

In the latter case if the system be suspended by a string attached to a point in one of the sides, find the position of the point that the triangle may rest with one side vertical.

When the triangle is at rest the line joining the centre of gravity and the point of suspension must be vertical, and $\therefore$ parallel to the vertical side; $\therefore$ the point of suspension is one of the points of trisection of the side in which it is, and is the one nearer the vertical line.

3. State Newton's Laws of Motion, and explain the nature of the reasoning by which they are arrived at.

Show how the second and third enable us to exhibit dynamic phenomena by means of equations.

4. (1.) A gun (wt. 3 tons) rests on a plane of inclination 30° to the horizon, being pointed downwards parallel to the plane; a shot of 60 lbs. is discharged from it with a velocity of 1,500 feet per second. Find how far up the plane the gun will recoil.

The gun being 100 times the mass of the ball will recoil with $\frac{1}{100}$ of its velocity, that is with a velocity of 15 feet per second. And since the force of gravity will cause a retardation down the plane equal to $\frac{1}{2}g$, $\therefore$

the motion of the gun will be stopped in—³⁰ seconds; during this time the gun may be supposed to move with a uniform velocity of $7\frac{1}{2}$ feet per second. The distance required is

$$\therefore 7\frac{1}{2} \times \frac{30}{g} = 7 \text{ feet nearly.}$$

(2.) Two weights of 5 and 10 lbs. are attached by a string, the heavier hanging vertically from the edge of a smooth horizontal table on which the lighter rests. Determine the motion.

Substituting in the formula

$$f = \frac{P}{W} g \text{ we get}$$

$$f = \frac{1}{15} g$$

Which determines the motion.

5. The Normal pressure on a surface

exposed to the action of fluid is equal to the pressure on a plane horizontal surface of equal area at the same depth below the surface, that the centre of gravity of the first surface is, gravity being the only force acting.

A tetrahedron whose faces are equilateral triangles is just filled with fluid and has three of its corners in a horizontal plane; show that when the fourth is above this plane, the total pressure on all the sides is three times the total pressure when this corner is below the plane.

Since the fluid is the same and the extent of surface in contact with it, the same, it follows that the total pressure will vary as the depth of the centre of gravity of the surface below the highest point of the fluid; and since this depth is three times as great in the first case as in the second; $\therefore$ the pressure must be so also.

6. When a body is immersed in a fluid it loses a portion of its weight equal to the weight of the displaced fluid.

A sphere of radius a is composed of a substance n times heavier than water; find the radius of a spherical portion that must be hollowed from its inside that it may float in water with $\frac{1}{n}$ th of its volume above the surface.

If the volume of the sphere be taken as the unit of volume, then the sphere is heavy enough to displace a volume of water whose measure is n ; but after part is removed the remainder can only displace a volume of

water whose measure is $\frac{n-1}{n}$.

$\therefore$ volume of sphere : volume of part left

$$\text{as } n : \frac{n-1}{n} = n^2 : n-1.$$

$\therefore$ sphere : part removed as $n^2 : n^2 - n + 1$, and the ratio of radii will be the cube root of

$$\text{this, } \therefore \text{ the radius required} = a \sqrt[3]{\frac{n^2 - n + 1}{n^2}}$$

EUCLID—1st C.

1. Where would the difficulty in the theory of parallel lines present itself, if they were