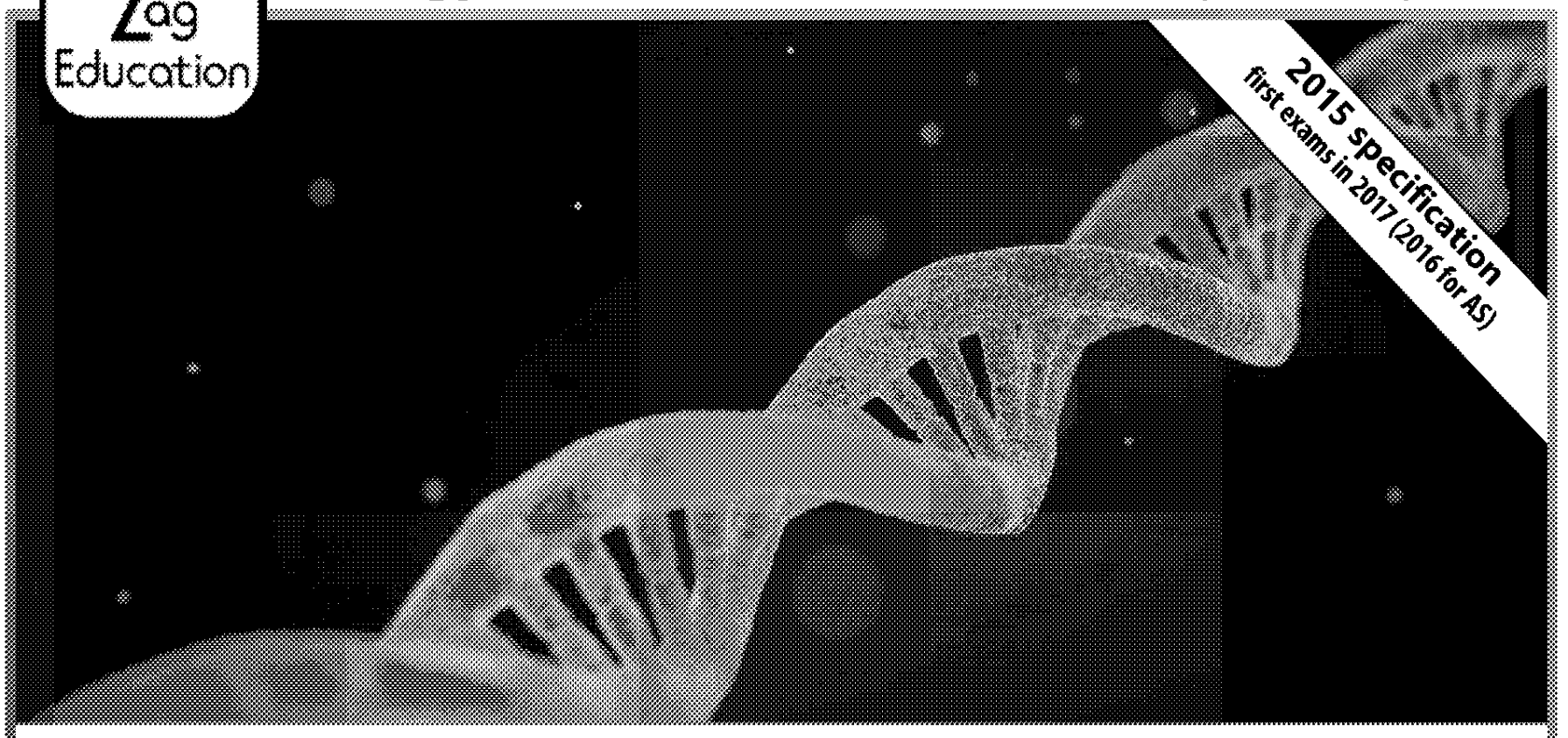
Zig Zag Education

Biology

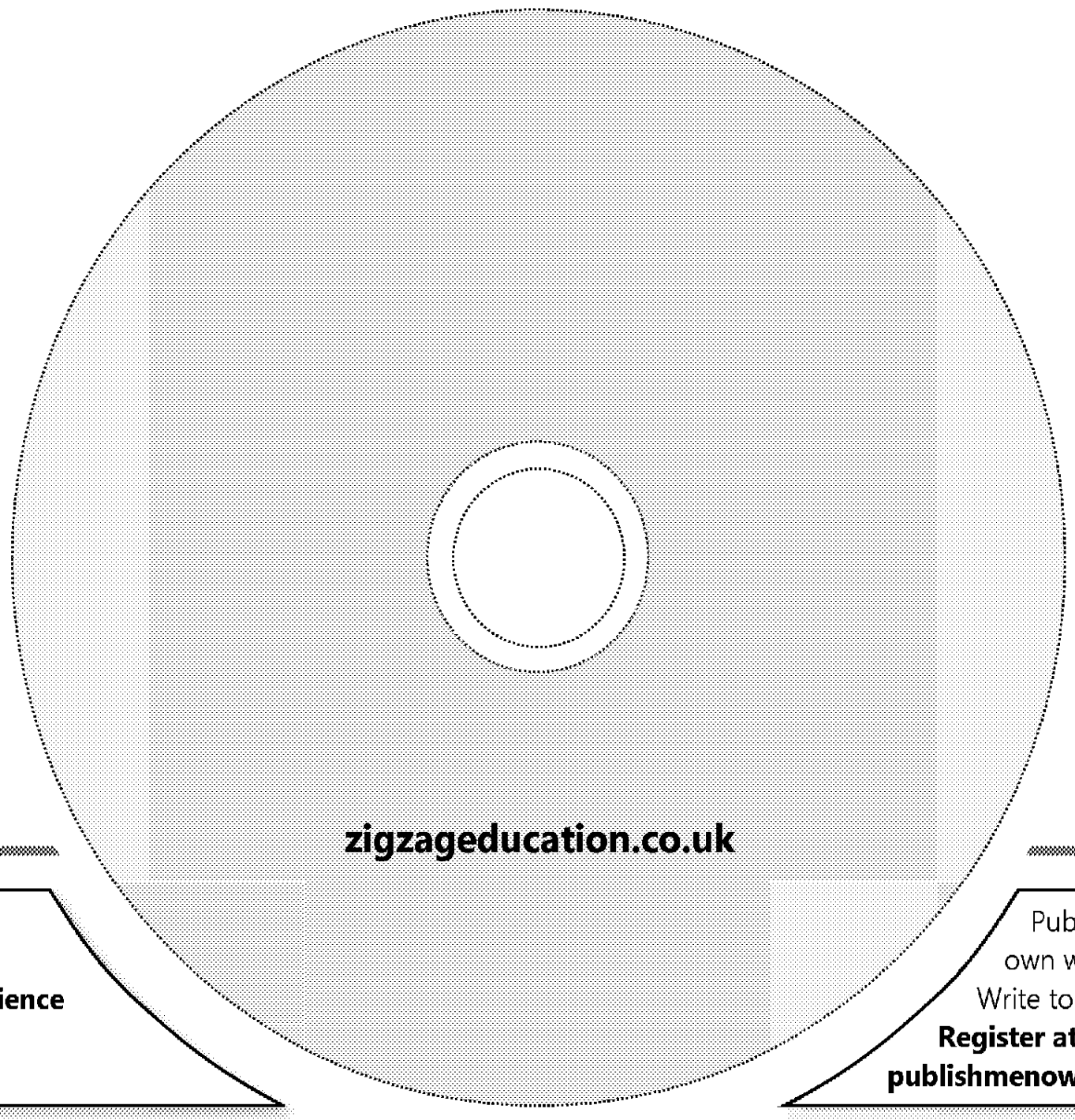
A Level Year 2 | OCR A | H420



PowerPoints and Worksheets

for A Level Year 2 OCR Biology A

Module 6: Genetics, Evolution and Ecosystems



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Contents

Teacher's Introduction

This resource supports delivery and learning of OCR A Level (Year 2) **Module 6** (Genetics, Evolution and Ecosystems).

The prescribed theory is broken down into 14 topic areas:

6.1.1	Cellular Control
6.1.2.1	Variation
6.1.2.2	Inheritance
6.1.2.3	Evolution and Artificial Selection
6.1.3	Manipulating Genomes
6.2.1.1	Cloning Plants
6.2.1.2	Cloning Animals

6.2.1.3	Biotechnology
6.2.1.4	Culturing Microorganisms
6.3.1.1	Energy in Ecosystems
6.3.1.2	Succession and Recycling Nutrients
6.3.1.3	Measuring Distribution and Abundance
6.3.2.1	Population Size and Interactions
6.3.2.2	Conservation and Preservation

For each of the topic areas listed above, there is the following:

1. A comprehensive PowerPoint presentation provided on CD, covering the topic theory. Packed with student-friendly notes, diagrams and images.
   Providing easy access to the presentations is an HTML menu.
   Tip: *copy the Module6 folder from the CD to an accessible network location and provide a link/shortcut to the index.html file inside it.*


PowerPoints & Worksheets

TITLE	SPEC REF	PRESENTATION
Cellular Control	6.1.1	PPTx
Variation	6.1.2.1	PPTx
Inheritance	6.1.2.2	PPTx
Evolution and Artificial Selection	6.1.2.3	PPTx
Manipulating Genomes	6.1.3	PPTx
Cloning Plants	6.2.1.1	PPTx
Cloning Animals	6.2.1.2	PPTx
Biotechnology	6.2.1.3	PPTx
Culturing Microorganisms	6.2.1.4	PPTx
Energy in Ecosystems	6.3.1.1	PPTx
Succession and Recycling Nutrients	6.3.1.2	PPTx
Measuring Distribution and Abundance	6.3.1.3	PPTx
Population Size and Interactions	6.3.2.1	PPTx
Conservation and Preservation	6.3.2.2	PPTx

2. Matching worksheets designed to develop both understanding and application of the presentation content. These worksheets feature a range of activities, including diagram labelling/annotation, definition matching and gap-filling exercises.

Answers for every worksheet, plus printed handouts for every presentation, are provided at the back of this resource.

October 2020

6.1 Genetics and Evoluti

6.1.1 Cellular Control

1. Using the triplet code provided, for the sequen A TG TGA CAA TGG A

First base	Second base			
	A	G	T	C
A	Phe Phe Leu Leu	Ser Ser Ser Ser	Tyr Tyr STOP STOP	Cys Cys STOP Trp
G	Leu Leu Leu Leu	Pro Pro Pro Pro	His His Gln Gln	Arg Arg Arg Arg
T	Ile Ile Ile Met	Thr Thr Thr Thr	Asn Asn Lys Lys	Ser Ser Arg Arg
C	Val Val Val Val	Ala Ala Ala Ala	Asp Asp Glu Glu	Gly Gly Gly Gly

A = adenine, T = thymine, G = guanine, C = cytosi

a) Si normal sequence of amino acids coded for.

.....

b) What would be the likely effect of the following mutations?

i) Insertion of C after first codon.

.....

.....

ii) Substitution of A in ninth position for C.

.....

.....

iii) Substitution of G in si os for T.

.....

iv) Substitution of G in sixth position for C.

.....

.....

