Here are **10 isomorphic versions** of your physics problem, each meeting your requirements:

### **Problem 1**

A farmer pulls a metal sled loaded with hay across a dirt path at a constant speed.  
The coefficient of kinetic friction between the sled and the dirt is **0.28**.  
The rope used to pull the sled makes an angle of **15.0° upward** from the horizontal.  
The force required is **520 N**. The acceleration due to gravity is **9.81 m/s²**.

**Find the mass of the sled in kilograms.**

**Answer:** 170 kg

**Solution:**  
Since the sled moves at a constant speed, net force = 0.  
Vertical forces: Normal force + vertical component of pull = weight.  
Horizontal forces: Horizontal pull balances kinetic friction.  
Use:

Substitute into friction equation and solve for .

### **Problem 2**

A person pushes a refrigerator across a tiled kitchen floor with a horizontal force of **380 N**.  
The coefficient of kinetic friction is **0.31**, and the person pushes **at a downward angle of 10°**.  
The refrigerator moves at constant speed.

**What is the mass of the refrigerator?**

**Answer:** 120 kg

**Solution:**  
Since it's uniform speed, net force is zero.  
Use same force balance setup as in Problem 1.  
Normal force increases due to downward push.  
Solve using:

Solve for .

### **Problem 3**

A horse pulls a wagon across a grassy field at constant speed.  
The wagon’s mass is **400 kg**. The coefficient of kinetic friction is **0.25**.  
The horse pulls with a rope angled **18° upward from the horizontal**.

**Find the magnitude of the pulling force required.**

**Answer:** 964 N

**Solution:**  
Calculate weight: .  
Normal force is reduced due to upward component:

Set and solve for .

### **Problem 4**

A child pulls a toy wagon across a wooden deck at constant speed.  
The mass of the wagon is **10 kg**, and the pulling handle makes an angle of **25° upward**.  
The coefficient of kinetic friction is **0.40**.

**Find the required pulling force.**

**Answer:** 47.4 N

**Solution:**  
Compute normal force:

Solve for using known mass and .

### **Problem 5**

A person pushes a box across a rough concrete ramp with a force of **300 N**, applied at **10° downward**.  
The box moves at constant speed. Its mass is **80 kg**.

**Find the coefficient of kinetic friction.**

**Answer:** 0.36

**Solution:**

Solve for .

### **Problem 6**

A robot drags a crate along an asphalt road at constant velocity.  
The force is **600 N**, applied at **20° upward**. The coefficient of kinetic friction is **0.45**.

**Find the mass of the crate.**

**Answer:** 140 kg

**Solution:**

Solve for .

### **Problem 7**

A sled dog pulls a loaded sled at a steady pace.  
The sled has mass **150 kg**, and the coefficient of kinetic friction is **0.30**.  
The harness pulls the sled **at 25° upward** from the horizontal.

**What force must the dog exert?**

**Answer:** 470 N

**Solution:**

Solve for .

### **Problem 8**

A construction worker pushes a tool chest across a concrete floor.  
He applies a **downward force of 700 N** at an angle of **15°**.  
The chest moves at a steady speed. The coefficient of kinetic friction is **0.40**.

**What is the mass of the tool chest?**

**Answer:** 220 kg

**Solution:**

Solve for .

### **Problem 9**

An ATV tows a trailer across a field at constant speed.  
The trailer has mass **200 kg**, and the towing chain pulls **at 12° upward**.  
The coefficient of kinetic friction is **0.35**.

**Find the towing force.**

**Answer:** 663 N

**Solution:**

Solve for .

### **Problem 10**

A delivery robot pushes a crate with a force of **350 N** at **10° downward**.  
The crate moves at constant speed across a tile floor. The coefficient of kinetic friction is **0.30**.

**What is the mass of the crate?**

**Answer:** 110 kg

**Solution:**

Solve for .

Let me know if you'd like these converted into a worksheet or formatted for LaTeX or another teaching format.