2. Describe any experiments that will serve to demonstrate (*a*) that oxygen is given off, (*b*) that carbonic acid is absorbed, and (*c*) that starch is formed, under certain conditions. State what these conditions are.

3. By what means and from what causes does a green plant obtain the nitrogen, hydrogen, sulphur, and phosphorus necessary for its nutrition? Describe carefully the course taken by the fluid circulating in a plant, and the general character of the fluid in various parts of its course.

4. Write a brief essay on the dispersion of seeds.

5. Give an account of the methods by which you would study the general anatomy of a bean plant (or any other flowering plant), including, of course, the flower and seed.

6. Enumerate the characters of the order *Coniferae*, and briefly describe three representatives of the order native to New Zealand.

Botany.—For Civil Service Senior. Time allowed: Three hours.

[Illustrate your answers by means of careful and fully labelled diagrams.]

1. What are the chemical elements necessary for the life of any plant?

From what chemical substances are the essential food constituents obtained by *Haematococcus*, yeast, and *Bacterium* respectively?

2. Write an account of the life history of a liverwort. Point out the corresponding phases in the life of a fern and of a pine.

3. Write a detailed description of *Haematococcus* and of a cell of *Spirogyra*. State where you would find analogous cells in a flowering plant. Describe one such cell, and give an account of its physiology in relation to the entire plant.

4. Describe carefully, with the use of such technical terms as may be necessary, the flower of a typical orchid, and show how it differs from that of a lily.

[N.B.—Do not merely quote the characters of the two orders.]

5. Mention as many genera as you can of the native New Zealand representatives of the following orders: *Myrtaceae*, *Leguminosae*, *Scrophulariaceae*, and *Compositae*. Give the characters of these orders, and point out any peculiarities presented by the native genera.

6. Given a leaf and a piece of the stem of a plant, describe in detail the processes by which you would examine their internal structure. How would you demonstrate the presence of cellulose, lignin, starch, and albuminoids?

Biology.—For Class D. Time allowed: Three hours.

[A candidate may not answer questions from both sections of the paper. All answers should be illustrated, where possible, by fully labelled diagrams.]

A. Animal Physiology.

1. In what important respects does an animal differ from a plant?

2. Write an account of the lungs of man or some other mammal. Describe their position in the body, say how they are filled and emptied, and explain their functions.

3. Write a description of the form, structure, and disposition of any muscle concerned in the movement of arm or leg. What causes it to contract?

4. A meal consists of a fat mutton chop, potatoes, broad-beans, rice pudding, milk, bread, and cheese. Refer these to their proper categories as "food stuffs" in a chemical and in a physiological sense, and trace the changes that each undergoes in its passage along the alimentary canal.

5. Give an account of the eye. State briefly the functions of its various parts.

6. Describe the elbow joint, the hip joint, or the knee joint.

B. Botany.

1. What is chlorophyll? Where and in what form does it occur in a flowering plant? State the function of chlorophyll, and give a careful drawing of a cell containing it.

2. Describe, with a careful and fully labelled drawing, a transverse section across the stem of (*a*) an annual plant, (*b*) a perennial plant. Give detailed drawings of the chief tissue-cells met with in such a section.

3. Give an account of the method of nutrition in a green plant. Describe an experiment which will serve to demonstrate the evolution of oxygen in sunlight.

4. What changes occur in the various parts of a flower as a result of the fertilisation of the ovule? (Take any of the *Rosaceae* as an example.)

5. How would you demonstrate to a class of students the germination of a seed, such as the bean? Describe the series of events observable to the naked eye.

6. Enumerate the general characters of the orders *Leguminosae* or *Ranunculaceae*, and describe three native representatives of each.

Elementary Physiology.—For Civil Service Junior. Time allowed: Three hours.

[Illustrate your answers wherever possible by diagrams.]

1. Briefly describe the structures that form the hip joint.

2. How can you distinguish between veins and arteries? Briefly describe the structure of each.

3. What is the diaphragm? Where is it situated, and what is its function?

4. Explain how you would dissect the eye of a sheep so as to show as much as possible of its structure.