2. Fill in the gaps to complete the paragraph below.

E. coli bacteria normally respire _____; however, when grown in lactose, they can respire lactose instead. They make two enzymes to help them. _____ allows cells to take up the lactose and _____ and _____. These genes are under control by the lac operon in the _____ which binds to the _____ so that it is unable to bind _____ free for RNA polymerase to bind there.

3. a) Explain the meaning of the term apoptosis.

.....

b) Suggest why the process of apoptosis is important in the metamorphosis

.....

.....

.....

.....

4. Explain how the base sequence of DNA can encode more than one protein.

.....

.....

.....

.....

6.1.2.1 Variation

1. Fill in the gaps to complete the paragraph below describing prophase I.

In early prophase I, homologous chromosomes pair up. The pairing is called _ paired chromosomes sometimes called _____ c tetrads. The ____ only) and starts migrating to or e ..es of the cell. The nucleolus is pres over (_____ mation) may occur, especially in the longer chromos can bre d reconnect with another chromatid. This introduces _____ The nuclear envelope and the nucleolus _____. At the end of propha

2. Match the following terms to their definitions or meanings. The first has be

1	A length of DNA (chromosome) that carries the instru for a particular protein or polypeptide
2	The position on a chromosome that carries the instructions for a
3	An alternative form of a gene, e.g. in th uman ABO blood g three alternati forms coding for A, B or O
4	e genetic make-up of an individual
5	e physical expression of the genes – this may be influenced by
6	An allele which is expressed when it is present in the g
7	An allele which is expressed only when the dominant allel – in reality when it is homozygous
8	Alleles which are partially expressed in the heterozygo and result in a mixing of the character, e.g. AB blood
9	Both alleles of a particular gene are the same
10	The t all le of a gene are different

A	Allele	D	Homozygous	H	C
B	Phenotype	E	Dominant	I	H
C	Recessive	F	Genotype	J	
		G	Gene		

3. What are the sources of genetic variation in sexually reproducing organisms? (one-line) description of each.

.....

.....

.....

.....

.....

.....

.....

4. A Himalayan rabbit has dark tips to its ears, nose, paws and tail. It has an allele that allows melanin production, but only at low temperatures.

Explain the distribution of darker fur in this rabbit.

.....

.....

.....

.....

6.1.2.2 Inheritance

1. a) Complete the monogenic cross for the F1 generation of pure-breeding which are all red-flowered with genotype Rr:

×	Female gametes: R	Female gametes: r
Male gamete: R		
Male gamete: r		

Offspring are red- or white-flowered in the ratio: .....

b) What can be deduced from the fact that all of the F1 generation were r

.....

.....

2. Carry out a χ^2 test for the following data to conclude whether the 9 : 3 : 3 : 1 degrees of freedom, the critical value at p = 0.95 is 0.35. Some of the table h

Pure-breeding parents	Round yellow seeds		Wrinkled gree
F1 generation	All round yellow seeds		
F2 generation	310 round yellow seeds	108 round green seeds	102 wrinkle yellow seed
Dihybrid ratio	9	3	3

Seed colour and texture	O	E	(O – E)	(O – E)²
Round yellow	310	312.75	[illegible]	7.5625
Round green	[illegible]	104.25		
Wrinkled [illegible]				
Wrinkled green				
				$\sum \frac{(O-E)^2}{E}$

Conclusion: .....

.....

.....

.....

.....

.....

3. Explai[illegible] ex linked recessive conditions are more common in males than

.....

.....

.....

.....

4. Use your knowledge of genetics to predict the phenotypic ratio of mice resu[illegible] individuals heterozygous for both genes (AaBb). Part of the cross has alrea[illegible]

Cross involving mice heterozygous for both coat colou[illegible] genotype A[illegible]Bb

		Gametes		
	×	**AB**	**Ab**	
Gametes	**AB**	AABB Agouti	AABb Agouti	
	Ab	AABb Agouti	AAbb Albino	

Offspring are:.....

Ratio: .....

6.1.2.3 Evolution and Artificial Sel

1. Assuming all the assumptions for the Hardy–Weinberg principle hold, calcu
a population where one in 500 people suffers from a condition caused by a r

You may use the following equations:

$p + q = 1$

$p^2 + 2pq + q^2 = 1$

.....

.....

.....

.....

.....

2. Use the table below to compare and contrast natural selection and artificial s

	Natural selection	
Definiti		
Selection pressure		
Effect		
Speed		

3. Sugge e characteristics that make for a good dairy cow.

1. .....

2. .....

3. .....

4. Manx cats do not have tails. The condition is caused by a dominant mutatio
development. Whenever a normal-tailed cat is mated with a Manx cat, 50 %
50 % have no tail (= Manx).

Suggest why such a condition might have become prevalent in the cats of t

.....

.....

.....

.....

5. Distinguish between the terms 'stabilising selection' and 'directional selecti

.....

.....

.....

.....

6.1.3 Manipulating Genome

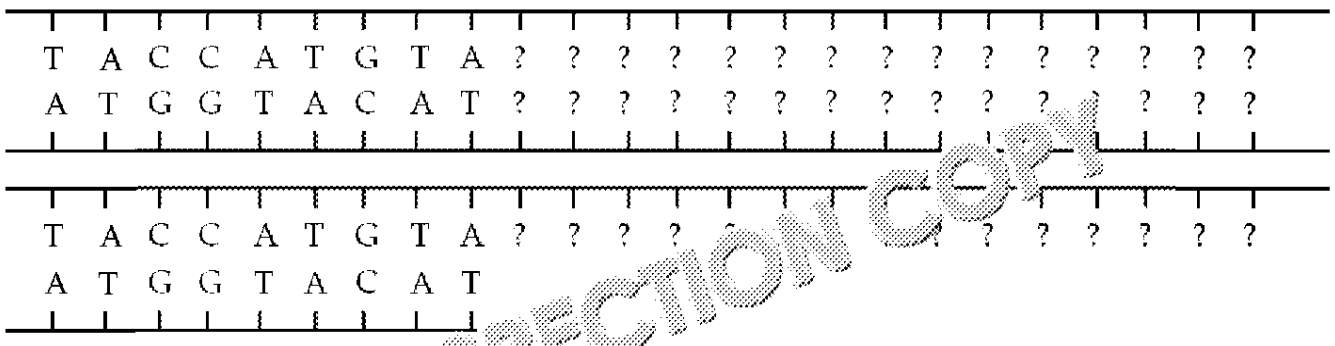
1. Match the following terms to their definitions or meanings. The first has be

1	A device used to transfer a gene or sequence of DNA bases from one
2	The use of a gene to repair a faulty or missing gene, and so treat or c Examples include attempts to treat cystic fibros and SCID (severe combined immunodeficiency dise
3	An enzyme that forms a covalent bond between the phosphate and the deoxyribose of another, so sealing the 'n in the sugar phosphate backbone of recombinant D
4	The transplantation of cells (or organs) from one species into a
5	These are small extrachromosomal circles of DNA found in bacte number of beneficial genes, e.g. antibiotic resistance genes. T are passed on to the daughter cells during binary fi
6	These are used to detect whether recombinant plasmids have b incorporated into bacteria. They are generally gen resistance to the antibiotics tetracycline and ampi
7	A technique that separates DNA fragments using an electric curre DNA fragments is based on the siz of fragment and the potentia
8	A technique used for amplifying small samples of DNA so that there analysed, e.g. mitochondria, chloroplasts and that retriev
9	Single stranded pieces of DNA that are complementary to a porti investigated. They are usually about 50–80 nucleotides long with either a fluorescent dye or a radioactive marker (

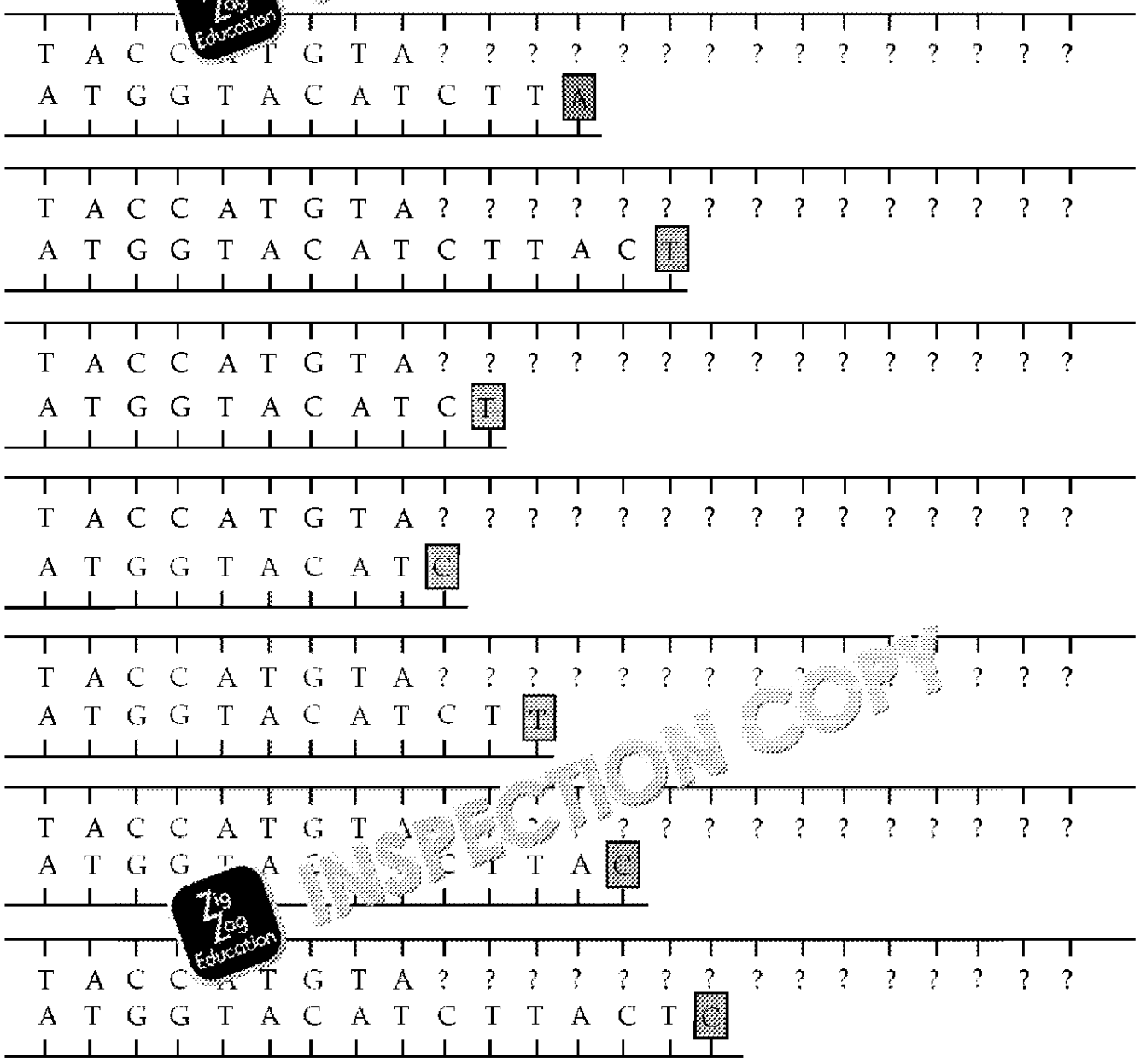
A	Vector	D	DNA probe	G	
B	Genetic marker	E	Electrophoresis	H	
C	Plasmid	F	Polymerase chain reaction	I	

