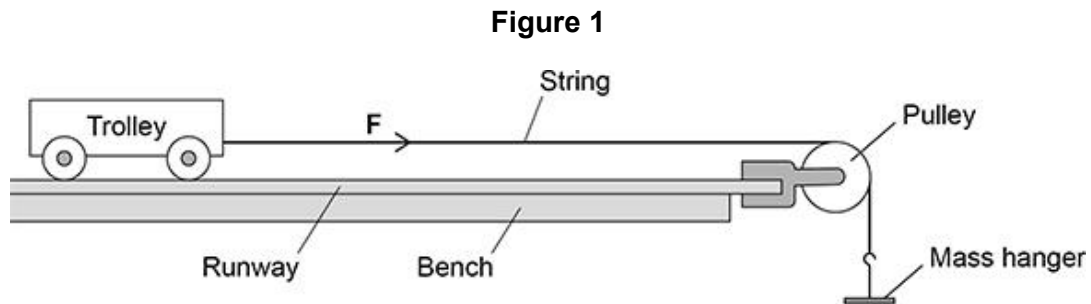**Questions are for both separate science and combined science students**

Q1.

A student investigated how the acceleration of a trolley varies with the resultant force on the trolley.

Figure 1 shows some of the equipment used.

Figure 1

(a) **Figure 1** shows the force **F** which acts through the string.

What name is given to force **F**?

_____

(1)

(b) Give **one** variable that should have been a control variable in this investigation.

_____

(1)

(c) The student held the trolley stationary and then released it.

The trolley moved along the runway with a constant acceleration.

The student recorded the time taken for the trolley to travel a measured distance along the runway.

Describe how the acceleration of the trolley can be calculated using the time taken and distance travelled by the trolley. **(HT only)**

_____

_____

_____

_____

_____

_____

(3)

For one set of results, the force acting through the string was 2.0 N.

(d)   The student released the trolley three times and determined the following values for acceleration:

1.36 m/s²   1.39 m/s²   1.33 m/s²

Calculate the uncertainty in the values of acceleration. **(HT only)**

_____

_____
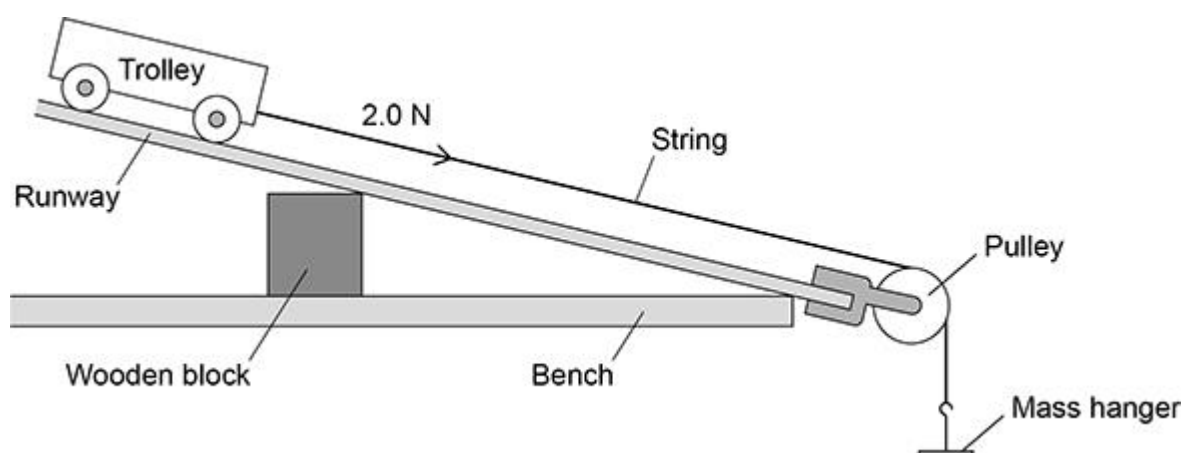
_____

Uncertainty = ± _____ m/s²

(2)

(e)   The runway was then raised at one end.

The force acting through the string remained the same.

Figure 2 shows this.

Figure 2

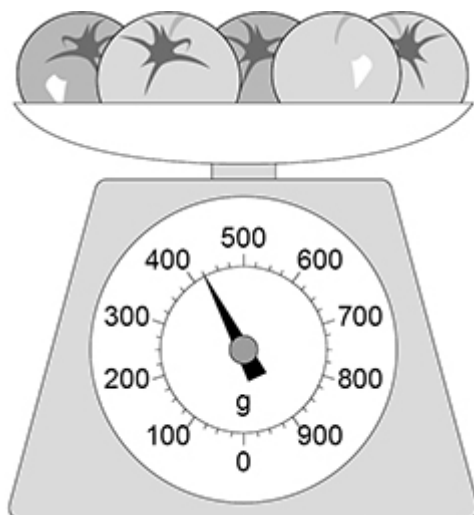Explain how the acceleration was affected by raising the end of the runway.

_____

_____

_____

_____

(2)

(Total 9 marks)

Q2.

Figure 1 shows a balance used to measure the mass of five tomatoes.

Figure 1

(a)   What is meant by 'centre of mass'?

_____

_____

(1)

(b)   Calculate the mean weight of a tomato in **Figure 1**.

Use the Physics Equations Sheet.

gravitational field strength = 9.8 N/kg
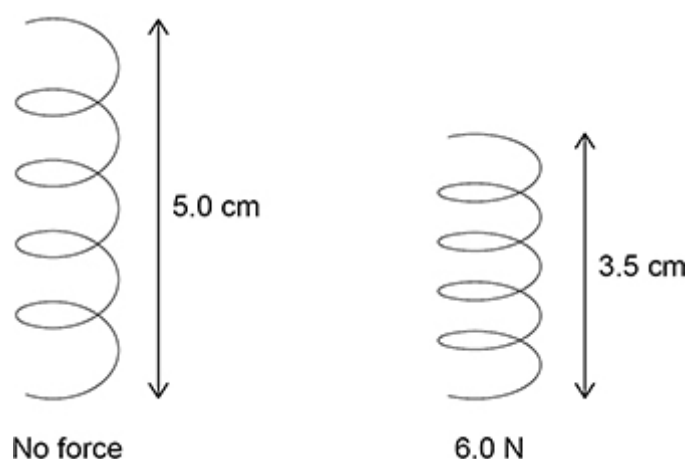
_____

_____

_____

_____

_____

Weight = _____ N

(3)

(c) The balance in **Figure 1** contains a spring that compresses when the tomatoes are placed on the balance.

Figure 2 shows the spring with no force acting and with a 6.0 N force acting.

Figure 2

Determine the spring constant of the spring.

Use the Physics Equations Sheet.

_____

_____

_____

_____

_____

_____

Spring constant = _____ N/m

(3)

(d) Explain **one** property of the spring that makes it suitable for use in the balance.

_____

_____

_____

_____

(2)

(Total 9 marks)