



EXAM PAPERS PRACTICE

Biodiversity and Natural Resources -1

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 -1

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



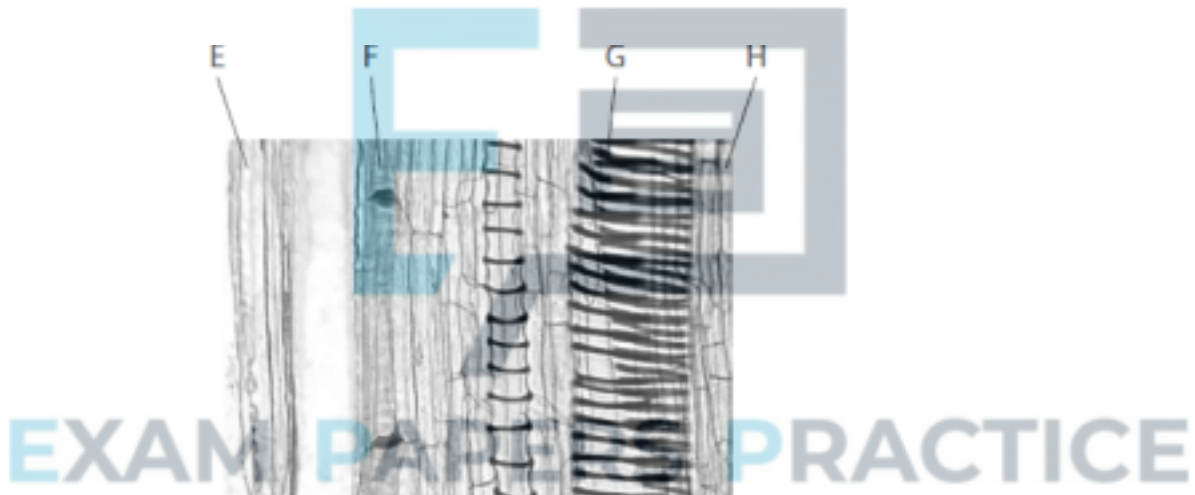
Questions

Q1.

Answer the questions with a cross in the boxes you think are correct . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

The stems of plants contain tissues involved in transport and in support.

The photograph shows a longitudinal section through one plant stem.



Cell image library - image ID 38928

(i) Which labelled structure in the photograph contains lignin?

(1)

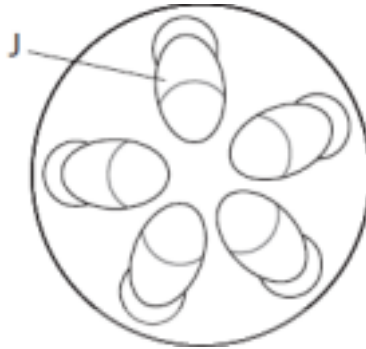
A E

B F

C G

D H

(ii) The diagram shows a transverse section through a plant stem.



Which of the labelled structures in the photograph is located in the area labelled J in the diagram?

(1)

- A E
- B F
- C G
- D H

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(Total for question = 2 marks)

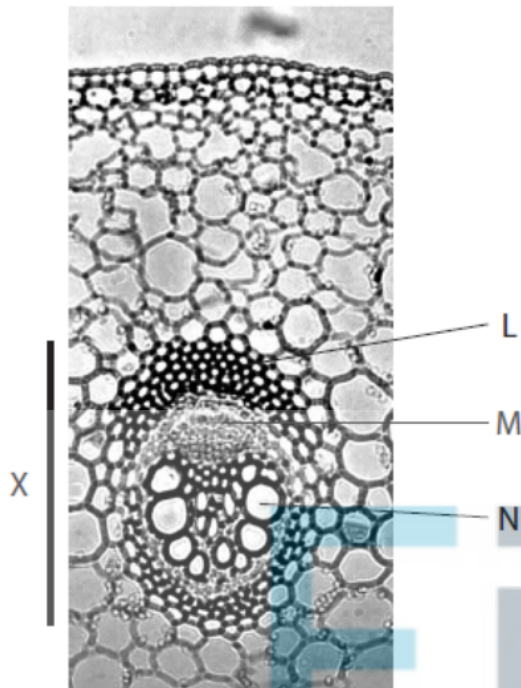
Q2.

Answer the questions with a cross in the boxes you think are correct . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

The stems of plants contain tissues involved in transport and in support.

The photograph shows a cross section of part of the stem of a plant.

Fibres can be extracted from stems similar to this one and used instead of fibres produced from oil-based plastics.



John Bebbington FRPS Science and Plants for schools – <https://www.saps.org.uk>

(i) The part of the stem labelled L contains

(1)

- A phloem that transports organic solutes
- B sclerenchyma fibres that provide support
- C sieve tubes that transport water
- D xylem vessels that transport water and mineral ions

(ii) The part of the stem labelled M contains

(1)

- A phloem that transports organic solutes
- B sclerenchyma fibres that transport water
- C sieve tubes that synthesise organic solutes
- D xylem vessels that transport water and mineral ions

(iii) The structure labelled N is a

- A part of the phloem that transports water
- B sclerenchyma fibre that provides support
- C sieve tube that transports organic solutes
- D xylem vessel that transports water and mineral ions

(1)

(iv) The line labelled X on the photograph represents the width of the vascular bundle. The actual width of the vascular bundle is 320 μm .

Calculate the magnification of the image.

(3)

Answer

(Total for question = 6 marks)

Q3.

Answer the questions with a cross in the boxes you think are correct . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

Electron microscopes have enabled scientists to view the ultrastructure of cells.

