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GCSE

Chemistry

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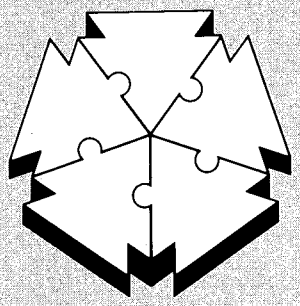

Midland
Examining
Group

GENERAL CERTIFICATE OF SECONDARY EDUCATION

SCIENCE: CHEMISTRY

Syllabus Code 1375

1994

Examination Syllabus

GENERAL INFORMATION

Availability: This syllabus will be examined by the Midland Examining Group (MEG) in the Summer of the year shown on the cover.

Details of the provision of Autumn examinations are given in Part 2 of the MEG Handbook for Centres.

Certification: This subject will be shown on the GCSE certificate as

SCIENCE: CHEMISTRY

Certificates will be issued by the Home Board on behalf of MEG.

Exclusions: In any one examination series, candidates entering for this subject may not in addition enter for any other MEG examination with the same certification title.

Entries: All candidates, including private candidates, must be entered by a Centre registered with MEG.

In order to enter candidates, a Centre must register with one of the MEG Boards (designated its Home Board). The Centre must make its entries for all MEG examinations through that Home Board.

All candidates must meet the full requirements of this syllabus and must therefore have their Course Work/Assessed Practical Work authenticated and assessed by an approved Centre.

Results: Results will be certificated as levels 4 - 10 of the National Curriculum ten level scale.

The relationship between the National Curriculum levels and GCSE grades certificated up to 1993 is shown below:

Grade	Level
A	10 9
B	8
C D E	7 6
F	5
G	4

Enquiries: All enquiries about MEG or its examinations should be made to the Centre's Home Board.

Addresses and telephone numbers of the Boards in MEG are given on the back cover of this syllabus.

Marginal downrules indicate alterations to the previous year's syllabus, where appropriate.

CHEMISTRY

Syllabus Code 1375

AIMS

The aims of the syllabus are:

1 to stimulate students and create and sustain their interest in, and enjoyment of, Chemistry.

2 to provide a body of chemical knowledge appropriate for students

(a) not studying the subject beyond this stage,

(b) continuing further studies in Chemistry,

(c) studying other subjects, at the same or at different levels.

3 to lead to an acquisition of knowledge and understanding of chemical patterns and principles.

4 to encourage students to apply their chemical knowledge and understanding to familiar and unfamiliar situations.

5 (a) to make students aware of the importance to scientific methods of accurate experimental work.

(b) to develop students' abilities to perform experiments, having due regard for safety.

(c) to develop skills of observation and the ability to record and interpret those observations.

(d) to develop the process of hypothesis formation and the design of experiments to test these hypotheses.

6 to develop the abilities to interpret, organise and evaluate data, as part of a problem-solving and decision-making process.

7 to develop the ability to communicate in appropriate ways.

8 to encourage students to appreciate the developing and sometimes transitory nature of chemical knowledge, principles and models.

9 to develop an appreciation of the scientific, social, economic, environmental and technological contributions and applications of Chemistry.

ASSESSMENT OBJECTIVES

The assessment objectives listed below reflect those aspects of the aims which will be assessed.

1 Experimental Work

Candidates should be able to:

1.1 follow instructions for practical work;

1.2 select appropriate apparatus;

1.3 handle and manipulate chemical apparatus and materials safely;

1.4 make accurate observations and measurements, being aware of possible sources of error;

1.5 record accurately and clearly the results of experiments;

1.6 draw conclusions and make generalisations from experiments;

1.7 plan and organise experimental investigations to test hypotheses.

Familiarity with practical work is expected in the context of assessment objectives 2, 3 and 4 below.

2 Knowledge

Candidates should be able to recall:

2.1 terminology, symbolism, units and conventions used;

2.2 chemical facts;

2.3 practical techniques, procedures and safe laboratory working;

2.4 chemical principles, concepts, theories, definitions, laws, models, patterns and generalisations;

2.5 everyday applications and uses of the knowledge of 2.1 to 2.4;

2.6 social, economic, environmental and technological contributions and applications of the knowledge in 2.1 to 2.5.

