the baby if there was no amniotic fluid around it?

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Complete the table on how the amniotic fluid protects the developing embryo

Protects embryo against:	How it does this:
Damage	
Variable temperatures	

Where is testosterone made in males?

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Where is oestrogen made in females?

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What changes in the human body do these hormones cause during puberty?

Oestrogen	Testosterone

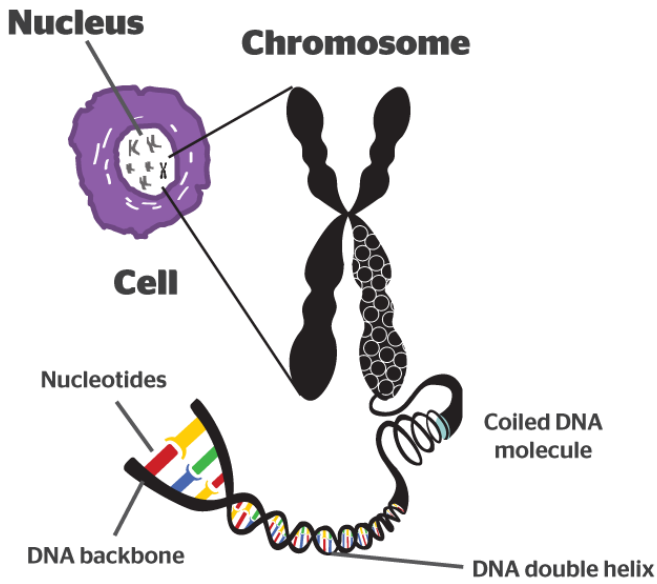
What are secondary sexual characteristics?

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### 3.14 – 3.34 Inheritance



What is the genome of an organism?

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What is a chromosome?

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Where are chromosomes found inside the cell?

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What is a gene?

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What do genes do?

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Describe the structure of DNA – use the words: **Bases, double-stranded, double helix, strands, paired bases**



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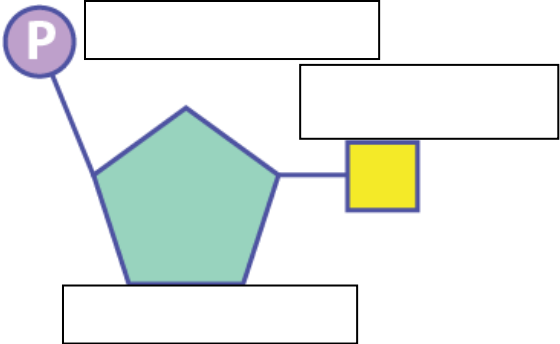
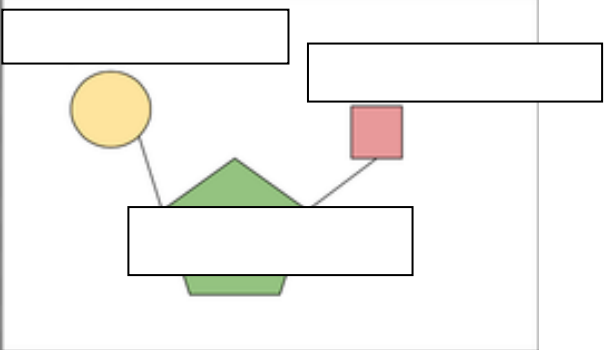
What are the names of the bases?

A: ..... T: ..... C: ..... G: .....

How do these bases pair up?

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Label the parts of the DNA and RNA nucleotides	
<p><b>DNA</b></p> 	<p><b>RNA</b></p> 

What are the differences between DNA and RNA?

Type of sugar			
Bases present			
Double or single stranded?			



**Reminder: what is the definition of a gene?**

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What is mRNA?

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What are ribosomes?

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What is tRNA?

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What is a codon and where are they found?

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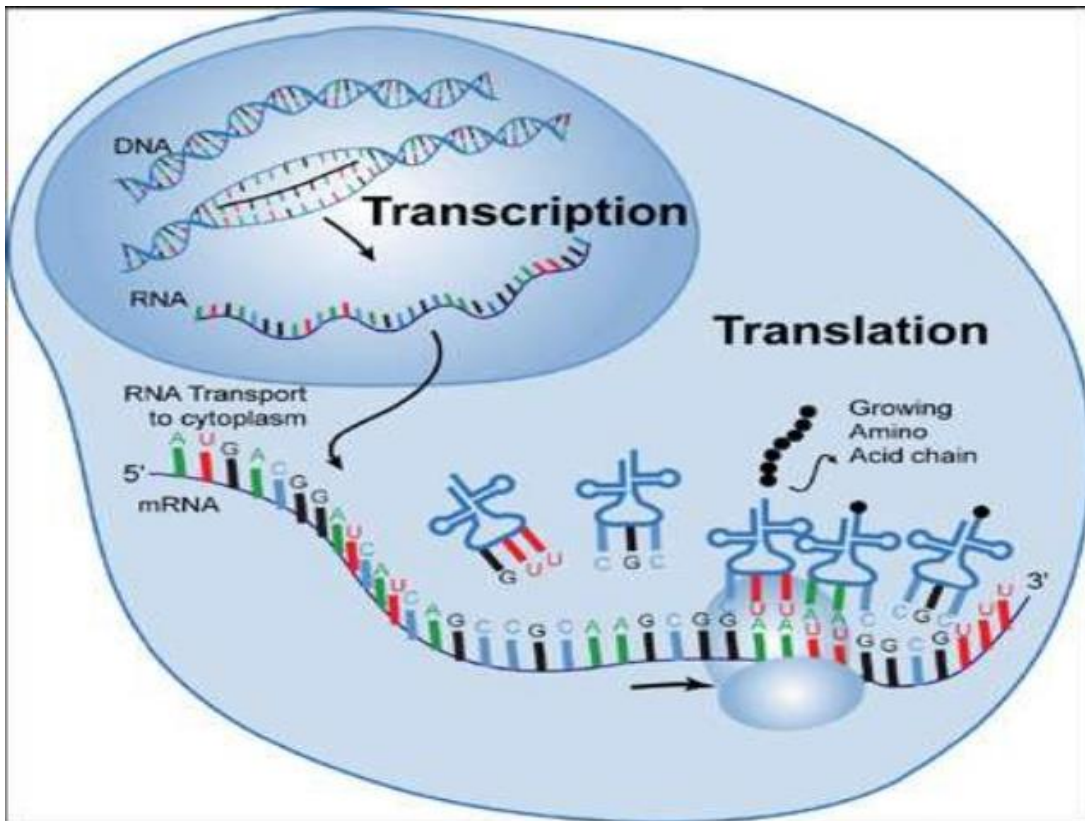
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What is an anticodon and where are they found?

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This is a diagram of transcription and translation. It shows how proteins are synthesised.



Describe the process of transcription and translation: Use the terms mRNA, ribosomes, tRNA, codons, anticodons and complimentary base pairing.

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What is an allele?

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Why do alleles give rise to differences in inherited characteristics?

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Define these terms and give examples of them:

Dominant: .....

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Recessive: .....

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Homozygous: .....

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Heterozygous: .....

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Phenotype: .....

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Genotype: .....

