



EXAM PAPERS PRACTICE

Biodiversity and Natural Resources -2

Name: _____

Class: _____

Date: _____

Time:

Total Marks Available:

Total Marks Archived:

Level: Edexcel A level Biology

Subject: Biology

Exam Board: Pearson Edexcel Level 3 GCE AS and A level Biology A (Salters-Nuffield) and also Pearsons Edexcel AS and A Level Biology B (9BI0) - Is however suitable for use by AS and A level Biology Students of other Boards

Topic: Biodiversity and Natural Resources -2

Type: Topic Questions

To be used by all students preparing for Edexcel AS and A level Biology A and Biology B - Students of other Boards may also find this useful



Questions

Q1.

Tropical rainforests play a role in maintaining biodiversity and in storing carbon. Information on biodiversity has been collected from various rainforest habitats in Madagascar.

(i) Describe what needs to be measured in order to compare the biodiversity of two rainforests.

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(ii) The biodiversity of the land area of Earth has been estimated.

The table shows information on the number of species of plants and vertebrate animals in the rainforests of Madagascar and for the land area of Earth.

Region	Plants		Vertebrate animals		Land area / km ²
	Number of known species	Number of known endemic species	Number of known species	Number of known endemic species	
Madagascar	12 000	9704	987	771	59 300
Land area of the Earth	300 000	300 000	27 300	27 300	149 000 000

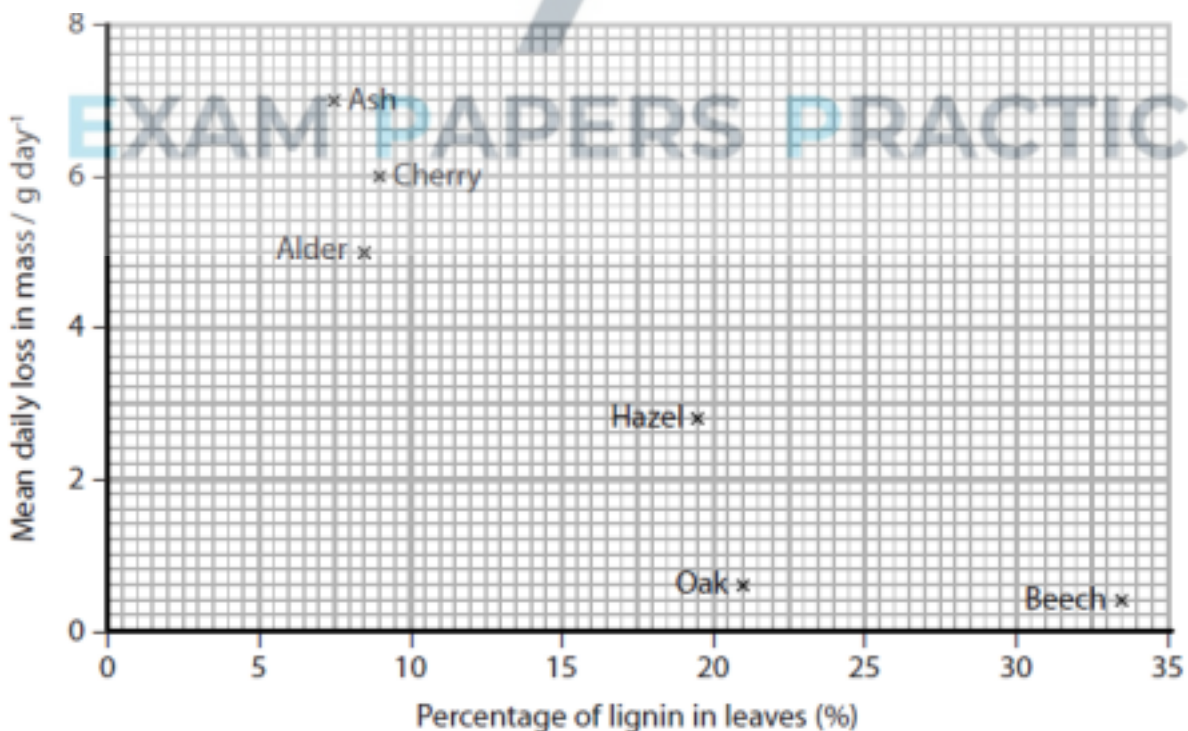
- A bacteria and fungi
- B bacteria and viruses
- C fungi and viruses
- D bacteria, fungi and viruses

(b) An investigation was carried out into the effect of lignin content on the decomposition of leaves from different types of tree.

The lignin content of leaves from an ash tree was determined. A pile of ash leaves was collected and weighed. The leaves were left for 40 days and reweighed. The mean daily loss in mass was calculated.

This was repeated for leaves from five other species of tree. All six piles of leaves had the same starting mass.

The results of this investigation are shown in the graph below.



(i) A student made the following conclusions from the data.



