Queensland Curriculum and Assessment Authority

Physics 2025 v1.2

IA1: Sample assessment instrument

This sample has been compiled by the QCAA to assist and support teachers in planning and developing assessment instruments for individual school settings.

Student name	sample only
Student number	sample only
Teacher	sample only
Exam date	sample only

Marking summary

Criterion	Marks allocated	Provisional marks
Data test (10%)	10	
Overall	**10**	

Conditions

Technique   Data test

Unit   Unit 3: Gravity and electromagnetism

Topic/s   Topic 1: Gravity and motion

Topic 2: Electromagnetism

Time   60 minutes + 5 minutes perusal

Seen / Unseen   Unseen questions and data sets

Other   QCAA-approved graphics or scientific calculator permitted.

Instructions

Use the datasets to respond to the associated questions in the spaces provided. Each question is associated with the dataset that immediately precedes it.

Dataset 1

A student set up the apparatus shown in Figure 1 to conduct an experiment to address the following research question:

What is the relationship between the force exerted by a bar magnet on another identical bar magnet when separated by distances (r) between $0.005 \, \text{m} \leq r \leq 0.050 \, \text{m}?$

The raw data from this experiment is presented in Table 1.
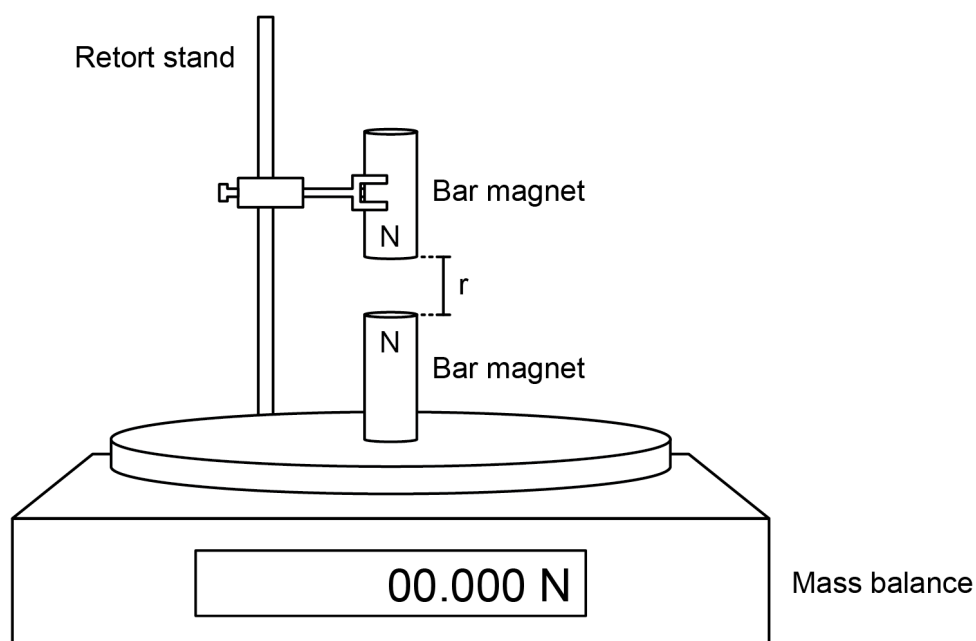
Figure 1: Apparatus for magnetic force experiment

Table 1: Results from magnetic force experiment

Distance r (m) ±0.005 m	Force F (N) ±0.001 N			Average force F (N)
	Trial 1	Trial 2	Trial 3	
0.010	1.000	1.000	1.020	1.007
0.020	0.255	0.245	0.250	0.250
0.025	0.156	0.156	0.156	0.156
0.030	0.103	0.103	0.107	0.104
0.040	0.060	0.060	0.062	
0.050	0.042	0.038	0.040	0.040

Question 1 (1 mark)

Calculate the average force for the distance $r = 0.040$ m.

Question 2 (2 marks)

Determine the percentage uncertainty of the mean for the force between the magnets when separated by a distance $r = 0.050$ m. Show your working.

Question 3 (2 marks)

Identify the relationship between the distance between two magnets and the force exerted by one magnet on the other. Show your reasoning.