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What is meant by codominance?

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How are blood groups an example of codominance?

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What does **polygenic** mean?

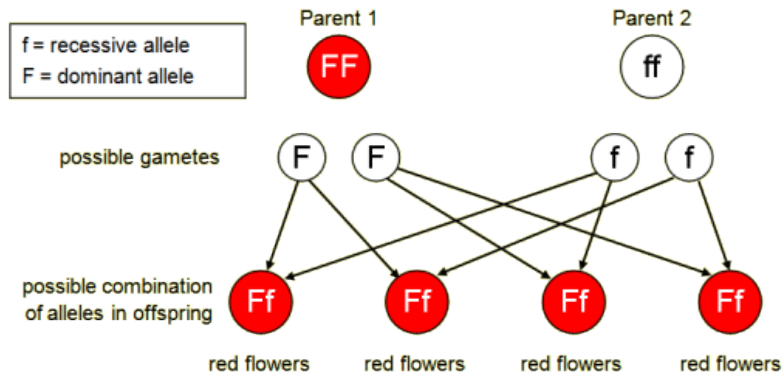
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Give an example of a polygenic inherited characteristic.

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Look at this genetic diagram and answer the following questions on it:



i. Why do the parents have a double letter to show their genotype?

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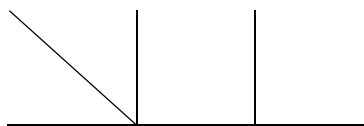
ii. Why do the gametes only have one letter to show their genotype?

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iii. How else can you represent this genetic cross? (please draw a punnett square)

iv. What would the genetic cross/punnett square look like if the offspring are allowed to self-fertilise




v. What would the ratio of red flowers to non-red flowers (the phenotype) be in the offspring?

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vi. What would the ratio of genotypes of the offspring be?

: :

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vii. What would the probability of the offsprings' phenotype (red/non-red) if you crossed:

Ff x ff:

/		

Ff x FF:

/		



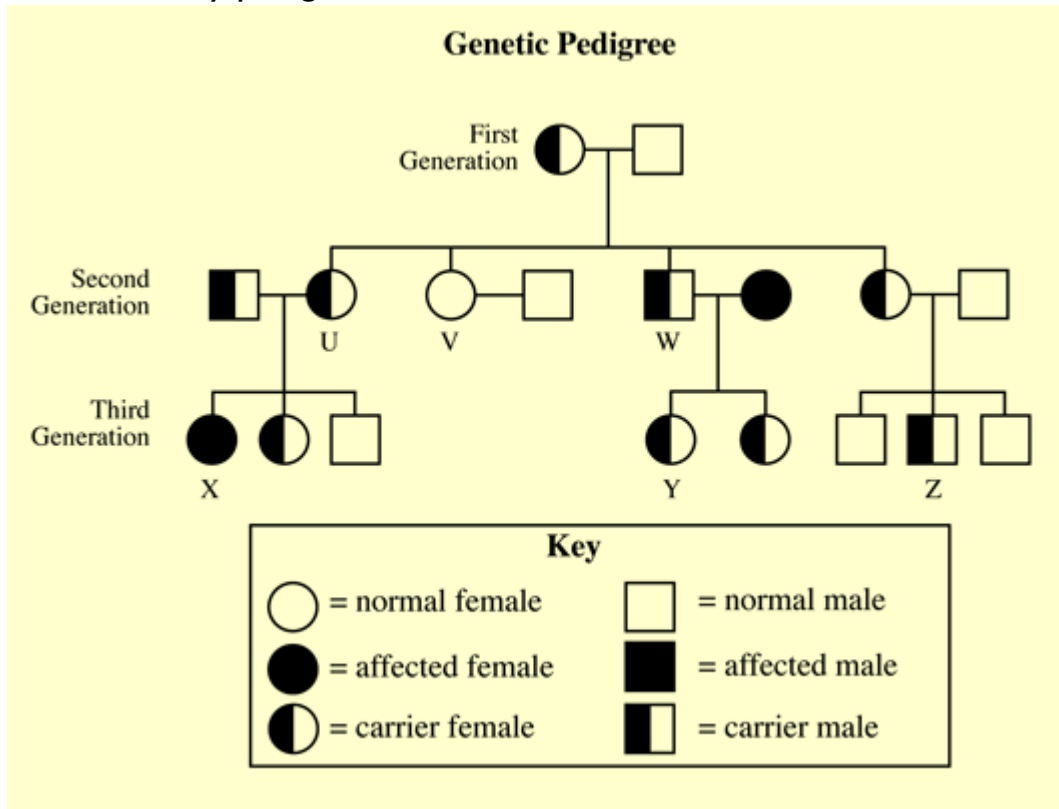


EXAM PAPERS PRACTICE

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This is a family pedigree chart of an inheritable disease



a) What is meant by a carrier?

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b) Why would the carrier be phenotypically normal?

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c) Is this disease caused by a dominant or recessive allele? Explain your answer

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d) What would the probability be of the offspring getting the disease if a carrier had children with an unaffected person? Show your working out using a Punnett square

What are the sex chromosomes? How are they commonly displayed?

Female: .....

Male: .....

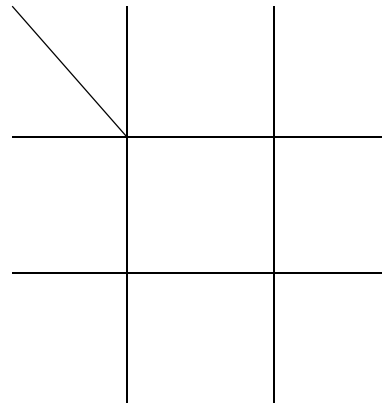
Why is this comment true? *'The sex of the offspring is determined by the sperm'*

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Draw a genetic diagram (or a Punnett square) to show why the probability of having male or female offspring is 50:50

**Genetic Diagram**

**Punnett Square**



What do these terms mean?

- Diploid .....

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- Haploid .....

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Describe the process of **mitosis**

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How many daughter cells are produced in mitosis? .....

Why do the daughter cells have genetically identical chromosomes?

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In organisms that have a nucleus (**not bacteria!**) what is mitosis for?

1. ....

2. ....

3. ....

4. ....

Describe the general process of **meiosis** (you do not need to go into much detail about the parts of the process – just explain it generally) include: *number of daughter cells produced, haploid or diploid, genetically identical or not?*

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What is the purpose of meiosis?

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What is variation?

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What is random fertilisation?

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Why does random fertilisation of gametes help produce genetic variation in offspring?

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What is the diploid and haploid number of chromosomes in **humans**? (Remember that different species have different numbers of chromosomes e.g. hedgehog  $2n=88$ , tobacco  $2n=48$ )

Diploid ( $2n$ ): .....

Haploid ( $n$ ): .....

Explain how variation within a species can be caused by either genetics, the environment, or a combination of both.

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List a few variations caused by each factor

Genetic	Environmental	Both

Define what a mutation is

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What are the different types of mutation?

*Duplication:*.....

*Deletion:* .....

*Substitution:* .....

*Inversion:* .....

How can the phenotype of an organism be affected by a change in DNA?

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Why can the shape and function of proteins be affected by a mutation?

