Aim : To determine the force of limiting friction for rolling of a roller on a horizontal plane.

Apparatus : A wheel base wooden / metal block(or trolley), weight box , friction less pulley, a plane horizontal plane, a balance a pan and a thread.

Theory: Rolling friction is that force of friction which comes into play when a body is rolling on the surface of another body.

Magnitude of the rolling friction is proportional to the normal reaction

$$F_r \, \alpha \, N$$
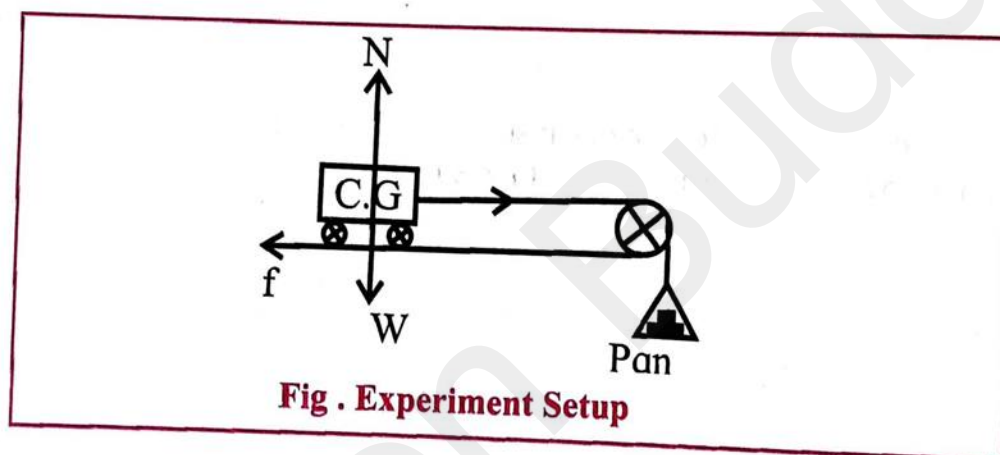
$$F_r = \mu_r \, N$$

$$\mu_r = \frac{F_r}{W}$$

Where μ_r = Coefficient of rolling friction

F_r = Magnitude of force of rolling friction

N = Normal reaction.

Diagram :

Fig . Experiment Setup

Procedure :
1. Measure the weight of wooden roller block (W_o) by using balance.
2. Measure the weight of Pan (P_o) by using balance.
3. Place wooden roller block on the horizontal plane plank. The one end of thread to block and other to the pan by passing it over the pulley. Pan should be freely suspended in air and thread between pulley and block should be horizontal.
4. Add weights in the plan gradually till the roller just starts rolling.
5. Note that minimum weight in the pan for which roller just start rolling.
6. Repeat the experiment by putting weights in the step of 50g on the wooden block.
7. In each case find the force of limiting friction (F_r)

Observations :

1. Weight of empty wooden block roller (W_o) = ...g.
2. Weight of empty scale pan (P_o) = ...g.

Observation Table :

Sr. No.	Mass on the block W_1 g.wt	Total load $W = (W_o + W_1)$ g.wt	Mass in the pan P, g.wt	Total Effort $F_r = (P_o + P_1)$ g.wt	$\mu_r = \dfrac{F_r}{W}$	Mean μ_r	
1	50g	28g	138.7	32.9	1.175	0.231	
2	100g	41g	188.7	45.9	1.119	0.243	1.082
3	150g	51g	238.7	55.9	1.09607	0.234	=
4	200g	61g	288.7	65.9	1.080321	0.228	
5	250g	73g	338.7	77.9	1.067123	0.236	

Calculation :

$$\mu_r = \frac{F_r}{W} = \frac{32}{28} = 1.14 \qquad \mu r = \frac{65}{61} = 1.06$$

$$\mu_r = \frac{fr}{W} = \frac{45}{41} = 1.09 \qquad \mu r = \frac{77}{73} = 1.05$$

$$\mu_r = \frac{fr}{W} = \frac{55}{51} = 1.07$$

Result :

1. Coefficient of rolling friction for the given surface μ_r = ...1.082
2. As the weight of pulley increases the effort increases.

Precautions :

1. Table top should be horizontal.
2. Pulley should be frictionless.
3. Weight in the pan should be increased in small steps.
4. Table top should be top gently.

FOR NOTES

Remark and sign of teacher: