Making your own microsyringe

Evaluating precision

5 c	2	**Evaluation of procedures with justification** Mark this section in a holistic way. Award 2 marks for an evaluative discussion supported by appropriate justification of any **four** of the following areas: ♦ means by which accurate measurements were achieved/sources of error in measurement and their impact on the results ♦ why the sample size was appropriate and how independent replication was achieved ♦ how the controls contributed to the overall validity of the investigation ♦ how confounding variables were controlled or monitored and their impact on the validity of results ♦ solutions to problems and reasoning behind modifications to procedures in light of the pilot study A detailed discussion of any two areas, or a weaker discussion of at least four areas, should be awarded 1 mark, provided they are supported by some justification.

Areas that candidates found demanding

Question paper

In the Question Paper, questions that related to experiments or Investigative Biology unit were considered “demanding”.

Project

Discussion

This is a demanding section of the report, which requires candidates to have a detailed understanding of both their particular project and the theory within the Investigative Biology unit. Many candidates found this part of the report particularly challenging. Candidates often took an overly simplistic approach and failed to show depth of understanding of the key issues affecting the validity and reliability of conclusions.

Although most candidates included a conclusion that was relevant to their aim, only a small proportion of conclusions were valid. In some cases, this was because the stated conclusion did not accurately reflect the data presented. As in previous years, the majority of invalid conclusions were the result of factors, such as the failure of candidates to adequately control or monitor key confounding variables; the absence of appropriate controls; and inadequate repeat or replicate measurements.

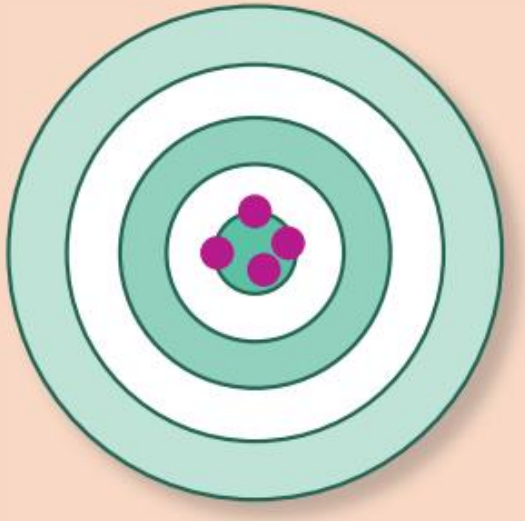
When evaluating procedures, some candidates provided little more than a description of equipment and the possible errors associated with their use. While some discussion of this nature may be relevant and appropriate, in many cases the accounts demonstrated little awareness of the bearing on validity and reliability. When evaluating procedures, candidates often mentioned controls, but few explained their importance. Discussion of reliability was commonly restricted to simple statements that the inclusion of repeats and replicates increased reliability. Candidates continue to identify flaws, such as a failure to control key confounding variables, which should be addressed at the planning stage of the investigation. Many candidates included a discussion of pilot studies, but they often failed to adequately address how these had affected the final experimental design. These issues were very similar to those encountered in previous years with, again, a very small proportion of candidates scoring both the marks available for the evaluation of procedures.

Curriculum

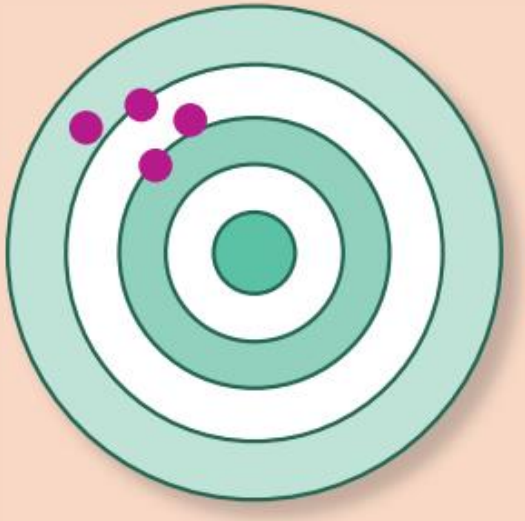
Investigative biology	
Key area	**Depth of knowledge required**
2 Experimentation Validity, reliability, accuracy and precision	Validity: variables controlled so that any measured effect is likely to be due to the independent variable. Reliability: consistent values in repeats and independent replicates. Accuracy: data, or means of data sets, are close to the true value. Precision: measured values are close to each other.

