Solutions

2.1

- Perpendicular: $N = mg\cos 20^\circ = 36.87$ N.
- Friction $= \mu_k N = 0.25 \times 36.87 = 9.22$ N up-slope.

2.2

- $a = g(\sin 20^\circ - 0.25\cos 20^\circ) = 1.051$ m/s^2.
- $v = \sqrt{2 \times 1.051 \times 2.00} = 2.050$ m/s.

2.3

- Slides when $a > \mu_s g = 2.943$ m/s^2.
- $2.5 < 2.943$: it holds, margin 15%.

2.4

- $F = ma = 4.0 \times 4.149 = 16.60$ N.
- $\mu_{min} = 16.60/(4.0 \times 9.81) = 0.423$.

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