IB · DP · Biology

50 mins 5 questions

Practice Paper 2

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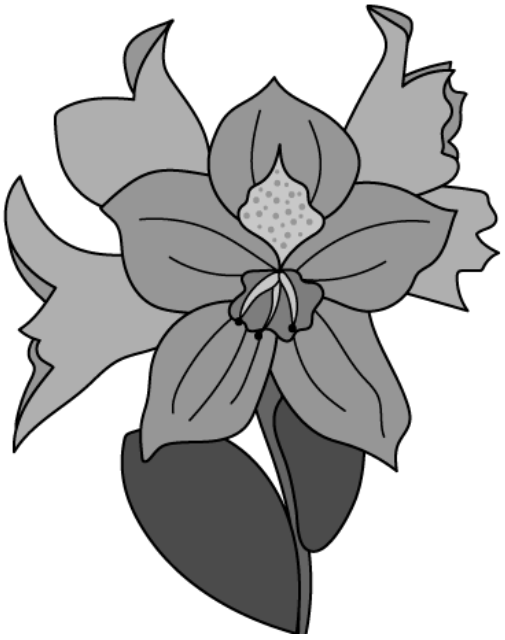
Total Marks **/50**

1 (a) *Rhododendron ponticum* (pictured below) is a fast-growing, non-native, invasive species currently threatening biodiversity in the UK.



