

Year 1 Test: July 2020

Name:

Topics included: Biodiversity and Population, nutrient cycles, Energy and Ecosystems and Osmoregulation (Kidneys). You will have from 2-3.30pm on Friday 3rd July to complete the test.

PLEASE ADD YOUR ANSWER IN A DIFFERENT COLOURED TEXT

Q1. Ecologists investigated changes in grassland communities on large islands off the coast of Scotland between 1975 and 2010. On each island, they used data from a number of sites to determine the change in mean species richness and the change in mean index of diversity.

- (a) **Table 1** shows plant species recorded at one site, on one island, in 1975.

Species	Number of individuals
<i>Hydrocotyle vulgaris</i>	3
<i>Plantago maritima</i>	19
<i>Ranunculus acris</i>	3
<i>Hieracium pilosella</i>	3
<i>Calliargon cuspidatum</i>	10
<i>Prunella vulgaris</i>	16
<i>Pseudoscleropodium purum</i>	6

Calculate the index of diversity for this site using the formula:

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

$d =$ _____(2)

- (b) Outline a method the ecologists could have used to determine the plant species richness at one site.

_____ (3)

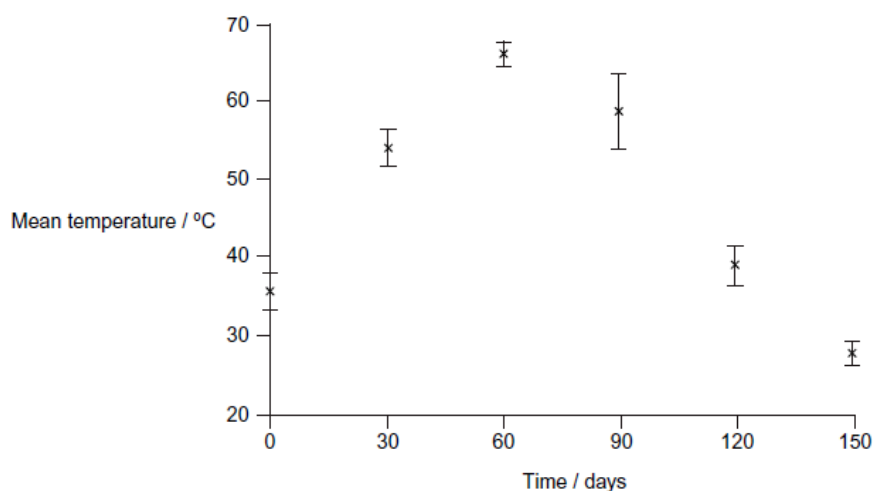
- (c) Some of the ecologists' results are shown in **Table 2**. They carried out a statistical test to find out whether any differences between the 1975 and 2010 means were significant. The values for P that they obtained are also shown in **Table 2**.

Island	Change in mean species richness between 1975 and 2010	Value of P	Change in mean index of diversity between 1975 and 2010	Value of P
Islay	+8.89	≤0.001	+0.22	>0.05
Colonsay	+14.70	≤0.001	+2.68	≤0.01
Harris	−5.13	≤0.001	−2.44	≤0.01

Do these data show that there were any significant changes in the grassland communities on these islands? Give reasons for your answer.

[illegible]