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Question 4 (2 marks)

**Predict** the magnitude of the force between the two magnets when they are 0.080 m apart. Show your working.

Dataset 2

An experiment was conducted to address the following research question:

What is the relationship between the projected angle (10° ≤ θ ≤ 80°) of a golf ball and its horizontal displacement (range) when launched from ground level with a constant initial velocity of 15.0 m/s?

The experimental data was collected and processed, and is presented in Graph 1.

Graph 1: Horizontal displacement of golf ball projected at various angles

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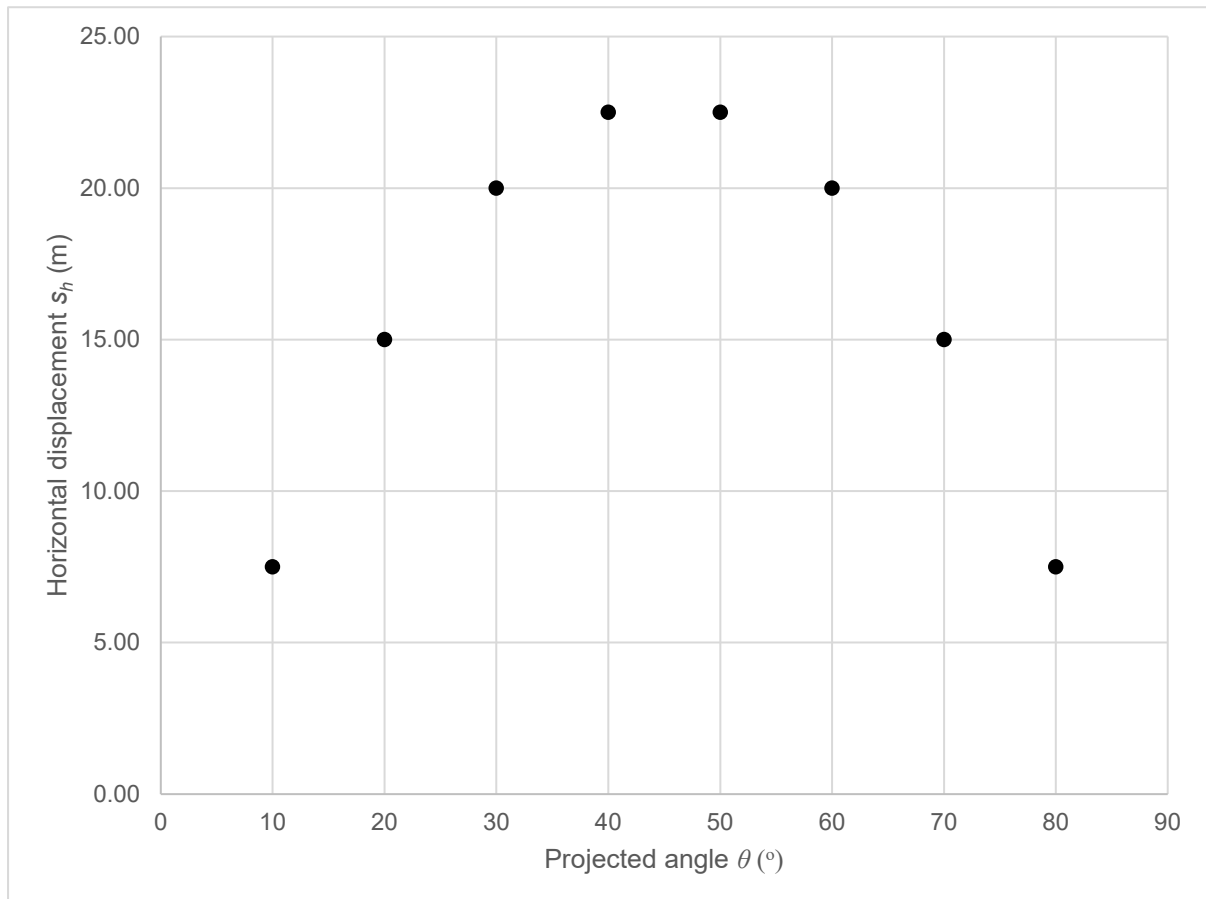
Question 5 (1 mark)

Identify the projected angle/s that produced a horizontal displacement of 20 m.

