Biology Summer Independent Learning

There are 2 things we are expecting of you from your SIL. Teachers will be checking that this has been completed in the first week back in September.

Core Content

1. Complete the questions, and mark (mark scheme at the back of the paper)
2. Test yourself on the content for 7.4 populations in ecosystems, in preparation for an assessment on your return to college

Highly recommended content will assist you in future topics covered in Y13

Learning Outcomes – 7.4 Populations in ecosystems (A-level only)

Learning Outcome	☺	😐	☹
Populations of different species form a community. A **community** and the non-living components of its environment together form an **ecosystem**. Ecosystems can range in size from the very small to the very large. Within a habitat, a species occupies a **niche** governed by adaptation to both **abiotic** and **biotic** conditions.			
An ecosystem supports a certain size of population of a species, called the **carrying capacity**. This population size can vary as a result of: • the effect of abiotic factors • interactions between organisms: **interspecific** and **intraspecific competition** and **predation**.			
The size of a population can be estimated using: • randomly placed quadrats, or quadrats along a belt transect, for slow-moving or non-motile organisms • the mark-release-recapture method for motile organisms. The assumptions made when using the mark-release-recapture method.			
Ecosystems are **dynamic** systems.			
Succession Primary succession, from colonisation by pioneer species to climax community. At each stage in succession, certain species may be recognised which change the environment so that it becomes more suitable for other species with different adaptations. The new species may change the environment in such a way that it becomes less suitable for the previous species. Changes that organisms produce in their abiotic environment can result in a less hostile environment and change biodiversity. Conservation of habitats frequently involves management of succession			
Students should be able to: • *show understanding of the need to manage the conflict between human needs and conservation in order to maintain the sustainability of natural resources* • *evaluate evidence and data concerning issues relating to the conservation of species and habitats and consider conflicting evidence* • *use given data to calculate the size of a population* estimated using the mark-release-recapture method.			
Required practical 12: Investigation into the effect of a named environmental factor on the distribution of a given species.			

If you need a recap before starting the questions, the following videos may be of help:

https://www.youtube.com/watch?v=daH5_hwJY8o&list=PL0Mjub5NT756kVDMLLq1Pbh_vXg1rtGTl&index=5

https://www.youtube.com/watch?v=J35QIX7b9sc&list=PL0Mjub5NT756kVDMLLq1Pbh_vXg1rtGTl&index=2

https://www.youtube.com/watch?v=y84tAo-IeLE&list=PL0Mjub5NT756kVDMLLq1Pbh_vXg1rtGTl&index=3

https://www.youtube.com/watch?v=_f6_f_7CJpA&list=PL0Mjub5NT756kVDMLLq1Pbh_vXg1rtGTl&index=4

Questions – Mark Scheme at the end of the document

Q1.

(a) What term is used to describe populations of different species living in the same habitat?

_____

(1)

(b) Different species occupy different ecological niches.

Explain the advantage of species occupying different niches.

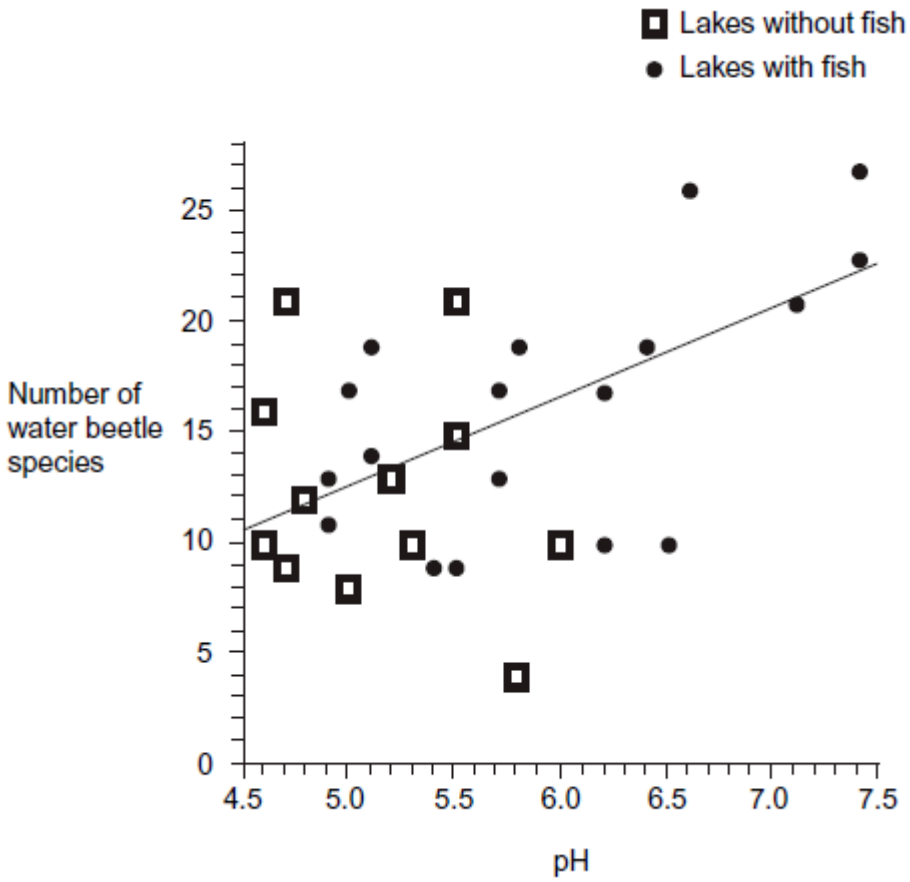
_____

_____

(1)

Scientists recorded the number of water beetle species in 30 lakes. In each lake, they measured the pH of the water and recorded whether there were any fish present.

The graph shows their results.



(c) A student concluded that a decrease in acidity caused an increase in the number of water beetle species.

Evaluate this conclusion.

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(3)

(d) Explain how the presence of fish in a lake could cause an increase in the number of water beetle species.

