1 The diagram below shows an ice skater, Skater A.

(a) Write down the equation that links mass, momentum and velocity.

_____

(1)

(b) Skater **A** travels with a velocity of 3.2 m/s and has a momentum of 200 kg m/s

Calculate the mass of Skater **A**.

_____

_____

Mass = _____ kg

(3)

(c) Skater **A** bumps into another skater, Skater **B**. Skater **B** is stationary.

The skaters move off together in a straight line.

Explain what happens to the velocity of each of the skaters.

Use the idea of conservation of momentum.

_____

_____

_____

_____

_____

_____

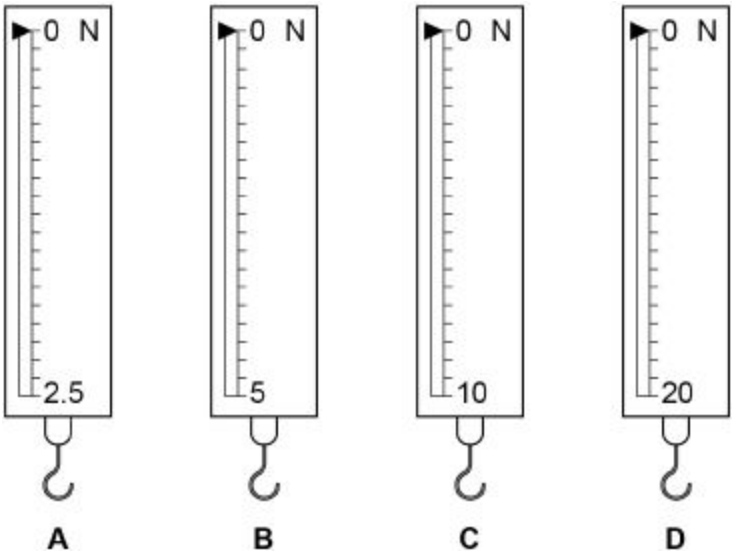
(3)

(Total 7 marks)

2 (a) **Figure 1** shows four newtonmeters.

Each newtonmeter contains a spring.

Figure 1



Which newtonmeter has the spring with the greatest spring constant?

Give a reason for your answer.

Newtonmeter _____

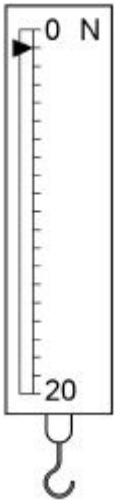
Reason _____

_____

(2)

(b) The newtonmeter in **Figure 2** will give an error when used to make a measurement.

Figure 2



Name the type of error.

Describe how this error can be corrected.

Type of error _____

Correction _____

_____

(2)

(c) A student hangs a weight on a newtonmeter.

The energy now stored in the spring in the newtonmeter is 4.5×10^{-2} J

The student then increases the weight on the newtonmeter by 2.0 N

Calculate the total extension of the spring.