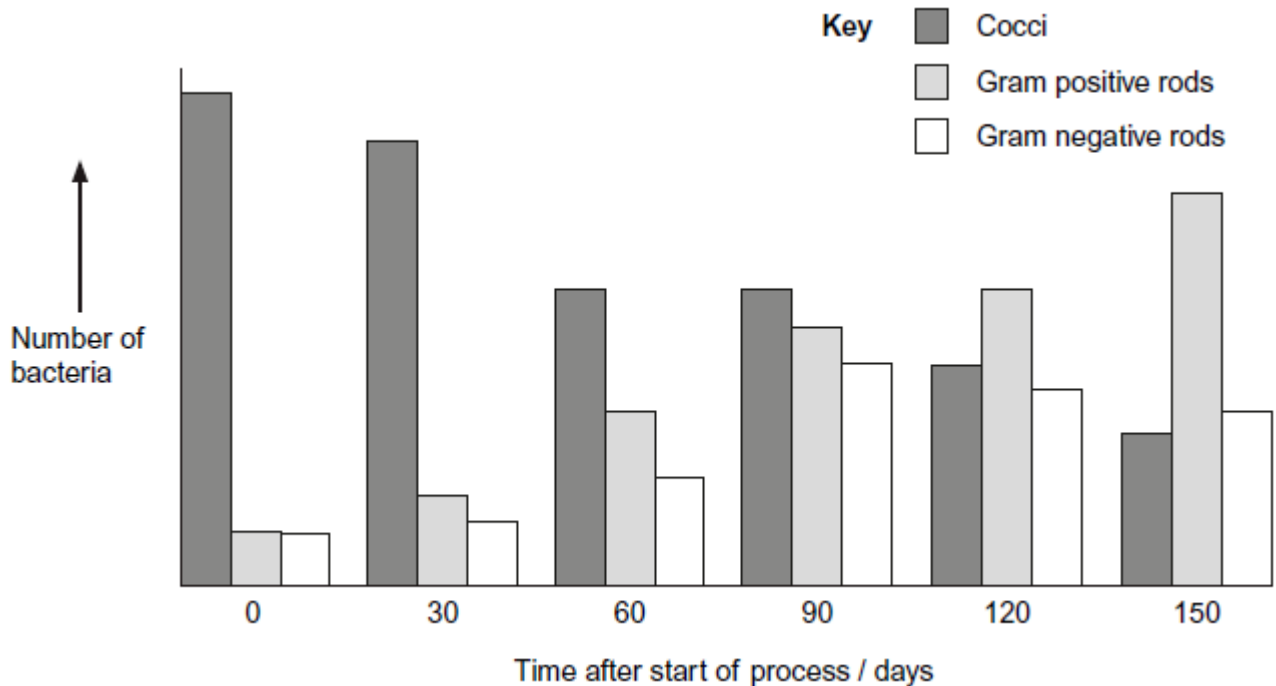
Q2. The organic material in household waste can be used to make compost for use as a fertiliser. Scientists investigated changes during one process used to make this compost. The method involved placing the waste in large containers for 150 days. At regular intervals the containers were rotated. The scientists measured the temperature of samples of waste during the investigation. **Figure 1** shows the results they obtained. The vertical bars show standard deviations.



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

(2)

- (b) 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.



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.

(3)

Q3. *Hydrilla (Hydrilla verticillata)* is an aquatic plant which has become a major pest of waterways in parts of the USA. *Hydrilla* is not a native species of the USA. It was introduced into natural habitats from aquariums. In many freshwater habitats it has rapidly become the dominant plant species.

- (a) In many freshwater habitats Hydrilla has rapidly become the dominant plant species. Suggest **two** reasons why.

1. _____

2. _____
 _____ **(2)**

- (b) The spread of Hydrilla has had economic consequences for commercial activities and for the government's environmental agency. Suggest **two** economic consequences of the spread of Hydrilla.

1. _____

2. _____
 _____ **(2)**

- (c) Scientists investigated the effect of the chemical fluridone as a method of controlling Hydrilla. The study was carried out using samples of Hydrilla grown under controlled laboratory conditions. Several samples of the plant were grown at different concentrations of fluridone. The results are shown in the following table.

	Days of treatment			
	0	20	40	60
Concentration of fluridone / $\mu\text{g dm}^{-3}$	Mean biomass of Hydrilla / g			
0.0	5.0	16.4	20.4	33.4
0.5	5.0	14.1	18.2	31.3
1.0	5.0	9.7	8.9	7.4
5.0	5.0	4.6	2.8	1.3
25.0	5.0	3.2	1.6	0.4

- (i) The scientists obtained the biomass of each sample by heating it at 75 °C for 2 hours. They then weighed the sample, reheated it for 15 minutes and weighed it again. They continued this cycle of reheating and weighing until they found the sample had a constant mass.

Explain how this method helped to provide a reliable measurement of the biomass.

 _____ **(2)**

- [illegible]

- Experiment 1 – Hydrilla left untreated
- Experiment 2 – Hydrilla treated with the fungus
- Experiment 3 – Hydrilla treated with fluridone
- Experiment 4 – Hydrilla treated with both fluridone and the fungus.

(i) Experiment **1** acted as a control. Explain why the scientists carried out experiment **1**.

(1)

(a) Use the information above to suggest how feather mites could affect breeding in great tits.

(2)

(b) The scientists located a large number of great tit nests. They sampled these at random.

For each nest they recorded

- the total number of eggs laid
 - the number of chicks that hatched from the eggs
 - the number of chicks that survived to leave the nest
 - the total number of feather mites on the two parent birds.
- (i) The scientists calculated the percentage of each pair's eggs from which chicks survived to leave the nest. They called this 'breeding success per pair'. The table shows some of the data that the scientists obtained.