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(1)

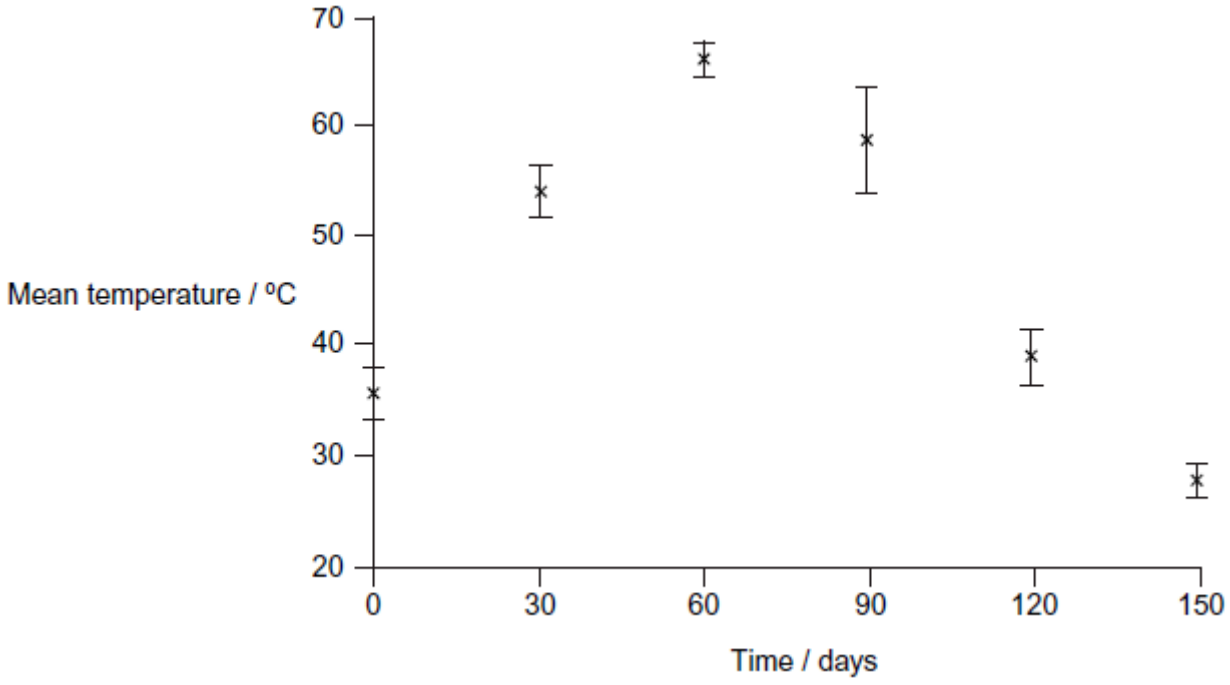
(Total 6 marks)

Q2.

The organic material in household waste can be used to make compost for use as a fertiliser. Scientists investigated changes during one process used to make this compost. The method involved placing the waste in large containers for 150 days. At regular intervals the containers were rotated. The scientists measured the temperature of samples of waste during the investigation.

Figure 1 shows the results they obtained. The vertical bars show standard deviations.

Figure 1



(a) Explain how microorganisms contributed to the increase in temperature during processing of organic waste.

_____

_____

_____

_____

(2)

(b) Explain the advantage of showing the data using standard deviations rather than ranges.

_____

_____

_____

_____

(2)

(c) Suggest **two** advantages of rotating the containers during the process.

1. _____

_____

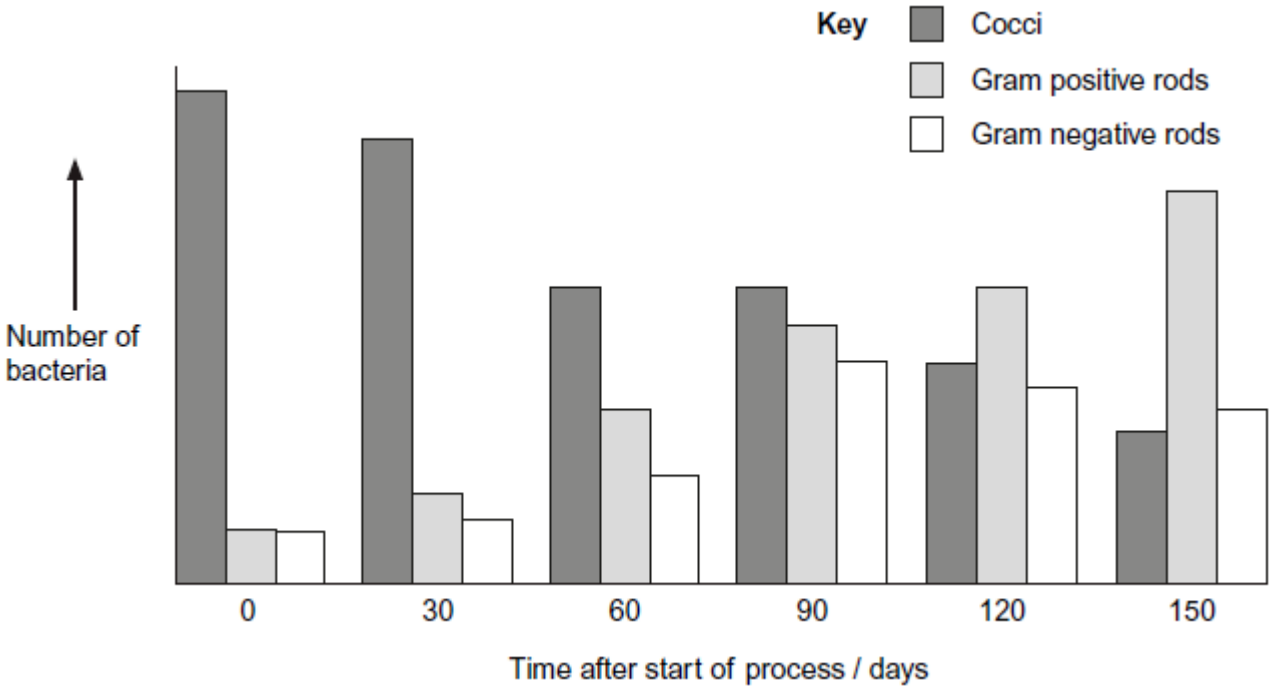
2. _____

_____

(2)

(d) The scientists took a sample of the waste at the start of the process. They then took samples every 30 days. In each sample, they determined the numbers of particular types of bacteria.
Figure 2 shows the changes in the number of three types of bacteria during the process.

Figure 2



The scientists concluded that the results in **Figure 1** and **Figure 2** are evidence for a form of succession during the process.

Use the information to suggest how they reached this conclusion.

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(3)

(Total 9 marks)

Q3.

