

Midterm #1, 121, Q3 Schwartz Name \_\_\_\_\_

From the syllabus: In order to achieve an "A": Consistently

- correctly identifies underlying physics concepts,
- sets up problem with good drawing and reasons,
- formulates method to solve problem,
- correctly uses units and
- verifies whether answer makes sense.

An answer alone is worth no credit. Please estimate answers: don't leave them in roots, trig., fractions.

A 10 kg object is shown against a frictionless vertical wall on earth as shown.

- a) If I push angle of  $30^\circ$  above the horizon on the box as shown with a force of 100 N, what is the box's acceleration? - please include angle and magnitude.

*Lens: Dynamics has to do with forces + acceleration*

$$\rightarrow \sum \vec{F} = m\vec{a}$$

$$\sum F_y = F_x + F_{gy}$$

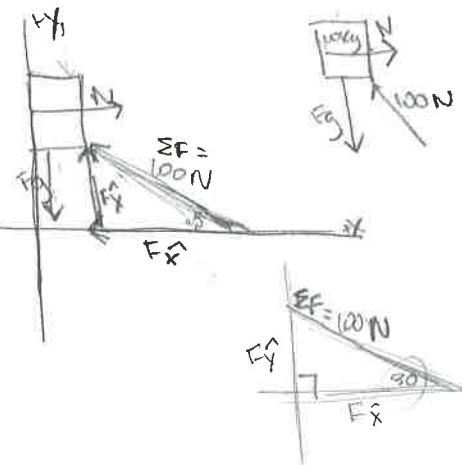
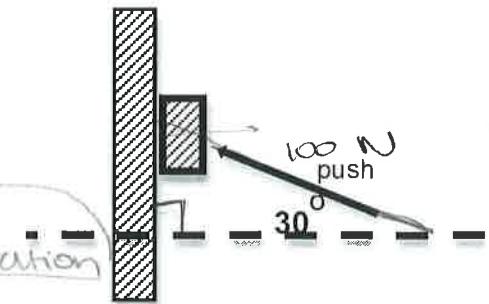
$$\sin(30) = \frac{F_x}{100N}$$

$$F_x = 100N \sin(30) \\ = 100N \left(\frac{1}{2}\right)$$

$$F_x = 50N$$

$$F_g = ma$$

$$F_g = (10 \text{ kg})(-10 \text{ m/s}^2) \\ = -100 \text{ N}$$



$$\sum F_y = 50N + (-100N) = -50N \rightarrow \sum \vec{F} = m\vec{a}$$

$$-50N = (10 \text{ kg})(a) \quad \text{the box accelerates down the wall with a of } -5 \text{ m/s}^2 \text{ at } 90^\circ$$

- b) What is the normal force acting on the box? - please include angle and magnitude.

*Lens:  $\sum F_x = 0$ , so dynamics in equilibrium*

$$\sum F_x = -F_x + N_{\text{normal}} = 0$$

great ↑

$$\pi < \sqrt{3} < \sqrt{4} \\ 1 < 1.75 < 2$$

$$\cos(30) = \frac{-F_x}{100N}$$

$$-F_x = 100N \cos(30) \\ = 100N \left(\frac{\sqrt{3}}{2}\right) \\ = 100N \left(\frac{1.75}{2}\right)$$

$$-F_x \approx 87N$$

$$F_x \approx -87N$$

$$\therefore \sum F_x = (-87N) + N_{\text{normal}} = 0$$

$$N = 87N \text{ at } 0^\circ$$

→ Normal force is 87N acting at  $0^\circ$  or perpendicular to the surface it rests on

$$\frac{100}{87} = \frac{7.00}{7.00} = \frac{8}{8} = 1$$

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