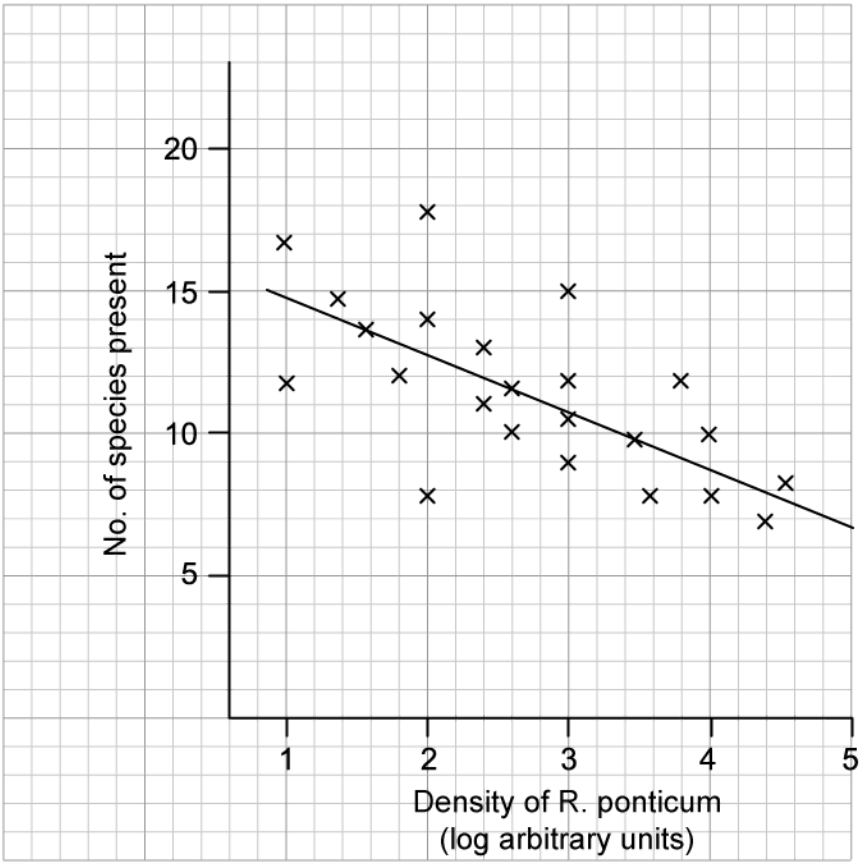
Rhododendron ponticum

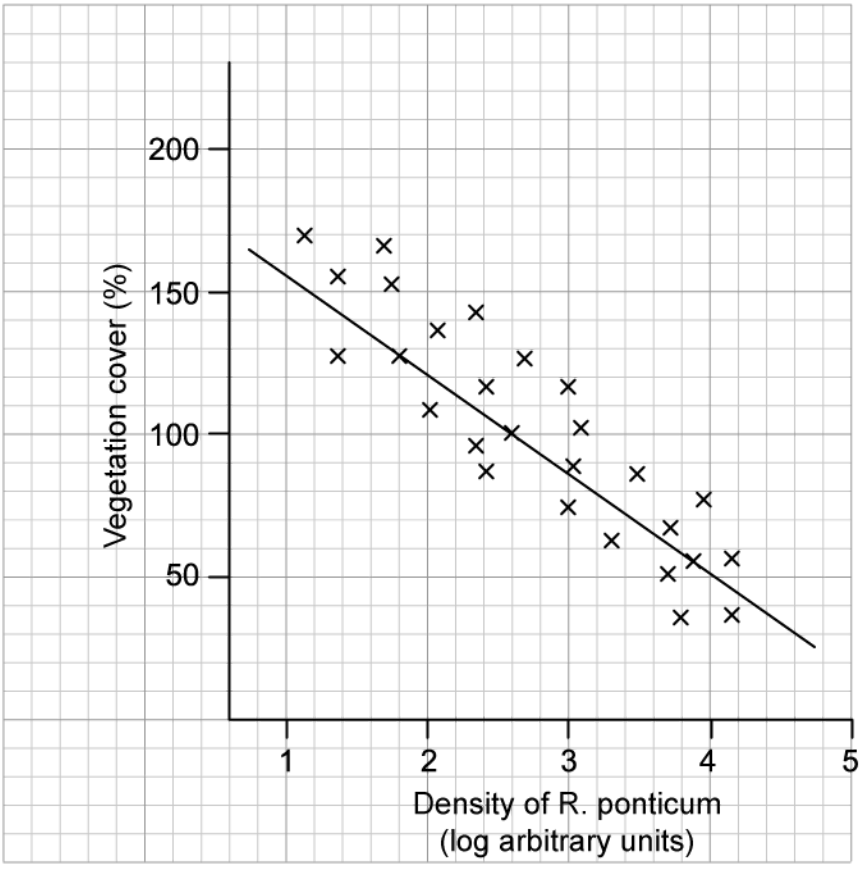
Originally introduced from Spain as a decorative plant for gardens, *R. ponticum* forms large thickets and outcompetes native plants such as bryophytes, other woody plants and wildflowers. Particularly severely affected are Atlantic oak woodland areas of coastal land in the western United Kingdom. Clearance programmes to remove *R. ponticum* have been in place for approximately 30 years in that region. Data was gathered on how the removal of *R. ponitcum* allows for affected sites to recover and for native species to be restored.

A quadrat study was carried out at three sites:

- An area of dense *Rhododendron ponticum* thickets
- An area of intermediate *ponticum* coverage
- An area of uninvaded land as a control

In each study, the number of species in each area's understorey was counted, as well as the % vegetation cover. This data is shown on the graphs below, which have been plotted with a line of best fit.





Calculate the range of species found at a *R. ponticum* density of 2 log arbitrary units.

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(1 mark)

(b) State how the % vegetation cover can exceed 100% in a given area.

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(1 mark)

(c) Suggest why a log scale is used to show the density of *R. ponticum* in the graphs.

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(1 mark)

(d) Explain the decline in the number of species found as the density of *R. ponticum* increases, as found in this study.

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(1 mark)

(e) Suggest **two** ways in which *R. ponticum* could affect competition.

