2. When steam is passed over red-hot iron, hydrogen is evolved; when hydrogen is passed over red-hot iron oxide, steam and metallic iron result: explain this apparently contradictory behaviour, and mention other reactions to which your explanation is also applicable.

3. Give a short account of the allotropic forms of sulphur and of phosphorus. What do you understand by the statement that prismatic and octahedral sulphur are in equilibrium at 96° C.?

4. How can the percentage of oxygen, water, and carbon dioxide in the air be accurately ascertained? What experimental difficulties attend the determination of the carbon dioxide?

5. What is the action of hot strong sulphuric acid upon each of the following substances: Charcoal, copper, alcohol, potassium iodide, and sulphuretted hydrogen? Indicate in each case the equation expressing the probable reaction.

6. Two grams of the ammonium salt of a monobasic acid were distilled with excess of caustic-soda solution, and the gas evolved neutralised 25 grams of five-per-cent. sulphuric acid: calculate the percentage of ammonia in the salt, and the molecular weight of the monobasic acid.

7. Show, by a comparison of the two elements and of their more important compounds, that magnesium is intimately related on the one hand to calcium, and on the other to zinc.

8. Demonstrate, by reference to the compounds of mercury and of iron, that the reactions of the salts of a metal are influenced not only by the nature of the metal and of the acid radicle, but also by the state of oxidation in which the metal exists.

No. 51.—Elementary Geology.—For Class D.

Time allowed: Three hours.

1. It is often stated that the interior of the earth differs in important physical and chemical respects from its exterior: state any facts that support this belief.

2. If you were given a rock specimen, how would you satisfy yourself that it belonged to the igneous, to the sedimentary, or to the metamorphic class?

3. By what characters is pyrites or mundic distinguished from other minerals? What is its chemical composition? State what you know of its general occurrence and of its occurrence in New Zealand.

4. Pumice is said to cover one-twenty-fifth part of the surface of New Zealand: state what you know of the composition and origin of pumice and of its distribution in New Zealand.

5. In what parts of New Zealand are artesian wells used? On what conditions does their existence depend? What reasons are there to expect that the flow of the water from them will decrease or that it will be permanent?

6. Describe the general arrangement of strata deposited near the mouth of a river off a low-lying coast undergoing gradual submergence.

7. What are the general differences between the coals mined on the east and on the west coasts of New Zealand? Account for these differences.

8. How are river valleys formed? Give any examples that you can from New Zealand.

No. 52.—Geology.—For Class C and for Civil Service Senior.

Time allowed: Three hours.

1. Mention and discuss the facts that have been quoted in support of the belief that the mineralogical and chemical composition of the earth's crust is different from that of its interior.

2. Upon what principles is the chronological classification of the rocks of the earth's crust based?

3. A land-surface consists of a central axis of Palæozoic rocks much folded and denuded. The rocks are slates and grits, and their strike is parallel to the axis. Round the flanks and in some of the larger valleys middle Tertiary limestones lie almost horizontally. The rivers have transverse valleys with broad shingle beds, and run indifferently over the Tertiary and Palæozoic rocks. Trace the geological history of the area.

4. Black ironsand fringes much of the west coast of New Zealand: of what minerals does it consist? From what rocks have they been derived? Account for its present distribution.

5. Classify and describe the formations in which payable auriferous deposits are found in New Zealand.

6. The New Plymouth "Sugarloaf" is composed of a light-coloured rock containing black crystals with bright cleavage-surfaces inclined 56° and 124°; also colourless crystals with bright cleavage-surfaces apparently inclined 90°, some showing simple and others polysynthetic twinning. These crystals are imbedded in a fine-grained ground-mass. What are the minerals and the rock they compose? Give reasons for your answers.

7. State any facts in connection with the New Zealand fauna and flora that tend to show that New Zealand was formerly connected with other lands.

No. 53.—Elementary Botany.—For Civil Service Junior.

Time allowed: Three hours. [*Illustrate your answers with careful and fully labelled diagrams.*]

1. Suppose that you have a healthy green plant completely submerged in water and exposed to sunlight—

(*a.*) State what phenomenon will be observed.

(*b.*) Explain carefully what is taking place in the plant.

(*c.*) By what steps do you arrive at your conclusions?

2. Describe the life-history of a fern.