2. Complete the following diagram to outline the main steps in base sequenci

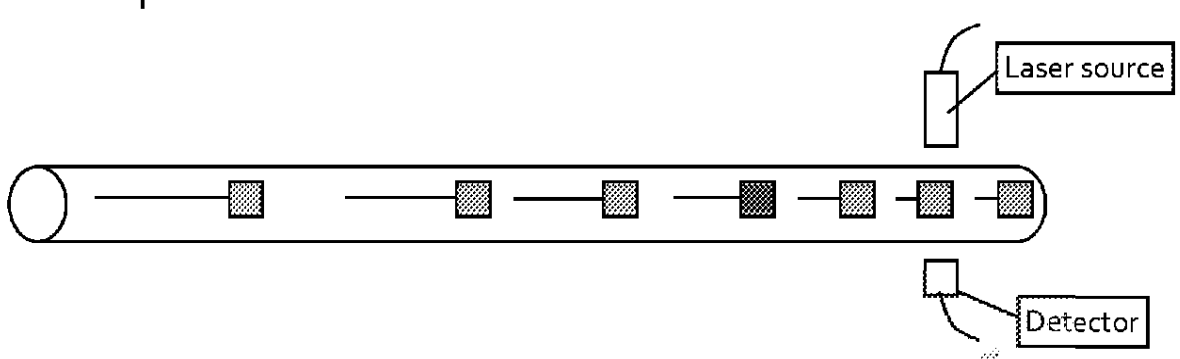
a) DNA section is denatured and primed:



b) Polym… …or … …chain termination:



c) Electrophoresis and detection of terminal nucleoside:



d) Sequence of colours is the same … …equence of bases:

3. In what ways is the polymerase chain reaction different from DNA replicati
DNA strands, length of sequence that can be replicated, and conditions em

.....

.....

.....

4. Fill in the gaps in the fol[illegible] table to compare somatic gene therapy and g

	Somatic gene therapy	
Definition	Gene is inserted into _____ cells and so cannot be passed on via gametes to the next generation.	The gen zygote o all cells o modifie
Mechanism of inserting gene (e.g. vector, direct method)	Liposomes and _____ have been used to treat cystic fibrosis. Retroviruses have been used to treat bone marrow cells of _____ patients.	Vector, n _____ Germlin UK or US
Need to repeat treatment?	Possibly; if only the affected cells are treated, repeat treatment is needed when these cells die and are replaced (e.g. CF). If _____ _____ are treated (e.g. SCID), repeat not needed.	Not requ in all cell _____ and repl
Extent of modificati[illegible] the organism	Only the treated cells.	All cells which c modifie

6.2 Cloning and Biotechno

6.2.1.1 Cloning Plants

1. Match up each type of vegetative propagation w[illegible] correct description.

Bulbs	Specialised stems that g[illegible] roots and a bud appear w[illegible]
[illegible]tubers	Basal sprouts grow[illegible] in [illegible]
Runners	Condensed shoots that [illegible] can develop an[illegible]
Rhizomes	Underground stems that [illegible] food reserves; growing [illegible]
Suckers	Lateral buds grow outw[illegible] swell at the shoot tips [illegible]

2. Fill in the gaps to complete the paragraph describing the advantages of clo[illegible]

When plants are cloned, it produces a numb[illegible]r o[illegible] _____ plants which [illegible] characteristics present in the _____. A large number of plants can be _____ a[illegible] because meristematic tissue is generally virus-free, the pl[illegible] _____. Cloning can also be used on GM plants and is an essential pro[illegible] that are incapable of normal _____ reproduction because their cells [illegible]

3. Give three disadvantages of cloning plants for agriculture.

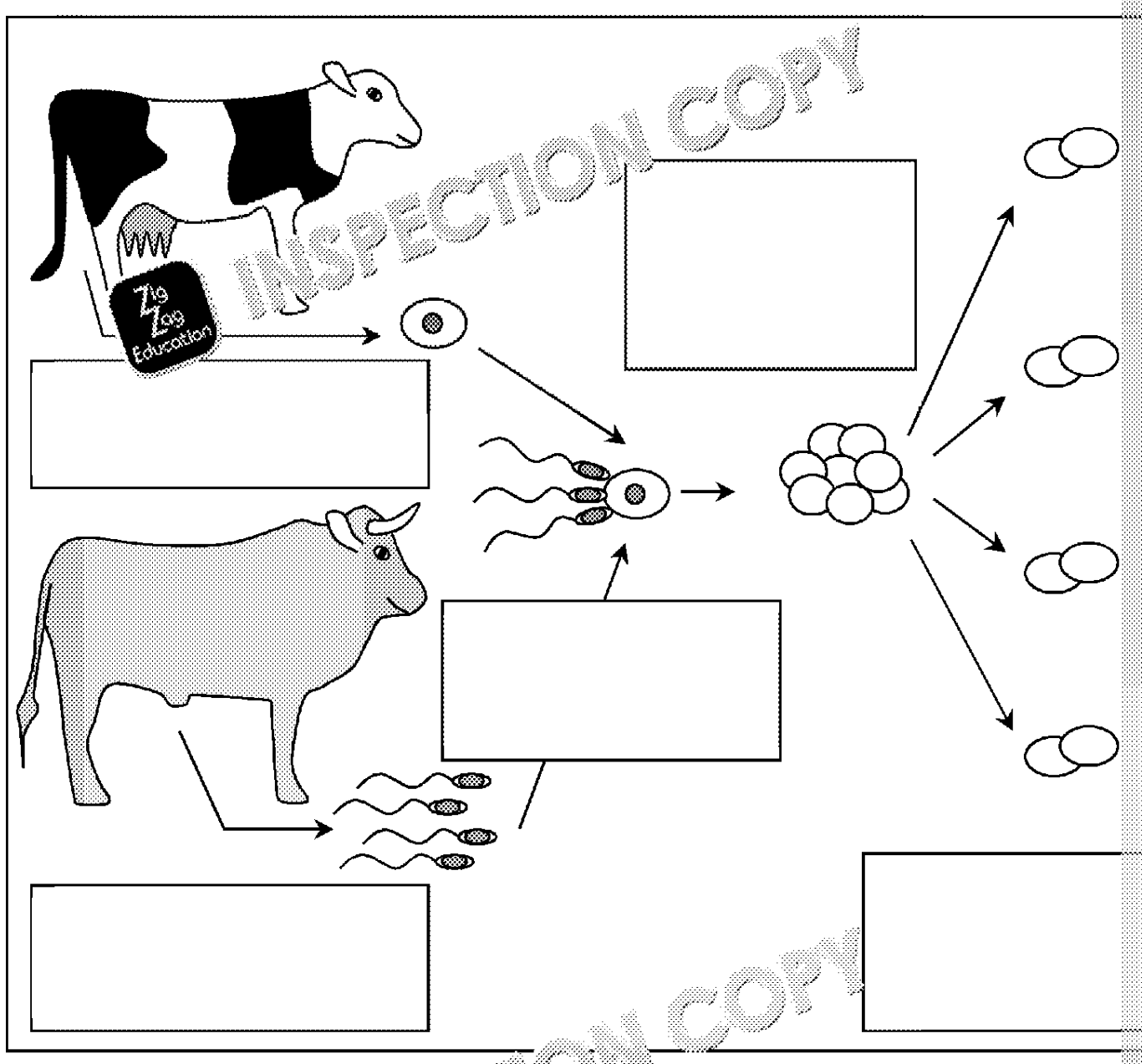
1. .....
.....
2. .....
.....
3. .....
.....

4. State w[illegible]er each of the following statements applies to meristem culture suspension/cell culture (S). Each statement applies to only one of M, C or S.

A mass of undifferentiated cells is formed: ___ Cells are transferred to a li[illegible]
Excised buds are surface sterilised: ___ Auxin and cytokinins are a[illegible]

6.2.1.2 Cloning Animals

1. Complete the diagram by giving descriptions of the stages in embryo splitti
following terms or concepts: IVF, implantation, clones, eggs, sperm, separa



2. Complete the p[illegible] describing SCNT.

_____ cell nuclear transfer, or SCNT, produces _____ whic

original animal. The most famous example is probably _____ the s

cell extracted from a Finn Dorset ewe fused with an _____ egg cell f

The embryo developed and was implanted into a surrogate mother, a Scott

as a _____ _____ lamb. The process used had a _____

the only lamb born out of 277 attempts.

3. Give three advantages and three disadvantages of animal cloning.

Advantages

1. .....

.....

2. .....

.....

3. .....

.....

Disadvantages

1. .....

.....

2. .....

.....

3. .....

.....

6.2.1.3 Biotechnology

1. Match up the biotechnological processes with the microbe required for eac

Producing mycoprotein	*Saccharomyc*
Producing soy sauce	*Pseudom*
Pr[illegible]te	*Aspergillus o*
Producing human insulin	*Aspergill*
Producing pectinase	*Thiobacillus fe*
Clearing up oil spills	*Fusar*
Copper extraction	*Escherichi*

2. Give the three basic differences between the production of hard cheese and

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

3. Suggest why biological detergents are considered by some to be environme

.....

.....

.....

.....