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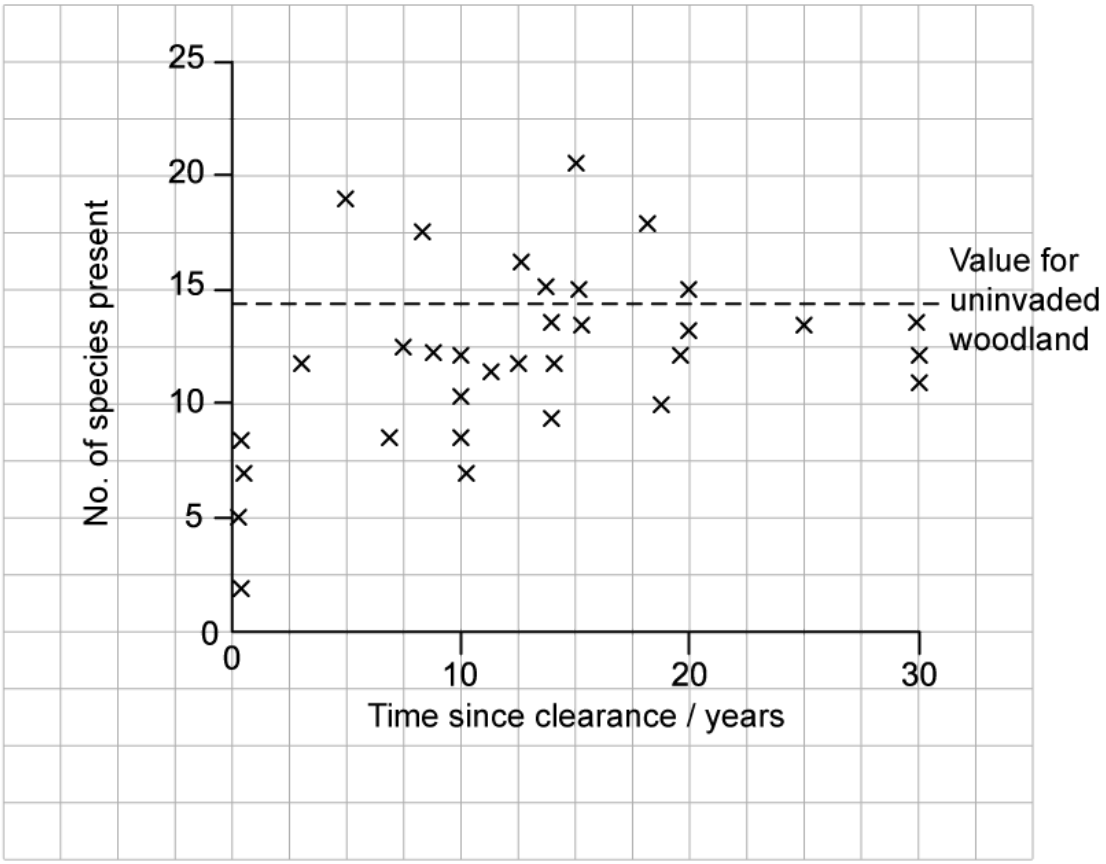
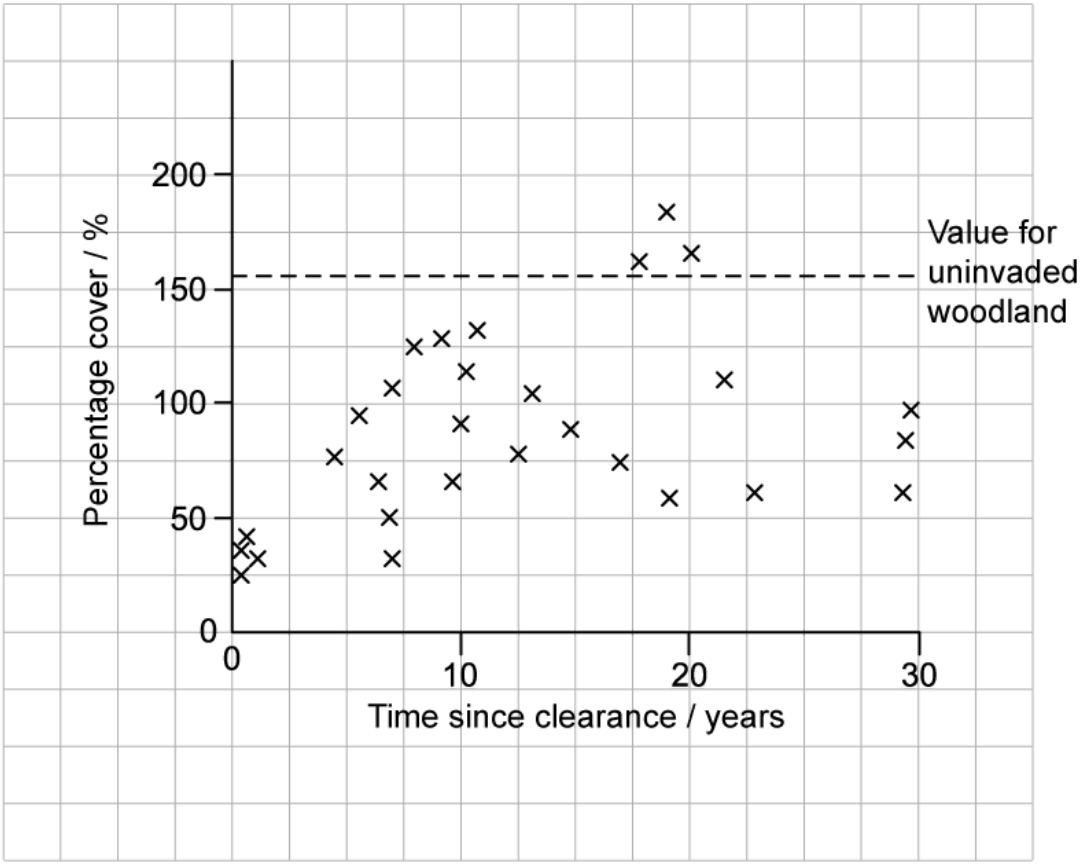
(2 marks)

