ANSWER KEY

DO NOT HAND OUT

A PREDICTIONS THAT EARN FULL MARKS

Length and period	Accept a reasoned prediction that period increases as length increases. The measured trend, not the prediction, is evidence.

B VARIABLES

Independent	String length from pivot to bob center: 20, 40, 60 or 80 cm.
Dependent	Mean time for 10 cycles (s), period T (s) and T^2 (s^2).
Controlled	Same bob, support, small release angle, cycle definition, timer and three-trial method.

C SAMPLE DATA

Illustrative ideal-model values calculated from $T = 2\pi\sqrt{(L \div g)}$, using $g \approx 9.8$ m/s² and converting cm to m; real results vary. The three trials per length are invented only to show the layout and average to the model value; they are not observed data.

LENGTH (CM)	TRIAL 1 (S)	TRIAL 2 (S)	TRIAL 3 (S)	MEAN (S)	T (S)	T^2 (S^2)
20	8.9	9.1	9.0	9.0	**0.90**	**0.81**
40	12.6	12.8	12.7	12.7	**1.27**	**1.61**
60	15.4	15.6	15.5	15.5	**1.55**	**2.40**
80	17.9	18.1	18.0	18.0	**1.80**	**3.24**
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Check using the rounded periods shown: $0.90^2 = 0.81$; $1.27^2 = 1.6129 \approx 1.61$; $1.55^2 = 2.4025 \approx 2.40$; $1.80^2 = 3.24$ s². Ten-cycle times are 10 × T, rounded to 0.1 s.

D MODEL CLAIM, EVIDENCE, REASONING

Claim: In this small-angle test, longer strings have longer periods; the relationship is not a one-for-one increase.
Evidence: The illustrative model gives T = 0.90 s at 20 cm and T = 1.80 s at 80 cm; class claims should replace these with their measured means.
Reasoning: For a simple pendulum, $T = 2\pi\sqrt{(L \div g)}$. Squaring gives T^2 proportional to L when g is fixed, so a T^2-versus-length graph should be closer to a straight line.

E THINK FURTHER

Change bob mass at one fixed length, keep the release angle small and use repeated ten-cycle timings. Compare the measured means; a small difference may be timing noise rather than a mass effect.

F QUICK GRADING GUIDE

Use the claim, evidence, reasoning and data-care rows. For full credit, check that the student used repeated measurements, correct seconds and seconds-squared units, and a graph of T^2 against length.