(i) Which of the following structures is found in animal cells?

(1)

A amyloplast

B chloroplast

C mesosome

D ribosome

(ii) Which of the following structures is found only in plant cells?

(1)

A amyloplast

B Golgi apparatus

C mesosome

D vacuole



(iii) Which of the following structures is found in both animal and plant cells? (1)

- A amyloplast
- B cell wall
- C pili
- D smooth endoplasmic reticulum

(Total for question = 3 marks)

Q4.

The arctic ground squirrel (*Spermophilus parryii*) lives in Alaska. It has small ears, a cylindrical body and a shorter tail than other species of ground squirrel.

The arctic ground squirrel can survive cold winters by hibernating for up to eight months per year. When hibernating, arctic ground squirrels use stored fat supplies as an energy source.



www.sciencephoto.com



Which combination of adaptations shown by the arctic ground squirrel have been described?

(1)

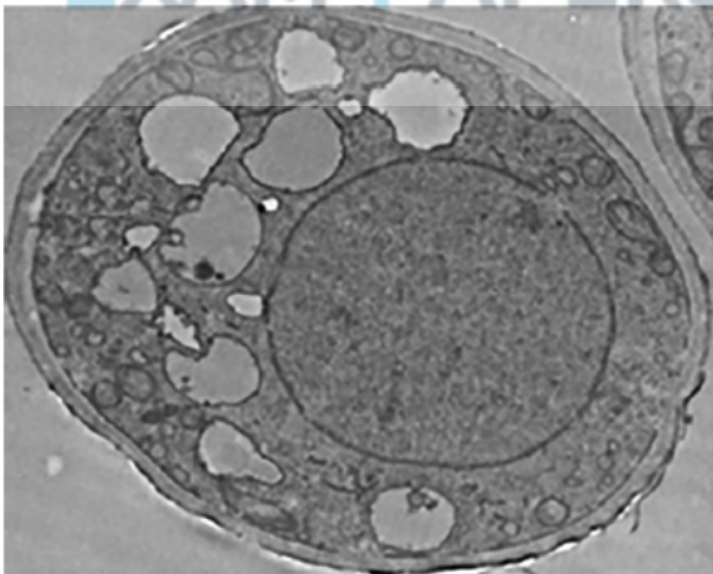
- A anatomical and behavioural only
- B anatomical and physiological only
- C anatomical, behavioural and physiological
- D behavioural and physiological only

(Total for question = 1 mark)

Q5.

Hymenoscyphus fraxineus (*H. fraxineus*) is the fungus that causes ash dieback. This disease usually kills all the ash trees that it infects.

The electron micrograph shows a section through a fungal cell.



Magnification $\times 1000$



To which group do fungi belong?

(1)

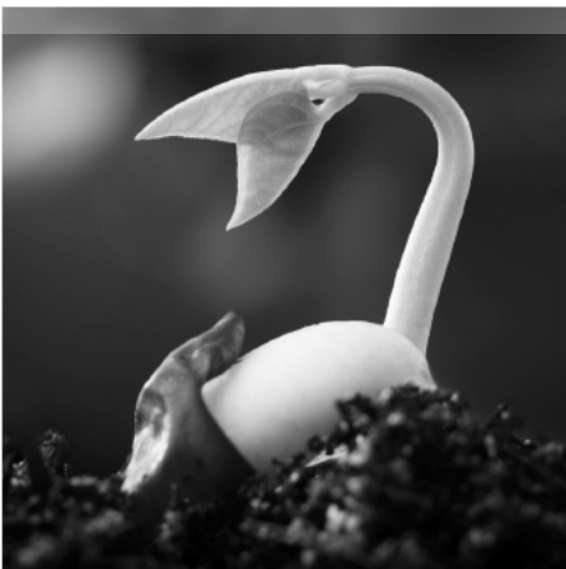
- A Archaea
- B Eukaryota
- C Prokaryota
- D Viruses

(Total for question = 1 mark)

Q6.

Plants can respond to and use light.

The photograph shows a seedling starting to grow from a germinating seed.



(a) Explain why the seedling needs a supply of magnesium ions.

(2)

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(Total for question = 2 marks)

Q7.

The scientific article you have studied is adapted from *The Biologist*.

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

Human cells can be grown in monolayers using tissue culture (Figure 1).

Devise a procedure to investigate the effect of temperature on the growth rate of a monolayer of human cells.

(5)

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(Total for question = 5 marks)

Q8.

Wildlife conservation can involve keeping animals in zoos as well as protecting habitats.

Describe the roles that zoos play in animal conservation.

(3)

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(Total for question = 3 marks)

Q9.

An experiment was carried out to investigate mineral deficiencies on the growth of seedlings. The effects of two mineral deficiencies on two different species of plant were investigated.

Test tubes were half filled with an aqueous gel containing a mineral solution without calcium ions. Seeds of rice or fenugreek were placed separately in these test tubes.

These test tubes were placed by a window for two weeks to allow the seeds to germinate and the seedlings to grow.

This was repeated using test tubes containing mineral solution without magnesium ions. A control should have been used in this investigation.

(i) Which of the following would be a suitable control?

(1)

A complete mineral ion solution

B distilled water

C dry gel

D tap water

(ii) In this investigation a control would have improved

(1)

A accuracy

B precision

C repeatability

D validity

(iii) The table gives some properties of rice seeds and fenugreek seeds.

Property of seeds	Rice	Fenugreek
Number per g	200	500
Calcium ion content / mg 100g ⁻¹	21	176
Magnesium ion content / mg 100g ⁻¹	177	191

The calcium content of one fenugreek seed was calculated to be 3.52 μg . Calculate the calcium content of one rice seed.

