



## Higher Uncertainties Questions

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1. What is meant by uncertainties caused by '**Systematic Effects**'?
  
2. a) What is meant by the term '**Random Uncertainty**'?  
b) State the equation used to calculate random uncertainty.
  
3. a) How would you estimate the uncertainty from an **analogue scale**?  
b) How would you estimate the uncertainty from a **digital scale**?
  
4. A 100m sprinter recorded the following times over the course of a season:  
**9.83 s, 10.03 s, 9.96 s, 10.14 s, 10.20 s and 10.08 s.**

**Calculate:**

- a) Mean time of the sprinter.
  - b) Random uncertainty in the times recorded.
  - c) Mean time  $\pm$  Random Uncertainty.
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5. A golfer drives his shots off the tee and achieves the following distances:  
**230 m, 243 m, 223 m, 248 m, 252 m, 235 m, 263 m and 234 m.**

**Calculate:**

- a) Mean range of the golf balls.
- b) Random uncertainty in the range of the golf balls.
- c) Mean Range  $\pm$  Random Uncertainty.

6. A pupil measures the speed of a trolley at the bottom of a slope with a QED and light gate arrangement.

The following speeds were recorded  $0.89 \text{ ms}^{-1}$ ,  $0.93 \text{ ms}^{-1}$ ,  $0.85 \text{ ms}^{-1}$ ,  $0.87 \text{ ms}^{-1}$  and  $0.91 \text{ ms}^{-1}$ .

**Calculate:**

- Mean speed of the trolley.
- Random uncertainty in the speeds recorded.
- Mean Speed  $\pm$  Random Uncertainty.

7. The following readings were taken during an Ohms Law experiment to measure resistance:

**Voltage =  $(14.00 \pm 0.05) \text{ V}$**

**Current =  $(2.5 \pm 0.1) \text{ mA}$ .**

**Calculate:**

- Resistance.
- % Uncertainty in Resistance.
- Resistance  $\pm$  Absolute Uncertainty.

8. The following readings were taken in an experiment to calculate the unbalanced force on an object:

**Mass =  $(250 \pm 1) \text{ g}$**

**Acceleration =  $(5.00 \pm 0.05) \text{ ms}^{-2}$ .**

**Calculate:**

- Unbalanced Force.
- % Uncertainty in the unbalanced force.
- Unbalanced Force  $\pm$  Absolute Uncertainty.

9. The following readings were taken to calculate the Electrical Work Done on a charge in an electric field, where

**Electrical Work Done = Charge x Voltage:**

**Charge =  $(1.6 \pm 0.1) \times 10^{-19} \text{ C}$**

**Voltage =  $(2500 \pm 50) \text{ V}$ .**

**Calculate:**

- Electrical Work Done.
  - Percentage Uncertainty in the Electrical Work Done.
  - Electrical Work Done  $\pm$  Absolute Uncertainty.
10. A trolley is released from rest at a point X at the top of a ramp and passes a point Y half way down the slope.  
The distance travelled by the trolley XY is measured with a metre ruler and the times are measured with a stopwatch.

**Distance XY =  $(0.25 \pm 0.01) \text{ m}$ .**

**Times = 1.41s, 1.38 s, 1.36 s, 1.42 s, 1.37 s, 1.49 s, 1.43 s, 1.40 s, 1.38 s and 1.44 s.**

**Calculate:**

- Mean Time.
- Random uncertainty in the mean-time recorded.
- Mean Time  $\pm$  Random Uncertainty.
- Average speed of the trolley.
- % uncertainty in the average speed.
- Average Speed  $\pm$  Absolute Uncertainty.