3 The relationship between air pressure P and height h above sea level is given by

$$P = P_0 e^{-bh}$$

where P_0 is the air pressure at sea level and b is a constant.

(a) Explain why a graph of $\ln P$ against h can be used to determine a value for b.

(2)

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(b) The table shows values of P measured at different values of h.

h / m	P / kPa	
305	97.7	
762	92.5	
1372	85.9	
1829	81.2	
2438	75.3	
3048	69.7	

(i) Plot a graph of $\ln P$ against h on the grid opposite.

Use the additional column for your processed data.

(5)

(ii) Determine the gradient of the graph.

(3)

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Gradient = ...

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(iii) The gradient of the graph is given by

$$\text{gradient} = -\frac{Mg}{kT}$$

where
M = mass of one air molecule
k = Boltzmann constant
T = 288 K

Determine a value for M.

(3)

$M =$ .....

(iv) The lowest point on dry land is 414 m below sea level.

Determine the value of P for this point.

(3)

$P =$ .....

(Total for Question 3 = 16 marks)