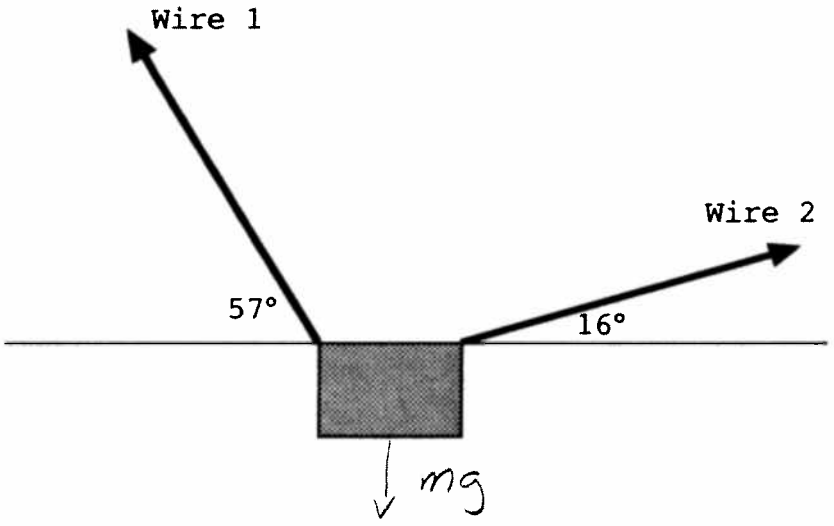
Physics 10154 - Exam #2a B

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. (30 pts) A 180-kg speaker is suspended over a crowd at a stadium by two wires as shown below. Find the magnitude of the tension force in each of the two wires. The horizontal line in the diagram below is simply for reference.



$$\Sigma F_x = -F_1 \cos 57^\circ + F_2 \cos 16^\circ = 0$$

$$\Sigma F_y = F_1 \sin 57^\circ + F_2 \sin 16^\circ - mg = 0$$

$$F_2 \cos 16^\circ = F_1 \cos 57$$

$$F_2 = \frac{\cos 57^\circ}{\cos 16^\circ} F_1 = .567 F_1$$

$$F_1 \sin 57^\circ + .567 F_1 \sin 16 - 180(9.8) = 0$$

$$F_1 = \frac{180(9.8)}{\sin 57^\circ + .567 \sin 16^\circ} = \boxed{1800\ N}$$

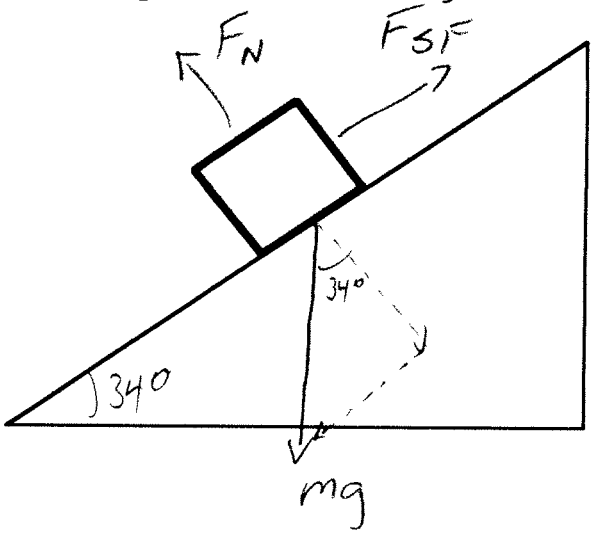
$$F_2 = (.567)(1800) = \boxed{1000\ N}$$

2. (40 pts) A 15 kg mass is initially at rest on a 34° inclined plane as shown below. The coefficient of static friction between the block on the plane is 0.75. The coefficient of kinetic friction is 0.50.

a) Does the block move?

b) If not, find the magnitude and direction of the force of static friction.

b) If yes, find the magnitude and direction of the acceleration.



$$\Sigma F_\perp = F_N - mg\cos 34^\circ = 0$$

$$F_N = mg\cos 34^\circ$$

$$= 122\ N$$

$$F_{SF,MAX} = \mu_S F_N$$

$$= 91\ N$$

Assume $a = 0$, find F_{SF}

$$\Sigma F_{||} = F_{SF} - mg\sin 34^\circ = 0$$

$$F_{SF} = mg\sin 34^\circ$$

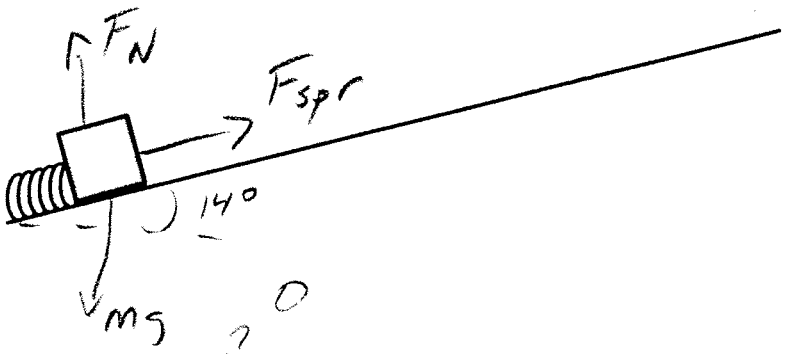
$$= 82\ N$$

Since $F_{SF} < F_{SF,MAX}$, block doesn't move

$F_{SF} = 82\ N$, up ramp

3. (30 pts) A 6.0 kg mass is initially at rest on a spring of strength k = 1200 N/m. The spring is initially compressed by 44 cm, and the apparatus is on a frictionless 14° inclined plane as shown below.

Measuring from its initial position on the spring, how far in meters does the mass move up the incline before coming to a stop?



$$W(N) + W(spr) + W(mg) = \tfrac{1}{2}mv^2 - \tfrac{1}{2}mv_0^2$$

$$\tfrac{1}{2}kx^2 - mgh = 0$$

$$\tfrac{1}{2}kx^2 - mg\Delta s \sin 14^\circ = 0$$

$$\Delta s = \frac{\tfrac{1}{2}kx^2}{mg\sin 14^\circ} =$$

$$\Delta s = \frac{\tfrac{1}{2}(1200)(.44)^2}{(6.0)(9.8)\sin 14^\circ} = \boxed{8.2\ m}$$