(3)

Answer μg

(iv) After two weeks, the seedlings of both rice and fenugreek grown in both solutions had green leaves.

The rice seedlings grown in mineral ion solution without calcium ions were shorter than the rice seedlings grown in mineral solution without magnesium ions.

The fenugreek seedlings grown in mineral ions solution without calcium ions grew to normal height.

Explain what is shown by these observations.

(3)

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Q10.

Mineral ions are required for plant growth.

(i) Nitrate ions are required for the synthesis of

(1)

- A** amino acids
- B** cellulose
- C** starch
- D** sucrose

(ii) Phosphate ions are required for the synthesis of

(1)

- A cellulose
- B chlorophyll
- C nucleic acids
- D sucrose

(iii) Magnesium ions are present in the structure of

(1)

- A amino acids
- B cellulose
- C chlorophyll
- D starch

(Total for question = 3 marks)

Q11.

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.



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

In most African elephant populations, 2% to 4% of elephants do not grow tusks.



(i) Explain why the percentage of elephants without tusks in Mozambique will probably increase in the future.

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(ii) Describe how the Hardy-Weinberg equation can be used to provide evidence for changes in the elephant population in Mozambique.

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(Total for question = 5 marks)



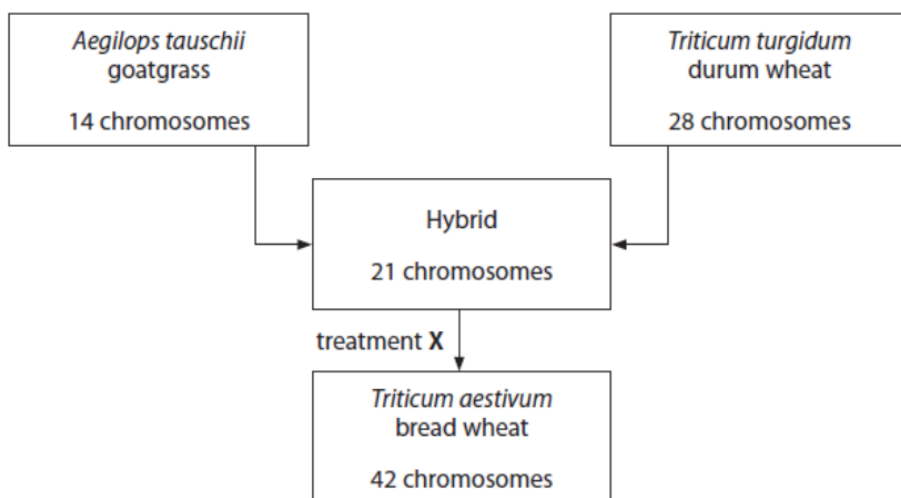
Q12.

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.





Which row in the table shows the number of chromosomes in cells from these different plant species?

(1)

	<i>A. tauschii</i> gamete	<i>T. turgidum</i> leaf cell	<i>T. aestivum</i> gamete
<input type="checkbox"/> A	7	14	42
<input type="checkbox"/> B	7	28	21
<input type="checkbox"/> C	14	28	42
<input type="checkbox"/> D	14	14	21

(Total for question = 1 mark)

Q13.

The polar bear, *Ursus maritimus*, preys on seals and fish. Polar bears are adapted to live in cold Arctic regions.



Polar bear
Magnification $\times 0.04$

A recent study has shown that all polar bears are descended from populations that diverged from the Irish brown bear, *Ursus arctos*, approximately 120 000 years ago.

In this study, DNA from modern polar bears, the remains of historic polar bears and the remains of Irish brown bears was analysed.

(a) The first part of the study involved the amplification of DNA to give large enough samples for analysis.

(i) Describe how small samples of DNA can be amplified.

(4)



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(ii) Name **one** technique that could be used to analyse the amplified DNA samples.

(1)

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(b) Suggest how the scientists who conducted the study had their results accepted by other scientists.

(2)

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(c) Suggest how each of the following may have contributed towards the divergence of polar bears and Irish brown bears into two separate species.

(i) Separation of the Arctic and Irish regions by sea

(2)

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(ii) Genetic mutation

(2)

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(Total for question = 11 marks)

Q14.

Wasps are insects that live in groups.

One species of wasp (*Vespula germanica*) has been shown to knock its body repeatedly against a hard surface. This signals the presence and quality of food to other wasps.

When threatened by another animal, it may use its stinger to inject a venom to protect itself.



bugguide.net

Phospholipase in the venom of wasps can cause allergic reactions.

Phospholipase can affect the Golgi apparatus in cells.

(i) Give two functions of the Golgi apparatus.

(2)

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(ii) A three-phase protocol will be used when developing the phospholipase inhibitor as a new drug.

Explain the purpose of each phase of this protocol for a phospholipase inhibitor.