4. Fill in the gaps to complete the paragraph about enzyme immobilisation.

In _____, a large number of enzymes a[illegible] bound to an inert

_____ interactions, so [illegible]sk of them _____ into t

are bound by st[illegible] _____ bonds to a support material there is l

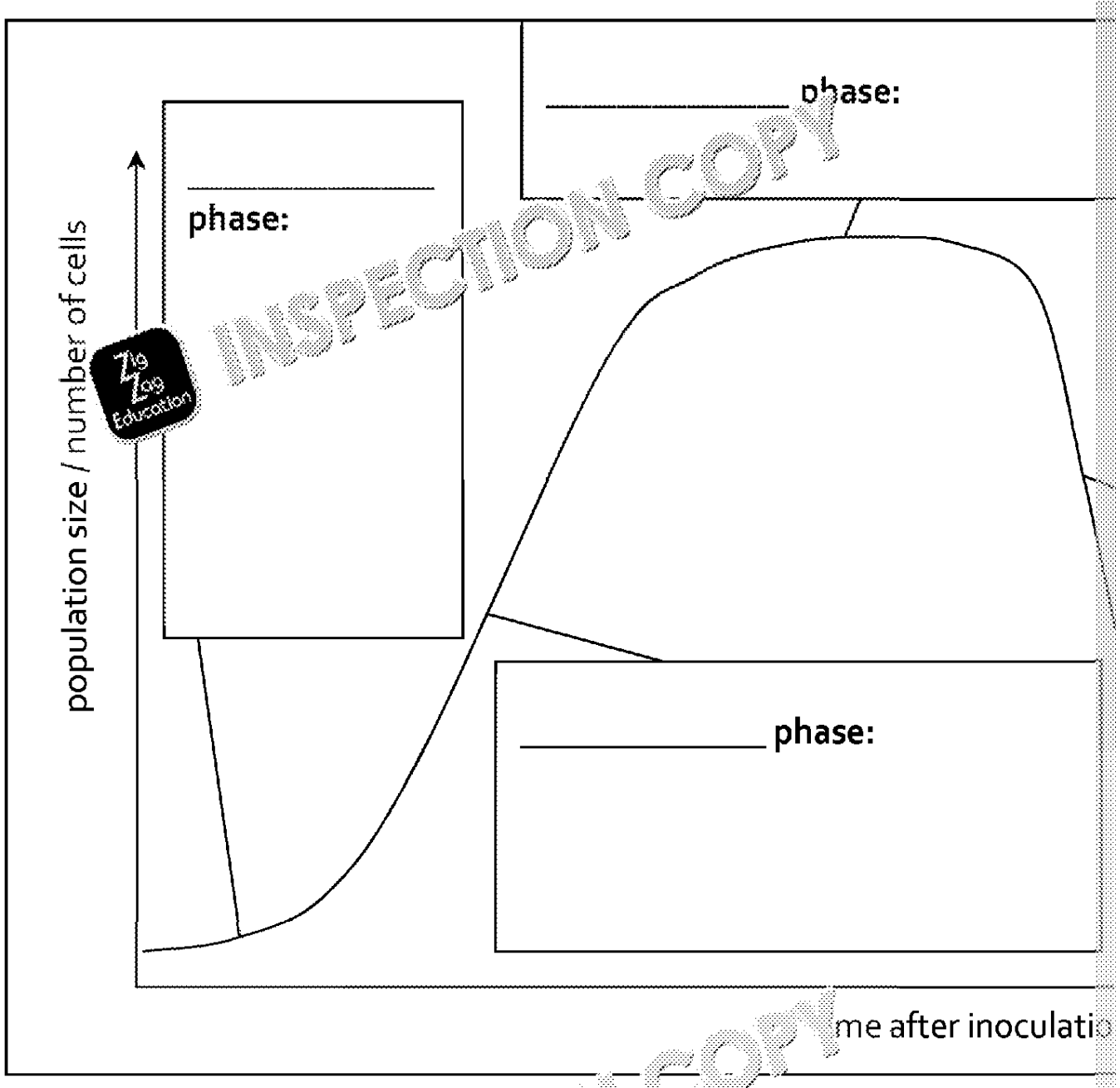
may re[illegible]ccess to the enzymes' _____ _____. In ____

_____, the enzymes are not bound and so are more accessible in t

may be a _____ to the substrate, which prevents them reaching th

6.2.1.4 Culturing Microorganis

1. Label the diagram with the phases of microbial growth, and add some brief no



2. Complet[illegible] table to compare batch and continuous fermentati

	Batch culture	
Type of metabolite produced by the fermentation		
Addition of nutrients		
Removal of products		
Example		
[illegible]tages		
Disadvantages		

3. Suggest why nutrient concentration needs to be carefully maintained:

a) In batch culture

.....

.....

b) In continuous culture

.....

.....

4. Match up each aseptic technique with the main reason for that technique.

Wear protective clothing	Safe rem
Autoclave media and glassware	Avoids
Use disposable sterile equipment	Avoi
Clean surfaces before use with a disinfectant	Kills p

6.3 Ecosystems

6.3.1.1 Energy in Ecosystems

1. Give three examples of biotic factors and three examples of abiotic factors in

Biotic

1. .....

2. .....

3. .....

Abiotic

1. .....

2. .....

3. .....

2. Use the information about food chains and the template below to construct aquatic system.

Several simple food chains can intermesh to produce a food web:

plants → tadpole → water beetle → perch → pike
plants → insect larvae → frog → perch/pike
plants → crustaceans → roach → perch/pike

Crustaceans can also be food for frogs and water beetles.
Insect larvae can also be food for water beetles and roach.

Quaternary consumers

Tertiary consumers

Secondary consumers

Primary consumers

Producers

3. Complete the gaps in the following paragraph.

Light is a key factor for photosynthesis as it drives the light-_____

_____ and reduced _____ for CO_2 fixation. Only a relativ

uptake is used for photosynthesis – most uptake is required to make up for w

If water is in short supply the _____ close to limit water loss. A conse

_____ uptake (and therefore, photosynthesis) is reduced, so limiting

also be a limiting factor for photosynthesis, which is controlled by enzymes, e.

carboxylase.

4. Calculate the photosynthetic efficiency of a system where 1 710 000 kJ m^{-2} y
87 403 kJ m^{-2} y^{-1} primary producers.

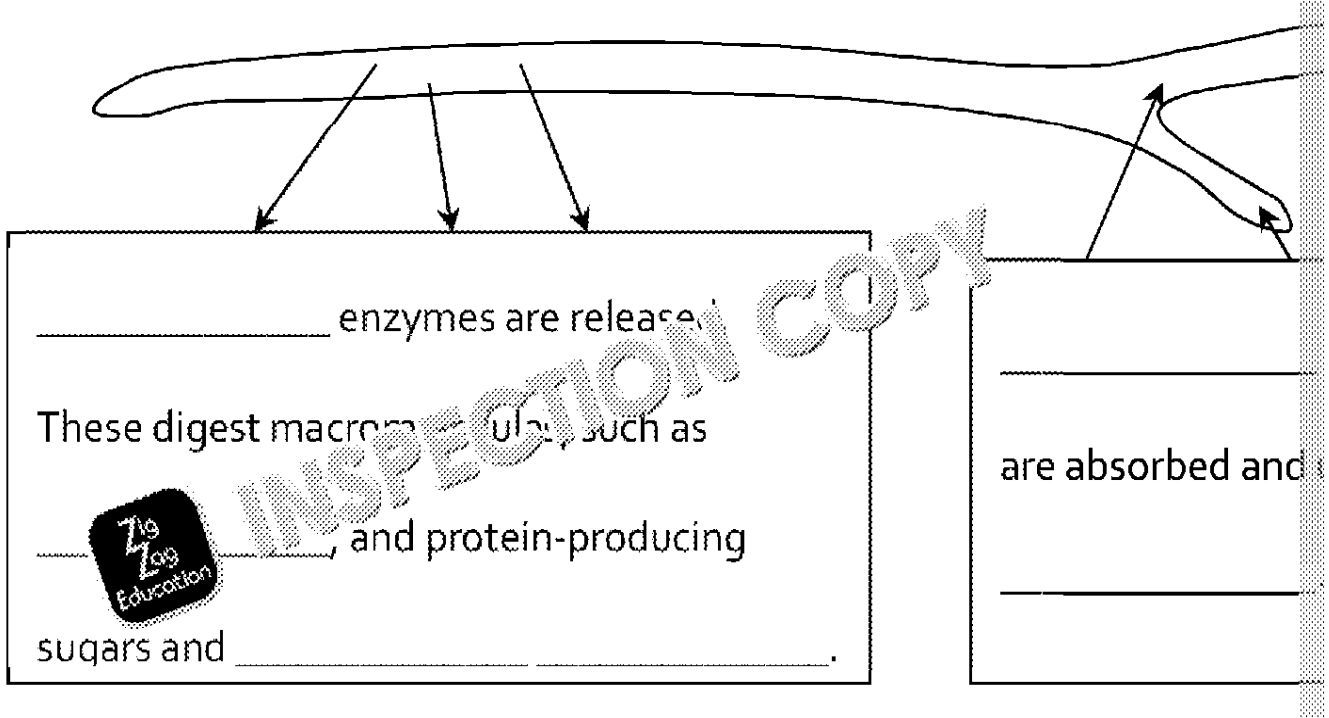
6.3.1.2 Succession and Recycling N

1. Statements about the nitrogen cycle are written below. Match them to the
The first one has been completed for you.

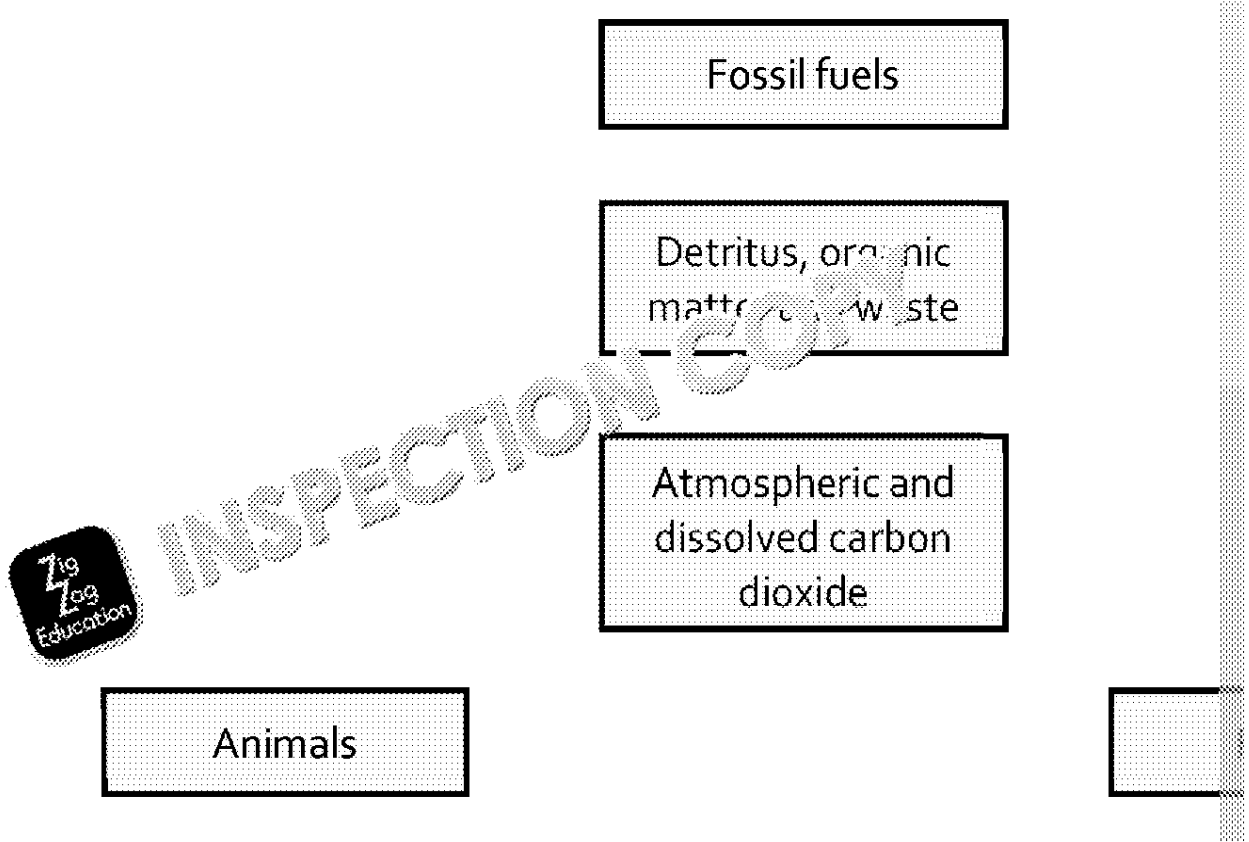
1	Conversion of o[illegible]ic [illegible]rogen into ammoniu
2	[illegible]onversion of nitrate ions into nitrogen gas
3	Conversion of ammonium into nitrate
4	A swelling on the root of a leguminous plant
5	Organism responsible for conversion of organic nitrogen in
6	Bacterium responsible for nitrogen fixation
7	Bacterium responsible for conversion of $NH_4^+ \rightarrow$ N
8	Bacterium responsible for [illegible]onversion of $NO_2^- \rightarrow$ N
9	Conversion of $N_2 \rightarrow NH_4^+$
10	Enzyme responsible for conversion of $N_2 \rightarrow NH$
11	Leached nitrate leads to this problem in lakes

A	ammonification	E	nodule	I	
B	*Nitrobacter*	F	*Nitrosomonas*	J	
C	*Rhizobium*	G	nitrogen fixation	K	
D	nitrogenase	H	[illegible]ification		

2. Complete the labelling of the diagram below to explain how fungi are involv



3. Add arrows and the following labels onto the diagram below showing the m
photosynthesis, respiration, decomposition, feeding, excretion, death and fo



4. Complete the table to give the terms with the following definitions:

	A sequence of changes that happens, leading to the de ecosystem. It happens whenever plants start to grow
	A sequence of changes that results in a plagioclimax d fire or grazing, that prevents th tablishment of a m
	The arrival of a the e. blishment of a species in an
	e st organism(s) to establish themselves in a new
	A stable, self-perpetuating collection of organisms fo Usually this would be a climatic climax (where climate
	A sequence of changes that happens following the cle flash floods or a hurricane, resulting in the developme

6.3.1.3 Measuring Distribution and A

1. Give three aspects you should consider when sampling with quadrats.

   1. .....

