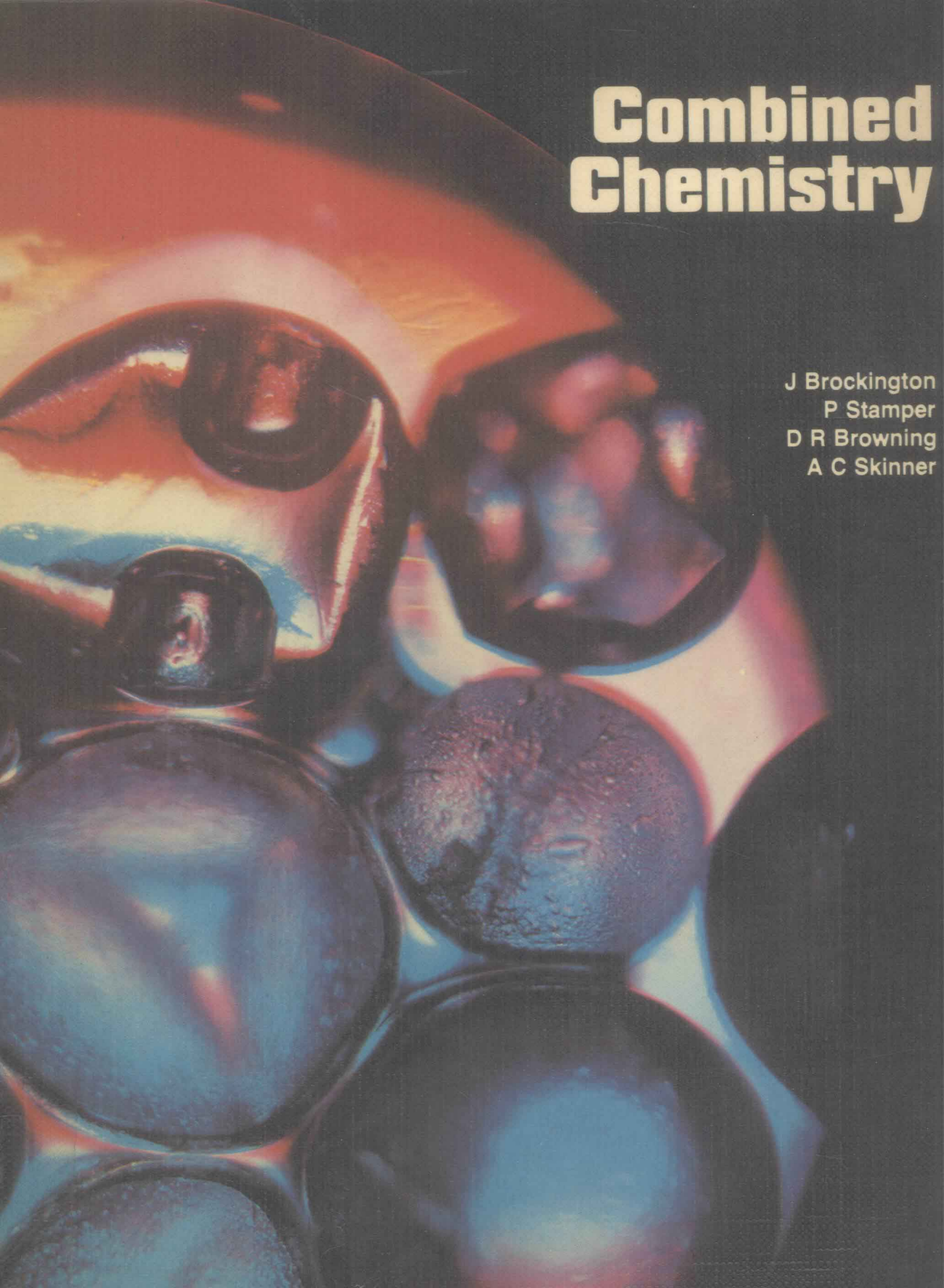

Combined Chemistry

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Safety note

WARNING!

Chemistry can be a hazardous occupation. Practical work must be carried out under the supervision of a teacher, and the instructions carefully followed. Unauthorised experiments should never be performed.

Some chemicals are particularly dangerous. Attention has been drawn to these in Part 2 of the book by means of the following EEC hazard warning symbols.

Toxic

Toxic (poisonous) substances are dangerous by ingestion, inhalation or skin absorption. They present a serious risk of acute or chronic poisoning. Some substances cause immediate acute effects of short duration, which cease on removal from exposure and on treatment. Other substances cause chronic effects which may be cumulative and irreversible and may not be apparent until long after the original exposure.

Toxic substances require to be handled:

(i) under conditions of total enclosure;
(ii) within an enclosure under exhaust ventilation;
(iii) with appropriate protective clothing and respirators.

