Aim: Comparison of coefficient of friction of various pairs of surfaces & determination of angle of repose.

Objectives:

a) To understand facts & concepts of development of frictional force with respect to applied external force causing motion or tends to cause the motion.

b) To find coefficient of friction of various pairs of surfaces

c) To find angle of repose

Apparatus:

Adjustable horizontal plane (surface) with the pulley at one end, wooden boxes with different bottom surfaces, hanger with thread, weight & bubble tube.

Layout:

Fig. 1   F.B.D.

Fig. 2   F.B.D.
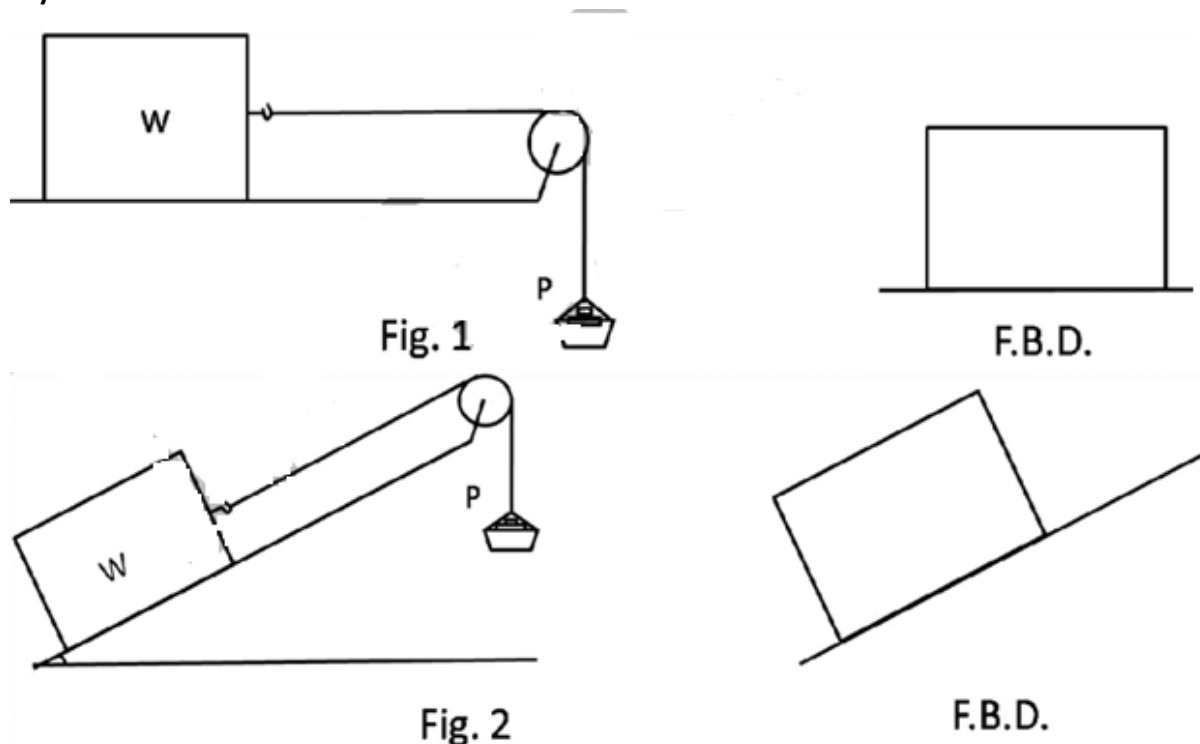
Theory:

Frictional force: The force which is always opposite to motion & acts tangentially at two surfaces of contact.

Types of friction:

1) Static friction: The friction exists between two surfaces at rest is called as static friction.

2) Dynamic friction: The friction exists between two surfaces in motion is called as dynamic friction.

3) Rolling friction: When one body rolls over another body then friction exists between them is called as rolling friction.

Co-efficient of friction (μ): Ratio of frictional force to normal reactions is always constant & is called as coefficient of friction.