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Most DNA in an organism is non-coding DNA (what used to be called junk DNA). Why would a mutation in non-coding DNA not necessarily affect the phenotype?

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What is a mutagen?

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Give examples of these two different types of mutagen:

Ionising radiation: .....

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Chemical mutagens: .....

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Define what survival of the fittest means

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
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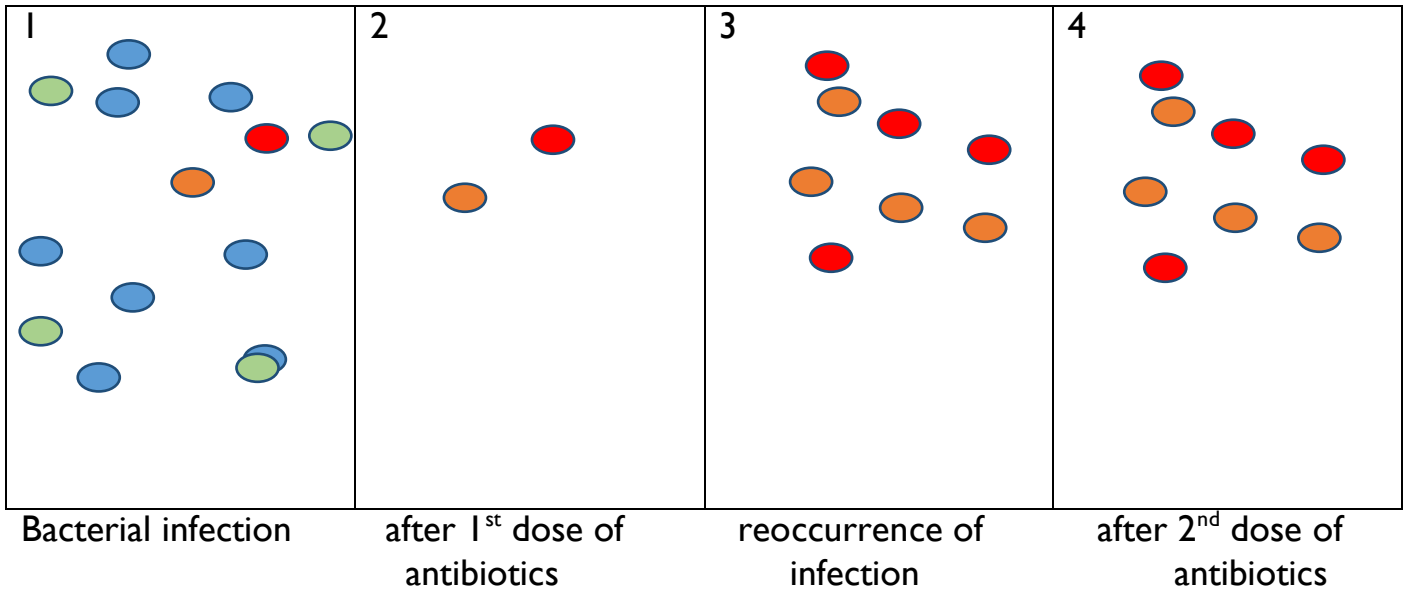
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Outline in bullet points how Darwin's theory of evolution by natural selection occurs:

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- .....
- .....
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Explain using the principles of natural selection how resistance to antibiotic in bacterial populations occur

Key:  +  = non-resistant bacteria (will get killed by antibiotics)  
 +  = Bacteria with mutations that make them resistant to antibiotics



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Why would infections be difficult to control if bacteria are antibiotic resistant?

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## **Section 4: Ecology and the environment**

### **4.1 – 4.5 The organism in the environment**

Define these terms:

Population	
Community	
Habitat	
Ecosystem	

What is a quadrat and what is it used for?

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Why must the placing of a quadrat be random?

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How can you set a quadrat randomly?

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**4.2 practical:** investigate the population size of an organism in two different areas using quadrats

There are two areas in a field that are used differently. Area A gets trampled more than area B. Design an experiment that will allow you to set random quadrats in both areas to work out the mean number of dandelions per m<sup>2</sup> in each area. What could your hypothesis be?

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What does the term biodiversity mean?

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What is species richness?

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What does the relative abundance of each species mean?

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Why is high biodiversity considered a good thing for an ecosystem?

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**4.4 Practical: investigate the distribution of organisms in their habitats and measure biodiversity using quadrats.**

There are two areas that seem to contain different numbers of various plant species. How could you use quadrats to determine the biodiversity of each area.

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What are abiotic factors? .....

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What are biotic factors? .....

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How can the population size and distribution of organisms be affected by:

- Abiotic factors like:

Light intensity: .....

Temperature: .....

Water availability: .....

Oxygen concentration: .....

Pollution: .....

- Biotic factors like:

Availability of food: .....

Competition for food: .....

Predation: .....

Parasitism: .....

Disease: .....

Availability of nest sites: .....

## **4.6 - 4.9 Feeding relationships**

What is a food chain?

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Where does the energy ultimately come from to start a food chain?

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What do the arrows represent in a food chain?

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What is a trophic level?

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Define the terms:

Producer	
Primary Consumer	
Secondary Consumer	
Tertiary Consumer	

<p style="text-align: center;">Decomposers (what are the two main types of decomposer?)</p>	
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What is the difference between a food chain and a food web?

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Sketch a pyramid of numbers, pyramid of biomass, and a pyramid of energy transfer from this food chain: 1 x Oak tree (10,000Kg), 1000 x caterpillars (10Kg), 20 x Blackbirds (5Kg), 1 x hawk (0.5Kg)

<p style="text-align: center;">Pyramid of numbers</p>	
<p style="text-align: center;">Pyramid of Biomass</p>	
<p style="text-align: center;">Pyramid of Energy transfer</p>	

Why are pyramids of numbers not a good representation of the feeding relationships in a food chain?

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Why are pyramids of energy a better way to represent the feeding relationships in a food chain?

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What is energy used for in living organisms?