(f) In an extension of this study, the spread of epiphytes (plants that grow on other plants, but not parasitically) was examined as a function of the time elapsed since the human clearance of *R. ponticum* from an area of ancient woodland. Typical taxa of epiphytes include mosses and liverworts. This was done to estimate how well a woodland habitat could recover from an invasion by *R. ponticum*. One theory is that *R. ponticum* can affect successive species long after all its biomass has been cleared away from a site. The results are shown in the diagram below.





Estimate the number of years before the number of species found on cleared land first exceeded the number of species found in uninvaded woodland.

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(1 mark)

(g) (i) Discuss whether the clearance of a *R. ponticum* invasion has an impact on the recovery of the woodland habitat.

(ii) Suggest a reason for any impact observed.

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(3 marks)

(h) In a further study, a series of measured soil core samples were taken from thirty sites within the Atlantic woodland

- 10 sites uninvaded by R. *ponticum*
- 10 sites cleared of *R. ponticum* more than 10 years previously
- 10 sites of dense R. *ponticum* coverage

The seeds contained within those samples were germinated in a laboratory greenhouse to display which species were present as ungerminated seeds in the soils. The study ran for 20 weeks. Control trays containing sterile compost showed negligible seedling growth.

The table below shows a summary of the results obtained.

Species		No of seedlings emerging in greenhouse trial	Number of sites where ungerminated seeds were found		
			Uninvaded	Cleared	Dense *R. ponticum* growth
European Poplar	*Populus tremula*	2 959	10	10	10
Rushes sp.	*Juncus sp.*	624	10	7	8
R. ponticum	*Rhododendron ponticum*	302	0	10	5
Broadleaf carpet grass	*Axonopus compressus*	402	10	2	3
Small cow wheat	*Melampyrum sylvaticum*	333	4	2	2
Others		2 566	125	51	42
		7 186	**159**	**82**	**70**

i) Identify the species that was sampled on the fewest sites when the *R. ponticum* growth was densest.

ii) Explain what this data shows for the prospects of growth of broadleaf carpet grass (*Axonopus compressus*) on cleared land following an *R. ponticum* invasion.

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(3 marks)

(i) Using the data in part (h), identify, with a reason, the species that benefited most from the clearance of *R. ponticum* from Atlantic coastal woodland.

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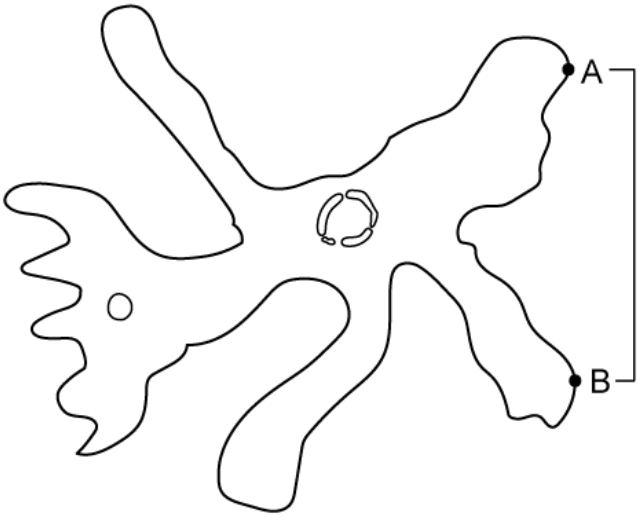
(1 mark)

2 (a) The diagram below is of an *Amoeba*. The actual size, measured between points **A** and **B**, is 320 µm.

When a student measured the same distance using an image from a microscope they determined the size to be 128 000 µm.



Calculate the magnification of this *Amoeba*. Show your working.

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(2 marks)

(b) Whilst examining the *Amoeba,* the student also measured the length of the organelles present, including the nucleus. The length of the nucleus on the microscope image was 28 000 µm.

If the student was examining the nucleus using the same magnification as part (a), in millimetres (mm), calculate the actual size of the nucleus.

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(2 marks)

The freshwater habitats of *Amoeba proteus* may contain organisms that have more complex structures eg. freshwater snails. The snails have primitive gills enabling them to breathe under water and mucus-producing glands that allow them to hibernate when the water freezes.

(c) Independently these structures have different properties but when combined they provide the snails with survival properties in the aquatic environment.