Algae are photosynthesising organisms. Some grow on rocky shores. Scientists investigated the abundance of different species of algae at two sites, **A** and **B**, on a rocky shore. Site **A** was on the upper shore and site **B** was on the lower shore. The diagram shows the location of sites **A** and **B** on the rocky shore.

Table 1 shows some of the results the scientists obtained.

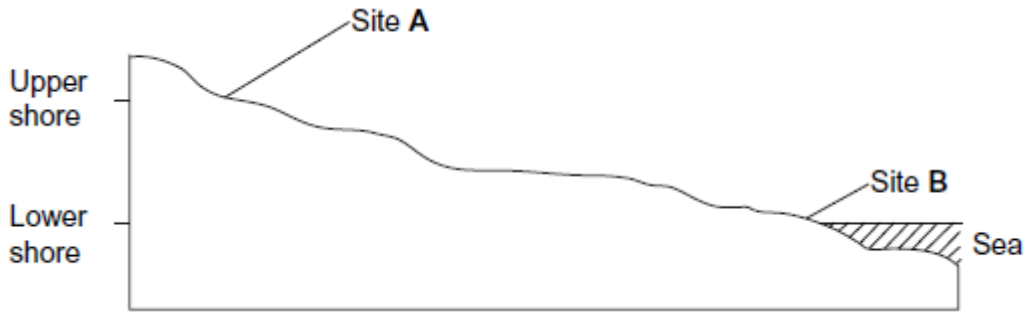

Table 1

	Site A **Upper shore**	**Site B** **Lower shore**
Species of algae with percentage cover more than 1%	*Gigartina leptorhynchos* *Gigartina canaliculata* *Gelidium coulteri* *Rhodoglossum affine*	*Gigartina spinosa* *Rhodoglossum affine* *Laurencia pacifica* *Gastroclonium coulteri* *Centroceros clavulatum* *Gigartina canaliculata* *Corallina vancouveriensis*

(a) The scientists recorded data from 40 large rocks at each site.

Describe **one** method that the scientists could have used to ensure that the large rocks were chosen without bias.

_____

_____

_____

_____

(2)

(b) The scientists used percentage cover rather than frequency to record the abundance of algae present

Suggest why.

_____

_____

(1)

(c) Apart from availability of water, describe and explain how **two** abiotic factors may have caused differences in the species of algae growing at sites **A** and **B**.

Factor 1 _____

Explanation _____

_____

Factor 2 _____

Explanation _____

_____

(2)

(d) Use the information provided in **Table 1** to explain why the diversity of consumers will be greater at site **B**.

_____

_____

_____

_____

(2)

(e) The scientists also investigated the algae eaten by two consumers found on the rocky shore, the sea slug and the shore crab. The scientists carried out their investigation in a laboratory.

- They put each consumer into a separate tank through which aerated seawater flowed slowly.
- Each tank contained 5 grams of one species of alga.
- After 50 hours, they measured the mass of the alga remaining in each tank.
- They repeated this procedure several times using a different sea slug and a different shore crab each time.

The scientists then calculated the mean mass of each species of alga eaten by the consumers. They used a statistical test to determine the P value.

Table 2 shows some of the results they obtained.

Table 2

Species of alga	Mean mass eaten / g		P value
	Sea slug	Shore crab	
Laurencia pacifica	4.42	0.22	<0.01
Egregia leavigata	0.12	0.08	>0.05
Microcystis pyrifera	0.19	0.14	>0.05
Cystoseira osmondacea	0.17	0.04	<0.05

(i) The consumers were starved for 5 days before the investigation.

Explain why.

_____

_____

_____

_____

(2)

(ii) The data in **Table 2** for the mean mass of alga eaten were adjusted for loss of mass by the alga due to respiration.

Suggest how the scientists were able to determine the loss of mass due to respiration of a sample of alga.

_____

_____

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_____

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_____

(3)

(iii) Suggest what conclusions the scientists could have made from this investigation when using the probability values in **Table 2**.

_____

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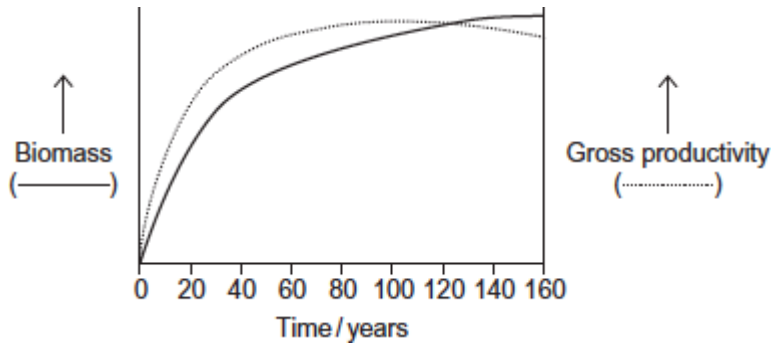
(3)

(Total 15 marks)

Q4.

The graph shows how gross productivity and biomass in an area changed with time in the succession from bare soil to mature woodland.



(a) (i) Suggest appropriate units for gross productivity.

_____

(1)

(ii) Explain the decrease in gross productivity as the woodland matures.

_____

_____

_____

_____

_____

(2)

(b) Use your knowledge of succession to explain the increase in biomass during the first 20 years.

_____

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(3)

(c) Use the information in the graph and your knowledge of net productivity to explain why biomass shows little increase after 100 years.

_____

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(2)

(d) Suggest **one** reason for conserving woodlands.

_____

_____

_____

(1)

(Total 9 marks)

Q5.

Ecologists used a method called proportional sampling to estimate the population size of an animal species. This method is based on assumptions. Two of the assumptions are given below.

1. They know the size of the area, **A**, where the animal population lives.
2. The animals are uniformly distributed in this area.

To carry out the method, the ecologists:

- chose a region of known size, **R**, inside area **A**
- counted the number of animals in region **R**. They called this number **S**
- assumed that the number, **S**, would be in proportion to the size of the total population, **P**, in area **A**.

(a) Proportional sampling can be used to estimate the population size of a species that is uniformly distributed.

(i) What is a **species**?

_____

_____

_____

(1)

(ii) What is meant by **uniformly distributed**?

_____

_____

_____

(1)

(b) Use the letters **A**, **R** and **S** to write an equation showing how proportional sampling is used to estimate the total size of a population, **P**. Show your working.

P = _____

(2)

(c) Population size can be estimated using proportional sampling or mark-release-recapture.

