

Name of the Student: _____

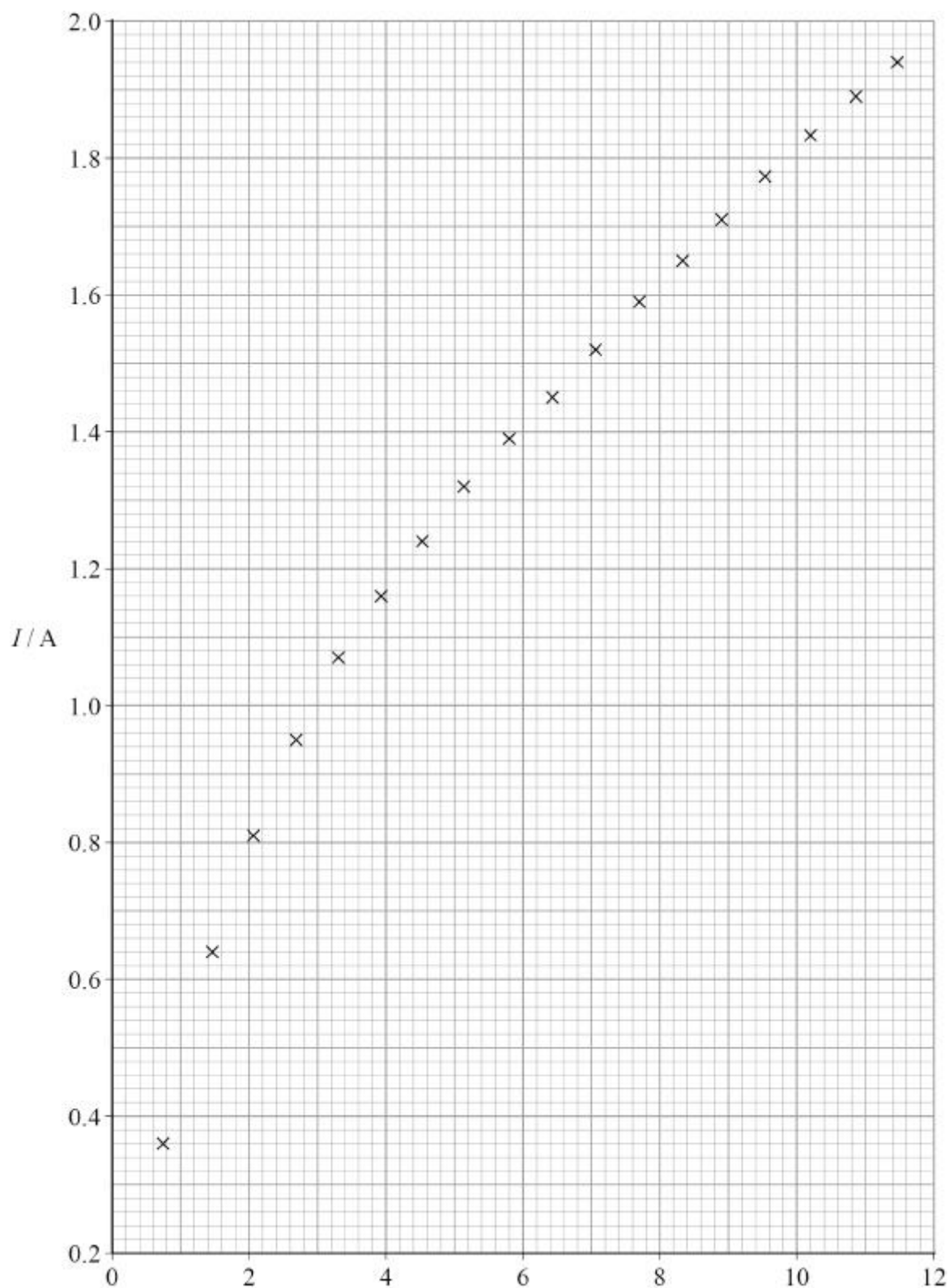
Max. Marks : 25 Marks

Time : 25 Minutes

Q1.