   2. .....

   3. .....

2. Indicate by shading the correct squares, where you should place the 16 qua

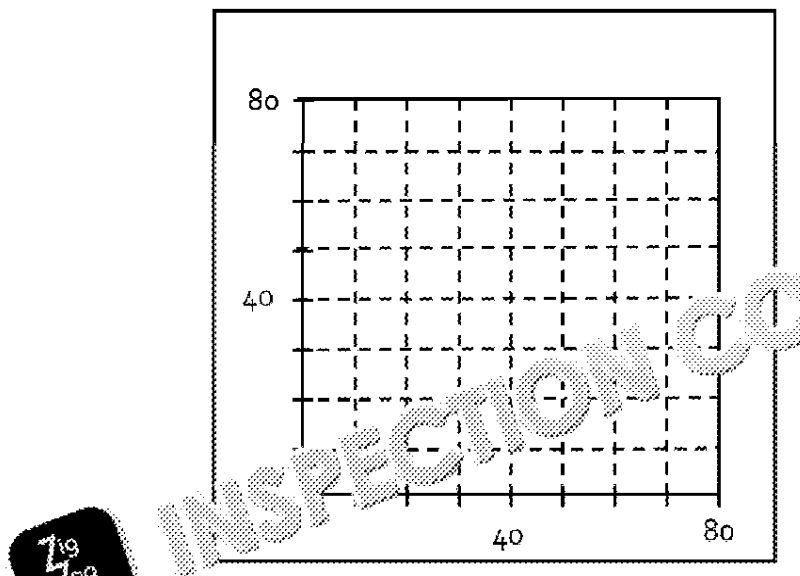
   a) the following coordinates have been generated for a sample:

   (10, 30), (50, 20), (70, 40), (30, 70),

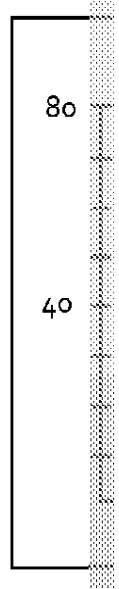
   (0, 20), (60, 70), (50, 50), (10, 60),

   (40, 0), (30, 60), (50, 30), (10, 40),

   (60, 10), (20, 30), (50, 70), (70, 0)



   b)



3. Calculate the frequency of dandelions in a sample in which they were prese thrown.

   .....

   .....

4. Which type of transect would be best for sampling along a 50 m line of woo

   .....

   .....

   .....

   .....

   .....

   .....

6.3.2.1 Population Size and Intera

1. Complete the table discussing types of limiting factor.

	Density dependent	D
Generally biotic or abiotic?		
Examples		
Effect of population size on the effect of the factor		

2. Statements about populations are written below. Match them to the letter
The first one has been completed for you.

1	The name for the typical growth curve of a popu
2	Any factor that stops a population from increasin
3	The phase in population growth where production of ne exactly matched by mortality
4	The upper limit in population size that the environmer
5	Population phase when mortality exceeds production of
6	Factors that are non-living
7	The sum of the effects of all factors on a popul

A	Sigmoid	E	Limiting
B	Environmental resi	F	Stationary p
C	g capacity	G	Decline pha
D	Abiotic		

3. The cormorant (*Phalacrocorax carbo*) and shag (*Phalacrocorax aristotelis*) ar eating birds found in Britain. During the breeding season both birds comm nest on the same sea cliffs. While this might suggest they compete with ea food and nest site preferences. The food eaten by both birds is summarise

Food species	Percentage of food	
	Cormorant	Shag
Sand eel	0	33
Herring	1	49
Flatfish	26	1
Shrimp and prawn	33	2
Goby	17	4
Other fish	23	

Data source: Lack, D L (1945) *Journal of Animal Ecology*, 14:12–16

It is worth noting that sand eel and herring swim close to the surface, while f found on the seabed.

a) Suggest how the cormorant and shag avoid direct competition for food

.....

.....

.....

.....

.....

.....

b) The cormorant and shag may compete for other resources.

i) Suggest a resource that these two species compete for.

.....

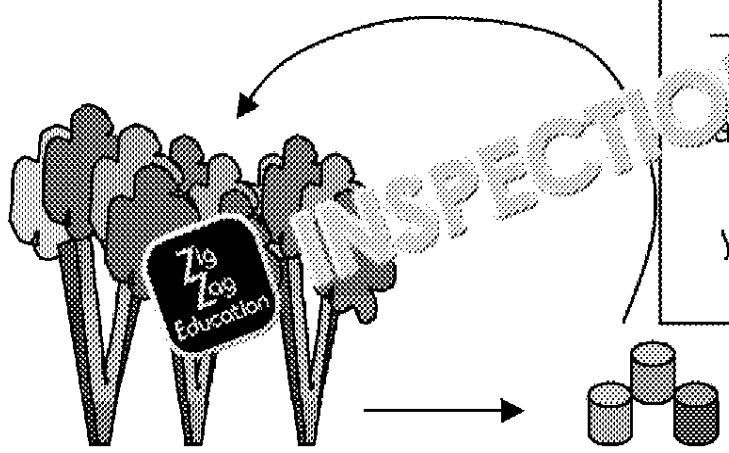
.....

ii) Is this an example of interspecific competition or intraspecific com

.....

6.3.2.2 Conservation and Preserv

1. The following diagram summarises the key elements of rotational coppicin labels by filling in the gaps as appropriate.



Trees are cut near to the _____,

producing stumps known as _____.

_____ide shoots sprout

and are allowed to grow for 6–12

years depending on the species.

The woodland is divided

example). One section o

Here there are 12 section

ove

2. Give one ethical reason, one social reason and three economic reasons for c

Ethical

1. .....

.....

Social

1. .....

.....

Economic

1. .....

.....

2. .....

.....

3. .....

.....

3. Fill in the gaps in the paragraph below about the Galapagos Islands.

The Galapagos Islands are home to many _____ species, i.e. uni
nowhere else in the world. However, most of these species are unfortunate
human activities. Giant tortoises have to compete wit eral _____
has decimated the vegetation on Pint n Darwin's _____ c
specialised to cope wi n food, e.g. cracking nuts or grabbing insect
under from _____, rats and dogs, which may hunt them o
Habitat loss is also a huge problem on the islands as increased human popu
require more _____ for buildings, agriculture and infrastructure
impact to the species in the form of _____ of habitats, reducing
between populations.

Answers

6.1.1 Cellular Control

1. a) Tyr Cys Thr Val Thr STOP

   b) i) Frame shift, completely changing all amino acids after the insertion a compromising the protein structure.

   ii) Silent mutation (change to amino acid so no change to phenotype)

   iii) [illegible] to STOP so sequence ends early, probably compromising

   iv) [illegible]ge from Cys to Trp, which may affect the structure but could stil

2. glucose, permease, β-galactosidase, galactose, repressor protein, promoter

3. a) After an appropriate period of cell growth and division, an orderly series o death.

   b) A young tadpole has external gills and a tail, but an adult frog does not.
   Cells of gills and tail die, blebbing or reverse invagination occurs and the b

4. The DNA can be spliced differently – by removing different introns from primar
   exons from the same section of DNA can form different mature mRNA which w

6.1.2 Variation

1. synapsis, bivalent, [illegible], chiasma, genetic variation, disappear, spindle

2. IG, 2J, 3[illegible]B, 6E, 7C, 8H, 9D, 10I

3. • Chiasma formation / cross-over:
   Chromatids from homologous chromosomes become entangled, break ar
   section from one homologous chromosome swapped with another

   • Random assortment:
   Chromosome behaviour at metaphase I / anaphase I is independent of the
   Produces 2^n possible combinations

   • Fertilisation:
   Gametes fuse randomly during production
   Gametes have undergone cross-over and random assortment

   • Mutation:
   Random changes to DNA
   Could be a single substitution, addition or a deletion

4. Ears, nose, paws and tail are the extremities and likely to be colder.

   The Hi[illegible]n allele can be expressed, and cooler regions of body produce me its colou

6.1.2.2 Inheritance

1. a)

×	Female gametes	
	R	r
Male gametes: R	RR	Rr
Male gametes: r	Rr	rr

Offspring are red- or white-flowered in the ratio: **3 red : 1 white**

b) The R allele for red flowers is dominant.

2. Answers in bold:

Seed colour and texture	O	E	(O – E)	$(O – E)^2$
Round yellow	310	312.75	-2.75	7.5625
Round green	108	104.25	[illegible]	**14.0625**
Wrinkled yellow	**102**	[illegible]	**-2.25**	**5.0625**
Wrinkled [illegible]	**36**	**34.75**	**1.25**	**1.5625**

$$\sum \frac{(O-E)^2}{E}$$

The calculated χ^2 < critical χ^2 so we must accept the null hypothesis that there is between the observed and expected number, i.e. there is a greater than 0.95 (or is due to chance and the 9 : 3 : 3 : 1 ratio is true.

3. In order for a female to be affected, she has to have a double dose of the affecte the single dose required in the male. A double dose can be lethal, as with haem

4. Answers in bold:

×		Gametes		
		AB	Ab	aB
Gamete	AB	AABB Agouti	AABb Agouti	**AaBB Agouti**
	Ab	AABb Agouti	AAbb Albino	**AaBb Agouti**
	aB	**AaBB Agouti**	**AaBb Agouti**	**aaBB Black**
	ab	**AaBb Agouti**	**Aabb Albino**	**aaBb Black**

Offspring are: **Agouti : Black : Albino**
Ratio: **9 : 3 : 4**

6.1.2.3 Evolution and Artificial Se

1. Let the proportion of the non-affected allele be p and the proportion of the affe
   Sufferers are homozygous recessive, so $q^2 = 0.002$
   So $q = 0.0447$
   $p = 1 - 0.0447 = 0.9553$
   So, 2pq (the carriers) = $2 \times 0.9553 \times 0.0447 = 0.05$

2.