3 Understanding

Candidates should be able to:

3.1 explain their knowledge in terms of the relevant principles, concepts, theories, definitions, laws, models, patterns and generalisations;

3.2 present, use and interpret chemical data/information in a diagrammatic, symbolic, graphical, numerical or written form and translate these from one form to another;

3.3 interpret and explain practical techniques, procedures and safe laboratory working;

3.4 perform numerical calculations in which guidance on the method of solution is provided;

3.5 interpret and explain everyday applications and uses of Chemistry;

3.6 explain the social, economic, environmental and technological contributions and applications of Chemistry.

4 Application, Analysis, Synthesis and Evaluation

Candidates should be able to:

4.1 apply appropriate chemical principles, concepts, theories, definitions, laws, models and patterns so as to interpret, draw conclusions from, make generalisations and make predictions from chemical facts, observations and experimental data;

4.2 select appropriate facts to illustrate a given chemical principle, concept, theory, model or pattern;

4.3 present chemical ideas in a clear and logical form;

4.4 select and/or organise data and perform calculations in which guidance on the method of solution is not provided;

4.5 select tests, procedures and practical techniques to investigate the validity of interpretations, conclusions, generalisations and predictions;

4.6 evaluate social, economic, environmental and technological aspects of Chemistry.

The relationship between Aims and Assessment Objectives is shown in the following grid.

SKILL	AIMS	ASSESSMENT OBJECTIVES
Experimental Work	5, 6, 7	1.1 to 1.7
Knowledge	2, 3, 8, 9	2.1 to 2.6
Understanding	3, 5, 6, 7, 8, 9	1.2, 1.4, 1.6, 1.7, 3.1 to 3.6
Application, Analysis, Synthesis and Evaluation	4, 5, 6, 7, 8, 9	1.6, 1.7, 4.1 to 4.6

SCHEME OF ASSESSMENT

Component Number	Component Title	Duration	% Weighting
1	Paper 1 Multiple Choice	1 hr	40
2	Paper 2	1 hr	40
3	Paper 3 (Optional)	1 hr 30 mins	80
4	Practical Assessment	—	20

There will be three written components and internal assessment of practical work of which Components 1, 2 and the Internal Assessment will be compulsory. Components 1 and 2 will be papers allowing scope for weaker candidates to demonstrate their ability in Chemistry. Component 3 will be an optional extension paper allowing scope for more able candidates to demonstrate their ability in Chemistry.

Components 1 and 2 together with the Internal Assessment are, therefore, intended for candidates of middle and low ability. Levels 7—4 may be awarded on the performance in this part of the examination.

Component 3 is designed to provide discrimination between candidates of higher ability and Levels 10 to 8 may be awarded on this part of the examination.

(a) Candidates will be awarded levels up to Level 7 on the basis of their performance on Papers 1 and 2 together with the Internal Assessment.

(b) Candidates who achieve a Level 7 or 6 on the basis of performance on (a) above and a Level 10 to 8 mark on the optional extension paper will be awarded Levels 10 to 8 respectively. Internal Assessment will play an appropriate part in the award of Levels 10 to 8. A poor performance on Paper 3, however, will in no way affect the level awarded for components 1, 2 and 4.

The following components will be set:

Component 1 — Multiple Choice Test (Paper 1) (1 hour). Fifty items of the five-choice type will be set.

Component 2 — Short answers and structured questions (answered on the question paper)(Paper 2) (1 hour). All questions will be compulsory and the structured questions will have a level of difficulty increasing within each question or part of a question.

Component 3 — Optional Paper 3 (structured questions and free response questions) (1½ hours). All questions will be compulsory and have the level of difficulty increasing within each question or part of a question. About two thirds of the total mark will be allocated to the structured questions.

Component 4 — Internal assessment of practical work.