Figure 1 is a plot of current–voltage data for a filament lamp **L**.

Figure 1



The current I was measured as the voltage V across L was increased at a steady rate. These data were obtained using a current sensor and a voltage sensor connected to a data logger. The logger recorded data at a rate of 2.5 Hz.

- (a) Determine, in $V\ s^{-1}$, the rate of increase of V .

(2)

1 _____

2 _____

(2)

Figure 2



In circuit **1**:

- In circuit **2**, **X** is used as a potential divider.

Support your answer with a calculation.

(4)

The table below shows some values of V that are plotted on **Figure 1** and corresponding results for I and for the power P dissipated in **L**.

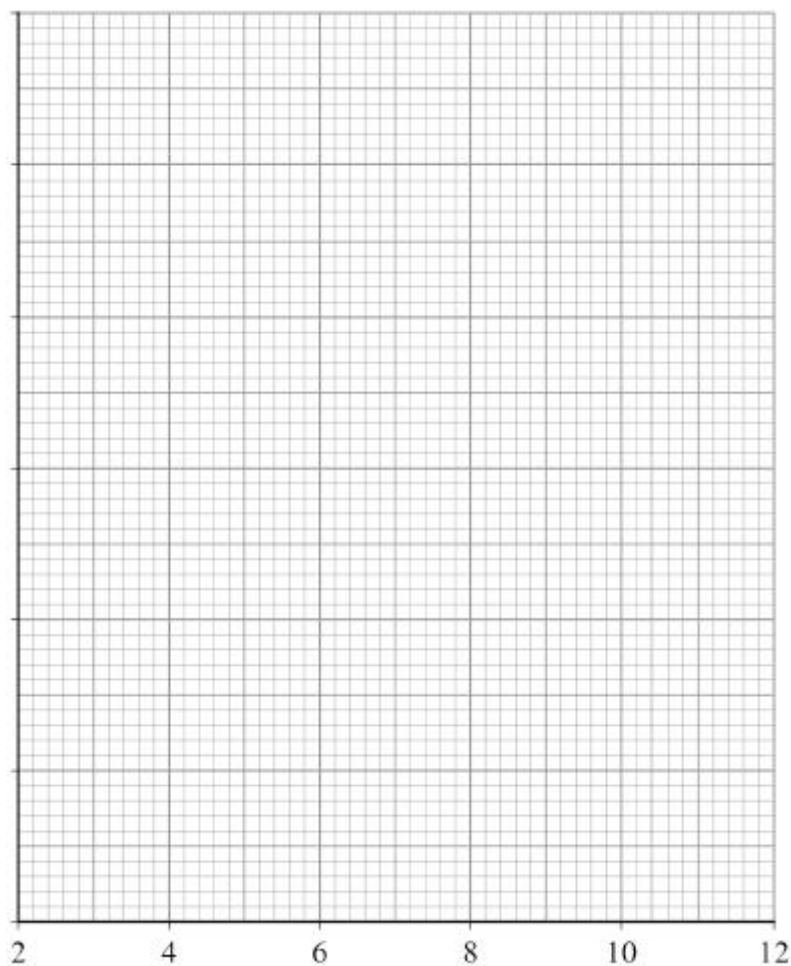
V / V	I / A	P / W
3.30	1.07	3.53
5.17	1.32	
7.69	1.59	12.2
9.58		
11.47	1.94	22.3

(d) Complete the table below above.

(3)

(e) Plot on **Figure 3** a graph of P against V .
You should use only the data in your completed table.

Figure 3



(3)

- (f) **L** is connected to a 12 V power supply of negligible internal resistance.
L then dissipates its rated power P_r .

A second lamp, identical to **L**, is now connected in series with **L**.

Determine the percentage of P_r that is dissipated in this circuit.

percentage = _____ %

(2)

(Total 16 marks)

Q2.