(i) How do the assumptions made in proportional sampling differ from those made in mark-release-recapture?

_____

_____

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(2)

(ii) Give **one** assumption about the animals caught that is made in both methods.

_____

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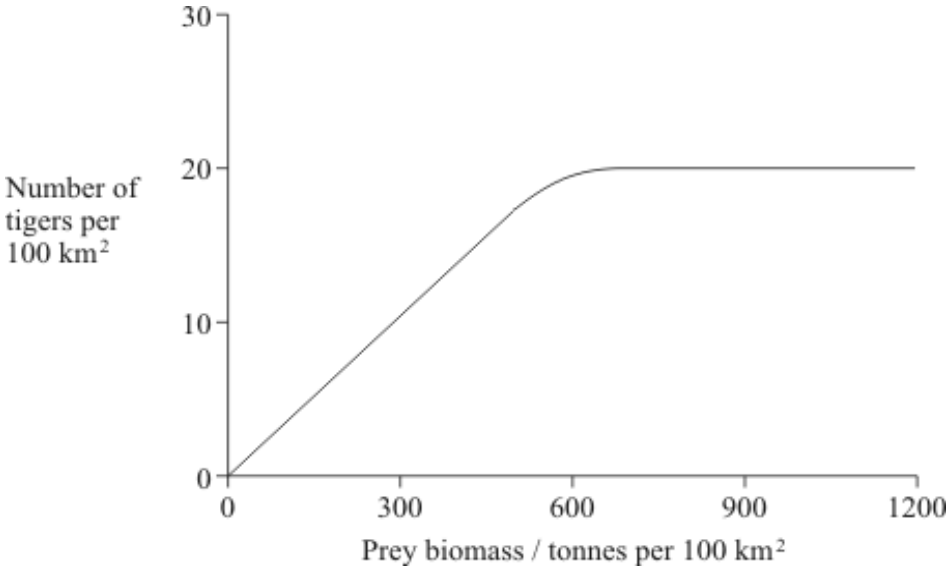
(1)

(Total 7 marks)

Q6.

Tigers inhabit forests where they feed mainly on large prey animals. Over the past fifty years, there has been extensive deforestation in many areas where tigers are found.

The graph shows the relationship between the prey biomass of an area and the tiger population that the area can support.



(i) What is meant by the ecological term *population*?

_____

_____

(1)

(ii) Use the graph to explain how deforestation might cause a reduction in the number of tigers in an area.

_____

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_____

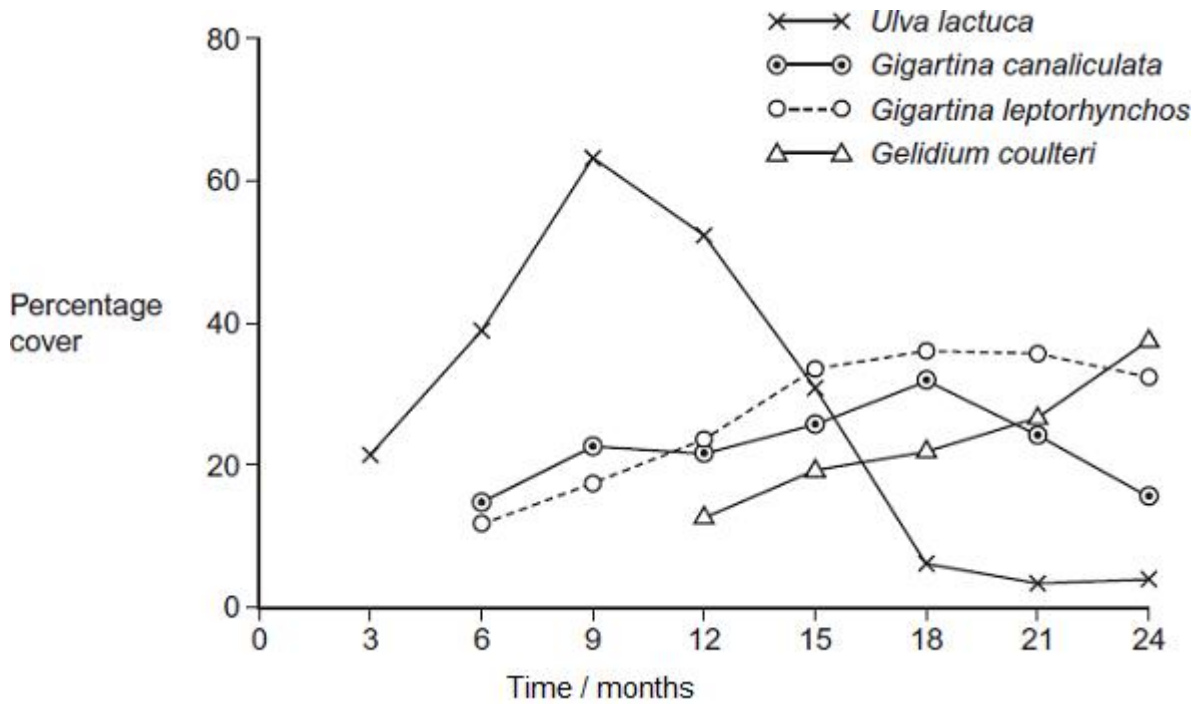
_____

(3)

(Total 4 marks)

Q7.

Algae are photosynthesising organisms. Some algae grow on rocky shores. A scientist investigated succession involving different species of algae. He placed concrete blocks on a rocky shore. At regular intervals over 2 years, he recorded the percentage cover of algal species on the blocks. His results are shown in the graph.



(a) Name the pioneer species.

_____

(1)

(b) (i) The scientist used percentage cover rather than frequency to record the abundance of algae present. Suggest why.

_____

_____

_____

(1)

(ii) Some scientists reviewing this investigation were concerned about the validity of the results because of the use of concrete blocks.
Suggest **one** reason why these scientists were concerned about using concrete blocks for the growth of algae.

_____

_____

(1)

(c) Use the results of this investigation to describe and explain the process of succession.

_____

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_____

(4)

(Total 7 marks)

Q8.

(a) Explain what is meant by

(i) succession;

_____

_____

_____

_____

(2)

(ii) a climax community.

_____

_____

(1)

Heather plants are small shrubs. Heather plants are the dominant species in the climax community of some moorlands. The structure and shape of a heather plant changes as it ages. This results in changes in the species composition of the community. A large area of moorland was burnt leaving bare ground. The table shows four stages of succession in this area.