Private Candidates:

The syllabus is available to private candidates provided they are able to undertake assessed practical work (Component 4).

Weightings

The different compulsory parts of the examination will be weighted as shown in the table below:

BASIC SCHEME for the award of Levels 7, 6, 5, 4		**EXTENDED SCHEME for the award of Levels 10, 9, 8**	
Components		**Components**	
Description	**Weighting**	**Description**	**Weighting**
Paper 1 (1 hour)	40%	Paper 3 (1½ hours)	80%
Paper 2 (1 hour)	40%		
Internal Assessment	20%	Internal Assessment	20%

Differentiation

The purpose of this differentiated scheme of assessment, by using components that are designed to test particular parts of the ability range, is to examine candidates at levels at which they can demonstrate achievement and provide positive evidence of attainment. This will enable effective discrimination over the whole of the ability range to be achieved.

It follows that if candidates are to obtain benefit from taking papers designed to meet their particular needs, centres must take care to ensure that each candidate is entered for the combination of papers for which he or she is most suited.

It should be recognised that papers designed primarily for candidates expected to achieve the lower levels will be unlikely to yield sufficient evidence of higher abilities for the highest levels to be awarded. Similarly, but perhaps less obviously, candidates who take an examination for which they are intellectually inadequate will have insufficient opportunity to demonstrate their limited levels of knowledge and skills in the optional paper. Paper 3 is, therefore, intended for those candidates who are expected to achieve Levels 10 — 8.

The relationship between the Assessment Objectives and the components of the Scheme of Assessment is shown in the following grids.

Theory Papers (80% of the total marks)

Assessment Objectives to Demonstrate	Approximate Weighting %
Recall/Knowledge	30
Understanding	30
Application	40

In these papers approximately 15% of the marks will be allocated to 'Chemistry in Industry' and approximately 20% to 'Social, Economic, Environmental and Technological Applications of Chemistry.' All the above weightings will apply to Papers 1 and 2 taken together and also to Paper 3.

Internal assessment of experimental skills (20% of the total marks.)

All of the skills below are to be equally weighted.

Skills	Assessment Objectives
A Using and organising techniques, apparatus and materials.	(1.1; 1.2; 1.3)
B Observing, measuring and recording	(1.4; 1.5)
C Handling experimental observations and data	(1.6)
D Planning, carrying out and evaluating investigations	(1.2; 1.6; 1.7)

Definitions

The following terms used in the syllabus should be interpreted as below.

(a) "Characteristics of ....." implies a descriptive statement of the main reactions/properties concerned.

(b) "The identification of ....." implies recognition of the material by simple test-tube tests.

(c) "The formation of ....." implies a knowledge of the reaction(s) leading to the material without details of apparatus and/or collection methods.

(d) "The manufacture of ....." implies a knowledge of the essential reactions involved in the commercial production of the material. Details of industrial plant are not expected.

(e) "The preparation of ....." implies that knowledge of the reaction(s) and apparatus necessary for the obtaining, purifying and collection of the material is required.

(f) "The use of ....." implies a brief statement of both commercial and domestic applications of the material with emphasis being placed on the property of the material which is appropriate to that use.

SUBJECT CONTENT

In setting questions the nomenclature and units used will be that indicated in the syllabus and will be consistent with the ASE proposals in 'Chemical Nomenclature, Symbols and Terminology for use in school science (1985)' but the over-riding consideration will be clarity and lack of ambiguity.

1 Applications and Implications of Chemistry

The syllabus content should, wherever relevant, be covered in such a way as to draw attention to the industrial, social, economic, environmental and technological aspects of chemistry.

Particular attention should be drawn to the

(i) implications of finite mineral and energy sources;

(ii) necessity for pollution control;

(iii) need for an adequate world food supply;

(iv) beneficial and anti-social effects of Chemistry.

Because of the novel nature of this area of the syllabus, which should be included in the teaching of sections 2 to 12, more details have been given in Section 13.

