ANSWER KEY

DO NOT HAND OUT

A PREDICTIONS THAT EARN FULL MARKS

Ratio and sinking	Accept a prediction that a higher cornstarch ratio may slow sinking and resist tapping more, or a reasoned uncertainty. Judge it from measured depths and tap observations.

B VARIABLES

Independent	Cornstarch-to-water volume ratio: 1:1, 1.5:1 and 2:1.
Dependent	Three marble depths after 5 seconds, their mean/range in millimeters, and one separate qualitative quick-tap note.
Controlled	Tray size and batch volume, marble, original mixture depth, gentle placement, five-second timing, measuring method and stirring time. Note any bottom limit.

C SAMPLE DATA

Illustrative values only, not targets or predictions. These example means decrease from 34 to 12 to 2 mm; a marble can still enter a dense suspension. The range describes variation among three spots in one batch, not variation among independent recipe preparations. Tap wording is qualitative. Tray depth, marble size, settling and stirring change actual results; record any bottom limit.

RATIO	SPOT 1 (MM)	SPOT 2 (MM)	SPOT 3 (MM)	MEAN / RANGE (MM)	QUICK TAP NOTE
1 : 1	32	36	34	**34 / 4**	**yielded**
1.5 : 1	10	14	12	**12 / 4**	**brief resistance**
2 : 1	1	3	2	**2 / 2**	**brief resistance**

Confirm all nine depths use the five-second endpoint and millimeters, calculate each mean and range correctly, and use the same marble, tray and batch method. Note bottom limits and that the readings share one recipe preparation; accept a different measured pattern when students report setup limits honestly.

D MODEL CLAIM, EVIDENCE, REASONING

Claim: In these illustrative readings, mean marble depth decreased as the starch-to-water ratio increased, while separate quick taps briefly resisted in the two richer batches.
Evidence: The example triples are 32, 36 and 34 mm (mean 34, range 4); 10, 14 and 12 mm (mean 12, range 4); and 1, 3 and 2 mm (mean 2, range 2).
Reasoning: A concentrated cornstarch suspension can resist rapid deformation while yielding under a slow load. The mixture remains a suspension, and three spots from one batch do not establish how independently prepared batches will behave.

E THINK FURTHER

Repeat the same ratio with a slower and a faster tap, keeping the hand motion and observation location consistent; describe how force rate changes the surface response.

F QUICK GRADING GUIDE

Credit accurate 5-second depths, the student's own tap observations and reasoning about slow versus rapid force. Do not treat the sample values as targets. Require that no mixture is poured into a drain and that cleanup follows the dry-and-trash method.