5.5 Newton's Laws of Motion

Question Paper

Course	AQA GCSE Physics
Section	5. Forces
Topic	5.5 Newton's Laws of Motion
Difficulty	Medium

Time allowed: 50

Score: /37

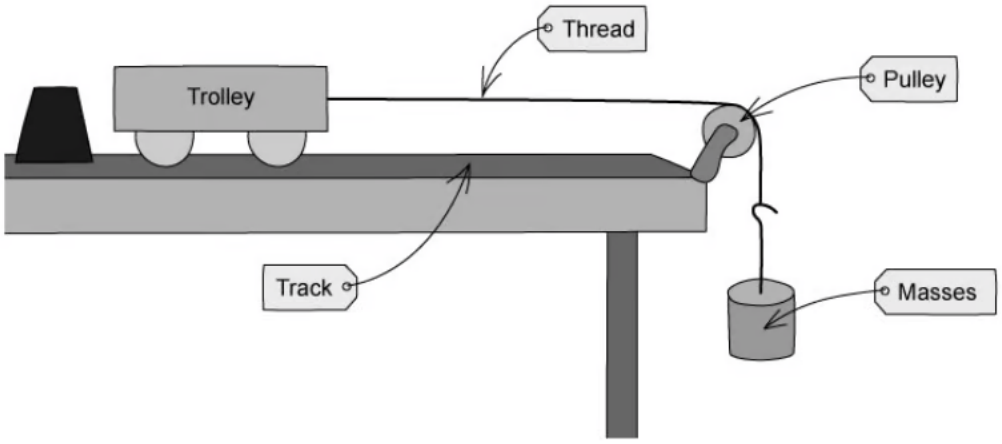
Percentage: /100

Question 1a

A student carries out an experiment to determine the relationship between the force applied to an object and the object's acceleration.

She sets up her apparatus as shown in **Figure 1.**

Figure 1



She places a number of masses on top of the trolley and then removes them, one at a time, placing them on the mass hanger in order to increase the force.

(a)
Explain why she keeps the unused masses on top of the trolley.

[2 marks]

[2 marks]

Question 1b

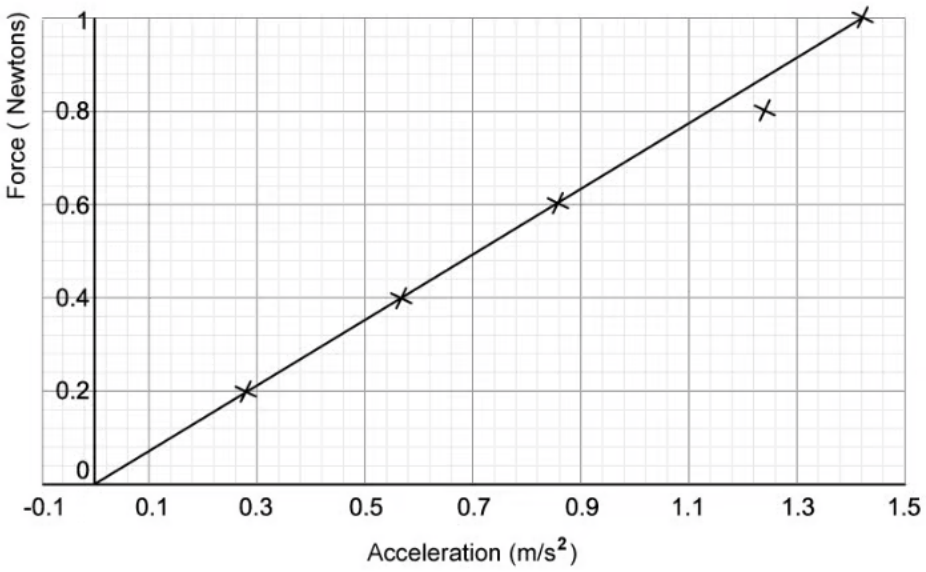
Table 1 below contains some of her results.

Table 1

Force	Acceleration (m/s^2)
0.2	0.29
0.4	0.57
0.6	0.86
0.8	1.24
1.0	1.43

Figure 2 shows the graph of the results the student has drawn.

Figure 2



The results contain an anomalous result.

(b)
Circle this anomalous result on the graph and explain why you have circled this point.

[2 marks]

[2 marks]

Question 1c

(c)
Use the graph to calculate the mass of the trolley. Clearly show your method.

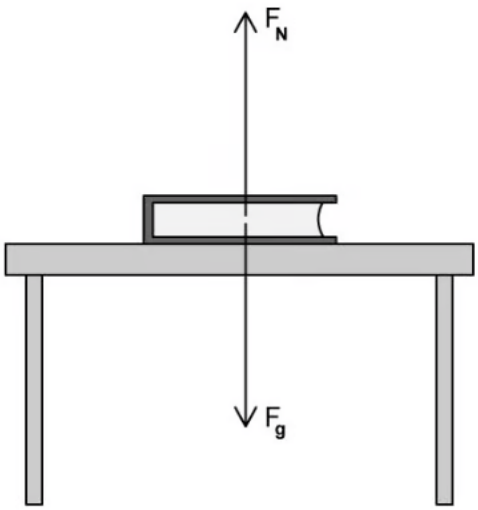
[3 marks]

[3 marks]

Question 2a

A student draws Newton's third law pair of force on a book, as shown in **Figure 1**.

