8. A bicyclist accomplished a journey in a hours. In returning he travelled n miles an hour faster, and finished the journey in b hours. What was the distance?

9. A farmer sold wheat and oats each to the value of £35, the price of the wheat a bushel being twice that of the oats. If he had sold 100 bushels more of wheat and 100 bushels less of oats he would have received altogether £8 15s. more. Find the quantities sold and the prices obtained.

Euclid.—For Class D, and for Junior Civil Service. Time allowed: 3 hours.

1. Give Euclid's definition of a point and of a line, and explain them. Define the terms *angle, right angle, circle, scalene triangle, isosceles triangle, rhombus, parallel straight lines, parallelogram, trapezium, gnomon.*

2. If two triangles have three sides of the one equal to three sides of the other the triangles are equal in every respect.

3. The angles that one straight line makes with another straight line, on one side of it, are either two right angles, or are together equal to two right angles.

The bisectors of adjacent angles are at right angles.

4. The greater angle of every triangle is opposite to the greater side.

Find a point in a given straight line the difference of the distances of which from two given points on the same side of the line is the greatest possible.

5. Triangles on the same base and between the same parallels are equal.

Bisect a triangle by a straight line drawn through a given point in one of the sides.

6. If a straight line be divided into any two parts, the square on the whole line is equal to the squares on the two parts, together with twice the rectangle contained by the parts.

7. In a triangle the square on the side subtending an acute angle is less than the squares on the sides containing that angle by twice the rectangle contained by either of these sides, and the straight line intercepted between the perpendicular let fall upon it from the opposite angle and the acute angle.

8. A, B, C, D are four pegs in the ground. A fifth peg, P, is tied by ropes to A, B, C, and D. Find where P should be placed so as to use as little rope as possible.

Euclid (Books I.–IV.).—For Senior Civil Service. Time allowed: 3 hours.

1. Explain the terms *postulate, hypothesis, corollary, converse proposition, gnomon, locus.*

2. If two angles of a triangle are equal to one another, the sides also which subtend the equal angles shall be equal to one another.

If the straight lines BO, CO be drawn, making equal angles with the base BC of an isosceles triangle ABC, show that the line AO, which joins the intersection of these lines with the vertex of the triangle, bisects the vertical angle.

3. Equal triangles on the same base, and the same side of it, are between the same parallels.

In a quadrilateral figure ABCD the diagonals AC, BD make equal angles with DC, and the angle DAC is equal to the angle CBD: show that the sides AB and DC are parallel.

4. In any triangle the square on a side opposite to an acute angle is less than the sum of the squares on the sides containing the acute angle by twice the rectangle contained by one of the latter lines and the projection of the other upon it.

5. Show how to divide a given straight line into two parts so that the rectangle contained by the two parts may be equal to a given square. Is there any solution of this problem possible when the side of the given square is greater than half the given line?

6. To draw a straight line from a given point, either without or in the circumference, which shall touch a given circle.

What is the *locus* of the extremities of equal tangents to a given circle?

7. If two straight lines cut one another within a circle, the rectangle contained by the segments of one of them is equal to the rectangle contained by the segments of the other.

Conversely, If two straight lines cut one another so that the rectangle contained by the segments of one of them is equal to the rectangle contained by the segments of the other, their four extremities will lie in the circumference of a circle.

8. If a circle roll within another of twice its diameter, any point in the circumference of the former will trace out a diameter of the latter.

9. About a given circle to circumscribe a triangle equiangular to a given triangle.

Show that the radius of the circle circumscribing an equilateral triangle is double of the radius of the circle inscribed in the same triangle.

Mechanics.—For Class D, and for Senior and Junior Civil Service. Time allowed: 3 hours.

1. If g denote the acceleration of gravity, explain precisely what you mean when you write $g = 32$. Describe a method of proving experimentally that the acceleration of gravity is sensibly uniform.

A stone is projected vertically upwards with a velocity of 160 ft. per second: find the height to which it will rise.

2. State Newton's *Second Law of Motion.* Explain what is meant by the phrases "change of motion" and "impressed force" as used in this law. Show how the law leads to the definition of an absolute unit of force.