

# Practice Paper 2

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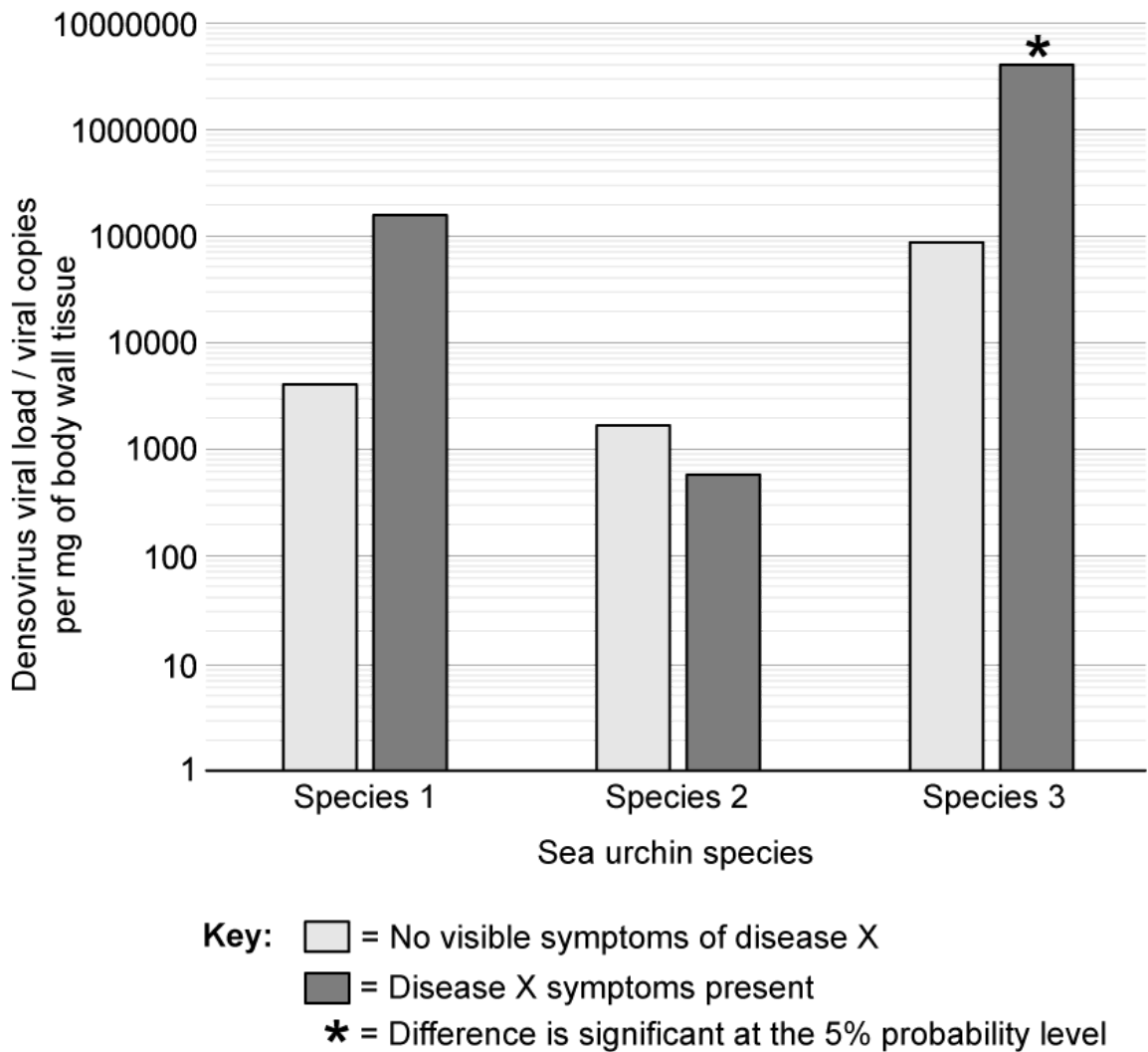
Total Marks

/72

1 (a) Disease X is a potentially fatal disease found in sea urchins, with symptoms such as body deflation, body lesions, and discoloration. The cause of disease X has yet to be determined, and several hypotheses have been tested.

One such study investigated the possible connection between the presence of viruses known as densoviruses and disease X in several species of sea urchin.

Some of the results of the study are shown in the graph below.



