Force, mass and acceleration

Physics required practical | AQA Combined Science 8464 and AQA GCSE Physics 8463 | 13 questions, 35 marks

GCSE science required practicals

This practical online

Name: _____ **Date:** _____ **Score:** _____ / 35

Aim: To find out how the acceleration of a trolley depends on the force pulling it and on its mass.

Equipment: Trolley; Smooth runway or bench at least 1.5 m long; Pulley clamped to the end of the bench; String; Mass hanger and ten 10 g slotted masses; Two light gates connected to a data logger; Card of known length fixed on top of the trolley; Metre ruler; Balance; Box of crumpled paper or a cushion to catch the masses.

Results

Kofi and Megan pulled a trolley along a runway with masses on a hanger. The total mass being accelerated was 1.00 kg every time. Two light gates measured the speed of the trolley at each gate and the time to travel between them. They took g as 9.8 N/kg.

Hanging mass in g	Force in N	Speed at gate A in m/s	Speed at gate B in m/s	Time between gates in s	Acceleration in m/s^2
20	0.20	0.25	0.47	1.40	0.16
40	0.39	0.38	0.70	0.92	0.35
60	0.59	0.47	0.88	0.75	0.55
80	0.78	0.55	1.02	0.63	0.75
100	0.98	0.61	1.15	0.57	0.95

Questions

1 Look at Kofi and Megan's investigation.

a. Name the independent variable.

b. Name the dependent variable.

c. Give one control variable.

(3 marks)

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2 The masses not on the hanger were taped to the trolley. Each time, one mass was moved from the trolley to the hanger. Explain why.

(2 marks)

3 A card is fixed to the top of the trolley. Describe how a light gate and data logger can use the card to find the speed of the trolley.

(2 marks)

4 Give one hazard in this investigation and say how the risk could be reduced.

(2 marks)

5 Describe the relationship between force and acceleration shown in the table.

(2 marks)

6 Calculate the weight of an 80 g hanging mass. Gravitational field strength = 9.8 N/kg. Give your answer to 2 significant figures.

(2 marks)

7 Use the data for the 80 g hanging mass to calculate the acceleration of the trolley. Give your answer to 2 significant figures. Show your working.

(3 marks)

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8 **Higher tier**

Megan ignored friction and used the 100 g row to work out the mass being accelerated.

a. Calculate the mass she would get. Give your answer to 3 significant figures.

b. The real total mass was 1.00 kg. Suggest why her answer is bigger.

Show your working.

(3 marks)

9 **Higher tier**

For the 100 g run the trolley went from 0.61 m/s at gate A to 1.15 m/s at gate B with an acceleration of 0.95 m/s^2. Calculate the distance between the two light gates. Give your answer to 2 significant figures.

$(\text{final velocity})^2 - (\text{initial velocity})^2 = 2 \times \text{acceleration} \times \text{distance}$

Show your working.

(3 marks)

10 **Higher tier**

Kofi says, "When we doubled the force from 0.39 N to 0.78 N, the acceleration more than doubled, so acceleration is not proportional to force." Explain why Kofi's conclusion is wrong, and suggest a change to the set-up that would fix the problem.

(3 marks)

11 Megan's teacher asks why they used light gates rather than timing with a stopwatch. Give two reasons.

(2 marks)

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12 Kofi and Megan repeated each run three times. Their three accelerations for the 60 g mass were 0.55, 0.54 and 0.56 m/s^2. Are these results precise? Explain your answer.

(2 marks)

13 Plan an investigation to find out how the mass of a trolley affects its acceleration when the pulling force stays the same.

(6 marks)

End of questions | Total 35 marks | The answers sheet has the full method as revision notes.

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