	Natural selection	
Definition	Organisms that are well adapted to their environment are more likely to survive and pass their alleles for the adaptations to their offspring	Organis… are us… char…
Selection pressure	Environment	
Effect	Changes gene frequency Evolution	
Speed	Relatively slow	

3. Any three from:
   - docile
   - good let down / milking reflex
   - good food conversion ratio
   - high protein content
   - high lipid conte…
   - hig… d … over milking cycle
   - hi… over several milking cycles

4. The Isle of Man is isolated from mainland UK and there is a small gene pool the… genetic drift / the founder effect allowed the condition to spread quickly throug…

5. Stabilising selection is a selection pressure that prevents deviation from the nor… weight increase mortality.
   Directional selection is a selection pressure that brings about change, e.g. grain…

6.1.3 Manipulating Genome

1. 1A, 2H, 3G, 4I, 5C, 6B, 7E, 8F, 9D

2. a) DNA is denatured and mixed with primer, dNTPs and ddNTPs, each with a

   b) Chance determines whether a dNTP or a ddNTP **forms hydrogen bonds with its c**

   When a dNTP bonds, **DNA polymerase can put a covalent bond into the** **copying continues.**

   When a ddNTP bonds, **DNA polymerase is unable to put a covalent bond** **cc ag ent is thrown off.**

   c) DNA fragments **are separated by electrophoresis and pass in size order** **This determines the colour of the terminal nucleoside.**

   d) If the colours are detected as blue, green, green, ..., this corresponds to ba **thymine...**

3. In PCR, single-stranded DNA is produced by denaturation.

   The DNA length is short in PCR (only a few hundred bases).

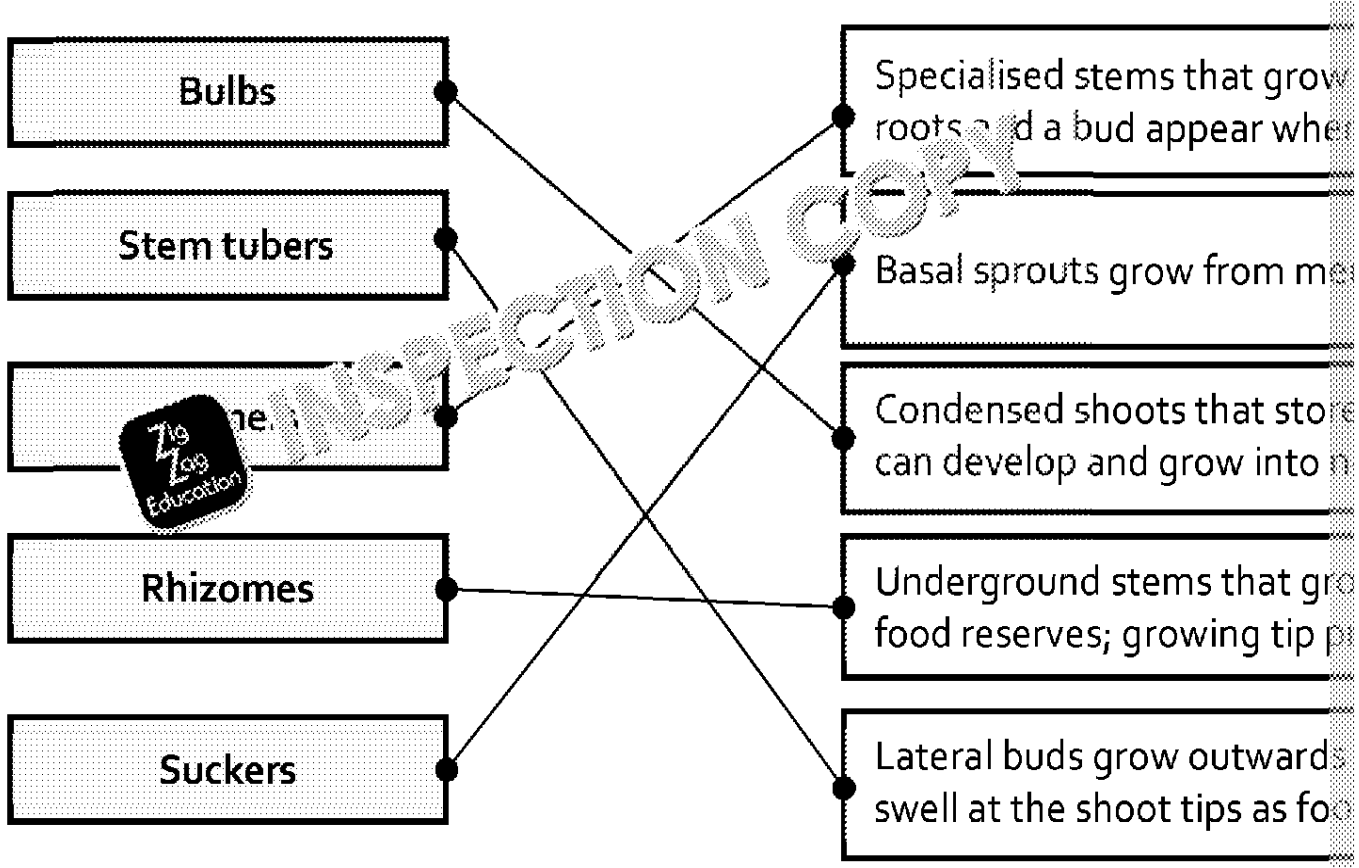
   Alternating high and low temperatures and primer is required for PCR.

4. *Gaps in somatic gene therapy from top to bottom:*
   body, adenoviruses, SCID, stem cells.

   Gaps in germline gene therapy from top to bottom:
   embryo, retrovirus, stem cells, gonads

6.2.1.1 Cloning Plants

1.



2. identical, parent, cheaply, disease, sexual

3. Any three from:
   - Genetic uniformity can make plants susceptible to disease.
   - Tissue culture and micropropagation is labour-intensive and requires train
   - Micropropagation requires aseptic conditions.
   - A stock could become contaminated if a single clone propagates a genetic the rest.

4. A mass of undiffere d cells is formed: **C**

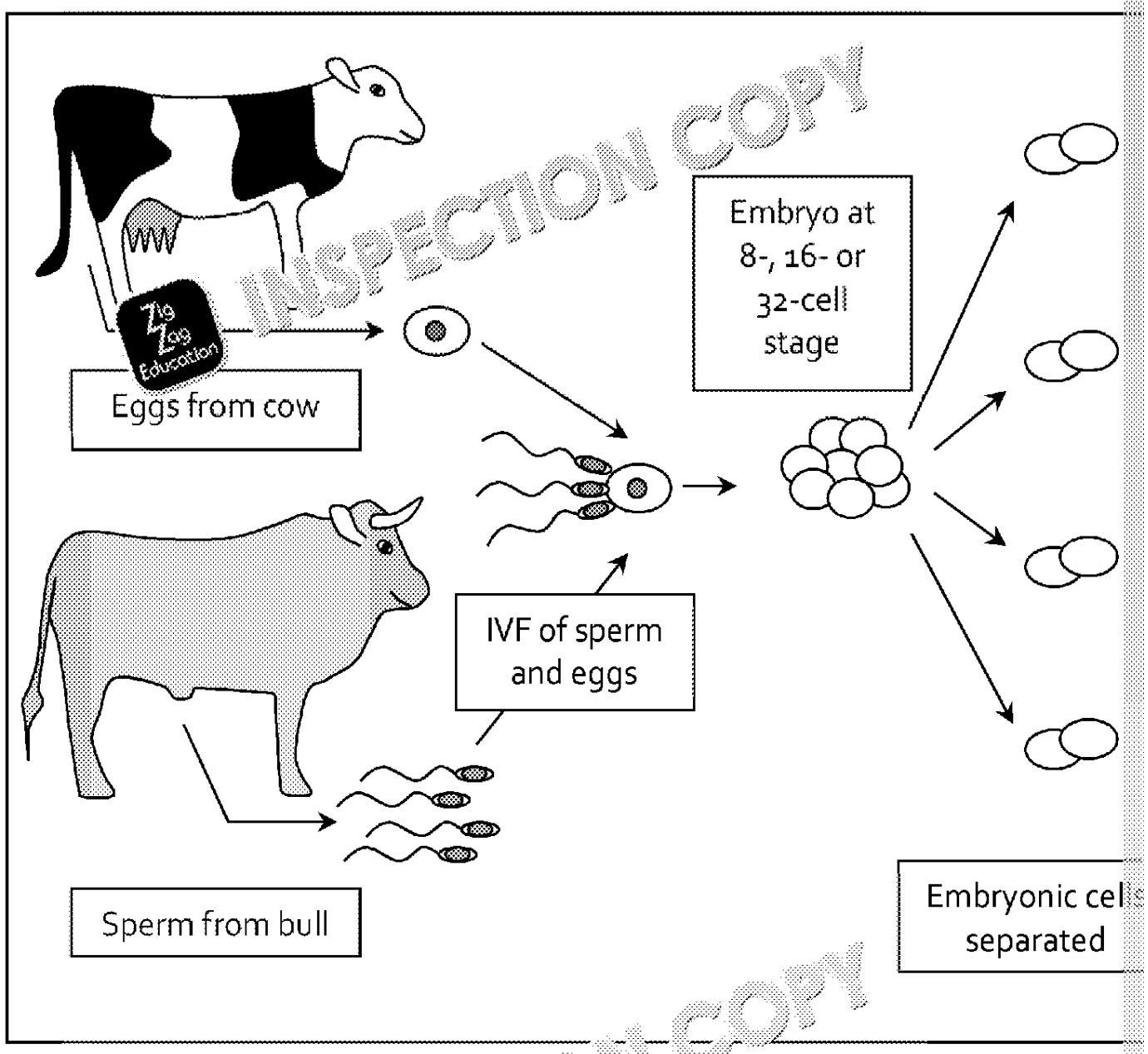
   Cells a fe d to a liquid medium in a bioreactor: **S**

   Excised buds are surface sterilised: **M**

   Auxin and cytokinins are applied to the medium: **C**

6.2.1.2 Cloning Animals

1.



2. Somatic, clones, Dolly the sheep, Finn Dorset, low

3. **Advantages**

Any three from:

- Clones are genetically identical so all have the good characteristics of the
- Can clone transgenic animals to produce a small group of animals that pro
- Can clone endangered animals to preserve their genes.
- Can rapidly improve the quality of herds.