Question 6 (2 marks)

Calculate the initial horizontal component of the velocity of the golf ball when it was projected at an angle of 20°.

Question 7 (1 mark)

Identify the trend between the projected angle and the horizontal displacement of the golf ball.

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Question 8 (2 marks)

Infer which projected angle would result in the largest horizontal displacement. Give a reason for your response.

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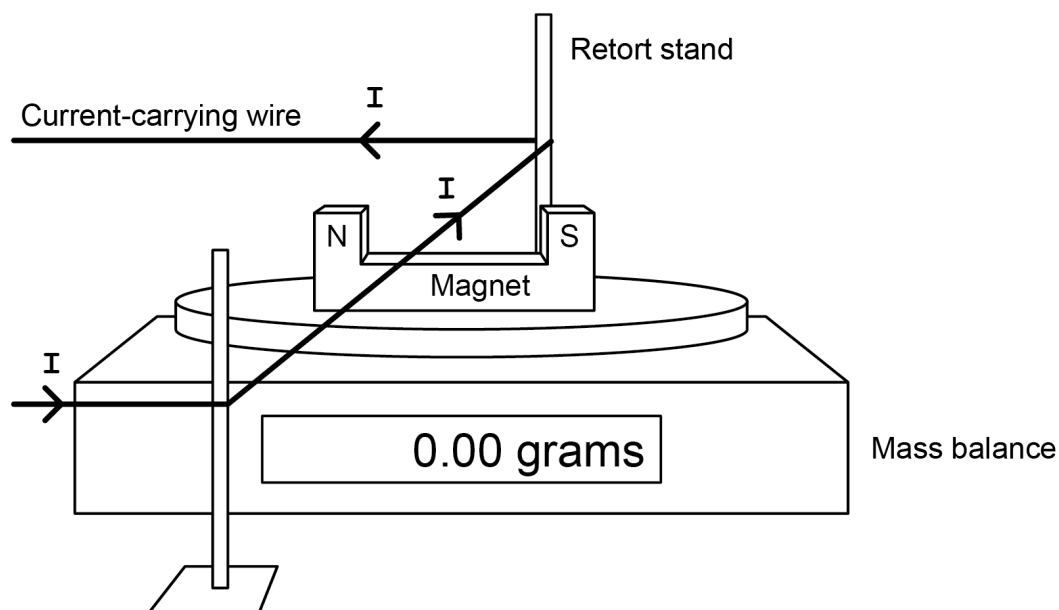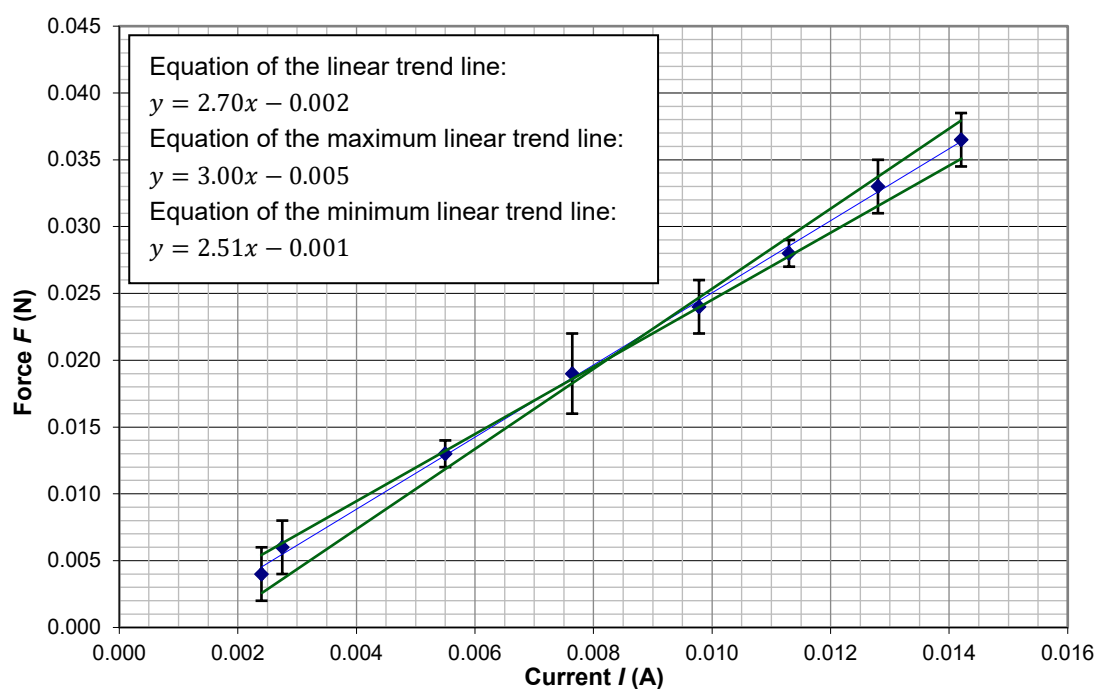# Dataset 3