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Beech leaves decompose faster than cherry leaves.
Microorganisms are needed for the decomposition of these leaves.
There is a causal relationship between lignin content and decomposition.

Place a cross in the box next to the number of correct conclusions made by the student.

(1)

A none

B one

C two

D three

(ii) Place a cross in the box next to the term that completes the following statement. Each pile of leaves had the same mass to ensure the investigation was

(1)

A accurate

B precise

C reliable

D valid

(iii) Suggest what happens to the cellulose in these leaves during decomposition.

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(iv) The student repeated this investigation on sycamore leaves.

Explain why it would be necessary to keep the temperature of this investigation the same as the original.

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(Total for question = 11 marks)

Q3.

Anabolic steroids and testosterone have been used as performance-enhancing drugs by some athletes. These drugs can increase muscle mass and strength.



An investigation was carried out to assess the effect of doses of testosterone on muscle size.

A group of men was randomised into four groups: A, B, C and D. Groups A and B were given a placebo. Groups C and D were both given doses of testosterone. Groups A and C had no exercise training. Groups B and D were given exercise training.

The cross-sectional area of the triceps muscle of each individual was measured at the start of the investigation and after 10 weeks.

The results are shown in the table.

Muscle	Mean cross-sectional area of muscle / mm ² ± SD			
	Group A Placebo without exercise	Group B Placebo with exercise	Group C Testosterone without exercise	Group D Testosterone with exercise
Triceps – at the start	3621 ± 213	4052 ± 262	3579 ± 260	3483 ± 217
Triceps after 10 weeks	3539 ± 226	4109 ± 230	4003 ± 229	3984 ± 239

(i) Deduce the effect of testosterone on the size of the triceps muscle.

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(ii) The purpose of the placebo is to

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- A** increase the accuracy of the measurements
- B** increase the reproducibility of the data
- C** show that exercise has an effect
- D** show that testosterone has an effect

(Total for question = 3 marks)

Q4.

The scientific article you have studied is adapted from *National Geographic*.

Use the information from the scientific article and your own knowledge to answer the following questions.

State what is meant by the term endemic (paragraph 35).

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(Total for question = 1 mark)

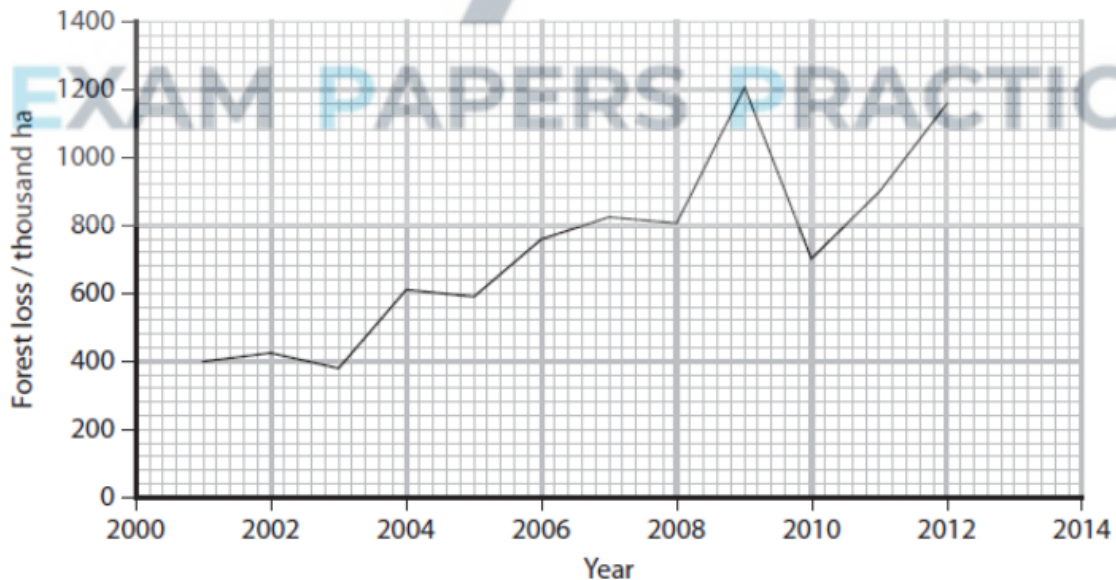


Q5.

The photograph shows an orangutan. These animals inhabit the forests of Borneo and Sumatra.



The orangutan population in Borneo decreased by 60% between 1950 and 2010. This has been linked to loss of habitat. Deforestation has resulted in the loss of natural habitat. The graph shows the area of forest loss in Borneo from 2001 to 2012.



(2)

(i) Calculate the mean rate at which forest was lost between 2010 and 2012.

Answer



*(ii) Land use has changed over time in Borneo, with areas of forest being removed due to logging. The land may then be used for planting oil palms, which are not a suitable habitat for orangutans.

The following comments refer to other issues concerning the conservation of orangutans in Borneo.