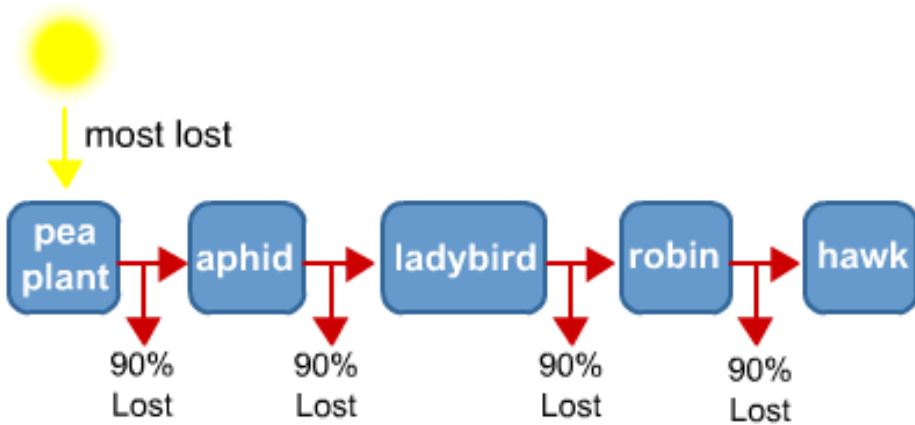
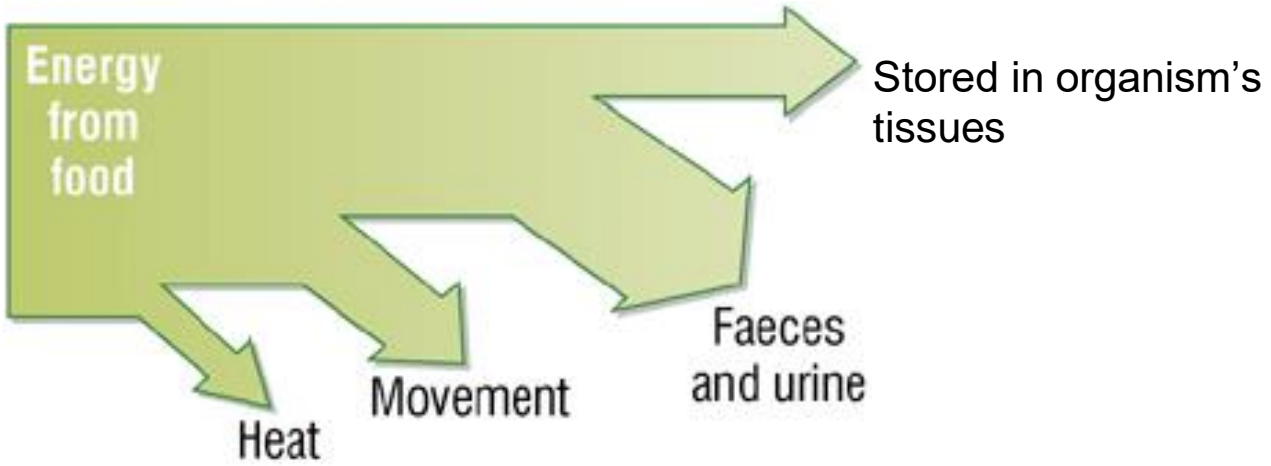
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Using the answer that you wrote in the question above, as well as these diagrams explain why only 10% of energy is passed on to the next trophic level and 90% is lost.



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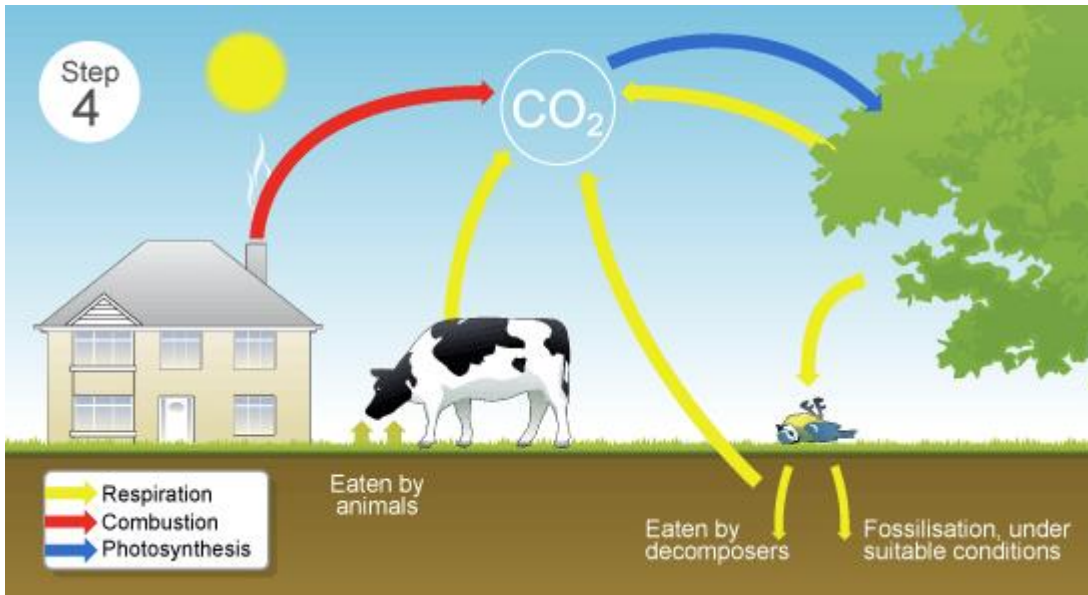
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### 4.10 – 4.11 Cycles within ecosystems

Carbon cycle: Describe the stages in the carbon cycle including these words – *respiration*, *photosynthesis*, *decomposition*, and *combustion*.



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Nitrogen cycle: All of the next questions are based on the nitrogen cycle

i) What is the composition of air?

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ii) What do organisms use nitrogen for?

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iii) What is the role of nitrogen fixing bacteria?

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iv) Where can you find nitrogen fixing bacteria?

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v) What is the role of decomposers?

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vi) What is the role of nitrifying bacteria?

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vii) What is the role of denitrifying bacteria?

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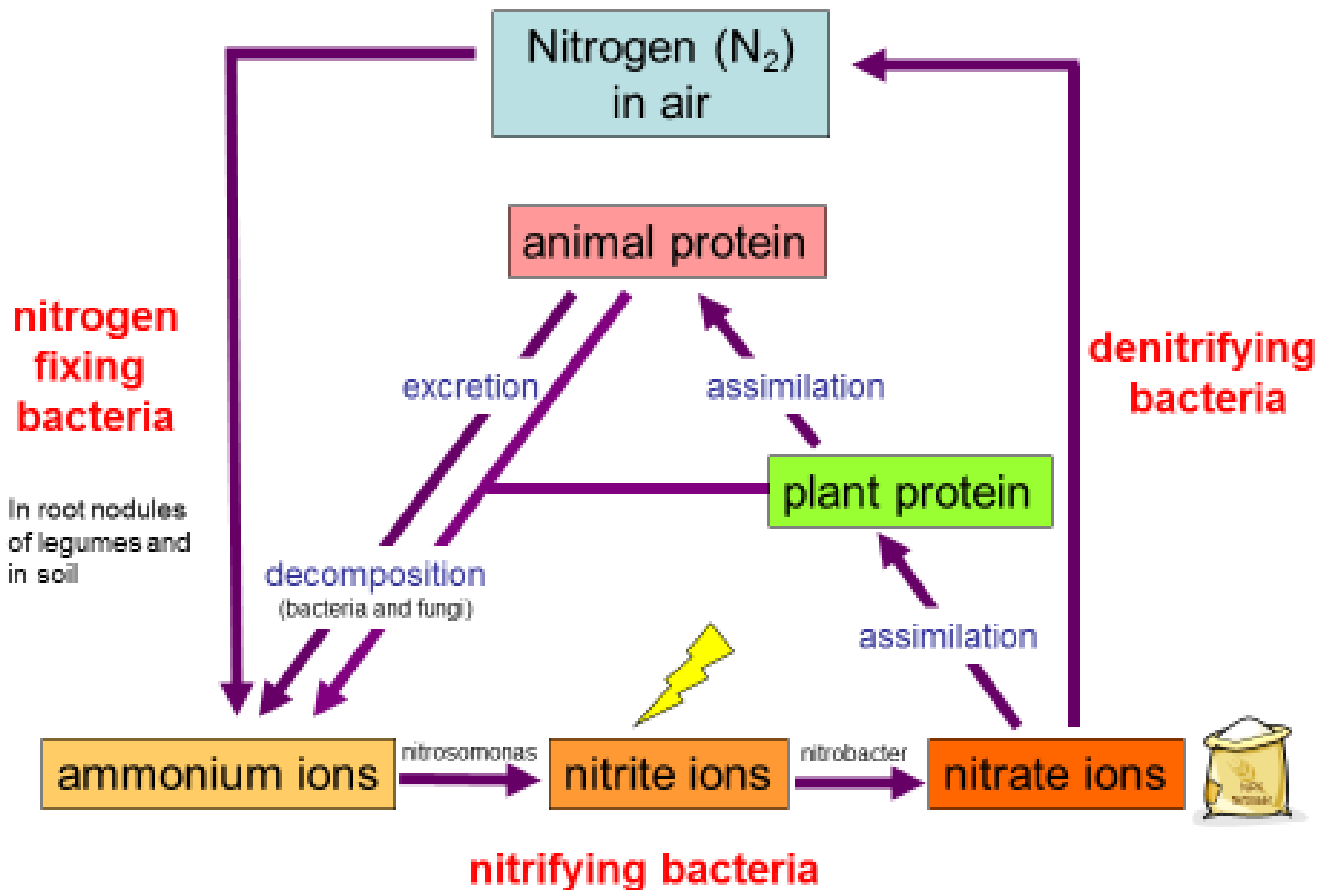
viii) How do plants get their nitrogen?

