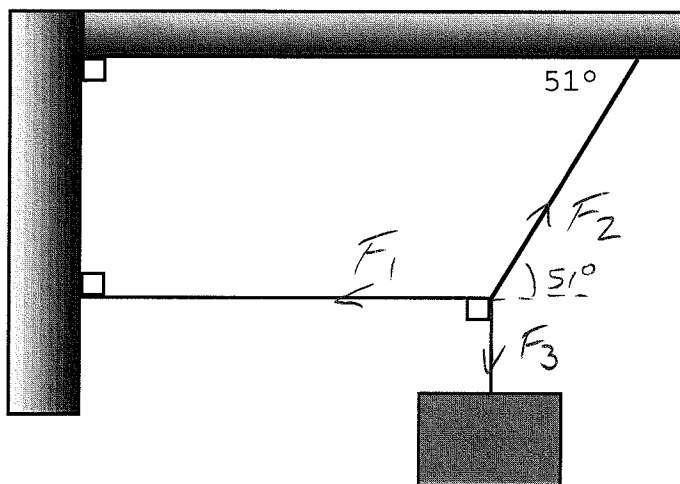


Physics 10154 - Exam #4C

Each problem is worth 50 points. Partial credit will be given provided you show all work and are solving parts of the problem correctly. Points will be deducted if you don't show your work (or if some parts are incorrect) even if you get the right answer. Clearly indicate your answer with a circle or box and remember to include correct units and significant figures.

1. A 220 Newton mass hangs vertically from a rope as shown below. Find the tension in each of the three segments of the rope.



$$\sum F_x = F_2 \cos 51^\circ - F_1 = 0$$

$$\sum F_y = F_2 \sin 51^\circ - F_3 = 0$$

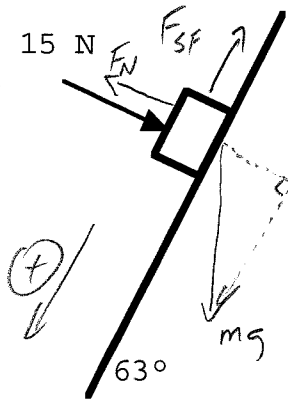
$$F_3 = 220 \text{ N}$$

$$\text{So } F_2 = \frac{220}{\sin 51} = 283 \text{ N}$$

$$F_1 = F_2 \cos 51^\circ = 178 \text{ N}$$

2. A 4.0 kg crate is on a 63° incline. An applied force of 15 Newtons is acting on the crate perpendicular to the incline as shown. The coefficient of static friction between the crate and the incline is 0.75. Does the crate move? $\mu_k = 0.45$.

If it does move, find the acceleration. If it does not move, determine the magnitude and direction of the force of static friction acting on the block.



$$F_N = mg \cos 63 + 15$$

$$= 32.8 \text{ N}$$

$$F_{SF, \text{MAX}} = \mu_s F_N = 24.6 \text{ N}$$

$$\Sigma F_{\parallel} = mg \sin 63 - F_{SF} = 0$$

$$F_{SF} = mg \sin 63^\circ$$

$$= (4)(9.8) \sin 63^\circ$$

$$= 34.9 \text{ N}$$

Since $F_{SF} > F_{SF, \text{MAX}}$, block moves

$$34.9 \quad 24.6$$

$$\text{So, } \Sigma F_{\parallel} = mg \sin 63 - \mu_k F_N = ma$$

$$34.9 - (0.45)(32.8) = 4a$$

$$a = \frac{34.9 - 14.8}{4} = \boxed{5.0 \text{ m/s}^2}$$