- Over the past 100 years, 80% of suitable habitat for orangutans has been lost.
- Only 2% of the remaining forest suitable as orangutan habitat is protected.
- From 1999 to 2015, the orangutan population decreased by 50%.
- Captive-bred orangutans may spread human diseases into wild populations.
- When captive-bred orangutans are released, their offspring often die young because the females have not learnt parenting behaviour from older individuals.
- Large numbers of orangutans are hunted in Borneo, even though they are a protected animal.

It has been stated that habitat protection is more important than captive breeding programmes for the conservation of orangutans in Borneo.

Evaluate this statement.

EXAM PAPERS PRACTICE

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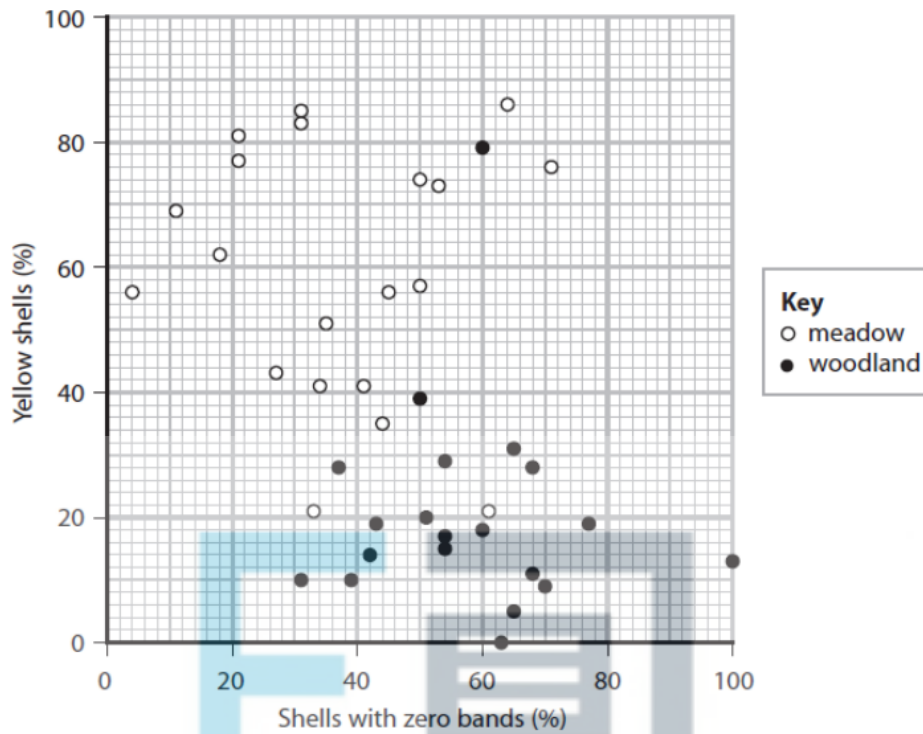
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(i) Explain the importance of the different shell patterns in these two habitats.

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(ii) Explain how a statistical test could be used to determine if the number of shells with zero bands is significantly different in these two habitats.

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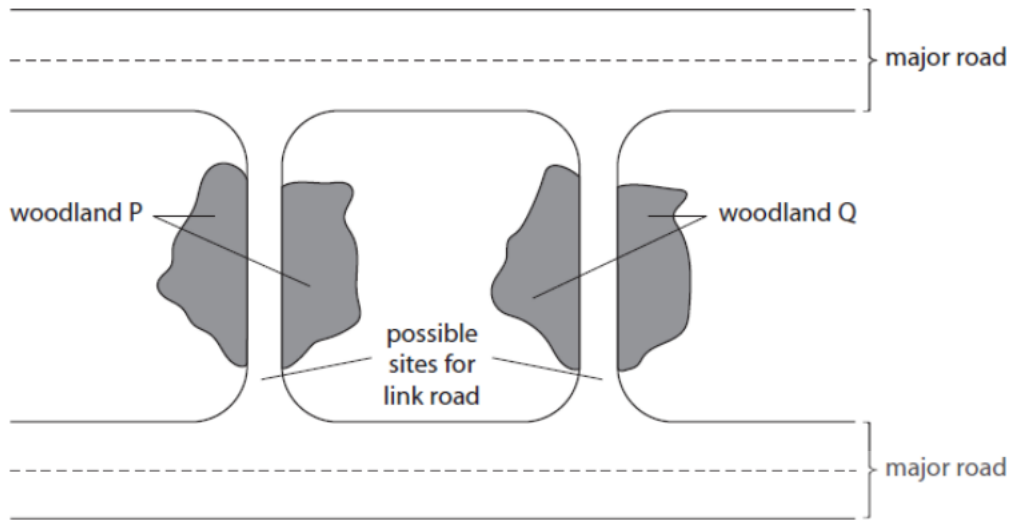
(Total for question = 5 marks)

Q10.