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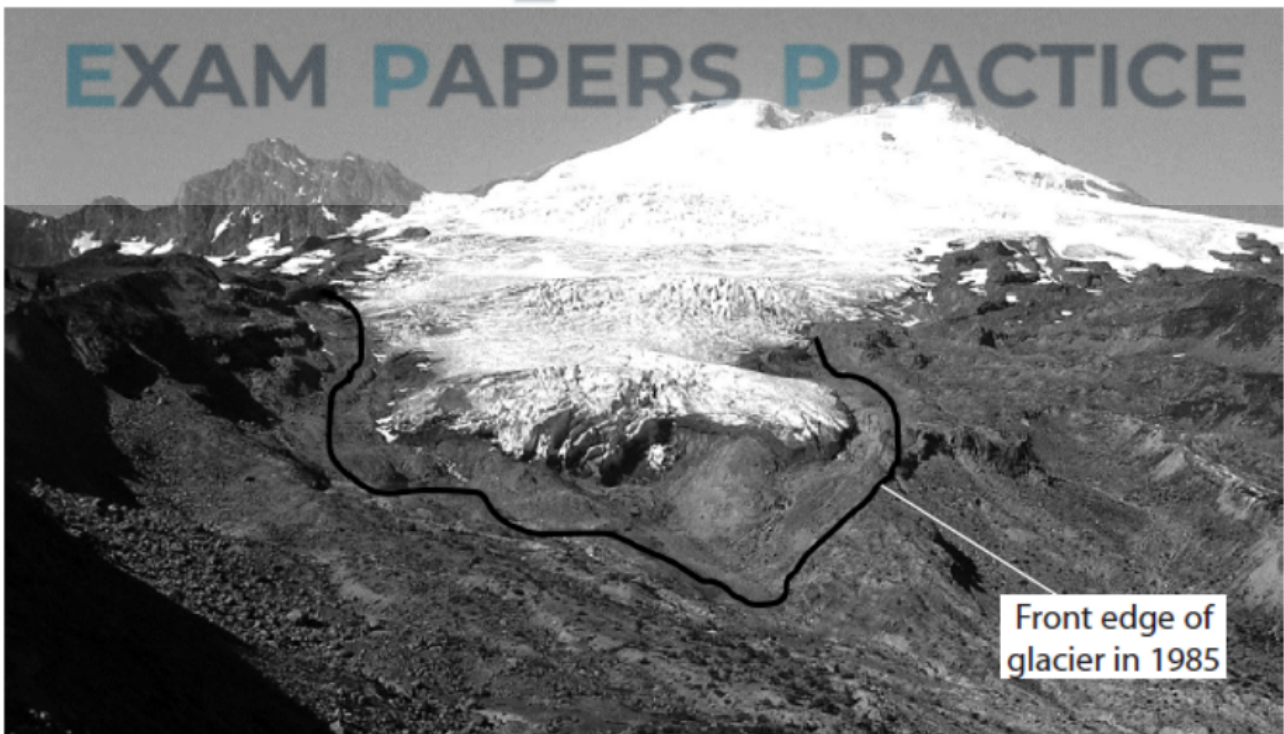
(Total for question = 5 marks)

Q15.

The photograph shows a glacier at the top of a mountain.

Glaciers in many areas of the world are retreating (reducing in size).

The line on the photograph shows the position of the front edge of the glacier in 1985.





Bare rock is exposed as the glacier retreats. Two hundred years ago, bare rock was exposed after a glacier retreated. A study has been made of the long-term changes in vegetation on that area of rock after the retreat of the glacier.

Plants such as lupin are often found in the early stages of glacial retreat. Lupin plants have nodules on their roots containing nitrogen-fixing bacteria that convert atmospheric nitrogen to ammonium ions. Plants can use ammonium ions as a source of nitrogen.

Explain why lupin plants are able to grow in the early stages of glacial retreat. (3)

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(Total for question = 3 marks)

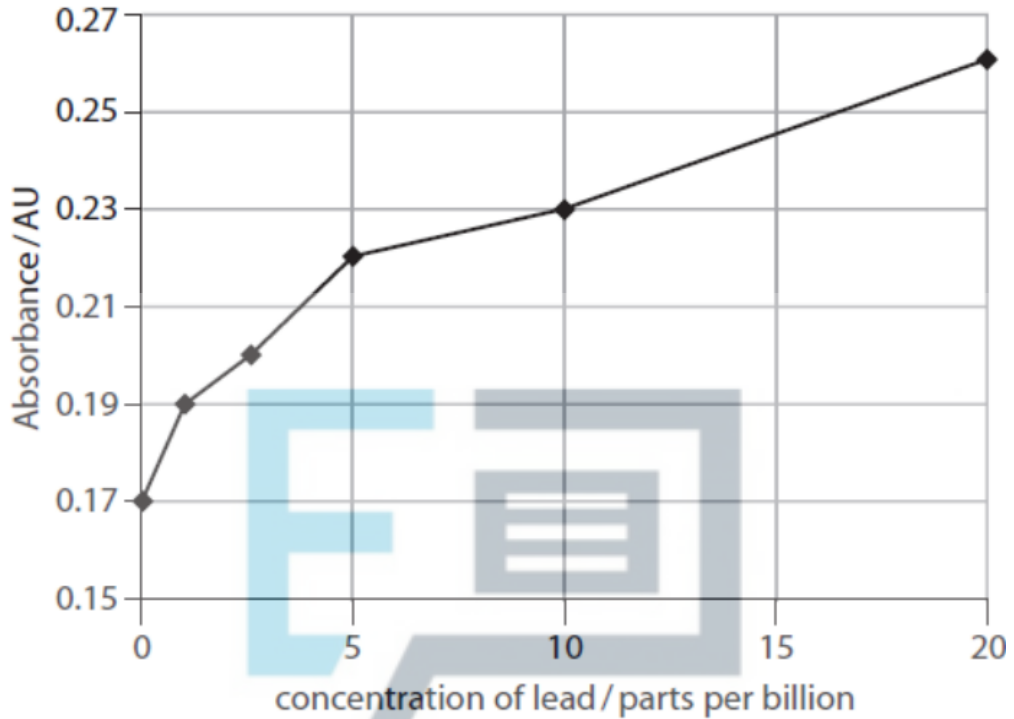
Q16.