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ix) How do animals get their nitrogen?

x) Why can farmers use manure to help fertilise their fields?

Use this diagram to help you remember the nitrogen cycle. **Remember that you do not need to know the specific names of the types of bacteria in the nitrogen cycle**



## 4.12 – 4.18 Human influences on the environment

How is sulfur dioxide and carbon monoxide produced?

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Explain what acid rain is and how it is formed.

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How does sulfur dioxide and carbon monoxide affect the body?

Sulfur Dioxide.....

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Carbon Monoxide.....

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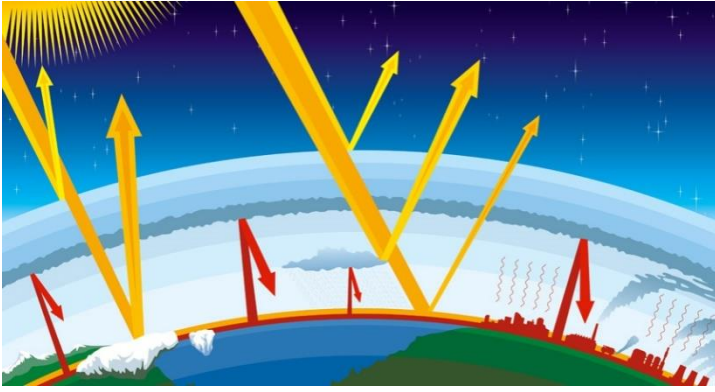
Explain what a greenhouse gas is.

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Name the 5 greenhouse gases that you need to know (*from the specification*)

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- .....
- .....
- .....
- .....

Use this diagram to help explain the greenhouse effect



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How do human activities contribute to greenhouse gases?

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If greenhouse gases increase in the atmosphere, explain how this could lead to global warming.

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What are the possible consequences of global warming?

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Why does the oxygen content of water decrease if it has been polluted with sewage?  
 Include in your answer *the increase of microorganisms*.

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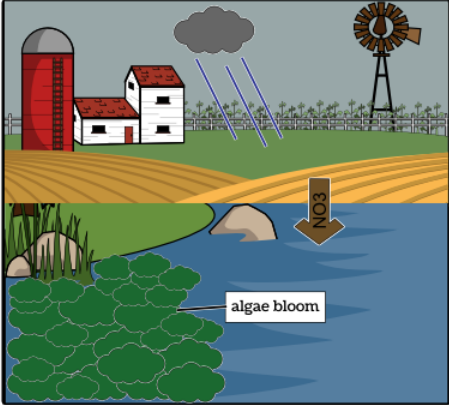
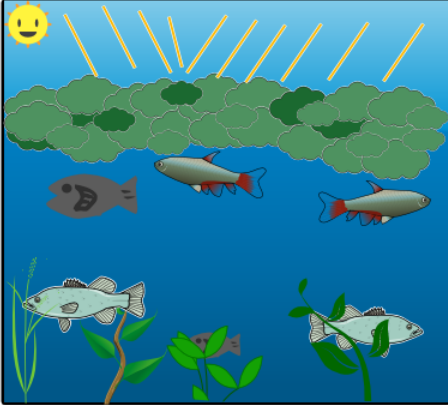
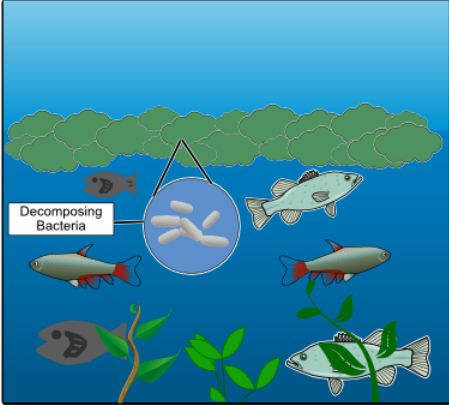
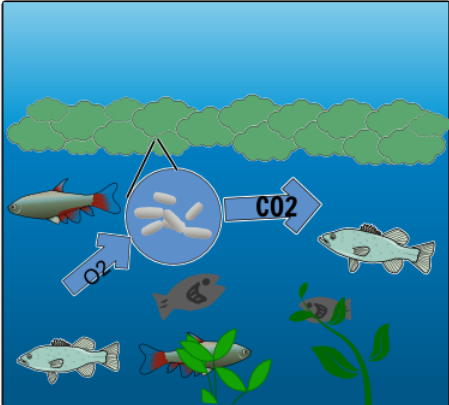
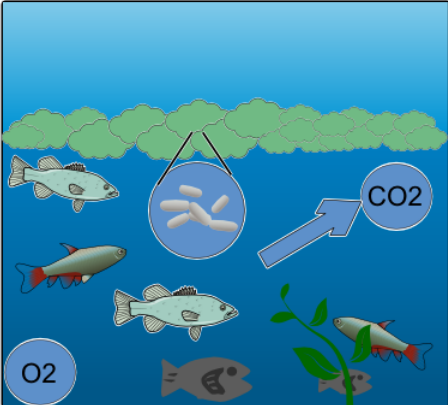
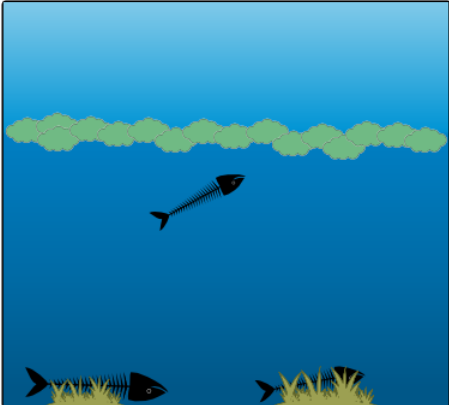
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Use this comic strip to outline how eutrophication works

What is deforestation?

