

Name of the Student: _____

Max. Marks : 26 Marks

Time : 26 Minutes

Q1.

Coat colour in mice is controlled by two genes, each with two alleles. The genes are on different chromosomes.

One gene controls the pigment colour. The presence of allele **A** results in a yellow and black banding pattern on individual hairs, producing an overall grey appearance called agouti. Mice with the genotype **aa** do not make the yellow pigment and are, therefore, black.

The other gene determines whether any pigment is produced. The allele **D** is required for development of coat colour. Mice with the genotype **dd** produce no pigment and are called albino.

(a) What type of gene interaction is occurring between the two genes? Explain your answer.

(2)

(b) Give all the possible genotypes for a black mouse.

(1)

(c) An agouti mouse of unknown genotype was crossed with an albino mouse of unknown genotype. Their offspring included albino, agouti and black mice.

(i) What was the genotype of the agouti parent?

(1)

(ii) Give **two** possible genotypes for the albino parent.

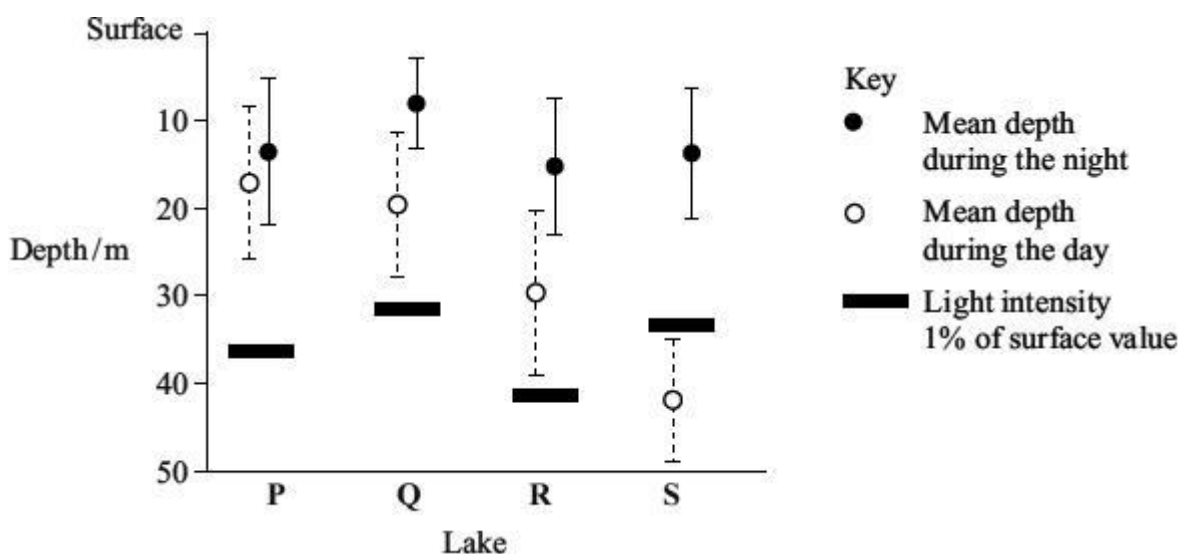
(1)

(iii) Suggest how the actual genotype of the albino parent could be determined.

(2)
(Total 7 marks)

Q2.

Zooplankton are very small animals which feed on algae (green protoctists) found in lakes. The chart shows the mean depth of zooplankton populations in four lakes, **P** to **S**, during the day and the night. It also shows the standard deviations of the means. The depth at which the light intensity is 1% of the surface light intensity is also shown.



- (a) Explain the evidence that the zooplankton feed at night.

(3)

- (b) Predatory fish, which hunt by sight, are present in some of the lakes. These fish have been present in the lakes for different lengths of time.

Lake	Estimated length of time predatory fish have been present / years
P	0
Q	5
R	25
S	Over 1000

- (i) Describe the relationship between the depth of the zooplankton during the day and the length of time predators have been present in the lake.

(1)

- (ii) Suggest how the differences in behaviour of the zooplankton populations in the four lakes might have evolved.

(3)
(Total 7 marks)

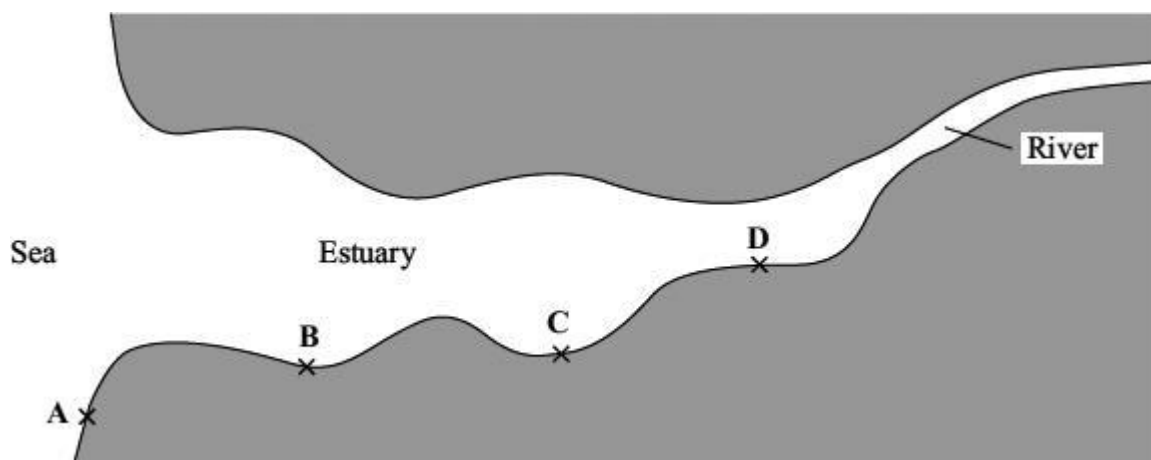
Q3.