Lead is a toxic metal that can affect the structure of proteins. Lead affects protein in a similar way to changing pH.

Beetroot vacuoles contain a pigment. The absorbance of a solution is proportional to the concentration of the pigment in the solution.



The graph shows the results of a scientific investigation to study the effect of increasing lead



concentration on the permeability of the membranes of beetroot cells.

(a) State the name of the membrane that surrounds the vacuole in beetroot cells.

(1)

(b) Calculate the difference in percentage increase in absorbance between the lead concentration of 0-10 parts per billion and 10-20 parts per billion.

(3)

Answer %

(c) (i) Explain the effect of lead on membrane permeability in beetroot cells. (2)

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(ii) Devise an investigation to determine whether pH has a similar effect to lead on the permeability of the membranes of beetroot cells.

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(Total for question = 10 marks)



Q17.

There are two main types of woodland in the UK. One consists of broadleaved deciduous trees, the other contains coniferous trees that have needle-like leaves.

The table shows some of the species of plant growing underneath the trees in a deciduous woodland.

Species	Number of individuals of each species (n)	n(n - 1)
Woodrush	2	
Holly	8	
Bramble	1	
Yorkshire fog	9	
Sedge	3	

(i) Complete the table to show $n(n - 1)$ for each species of plant.

(1)

(ii) Calculate the diversity index (D) using the data in the table.

$$D = \frac{N(N - 1)}{\sum n(n - 1)}$$

(2)

Answer

(Total for question = 3 marks)

Q18.

A student carried out an investigation to compare the antibacterial effect of a garlic extract with that of three antibiotics, all at the same concentration.

(a) (i) To obtain the extract, a clove of garlic was cut into lots of small pieces and soaked in 0.1% ethanol for a long time.

Explain why this is an effective method of extraction.

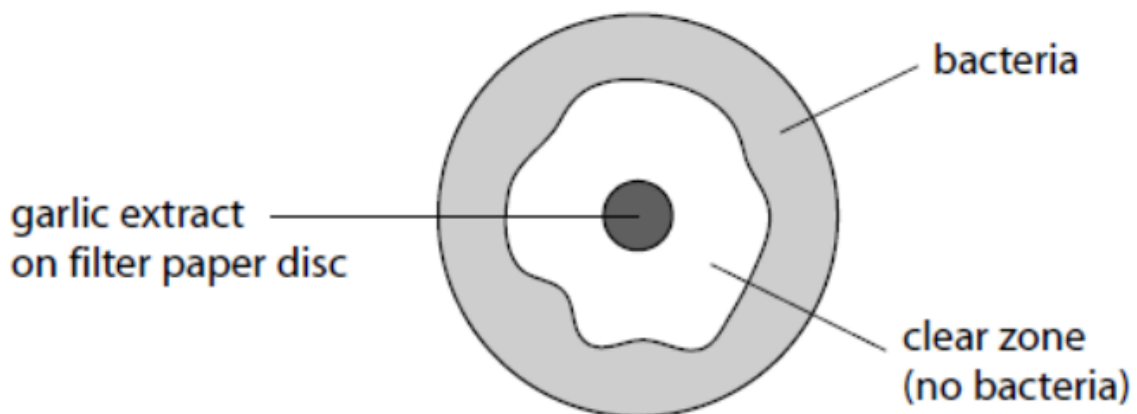
(2)

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(ii) The diagram shows the effect of the garlic extract on bacteria growing on an agar plate.





The area of the clear zone was calculated by assuming it is a circle and estimating the diameter. The estimate made was 4.3 cm.

Calculate the estimated area of the clear zone.

(2)

Answer

Sample number	Estimated area of clear zone / mm ²			
	Antibiotics			Plant extract
	Chloramphenicol	Tetracycline	Streptomycin	Garlic
1	28	16	15	20
2	26	19	13	28
3	29	11	14	18
4	28	21	12	25
5	26	7	14	27
6	29	11	15	26
7	22	8	9	25
8	25	21	14	25
9	29	10	12	29
Mean	27	14	13	25
Standard deviation	2.37	5.54	1.90	3.60

(b) The results of the investigation are shown in the table.



These data were analysed using *t*-tests.

(i) Several statistical tests were available to the student to analyse these data, including the *t*-test, Chi squared and the correlation coefficient.

Explain why the *t*-test was chosen to analyse these data, rather than the other two tests.

(3)

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(ii) Calculate the *t* value for the data to compare garlic with chloramphenicol, using the formula:

$$t = \frac{|\bar{x}^1 - \bar{x}^2|}{\sqrt{\left(\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}\right)}}$$

(3)

Answer

(iii) The table shows the critical values of *t* with 16 degrees of freedom.

Significance level (p)	0.20	0.10	0.05	0.01	0.001
Critical value of <i>t</i>	1.34	1.75	2.12	2.92	4.02



Use your value of t to test the validity of a stated null hypothesis.

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(c) The size of the clear zone depends on variables other than the antibacterial properties of the substances used, such as size and solubility of the antimicrobial molecules in the extract.

A new method was developed in which the minimum concentration of extract that causes inhibition of bacterial growth (Minimum Inhibitory Concentration, MIC), was found.

