HOLY CROSS COLLEGE
Life to the Full

11 PHYSICS ATAR
TEST 1: MEASUREMENT
(Open Book)

NAME: SOLUTIONS MARK: ___/26

1. How many significant figures are involved in the following? (4 marks)

(a) 27300 tonnes 3 (b) 0.000361 mm 3

(c) 1.250×10^{15} km 4 (d) 15 days 2 [1 mark each]

2. Convert the following to ***standard units*** and express your answers in ***scientific notation***. (4 marks)

(a) $4.63 \times 10^{4}\ mm^2$ $4.63 \times 10^{-2}\ m^2$

(b) 35.43 days $3.061 \times 10^{6}\ s$

(c) 0.00725 tonnes $7.25\ kg$

(d) 563 ns $5.63 \times 10^{-7}\ s$ [1 mark each]

3. For the following measurements, determine the absolute and percentage uncertainty associated with each. (4 marks)

(a) 4.5 kg Absolute: $\pm 0.05\ kg$ (1)

Percentage: $\pm 1.1\%$ (1)

(b) 15.015 m Absolute: $\pm 0.0005\ m$ (1)

Percentage: $\pm 3.3 \times 10^{-3}\%$ (1)

4. Perform the following calculations, expressing the answer to the correct number of significant figures. (4 marks)

(a) $7.435 + 14.32 - 3.9$

17.9

[Answer = 1 mark
Sig fig = 1 mark]

(b) $\dfrac{(7.43 \times 10^{-4})(48.3 \times 10^{2})}{(8.37)(1.3 \times 10^{-3})}$

3.3×10^{2}

5. The dimensions of a rectangular sheet of aluminium as measured by a student are as follows.

length: 12.3 ± 0.1 cm width: 8.3 ± 0.1 cm

Calculate the area of the sheet, expressing your answer in ***standard units*** with the associated ***absolute uncertainty*** and the correct number of ***significant figures***. (4 marks)

$l = 12.3 \pm 0.1\ \text{cm}\ (\pm 0.81\%)$

$= 0.123\ \text{m} \pm 0.81\%$ (1)

$w = 8.3 \pm 0.1\ (\pm 1.21\%)$

$= 8.3 \times 10^{-2}\ \text{m} \pm 1.21\%$ (1)

$A = l \times w$

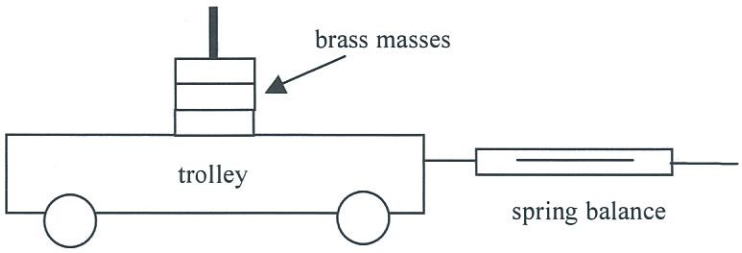
$= (0.123)(8.3 \times 10^{-2})$

$= 1.0 \times 10^{-2}\ \text{m}^2 \pm 2.02\%$ (1)

$= 1.0 \times 10^{-2} \pm 2.0 \times 10^{-4}\ \text{m}^2$ (1)

[Incorrect sig. fig. - 1 mark off]

6. A group of students investigated how the mass of a trolley affected the force required to just start it moving. The force was measured by a spring balance, and 50 g brass masses were added on top of the trolley.



The results obtained by the students are shown in the table below.

Mass added (g)	Force (N)
0	2.8
50	3.6
150	5.1
200	5.8
400	8.9

(a) Graph the data on the grid provided and draw a line of best fit. (4 marks)

(b) Determine the gradient of the line of best fit. Indicate clearly which points you are using to calculate the gradient. Remember to include the appropriate units and number of significant figures. (3 marks)

$$\text{gradient} = \frac{(8.9 - 2.8)}{(400 - 0)}$$

$$= 1.5 \times 10^{-2}\ \text{Ng}^{-1}$$

[Calculation - 1 mark
Sig. fig - 1 mark
Units - 1 mark]

Labels + units - 1 mark
Scales - 1 mark
Plotting - 1 mark
Line of best fit - 1 mark