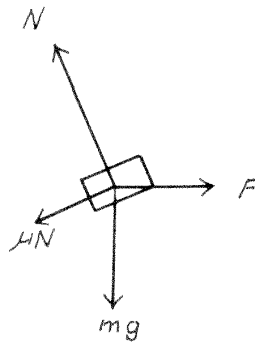


1. a) 4 points



1 point for each of the four arrows. Directions must be correct. Any reasonable label is acceptable.

4 points

b) 7 points

$$\Sigma \vec{F} = m\vec{a} \text{ or facsimile}$$

1 point

$$f_k = \mu N \text{ or facsimile}$$

1 point

From summing forces perpendicular to the plane

$$N = mg \cos \theta + F \sin \theta$$

1 point

From using Newton's second law in a direction parallel to the plane

$$a_{||} = \underbrace{\frac{F}{m} \cos \theta}_{1 \text{ pt.}} - \underbrace{g \sin \theta}_{1 \text{ pt.}} - \underbrace{\frac{\mu N}{m}}_{1 \text{ pt.}}$$

3 points

or

$$a_{||} = \underbrace{\frac{F}{m} \cos \theta}_{1 \text{ pt.}} - \underbrace{g \sin \theta}_{1 \text{ pt.}} - \underbrace{\left(\mu g \cos \theta + \frac{\mu F}{m} \sin \theta \right)}_{1 \text{ pt.}}$$

Also, for correct algebra to get expression.

1 point

Solution

Distribution of Points

c) 4 points

$$v = \text{const} \Rightarrow a_{||} = 0$$

1 point

$$\therefore F = mg \left(\frac{\mu \cos \theta + \sin \theta}{\cos \theta - \mu \sin \theta} \right)$$

1 point

$$F > 0 \Rightarrow \cos \theta > \mu \sin \theta$$

1 point

$$\therefore \tan \theta < \frac{1}{\mu}$$

1 point

Total 15 points