Spring constant = 400 N/m

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

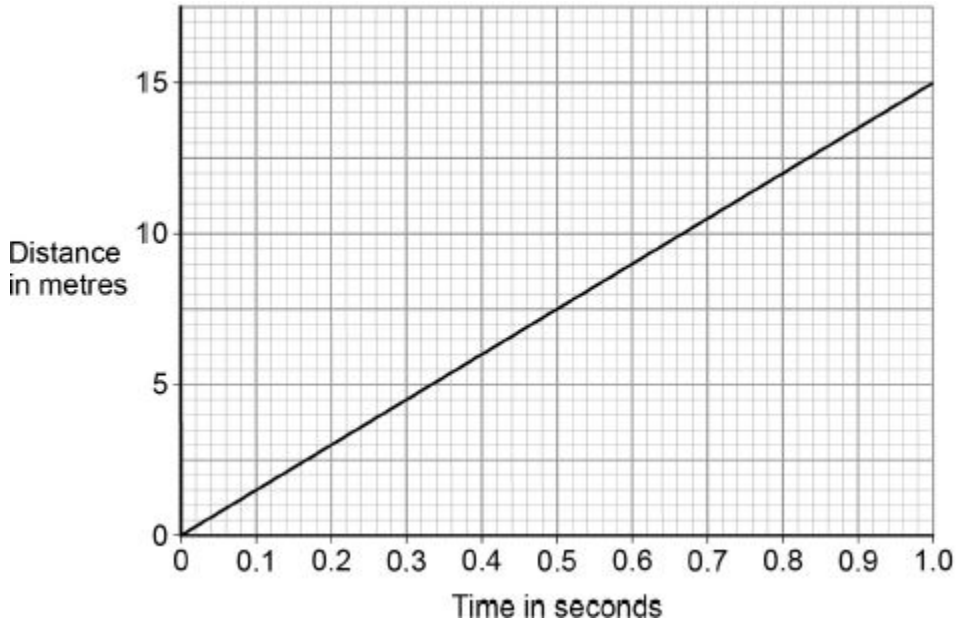
Total extension = _____ m

(6)

(Total 10 marks)

3 (a) **Figure 1** shows the distance-time graph for a car travelling at 15 m/s

Figure 1



When the driver is tired, his reaction time increases from 0.50 seconds to 0.82 seconds.

Determine the **extra** distance the car would travel before the driver starts braking.

_____

_____

_____

Distance = _____ m

(2)

(b) When the brakes are used, the temperature of the brakes increases.

Explain why. Use ideas about energy in your explanation.

_____

_____

_____

_____

(2)

(c) A lorry travels 84 m with a constant acceleration of 2.0 m/s^2 to reach a velocity of 19 m/s

Calculate the initial velocity of the lorry.

Use the Physics Equations Sheet.

_____

_____

_____

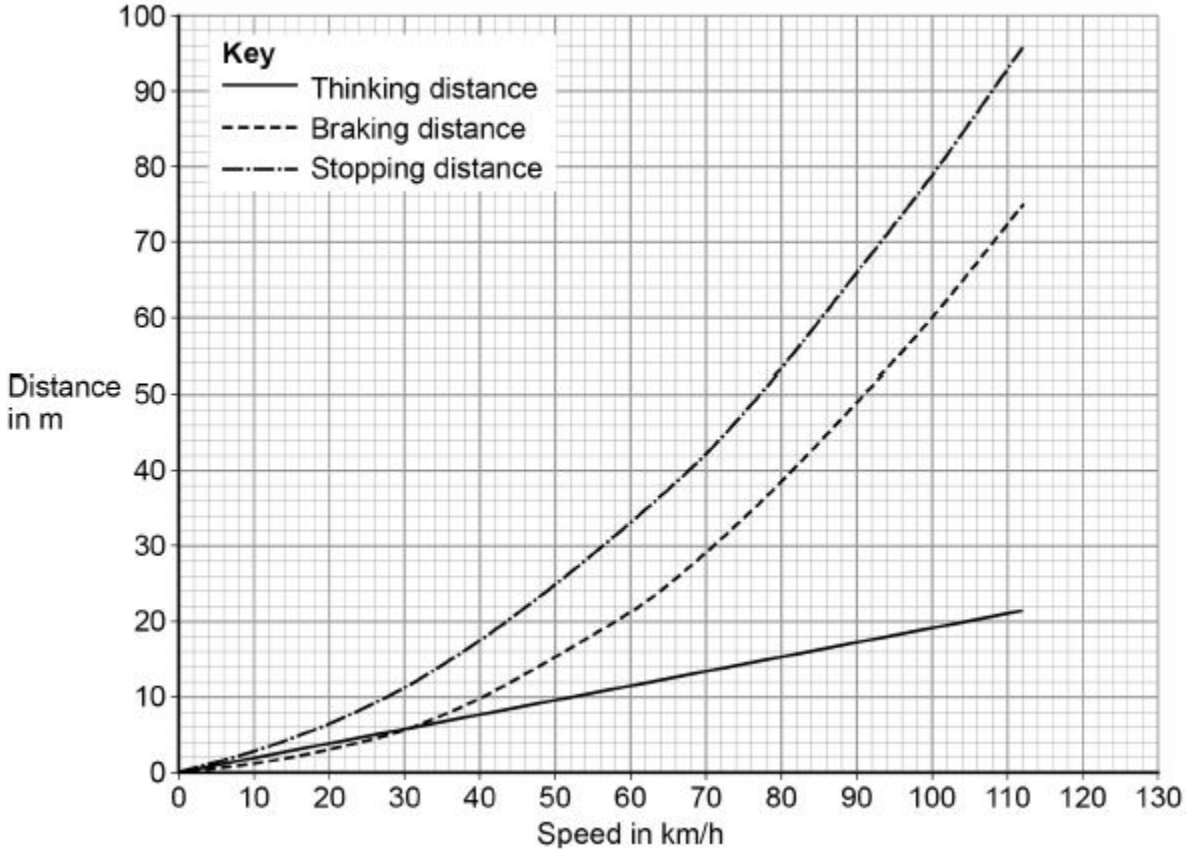
_____

Initial velocity = _____ m/s

(3)

(d) **Figure 2** shows how the thinking distance, braking distance and stopping distance for a car vary with the speed of the car.