State the viral load of species 2 when symptoms are present.

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(1 mark)

(b) Compare and contrast the relationship between viral load and disease X symptoms in the different species studied.

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(2 marks)

(c) Use the graph in part (a) to deduce the impact of densoviruses on disease X.

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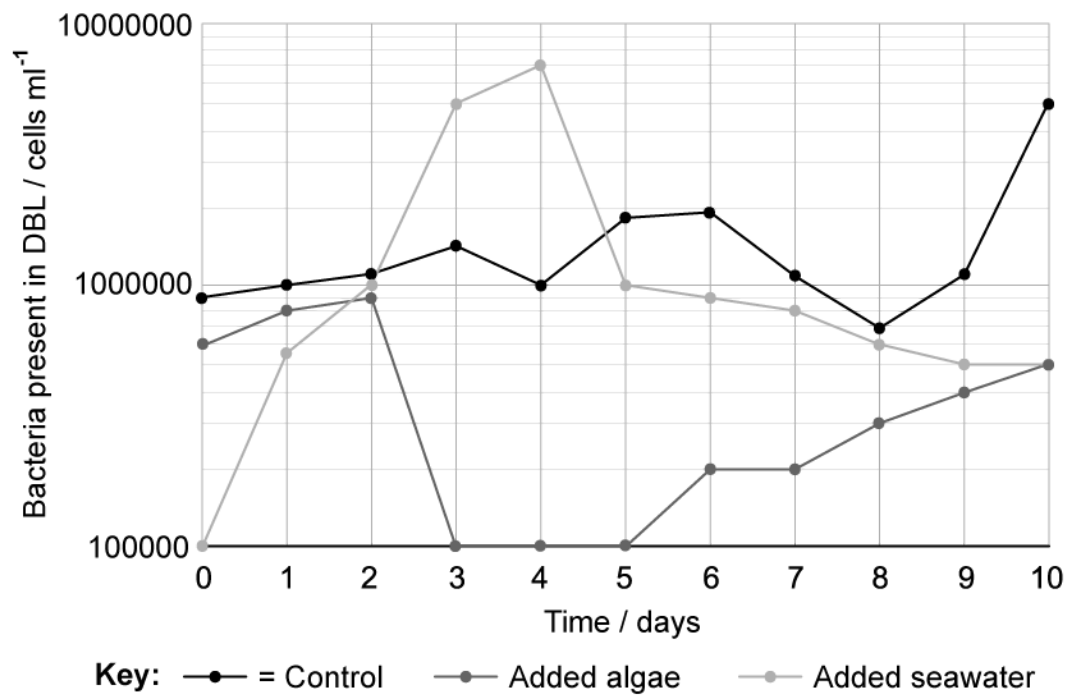
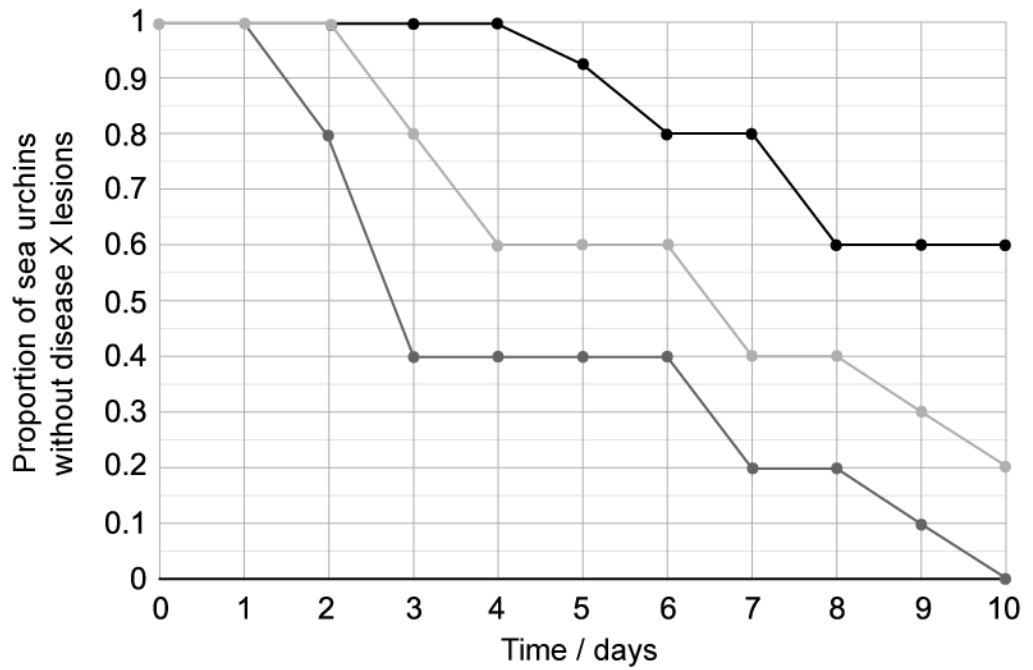
(2 marks)

