**Year 12 Biology**

**Investigation: Modelling**

**Disease Outbreak**

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Simulation models are tools used by epidemiologists to predict the impact of different factors (variables) on the spread and outcome of a disease epidemic. The **Disease Lab** simulator can be used to modify various disease characteristics.

Explore the interactive referring to the information given about the different scenarios, factors that can be changed and the data that can be obtained.

<http://www.learner.org/courses/envsci/interactives/disease/disease_help.php>

The model allows you to change characteristics of the disease such as type of disease, sick days (persistence), transmission rate (infectivity), or characteristics of the human population such as density, mixing or vaccination rates.

You can measure the effects different factors have on the spread of the disease using the Death toll (total numbers), Sick days (total numbers), Sick days (per capita) or the time a disease takes to spread.

**PART A: Your task is to plan and conduct an investigation into some of the factors affecting diseases using this simulator.**

1. **Choose two factors from those mentioned above and write an hypothesis on each stating the effect you think that changing it will have on a disease.**
2. **Choose a disease from the simulation to investigate.**
3. **Carry out your simulations making sure that you plan for validity and reliability in your investigations.**
4. **Record the appropriate results.**
5. **Repeat the investigations using a different disease from the simulator.**

**(Note: Each time you run a simulation it is possible to get a different result)**

**Time allowed:**

* **2 lessons to plan and collect data.**
* **Homework to complete questions 1-4.**

**PART B: You will complete a 50 minutes validation test on Graphing results, Discussion, Conclusions and the effectiveness of computer modelling.**

**Part A: Planning and conducting (15 marks)**

1. Aim of the investigation. (1 mark)
2. Hypotheses. (one for each factor tested) (2 marks)

Scenario 1 Hypothesis:

Scenario 2 Hypothesis:

1. Identify the dependent, independent and controlled variables for each scenario. (6 marks)

|  |  |  |  |
| --- | --- | --- | --- |
|  | Independent | Dependent | Controlled variables |
| Scenario 1 |  |  |  |
| Scenario 2 |  |  |  |

1. Collect and record data in appropriate tables demonstrating **necessary calculations.**

(6 marks)

**Part 2: Validation Test (50 minutes in class, under test conditions) 16 marks**

1. Represent your data in the form of a graph/s. (6 marks)

Depending on the investigation planned students may produce two graphs or four graphs to represent the data.

* Title relating dependent and independent variables (2)
* Axes labels and units (2)
* Points plotted correctly with straight lines(1)
* Key for sets of data plotted on the same graph (1)

1. Describe the results and make **conclusions** from the two simulations. (6 marks)

Scenario 1 Scenario 2

* Describe trend (1) Describe Trend (1)
* Quote two data points (1) Quote two data points (1)
* Conclusions relate to hypothesis(1) Conclusions relate to hypothesis(1)

1. What differences were there between the results of the two diseases? Account for the differences?
2. Outline two benefits of using modelling to predict the outcome of epidemics. (2 marks)

Any 2 of the following

* Characteristics of a disease are well known therefore these can be pre-set depending upon a scenario to predict the outcome of a disease
* Don’t need to use real data so preventing deaths occurring
* Allows epidemiologists to put control measures in place such as vaccination programs

1. Describe two limitations of using computer simulation models in this way.

Any 2 of the following (2 marks)

* Cannot set population size
* Doesn’t account for susceptibility of particular age groups/sections of society
* Environmental factors such as humidity, temperature (climate not adequate)
* Only 3 settings for high, medium, low mixing
* Doesn’t account for natural immunity of the population at the onset of the outbreak.
* Doesn’t account for natural immunity of the population at the onset of the outbreak.
* Doesn’t account for the pathogen evolving

Needs some reference to why we tested the hypotheses with three different diseases.