2 Techniques of Chemistry

2.1 Separation of mixtures and purification.	Solution, crystallisation, distillation, fractional distillation, filtration, centrifuging, decantation and paper chromatography.
2.2 Test for purity.	Melting points, boiling points.
2.3 Measurement.	The measurement of mass, temperature, volume, time and length, using appropriate apparatus.

3 Nature of Matter

3.1 Kinetic theory.	States of matter and changes of state outlined in particulate terms. Diffusion. Evidence for the movement of particles in gases and liquids. Relative rates of diffusion treated qualitatively.
3.2 Elements and compounds.	The difference between elements and compounds.
3.3 Atomic structure	The relative mass and charge of protons, neutrons and electrons. Atomic number, mass number, isotopes and relative atomic mass. The simple electronic structure of atoms limited to the first twenty elements. The relationship between the outer electronic structure and the position of an element in the Periodic Table. (Treatment of the electronic structure of transition metals is not required.) Note that a copy of the Periodic Table will be provided in the examinations.

3.4 Bonding.

(a) Ionic. Ion formation by loss or gain of electrons. The structure and characteristics of typical ionic compounds, e.g., NaCl, MgO.

(b) Covalent. Covalent bond formation by electron sharing.

The structure and characteristics of simple covalent molecules. A simple consideration of macromolecules restricted to diamond, graphite and poly(ethene).

(c) Metallic. A simple treatment to explain electrical conduction.

4 The Mole Concept

Symbols, formulae and equations, to include word and balanced chemical equations.

Relative atomic mass A_r.
Relative molecular mass M_r. The mole. Concentration expressed in mol/dm^3 (mol/litre) or g/dm^3 (g/litre).

The calculation of empirical formulae and of molecular formulae.

Simple mass and gas volume calculations from formulae and equations. Molar gas volume taken as 24 dm^3 (litres) (at room temperature and pressure).

5 Acids, Bases and Salts

Characteristics of acids and bases.

The meanings of the terms acid and alkali in terms of the ions they contain or produce in aqueous solution.

A qualitative treatment of the use of indicators and of the pH scale to determine acidity, alkalinity and neutrality.

The preparation of

(a) soluble salts by the action of acids with metals, soluble and insoluble bases and carbonates;

(b) insoluble salts by precipitation.

Identification of ions.

(a) Anions: NO_3^-(by reduction with aluminium), CO_3^{2-}, Cl^- and SO_4^{2-}.

(b) Cations. The use of aqueous sodium hydroxide and/or aqueous ammonia to identify: Al^{3+}, Cu^{2+}, Fe^{2+}, Fe^{3+}, Zn^{2+}, NH_4^+, (formulae of complex ions are not required).

6 Energy Changes in Chemical Reactions

6.1 Heat energy. Exothermic and endothermic reactions treated qualitatively.

6.2 Electrical. Electrolysis. Simple ionic theory and electrode reactions. Examples of electrolysis should include:

a molten halide,
dilute aqueous sulphuric acid,
concentrated aqueous sodium chloride,
aqueous copper(II) sulphate,
all with inert electrodes,
and aqueous copper(II) sulphate using copper electrodes.

Reference should be made to electroplating, anodising and copper refining. The manufacture of aluminium, chlorine and sodium hydroxide outlined (one suitable method in each case).

A treatment of cells is not required.

7 Speed of Reaction

The effect of concentration, pressure, particle size, catalysts and temperature on the rates of chemical reactions. A simple explanation of these effects in terms of collisions and the energies of the reacting particles.

Reference should be made to reversible reactions in the context of SO_3 and NH_3 manufacture; further treatment of equilibrium is not required.

8 Redox Reactions

Oxidation and reduction in terms of oxygen/hydrogen loss/gain, leading to the concept of electron transfer.

The concept of oxidation number is not required.

9 The Periodic Table

9.1 Periodic trends.

The Periodic Table as a method of classifying elements.

The change from metallic to non-metallic character across a Period.

9.2 Group trends and characteristics.

(a) lithium, sodium and potassium;

(b) chlorine, bromine and iodine;

(c) helium, neon and argon.