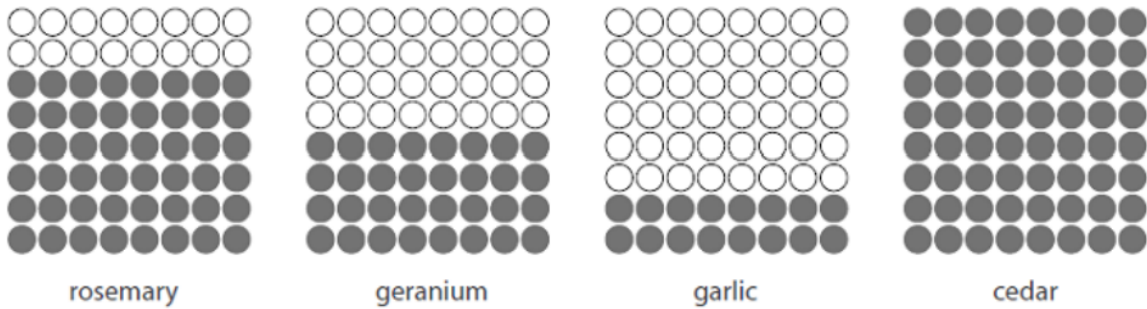
Samples of extract, bacteria (*E. coli*) and a respiration indicator were placed in a micro-titre tray.

	A	B	C	D	E	F	G	H
1	○	○	○	○	○	○	○	○
2	○	○	○	○	○	○	○	○
3	○	○	○	○	○	○	○	○
4	○	○	○	○	○	○	○	○
5	○	○	○	○	○	○	○	○
6	○	○	○	○	○	○	○	○
7	○	○	○	○	○	○	○	○
8	○	○	○	○	○	○	○	○

1 = 4%
2 = 2%
3 = 1%
4 = 0.5%
5 = 0.25%
6 = 0.125%
7 = 0.0625%
8 = 0.0%

concentration of extract

The diagrams show the results obtained. The tubes are black when respiration occurs and clear when no respiration occurs.



(i) Analyse the data to explain the results of this experiment.

(2)

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(ii) Give **two** changes that can be made to the procedure to get a more accurate measure of MIC.

(2)

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(iii) It was concluded that plant extracts inhibit respiration of bacteria. This conclusion may not be valid because the investigation has limitations.

Describe how the investigation could be modified to reduce the effect of two named limitations.

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(Total for question = 20 marks)

Q19.

A number of seed banks have been set up around the world.

When a seed bank receives new seeds, it processes them in several ways. The processes can include the following stages:

- washing the seeds with disinfectant
- allowing the seeds to dry.

Explain the advantages of these two stages.

(3)



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(Total for question = 3 marks)

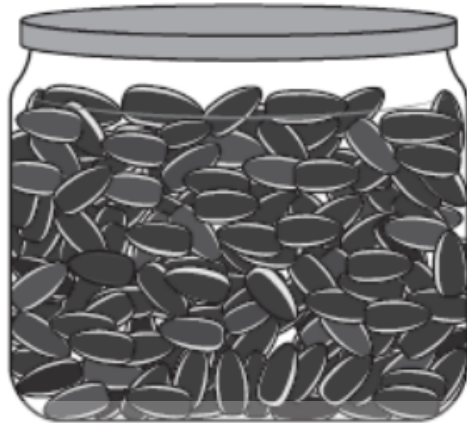
Q20.

A number of seed banks have been set up around the world.

The processed seeds are stored at minus 20 °C. At intervals, samples of seeds are removed from storage and tested for viability.

If at least 75% of the seeds in the sample germinate, the remaining seeds are described as viable.

The diagram shows a container with many seeds in it.



Sunflower Seeds
mass of 1000 seeds = 50 g

A sample of 3 g of seeds was removed from this container. These seeds were given optimum conditions for germination.

However, only 48 seeds germinated.

Determine whether the remaining seeds in the container are viable or not. (3)

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(Total for question = 3 marks)



Q21.

The group of birds, known as warblers, contains many species which are very similar in external appearance.

Two of these species, the chiffchaff, *Phylloscopus collybita*, and the willow warbler, *Phylloscopus trochilus*, are so similar that many experts can identify them only by listening to their individually-characteristic songs.

These songs are used during breeding to mark territory and attract mates. The photographs below show these two warblers.



Chiffchaff

Willow warbler

(a) Although chiffchaffs and willow warblers are often found at the same time in the same woodlands, they do not interbreed.

(i) Suggest why successful interbreeding between chiffchaffs and willow warblers would make some scientists doubt their classification as separate species.

(3)

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(ii) Suggest reasons why the two species do not interbreed.

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(b) Records show that very little change in the appearance of chiffchaffs and willow warblers has occurred during the last two hundred years.

Suggest why the rate of change in the appearance of these two species is relatively slow.

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(Total for Question = 9 marks)



Q22.

The group of birds, known as warblers, contains many species which are very similar in external appearance.

The chiffchaff, *Phylloscopus collybita*, and the willow warbler, *Phylloscopus trochilus* are two species of warbler.

These warblers are so similar that many experts can identify them only by listening to their characteristic songs. Their songs are used during breeding to mark territory and attract mates.



The photographs below show these two warblers.

(a) Explain the meaning of the term **species**.

(1)

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(b) Suggest how these two types of warbler became separate species.

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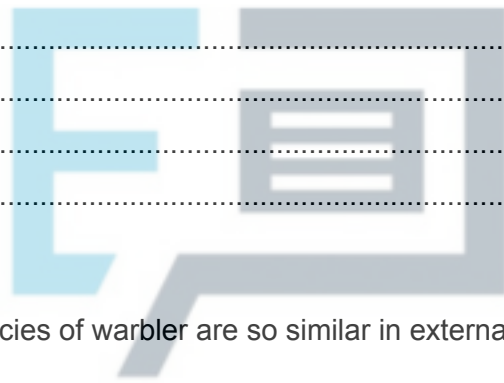
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(c) Suggest why these two species of warbler are so similar in external appearance.