Curriculum

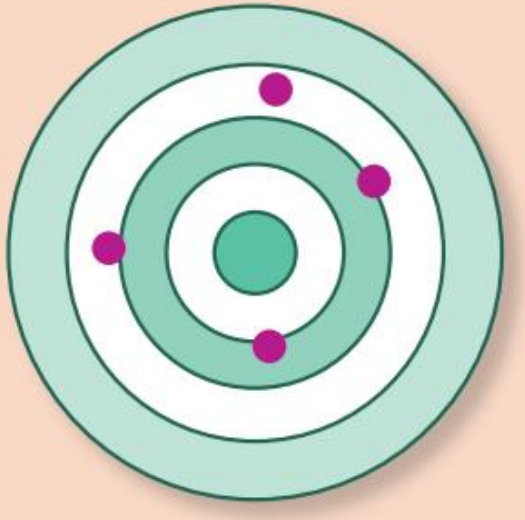
(b) Reporting and evaluating experimental design	
A method section should contain sufficient information to allow another investigator to repeat the work	
Experimental design should address the intended aim and test the hypothesis	The validity and reliability of the experimental design should be evaluated. An experimental design that does not address the intended aim or test the hypothesis is invalid.



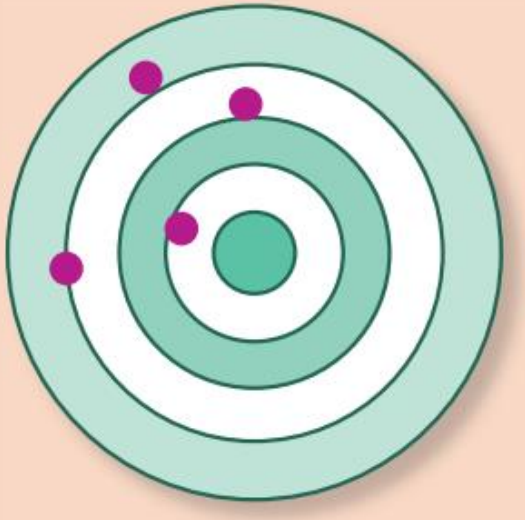
Accurate and precise



Precise but not accurate
(shows bias or systematic error)



Accurate but not precise
(shows range or random variation
but mean is close to true value)



Neither accurate nor precise
(shows random and systematic error)

Making our own microsyringe – is it precise?

Microsyringes (8)

£38.40

- 1 + Add to Basket

Description

Pack of eight microsyringes (to be used with graduated white tips).
www.ncbe.reading.ac.uk/MATERIALS/Electrophoresis%20and%20DNA/replacementparts.html

Read More

NCBE University of Reading

These fixed volume micropipettes come in multiple sizes.

PIPETTE TIPS

White 10 µl graduated microtips, 300 ..... £17.00 (GBP)
Yellow 100 µl tips, 100 ..... £9.50 (GBP)

FIXED VOLUME MINIPIPETTES

Minipipet.....10 µL.....£24.00 (GBP)

Minipipet ..... 20 µL ..... £24.00 (GBP)

Minipipet ..... 25 µL ..... £24.00 (GBP)

Phillip Harris

eisco Variable Volume (Adjustable) Micropipette 100-1000µl (Fully Autoclavable)

