OXFORD CAMBRIDGE AND RSA EXAMINATIONS

LEVEL 2

R072/02/I

CAMBRIDGE NATIONAL IN SCIENCE

How scientific ideas have developed

INSERT

WEDNESDAY 6 JANUARY 2016: Morning

DURATION: 1 hour
plus your additional time allowance

MODIFIED ENLARGED 24pt

INSTRUCTIONS TO CANDIDATES

This Insert contains the case study required to answer Question 1. Question 1 accounts for 25% of the total marks.

INFORMATION FOR CANDIDATES

Any blank pages are indicated.

INSTRUCTION TO EXAMS OFFICER/ INVIGILATOR

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THE ORGANISATION MAN

CARL LINNAEUS (1707–1778) was interested in plants and became a great botanist. He sorted all the species of plants and animals known in his day in a systematic and organised way. The simplicity and logic of his classification system (his taxonomy) made natural history accessible to amateurs, perhaps starting the Victorian passion for nature.

Before Linnaeus, taxonomy was uncoordinated. Even the commonest species had complex names. The tomato plant, for example, was called *Solanum caule inermi herbaceo, foliis pinnatis incises*. This means 'the solanum with the smooth stem which is herbaceous and has incised pinnate leaves'.

Linnaeus knew nothing of DNA or other modern developments. He lived in Sweden and he decided to apply the social hierarchy of his day, with kingdoms, counties, towns and villages, to the natural world. He slotted plants and animals into a framework of categories, as shown in FIG. 1.

FIG. 1

LINNAEUS' CLASSIFICATION

FIG. 2

He decided to call each living thing by just two Latin names, representing GENUS and SPECIES. This innovation was known as binomial nomenclature. It has proved to be Linnaeus' greatest gift to science. Any time *Homo sapiens* (human being) mention *Felis domestica* (house cat) or *Lycopersicon esculentum* (tomato plant), Linnaeus' naming system is being used. From the many competing ways to name species, he made a single, universal scientific language.

Linnaeus liked to say, "God created, but Linnaeus organised." In 1735 he published an 11-page booklet called '*Systema naturae*'. This split the world into three Kingdoms: animals, plants and minerals. He kept adding to his booklet throughout his life, and when the 13th edition was published in 1770, it had grown to 3000 pages. His classification system was so easy to use that scientific discoveries became much more common. However, the number of species which have been discovered mean that no one person could ever hope to create such a complete record working alone.

CLASSIFYING PLANTS

Linnaeus had to find categories for the many forms of life. In classifying plants, Linnaeus chose to focus on sexual characteristics. He placed plants into CLASSES according to the number, length and features of their stamens (male parts), and into ORDERS according to their female parts. The approach was not popular. His colleagues objected to his descriptions of plants and some refused to use his system.

CLASSIFYING ANIMALS

For animals, Linnaeus used different features. He grouped mammals according to their teeth, toes and teats; fish by their fin bones; insects by their wings; and birds by their feet and their beaks (FIG. 3).

FIG. 3

NOT TO SCALE

Linnaeus knew that his categories for plants and animals were arbitrary and his classification no more than a rough attempt at finding nature's pattern. Despite their shortcomings, Linnaeus' names for about 12 000 organisms he examined over the course of his life became the starting point for biological classification.

LINNAEUS, LAMARCK AND DARWIN

As Linnaeus travelled, he discovered and named over 100 new species. He wondered if he could cultivate crops from all over the world where he lived in Sweden. Although he lived long before Lamarck, Linnaeus believed that organisms would rapidly become adapted to a new environment and grow successfully.

Ultimately, Linnaeus was mistaken in his view that plants will adapt to grow anywhere. He reluctantly came to accept this after most of his transplants failed. He was also wildly wrong about the number of living species. He thought there might be around 40 000 altogether. Estimates today range from 10 million to 100 million, most of which are microscopic.

When Darwin published his ‘On the Origin of Species’, he stressed the importance of biodiversity. Species could come into being and become extinct as a result of environmental changes. Many years earlier, Linnaeus had written, “I do not know how the world could persist gracefully if but a single animal species were to vanish from it.”

CLADISTICS

How much longer will the Linnaean classification system last? Some taxonomists believe its structure is not flexible enough. They want to abolish the strict hierarchy of family, order, class, etc. In its place they use ‘clades’. A clade is the group of organisms which have evolved from a common ancestor. These are groups based on genetic relationships. Clades can be expanded, contracted or redefined as new relationships are discovered.

FIG. 4

A VERTEBRATE CLADOGRAM

NOT TO SCALE

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