(3)

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(Total for Question = 8 marks)



Q23.

There are two main types of woodland in the UK. One consists of broadleaved deciduous trees, the other contains coniferous trees that have needle-like leaves.

Another measure of diversity is species richness.

(i) Species richness is the number of

(1)

- A different alleles in one species
- B different species in one area
- C individuals of one species in one area
- D individuals of one species in different habitats

(ii) Devise an investigation to compare species richness of the plants growing under the trees in a deciduous woodland with that of a coniferous woodland.

(5)

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(Total for question = 6 marks)

Q24.

A study of the genetics of grass snakes has led to the identification of a new species of grass snake in the UK.

The barred grass snake was thought to be a variation of the common grass snake, *Natrix natrix*.

However, the barred grass snake, *Natrix helvetica*, has been found to be a different species.

Both types of grass snake are normally found in lowland regions in the south of England. The snakes can be more than a metre long, are found near water and eat mainly amphibians such as frogs and newts.

The common grass snake is olive green with a bright yellow collar.

The barred grass snake, shown in the photograph, is grey with black markings.



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State what is meant by the term species.

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(1)

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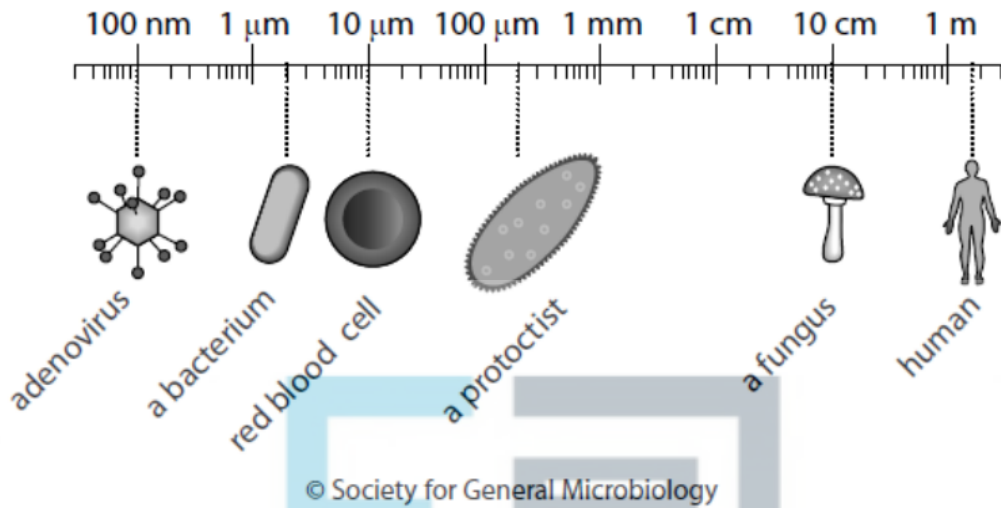
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(Total for question = 1 mark)



Q25.

The diagram compares the size of some microbes with that of a human and a human cell.



(a) Which of the following belong to the domain Eukaryota?

- A adenovirus, bacterium and protist
- B human, bacterium and red blood cell
- C human, red blood cell and protist
- D adenovirus, fungus and human

(1)

(b) Which of the following do **not** have a nucleus?

(1)

- A bacterium and protoctist
- B bacterium and red blood cell
- C fungus and adenovirus
- D protoctist and adenovirus

(c) Which of the following shows how many times bigger the bacterium is than the adenovirus? (1)

- A 45 times
- B 22 times
- C 2 times
- D 10 times

(d) State **one** way in which the structure of a virus is different from that of a bacterium.

(1)

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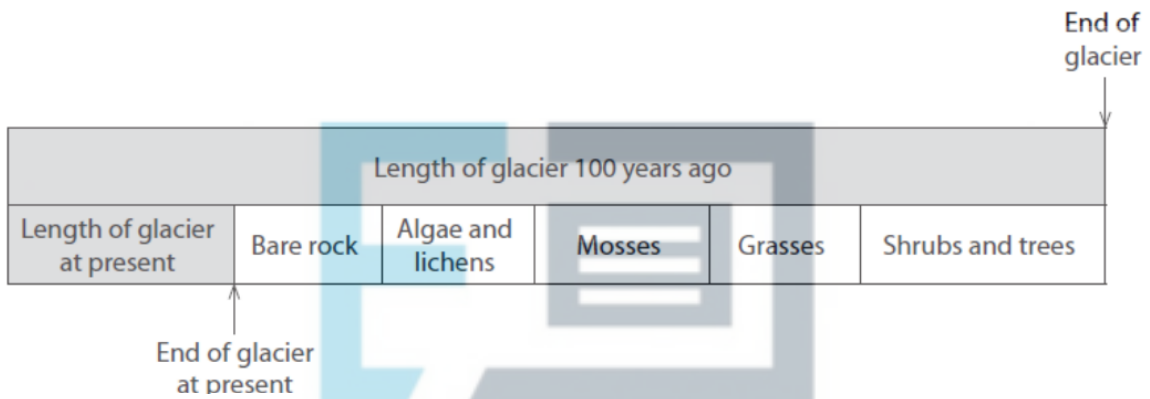
(Total for question = 4 marks)



Q26.

