1 Simple measurements using a temperature sensor

1. Making reference to the graph in fig. 1 describe how the resolution of sensor A varies with temperature.

2. A student realises that the system for sensor B was not set up correctly during calibration. The voltmeter for sensor B should have read 0.0 mV at 0 ^{o}C. Why is this a systematic error. If temperatures were measured using a sensor that was set to record 0.0mV at 0^{o}C what is the correction necessary for all recorded temperatures?

2 Trolley down a ramp

1. Explain with calculations how the height h can be used to set the ramp to an angle of 5^{o}. Length of ramp = 1.22m

2. If h can be set to the nearest 1mm, what is the precision/uncertainty that can be achieved when setting the ramp to an angle of 5^{o}? Give your answer in degrees.

3. If the ramp were set to the same angle using a protractor estimate what precision could be achieved? Give your answer in degrees.

4. The trolley passes through the light gate at 2.32ms^{-1}. The mask is 5cm long.
    a. How long does it take for the mask to pass through the light gate.

    b. If the timer measures to the nearest 1ms, what is the percentage uncertainty in the measured time?

    c. Since $a = \frac{v^2}{2s}$ what is the percentage uncertainty in the measurement of a?

3 Measuring the speed of light

1. Using Galileo's method estimate the time that might have been measured for a round trip of 2 miles (3200m)

2. Use your answer to calculate a minimum value for the speed of light.

3. Why is your answer a minimum value?

4. Michelson gave his value of the speed of light as 299910 ± 50 kms-1.

    a. According to Michelson what is the allowed range of values for the speed of light?

    b. Compare this range to the accepted value for the speed of light. How might this imply that:
        i. Michelson had a systematic error

        ii. Michelson had under estimated his uncertainty.

5. Why was it necessary for the first time to correct the speed of light in air once Michelson had published.