Oxidising agent

Oxidising substances may give rise to exothermic reactions in contact with organic matter or other easily oxidised chemicals.

Store away from organic materials and reducing agents.

Harmful/ irritant

Harmful substances present a moderate risk of chronic or acute poisoning by ingestion, inhalation or skin contact.

Use under conditions to prevent contact with skin, eyes or clothing or inhalation of dust, fume or vapour.

Irritant substances are liable to cause inflammation of living tissues and irritation of the respiratory system. Prolonged contact may destroy living tissue.

Use under conditions to prevent contact with skin and eyes, and avoid breathing dust, fumes or vapour.

Explosive

Explosive substances are liable to explode when in the dry state or when subject to shock, friction or heat. Often supplied wet and become dangerous on drying.

Corrosive

Corrosive chemicals may cause ulceration, burns or destruction of living tissue.

Protection of skin and eyes is essential.

Most corrosive chemicals will require rapid treatment to prevent serious injury or damage.

Radioactive

Radioactive substances are controlled by regulation and Codes of Practice and these should be strictly observed. Only qualified and trained personnel should be allowed to store, handle or use such products.

Flammable

Flammable substances readily ignite at temperatures above their flash point. (The *flash point* of a substance is the minimum temperature at which the vaporised substance will ignite in air when a spark is applied.)

Ensure that the correct type of fire extinguisher is readily available. Observe regulations governing the storage, handling and use of certain flammable liquids.

Highly flammable substances, with a flash point below 32 °C, are a serious fire hazard and may form explosive mixtures with air.

Eliminate potential ignition sources such as naked lights, heat, sparks (including static charges) and burning cigarettes. Store and use where there is good ventilation and spillages may be contained.

Taken from *Chemical Hazards*, wall chart: Fisons Scientific Apparatus.

Preface

Combined Chemistry is intended primarily for students on GCE 'A' level and similar courses. Combined texts of physical, inorganic and organic chemistry have always been popular at this level, partly for their convenience and partly because they offer good value for money. We trust that these traditional advantages have been retained in this new work, which has been written to meet the requirements of modern syllabuses.

In planning the book we have tried to break away from the rigid division of chemistry into three subject areas. The limitations imposed by established teaching patterns prevent the adoption of a completely integrated treatment – at least for the time being – and we have therefore divided our book into two parts. Part 1, entitled *Principles*, contains physical chemistry together with those topics, such as oxidation–reduction, strengths of acids and bases, etc, sometimes described as physical inorganic or physical organic. Part 2, *Detailed Chemistry*, consists of factual inorganic and organic chemistry, with the organic material in its logical place in group 4B of the periodic table. For ease of reference each chapter has been structured and numbered.

Nomenclature poses a particular problem to anyone studying chemistry at present, and we have devoted Chapter 1 largely to this topic. Throughout the book we have employed SI units in general use; e.g. for density, g cm^{-3} rather than kg m^{-3}. In this we have been guided by J. G. Stark and H. G. Wallace in their excellent *Chemistry Data Book* (John Murray); both the values and the units of chemical constants in this textbook are in agreement with those in the *Chemistry Data Book*. We have quoted temperatures in degrees Celsius with the corresponding values in kelvins in parentheses; likewise pressures are given in atmospheres with the equivalents in kilopascals (1 atmosphere is approximately equal to 100 kPa). This allows for a possible change in educational practice.

At the end of each chapter will be found a selection of recent 'A' level questions, reprinted by kind permission of the examination boards concerned. One of the boards refers directly to the *Chemistry Data Book* in some of its questions, and it will be necessary to use the book when answering these questions.

When referring to chemical compounds we have used IUPAC rather than ASE names, although in the sections on nomenclature we have given both names wherever they differ. In the event of IUPAC allowing a choice between a trivial name (e.g. acetone) and a systematic name (e.g. propanone) we have selected the latter, and where both radicofunctional names (e.g. dimethyl ketone) and substitutive names (e.g. propanone) are permitted we have again taken the latter.

With a new book of this length and complexity it would be immodest if not foolish of us to claim, as did Voltaire's hero Candide, that '*Tout est pour le mieux dans le meilleur des mondes possibles*'. Nevertheless, we hope that our *magnum opus* will be found to be distinctive and stimulating. We thank all those concerned with its production, especially Mandy Keyho at Longman; and we should welcome any constructive criticisms that readers may care to offer.

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May 1980

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Cover photograph by Paul Brierley

Microencapsulation: the technology of sealing measured amounts of chemicals in spherical capsules. Seen under the microscope at the stage where the outer shell dissolves in a liquid phase. Photographed using two sources (red and blue) of transmitted light. Scale: $\times 275$.

Contents

1 Principles