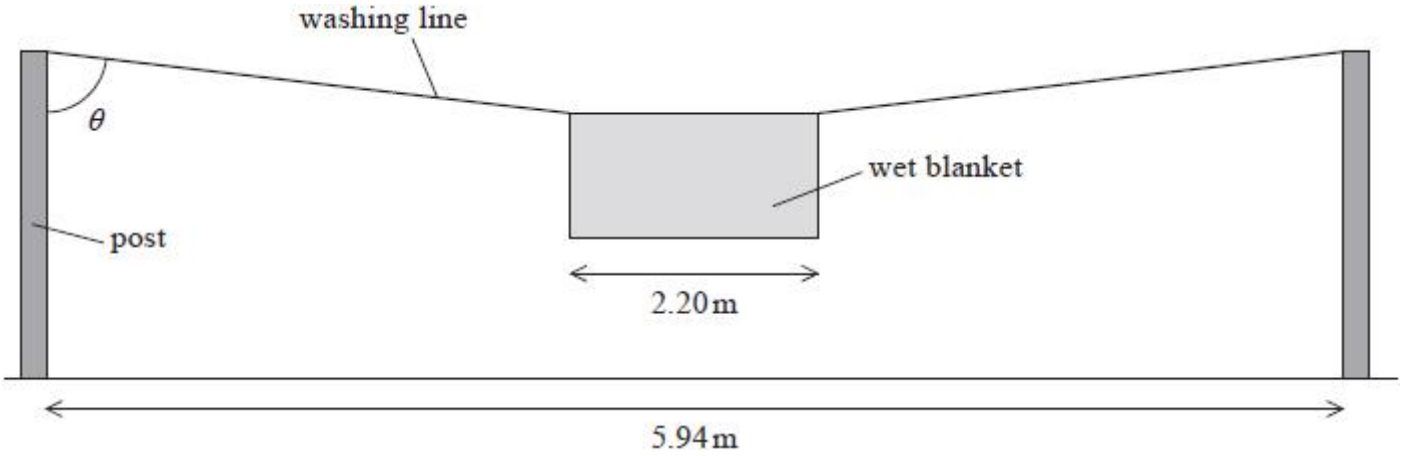
Name of the Student:_____
Max. Marks : 19 Marks **Time : 19 Minutes**

Q1.

A washing line is attached to two posts which are a distance 5.94 m apart. A wet blanket of width 2.20 m is hung from the centre of the washing line. The washing line stretches to a length of 6.06 m and hangs at an angle θ, as shown.



Explain what happens to the height of the blanket from the ground as the blanket dries. Your answer should make reference to the Young modulus of the material of the line.

(5)

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

(Total for question = 5 marks)

Q2.

