

13. The resting metabolic rate, R ml of oxygen consumed per hour, of a particular species of mammal is modelled by the formula,

$$R = aM^b$$

where

- M grams is the mass of the mammal
- a and b are constants

(a) $\log R = \log(aM^b)$
 $\log R = \log a + \log(M^b)$ (1 mark)
 $\log R = \log a + b \log M$ (1 mark)

(a) Show that this relationship can be written in the form

$$\log_{10} R = b \log_{10} M + \log_{10} a$$

(2)

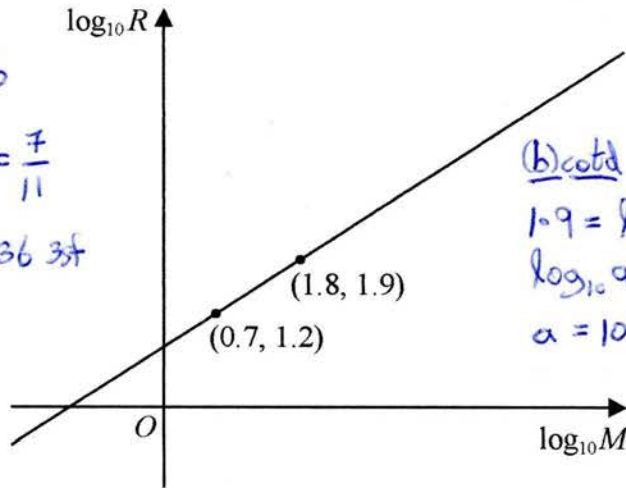


Figure 3

(b) gradient of line = b
 $= \frac{1.9 - 1.2}{1.8 - 0.7} = \frac{0.7}{1.1} = \frac{7}{11}$
 $= 0.6363... = 0.636$ 3sf
 (1 mark)

(b) cont'd at (1.8, 1.9),
 $1.9 = \log_{10} a + 0.636(1.8)$
 $\log_{10} a = 0.7552$
 $a = 10^{0.7552} = 5.691...$
 $= 5.69$ 3sf (1 mark)

A student gathers data for R and M and plots a graph of $\log_{10} R$ against $\log_{10} M$

The graph is a straight line passing through points (0.7, 1.2) and (1.8, 1.9) as shown in Figure 3.

(b) Using this information, find a complete equation for the model.
 Write your answer in the form

$$R = aM^b$$

giving the value of each of a and b to 3 significant figures.

(3)

(c) With reference to the model, interpret the value of the constant a

(1)

(b) cont'd. so, $R = 5.69 M^{0.636}$ (1 mark)

(c) when Mass = 1g, $R = a(1)^b = a$

so a is the resting metabolic rate for a mammal of mass 1g
 (1 mark)