

# M5–M8 Mixed Quiz 2 (15 MC)

2025-08-26

## 1 Questions

- 1) M5 — Which action most improves precision without changing accuracy?
  - A. Calibrate against a certified standard
  - B. Use an instrument with finer resolution and average repeated trials
  - C. Remove zero offset
  - D. Switch to SI base units
- 2) M6 — A thermistor–bridge circuit is non-linear. The most appropriate correction is:
  - A. Increase sampling rate
  - B. Apply a calibration curve fit to convert voltage to temperature
  - C. Assume linearity for small ranges only
  - D. Use more significant figures
- 3) M7 — A claim is supported by an RCT with  $p = 0.04$ . Which is true?
  - A. The claim is proven true
  - B. The result is statistically significant at  $\alpha = 0.05$  but practical significance requires effect size and context
  - C. The result will replicate 96% of the time
  - D.  $p$  indicates the probability the hypothesis is true
- 4) M8 — Which consideration best addresses equity in science policy?
  - A. Maximise total benefit regardless of distribution
  - B. Ensure access across socio-economic groups and remote communities
  - C. Prioritise lowest cost options only
  - D. Ignore stakeholder consultation to avoid bias
- 5) M5 — A variable should be controlled when it:
  - A. Is independent
  - B. Is dependent
  - C. Could affect the dependent variable but is not the focus of the study
  - D. Is a systematic error

- 6) M6 — The Nyquist criterion states that to avoid aliasing you must sample:
- A. At least twice the highest frequency component in the signal
  - B. At least the same as the highest frequency
  - C. Every 1 s
  - D. At random intervals
- 7) M7 — “Post hoc ergo propter hoc” is a fallacy meaning:
- A. After this, therefore because of this
  - B. To this, therefore according to this
  - C. Without this, therefore because of this
  - D. Straw man argument
- 8) M8 — The most ethical approach to environmental sampling on culturally significant land is:
- A. Proceed immediately; scientific benefit overrides concerns
  - B. Seek permission, consult Traditional Owners, minimise harm, and share results
  - C. Outsource to avoid liability
  - D. Compensate and proceed without consultation
- 9) M5 — A Bland–Altman plot primarily assesses:
- A. Correlation between variables
  - B. Agreement between two measurement methods
  - C. Linearity of calibration
  - D. Random error magnitude only
- 10) M6 — Sensor hysteresis implies:
- A. Output depends only on current input
  - B. Output depends on input history; use up/down calibration cycles to quantify
  - C. Random spikes at high frequency
  - D. Saturation at low input
- 11) M7 — Which best reduces confirmation bias during analysis?
- A. Pre-register analysis plans and conduct blinded assessments where feasible
  - B. Use complex models
  - C. Increase sample size only
  - D. Select results matching expectations
- 12) M8 — Risk communication should:
- A. Avoid uncertainty to prevent panic
  - B. Be transparent about uncertainty and actions people can take
  - C. Focus on worst-case scenarios only
  - D. Use technical jargon to ensure accuracy

- 13) M5 — Measurement uncertainty ( $\pm$ ) attached to a mean originates primarily from:
- A. Systematic error only
  - B. Random variation (e.g., standard error) and instrument resolution
  - C. Unit conversions
  - D. Population variance only
- 14) M6 — A 16-bit ADC over  $\pm 10.0$  V has resolution of approximately:
- A. 0.0003 V
  - B. 0.00015 V
  - C. 0.0006 V
  - D. 0.0015 V
- 15) M7/M8 — A public health intervention shows small individual benefit but large population impact. This is an example of:
- A. Ecological fallacy
  - B. Population attributable effect relevant to policy decisions
  - C. Simpson's paradox
  - D. Publication bias

## 2 Answer key

Q	Ans	Rationale
1	B	Precision: spread; averaging and finer resolution improve precision.
2	B	Use calibration curve to correct non-linearity.
3	B	$p < 0.05$ statistical significance; practical significance needs effect size.
4	B	Equity: ensure fair access and participation.
5	C	Control potential confounders.
6	A	Nyquist $2 \times$ highest frequency.
7	A	Classic causal fallacy.
8	B	Respect, minimise harm, share benefits.
9	B	Agreement between methods.
10	B	Hysteresis depends on history; quantify via cycles.
11	A	Pre-registration/blinding mitigates bias.
12	B	Transparent, actionable communication.
13	B	Random variation and resolution dominate uncertainty around mean.

Q	Ans	Rationale
14	A	Range 20 V/65536 = 0.000305 V per count ( 0.0003 V).
15	B	Small individual, large population effect guides policy.

Note Q14: Correct is 0.000305 V; answer A.