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Surviving Maths in AS Biology

by

Dr Robert Mitchell

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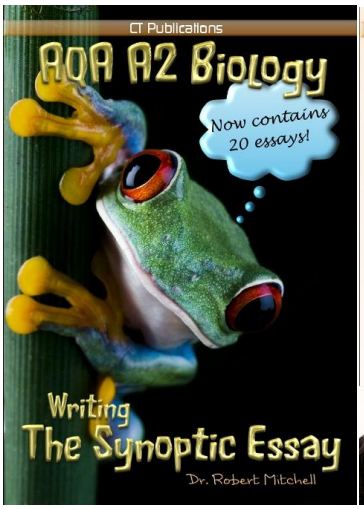
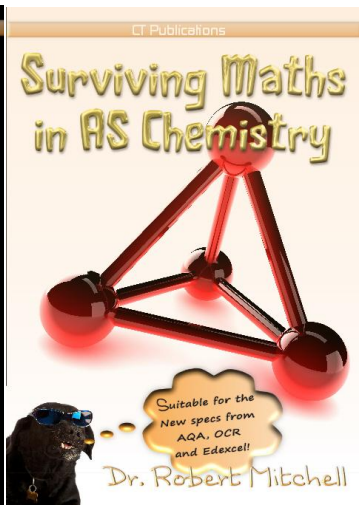
About the author

Rob is a private tutor in chemistry and biology in Bolton. He's formerly worked in medical research as technician, research assistant and post-doctoral researcher and has contributed to the publication of over 40 research papers. During a varied career in science, he's been a project leader in industry, a lecturer and examiner and blogs daily as *Chemicalguy*. He likes dogs, and pies, going to the movies and walking!

Other books by the author

AQA A2 Biology; Writing the Synoptic Essay	May 2010
Surviving Maths in AS Chemistry	August 2010
Ultimate Exam Preparation; AQA Chemistry Unit 1	October 2010 (in press)
Ultimate Exam Preparation; AQA Biology Unit 1	November 2010 (in press)
Biofuelishness (Popular Science)	December 2010 (in press)





Frequency tables, pie charts, bar charts and histograms

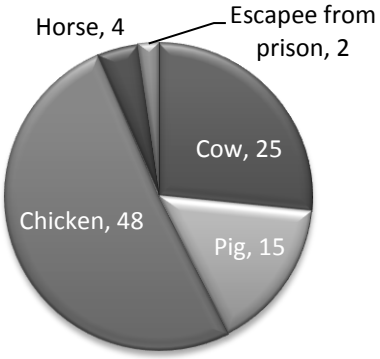
A *frequency table*, or *tally chart* is a means of collecting and organising data into discrete groups. The data is then often presented as a *bar chart* or *histogram*. Tally charts for sampling biological data usually have two or more columns, the first of which is for recording the *independent variable*. If the independent variable can be numbered (like a weight, height etc) it is quantitative), if cannot be numbered it is said to be qualitative (like brown eyes, blue eyes etc).

Categoric data

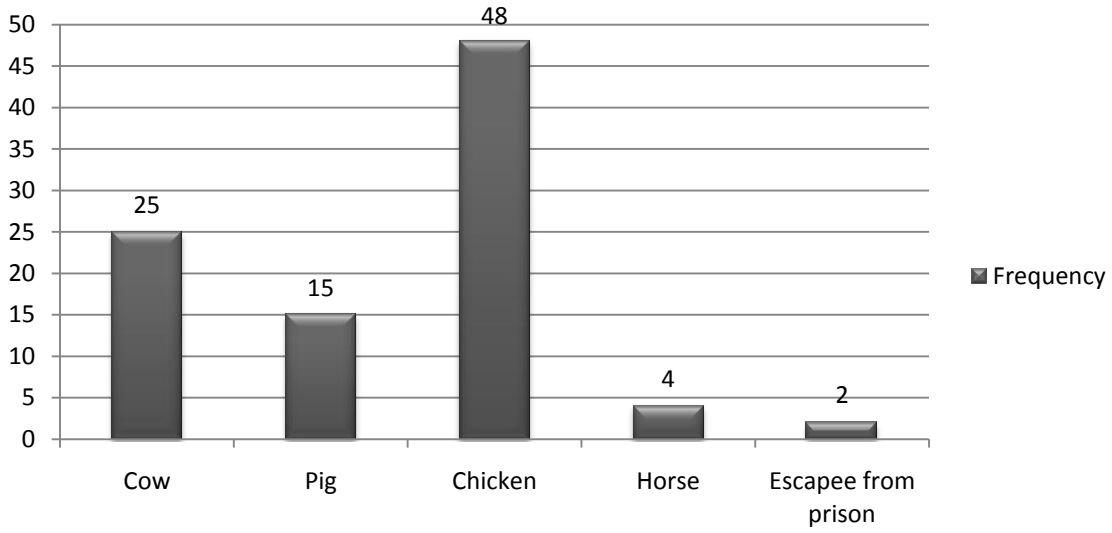
If we were to make a frequency table for animals in a farmer's field we might list the different animals in the first column and tally the number (or *frequency*) of that animal in the second column. Because the animals fall into different categories that do not overlap, the data is said to be categoric and discontinuous. As they aren't numbers, the data is said to be qualitative.

