M5–M8 Mixed Quiz 5 (15 MC)

2025-08-26

1 Questions

1) M5 — Which is the best operational definition for “reaction rate” in a catalase experiment?

- A. How fast it goes
- B. Volume of O2 produced per second measured with a gas syringe at STP
- C. The speed of bubbles
- D. The change in colour

2) M6 — A GPS unit claims accuracy ±3 m (95% CI). Which is true?

- A. All readings are within ±3 m
- B. About 95% of readings fall within ±3 m of true position under test conditions
- C. The resolution is 3 m
- D. Readings are unbiased by environment

3) M7 — In evaluating an extraordinary claim, which standard applies?

- A. Ordinary evidence suffices
- B. Extraordinary claims require stronger evidence, replication, and converging lines of support
- C. Only expert opinion is needed
- D. Single case studies are conclusive

4) M8 — “Open science” practices include:

- A. Hiding code to prevent misuse
- B. Pre-registration, sharing data/code (where ethical), and open peer review
- C. Publishing only positive results
- D. Fast-tracking without review

5) M5 — The most suitable control for testing a new fertiliser’s effect on plant growth is:

- A. Different plant species with fertiliser

- B. Same species under identical conditions without fertiliser
- C. No water
- D. Different soil

6) M6 — Time synchronisation across sensors is critical for:

- A. Slowly varying signals only
- B. Multi-sensor fusion and event correlation; use NTP/GPS or shared clocking
- C. Single sensor systems
- D. Avoiding random error

7) M7 — A funnel plot asymmetry in meta-analysis suggests:

- A. No publication bias
- B. Possible publication bias or heterogeneity
- C. Measurement error only
- D. Perfect symmetry always occurs

8) M8 — In risk matrices, "likelihood × consequence" is limited because:

- A. It is too quantitative
- B. It may ignore uncertainty ranges and interdependencies; sensitivity analysis is required
- C. It cannot be visualised
- D. It ignores stakeholders

9) M5 — Which technique best checks for outliers influencing the mean?

- A. Use median/IQR and residual plots; apply robust methods where appropriate
- B. Increase decimals
- C. Convert to percentages
- D. Remove all extreme values automatically

10) M6 — If an accelerometer shows cross-axis sensitivity:

- A. It measures only one axis accurately
- B. Inputs on one axis appear on another; mount carefully and correct in calibration matrix
- C. This is random noise
- D. Increase gain

11) M7 — Which practice improves reproducibility?

- A. Keep protocols informal
- B. Version-control code/data and specify seeds, software versions, and analysis notebooks
- C. Summarise methods loosely
- D. Share figures only

12) M8 — A transparent conflict-of-interest declaration means:

- A. The evidence is invalid
- B. Readers can interpret findings with awareness of potential influence
- C. The work is biased
- D. It is not needed

13) M5 — A 95% CI for a mean difference excludes zero. This implies:

- A. Statistically significant difference at = 0.05
- B. No difference
- C. Practical significance guaranteed
- D. The true difference is exactly the CI midpoint

14) M6 — A 10-bit ADC over 0–3.3 V has LSB approximately:

- A. 3.2 mV
- B. 6.4 mV
- C. 1.6 mV
- D. 0.33 mV

15) M7/M8 — Communicating uncertainty effectively involves:

- A. Hiding ranges to avoid confusion
- B. Using ranges/intervals, scenario bands, and plain-language explanations of what uncertainty means
- C. Only quoting p-values
- D. Avoiding numbers completely

2 Answer key

Q	Ans	Rationale
1	B	Operational definition specifies how measured (gas syringe, SI).
2	B	±3 m applies to ~95% under conditions; not all points.
3	B	Stronger, converging evidence required.
4	B	Core open-science practices.
5	B	Same species/conditions; only fertiliser differs.
6	B	Synchronisation critical for fusion/correlation.
7	B	Asymmetry suggests bias/heterogeneity.
8	B	Address uncertainty/interdependence with sensitivity analysis.
9	A	Robust stats and residuals help detect/mitigate outliers.
10	B	Cross-axis sensitivity managed via mounting/calibration.

Q	Ans	Rationale
11	B	Versions/seeds/notebooks improve reproducibility.
12	B	Transparency allows informed interpretation.
13	A	CI excluding zero significant at 5%.
14	A	3.3/1024 0.00322 V 3.2 mV.
15	B	Communicate ranges with clear explanations.