Class D.—Algebra (Optional).
Time allowed: Three hours.

1. From the number which, when multiplied by itself, gives the sum of the numbers three times a and twice b, is subtracted the quotient obtained by dividing the number a by the number b, and the remainder is multiplied by itself: write down the algebraical expression for the result, and find its value when $a = 5\frac{1}{3}$ and $b = 4\cdot5$.

   Explain the meaning of $\dfrac{3a^2}{b} - \sqrt{\dfrac{b}{a}}$.

2. From $[1 - (2a + bx - bc + d)x]a^2$ take $(abc - a^2c)ax + 2a(a + d)$.

3. If $s = \frac{1}{2}(a + b + c)$, prove that
   $$\tfrac{1}{2}(b + c - a) \times \tfrac{1}{2}(c + a - b) \times \tfrac{1}{2}(a + b - c) = s^3 - (a + b + c)s^2 + (ab + ac + bc)s - abc.$$

4. Divide $x^6 + (a^2 - 2b^2)x^4 - (a^4 - b^4)x^2 - a^6 - 2a^4b^2 - a^2b^4$ by $x^2 - a^2 - b^2$.

5. Simplify—
   $$3a + 2b - \left\{ -2c - 4[a + b - 2(a - b + c)] - 2a \right\};$$
   $$\frac{7a - 5b}{2} - \tfrac{1}{3}\left\{ 2a - 3b - \left[\frac{a + b - c}{2} - \tfrac{1}{3}(a + 2c)\right] + c \right\}.$$

6. Simplify—
   $$\frac{a(xy - z)}{xy + z} - \frac{a(xy + z)}{xy - z};$$
   $$\left(\frac{6ab}{5c} + \frac{b^2}{4ac}\right) \times \frac{10a^2c}{48a^2b + 10b^2};$$
   $$\frac{a}{4a + 4} - \frac{2a}{a + 2} + \frac{9a}{4(a + 3)} - \frac{a - 1}{(a + 2)(a + 3)}.$$

7. Solve the equations—
   $$\frac{a - b}{x - c} = \frac{a + b}{x + 2c};$$
   $$\frac{2x + 1}{29} - \frac{402 - 3x}{12} = 9 - \frac{471 - 6x}{2}.$$

8. On a certain journey I find that, if I travel 5 hours at the rate of x miles an hour, I fall short of my destination by y miles; but if I travel 3 hours at y miles an hour, I go x miles beyond the place: find the relation between x and y.

Class D.—Euclid (Optional).
Time allowed: Three hours.

1. Define *parallel straight lines*, and a *parallelogram*. What is a parallelogram called when its angles are right angles? Quote the axiom on which Euclid has based his treatment of parallel straight lines.

2. To bisect a given rectilineal angle, that is, to divide it into two equal angles.
   Explain why, in the construction of the figure, the equilateral triangle is to be described with its vertex turned away from the given angle.

3. If two triangles have two sides of the one equal to two sides of the other, each to each, but the angle contained by the two sides of one of them greater than the angle contained by the two sides equal to them of the other, the base of that which has the greater angle shall be greater than the base of the other.
   Prove that, if a line be drawn bisecting another line at right angles, any point situated in the former line is equidistant from the extremities of the latter, and any point not situated in the former line is at unequal distances from the extremities of the latter.

4. All the interior angles of any rectilineal figure, together with four right angles, are equal to twice as many right angles as the figure has sides.
   By how much does one of the interior angles of a regular octagon exceed an interior angle of a regular hexagon?

5. To describe a parallelogram that shall be equal to a given triangle, and have one of its angles equal to a given rectilineal angle.

6. If a straight line be divided into any two parts, the square of the whole line is equal to the squares of the two parts together with twice the rectangle contained by the parts.
   In a right-angled triangle, if a perpendicular be dropped from the right angle on the hypothenuse, prove that the square on this perpendicular is equal to the rectangle contained by the segments of the hypothenuse.

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

Class D.—Chemistry (Optional).
Time allowed: Three hours.

1. Write down three equations to show how oxygen is made.

2. Explain how water may be formed from its elements. How much of each of its constituent elements is there contained in 100 grammes of water?

3. Write down the names and symbols of the oxides of nitrogen. In what respects does atmospheric air differ from these?

4. State what you know of chlorine under the following heads: (1) Its source, (2) its manufacture, (3) its properties, (4) its uses or applications.