Animal	Frequency
Cow	25
Pig	15
Chicken	48
Horse	4
Escapee from prison	2

Such data can be presented on a pie or bar chart. The pie chart represents the total number of animals as 100%, and is the entire 360^0 of the circle. Each variable is then attributed a *slice* of the pie whose size is proportional to the frequency, so the more it is then the bigger the slice. In the example below, 48 out of 94 animals are chickens and so their slice of the pie is just over a half at 51%, or 183.8^0 and so on for the rest of the animals.



The same data is presented below, but as an unranked bar chart. This time, the area of their rectangular bar is proportional to the number of animals in each category.



These kinds of chart are useful for presenting data sampled for discontinuous variables, but sometimes the data is *continuous*. In such cases a histogram is a better option.

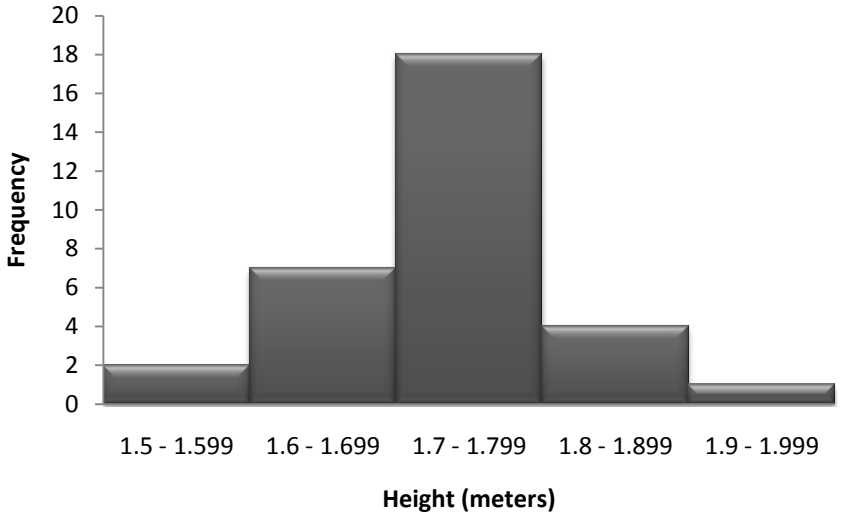
Continuous data

For variables such as height or weight that show a *quantifiable* change (a change you can put a number to) the frequency table can be used to produce a histogram. Consider the following table showing a *distribution* of the number of male students and their heights in a class of AS biology students.

Height	Frequency
1.5 - 1.599	2
1.6 - 1.699	7
1.7 - 1.799	18
1.8 - 1.899	4
1.9 - 1.999	1

The independent variable now reflects a change in the heights of the students from 1.5 meters up to 2 meters and the number of students falling to specified height groups are tallied and counted. The "bar chart" formed is now termed a histogram and the data shows the distribution of heights in the student's class.

This type of bell-shaped curve is called a *normal distribution* curve and forms the basis of some slightly more complex statistical testing which you will tackle later in the A2.



If you were to imagine and visualise this data, you would see that "most" students are of average height with one very tall and two very short class members. It is this ability to visualise a distribution in different ways which makes this kind of data presentation a powerful tool in biology.

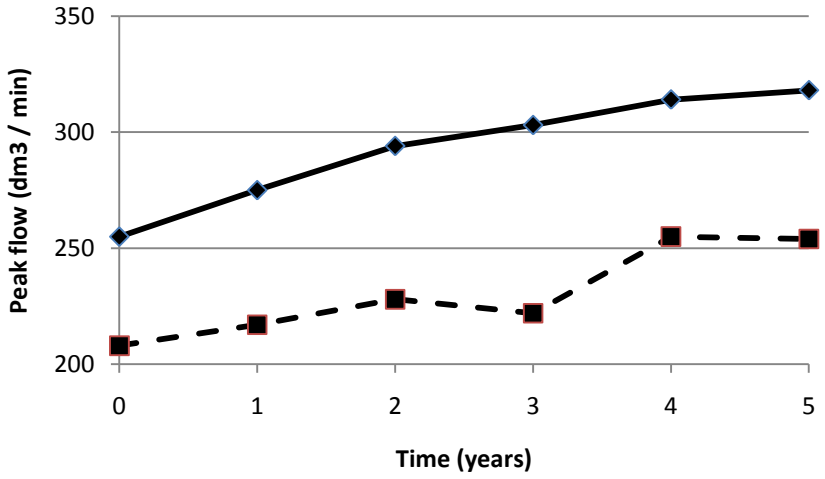
16. The table shows the proportion of different bases in DNA extracted from four different species.