Figure 2



Describe the relationships shown in **Figure 2**

You should include factors that would affect the gradient of the lines.

(6)

(Total 13 marks)

4 Forces are vector quantities.

(a) What is the difference between a vector quantity and a scalar quantity?

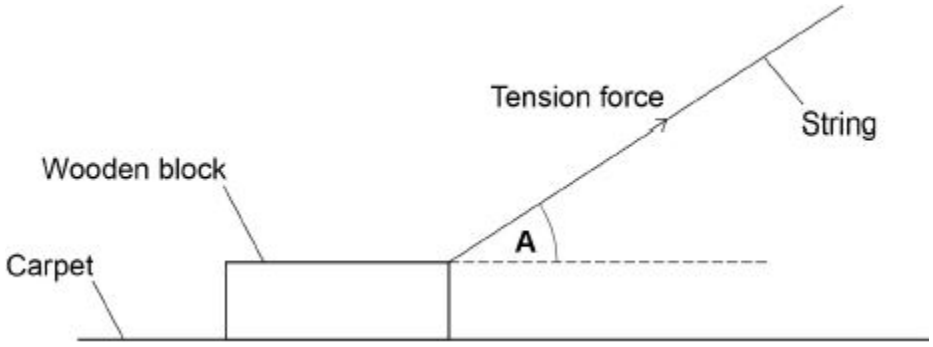
(2)

Figure 1 represents a wooden block being pulled across a surface at a constant speed in a straight line.

The block is in contact with the surface.

The arrow in **Figure 1** represents the tension force in the string pulling the block.

Figure 1

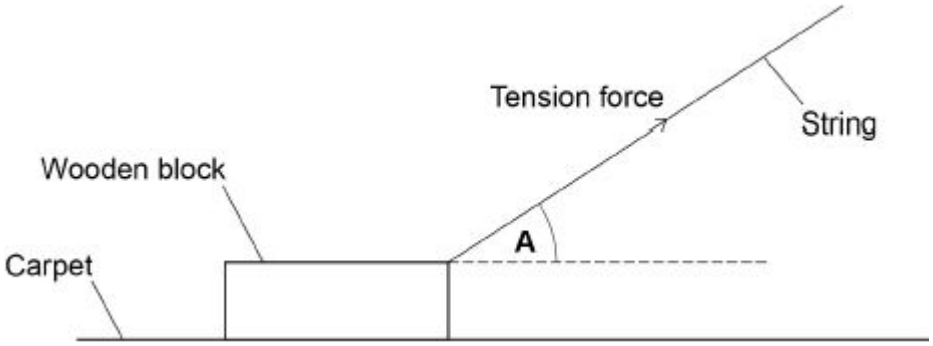


(b) Complete **Figure 1** to show the other three forces acting on the block.

(3)

Figure 2 is a copy of **Figure 1** to help you answer the following question.

Figure 2



(c) **Figure 2** is drawn to scale. The scale is 1 cm : 0.5 N

Determine the horizontal and vertical components of the tension in the string.

Show these components on **Figure 2**.

Horizontal component = _____ N

Vertical component = _____ N

(3)

A student collects data on the size of the force required to pull the block across different surfaces at a constant speed.

The table below shows the results.

Type of surface	**Force in N**			**Mean force in N**
	Trial 1	**Trial 2**	**Trial 3**	
Cardboard	1.4	1.6	1.5	1.5
Carpet	2.6	3.1	3.9	3.2
Glass	0.7	0.8	0.6	0.7
Sandpaper	5.2	**X**	5.3	5.4

(d) Calculate value **X** in the table above.

X = _____ N

(2)

(e) Give **three** control variables for this investigation.

1. _____

_____

2. _____

_____

3. _____

_____

(3)

(Total 13 marks)