Glaciers are long, large masses of ice that formed thousands of years ago. As a result of warmer climates, more ice is melting. This is reducing the length of the glaciers. As a result, bare rock that was once covered by the glacier becomes exposed.

The diagram below shows the length of a glacier 100 years ago and the glacier at present. It also shows what is now found in a transect taken from where the front edge of the glacier is at present.



(a) Using the information in the diagram, describe and explain the changes in the distribution of organisms with distance from the front edge of this glacier.

(3)

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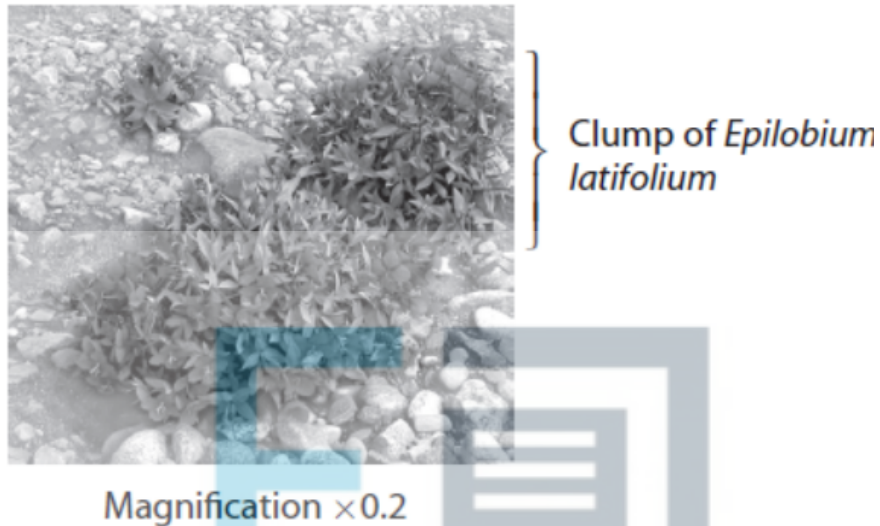
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(b) *Epilobium latifolium* is a plant that occupies a niche in an area once covered by this glacier. It is a short flowering plant that grows in clumps.

The photograph below shows three clumps of *Epilobium latifolium*.



(i) Explain what is meant by the term **niche**, using the plant *Epilobium latifolium* as an example.

(3)

EXAM PAPERS PRACTICE

(ii) Describe how to carry out a study of the distribution of *Epilobium latifolium* from the front edge of this glacier.

(4)



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(iii) Suggest **one** abiotic factor that might affect the abundance of *Epilobium latifolium* and describe how this factor could be measured.

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(Total for question = 13 marks)

Q27.

Frogs are ectothermic animals. This means that their body temperature will vary as the environmental temperature varies.

(a) Explain why body temperature affects the rate of development of animals.

(3)

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(b) Several species of the frog genus, *Rana*, can be found in North America. Many of these species inhabit areas within a range of latitudes from the colder north to the warmer south.

The table below shows data for four of these species, *R. clamitans*, *R. palustris*, *R. pipiens* and *R. sylvatica*.

Species	Body temperature of frog / °C			
	Lower lethal, below which frog dies	Minimum to start development	Maximum to complete development	Upper lethal, above which frog dies
<i>R. clamitans</i>	10.0	11.0	35.0	37.0
<i>R. palustris</i>	5.0	7.0	30.0	31.0
<i>R. pipiens</i>	3.0	6.0	28.0	30.0
<i>R. sylvatica</i>	0.0	2.0	24.0	25.0

Using the information, suggest why the lower and upper lethal temperatures limit the range of latitudes inhabited by each species of frog.

(2)

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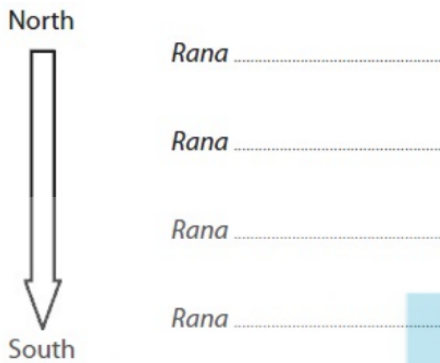
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(c) Complete the species names in the diagram below to show the most likely distribution of *Rana* from north to south.

(2)



(d) Populations of the different species overlap on the boundaries of each latitude range. Suggest why interbreeding does not take place between these populations.

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(e) Suggest how global warming may affect the distribution of these species of Rana in North America.

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(Total for question = 13 marks)

Q28.

EXAM PAPERS PRACTICE

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

Ropes used in climbing need to have high tensile strength.

State what is meant by the term **tensile strength**.

(1)

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(Total for question = 1 mark)

Q29.

There are many reasons why humans may lose muscle mass.

Two known causes are hip replacement surgery and some genetically inherited conditions.

Muscular dystrophy (MD) is a range of genetically inherited conditions in which a loss of muscle mass can occur.

Limb-girdle muscular dystrophy (LGMD2A) is a rare type of MD. Only six people per million have this recessive condition.

In 2018 there were 66.5 million people in the UK.

(i) Calculate the number of people in the UK who are carriers of LGMD2A using the Hardy-Weinberg equation.

(3)

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

EXAM PAPERS PRACTICE Answer

(ii) In the human population, the frequency of the allele for LGMD2A may change from one generation to the next.

Explain why the frequency of this allele may change from one generation to the next.

(3)

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(Total for question = 6 marks)

Q30.

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

Tissues that contain lignin provide strength to plant fibres.

Describe the positions in the stem of those tissues that contain lignin.

(2)

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(Total for question = 2 marks)