Laws of static friction:

1) Frictional force is always opposite to motion & acts tangentially to the two surfaces in contact.

2) Frictional force is directly proportional to normal reaction; the ratio of frictional force to normal reaction is called as coefficient of friction.

3) Frictional force depends on nature of surfaces in contact.

4) Frictional force does not depend upon amount of surface in contact.

Angle of repose:

When the body is in limiting equilibrium then angle made by inclined surface with horizontal is called as angle of repose.

Uses of friction:

1) It reduces the efficiency.

2) One can easily walk on a rough surface than on a very smooth surface.

3) A vehicle moving on road surface can be stopped suddenly by applying breaks when the sufficient friction is developed.

4) The types of vehicle are made up of certain special designs due to which sufficient friction can be developed between the tyres& the road surface so that accidents due to sleeping are avoided.

As a cart goes up or down an inclined plane, it will be under the influence of two primary forces – gravity and friction. As the cart moves uphill (below left), the component of gravity and the friction force are both acting against the motion. This results in acceleration that we will call aup. This is the acceleration that slows the cart while it is going uphill.

Cart going up the incline   Cart going down the incline
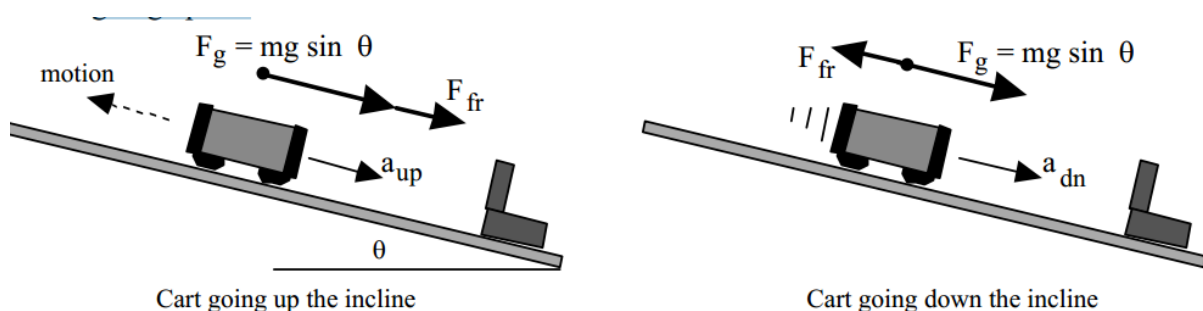
As the cart moves downhill (above right), the component of gravity pulls it down while the friction force pulls uphill, working against its motion, resulting in adn.

Procedure:

A) Study of frictional force:

1. Organize the physical set up of experiment with plane in horizontal position. (θ=0)

2. Predict that as you go on applying force by adding weights in pan (P); the frictional resistance developed restricts the motion of box. (P = weight of pan + weight in pan)

3. Predict that at particular value of P, the box just starts moving.

4. Observe the weights in pan (P) & corresponding position of box (steady / just starts moving / moves faster)

5. Tabulate.

Sr. No.	Weights in pan (P) in N	State of box

6. Infer: Frictional force developed increases till the box just starts moving. Maximum frictional force is developed at point of motion of box.

B) Study the relation between frictional force & area of contact:

1. Organize the physical set up of experiment.

2. Predict that as you change the area in contact of same body of same weight, the limiting (total) value of friction will remain unchanged.

3. Observe:

a) Place the rectangular wooden body on given plane with larger surface area in contact.

b) Go on increasing the weights in pan till body just starts moving.

c) Place the same body on same plane with smaller surface area in contact.

d) Observe the weights in pan till body just starts moving.

Sr. No.	Area in contact with plane	Weights in pan

Conclusion:

1. Average value of co-efficient of friction between wooden surfaces is_____ (less than/ greater than/ equal to) average value of wood and

2.Magnitude of slope of the graph plotted between load and effort for different surfaces is _____ (less than / greater than/equal to/ nearly equal to) observed magnitude for the same surfaces.