9 A biologist is investigating the growth of bacteria in a piece of bread.
He believes that the number, N, of bacteria after t hours may be modelled by the relationship $N = A \times 2^{kt}$, where A and k are constants.

(a) Show that, according to the model, the graph of $\log_{10} N$ against t is a straight line.

Give, in terms of A and k,

- the gradient of the line
- the intercept on the vertical axis. **[4]**

The biologist measures the number of bacteria at regular intervals over 22 hours and plots a graph of $\log_{10} N$ against t. He finds that the graph is approximately a straight line with gradient 0.20.
The line crosses the vertical axis at 2.0.

(b) Find the values of A and k. **[2]**

(c) Use the model to predict the number of bacteria after 24 hours. **[1]**

(d) Give a reason why the model may not be appropriate for large values of t. **[1]**