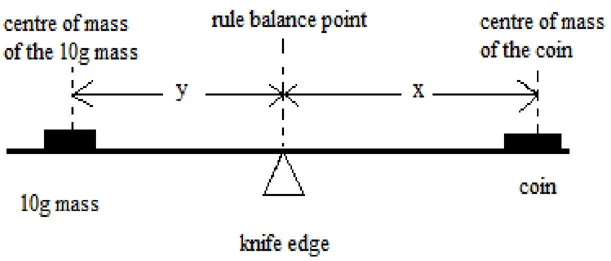
Exemplar 2pCoin Analysis

Summary of Results from experiment

These results are heavily simplified JUST to show the values required for analysis of the experiment.

Coin Thickness	1	2	3	4	5	**Ave**
Reading /mm	*1.84*	*1.86*	*1.81*	*1.80*	*1.85*	***1.83***

5 coin Diameter = *126mm* ➔ Coin diameter = *126/5 = 25.2mm*



Mass Calculation	X / mm	Y / mm	M_{coins} /g
Single coin	*206*	*135*	*6.53*
Stack of 5 coins	*208*	*143*	*34.4* (*1coin = 6.88g*)

	Density / kgm^{-3}
1 coin	*7320*
From 5 coins	*7540*

Analysis

(This is an example! Your values will be different BUT the methods should be the same)

State the (absolute) uncertainty in your value for the thickness of the coin, h.

*Would either be the ½ smallest division of the micrometer at either end (there is also an uncertainty in where the micrometer closes, so 2 x ½ of 0.01mm i.e. 0.01 mm) OR ½ range of repeats… In this case the **range** of readings of coin thickness is 1.86-1.80 = **0.06mm** . The ½ range = **0.03mm** so ½ range is greater so **Absolute uncertainty of coin thickness = 0.03mm***

Calculate the percentage experimental uncertainty in your value for h using:

*h= 1.83mm; absolute uncertainty = 0.03mm ➔ %U = (0.03/1.83)*100 = **1.64%***

In measuring the diameter of the 2p coins, explain why it is better to measure across all of the coins rather than measuring them individually

The 5 coin measurement is larger and therefore will have a lower % uncertainty. It will also reduce the effect of any random error associated with differences in the diameter of individual coins.

State the (absolute) uncertainty in your value for the measurement of 5d.

*The ruler's smallest division is 1mm (½ is 0.5mm) BUT counted at the start and end so doubled so uncertainty of diameter incorporating 2 measurements = **1mm***

Calculate the percentage experimental uncertainty in your value for 5d:

*5d = 126mm; absolute uncertainty = 1mm ➔ %U = (1/126)*100 = **0.794%***

Work out the total percentage experimental uncertainty for the volume value you calculated.
(% uncertainty in volume = (2 × % uncertainty in d) + % uncertainty in h)

$\%U_h$=1.64% ; $\%U_d$=1.59%; ➔ ***$\%U_{vol}$*** *= (2×0.794) + 1.64 =* ***3.23%***

State the (absolute) uncertainty in your value for distance "x"

The ruler's smallest division is 1mm so the uncertainty of "x" incorporating 2 measurements **= *1mm***

Calculate the percentage uncertainty in your value for distance "x"
for 1 coin and 10g

*x = 206mm; absolute uncertainty = 1mm ➔ %U =(1/206)*100 = **0.485%***

for 5 coins and 50g

x = 208mm; absolute uncertainty = 1mm ➔ *%U =(1/208)*100 =* ***0.481%***

State the (absolute) uncertainty in your value for distance "y"
The ruler's smallest division is 1mm so the uncertainty of "y" incorporating 2 measurements **= *1mm***

Calculate the percentage uncertainty in your value for distance "y"
for 1 coin and 10g
y = 135mm; absolute uncertainty = 1mm ➔ *%U =(1/135)*100 = 0.**741%***

for 5 coin and 50g
y = 143mm; absolute uncertainty = 1mm ➔ *%U =(1/143)*100 =* ***0.699%***

Work out the total percentage experimental uncertainty for the mass value you calculated

(if we assume $\%U_{Mass(mass)}$ =0%) then $\%U_{mass(coin)} = \%U_x + \%U_y$

for 1 coin and 10g
$\%U_{mass(coin)} = \%U_x + \%U_y$ = *0.485 + 0.741=* ***1.23 %***

for 5 coin and 50g
$\%U_{mass(coin)} = \%U_x + \%U_y$ = *0.481 + 0.699 =**1.18 %***

Calculate the % difference between the two values of coin mass you obtained in the experiment.

$$\% \text{ difference} = \frac{\text{difference between the 2 values}}{\text{average of the 2 values}} \times 100$$

mass of coin (from 1 coin and 10g) = 6.53g; mass of coin (from 5 coin and 50g) = 6.88g
Average = (6.53+6.88)/2 = 6.71g; Difference = 6.88-6.53 = 0.35g
% diff = (0.35/6.71)*100 = 5.22% *(that means they were consistent with each other)*

Work out the total percentage experimental uncertainty for the density value you calculated in the previous experiment $\%U_{density} = \%U_{mass} + \%U_{volume}$

For 1 coin and 10g (NB $\%U_{volume}$ is the same for both!)
$\%U_{mass}$ = *1.48 %* $\%U_{volume}$ = *3.23%*
$\%U_{density} = \%U_{mass} + \%U_{volume}$ = 1.23 + 3.23 = ***4.46 %***

For 5 coins and 50g
$\%U_{mass}$ = *0.955 %* $\%U_{volume}$ = *3.23%*
$\%U_{density} = \%U_{mass} + \%U_{volume}$ = 1.18 + 3.23 = ***4.41 %***

Work out the maximum and minimum values for your density value.
(This is just going to be done for the 5coin and 50g value)
Density= 7540 kgm^{-3}
Maximum= 7540 × 1.044 **= 7870 kgm^{-3}**
Minimum = 7540 × 0.956 **= 7210 kgm^{-3}**

Which metal is it most likely to be?
The only metal from the table that has a density that overlaps with this result is ***Mild Steel***

Metal	Density/kgm^{-3}
Copper	8930
Brass	8500
Mild steel	7860