



APPLICATIONS OF LAWS OF MATHEMATICS AND PHYSICS IN SPORTS

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Abstract:

Introduction:

Science covers each and every aspect of life in such a wonderful way that many a times we are ignorant about its effects, its laws, its perspectives and the results. Mathematics and Physics are the beautiful branches of science. In fact, science was in existence vary before the word science came into picture.

Sports are again the beautiful activities of human life from very ancient time. People are indulged into sports for recreation, entertainment for physical fitness and many times to prove the perfection in different skills. Sportsmen spirit is a wonderful feeling to experience, to explain, to follow and hence, is having a high position in human behavioral psychology.

The geometric figures in its raw form, in its perfect forms etc. are used in sports frequently and compulsorily. The shapes like - rectangle, square, circle, semicircle, ellipse, parabola, straight lines, projectile path etc. are used in sports in this way or that way. The concept of parallelity, perpendicularity, intersection of lines making angles etc are often observed in sports. The idea of speed, weight, frequency, friction, up thrust are frequently used in sports. All those things play very important role in the performance and results of any game. If these concepts are well understood then we get wonderful result. The example of world famous swimming champion Phelps is well known who waxes his whole body to minimize the resistance of water by body hair. Thus, after the study of resistance of water, the up thrust created by water, the weight of body due to gravitation force and

the speed of swimmer, he had given this world record result.

Applications of law of Mathematics and Physics in some basic sports :

Long Jump : For the best results in long jump the athlete increases the horizontal velocity gradually mostly it is up to 30km/hr. The take off angle is many a times 21 degrees. After the take off the athlete proceeds by making an arc, the feet stretched in forward direction, the landing should be done on soft surface. Considering all those things in mind in well synchronized way we can get the required result.

Ski : This is very popular sport in western countries. Now it is getting equally popular in India also. When a skier performs on ice, he has to keep in mind the following things. Wherever pressure is applied on ice, the ice melts, thus, forming a thin layer of water there beneath, when the pressure is removed the water again freeze into ice. This phenomenon is called as the analogous behavior of water. Because of this water film the friction is minimized creating a slippery effect. While skiing, downhill ride the landing is very important. The momentum of jump should be maintained which includes body weight of skier, his velocity and path of ski. While landing, the face should be downwards to minimize the friction. The landing should be on tender snow. At landing position the forward lean should be avoided otherwise the momentum will through the skiers in forward direction. Same results are seen while driving cars on icy road. Because of ice on road and anomalous behavior of water there is no

friction, no traction also gravity is working on cars and hence, it is very difficult to control the car.

If one wants to slide on floors, he needs kinetic friction. For that he has to run fast to generate force this fast running is converted into kinetic friction, then he can have a good slide on floor.

Wheelie Riding : This also is a popular sport on cycle or bike. While wheeling the rider increases the speed up to required level, leans backwards so that the centre of mass is shifted from the central position to a little backwards direction then he lifts the front wheel and has a proper riding on the back wheel. The speed gives necessary friction to the tyre. For the finish, the acceleration should be reduced; breaks should be applied such that the bike should not stop. Control of turning effect is also done perfectly.

Similar laws with little modification are used while cycle jump or turn is done. To rotate the cycle in 360 degrees after a proper jump, the sideways rotation, the angle of momentum and rotation in air should be managed effectively. One should keep in mind that while landing the centre of mass should be shifted above the paddles.

Pole Vault : This game mainly depends on the pole used. The pole should be strong, flexible and light weighted, should be having a good elastic property, for this purpose the pole made up of carbon-carbon matter is used which fulfills all the above said properties the run up of the athlete stores energy. This kinetic energy MV^2 due to velocity is shifted to the pole, it becomes the potential energy and thus gives proper jumping height as per the formula $P.E. = mgh$. In general 17 feet pole helps to jump up to 20 ft.

Gymnastics : Again a very popular game form, totally depending on the balance of the body, the control over centripetal force and centrifugal force, the friction generated and so many things. The balance on balloon in a stand up position needs a very strong neuromuscular control of the body. For the hand stand the strength of arms, the balance of body is must but, the most important thing is that the centre of mass of

the body should be near the wrist. The distribution of the body weight should be done equally between the front and back wrists, while want to walk on hands. For perfect landing the legs should be rotated making proper angle with the body and the bench.

Boat Racing : Mainly works on the Archimedes Principle. Any floating body, when dipped in water removes water, this volume of removed water creates an up lift force, which is responsible for floating of that body. In case of boat racing the surface of the boat is kept in minimum touch with water body so as to minimize the friction. But, when air comes in between boat and water, it sometimes throws the boat away. To avoid this the speed of boat and shape of boat plays a very important role.

Same is true for kiting. When there is uneven heating of earth surface and atmosphere by sun, the hot air rises up and the cold air rushes in to fill the gap. This air current helps in kiting. For heavy kite, one should stand strongly and lean in backwards direction, while moving forward caring kite the backward lean is maintained.

Conclusion :

We had seen a few examples of application of science for the better results in any game. It is clear that every sport activity depends on complicated laws of science. So, we cannot ignore the importance of science in sports although, it is commonly said that what a sports person has to do with Maths or Physics?
