

nodes and loops in (a) a vibrating string, (b) a vibrating column of air?

7. Explain, with diagrams, how you would determine whether a mirror which you cannot touch, but in which you can see objects reflected, be plane, concave, or convex.

8. Make drawings to show the action of a convex lens when used (a) as a simple microscope, (b) for projection purposes.

9. What is a spectrum? What apparatus do you require, and how would you arrange it, to produce a pure spectrum from a gas flame? Make a diagram showing the path of the rays.

FORM IV.

1. (a) Show how to find, graphically or otherwise, the resultant of a number of forces acting at a point.

(b) Two forces, acting at right angles on a particle, are balanced by a third force making an angle of 120° with one of them. The greater of the two forces being 4 pds., what must be the values of the others?

2. A stone, *A*, is thrown vertically upwards from a high bridge with a velocity of 96 feet per second; find how high it will rise. After 4 seconds from the projection of *A* another stone, *B*, is let fall from the same point. How many seconds will elapse before *A* overtakes *B*?

3. Water is poured into a U tube, the limbs of which are 12 inches long, until they are half full. Oil (Sp. Gr. = 0.9) is then poured into one of the limbs to a depth of 4 inches. As much alcohol (Sp. Gr. = 0.8) as possible is then poured on top of the oil. What length of the tube will the alcohol occupy?

4. A piece of iron (Sp. Gr. = 7.2) is

covered with wax (Sp. Gr. = 0.96) and the whole just floats in water, the weight of the combined mass being 36 grams. Find the weight of the iron and the wax respectively.

5. Describe two methods of finding the resistance of a copper wire, explaining the principle of the measuring instrument used in each case.

6. (a) Describe any simple voltaic cell, explaining the formation of that which is called the *current*.

(b) Describe a series of experiments which show that the E. M. F. of a cell does not depend upon the dimensions of the cell but upon the materials used in its construction.

7. (a) Explain the acoustical phenomenon of *interference*.

(b) How would you exhibit this phenomenon by means of an ordinary tuning fork?

(c) Describe fully another method of exhibiting *interference*.

8. (a) Describe how the air vibrates in an open and in a closed organ pipe.

(b) An open organ pipe, 2 feet in length, when excited, emits the note C_1 of the diatonic scale. Find the length of a closed organ pipe which will emit the note G_1 of the same scale.

9. If the index of refraction for a ray of light passing from air to glass is $\frac{3}{2}$ and from air to water $\frac{4}{3}$, show graphically that the index of refraction for a ray passing from *glass* to *water* is $\frac{3}{4}$.

10. A convex lens of focal length f is placed at a distance $4f$ in front of a concave mirror of radius f , and an object is placed half-way between the two. Make a diagram to show the positions of the images formed by refraction through the lens (a) direct-