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How does deforestation effect:

Soil leaching: .....

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Soil erosion: .....

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Disturbance of evapotranspiration and the carbon cycle: .....

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The balance of atmospheric oxygen and carbon dioxide:

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## **Section 5: Use of Biological Resources**

### **5.1 – 5.4 Food production with crop plants**

Define what is meant by yield when talking about crop plants

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Describe how polythene tunnels and glasshouses can be used to increase yield of certain crops

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Explain in what 2 ways how putting a gas burner inside a glasshouse could help increase crop yield (what does burning gas produce that will help plants grow?)

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What mineral ions do fertilisers contain?

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How do fertilisers increase crop yield?

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Define what a pest is

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In what ways can pests lower crop yields?

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.....

What is a pesticide?

.....

Define what biological control is

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.....

Write down the advantages and disadvantages between using pesticides and biological control

	Pesticides	Biological control
Advantages		
Disadvantages		

Give an example of a biological control

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**5.5 – 5.8 Food production with microorganisms**

Write the word equation of anaerobic respiration in yeast

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What does fermentation mean?

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.....

Why is yeast used to make alcoholic beverages?

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When making beer where do the sugars come from to make the yeast respire?

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Describe how yeast is used in bread making

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Explain why unleavened bread does not rise whereas other breads do rise. (*What causes the bread to rise?*)

.....

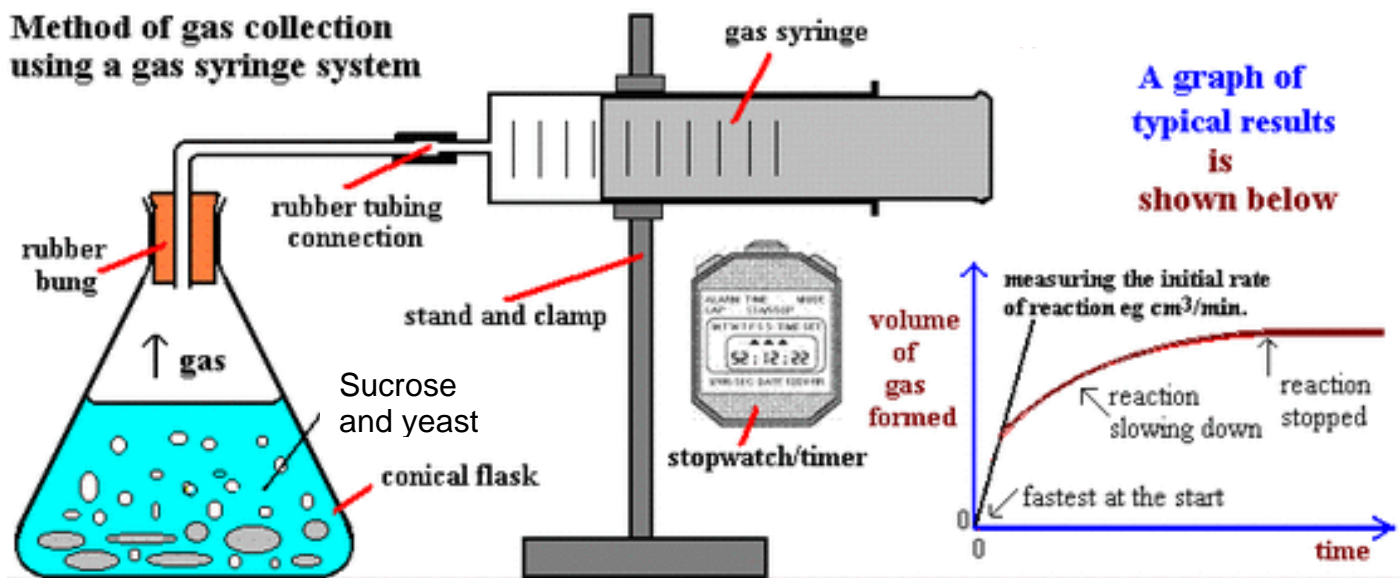
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**5.6 Practical:** The next few questions will be based on investigating carbon dioxide production by yeast, in different conditions.

**Method of gas collection using a gas syringe system**



**A graph of typical results is shown below**

a) Why does the yeast produce carbon dioxide?

.....

b) If you were investigating how the amount of sucrose affected the volume of carbon dioxide formed, what would be the:

i. Control variables?

.....

.....

ii. Independent variable?

.....

iii. Dependent variable?

.....

iv. What would you expect to see as you increased the amount of sucrose?

.....

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c) If you were investigating how the temperature of the sucrose and yeast solution affected the volume of carbon dioxide formed, what would be the:

i. Control variables?

.....  
.....

ii. Independent variable?

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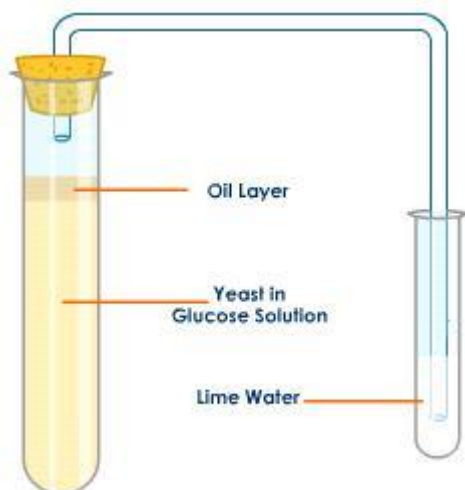
iii. Dependent variable?

.....

iv. What would you expect to see as you increased the temperature?

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In the next experiment please describe what the diagram is showing and what would the positive result for carbon dioxide be?



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Why is there a layer of oil on top of the yeast?

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.....  
What sugar is found in milk?

.....  
What is the name of the bacteria that is used to turn milk into yogurt?

.....  
What does this bacteria produce as it uses the sugar in anaerobic respiration?

.....  
Explain what happens to the pH as the milk is being turned into yogurt

.....  
.....

How does the change in pH affect the proteins found in milk?

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What gives the yogurt its characteristic tart/sour taste?

.....  
.....

Some fermenters are aerobic and not anaerobic. Give some examples of organisms and the products they produce that are grown in these types of fermenter.