Wildlife conservation can involve keeping animals in zoos as well as protecting habitats. Habitats can be destroyed by road building.

A link road is planned to connect two major roads.

The diagram shows the two possible sites for the link road and two woodland habitats.



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(ii) To decide which of the two link roads should be built, studies of the biodiversity of woodlands P and Q need to be carried out.

Discuss what information needs to be collected from the two woodlands to make a decision about the site of the link road.

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(Total for question = 5 marks)

Q11.

Plant fibres and oil-based plastics have both been used to make ropes.

Climbing ropes can be made from manila (a plant fibre) or nylon (an oil-based plastic). Various factors affect the tensile strength of these ropes, including diameter and storage conditions.

The table shows the effect of rope diameter on tensile strength.

Diameter of rope / mm	Tensile strength / kN	
	Manila rope	Nylon rope
6	2.4	7.5
8	4.2	12.1
10	5.7	16.3
12	10.6	28.4



Q13.

The golden snub-nosed monkey (*Rhinopithecus roxellana*) is endemic to high mountainous regions of China.

This endangered species of monkey feeds on seeds.



State what is meant by the term endemic.

EXAM PAPERS PRACTICE

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(Total for question = 1 mark)

Q14.

Some marine snails produce chemicals called conotoxins. These chemicals paralyse the prey of these snails by interfering with the conduction of nerve impulses to muscles.

Conotoxins can be modified to produce painkillers.

The effects of conotoxins on the nervous system were first demonstrated in experiments involving animals.

These experiments were involved in the development of painkillers from conotoxins.

(i) Describe the ethical issues concerning the use of animals in this research.

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(ii) After testing on animals, painkillers undergo three-phased testing.

In an investigation testing the effectiveness of a painkiller produced from conotoxin, the new painkiller was tested on a group of healthy volunteers.

Explain the reasons for this stage in the testing of the painkiller.

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Q15.

Seed banks store seeds to conserve different varieties of plants.

Seeds are stored for long periods of time in conditions that allow them to be germinated when required.

An investigation was carried out to study the effect of storage time on wheat seeds of two different varieties.

Wheat seeds of one variety, P, were collected and divided into six groups, each with the same number of seeds. Each group of seeds was stored in an atmosphere of 80% humidity at a temperature of 42 °C.

Each group was stored in these conditions for different lengths of time. One group of seeds was germinated immediately after collection. This was the control group.

After storage, the seeds were planted in suitable conditions to allow germination. The number of seeds that germinated was found and the mean percentage germination calculated.

This was repeated using wheat seeds of a different variety, Q.

All other variables were kept constant.

The results are shown in the table.



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Storage time / hours	Mean percentage germination (%)	
	Wheat variety P	Wheat variety Q
0 (control)	97	99
24	96	99
48	95	98
72	94	81
96	60	66
120	57	63

(i) Describe the effect of storage time on the germination of seeds for these two varieties of wheat.

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(ii) Explain how the results for the control were useful in this investigation.

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(Total for question = 5 marks)

Q16.

The modern bread wheat plant (*Triticum aestivum*) has been developed from other plant species that have different genomes.

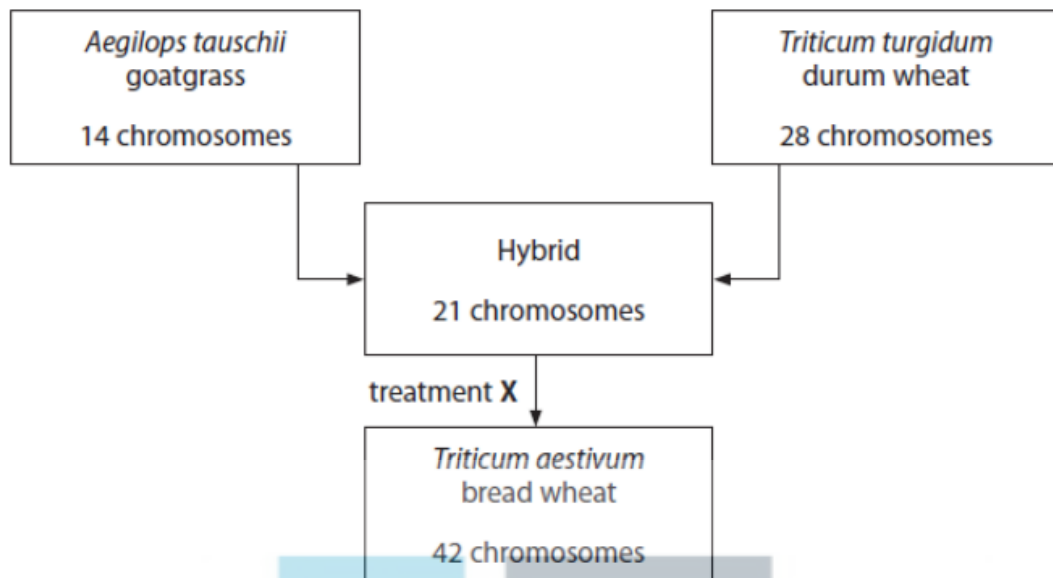
Three species of plant and their genomes are shown in the images.