	Adenine	Cytosine	Thymine	Guanine
Human	30.8	19.9		
Chimpanzee	27.2	22.8	27.2	22.8
Shrew	26.7			23.3

(a) Fill in the missing data in the table [2]

(b) Compare the data of the shrew and the chimpanzee [2]

17. Smoking can impair lung function. An investigation was carried out into the effect of smoking on lung function over 5 years. The peak flow rate (a measure of lung function) is the maximum volume of air expelled from the lungs in 60 seconds ($dm^3\ min^{-1}$). Two female volunteers, one a smoker (dashed line) and one a non-smoker (solid line) were both aged 12 at the start of the study. They both had their peak flow measured once a year for five years. The results are shown on the graph below.



(a) Describe the data for the non-smoker. [1]

(b) Compare the data from the two volunteers. [3]

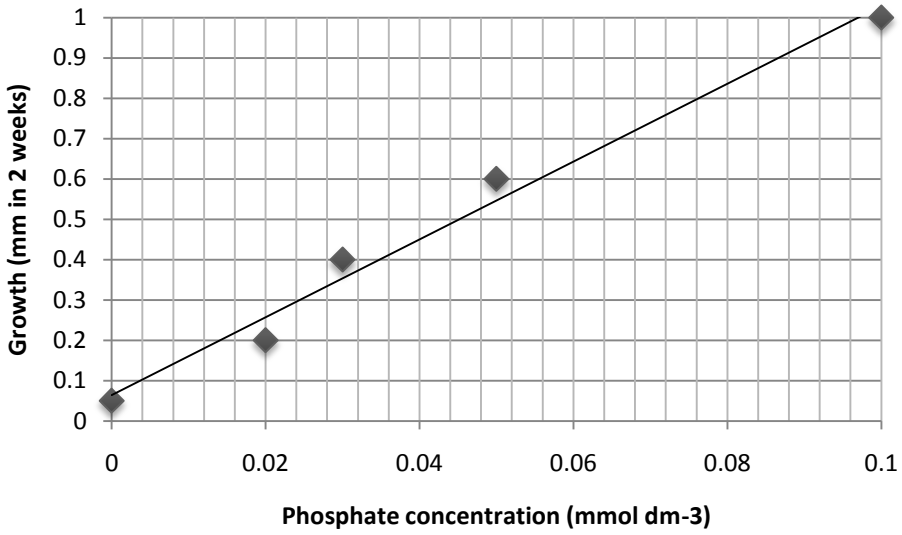
18. In 1978 the population of Elephant seals at Macquarie Island off the coast of Antarctica was estimated at 140 000. It was thought that the population had declined by 75% over the previous 10 years. In 1998 a study estimated the island population to have recovered to 580 000.

(a) Calculate the estimated population of Elephant seals in 1968. Show your working. [2]

27.

	Prophase	Metaphase	Anaphase	Telophase
Number of cells	15	**6** **60- (15+9+30)**	9	30
% of cells in stage	25	**10** **6 ÷ 60 x 100**	15	**50** **30 ÷ 60 x 100**
Degrees on pie chart	90	36	**54** **15% x 360**	180 **50% x 360**

28. (a)



x-axis labelled correctly [1]
y-axis labelled correctly [1]
points plotted correctly [1]
line of best fit appropriately placed [1]

(b) As the sodium phosphate concentration increased from 0 to 0.1 mmol dm^{-3} the growth of the seedlings increased proportionally [1].

(c) *Any one of ...*
The line of best fit does not go through the origin. [1]
When phosphate is not present, there is still some growth. [1]
There is scatter about the line. [1]

(d) *Any one of ...*
More data points (particularly between 0.06 and 1). [1]
Repeat several times and take the average. [1]
Increase the length of time the seedlings grew. [1]

29. The replication rate (in cycles per week) is: **B 10**
Hours per week = 24 x 7 = 168
Number of cycles = 168 hours ÷ 16.8 = 10

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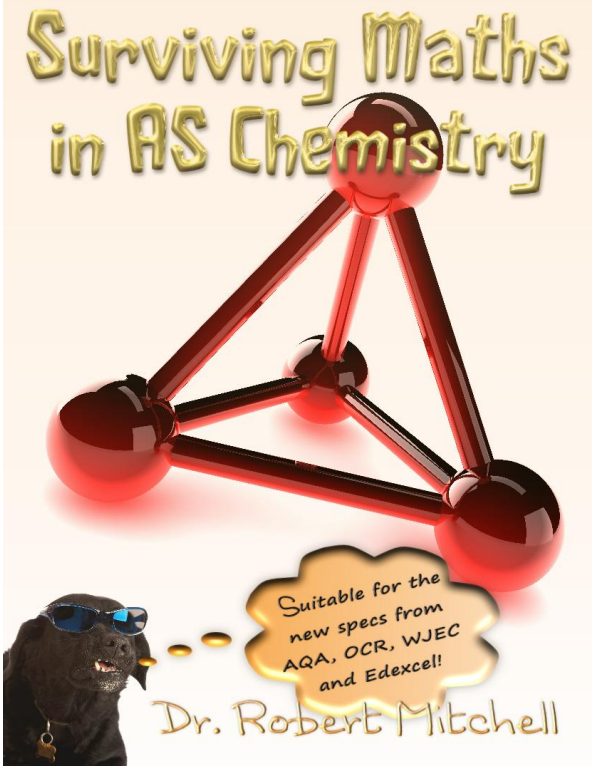

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