(d) Aquatic organisms have a thin layer of water surrounding their bodies known as the diffusive boundary layer (DBL). Organisms exchange substances with their environment via this layer, and its composition is different to that of the surrounding seawater.

Another study looked at the impact of the composition of the DBL on the development of disease X. Two types of organic matter were added to the water surrounding sea urchins of species 2:

- Organic matter in the form of lab-grown algae.
- Seawater containing normal levels of organic matter.

The sea urchins were assessed over 10 days for signs of disease X lesions and the water in the DBL was tested for bacteria. Note that the control contained no additional organic matter.



Describe the formation of disease X lesions over the testing period.

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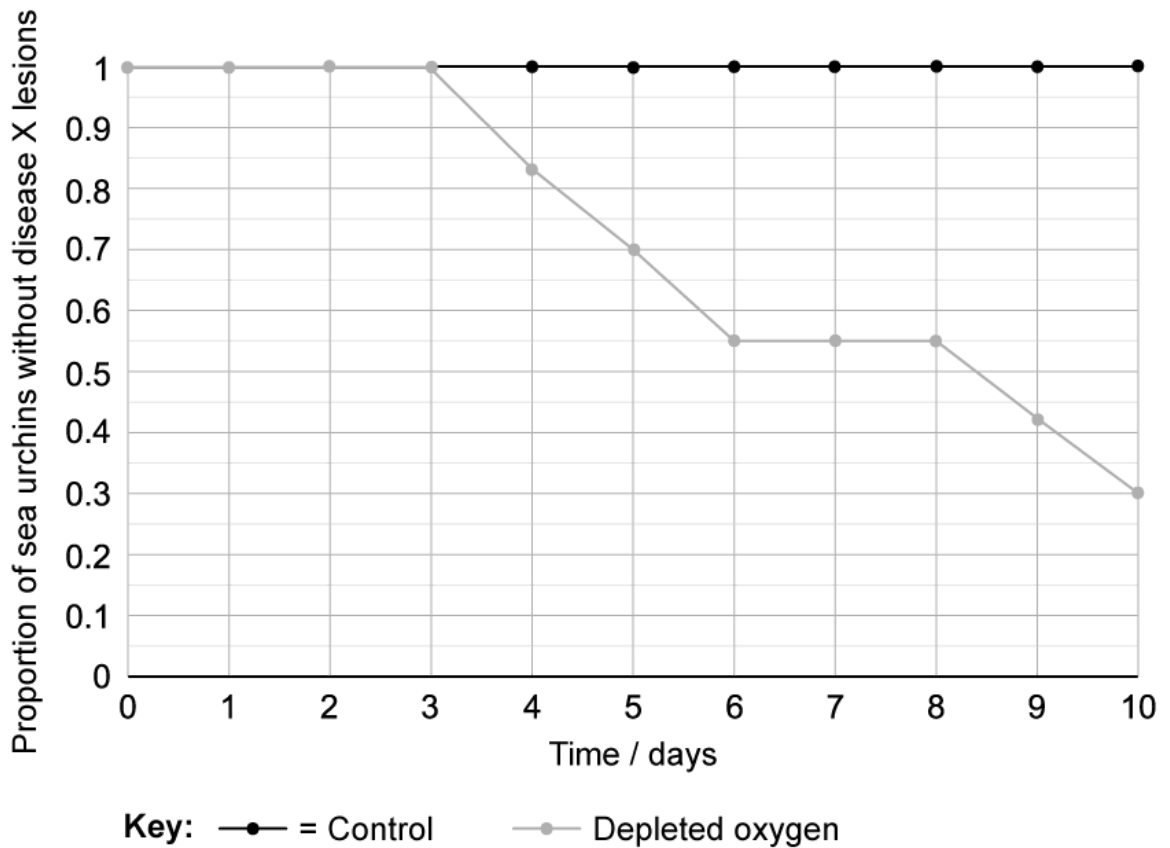
(2 marks)

- (e) Discuss any observations on the growth of disease X lesions and the abundance of bacteria in the DBL shown in part (d).