The diagram shows how chromosomes from different species have combined to produce the bread wheat species used to produce flour.



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* New varieties of plants with desirable combinations of characteristics can be produced using the methods shown in the table.

Method	Example
Formation of hybrids	In wheat, genome D includes genes for a tolerance of harsh conditions and genome A promotes large starch stores in seeds.
Genetic modification	Production of specific molecules in plant cells.
Selective breeding	Plants with desired characteristics can be used for breeding to produce plants with combinations of desired characteristics.

Evaluate the risks and benefits of producing varieties of plants using these methods.

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(Total for question = 5 marks)

Q18.

The scientific article you have studied is adapted from *National Geographic*.

Use the information from the scientific article and your own knowledge to answer the following questions.

Dengue is a disease caused by a virus carried by *Aedes aegypti*.

Using CRISPR and a gene drive, it may be possible to stop the reproduction of *Aedes aegypti* mosquitoes (paragraphs 20 and 21).

Explain why stopping the reproduction of this species of mosquito might not stop the spread of this disease.

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(Total for question = 3 marks)

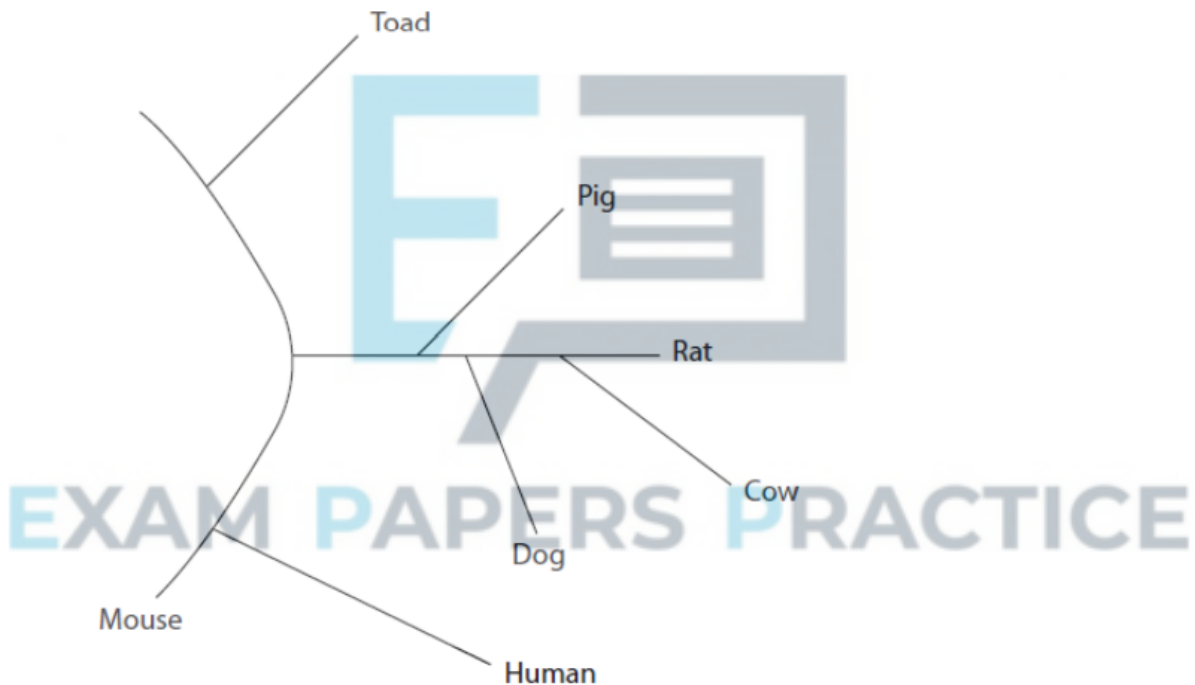
Q19.

Trypsin is an enzyme found in many groups of living organisms.

Trypsin specifically acts on a polypeptide to form amino acids.

The primary structures of trypsin molecules from different species have been used to produce a phylogenetic tree for trypsin.

Each branch of the following phylogenetic diagram represents trypsin from a different species.



Explain how the primary structure of trypsin molecules can be used to produce a phylogenetic tree.

