8.—What force would be necessary to separate the same hemispheres at sea-level if only one-fourth of the air be removed from them?

9.—A stone weighing a kilo rests upon a shelf, and another stone of the same weight is suspended by a string. What effect is produced by the force of gravity acting on each?

10.—If the shelf is removed and the string is cut, what changes in the effects of gravity will occur?

11.—In the experiment with vessel *B*, Fig. 22, why is the rubber pressed in farther the higher the vessel is raised? Is it because the pressure of the air increases as the vessel is raised?

12.—Lay a piece of paper on the smooth surface of a board and let both drop. They reach the ground together; but if separated and dropped simultaneously, the board reaches the ground first. Explain.

13. Raise the piston *t*, Fig. 43, p. 63, to the top of the cylinder *s*, and stop up the tube *u* at its opening into the cylinder. What force must be applied to the piston to pull it to the bottom of the cylinder, the area of the transverse section of the piston being 20^{qcm}? Suppose that the piston, at the beginning, is at the middle of the cylinder, will the force required to keep it in motion be constant? About how great will be the force when it reaches the bottom of the barrel? Suppose the force at that point is withdrawn, what will happen? Suppose the apparatus to be inverted, and a person were to blow with a force of 10g, the area of the cross section to the bore of the tube being 1^{qcm}, what weight placed upon the piston might be sustained? If, while thus inverted, the free extremity of the tube is raised 2^{m} above the lower extremity of the piston, and water is poured into the tube until it is filled, what weight placed upon the piston will be sustained by the water? What name would the apparatus receive in the last case? Suppose that a plug, just fitting the interior of the tube, were forced into the tube pressing against the water, what would the apparatus become?

14.—The diameter of the mouth of an air pump receiver is 20^{cm}. Three-fourths of the air has been removed from the receiver. The receiver weighs 1.5^{k}. What force will be required to raise it from the pump-plate?

15.—A person is on the deck of a vessel which is moving due east at the rate of one mile an hour; at what rate must he walk due south-west in order that his resultant motion may be due south? What will be his southerly velocity? (Solve by constructing a diagram).

16.—A steamship is moving due north at the rate of 10 miles an hour; the tide carries it due north-east at the rate of 2 miles an hour, while the wind carries it due north-west at the rate of four miles an hour. What is its actual course and velocity?

17.—If two boats just alike are connected by a rope, and two men, one in each boat, pull at the rope, at what point between them will they meet? At what point if only one man pulls? Why?

18.—State three causes for the variation of gravity on the earth's surface.

19.—Can you move without the aid of some other body?