(2 marks)

- (f) As part of the same study, the researchers looked at the impact of reduced oxygen levels in the DBL on lesion growth in a fourth species of sea urchin.

Their results are shown in the graph below.



Calculate the number of individuals that **would have lesions** after 10 days with depleted oxygen levels in a population of 23.

**(1 mark)**

- (g)** A student read the results described in parts (d) and (f) and concluded that disease X is caused by an increase in organic matter and a decrease in oxygen levels in the DBL of sea urchins.

Evaluate the student's conclusion.

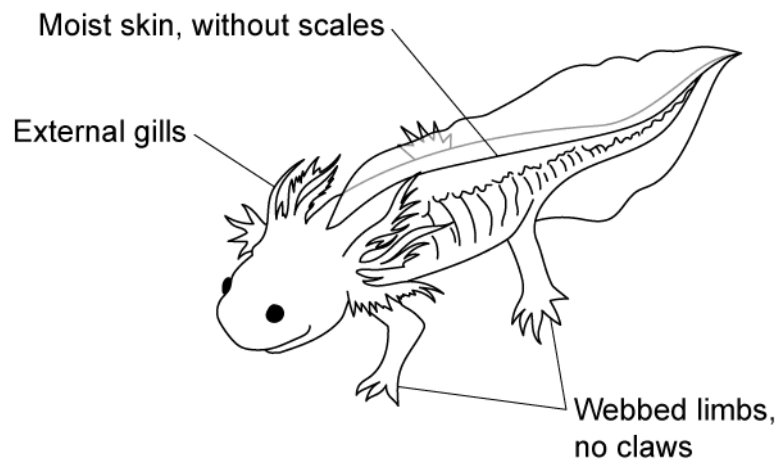
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**(3 marks)**

2 (a) Study the following diagram showing some features of specimen **A**.



Use the dichotomous key below to identify the class that specimen **A** belongs to.

1	Four limbs are present..... Four limbs are absent.....	Go to 2 Go to 3
2	External ear flap is absent..... External ear flap is present.....	Go to 3 Mammalia
3	Gills are present..... Gills are absent, lungs are present.....	Go to 4 Go to 5
4	Dorsal fins are present..... Dorsal fins are absent.....	Fish Go to 6
5	Feathers and a beak are present..... Feathers and a beak are absent.....	Birds Go to 6
6	Moist, smooth skin..... Dry, scaly skin.....	Amphibian Reptile

(1 mark)

(b) Specimen **A** is classified by using a natural classification system.

Define the term 'natural classification'.

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(2 marks)

(c) Natural classification can be very useful in conducting research in the field of biodiversity.

List **two** advantages of natural classification systems.

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(2 marks)



**3 (a)** Describe the early events that led scientists to discover exceptions to Mendel's predicted phenotypic ratios for dihybrid crosses.

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**(2 marks)**

**(b)** Recombinant offspring are those that have a different allele combination to their parents.

Explain how test crosses can be used to identify recombinant individuals in offspring.

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**(2 marks)**

**(c)** A set of identical twins were raised in similar conditions by the same parents. One of the twins fell off a swing, which left a permanent scar on his chin.

State the impact this would have on the phenotypic variation between the twins.

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**(1 mark)**

**(d)** Shepherd's purse (*Capsella bursa*) is a flowering plant which belongs to the mustard family. Fruit shape in this plant is determined by two alleles, namely allele T for a triangular fruit shape, which is dominant over allele t for top-shaped fruit. A plant with triangular-shaped fruit was crossed with a plant that has top-shaped fruit. All 30 offspring of this cross had triangular-shaped fruit.

State, with a reason, whether there can be certainty that the original parent plant with triangular shaped fruit had a genotype of TT.

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**(2 marks)**

**4 (a)** DNA was studied by X-ray diffraction by Rosalin Franklin and Maurice Wilkins in the 1950's.

Explain how X-ray diffraction allowed Franklin and Wilkins to view the molecular structure of DNA.

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**(3 marks)**

**(b)** Today, visualisation software can be utilised to analyse DNA in very high detail. The association between protein and DNA within the nucleosome can be seen.

