NATURAL SCIENCES TRIPOS.

March 6, 1860.

GEOLOGY.

1. How have the following conclusions been made probable by direct experiments or by fair inductive reasoning? (1) That there is a very high temperature in the lower regions of the Earth. (2) That the solid crust of the Earth is of great thickness.

2. Rocks are divided into aqueous and igneous. Point out the leading facts in their structure, and in their position among contiguous formations, by which the two classes of rocks may generally be distinguished.

3. Stratified Rocks are divided into Primary or Palæozoic, Secondary or Mesozoic, Tertiary or Neozoic. Explain these terms, and enumerate one or two of the Genera or Species of Fossils by help of which, in each case, one of the three divisions may be separated from the other two.

4. Enumerate the formations, or subordinate groups, into which the Tertiary Rocks of Britain, (from the oldest Eocene to the newest Pleistocene) have been divided. Point out one or two Fossils characteristic of each group, and the climatal conditions under which each group appears to have been deposited.

5. Enumerate in like manner the great successive formations or collective groups, into which the whole Palæozoic Series has been divided. Mention one or two of the Fossils characteristic of each. Point out, by help of actual sections, the evidence for the succession; and especially notice the places where the sections are broken, and the places where there is a sudden change in the groups of characteristic Fossils.

6. Enumerate some of the most remarkable Granitic Rocks found in England. Shew by the direct evidence of sections, that, as a general rule, they are not metamorphic but eruptive rocks. Describe some important recent observations upon the internal structure of the component crystals of Granitic Rocks, which seem to indicate the temperature under which they became solid.

7. Explain, and indicate by examples, what is meant by the *linear arrangement* of the great volcanic vents on the surface of the Earth. Give some of the facts, from Humboldt and other writers, which prove a sympathetic volcanic action through very extensive geographical regions.

8. Enumerate some of the chief mineral distinctions between the rocks in modern lava-streams, and the basaltic or porphyritic formations which are found interlaced with the rocks of the Palæozoic and Mesozoic divisions.

9. Describe the chief discoveries respecting the geology of the Arctic Islands, made by the great navigators (from Parry to MacClintock) who have gone in search of the "North-West Passage."

10. What changes do these discoveries indicate in the Arctic climate? Can the changes be satisfactorily explained by any of the known causes which now modify the superficial temperature of the Earth? Give the four theories which have been offered in explanation of the phenomena, and your reasons for the acceptance or rejection of any one of them.

11. Explain what has been understood by the theory of Development and Transmutation. Give a short synopsis of Darwin's published views on this theory, pointing out how far they are to be regarded as inductive, and how far as hypothetical.

12. Endeavour to test Darwin's theory by answering the following questions:

(1) Is there any proof that the large Cephalopods of the Palæozoic rocks were gradually driven out of the old Fauna by the incursion of more highly organized and more powerful animals of a kindred organization and function?

(2) Is there any proof, based on known geological facts, that the strongest and most highly organized Palæozoic Fishes disappeared from the old Fauna through any like cause?

(3) Are the Reptiles, that have been discovered among the Palæozoic Rocks, of a low organic type? Is there any proof that the highly organized and powerful Reptiles of the Secondary period were driven out of the Fauna by any process of development and "Natural Selection"?

(4) Is there any proof that the large extinct Mammals of South America and New Holland became, by any conceivable process of "Natural Selection," the progenitors of the existing Edentata and Marsupialia of those countries?

(5) Is there a shadow of proof, from the ethnographical and physical history of Man, that any one of his oldest varieties was derived from a Quadrumanous progenitor?

(6) Is there any *physical indication* of an enormous interval of geological time between the appearance of the Permian Fauna and that of the Muschel Kalk, or between the Fauna of the Muschel Kalk and that of the Lias?

(7) Is there any proof, derived from the records of Natural History, that Time has in itself, and independently of varying conditions, a tendency to change an existing Fauna?

13. Contrast the principles adopted by Cuvier and Owen in their classification of Mammals.

Point out the differences in their determination of the Mammal Orders, and in their arrangement of the following Species: viz. Dog, Horse, Sheep, Duck-Mole, Elephant, Bat, Rat, Sloth, Hare, Kangaroo.

14. Enumerate and define the subdivisions of Cephalopoda, the families of Tetrabranchiata, and the principal forms of the Genera. Name such of the Genera as are characteristic of geological periods.

15. State the arrangement and functions of the muscles of a Brachiopod. Can this arrangement be traced in the Terebratula biplicata? Distinguish Terebratula from Rhynchonella, and the latter from Terebratulina.

16. Explain, by help of sections, the successive formations (from the Chalk to the Oxford Clay) which appear within twenty miles of Cambridge. Point out the faults and peculiarities of the several sections. Shew that they are compatible with the existence of Artesian wells in the vicinity of Cambridge, indicating the stratum from which the water may be derived.

17. Describe the composition of the dark nodules in the Upper Green Sand of Cambridge, and the process by which they are made of great value in agriculture. Enumerate some of the most remarkable remains of Reptiles and Cephalopods which have been discovered in the excavations recently made among these deposits.

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