10 Metals

10.1 Properties of metals.

Their general chemical and physical properties related to their uses.

10.2 Reactivity series.

Sodium, calcium, magnesium, aluminium, zinc, iron, lead, (hydrogen) and copper. Their relative reactivity illustrated, where appropriate, by the following reactions.

(i) Their displacement from aqueous solutions and from their oxides.

(ii) Their reactions with oxygen, water and/or steam and dilute hydrochloric acid.

(iii) Reduction of their oxides by hydrogen and by carbon.

(iv) The action of heat on their carbonates and their nitrates.

10.3 Extraction of metals.

(a) General principles related to the reactivity series.

(b) The essential reactions involved in the industrial production of aluminium (from pure Al_2O_3) and of iron (from haematite).

11 Non-Metals

11.1 Hydrogen.

A product of the reaction between

(i) reactive metals and water and/or steam.

(ii) metals and acids.

Identification, properties and uses.

Water. Causes of hardness, its effect on soaps and detergents and its removal. Pollution of water. An outline of the purification and recycling of water.

11.2 Oxygen.

Preparation from hydrogen peroxide. Identification, properties and uses.

Classification of oxides as acidic, basic, amphoteric or neutral.

Rusting, combustion and respiration. The approximate composition by volume of the air: its variability and common pollutants.

11.3 Nitrogen.

Uses of nitrogen. The essential conditions (without technical details or diagrams) of the Haber process. The uses of ammonia and of ammonium salts.

The displacement of ammonia from its salts. Identification of ammonia and its reactions with (i) acids, (ii) aqueous solutions of Al^{3+}, Cu^{2+}, Fe^{2+}, Fe^{3+}, Zn^{2+} (formulae of complexes are not required).

11.4 Sulphur.

The manufacture of sulphuric acid from sulphur (technical details and diagrams are not required) and its industrial uses.

The reactions of sulphuric acid

(i) as an acid,

(ii) as an oxidising agent with special reference to copper,

(iii) as a dehydrating reagent with sugar and hydrated copper(II) sulphate.

11.5 Chlorine.

The oxidation of hydrochloric acid to chlorine. Identification of chlorine and its reactions with metals, $Br^-(aq)$, $I^-(aq)$, and the conversion of Fe^{2+} to Fe^{3+}.

Outline manufacture of chlorine by the electrolysis of brine.

The uses of chlorine.

11.6 Carbon.

Structure of diamond and graphite related to their properties and uses.

The reducing properties of carbon and of carbon monoxide.

Carbon monoxide as a product of incomplete combustion. Its poisonous nature.

Carbon dioxide — a product of respiration and the complete combustion of carbon compounds. Identification of carbon dioxide and its uses.

Carbonates — their thermal decomposition related to the reactivity series. The relative solubilities of the hydrogencarbonate and the carbonate of calcium with particular reference to hard and soft water.

The industrial importance of calcium carbonate, e.g., in the production of iron.

12 Organic Chemistry

Coal, natural gas and petroleum as fuels.

Fractional distillation and cracking of crude oil as a source of organic compounds.

The structure and names of the unbranched alkanes containing up to four carbon atoms.

The concept of isomerism, illustrated by C_4H_{10}.

The concept of homologous series.

Alkanes. Substitution reaction with bromine.

Structures of alkenes: ethene and propene only. Ethene, its addition reactions with bromine, hydrogen and with steam. The formation of poly(ethene).

Alcohols, typified by ethanol, its formation by fermentation, its uses and its oxidation to ethanoic acid.

13 Social, economic, environmental and technological applications of chemistry.

13.1 Mineral and energy Sources.

The sea as a source of magnesium, bromine and common salt. Rocks as a source of bauxite, haematite and rock salt.

Finite nature of supplies of North Sea gas, oil, coal and minerals. Alternative sources of energy.

The chemical and economic importance of conserving and recycling materials such as iron and aluminium.