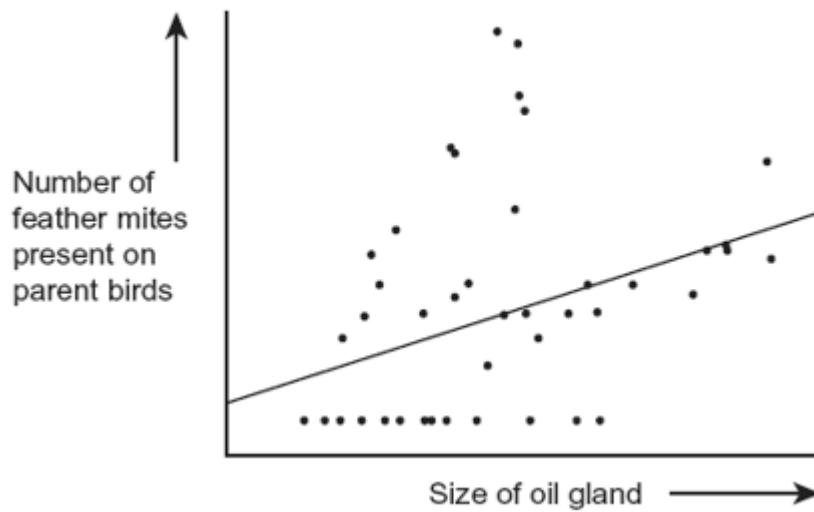
Total number of feather mites on both parent birds	Breeding success per pair
0	86
2	100
5	64
10	82
14	70
15	85
170	42

Do these data support the hypothesis that the presence of feather mites reduces the ability of great tits to reproduce successfully? Give reasons for your answer.

(3)

(c) The oil that a great tit puts on its feathers is made in an oil gland at the base of the tail. The bird uses its beak to spread the oil over its feathers. This is called preening. Preening takes place in early morning and evening and empties the oil gland each time. After preening, the oil gland is considerably smaller.

At the same time that the scientists recorded the number of feather mites on each great tit, they also measured the size of the oil gland. The graph shows their results and includes the scientist's line of best fit.



- (i) Describe the relationship between the number of feather mites present on each great tit and the size of the oil gland.

(2)

- (ii) Explain how measuring the oil gland at the same time as counting the feather mites may have affected the reliability of the data.

#

- (b) Scientists have developed a standard procedure for comparing RFI in cattle. They control **two** factors. These are type of food and environmental temperature. Explain why each of these factors needs to be controlled.

Type of food

Environmental temperature

(4)

Q7. (a) The control of water balance in the body involves negative feedback.

- (i) Describe what is meant by *negative feedback*.

(1)

- (ii) Water is removed from the body via the kidneys. Give **two** other ways in which water is removed from the body.

1. _____

2. _____ (2)

- (iii) Name the part of the brain which acts as the coordinator in the control of water balance.

(1)

- (b) **Figure 1** shows the cells lining the collecting duct in a human kidney. ADH molecules bind to the receptor proteins and this triggers the vesicles containing aquaporins to bind with the plasma membrane next to the lumen. **Figure 2** shows an aquaporin which is a large channel protein.

