

*Elementary Experimental Science.—For Class D. Time allowed: Three hours.*

1. How do you explain the fact that only a small horizontal force is required to prevent a heavy sphere from rolling down a gently inclined plane?
2. A piece of cork weighed in air 15 grams; in water, with a sinker attached, it weighed apparently nothing; the weight of the sinker alone in water was 5 grams. What was the specific gravity of the cork?
3. What is meant by a sound wave? Explain the terms amplitude, length, and phase, as applied to sound waves.
4. Define the terms principal focus and principal axis of a lens. An object is placed in the principal axis of a double convex lens at twice the focal distance from the lens. Show by a diagram the position of the image. Will the image be real or virtual?
5. Describe any simple experiment which you would show in order to demonstrate the great latent heat of vaporization of water.
6. A current from a battery is passed in succession through (a) a vertical coil of wire in the centre of which a magnetic needle is suspended, (b) a coil of wire surrounding a soft iron bar, (c) a coil of wire wrapped round the bulb of a thermometer, (d) a dilute solution of copper sulphate. Explain the effect produced in each case, and point out which of the observed phenomena are made use of for measuring the strength of electrical currents.
7. By what simple tests could you distinguish between (a) chlorine and hydrochloric acid, (b) the dioxides of sulphur and of carbon, (c) nitric and sulphuric acids?
8. Indicate by a sketch the position and shape of the lungs, liver, and kidneys in the human body. What do you believe to be the special functions of each of these organs?

*Botany.—For Civil Service Junior. Time allowed: Three hours.*

[N.B.—Illustrate your answers, wherever possible, by fully lettered diagrams.]

1. Describe the essential characters of a vegetable cell; and write an account of protoplasm.
2. From what sources, and by what organs, does a green plant obtain the chemical substances necessary for its nourishment? What are these substances?
3. Draw diagrams—fully lettered—of longitudinal and transverse sections through any flower you are familiar with. Explain briefly the functions of the various parts.
4. What do you understand by a "seed"? Of what parts does it consist, and how is it formed? Describe, so far as observation by the naked eye enables you to do, the series of events that occur after a seed is sown in a suitable medium.
5. Give some account of the various kinds of fruit met with in the *Rosaceae*. What purpose is served by succulence and by bright colours in fruits?
6. Enumerate the characters of the order *Compositae*. Mention and describe briefly some representatives of this order native to New Zealand.

*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 diagrams.]

ANIMAL PHYSIOLOGY.

1. Give a description of the vertebral column.
2. Describe the mechanism of the process of respiration, and the chemical changes it brings about.
3. How many teeth has a grown-up man, and what differences do they present?
4. What is the general composition of the principal food-stuffs? Explain why a mixed diet is the best for man.
5. Give a description of the heart and its valves.
6. What are the effects of drinking water containing mineral and organic impurities? By what means may water be freed from these two kinds of impurities?
7. Describe the sympathetic nerve system, and state its functions.
8. Give an account of the papillae of the tongue, and say what influence the sense of smell has on that of taste.

BOTANY.

1. What are the substances on which an ordinary green plant feeds, and how does the plant obtain them?
2. Describe the process of capturing insects by some insectivorous plant, and explain how the capture benefits the plant.
3. What is meant by floral diagrams? Give three examples.
4. Describe the difference in structure and in function between roots and underground stems.
5. Mention three different modifications of leaves, and explain their uses.
6. Describe the germination of the seed of a dicotyledonous plant, such as the bean.
7. What is meant by geotropism and by heliotropism? Give examples.
8. Give the characters of the flowers and fruit in the following orders: *Leguminosae*, *Geraniaceae*, *Iridaceae*, and *Cruciferae*.