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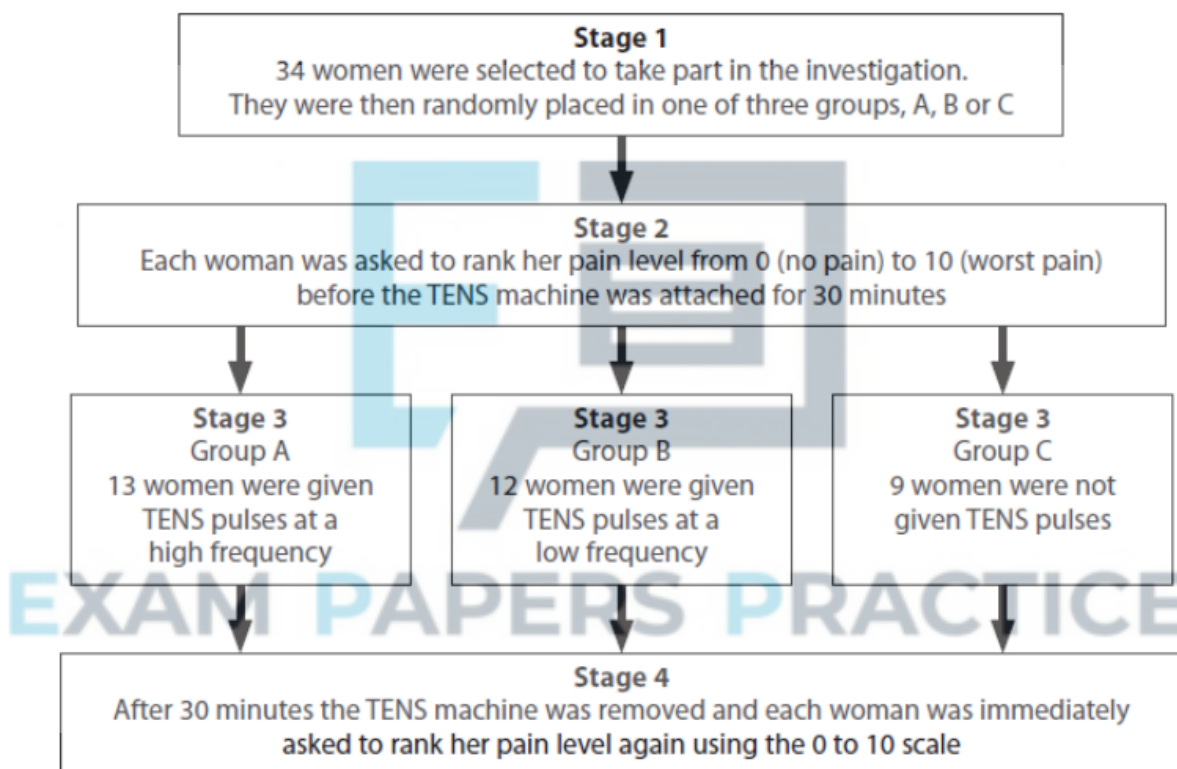
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A TENS (transcutaneous electrical nerve stimulation) machine releases regular pulses of electricity onto the skin surface and can be used in pain relief.

An investigation was carried out to study whether the frequency of the pulses from a TENS machine could help these women with their pain relief.

The diagram shows how the investigation was carried out.



Explain why group C was included in this investigation.

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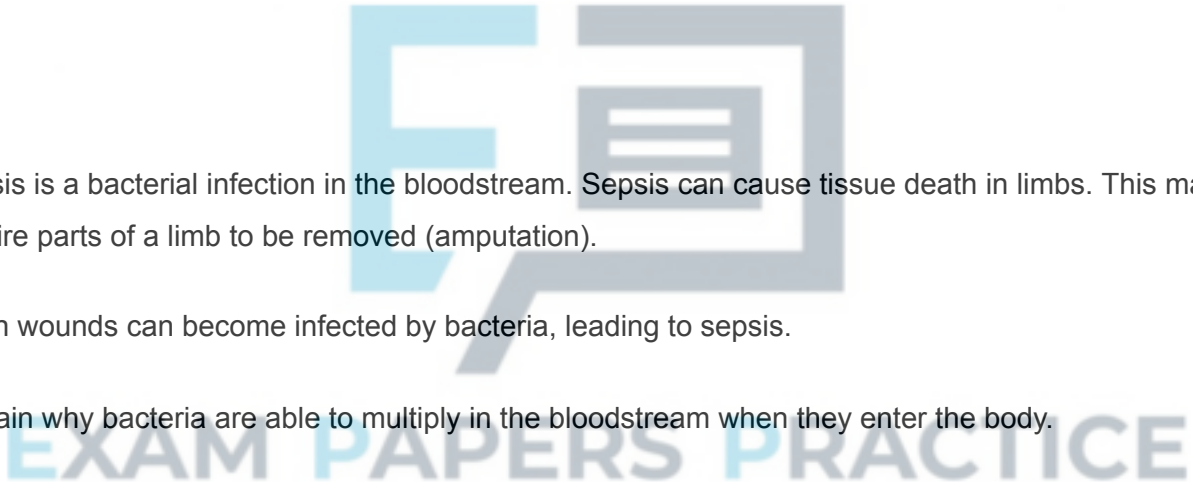
(Total for question = 2 marks)

Q22.

