

Supposing this force to act for 10 seconds on a mass of 8 lbs., which is also exposed to the action of gravity, and is initially at rest, what velocity will be communicated to the mass, the vertical component of the force acting upwards?

5. The arms of a bent lever are at right angles to one another, and their length are in the ratio of 5 to 1. The longer arm is described 45° to the horizon, and carries at its extremity a weight of 10 lbs. The end of the shorter arm presses against a smooth horizontal plane. Draw a figure, showing the forces in action, and find the pressure between the shorter arm and the plane.

6. What is the centre of gravity of a body?

A uniform plate of metal 10 inches square has a hole 3 inches square cut out of it, the centre of the hole being $2\frac{1}{2}$ inches distant from the centre of the plate. Find the position of the centre of gravity of the plate.

7. A body is in equilibrium under the action of three forces whose directions are not parallel. State fully the conditions which must be fulfilled.

A heavy uniform ladder rests with its upper end pressing against a smooth vertical wall; show by a figure how to determine the direction of the resultant force acting upon the foot of the ladder.

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8. What is meant by the specific gravity of a substance?

A body floats with one-tenth of its volume above the surface of pure water. What fraction of its volume would project above the surface if it were floating in liquid of specific gravity 1.25?

9. Explain the principle of action of the common pump. How may it be converted into a lift pump? A lift pump is employed to raise water through a vertical height of 200 feet. If the area of the piston be 100 square inches, and a cubic foot of water contain $62\frac{1}{2}$ lbs., what force (in addition to its own weight) will be required to lift the piston?

10. Describe the common air-pump.

In the process of exhausting a certain

receiver, after ten strokes of the pump, the mercury in the gauge stands at 20 inches, the barometer standing at 30 inches. At what height will the mercury in the gauge stand after twenty more strokes?

11. A beaker of water, with a wooden sphere floating on it, is placed under the receiver of an air-pump: explain how the sphere will be affected on exhausting the air from the receiver.

If the density of water be 800 times that of air at ordinary pressure, state precisely what will happen supposing the sphere originally to have been immersed to the depth of its centre.

12. Show how to find the position and size of the virtual image of a given object formed by a concave lens of known focal length.

A concave lens, whose focal length is 12 inches, is placed on the axis of a concave mirror of 12 inches radius at a distance of 6 inches from the mirror. An object is so placed that light from it passes through the lens, is reflected from the mirror, again passes through the lens, and forms an inverted image coincident with the object itself. Where must the object be placed?

13. What is meant by the statement that the index of refraction of water is $\frac{4}{3}$?

Walking by the side of a shallow stream of clear water of uniform depth, the gravel bottom appeared to possess a wave motion, the trough of the wave being always vertically beneath the observer. Explain this by means of a diagram.

14. Distinguish between the absolute and the apparent expansion of mercury contained in a thermometer.

The co-efficient of absolute (cubic) expansion of mercury is .00018, the co-efficient of linear expansion of glass is .000008. Mercury is placed in a graduated glass tube, and occupies 100 divisions of the tube. Through how many degrees must the temperature be raised to cause the mercury to occupy 101 divisions?

15. What is meant by the statement that the latent heat of steam is 537?