Time after burning / years	Appearance of heather plant	Mean percentage cover of heather	Other plant species present
4		10	Many
12		90	Few
19		75	Several

24		30	Many

(b) Explain why the number of other plant species decreases between 4 and 12 years after burning.

_____

_____

_____

_____

(2)

(c) The rate at which a heather plant produced new biomass was measured in g per kg of heather plant per year. This rate decreased as the plant aged. Use the information in the table to explain why.

_____

_____

_____

_____

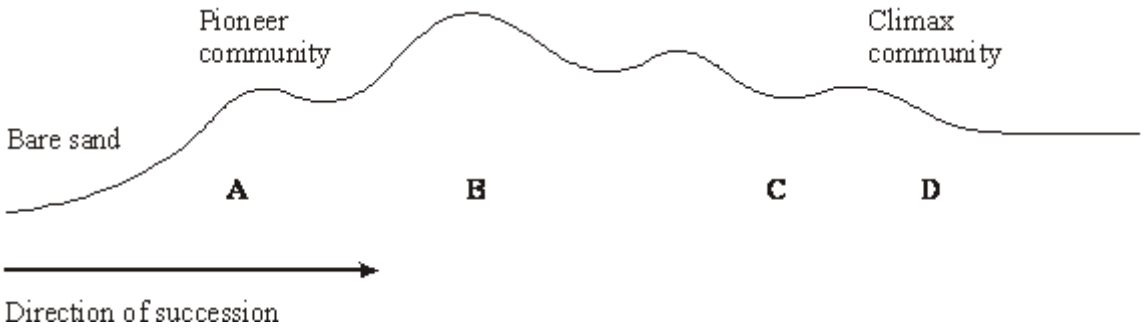
_____

(3)

(Total 8 marks)

Q9.

In a sand dune succession the pioneer community (**A**) colonises bare sand. This community is replaced over time by other communities (**B** and **C**) until a climax community of woodland (**D**) is formed.



(a) The communities **A** to **D** are composed of different species. Explain how the change in species composition occurs in a succession.

_____

_____

_____

_____

(3)

(b) Which community, **A** to **D**, is the most stable? Explain what makes this the most stable community.

_____

_____

_____

_____

(2)

(c) Many species in the pioneer community are xerophytes. Suggest and explain how having sunken stomata is an advantage to these plants.

_____

_____

_____

_____

(3)

(d) Explain why it would be more appropriate to use a transect rather than random quadrats when investigating this succession.

_____

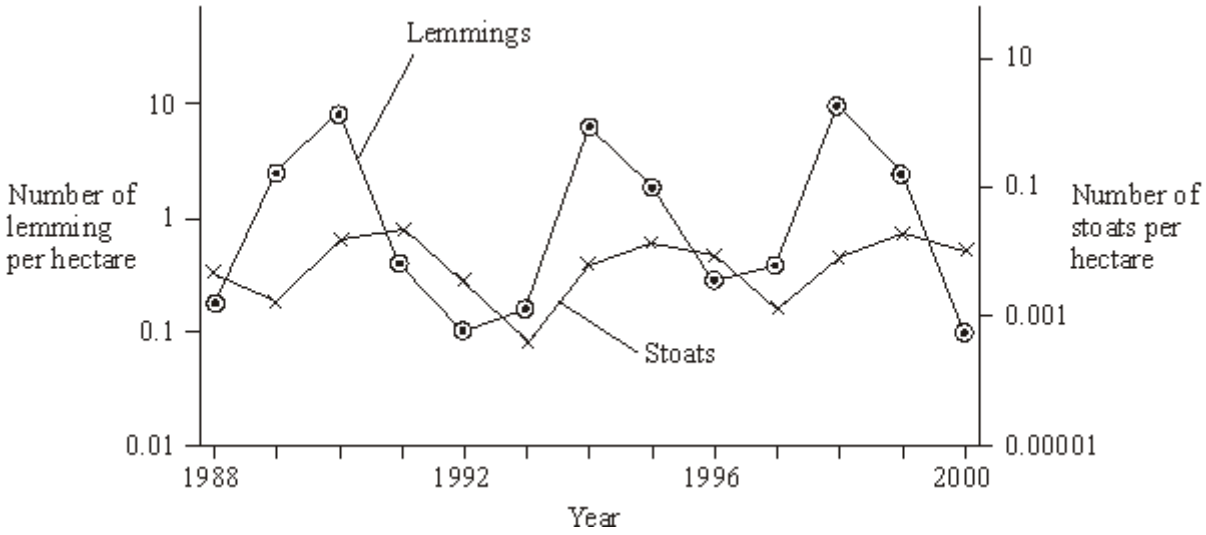
_____

(1)

(Total 9 marks)

Q10.

Lemmings are small mammals which live in the Arctic. Their main predator is the stoat, a small carnivorous mammal, which feeds almost entirely on lemmings. The graph shows the changes in the numbers of lemmings and stoats from 1988 to 2000.



(a) Describe and explain the changes which occur in the lemming and stoat populations.

_____

_____

_____

_____

_____

(6)

(b) Lemmings often live in isolated populations. From time to time some lemmings move and join other populations. Explain how this movement is important in maintaining genetic variability in lemming populations which have large fluctuations in size.

_____

_____

_____

_____

(2)

(c) James Bay is a large ocean bay in northern Canada. It was formed by the melting of glaciers. One species of lemming inhabits the eastern side of James Bay and another species of lemming inhabits the western side. Before the glaciers melted there was only one species of lemming present. Explain how two species of lemming evolved from the original species.