Sepsis is a bacterial infection in the bloodstream. Sepsis can cause tissue death in limbs. This may require parts of a limb to be removed (amputation).

Open wounds can become infected by bacteria, leading to sepsis.

Explain why bacteria are able to multiply in the bloodstream when they enter the body.



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(Total for question = 3 marks)



Q23.

The scientific article you have studied is adapted from several sources.

Use the information from the scientific article and your own knowledge to answer the following questions.

Explain why genetically modified bacteria delivering drugs 'to the exact tissue in the body where they're needed and nowhere else' would decrease side effects (paragraph 34).

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(Total for question = 2 marks)

Q24.

The modern bread wheat plant (*Triticum aestivum*) has been developed from other plant species that have different genomes.

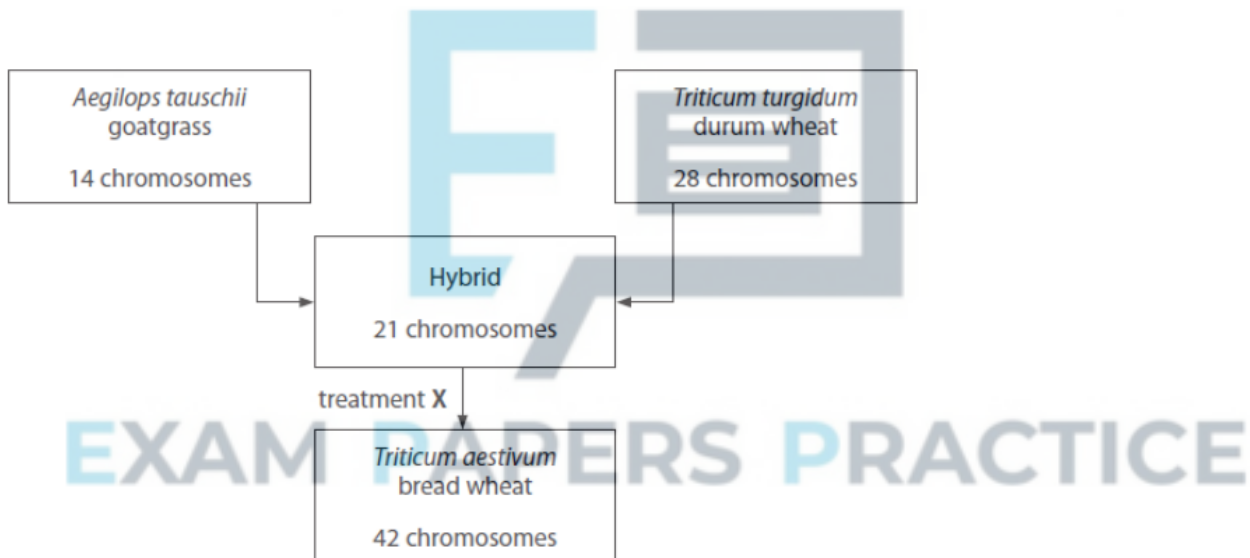
Three species of plant and their genomes are shown in the images.



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The diagram shows how chromosomes from different species have combined to produce the bread



wheat species used to produce flour.

Explain why the hybrid plant cannot produce haploid gametes.

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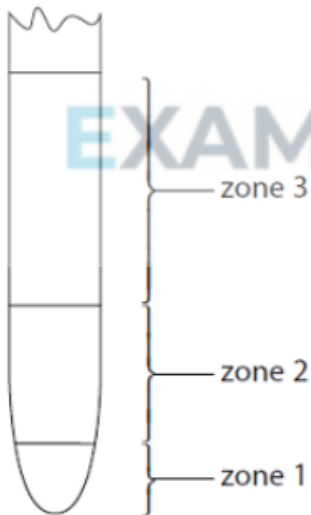
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(Total for question = 2 marks)

Q25.

The diagram shows three different zones found in a plant root.



In zone 3, some of the cells differentiate to give rise to phloem sieve tube elements and others differentiate into phloem companion cells.



(i) Explain how genetically identical cells in zone 3 can differentiate to give rise to different tissues.

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(ii) The student also hypothesised that the cells in zone 1 would be smaller in size than the cells that had differentiated into xylem vessels in zone 3.

The student prepared microscope slides of sections from zones 1 and 3.

Explain how the student could compare the sizes of cells in zone 1 with the sizes of xylem vessels in zone 3.

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(Total for question = 6 marks)



Q26.

A new species of mosquito has evolved in the tunnels of the London Underground. These mosquitoes are believed to be the descendants of bird-biting mosquitoes which colonised the tunnels 100 hundred years ago. The mosquitoes now feed on rats, mice and human beings instead of birds.

(a) Place a cross in the box next to the best definition of a species.