State the type of property that multicellular organisms, like the freshwater snail, have.

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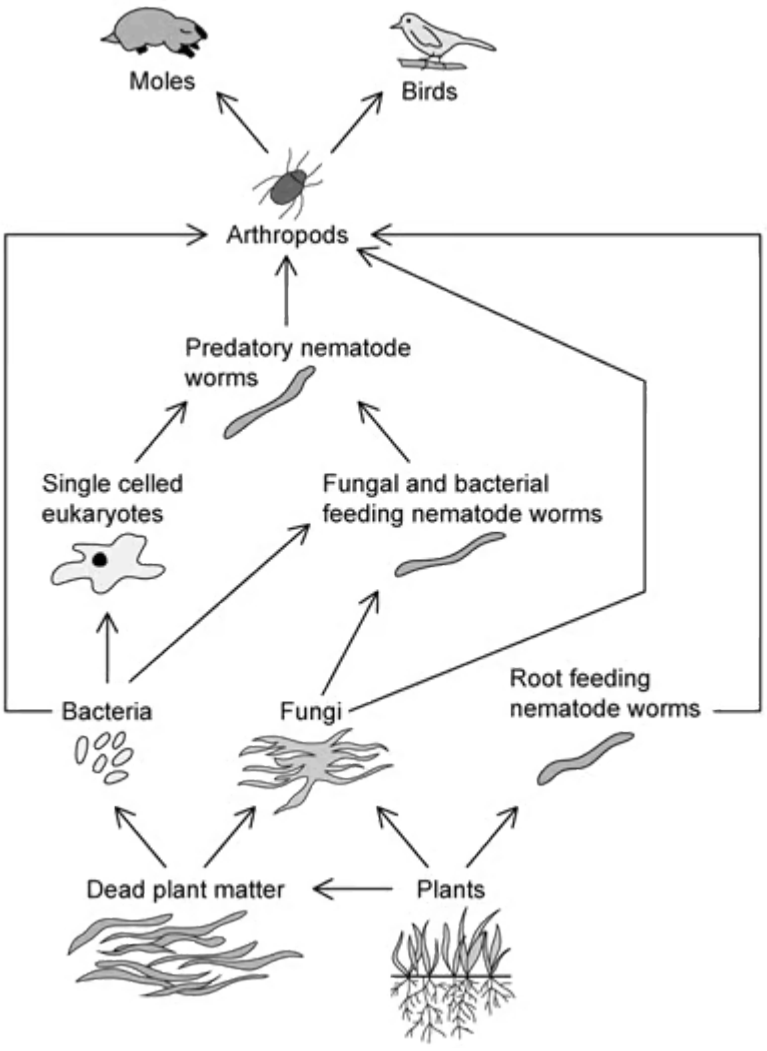
(1 mark)

3 (a) The diagram below shows a soil food web.



State the specific mode of nutrition used by the following organisms:

(i) Plants

(ii) Fungi

(iii) Root feeding nematode worms

(3 marks)

(b) Draw a food chain that includes bacteria from the food web shown above

(1 mark)

(c) The longest food chain in the food web above contains 7 organisms. Explain why it is unusual to see food chains of this length.

(2 marks)

(d) Outline how the soil food web will be affected by a farmer harvesting crop plants from a field.

(3 marks)

4 (a) Haemophilia B is a rare genetic disorder where the body produces very little or no factor IX, a protein that is responsible for a cascade of reactions resulting in the conversion of fibrinogen into fibrin.

Explain the effect of insufficient levels of factor IX on the process of blood clotting.

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(2 marks)

(b) A person suffering from haemophilia B will be more prone to excessive bruising.

Based on the information provided, suggest a reason for this.

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(1 mark)

(c) Haemophilia B cannot be cured but one form of treatment involves injecting patients with factor IX, which is derived either from donated blood or artificially produced using genetic engineering.

Explain the importance of determining the correct dosage of factor IX before injecting patients.

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(2 marks)

(d) In certain rare cases, the body may produce antibodies against factor IX that is injected during replacement therapy,

Suggest **one** effect these antibodies may have on the treatment.

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(1 mark)

5 (a) *One mark is available for clarity of communication throughout this question.*

Draw a labelled diagram to show a cell in the following stages of meiosis:

- Metaphase I
- Prophase I

(4 marks)

(b) Outline how developments in scientific methods facilitated the discovery of meiosis.

(4 marks)

(c) Explain how genetic variation may be introduced into a population.

(8 marks)