STAGE 2 PHYSICS
TEST 1: MEASUREMENT
(Open Book)

NAME: SOLUTIONS MARK: ___/26

1. How many significant figures are involved in the following?

(a) 2130 kg 3 (b) 0.00410 mm 3

(c) 120,000,000 km 2 (d) 5.0 days 2

(1 mark each) (4)

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

(a) 5.53×10^{-3} μm

5.53×10^{-9} m

(b) 3.32×10^{2} mm^2

3.32×10^{-4} m^2

(c) 0.0000235 MJ

2.35×10^{1} J

(d) 4.35×10^{2} tonnes

4.35×10^{5} kg

(1 mark each)

(4)

3. For the following measurements, determine the ***absolute and percentage uncertainty*** associated with each.

(a) 12.3 g Absolute: $\pm$ 0.05 g

Percentage: $\pm$ 0.406 %

(b) 3.004 m Absolute: $\pm$ 5×10^{-4} m

Percentage: $\pm$ 1.66×10^{-2} %

(1 mark each) (Give credit for working.)

(4)

4. Perform the following calcualtions, expressing the answer to the correct number of significant figures.

(a) $31.4 + 0.049 - 8.91$

22.5

(b) $\dfrac{(3.23 \times 10^{-2})(4.1 \times 10^{5})}{(9.689 \times 10^{-3})}$

1.4×10^{6}

(1½ marks each)

½ mark off each error.

(3)

5. A student performing an experiment measured the dimensions of a rectangular piece of plastic as follows.

length: 23.1 ± 0.05 mm ($\pm 0.216\%$) width: 14.5 ± 0.05mm ($\pm 0.345\%$) thickness: 1.05 ± 0.005 mm ($\pm 0.476\%$) (1½)

Calculate the volume of the plastic, expressing your answer in standard units with the associated absolute uncertainty.

$V = l \times w \times t$

$= (23.1 \times 10^{-3})(14.5 \times 10^{-3})(1.05 \times 10^{-3})$ (1)

$= 3.52 \times 10^{-7}\ m^3 \pm 1.037\%$ (½)

$= 3.52 \times 10^{-7} \pm 3.65 \times 10^{-9}\ m^3$ (1)

(4)

6. The force on a current-carrying wire is given by the relationship:

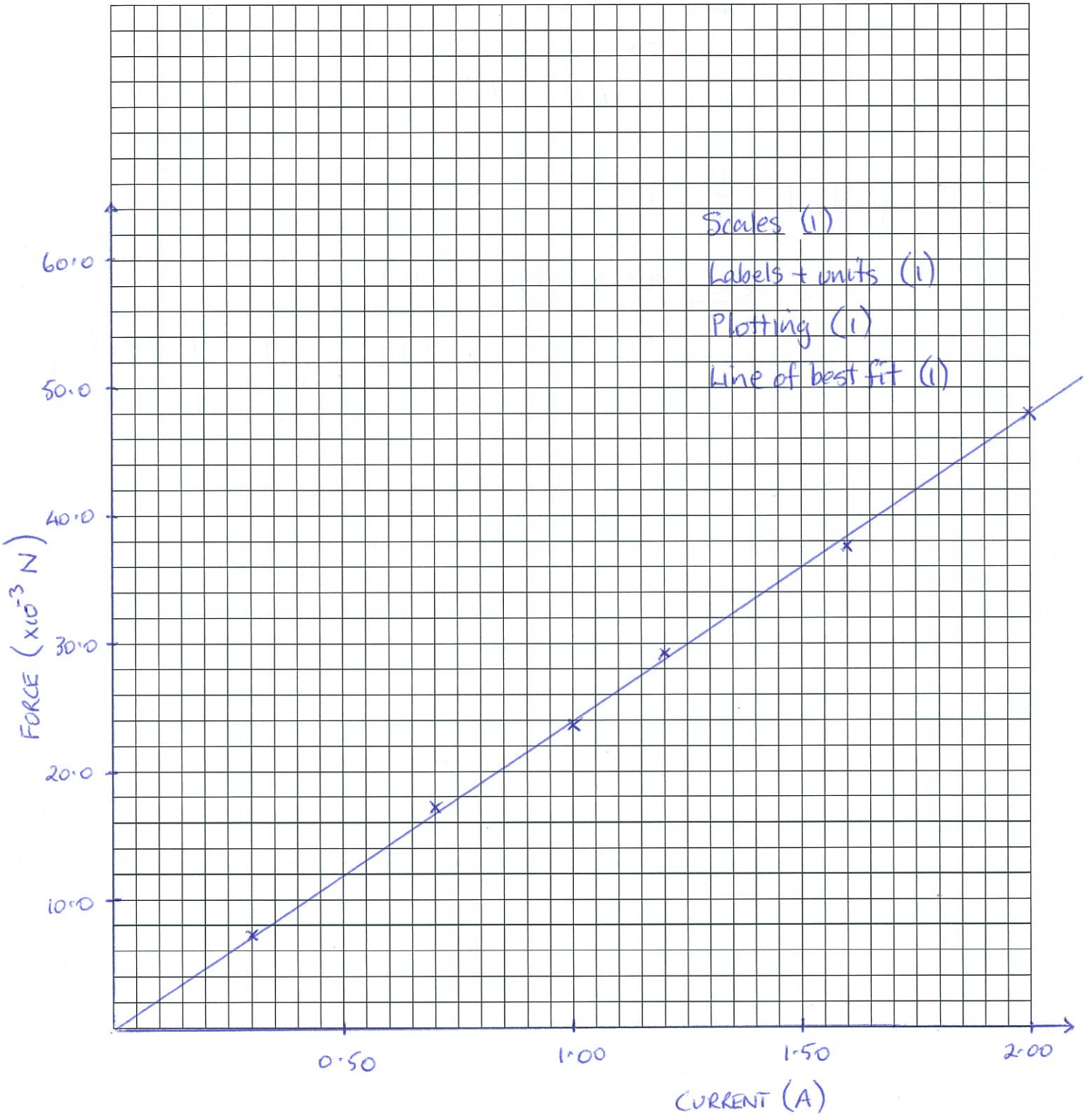
$$F = kI$$

where F = the force experienced (N)
I = the current flowing (A)
k = a constant.

A group of students obtained the following data whilst investigating this relationship.

Current (A)	Force (x 10^{-3} N)
0.30	7.2
0.70	17.1
1.00	23.9
1.20	29.2
1.60	37.8
2.00	48.0

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



(b) Use the gradient of the line of best fit to determine the value of k. Remember to include the appropriate units.

gradient = $\frac{48.0 \times 10^{-3} - 0}{2.00 - 0}$ (1)

$= 2.40 \times 10^{-2}\ NA^{-1}$ (1)

gradient = $\frac{F}{I} = k$

$\therefore k = 2.40 \times 10^{-2}\ NA^{-1}$ (1)

(3)

[Wrong sig fig - 1 mark off
Units - ½ mark off.]