



AI First Engineering

FUNDAMENTALS OF AI-AUGMENTED ENGINEERING: A Conversational Approach

CHAPTER 1

LAB-1: Engineering Report Template

Ball Drop Fall Time

Can we trust the model, the computer, or the AI — and how would we know?

Team Information

Team name / number	
Team members	1) 2) 3) 4)
Date	
Section (if applicable)	

How to use this template: *replace every gray italic guide with your team's actual evidence and reasoning, insert your photographs and plots in the dashed boxes, and delete nothing else. Concise evidence + engineering reasoning beats pages of polished prose. Your AI teammate may help assemble this report from your engineering record — Section 17 is where the humans take responsibility for it.*

1. Problem / Objective

What engineering question did this investigation answer? One or two sentences.

2. Physical Model

The governing model and the prediction it produces.

$$h = \frac{1}{2} g t^2 \qquad t = \sqrt{(2h / g)}$$

with $g = 9.81 \text{ m/s}^2$ (state anything else your model relies on below)

3. Assumptions

Documented BEFORE experimentation. What does the simple free-fall model assume about the release, the object, the air, and g ?

4. Experimental Setup

- Object dropped (type, size, why chosen):
- Height measurement method:
- Phone / camera used and video frame rate (fps):
- Camera placement (distance, framing, known-length object for Tracker):

PHOTOGRAPH OF ACTUAL SETUP

Insert your team's setup photo — release point, tape measure, and camera visible

Caption: *(what does this figure show, in one sentence?)*

5. Prediction / Computation

Computational tool used, the code or calculation, model inputs, and the committed predictions (before any drop).

Tool: *(calculator / Excel / Python / ...)*

Code or calculation:

```
# paste your fall-time computation here (e.g., the 5-line Python cell)
```

6. Experimental Data — the Team Dataset

Every legitimate run — two heights per student, 6–8 runs. Do not discard inconvenient measurements; a run may be excluded only for a documented procedural failure, noted in the table.

```
% diff = (t_measured - t_predicted) / t_predicted × 100          g_est = 2h / t²
```

Two measurement methods are used: Manual (iPhone video) and Tracker. Keep the sign of % diff; measured values may fall above or below the prediction.

Run	Student / dropper	Height h (m)	Predicted t (s)	Manual t (s)	Tracker t (s)	Manual % diff	Tracker % diff	Manual g_est (m/s ²)	Tracker g_est (m/s ²)
1									
2									
3									
4									
5									
6									
7									
8									
9									

Compact comparison summary (optional second table):

Comparison	Value / result	What it tells us
Mean manual t vs. prediction		
Mean Tracker t vs. prediction		
Manual vs. Tracker (same runs)		
Mean estimated g vs. 9.81 m/s ²		

7. Manual Video Analysis

Trim-method timing: open each video, scrub the trim handle to release and impact, read the displayed times.

$$t_{\text{fall}} = t_{\text{impact}} - t_{\text{release}}$$

- Typical t_{release} / t_{impact} readings and how you identified each instant:
- Ambiguities (where the team disagreed about release or impact):
- Temporal resolution: your frame rate and what ± 1 frame means in seconds:

8. Tracker Analysis

Same videos, second method — scale, coordinates, track, $y(t)$, fall-time estimate. At least one analysis per student.

TRACKER SCREENSHOT + $y(t)$ PLOT

Insert a Tracker window screenshot and/or the $y(t)$ data plot

Caption: *(what does this figure show, in one sentence?)*

- Tracker-derived fall time(s) and how you read them from the data:
- Observations (tracking difficulties, scale calibration, anything odd):

9. Fall Time vs. Height

Plot all runs: t on the vertical axis, h on the horizontal. BEFORE fitting: does it look linear? Then fit a curve (AI/Python may assist) and compare with the model.

t vs. h PLOT (with curve fit)

Navy points = your runs · maize curve = the fit

Caption: *(what does this figure show, in one sentence?)*

- Before fitting — did the relationship look linear? What did the team vote?
- What curve did you fit, and what did it find?
- The model predicts $t = \sqrt{2h/g}$, i.e., $t \propto \sqrt{h}$. Does your data support that shape?
- Does the curve fit make physical sense?

10. Experimental Estimate of g

$$g = 2h / t^2$$

One estimate per run, from measured h and experimental t . Plot estimated g vs. run number with a reference line at 9.81 m/s^2 .

ESTIMATED g vs. RUN NUMBER

Navy points = per-run estimates · maize line = 9.81 m/s^2

Caption: (what does this figure show, in one sentence?)

- Scatter — how spread out are your estimates?
- Bias — do they sit mostly above or mostly below 9.81 ? Why might that be?
- Outliers — does any run disagree with its siblings? What do its notes say?
- Does the pattern suggest a measurement problem, or a model problem?

11. Model–Experiment Comparison

Bring it together: theoretical predictions vs. manual measurements vs. Tracker measurements vs. the g estimates. What agrees, what disagrees, and by how much — judged against your timing resolution from Section 7.

12. Error / Discrepancy Analysis

Classify candidate causes with the course taxonomy: physical/modeling · measurement/experimental · numerical · programming · inappropriate assumptions · AI-generated. For your top candidates, distinguish a POSSIBLE source from a source LARGE ENOUGH TO MATTER — estimate sizes; don't vibe.

13. AI Contribution

What did your AI teammate materially contribute — planning, coding help, calculations, plotting, data organization, hypotheses, report structure? Cite the workspace; do NOT paste the whole conversation.

14. Human Verification & Engineering Judgment

What did the team independently verify, recalculate, reject, correct, modify, or test? Which AI suggestions did you NOT accept — and why? (Your BREAK THE AI verdicts belong here.)

15. Conclusions

What does the evidence actually support — about the model, the measurements, and the AI's reliability? Avoid unsupported certainty.

16. Improve

If the experiment were repeated: what would the team change, what additional data would you collect, and what would most improve measurement quality?

17. Human Review & Approval

“We have reviewed this report against our original experimental record — measurements, calculations, observations, plots, and supporting evidence. We accept responsibility for the submitted engineering work.”

Human reviewed and approved.

Would you confidently put your name on this result? Sign only when the answer is yes.

Name · Signature · Date

Name · Signature · Date

Name · Signature · Date

Name · Signature · Date

AI assists. Humans observe. Humans verify. Humans decide. Humans approve.

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