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_____

(4)

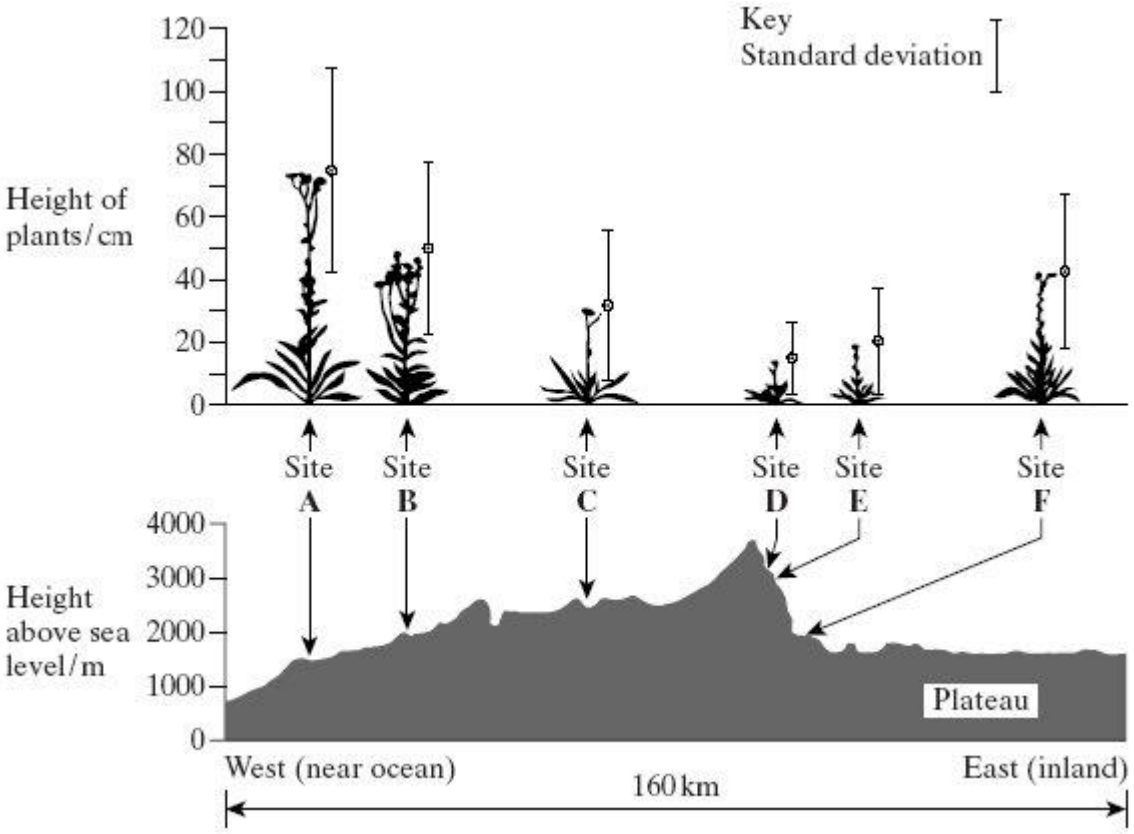
(Total 12 marks)

Q11.

Climatic factors, such as temperature and rainfall, vary greatly over short distances across mountain ranges. In an investigation, populations of the plant, *Achillea lanulosa*, were sampled from several sites on a transect across a mountain range. At each sampling site, seeds were collected at random. Each batch of seeds was germinated and grown to maturity under the same experimental conditions.

The diagram shows

- a profile indicating the position and altitude of the sampling sites
- the mean height of mature plants grown from each sample of seeds
- the standard deviation of heights of the mature plants grown from each sample of seeds.



(a) (i) Give **one** limitation of using a line transect to collect these data.

_____

_____

(1)

(ii) Suggest how plants should be chosen at each sampling site to avoid bias and to be representative.

_____

_____

_____

_____

(2)

(b) (i) What information does the bar representing standard deviation give about the plants in a sample?

_____

_____

(1)

(ii) Describe what the results show about the variation of the height of the plants in relation to altitude.

_____

_____

_____

_____

(2)

(iii) There was a significant difference between the mean heights of the plants grown from seeds taken from sites **A** and **D**. Describe the evidence from the information given which shows that this is likely to be due to genetic differences between the two populations.

_____

_____

(1)

(Total 7 marks)

Q12.

A student investigated an area of moorland where succession was occurring. She used quadrats to measure the percentage cover of plant species, bare ground and surface water every 10 metres along a transect. She also recorded the depth of soil at each quadrat. Her results are shown in the table.

	Percentage cover in each quadrat A to E				
	A	**B**	**C**	**D**	**E**
Bog moss	55	40	10	–	–
Bell heather	–	–	–	15	10
Sundew	10	5	–	–	–
Ling	–	–	–	15	20
Bilberry	–	–	–	15	25
Heath grass	–	–	30	10	5
Soft rush	–	30	20	5	5
Sheep's fescue	–	–	25	35	30
Bare ground	20	15	10	5	5
Surface water	15	10	5	–	–
Soil depth / cm	3.2	4.7	8.2	11.5	14.8

– Indicates zero percentage cover.

(a) Explain how these data suggest that succession has occurred from points **A** to **E** along the transect.

_____

_____

_____

_____

_____

_____

(3)

(b) The diversity of animal species is higher at **E** than **A**. Explain why.

_____

_____

_____

_____

_____

(2)

(c) The student used the mark-release-recapture technique to estimate the size of the population of sand lizards on an area of moorland. She collected 17 lizards and marked them before releasing them back into the same area. Later, she collected 20 lizards, 10 of which were marked.

(i) Give **two** conditions for results from mark-release-recapture investigations to be valid.

1. _____

_____

2. _____

_____

(2)

(ii) Calculate the number of sand lizards on this area of moorland. Show your working.

Answer = _____

(2)

(Total 9 marks)

Q13.

Biologists studied the process of succession in an area of wasteland over a period of ten years. They calculated the index of diversity of the area every year. After three years, the index of diversity was 1.6. After ten years, it had risen to 4.3.

(a) What information concerning the organisms present in the area is suggested by the increase in the index of diversity?

_____

_____

_____

_____

(2)

(b) The increase in the index of diversity is one indication that a biological succession is taking place in the area. Describe those features of a succession that would bring about an increase in the index of diversity.

_____

_____

_____

_____

_____

_____

_____

(3)

(Total 5 marks)

Highly recommended content

Required practical 9 - Respiration

Watch the YouTube clip and answer the following questions:
https://www.youtube.com/watch?v=1YUONb7_CLs&list=PL0Mjub5NT75746Ok9jijVZoNXjrEzU53G&index=14&t=0s

1. **State the independent variable in the investigation**

2. **State the dependent variable in the investigation**

3. **State 2 control variables and explain how they are kept constant**

4. **What is the purpose of the oil?**

5. **Why does the fluid move?**

Mark schemes

Q1.

(a) Community;

1

(b) (Less) competition for food/resource;

Ignore: competition for niche/habitat.

Accept: space/named resource.

Reject: intraspecific competition.

1

(c) 1. Correlation **but** does not mean a causal effect;

Ignore: positive/ negative (correlation).