13.2 Pollution

Air pollution. The harmful effect of sulphur dioxide on metals, stonework and living things. The poisonous nature of carbon monoxide, nitrogen oxides and lead compounds. The non-biodegradable nature of many plastics. The reduction of pollution, e.g., smokeless zones, lead-free petrol.

Water pollution. Harmful effect of untreated sewage, chemical waste, fertilisers, pesticides and detergents.

13.3 Food supply

The need for fertilisers. The manufacture of nitrogenous fertilisers. The importance of N, P and K to plant life.

The need for food preservatives such as salt, sulphur dioxide and ethanoic acid.

13.4 Use and abuse of chemicals.

The use of chemicals in the prevention and treatment of illness. The potentially harmful effect of some chemicals, e.g., alcohol, pesticides and fertilisers.

INTERNAL ASSESSMENT OF EXPERIMENTAL SKILLS

The experimental skills A to D to be assessed are given below.

A Using and organising techniques, apparatus and materials.

B Observing, measuring and recording.

C Handling experimental observations and data.

D Planning, carrying out and evaluating investigations.

The four skills carry equal weighting.

All assessments must be based upon experimental work carried out by the candidates.

It is expected that the teaching and assessment of experimental skills will take place throughout the course.

The assessment scores finally recorded on the Assessment Sheet (Appendix A) for each skill must represent the candidate's best two marks for each skill.

The minimum Course Work requirement for this syllabus is as follows. Each candidate should attempt at least one piece of Course Work and this should be assessed for at least one skill according to the criteria in the syllabus. If the piece of work does not satisfy the criteria for the award of one mark, a mark of 0 should be awarded.

Candidates who do not attempt any Course Work should be marked 'A'.

For candidates who miss the assessment of a given skill through no fault of their own, for example because of illness, and who cannot be assessed **on another occasion**, MEG's procedures for special arrangements should be followed as specified in the current Handbook for Centres. However, candidates who for no good reason are absent from an assessment of a given skill, should be given a mark of 0 on that occasion.

Teachers must ensure that they can make available to the moderator the evidence for two assessments of each skill for each candidate. For skills A to D, inclusive, information about the tasks set and how the marks were awarded will be required. For skills B, C and D, the candidate's written work will also be required.

Experimental Skills and Assessment Objectives

Experimental Skills	Assessment Objectives
A Using and organising techniques, apparatus and materials.	(1.1; 1.2; 1.3)
B Observing, measuring and recording	(1.4; 1.5)
C Handling experimental observations and data	(1.6)
D Planning, carrying out and evaluating investigations	(1.2; 1.6; 1.7)

Criteria for Assessment of Experimental Skills

Each skill must be assessed on a 6 point scale, point 6 being the highest level of achievement.

Each of the skills is defined in terms of three points of achievement at scores of 2, 4 or 6.

A score of 0 is available if there is no evidence of positive achievement for a skill.

For candidates who do not meet the criteria for a score of 2, a score of 1 is available if there is some evidence of positive achievement.

A score of 3 is available for candidates who go beyond the point defined for 2, but who do not meet fully the criteria for 4.

Similarly, a score of 5 is available for those who go beyond the point defined for 4, but do not meet fully the criteria for 6.

Skill A - Using and Organising Techniques, Apparatus and Materials

1

2 —Follows written, diagrammatic or oral instructions to perform a single practical operation.
Uses familiar apparatus and materials adequately, needing reminders on points of safety.

3

4 —Follows written, diagrammatic or oral instructions to perform an experiment involving a series of step-by-step practical operations.
Uses familiar apparatus, materials and techniques adequately and safely.

5

6 —Follows written, diagrammatic or oral instructions to perform an experiment involving a series of practical operations where there may be a need to modify or adjust one step in the light of the effect of a previous step.
Uses familiar apparatus, materials and techniques safely, correctly and methodically.

Skill B - Observing, Measuring and Recording

1

2 —Makes observations or readings given detailed instructions.
Records results in an appropriate manner given a detailed format.

3

4 —Makes relevant observations or measurements given an outline format or brief guidelines.
Records results in an appropriate manner given an outline format.