The shore crab is common in Britain. It lives both in the sea and in river estuaries, where it feeds on a wide variety of species.

- (a) The shore crab has recently spread to, and has established large populations in, the coastal waters of the USA, where it is not a native species. Explain how the shore crab has been able to establish large populations and why this is causing concern to ecologists in the USA.

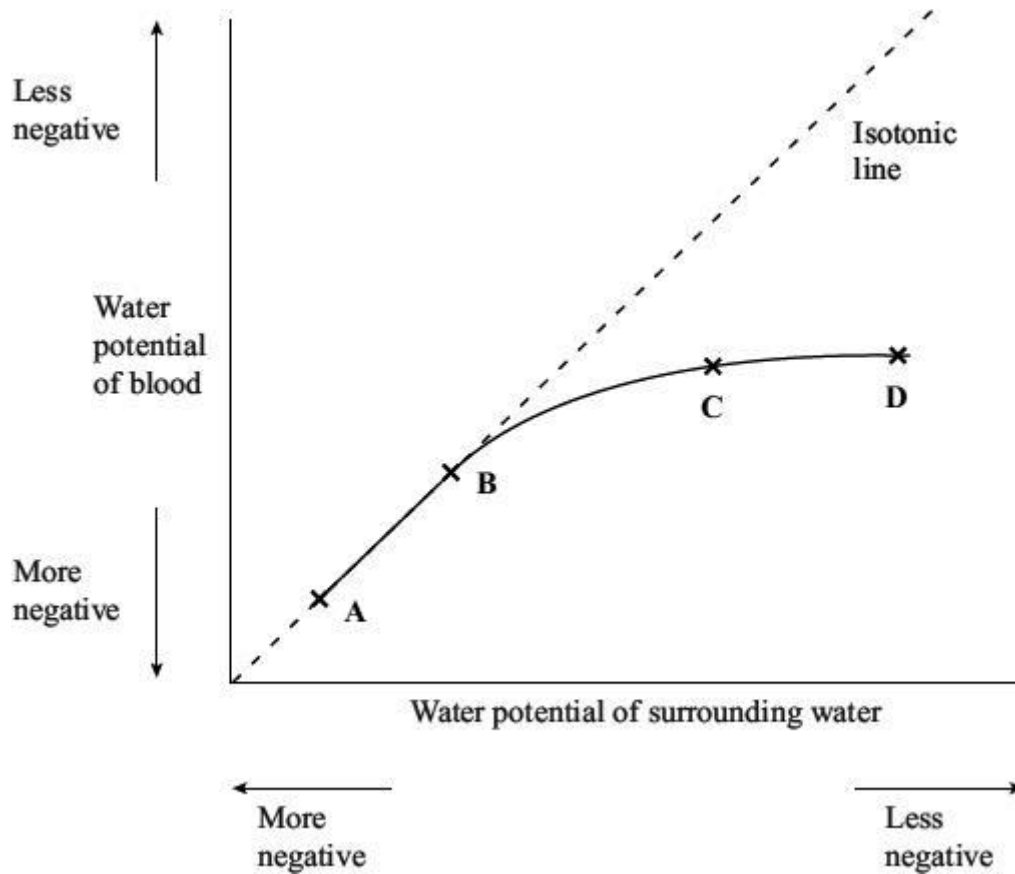
(5)

In Britain, crabs living in an estuary and along the neighbouring coast were studied. Crabs were collected from four different sites, **A** to **D**, as shown in the map.



The graph shows the mean water potential of the blood of samples of crabs from the four sites in relation to the water potential of the environment at the same sites. The isotonic line shows values at

which the water potential of the blood and surrounding water would be the same.



- (b) Describe the relationship between the mean water potential of the blood of the crabs and the water potential of the surrounding water.

(1)

- (c) Is there any net movement of water in or out of the blood of the crabs at sites **A** and **B**? Explain your answer.

(1)

- (d) Crabs living at sites **C** and **D** actively transport salts into their blood through their gills.

- (i) Explain how this enables crabs to survive at these sites.

(2)

- (ii) Crabs are unable to control their body temperature. In winter, when the water temperature falls, crab populations at sites **C** and **D** migrate towards the sea. Suggest the advantage of this behaviour.

(3)

(Total 12 marks)