Figure 1 shows a conveyor used to raise concrete blocks on a building site. The blocks do not slip on the belt at any time.

Figure 1

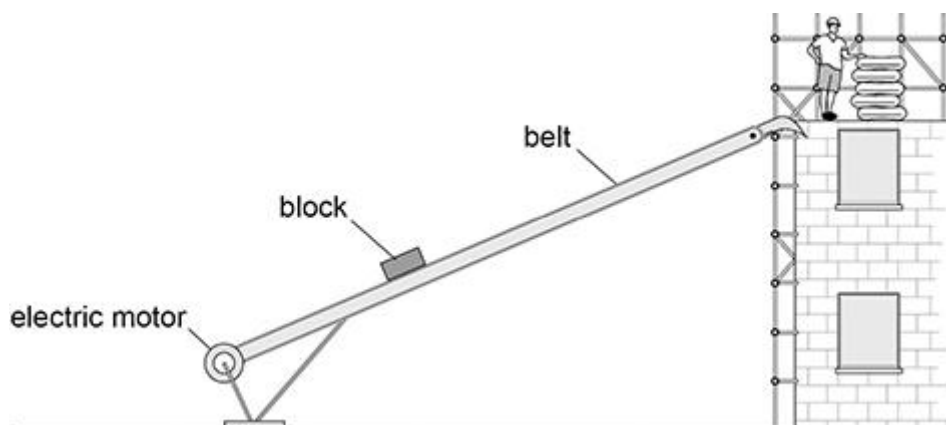
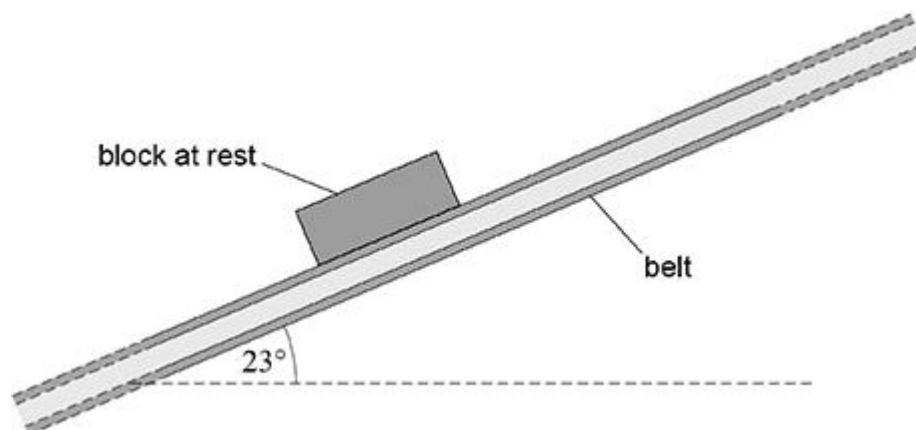


Figure 2 shows an enlarged view of one block on the belt. The belt is inclined at 23° to the horizontal. The mass of the block is 19 kg.

Figure 2



The belt exerts a frictional force F on the block when the block is at rest.

(a) Draw an arrow on **Figure 2** to show the line of action of F .

(1)

(b) Show that the magnitude of F is approximately 70 N.

(1)

(c) The belt is driven by an electric motor. When the motor is switched on, the belt and the block accelerate uniformly from rest to a speed of 0.32 m s^{-1} in a time of 0.50 s.

Calculate the magnitude of the frictional force of the belt on the block during this acceleration.

frictional force = _____ N

(3)

- (d) The motor is connected to a 110 V dc supply that has negligible internal resistance. The maximum operating current in the motor is 5.0 A.

The efficiency of the motor and drive system of the conveyor is 28%. The belt travels at 0.32 m s^{-1} and is 8.0 m long.

Deduce the maximum number of blocks that can be moved on the belt at one time.

maximum number of blocks = _____

(4)

(Total 9 marks)