Figure 1



F_g is the gravitational force and F_N is the normal reaction force.

(a)
State whether the student has drawn a Newton's third law pair of forces correctly.
Explain your answer.

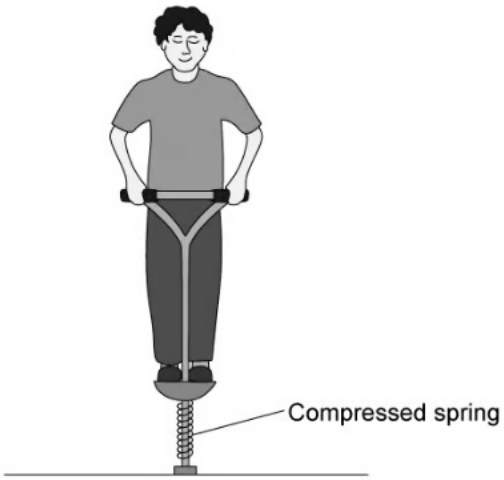
[2 marks]

[2 marks]

Question 2b

A child balances on a pogo stick as shown in **Figure 2.** The child and the pogo stick are stationary.

Figure 2



(b)
Draw a Newton's Third law force pair on **Figure 2**

[2 marks]

Question 2c

(c)
Using Newton's Third law, explain how the forces on a person's foot enables them to walk on the ground.

[3 marks]

[3 marks]

Question 3a

(a)
Using Newton's First law, explain why a comet moves in a straight line at constant speed whilst travelling in space.

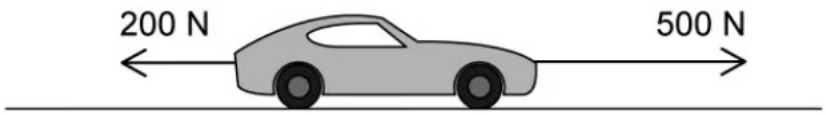
[2 marks]

[2 marks]

Question 3b

Figure 1 shows the forces on a car that is travelling to the right.

Figure 1



(b)
Calculate the resultant force on the car. State an appropriate unit for your answer.

[3 marks]

[3 marks]

Question 3c

The car initially accelerates at 0.25 m/s^2.

(c)
Calculate the mass of the car.

[3 marks]

[3 marks]

Question 3d

The car eventually reaches a top speed which it cannot go any faster.

(d)
State the acceleration of the car at this point. Explain your answer.

[2 marks]

[2 marks]

Question 4a

Higher Only

All objects have inertia.

(a)
Which of Newton's Laws of motion is also called 'the law of inertia'. Explain your reasoning.

[3 marks]

[3 marks]

Question 4b

Higher Only

A trolley accelerates at 3.8 m/s^2 when a force of 5.0 N is applied to it.

(b)
Calculate the inertial mass of the trolley.

[3 marks]

[3 marks]

Question 5a

A group of students apply a constant force of 0.5 N to a trolley with a mass of 200 g. They then measure the trolley's acceleration.

They want to investigate how changing the mass of the trolley affects the acceleration of the trolley.

(a)
Name a control variable in this experiment.

[1 mark]

[1 mark]

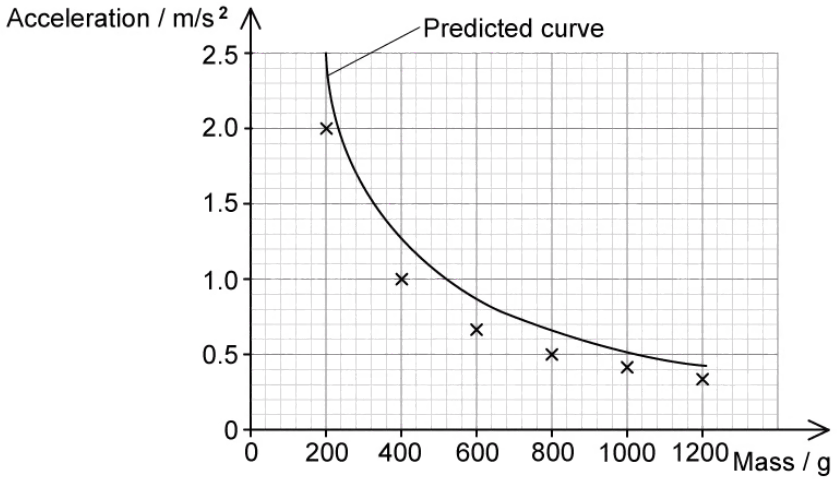
Question 5b

The students increase the mass added to the trolley by 200 g each time and record the acceleration using light gates.

They draw a predicted curve on **Figure 2** using Newton's second law and neglecting the mass of the trolley.

Their actual data were recorded with crosses on the graph in **Figure 2**.

Figure 2



(b)

Use data from **Figure 2** to show that mass and the **actual values** of acceleration are inversely proportional.

[3 marks]

[3 marks]

Question 5c

(c)

Suggest why the actual values of acceleration are lower than those predicted.

[1 mark]

[1 mark]

Question 5d

The difference between the curves could be due to an external force acting.

(d)
Calculate the magnitude of this external force on the trolley.

[2 marks]

External force = ... N

[2 marks]