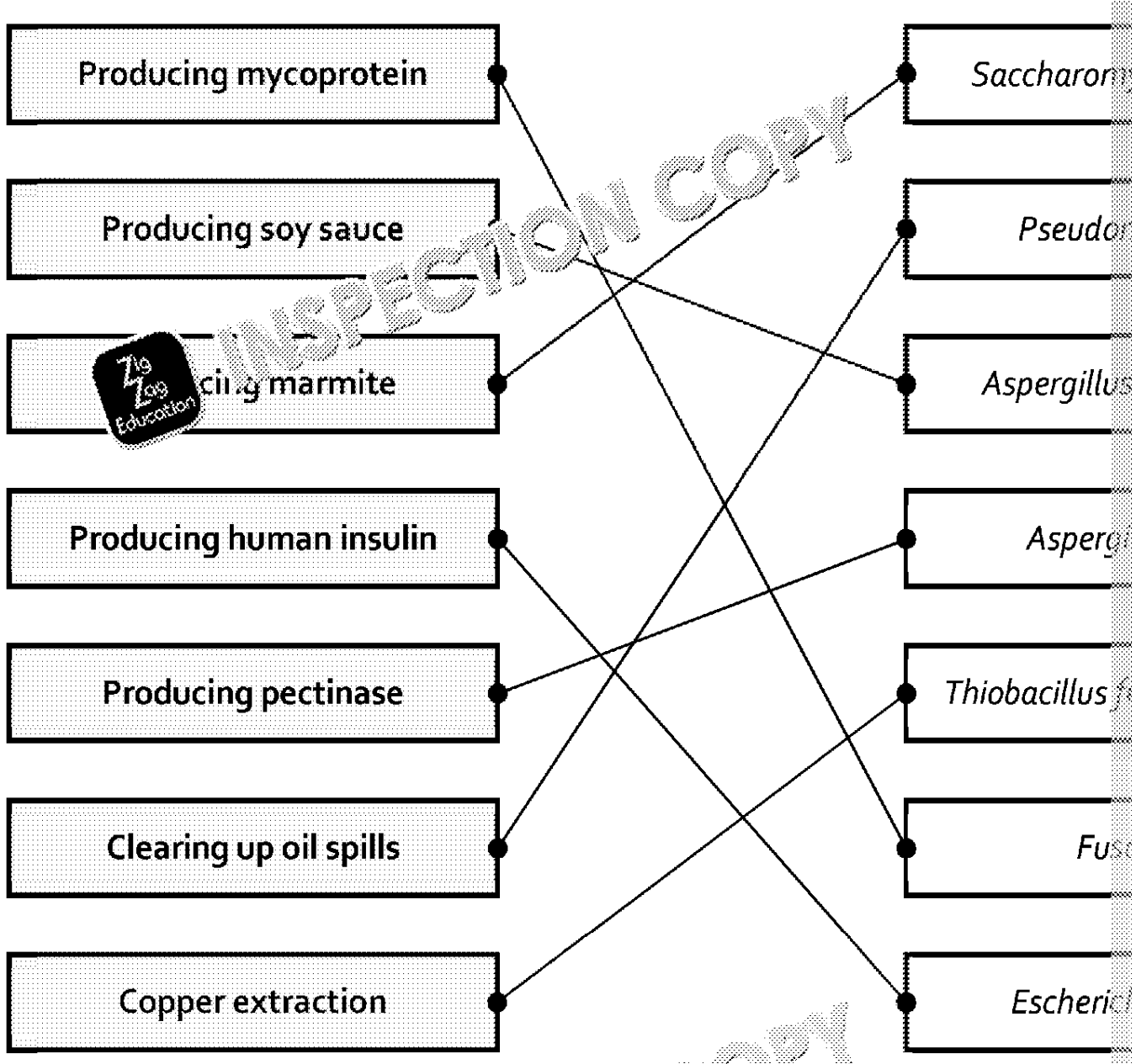
Disadvantages

Any three from:

- Clones may have an unknown genetic disease or susceptibility to disease.
- Quality of life of cloned animals may be poor, shorter life expectancy, isola
- Could be problems of genetic drift or evolutionary bottlenecks as all clones
- Success rate may be very high.

6.2.1.3 Biotechnology

1.



2. Type of lactic acid bacteria us

   Temperature use (high for hard cheese)

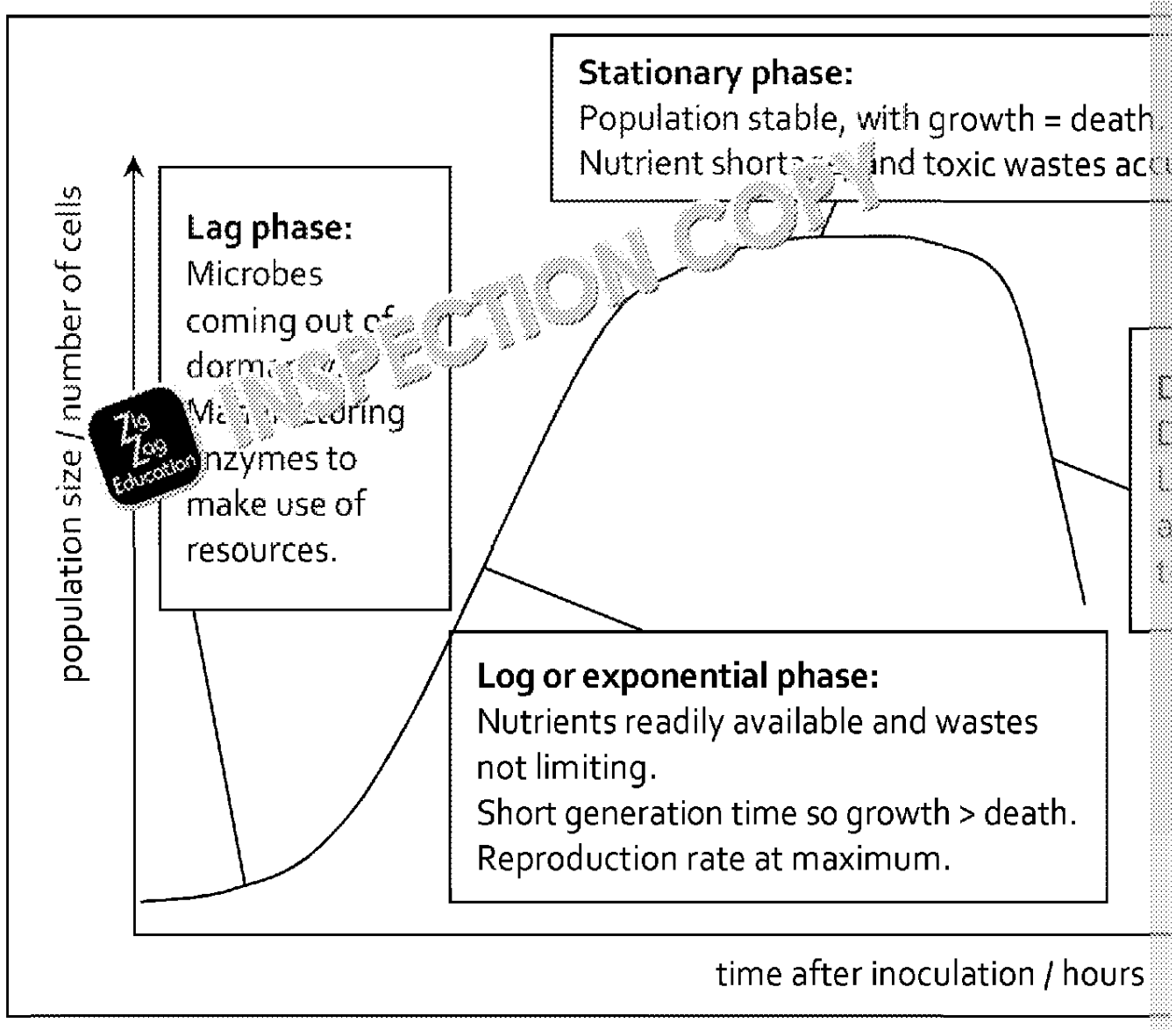
   Use of (cheese only)

3. They are more effective than non-biological detergents at removing stains at lo is used to heat water, which means they have a reduced carbon footprint.

4. adsorption, hydrophobic, leaching, covalent, active sites, membrane, entrapme

6.2.1.4 Culturing Microorganis

1.



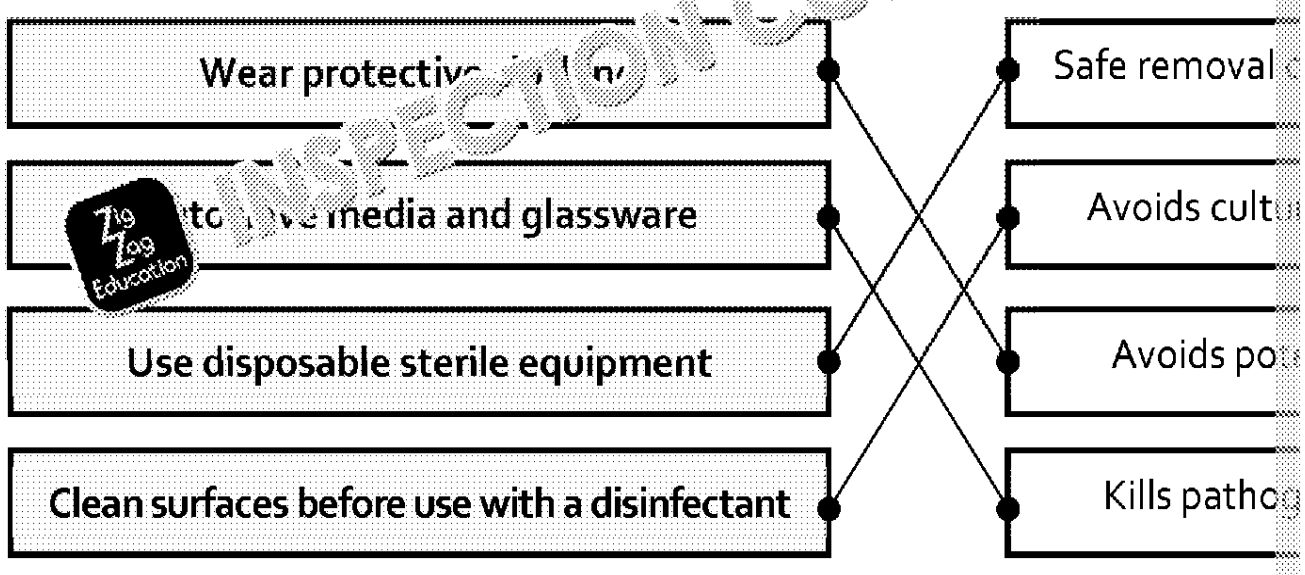
2.

	Batch cult	
Type of metabolite produced by the fermentation	Generally secondary	
Add f nutrients	All added at the start of the fermentation	Added
Removal of products	All removed (extracted) at the end of the fermentation	E
Example	Wine, beer, dairy, penicillin (fed-batch)	Q
Advantages	Relatively easy to control; can obtain secondary metabolites	Ex
Disadvantages	Fermenters are large; waste accumulates	C

3. a) In batch culture: nutrients need to be restricted once stationary phase is re
metabolites are produced by the ageing culture.

b) In continuous culture: nutrients need to be continu added to maintain
maximum rate of growth.

4.