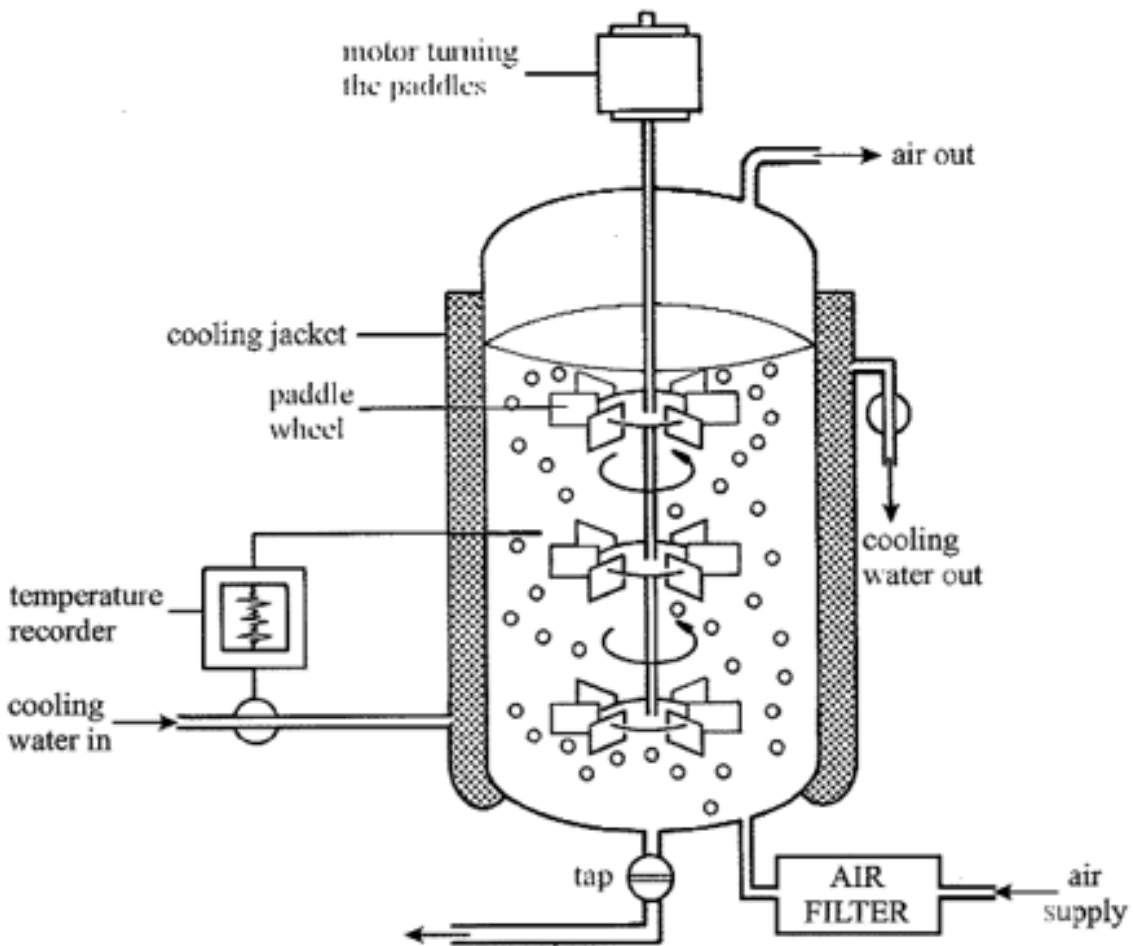
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The next few questions will be based on the diagram below. This is an industrial fermenter:



a) Is this an aerobic or anaerobic fermenter? How can you tell?

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b) Why do the air and nutrients going into the fermenter need to be sterile?

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.....

c) What things does the movement of the paddles help distribute evenly?

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.....

d) One of the other reasons why there are paddles is so that there isn't a build-up of sedimentation. Suggest how this could affect the growth rate of the organism if the fermenter didn't mix the solution.

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e) Respiration is an exothermic reaction. Why does temperature need to be kept constant in this fermenter?

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f) How is temperature controlled?

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g) Explain what would happen to the enzymes in the organisms inside the fermenter if the pH was not kept at the optimum pH.

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**5.9 Fish farming**

Which food nutrients are fish a good source of?

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Fish farms keep lots of fish in very small tanks to minimise space requirements. However, this can affect how the fish grow. Explain what is meant by the terms:

- Intraspecific competition: .....

.....  
.....  
.....

*How can intraspecific competition be minimised?*

.....  
.....

- Interspecific competition: .....

.....  
.....  
.....

*How can interspecific competition be minimised?*

.....  
.....

As well as competition, **predation** occurs. Explain what is meant by the terms:

- Intraspecific predation: .....

.....  
.....



.....

*Give ways in which intraspecific predation be controlled*

.....

.....

.....

- Interspecific predation: .....

.....

.....

.....

*Give ways in which interspecific predation be controlled*

.....

.....

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Explain why, if not controlled, diseases and parasites have the possibility of spreading quickly through the fish stock.

.....

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*Give ways in which diseases and parasites can be controlled*

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.....

.....

Why is sterile water pumped in continuously?



Explain why waste water is washed out regularly

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Why are fish fed a protein rich diet and sometimes have hormones pumped into the water?

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What could happen if excess food that is not eaten is allowed to settle on the floor or falls out of the fish's enclosure?

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Explain how the use of selective breeding can help breed bigger fish.

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**5.10 –5.11 Selective Breeding**

Define what selective breeding is

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What can be desirable characteristics in plants that farmers or consumers want or need?E.g. large fruit

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Explain how you might go about producing strawberry plants that used to have small fruit but after selective breeding now have large fruit. (You may want to draw a diagram to help you visualise it)

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What desirable characteristics in livestock animals (and pets) do farmers and consumers want or need? E.g. more milk produced per cow

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Bulls with desired characteristics have their semen collected by artificial means. Why is the sperm then diluted into many different vials?

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Explain what artificial insemination is

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**5.12 – 5.16 Genetic modification (genetic engineering)**

Describe what DNA is

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Define what the genetic code is.

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Define what a gene is.

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Define what genetic engineering is.

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Define what **transgenic** means.

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Enzymes are used in genetic engineering. What do these enzymes do?

- Restriction enzyme .....

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- DNALigase enzyme .....

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What is a vector?

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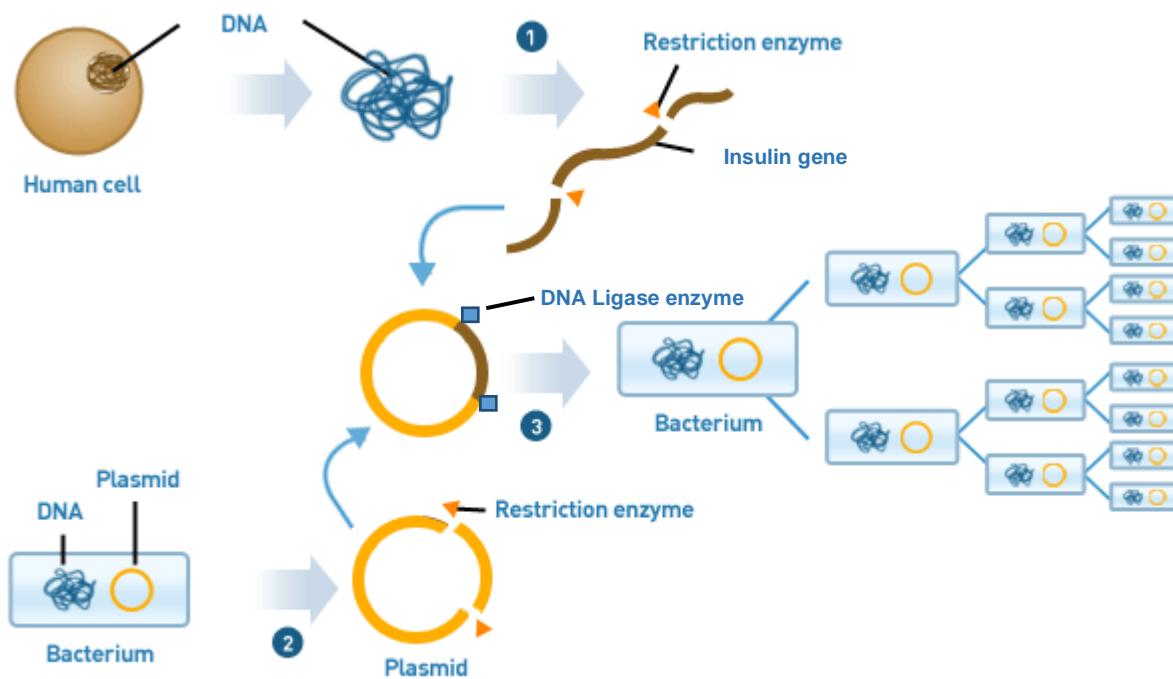
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Plasmids are found in bacteria. What are they?

