more work before coming to rest, and in what proportion?

3. A number of forces act at a point in different directions. Explain how to determine their resultant in magnitude and direction.

Forces P, $2P$, $3P$ and $4P$ act along the sides of a square $ABCD$, taken in order. Find the magnitude, direction, and line of action of the resultant.

4. What is the centre of gravity of a body? How would you determine experimentally the position of the centre of gravity of a thin plate?

Weights of 1 lb., 2 lbs., 3 lbs. and 4 lbs. are suspended from a uniform lever 5 ft. long at distances of 1 ft., 2 ft., 3 ft. and 4 ft. respectively from one end. If the mass of the lever is 4 lbs., find the position of the point about which it will balance.

5. Explain how to find the relation between the power and weight on a screw. A screw whose pitch is $\frac{1}{4}$ in. is turned by means of a lever 4 ft. long. Find the power which will raise 15 cwt.

Describe the differential screw.

B.

6. Distinguish between the whole pressure and the resultant pressure of a fluid upon any surface, and state under what circumstances they are equal to one another.

The base of a triangle is 1 ft. in length, and the altitude of the triangle is 10 inches. What will be the pressure on the triangle when it is immersed with its vertex at the surface of the water, and the middle point of its base 4 in. below the surface—atmospheric pressure being neglected, and the mass of a cubic foot of water being taken to be $62\frac{1}{2}$ lbs.?

7. A Nicholson's Hydrometer, when loaded with 200 grains in the upper pan, sinks to the marked point in water; a stone is placed in the upper pan, and the weight required to sink it to the same point is found to be 80 grains; the stone is then placed in the lower pan, and the weight required is 128 grains. Find the specific gravity of the stone.

Explain how you would determine the specific gravity of a solid lighter than water.

8. The top of a uniform barometer-tube is 36 inches above the surface of the mercury in the tank. In consequence of the presence of dry air above the mercury, the barometer reads 27 inches when it should read 28.5 nches. What would be the true pressure if the reading of the barometer were 30 inches?

What is the difference between the behaviour of this barometer and that of a second barometer in which the depression is due to the presence of water and aqueous vapour, instead of dry air, above the mercury?

9. The volume of a balloon and its appendages is 64,000 cubic feet, and its mass, together with that of the gas it contains, is 2 tons. At what rate of acceleration will it begin to ascend, if the mass of a cubic foot of air be 1.24 oz.?

10. What is the index of refraction of a transparent medium?

What is the position of *minimum deviation* for a prism? Describe and explain the appearance presented when the image of a window is looked at through a pris... with its edge vertical.

11. Given the focal length of a lens, show how, by a geometrical construction, to find the position and magnitude of the image of an object whose distance from the lens is given.

An object whose length is 2 inches is placed 6 inches in front of a convex lens whose focal length is 4 inches. What is the length of the image?

12. Distinguish between a real image and a virtual image. Explain the action of a convex lens when used as a magnifying glass. Is the image seen by the eye real or virtual?

How would you determine the focal length of a convex lens if sunlight were not available?

PROBLEMS IN ARITHMETIC.

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1. How much change should a man receive who has bought the following articles, and