A student set up the apparatus shown in Figure 2 to conduct an experiment to investigate the force acting on a conductor in a magnetic field. The student varied the current through the conductor and measured the tared mass reading on the mass balance. The data was processed and plotted in Graph 2.

The effective length of the wire in the magnetic field was 2 cm. The wire was orientated at 90° to the magnetic field.

Figure 2: Apparatus to measure the force on a current-carrying conductor in a magnetic field

Graph 2: Force on a current-carrying conductor in a magnetic field

Equation of the linear trend line:
$y = 2.70x - 0.002$
Equation of the maximum linear trend line:
$y = 3.00x - 0.005$
Equation of the minimum linear trend line:
$y = 2.51x - 0.001$

Question 9 (3 marks)

Identify a mathematical relationship between the force acting on the conductor and the current passing through the conductor, including the uncertainties of the gradient and *y*-intercept.

Question 10 (4 marks)

Draw a conclusion that quantifies the magnitude of the magnetic field through which the wire is passing, including the absolute or percentage uncertainty in the value you determine. Show your reasoning.

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Instrument-specific marking guide (IA1): Data test (10%)

Data test	Cut-off	Marks
The student response has the following characteristics:		

• consistent demonstration, across a range of scenarios, of
  – selection and correct application of scientific concepts, theories, models and systems to predict outcomes, behaviours and implications
  – correct calculation of quantities through the use of algebraic, visual and graphical representations of scientific relationships and data
  – correct and appropriate use of analytical techniques to correctly identify trends, patterns, relationships, limitations and uncertainty
  – correct interpretation of evidence to draw valid conclusions
	>90%	10

	>80%	9

• consistent demonstration of
  – selection and correct application of scientific concepts, theories, models and systems to predict outcomes, behaviours and implications
  – correct calculation of quantities through the use of algebraic, visual and graphical representations of scientific relationships and data
  – correct use of analytical techniques to correctly identify trends, patterns, relationships, limitations and uncertainty
  – correct interpretation of evidence to draw valid conclusions
	>70%	8

	>60%	7

• adequate demonstration of
  – selection and correct application of scientific concepts, theories, models and systems to predict outcomes, behaviours and implications
  – correct calculation of quantities through the use of algebraic, visual and graphical representations of scientific relationships and data
  – correct use of analytical techniques to correctly identify trends, patterns, relationships, limitations and uncertainty
  – correct interpretation of evidence to draw valid conclusions
	>50%	6

	>40%	5

• demonstration of elements of
  – selection and correct application of scientific concepts, theories, models and systems to predict outcomes, behaviours and implications
  – correct calculation of quantities through the use of algebraic, visual or graphical representations of scientific relationships or data
  – correct use of analytical techniques to correctly identify trends, patterns, relationships, limitations or uncertainty
  – correct interpretation of evidence to draw valid conclusions
	>30%	4

	>20%	3
• demonstration of elements of – application of scientific concepts, theories, models or systems to predict outcomes, behaviours or implications	>10%	2
	>1%	1

Data test	Cut-off	Marks
– calculation of quantities through the use of algebraic or graphical representations of scientific relationships and data – use of analytical techniques to identify trends, patterns, relationships, limitations or uncertainty – interpretation of evidence to draw conclusions.		
The student response does not match any of the descriptors above.		0