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This is a diagram of the general process of genetic engineering using the human insulin gene and bacteria.



Describe what is happening in this diagram

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Where will the bacteria be grown to make the insulin?

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Why are there fewer ethical issues to genetically engineering plants?

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Genetically modified (GM) crops are engineered to have many new characteristics. List a few of them:

- .....
- .....
- .....
- .....
- .....

Many GM crops are engineered to be resistant to pests. Why would this reduce the use of pesticides?

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Suggest how the use of GM crops would affect the environment and food chains

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### 5.17 – 5.20 Cloning

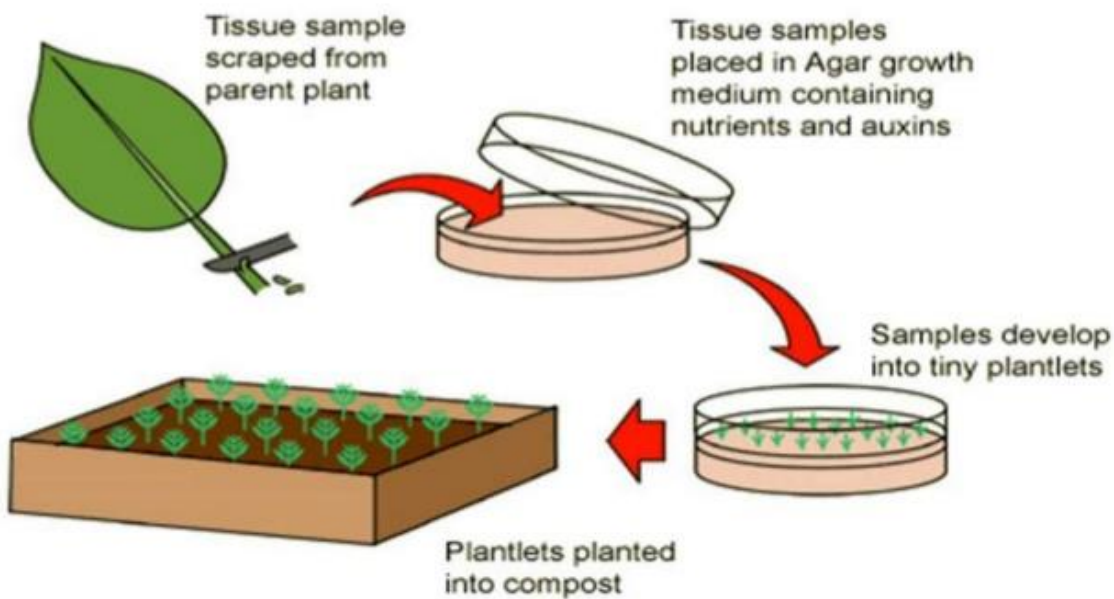
Define what micropropagation is.

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## Diagram of Propagation

5.17 describe the process of micropropagation (tissue culture) in which small pieces of plants (explants) are grown *in vitro* using nutrient media.



This is a lovely diagram of micropropagation. It shows the general process of how to produce many plants from one sample. It is missing some details so you'll have to fill in the missing information.

a) Why does the agar medium contain nutrients and auxins? (*hint: will the tissue samples be able to photosynthesise?*)

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b) Why do the tissue samples need to be grown *in vitro* in sterilised conditions?

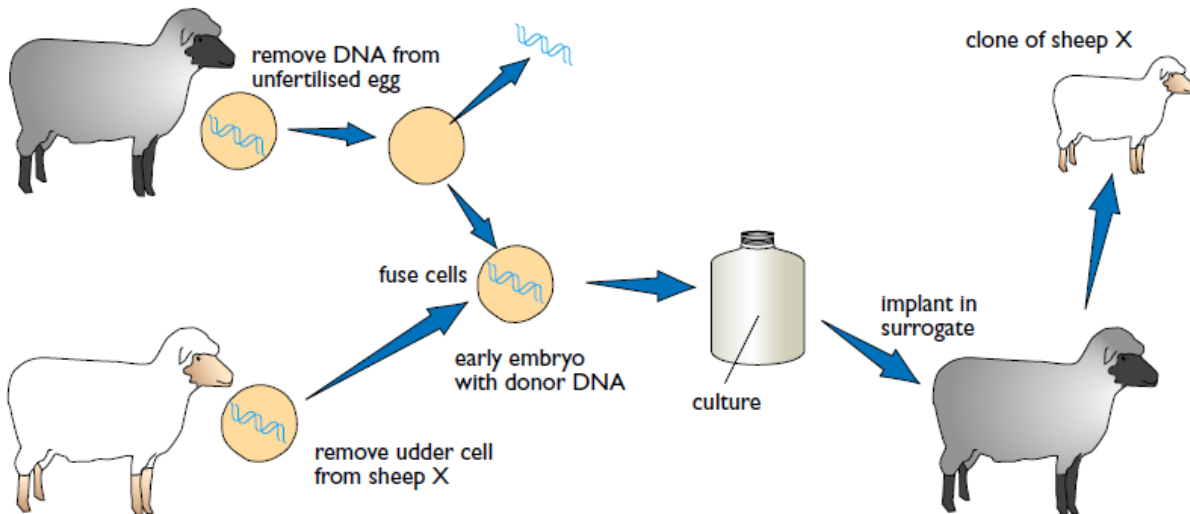
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 c) Why are the plantlets genetically identical to the plant that the tissue samples came from?  
 .....

.....  
 d) Why do farmers use micropropagation to produce commercial quantities of identical plants with desirable characteristics?  
 .....

This is how Dolly the sheep was created. The following questions will be based on this.



a) Why is the DNA/nucleus removed from the egg cell?  
 .....

b) Why can a clone only be created using the DNA from a cell from the body and not from the DNA from an egg cell?  
 .....

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Complete this table on the advantages and disadvantages of cloning animals.

Advantages	Disadvantages

Cloning transgenic (genetically engineered) animals can have many potential uses:

- Research – Transgenic mice can be produced with human disease traits. How could this help research?

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- Drug production – Transgenic animals can be used to produce human antibodies or other human proteins. How could this be helpful?

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- Organ production – Pigs can be genetically modified to produce human organs such as kidneys. What advantages would this have to organ transplantation?

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