(1)

- A** individuals can interbreed to produce fertile offspring
- B** individuals can interbreed to produce hybrid offspring
- C** individuals can interbreed to produce sterile offspring
- D** individuals can interbreed to produce offspring

(b) Explain how this species of mosquito may have evolved.

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EXAM PAPERS PRACTICE

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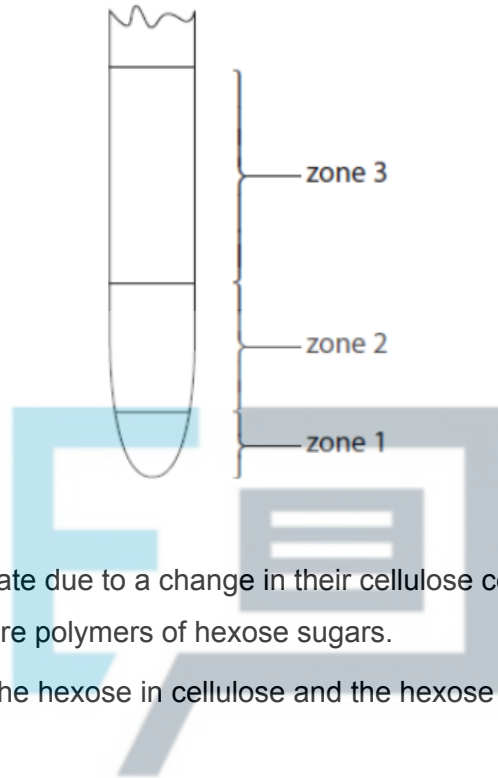
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(Total for question = 6 marks)

Q27.

The diagram shows three different zones found in a plant root.



In zone 2, the plant cells elongate due to a change in their cellulose cell walls.

(i) Cellulose and amylopectin are polymers of hexose sugars.

State one difference between the hexose in cellulose and the hexose in amylopectin.

(1)

EXAM PAPERS PRACTICE

(ii) The cellulose molecules form microfibrils.

Name the bond between adjacent cellulose molecules in a cellulose microfibril.

(1)

(Total for question = 2 marks)

Q28.

A population of white-tailed deer *Odocoileus virginianus* was introduced from North America into Finland in 1934. There were four females and one male. The population has since increased rapidly.

A study in 2012 compared the genetic diversity of the population in Finland with the population in North America.

Ten genes were compared from 72 deer in each population. The allele richness (number of alleles in the population) of each gene was measured.

A χ^2 test was carried out to compare the two populations.

(i) The null hypothesis for this investigation is

(1)

- A** the allele richness in the population from Finland is higher than the USA.
- B** the allele richness in the population from the USA is higher than Finland.
- C** the population in the USA is more genetically diverse than the population in Finland.
- D** there is no difference in allele richness between the two populations.

(ii) The values from the population in the USA can be taken as the expected values and a χ^2 test can be carried out.



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Gene	Allele richness (Finland population) X (observed)	Allele richness (USA population) Y (expected)	X - Y	(X - Y) ²	(X - Y) ² / Y
1	6	14	8	64	4.57
2	4	5	1	1	0.2
3	7	13	6	36	2.77
4	7	15	8	64	4.27
5	6	6	0	0	0
6	8	12	4	16	1.33
7	2	3	1	1	0.33
8	4	4	0	0	0
9	4	9			
10	3	4			

Complete the table to calculate the χ^2 value, using the formula

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

(3)

Answer

(iii) The table shows the critical values of chi-squared at different levels of probability.



Degrees of freedom	Probability	
	p=0.10	p=0.05
1	2.706	3.841
2	4.605	5.991
3	6.251	7.815
4	7.779	9.488
5	9.236	11.070
6	10.645	12.592
7	12.017	14.067
8	13.362	15.507
9	14.684	16.919
10	15.987	18.307

Deduce the effect of a small founder population on the allele richness in the population of white-tailed deer in Finland.

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(Total for question = 7 marks)



Q29.

During the civil war in Mozambique, from 1977 to 1992, 90% of the African elephants were killed for the ivory in their tusks.

Since 1992, the elephant population in Mozambique has increased.

The photograph shows a group of elephants in Mozambique.



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A study of an elephant population in Mozambique was carried out in 2017. The elephants studied were all born before 1992.

The table shows the number of elephants with and without tusks.

Elephants	Number of elephants
with tusks	98
without tusks	102

The presence of tusks is controlled by a single gene. The allele for tusks is known to be dominant.



The frequency of alleles in a population can be determined using the Hardy-Weinberg equation.

Calculate the frequency of the dominant and recessive alleles in this population. Give your answer to 2 decimal places.

(3)

Frequency of the dominant allele

Frequency of the recessive allele

(Total for question = 3 marks)

Q30.

The scientific article you have studied is adapted from *National Geographic*.

Use the information from the scientific article and your own knowledge to answer the following question.

Explain how two populations of mosquito could be shown to belong to different species (paragraph 4).

(2)

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(Total for question = 2 marks)