

### What is going on?

With increase in number of pulleys in a system, the effort required to lift a given load goes on decreasing.

In the first case, there is a force (tension) on the thread that is equal to the weight of the load. This force is same all along the thread. In order for the weight and pulley to remain in equilibrium, the other end of the thread must be pulled down by a person, with a force which is equal in magnitude to the tension in thread. For this pulley system the force is equal to the weight as shown in the diagram. Therefore the mechanical advantage of the system is 1.



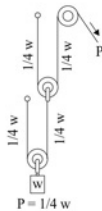
In the second case, the weight (load) is supported by the thread, both - the thread fixed to the hook, and the thread passed over fixed pulley (as shown in diagram). Each side of the thread is supporting the weight. Therefore each thread carries only  $\frac{1}{2}$  of the weight. So the force (effort) needed to lift the load in this system is equal to the  $\frac{1}{2}$  of the weight. The mechanical advantage of this system is 2.



In the third system each thread carries only  $\frac{1}{4}$ th of the weight (as shown in diagram). Therefore the effort needed to lift the load in this system of pulley is equal to the  $\frac{1}{4}$  of the weight. The mechanical advantage of this system is 4.



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The mechanical advantage in each system can be calculated using the following relation.

Mechanical Advantage =  $\frac{\text{Output load}}{\text{Input load}}$

Here output load is 100 gm wt which is fixed in all the 3 cases and input load is the reading of the spring balance in each case.



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THE WAY TOWARDS PRACTICAL SCIENCE

## SYSTEM OF PULLIES

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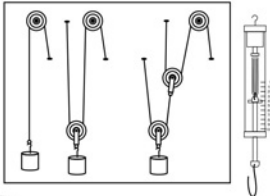
## SYSTEM OF PULLIES

### Mechanical Advantage

#### Assembly :

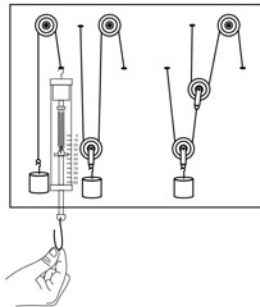
Consists of 3 System of Pulley arranged on an aluminium board (of size 24"x18"). For all the 3 System of pulleys a hexagon load of 100 gm wt is used.

The first pulley system consists of one fixed pulley. It does not move when the thread is pulled. It is fixed to the board. A load is passed over it using thread as shown in diagram. The other end of the thread is tied to a ring (plastic red coloured) fixed to hook which in turn is fixed to the board. The second system of pulley consists of an fixed and one movable pulley. As the thread is pulled, the movable pulley moves up. The load is fixed to the movable pulley and the thread is passed over both the pulleys as shown in diagram. Both ends of the threads are fixed to the hooks which are fixed the board. The third system of pulley consist of one fixed pulley and two movable pulleys. Both movable a pulleys move up as the thread is pulled. The load is fixed to the lower movable pulley. The threads are fixed and passed over pulleys as shown the diagram. A 0-100 gm wt (newton) spring balance comes with the assembly for the measurement of the effort.



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### To do and observe :



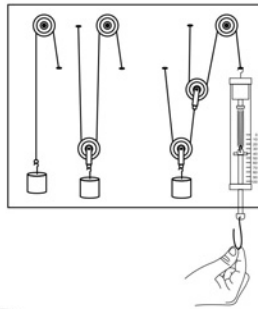
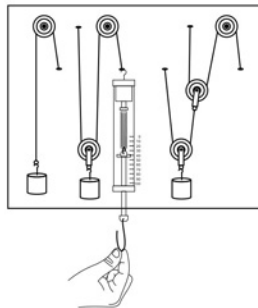
Step 1 :Place the hook of the Spring balance in the red coloured ring of the first system and pull it. Note the reading of the spring balance in newton.

Step 2 : Repeat the Step 1 for the second and third system of pulleys and note down spring balance reading in both the cases.

You will observe that the readings of the spring balance will be different in all the 3 cases. The reading in the second system will be less than that of the first system and reading of the 3<sup>rd</sup> system will be less than that in the cases of 2<sup>nd</sup> system.



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