The University of the State of New York

EXAMINATION FOR QUALIFYING CERTIFICATES

SOLID GEOMETRY

Monday, September 9, 1918—1.15 to 4.15 p. m., only

Answer eight questions. Papers entitled to less than 75 credits will not be accepted.

1 Prove that the perpendicular is the shortest line that can be drawn from a point to a plane.

2 Prove that the locus of points within a dihedral angle and equally distant from its faces is the plane bisecting that angle.

3 Prove that the lateral area of a prism is equal to the product of a lateral edge and the perimeter of a right section of the prism.

4 Prove that the volume of a triangular pyramid is equal to one third of the product of its base and its altitude.

5 The total surface of a right cylinder is S and the altitude is equal to the diameter of its base; find the volume of the cylinder in terms of S.

6 Prove that a line parallel to each of two intersecting planes is parallel to their intersection.

7 A hollow sphere 8″ in diameter and 1½″ thick is melted and cast into a cylinder 3″ in diameter; find the height of the cylinder.

8 Water flows at the rate of 4.76 feet per second through a cylindric pipe 12″ in diameter; find the rate in gallons per minute if the pipe runs full.

9 A cast iron dumb-bell consists of two spheres, each 3″ in diameter, joined by a cylindric bar 1″ in diameter; the centers of the spheres are 7″ apart. Find the weight of the dumb-bell if 1 cubic inch weighs .26 pounds.

10 Prove that every section of a prism made by a plane parallel to a lateral edge is a parallelogram.

9 A house is 30 feet square and 25 feet high; its roof has the form of a square pyramid 10 feet high. Find the entire surface and the volume of the house.

10 A sphere is inscribed in a right circular cylinder. Prove that (*a*) the total areas of the two solids have the ratio 2 : 3, (*b*) the volumes of the two solids have the ratio 2 : 3. [Theorem due to Archimedes.]

11 A hexagonal nut has the form of a regular hexagonal prism throughout which a cylindric hole is bored from base to base. If the base edge is b and the height h, find the formula for the volume of the nut when the diameter of the hole equals the base edge.

12 A right triangle whose legs are 6 inches and 8 inches in length revolves about the hypotenuse as an axis. Find the area and the volume of the resulting solid.