2. Other abiotic/biotic/named factor involved;

Accept: due to presence/absence of fish.

Reject: 'other factors' unless further qualified.

3. Variation in numbers of beetles species at same/similar particular pH;

Accept: same number of beetles at different pHs.

Accept: 'scattered results' / 'anomalies' / 'spread of results'.

4. Large sample;

Max 3

(d) Fish feed on predator/consumer of water beetle;

Accept: beetles feed on fish/faeces.

1

[6]

Q2.

(a) 1. Respiration/metabolism/ammonification;

2. (Releases/produces) heat;

Reject: 'produces energy'.

2

(b) 1. SD is spread of data around the mean;

Accept: variation around the mean.

*Accept: range is difference between highest and lowest values/extremes **or** range includes anomalies/outliers.*

2. (SD) reduces effect of anomalies/ outliers;

Reject: (SD) removes anomalies/outliers.

3. (SD) can be used to determine if (difference in results is) significant/not significant/due to chance /not due to chance;

Ignore: reliability/accuracy/validity.

2 max

(c) 1. Distributes heat / prevents 'hot' spots;
2. Distributes microorganisms;
3. More enzyme-substrate complexes;
4. Increases rate of decomposition;

Accept: increases nitrification/ammonification or 'breaks down waste faster'.

5. Aeration/provides oxygen;

2 max

(d) 1. Microorganisms change the abiotic conditions/temperature/organic waste /provide nutrients;

Must refer to microorganisms or bacteria/named bacteria causing the change.

Ignore: change the environment.

2. Less hostile conditions;
3. Decline in Cocci **and** increase in rods;

Accept: 'decrease in cocci, others are going up'.

Accept: decrease in cocci and increase in either rod type or increase in both types.

4. Gram positive outcompete / better competitors;

Accept: rods outcompete (cocci) / better competitors.

3 max

[9]

Q3.

(a) 1. (Use) coordinates / number the rocks/sites/squares;

Ignore: references to grid, tape measures, metre rulers etc.

2. Method of generating/finding random numbers e.g. calculator/computer/random number generator/random numbers table;

Accept: numbers out of a hat / use of dice.

2

(b) Difficult/too many to count / individual organisms not identifiable / too small to identify/count / grows in clumps;

Ignore: easier/quicker/representative/ more accurate, unless qualified.

1

(c) Any suitable factor with valid explanation = 1 mark

1. Wave action - firmer grip on rock is necessary (at either site);
2. Wind/air movement/less humid - more evaporation at site A / more (physical) damage;
3. Light – (linked to) photosynthesis (at either site);
4. Temperature – (linked to) photosynthesis/respiration/enzymes/ evaporation (at either site);
5. pH – (linked to) enzymes/proteins;

Note: other common factors include salt (salinity) linked to water potential / named nutrient e.g. nitrate linked to protein/DNA.

Ignore: carbon dioxide/oxygen/pollution/rainfall/food/nutrients.

Reject: biotic factors e.g. predation.

2 max

(d) 1. Greater variety of food / more food sources;

Ignore: more food.

2. More/variety of habitats/niches;

Ignore: homes/shelters.

Accept: different habitats.

2

(e) (i) 1. (So they were) hungry/not full;

Accept: description of hunger e.g. appetite / 'empty stomach'/'so they eat'.

2. (Allows) comparison;

2

(ii) 1. Alga without consumer/named consumer/animal;

Accept: repeat experiment without consumer.

Accept: in separate tank / in tank where not eaten.

2. (Find change in mass) in dark;
3. For 50 hours;

Accept: 'same time as in experiment'.

Accept: For lower time period then scaled up to 50.

3

(iii) 1. For *Laurencia pacifica* **and** *Cystoseira osmondacea* (difference in results) significant /reject null hypothesis / not due to chance / less than 5%/0.05 probability due to chance;

Accept: for Laurencia pacifica 'less than 1%/0.01 probability'.

2. For *Egregia leavigata* **and** *Microcystis pyrifera* no significant (difference in results)/accept null hypothesis / is due to chance/more than 5%/0.05 probability due to chance;

   Accept: 'insignificant' for 'no significant difference'.

3. (Difference in results) for *Laurencia pacifica* is the most significant;

   Note: reference to probabilities on their own is not sufficient.

   1, 2 and 3. Accept: abbreviations for all species.

3

[15]

Q4.

(a) (i) Unit of energy / mass, per area, per year.

1

(ii) 1. Less light / more shading / more competition for light;

Neutral: references to animals

2. Reduced photosynthesis.

Accept: no photosynthesis

2

(b) 1. Pioneer species;
2. Change in abiotic conditions / less hostile / more habitats / niches;

Accept: named abiotic change or example of change e.g. formation of soil / humus / organic matter / increase in nutrients

Neutral: reference to change in environment unqualified

Neutral: more hospitable / habitable / homes / shelters

3. Increase in number / amount / diversity of species / plants / animals.

Accept: other / new species (colonise)

3

(c) 1. Net productivity = gross productivity minus respiratory loss;
2. Decrease in gross productivity / photosynthesis / increase in respiration.

2

(d) 1. Conserving / protecting habitats / niches;
2. Conserving / protecting (endangered) species / maintains / increases (bio) diversity;
3. Reduces global warming / greenhouse effect / climate change / remove / take up carbon dioxide;
4. Source of medicines / chemicals / wood;
5. Reduces erosion / eutrophication.

Accept: tourism / aesthetics / named recreational activity

1 max

[9]

Q5.

(a) (i) (Organisms that) can breed together / interbreed **and** produce fertile offspring;

Need both aspects. Reject 'inbreed'

Reject viable offspring

1

(ii) Same number (of organisms) in each region / (organisms) equally spread;

Allow other ways of expressing 'region' or 'equally spread', eg not clumped together, same number per unit area

1

(b) $$P = \frac{AS}{R} \;;;$$

2 marks for correct answer

*1 mark for having **A** on top of equation (recognises that total population related to total area)*

Note:

P = A × S / R or
P = A / R × S

are also correct.

Allow 1 mark for

$$\frac{S}{P} = \frac{R}{A}$$

2

(c) (i) *In mark–release-recapture (technique)*

Accept converse by considering assumptions of proportional sampling

1. No assumption that organisms are uniformly distributed;

2. Size of total area / size of sampled region not required;

Marking point 1 or marking point 2 do not have to start with the same technique

In this case, allow difference by implication i.e. do not penalise if the two techniques are not compared

2

(ii) Animals are from / all part of the same population;

1

[7]

Q6.