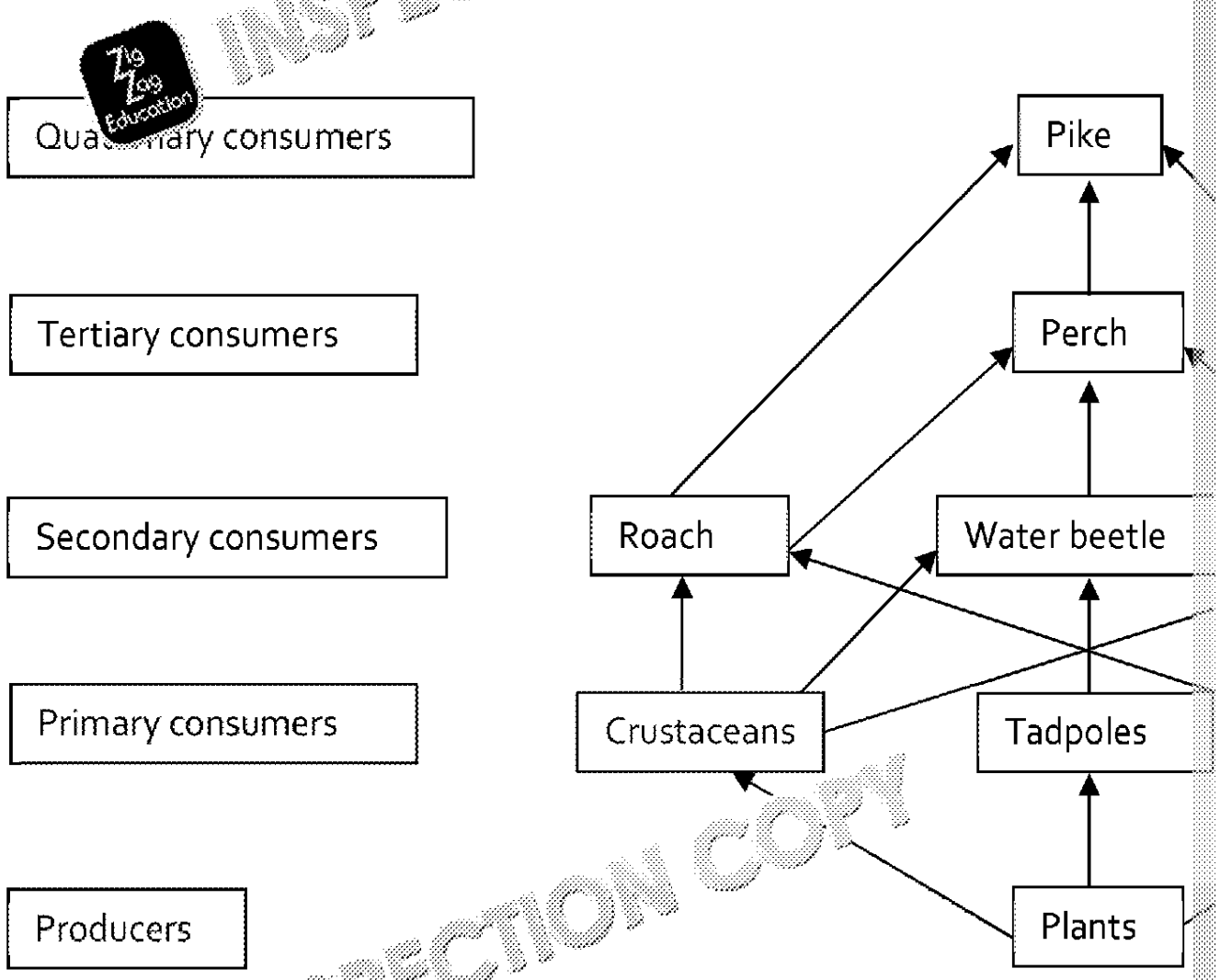
6.3.1.1 Energy in Ecosystems

1. **Biotic** – any three from:

   Grazing by herbivores, predation by carnivores, parasitism by parasites, symbio between organisms, disease

   Abiotic – any three from:

   Temperature, light intensity, oxygen concentration, carbon dioxide concentrati wind speed, soil factors (mineral nutrients, drainage, aeration, water content)

2. 

3. dependent, ATP, NAD, transpiration, stomata, CO_2, ribulose

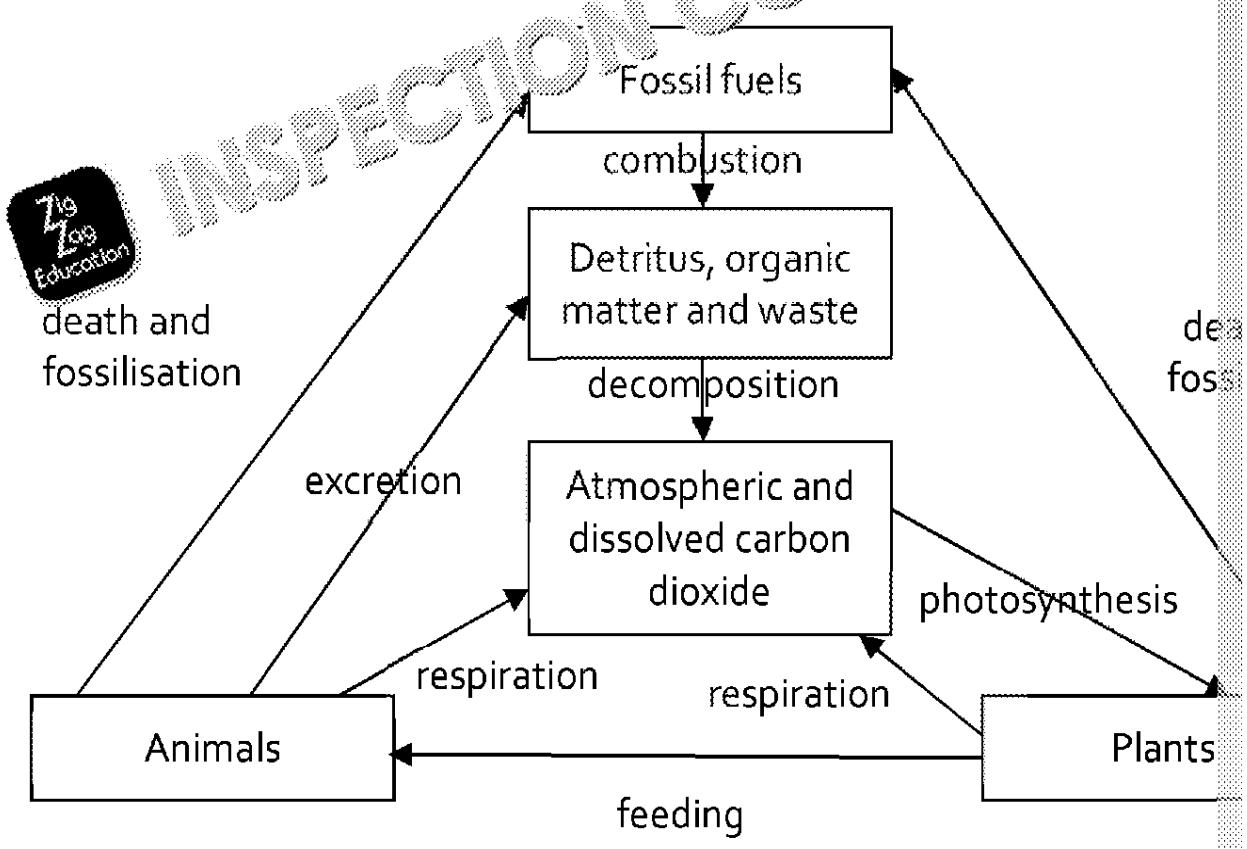
4. (87 403 ÷ 1 710 000) × 100 = 5.111286... = 5.1 %

6.3.1.2 Succession and Recycling N

1. 1A, 2K, 3G, 4E, 5J, 6C, 7F, 8B, 9H, 10D, 11I

2. Extracellular, starches, amino acids
   Soluble, growth

3.

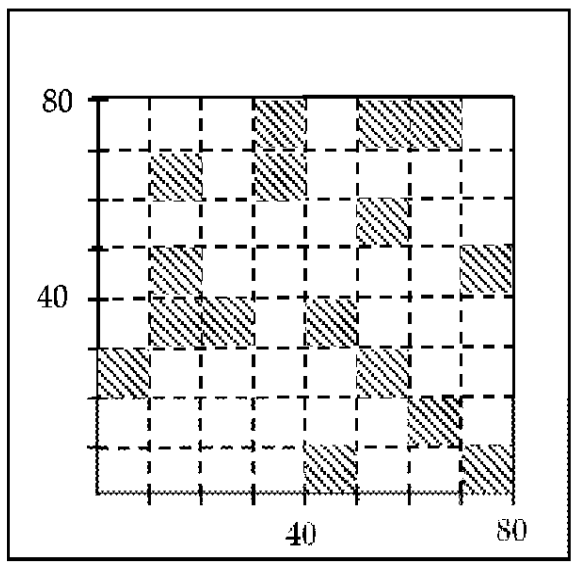


4. primary succession, deflected succession, colonisation, pioneer, climax commu

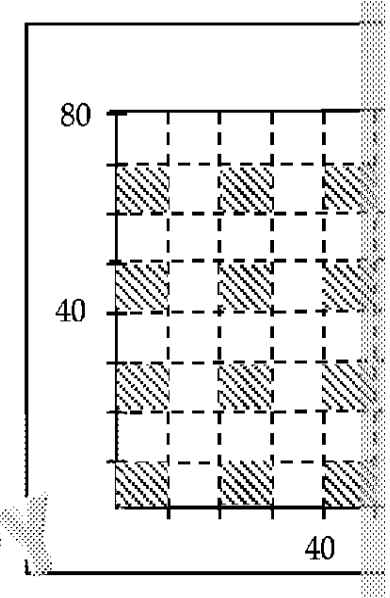
6.3.1.3 M[illegible]ng Distribution and A

1. Quadra[illegible]umber of quadrats, positioning of quadrats

2. a)



b) (or any other arrangem



3. Frequency = (number of quad[illegible]t in / total number of quadrats) × 100 =

4. An inter[illegible]d [illegible]sect would probably be best as it is a good compromise types. [illegible]ransect would be unsuitable as a woodland floor is likely to have everythi[illegible]that touches the line would take a long time. Similarly, a belt transe over 50 m, even with large quadrats, so only sampling every 5 *m* would be a mu

6.3.2.1 Population Size and Intera

1.

	Density dependent	D
Generally biotic or abiotic?	Generally bi	
Examples	Food availability, predation, disease, nesting sites / territory / availability of shelter, parasitism	Mineral nutri
Effect of population size on the effect of the factor	The effect of limiting factors is greater at higher population densities	Population si

2. 1A, 2E, 3F, 4C, 5G, 6D, 7B

3. a) They avoid direct competition for food by feeding on different prey species

   Cormorant feeds on bottom-dwelling fish such as flatfish, shrimp and prawn cormorant's food compared to 3 % of the shag's food.

   The shag feeds on surface-swimming fish such as sand eel and herring; the food compared to 15 % of the cormorant's food.

   b) i) Other items in their diet, e.g. goby and [illegible], nesting sites and

   ii) Interspecific competition (b[illegible] different species)

6.3.2.2 Conservation and Preserv

1.

Dormant side shoots sprout and are allowed to grow for [illegible] years, depending on the species.

Trees are cut near to the **ground**, producing stumps known as **stools**.

The woodland is c[illegible] this example). One [illegible] Here there are 12 [illegible]

2. **Ethical** – either:
   - A duty to protect our planet for future generations
   - Species have a right to exist and remain

   Social – either:
   - Recreational use of ecosystems for walking, wildlife-watching and relaxing
   - Aesthetic reasons

   Economic – any three from:
   - Direct (or unknown future) economic value of resources
   - Indirect benefits e.g. pollination, maintaining water quality, prevent[illegible]
   - Plants and [illegible] are important food sources
   - Sc[illegible] genetic diversity
   - Medicinal plants
   - Natural pest control agents
   - Ecotourism

3. endemic, endangered, goats, finches, cats, land, fragmentation