PP00052737

In stock

£60.15

£72.18 inc VAT

Variable Volume (Adjustable) Micropipette 5-50µL

B8R05604

In stock

£90.65

£108.78 inc VAT

Add to Basket

Timstar

Adjustable Micropipettes, 20-200 µL

BT100542

In stock

£77.90

£93.48 Inc. VAT

Add to Basket

Adjustable Micropipettes, 2-20 µL

BT100544

In stock

£77.90

£93.48 Inc. VAT

Add to Basket

Adjustable Micropipettes 0.5 - 10 ul

BT140555

In stock

£77.90

£93.48 Inc. VAT

Add to Basket

Adjustable Micropipettes 10 - 100 uL

BT140560

In stock

£77.90

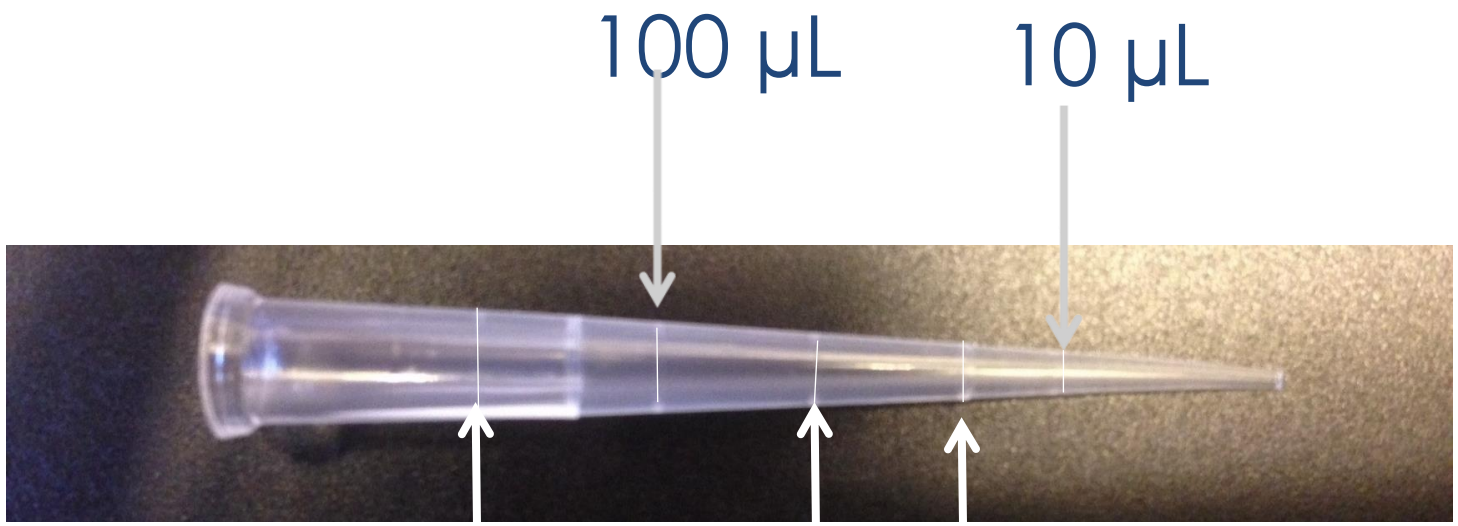
£93.48 Inc. VAT

Add to Basket

- Accuracy?
- Precision?
- Cost?

Equipment

Equipment



Precise and accurate?

1. Draw up some air ~ 100 µl
2. Tare balance using an empty weigh boat
3. Draw up 100 µl water
4. Expel into weigh boat
5. Repeat 9 times - measure mass
6. Repeat using 50 µL increments

1 cm^3 water weighs 1 g.

i.e. the density of water is 1 g / cm^3.

Accuracy – does the mass always go up by 0.1 g per 100 µl?
Precision – does the mass always go up by the same mass per 100 µl?

Volume added (cm^3)	Mass (g)
0.1	
0.2	
0.3	
0.4	
0.5	
0.6	
0.7	

Volume added (cm^3)	Mass (g)
0.05	
0.1	
0.15	
0.2	
0.25	
0.3	
0.35	

(d)Reliability Variation in experimental results may be due to the reliability of measurement methods and/or inherent variation in the specimens The precision and accuracy of repeated measurements	The reliability of measuring instruments or procedures can be determined by repeated measurements or readings of an individual datum point. The variation observed indicates the precision of the measurement instrument or procedure but not necessarily its accuracy.	 Determine the precision of a measuring procedure by repeated measurements, and the accuracy of a measuring procedure by calibration against a known standard.

"*Determine the precision of a measuring procedure by repeated measurements*".

This step is an important part in learners working towards overall reliability in their results.

Testing the accuracy, reliability, and precision of your colorimeter

LEE Filters – range of filters

Neutral density options

For 50% transmission:

A = 0.30

%T
71
50
25
12.5
6.25

1. Set to red diode
2. Empty cuvette as blank
3. Calibrate (CAL) colorimeter
4. Measure & record absorbance
5. Add a ND filter - record absorbance
6. Repeat with extra ND filters
7. Plot data

Number of pieces of neutral density filter	Absorbance at 465 nm (blue diode)	Absorbance at 525 nm (green diode)	Absorbance at 630 nm (red diode)
0			
1			
2			
3			
4			
5			