



SURNAME:

Lin

FORENAME(S):

Xuyuan

12 Pages

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners will not accept more illegible script or have it typed and the expense of typing charged to the candidate.
4. Write your answers in ink.
5. Begin each answer on a fresh page. Do all rough work in the answer book and cross it through.
6. No part of this book is to be torn out; it must be handed in complete.
7. If more books than one are used, fasten them together using the tags available from the invigilator(s).
8. **Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.**

1	Student Number	1804601
2	Title of Examination Paper	Transducers and signal conditioning
3	Module Code	AcDA5006
4	Date and Time of Examination	15.5.2019 12:00pm
5	Examination Venue	ID 310
6	Seat Number	G001
7	Number of Answer Books handed in	1

[illegible]

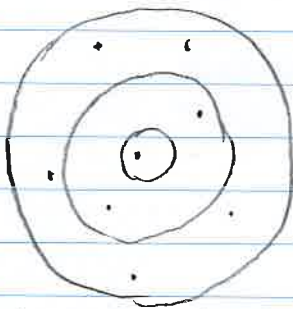
(Gweler yr ochr arall am y fersiwn Cymraeg)

85.7 %

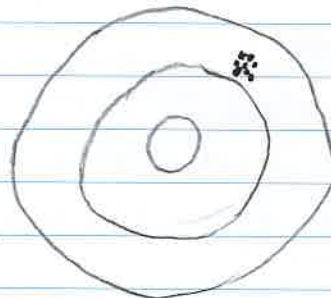
85.7%

466

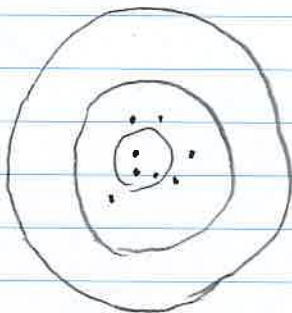
1. Precision is a term that describes an instrument degree of freedom from random errors. If a large number of readings are taken of ~~physical quantity~~ the same physical quantity ~~times~~ by a high-precision instrument then the spread of readings will be very small.
- accuracy is the degree of measurement to the correct value.
- High precision can be low accuracy.



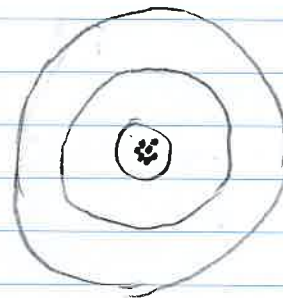
Low precision
Low accuracy



High Precision
Low accuracy



Low Precision
High accuracy



High Precision
High accuracy

5

5

2.

a)

graph is on the paper

3 1/2

b)

$$\text{sensitivity} = \frac{\Delta y}{\Delta x}$$

$$\text{sensitivity (21}^\circ\text{C)} = \frac{25-0}{1-0} = 25 \frac{1-0}{25-0} = 0.04 \text{ mm/kg}$$

$$\text{sensitivity (35}^\circ\text{C)} = \frac{1.3-0.2}{25-0} = \frac{1.1}{25} = 0.044 \text{ mm/kg}$$

c)

change of temperature is $35^\circ\text{C} - 21^\circ\text{C} = 14^\circ\text{C}$ ~~zero drift =~~~~zero offset =~~

$$\text{zero offset (21}^\circ\text{C)} = 0 \text{ mm}$$

$$\text{zero offset (35}^\circ\text{C)} = 0.2 \text{ mm}$$

$$\text{zero drift} = \frac{0.2-0}{14} = 0.0143 \text{ mm}/^\circ\text{C} = 14.3 \mu\text{m}/^\circ\text{C}$$

$$\text{sensitivity drift} = \frac{0.044-0.04}{14} = \frac{0.004}{14} = 0.0002857 \text{ (mm/kg)}/^\circ\text{C}$$

$$= 0.2857 \mu\text{m/kg}/^\circ\text{C}$$

3.

a) ~~4.290, 4.292, 4.292, 4.293, 4.293, 4.290~~
 4.290, 4.291, 4.292, 4.292, 4.293, 4.293, 4.294, 4.294, 4.295
 minimum 4.296 maximum