Figure 1

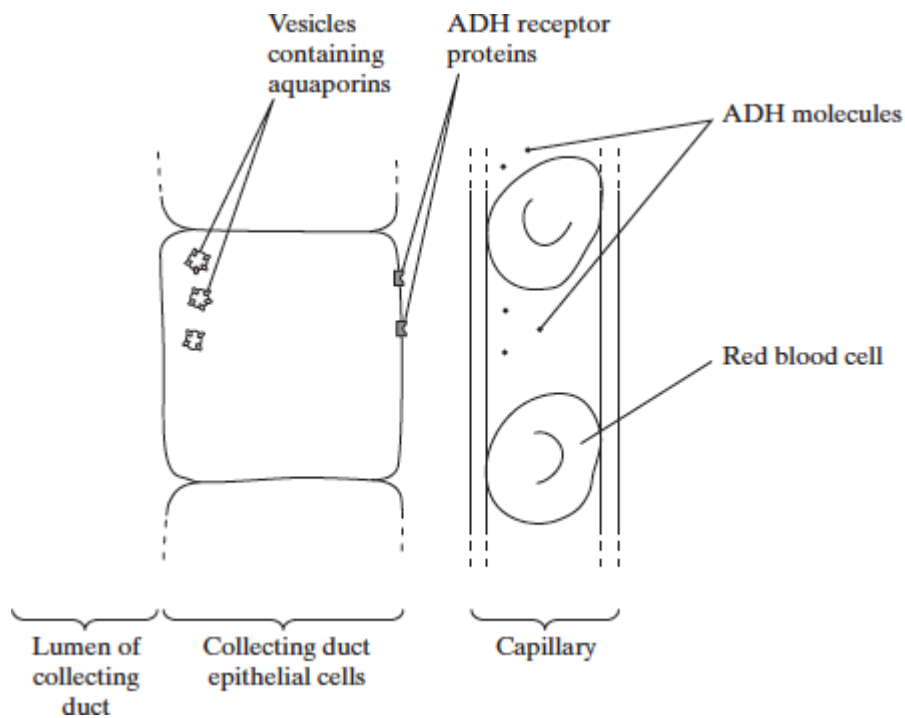
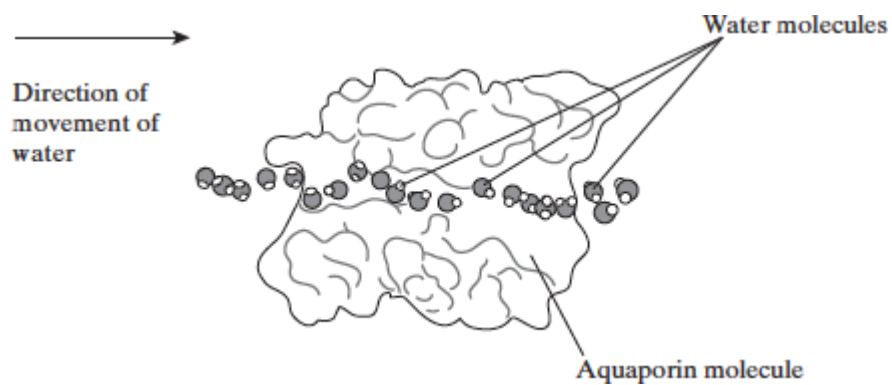


Figure 2



- (i) From which gland is ADH released?

_____ (1)

- (ii) Use the information given to explain how ADH increases the movement of water from the lumen of the collecting duct into the blood.

_____ (4)

Q8. Mammals and fish remove nitrogenous waste from their bodies in different forms.

(a) Name **two** polymers present in mammals and fish that contain nitrogen.

1. _____

2. _____ (2)

(b) In a mammal urea is removed from the blood by the kidneys and concentrated in the filtrate.

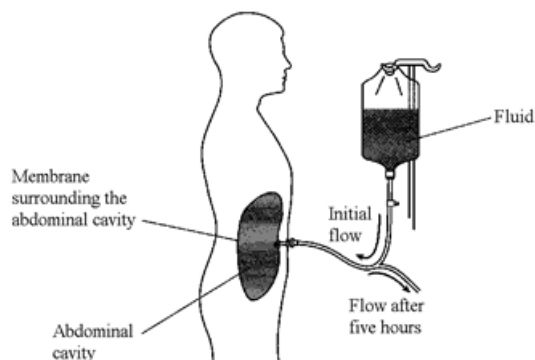
(i) Describe how urea is removed from the blood.

_____ (2)

(ii) Explain how urea is concentrated in the filtrate.

_____ (4)

(c) The diagram shows one way in which a person who has kidney disease can have the condition managed. In the process a fluid is put into the abdominal cavity. Exchange of materials takes place across the membrane that surrounds the abdominal cavity. This removes waste products from the blood. After five hours the fluid is drained out of the cavity and discarded. The cavity is then refilled with fresh fluid.



The table shows the concentration of solutes in the fresh fluid.

Solute	Concentration / mmol dm ⁻³
Sodium ions (Na ⁺)	132
Chloride ions (Cl ⁻)	96
Calcium ions (Ca ²⁺)	1.25
Magnesium ions (Mg ²⁺)	0.25
Glucose	76
Urea	0

- (i) By what process does urea enter the fluid in the abdominal cavity from the blood?

_____ (1)

- (ii) Explain why the fluid is changed every five hours.

 _____ (1)

- (iii) Fluid of the composition shown in the table is used instead of distilled water.
Explain why.

 _____ (2)

This is the end of the test. You will have till 3pm to upload the completed test AS A PDF document onto connect.

If you are having issues then please email your Biology teacher ASAP.

Total for Exam: 66 marks.

Total: ____/66 %: ____