(i) Population is the total number of organisms / individuals of a species / tigers in an area (at a given time);

1

(ii) (Deforestation involves) habitat destruction / destruction of niches;

Some prey animals move out or die / fewer suitable prey for tiger / less food for tiger; Reduces tiger population if prey biomass falls below 600 (tonnes per km^2);

3

[4]

Q7.

(a) *Ulva lactuca*;

Reject: Ulva on its own

Accept: lactuca on its own

Accept: Incorrect spelling

1

(b) (i) Difficult / too many / too many to count / individual organisms not identifiable / too small to identify / grows in clumps;

Neutral: easier / quicker / representative / more accurate, unless qualified

1

(ii) Any described feature of concrete eg texture / flat / composition chemicals / nutrients etc;

Neutral: not natural / man made / are different, without further qualification

1

(c) 1. Pioneer species / *Ulva* increases then decreases;

1 and 4. Growth / reproduces = increases. Dies = decrease

2. Principle of a species changing the conditions / a species makes the conditions less hostile;

2. Accept description of change in conditions eg soil / humus forms, nutrients increased

3. New / named species better competitor / previous / named / pioneer species outcompeted;

Pioneer species grows, dies and forms humus = 2 marks

G. coulteri / Gelidium outcompetes other / named species = 2 marks

4. *G. coulteri / Gelidium* increases <u>and</u> other / named species decreases;

4

[7]

Q8.

(a) (i) change in community over time;
either due to change environmental / abiotic factors / change is due to species present;

2

(ii) stable community / no further succession / final community;

1

(b) (increased) <u>interspecific</u> competition;
for light / nutrients / named nutrient / water;

2

(c) fewer leaves / lower surface area / shading of leaves so less photosynthesis to produce new biomass / glucose / growth; competition with other species for nitrates / named nutrients so reduced synthesis of protein or named compound; ratio of leaves to woody parts and roots decreases so higher respiration relative to photosynthesis;

3

[8]

Q9.

(a) species present change the habitat / named change;
other species able to colonise;
new species better competitors;

3

(b) D - as more species present;

more complex food webs;

or

change in one species will have little effect on others;
as alternative food sources;

2 max

(c) sand drains easily / low water retention;
(sunken stomata) reduce transpiration;
as pocket pf saturated air trapped near stomatal pore;
this reduces diffusion / water potential gradient;

3 max

(d) series of changes over a distance / gradient of environmental factor / named environmental factor / cline present / ensures sampling of each community;

1

[9]

Q10.

(a)
1 4 year cycles;
2 predator / stoat peaks after prey / lemming;
3 lemmings increase due to low numbers of stoats / available food;
4 more food for stoats so numbers increase;
5 increased predation reduces number of lemmings;
6 number of stoats decreases due to lack of food / starvation;

6

(b) smaller populations have fewer different alleles / more homozygosity / less heterozygosity / smaller gene pool / lower genetic variability;
migrants bring in new alleles / increase gene pool;

2

(c) geographical isolation of populations;
variation present in population(s);
different environmental conditions / different selection pressures / different phenotypes selected;
change in genetic constitution of populations / gene pools / allele frequency;

4

[12]

Q11.

(a) (i) transect line may not go through representative areas / may avoid certain areas;

1

(ii) large sample;

how random coordinates are generated / how random places chosen;

2

(b) (i) spread of values around the mean height of the plant;

1

(ii) smaller plants at higher altitude;
greater the altitude the lower the standard deviation ;
reference to figures to make a comparison;

2 max

(iii) the plants measured were grown under uniform conditions;

1

[7]

Q12.

(a) 1. Decrease in (percentage cover) of bare ground / water linked to more plants / species / increase in plant coverage;

*Allow **one maximum mark** for answers which describe all three changes **without** a suitable explanation for any change*

Must be idea of more / increase not just change in species / plants

2. Change in diversity / number of plant / species / named (species) as abiotic conditions altered / due to competition / more soil / less hostile;

Accept pioneer species replaced due to competition

Accept description of change in species

Accept 'more suitable' = less hostile

3. Increase in depth of soil as plants die / humus formed;

3

(b) 1. Greater variety of food / more food sources;

'More food' = neutral

2. More / variety of habitats / niches;

Ignore 'more homes' or reference to 'shelters'

2

(c) (i) 1. Marking is not removed / marking does not affect survival / predation;

2. Limited / no immigration / emigration;

Accept 'migration' and descriptions of immigration / emigration

2. and 4. Increase / decrease in population is not sufficient – there must be a reason

3. Sufficient time for (marked) individuals to mix (within the population);
Accept – 'For mixing to occur between samples'

4. No / little births / deaths / breeding;

5. Sampling method is the same;
Ignore 'random sampling'

2 max

(ii) Correct answer of ...34 = 2 marks;
***Allow one mark** for an answer of 51 as candidate has misinterpreted the second sample as being = 30*

Incorrect answer but shows correct formula in words or numbers
e.g. 17 × 20 ÷ 10;
Reject correct formula multiplied by 100

2

[9]

Q13.

(a) Increase in number of species;

Increase in numbers of some species;

2

(b) Initial environment hostile / few organisms adapted;

These organisms change the environment / suitable example;

More niches / more habitats;

Allowing other organisms to become established;

max. 3

[5]

Required practical 9 - Respiration

Watch the YouTube clip and answer the following questions:

https://www.youtube.com/watch?v=1YUONb7_CLs&list=PL0Mjub5NT75746Ok9jijVZoNXjrEzU53G&index=14&t=0s

1. **State the independent variable in the investigation**

Type of sugar

2. **State the dependent variable in the investigation**

Time taken for fluid to move 10mm

3. **State 2 control variables and explain how they are kept constant**

Temperature – water bath. Monitored with a thermometer, if it gets too cold, more hot water is added
Yeast conc and volume (10cm^3 5% yeast) and Substrate concentration and volume (10cm^3 5% of each sugar).

4. **What is the purpose of the oil?**

Prevent Oxygen entering the yeast solution. Enables conditions to become anaerobic.

5. **Why does the fluid move?**

Anaerobic respiration produces CO_2 but doesn't use O_2. Therefore as CO_2 is produced, the pressure increases, pushing the fluid along.