Describe what may be visualised when analysing a nucleosome.

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**(3 marks)**

**(c)** Many visualisation techniques have been used to understand and study the structure of DNA. Watson and Crick used visualisation techniques, such as Franklin's X-ray diffraction, to build a physical model of DNA. Their models were also influenced by the findings of other researchers, such as Erwin Chargaff.

Describe how the research findings of Franklin and Chargaff facilitated Watson and Crick to determine the structure of DNA.

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**(3 marks)**

- 5 (a) Bowel cancer can result from adenoma polyps. Adenoma polyps form as a result of mutations occurring in dividing cells of the colon lining.

Suggest the differences in the cell cycle of a cancer cell compared with that of a normal intestinal cell.

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**(2 marks)**

- (b) Compare and contrast the process of cytokinesis in plants and animals.

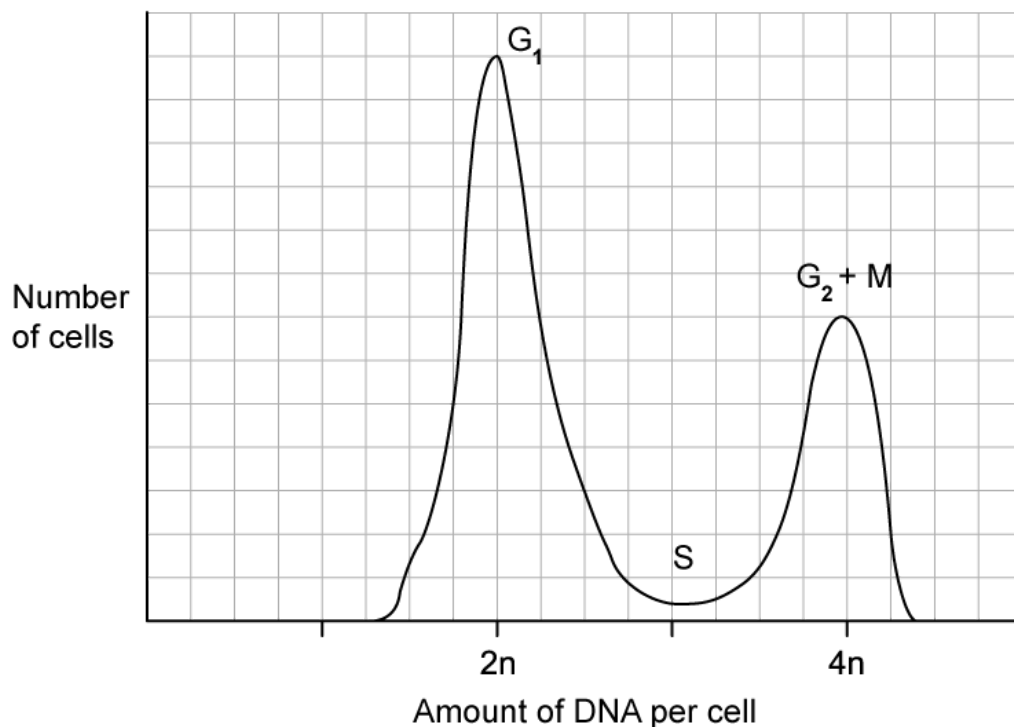
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**(3 marks)**

- (c) The graph below shows data produced from a flow cytometer. This measures the number of cells that are labelled with DNA bound to a fluorescent dye, as this is proportional to DNA content. The stages of the cell cycle are indicated.



Suggest why, during the S phase, that the amount of DNA per cell is between  $2n$  and  $4n$ .

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**(2 marks)**

**6 (a)** *One mark is available for clarity of communication throughout the last two questions.*

Describe the process of plant micropropagation.

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**(7 marks)**

**(b)** Outline some of the commercial and environmental benefits of micropropagation.

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**(5 marks)**

**(c)** Explain how microarrays are used in genomics to increase our understanding of plant hormones and their effect on gene expression.

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**(3 marks)**

7 (a) One mark is available for clarity of communication throughout the last two questions.

Outline the role of the zona pellucida in an oocyte.

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(3 marks)

(b) Compare and contrast the processes of oogenesis and spermatogenesis.

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(7 marks)

(c) Explain the advantages of internal fertilisation to terrestrial animals.

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(6 marks)