The average of 10 times is 4.293 ✓

The minimum is 4.290 m

The maximum is 4.296 m

$$4.290 - 4.293 = -0.003 \text{ m}$$

$$4.296 - 4.293 = +0.003 \text{ m}$$

∴ The measurement precision is $\pm 0.003 \text{ m}$ ✓

b) All the ultrasonic measurements is large than 4.276 m

~~4.2~~ The maximum inaccuracy is :

$$4.296 - 4.276 = 0.02 \text{ m}$$

maximum inaccuracy is $+0.02 \text{ m}$ ✓

c) The All the measurements is ^{larger} ~~smaller~~ than 4.276 m

The ~~minimum~~ ^{maximum} measurements is ~~4.424~~ m

$$4.430 - 4.276 = +0.154 \text{ m}$$

The maximum measurement inaccuracy is $\pm 0.148 \text{ m}$
 $+0.154$ ✓

d) As the ~~calculation~~ calculation of b), c), when the temperature increase, the maximum measurement ~~in~~ inaccuracy get bigger. So It ~~is~~ can make the measurement in a suitable temperature ^{alittle} lower than 20°C , such as 18°C or 19°C . It can make accuracy increase.

4. Random errors are ~~also~~ caused by mistakes when ~~observer~~ observer is ~~do~~ doing the experiment. The ~~random~~ ^{random} errors can be avoid. The ~~random~~ random errors often caused by uncalibrated instrument, ~~mistake~~ mistake of people, ~~wrong~~ incorrect data recording.

systematic errors are caused by system of the experiment. It can not be avoid from experiment unless design a new way to measure. The systematic errors caused by incorrect experient design of designer.

3 1/2

3.5

5.

a) graph is on the paper (4) (4)

b)

maximum non-linearity is $7.5 \pm 0.75 \text{ V}$

$$\text{percentage} = \frac{7.5}{13} \pm \frac{0.75}{13} = 0.0577 = 5.77\%$$

(2) (2)

c)

$$\text{sensitivity} = \frac{\Delta Y}{\Delta X} = \frac{8.0 - (-2.5)}{70 - 0} = 0.15$$

(2) (2)

- Some tolerance allowed due to differences
in line of best fit

6.

a)

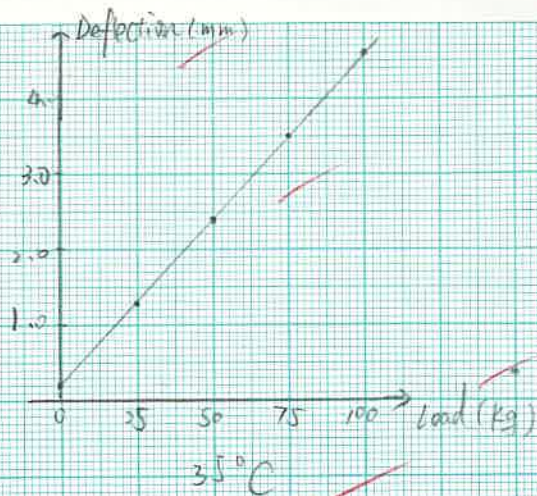
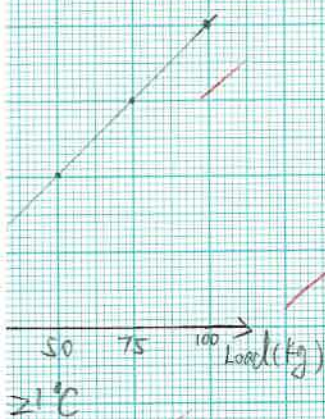
Pressure sensor is needed in tyre inflator to ~~not~~ measure the weight. ~~The~~ ^{These} pressure sensors are needed on the road and the car can cross over the pressure sensors. It should be ~~convenient~~ easy to go through and can accept the pressure from the ~~truck~~ cars.

b)

These type of pressure sensor ~~is~~ ^{are} on the airplane. It can measure the ~~altitude~~ altitude of the plane by ~~meas~~ measuring the pressure of the air. It should be ~~exactly~~ to measure the specific ~~measure~~ of pressure, in case the accident of plane.

(2)

(force)



2. a)

graphs are a bit small

— could have used same axes

3 1/2

1804601

2.3
Yes, too small.

(80x60)

simultaneous
- linearity

20 30 40 50 60 70 80 90 100

x

4

4

5. a