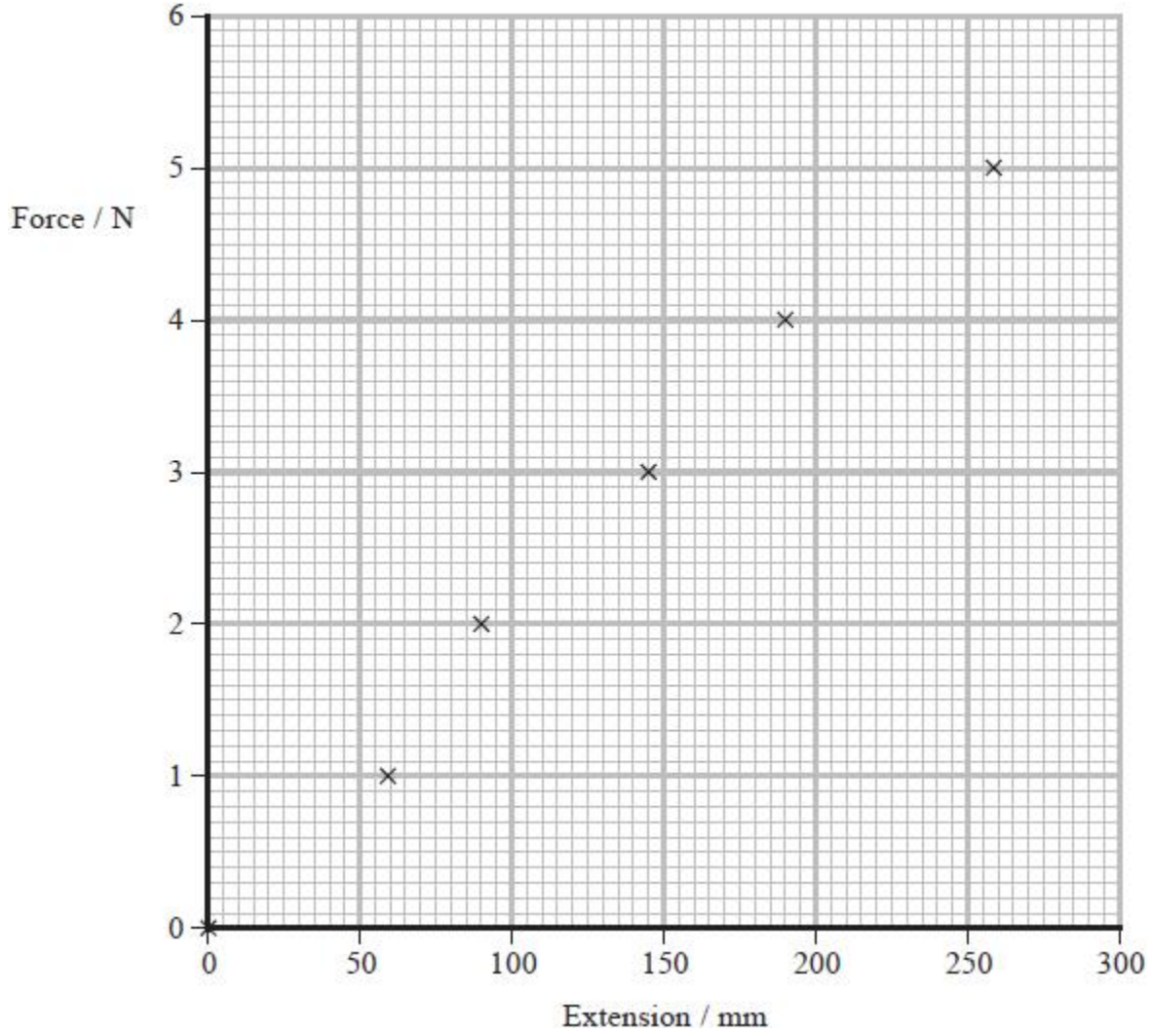
A manufacturer gives the following information about a spring.

1. Follows Hooke's law up to loads of 5 N
2. Maximum extension without permanent deformation 0.4 m
3. Stiffness 21 $N m^{-1}$ ±5%
4. Stores up to 1.6 J

A student carried out an investigation on the spring to test this information.

She applied a range of forces from 0 N to 5 N to the spring. She measured the length of the spring and recorded the extension for each force.

She plotted a graph of force against extension.



Discuss the extent to which the student's results are consistent with the information given by the manufacturer.

(6)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 6 marks)

Q3.

A student is investigating a 'Cartesian diver'.

The diver is made from a plastic pipette. When placed in a plastic bottle full of water the diver rises to the top and touches the lid.

(a) Show that the downward force of the lid on the diver is about 0.02 N.

volume of diver = 8.0×10^{-6} m^3
mass of diver = 0.0059 kg
density of water = 1.0×10^3 kg m^{-3}

(3)

.....

.....

.....

.....

.....

.....

(b) When the pressure is increased by squeezing the bottle, water is forced into the diver increasing its weight. The diver sinks, then remains at rest in the position shown.

The volume of air in the empty pipette in part (a) was 8.0×10^{-6} m^3.
Show that the volume now occupied by the air is about 6×10^{-6} m^3.

(3)

.....

.....

.....

.....

.....

.....

(c) The pressure of the air in the empty pipette in part (a) was 1.01×10^5 Pa.

Calculate the pressure of the air in part (b).

(2)

.....

.....

.....

.....

.....

Pressure = ...

(Total for question = 8 marks)