5

6 —Makes relevant observations or measurements to a degree of accuracy appropriate to the instruments or techniques used.
Records results in an appropriate manner given no format.

Skill C - Handling Experimental Observations and Data

1

2 —Processes results in an appropriate manner given a detailed format.
Draws an obvious qualitative conclusion from the results of an experiment.

3

4 —Processes results in an appropriate manner given an outline format.
Recognises and comments on anomalous results.
Draws qualitative conclusions which are consistent with obtained results and deduces patterns in data.

5

6 —Processes results in an appropriate manner given no format.
Deals appropriately with anomalous or inconsistent results.
Recognises and comments on possible sources of experimental error.
Expresses conclusions as generalisations or patterns where appropriate.

Skill D - Planning, Carrying out and Evaluating Investigations

1

2 —Suggests and carries out a simple experimental strategy to investigate a given practical problem.

Attempts ' trial and error' modification in the light of the experimental work carried out.

3

4 —Specifies and carries out a sequence of activities to investigate a given practical problem.

In a situation where there are two variables, recognises the need to keep one of them constant while the other is being changed.

Comments critically on the original plan, and implements appropriate changes in the light of the experimental work carried out.

5

6 —Analyses a practical problem systematically, produces a logical plan and carries out the investigation.

In a given situation, recognises that there are a number of variables and attempts to control them.

Evaluates chosen procedures, suggests/implements modifications where appropriate and shows a systematic approach in dealing with unexpected results.

Areas which might be suitable for Assessment

Teachers should feel free to devise their own methods of assessment of particular aspects of their course and to make use of the practical work which is an integral part of the examination syllabus. It must be strongly stressed that the following examples do not form a prescribed list of exercises but are provided only as illustrative material.

(a) Rate of decomposition of dilute hydrogen peroxide/manganese(IV) oxide. Effect of time, temperature and concentration.

(b) Determination of the formula of salt hydrates, e.g., magnesium sulphate.

(c) Precipitation of hydroxides using aqueous ammonia or aqueous sodium hydroxide.

(d) Rate of reaction between calcium carbonate and dilute acid.

(e) Separation of mixtures including solid/solid and liquid/liquid.

(f) Preparation of crystals of a soluble salt.

(g) Investigation of reacting masses, e.g., reduction of copper(II) oxide.

(h) Investigation of electroplating.

(i) Simple cation/anion analysis.

(j) Investigation of the reaction between ammonium compounds and bases.

(k) Investigation of the reaction between solid carbonates and dilute acids to produce carbon dioxide.

(l) Rate of production of hydrogen from dilute acid and magnesium using a gas syringe.

(m) Investigation of the hardness of various types of water.

(n) Investigation of redox reactions, e.g., iron(II) compounds to iron(III) compounds with various oxidising agents.

(o) Investigation of the order of reactivity of various metals.

(p) Investigation of the decomposition of metal nitrates and metal carbonates.

NOTES FOR GUIDANCE

The following notes are intended to provide teachers with information to help them make valid and reliable assessments of the skills of their candidates.

The assessments should be based on the principle of positive achievement. Candidates should be given opportunities to demonstrate what they understand and can do.

It is expected that candidates will have had opportunities to acquire a given skill before assessment takes place.

Assessments can be carried out at any time during the course. However, at whatever stage assessments are done, the standards applied must be those expected at the end of the course as exemplified in the criteria for the skills.

Assessments should normally be made by the person responsible for teaching the candidates.

It is recognised that a given practical task is unlikely to provide opportunities for all aspects of the criteria at a given point for a particular skill to be satisfied. For example, there may not be any anomalous results (Skill C). However, by using a range of practical work, teachers should ensure that opportunities are provided for all aspects of the criteria to be satisfied during the course.

The educational value of extended experimental investigations is widely recognised. Where such investigations are used for assessment purposes, teachers should make sure that candidates have ample opportunity for displaying the skills required by the Scheme of Assessment.

It is not necessary for all candidates in a Centre, or in a teaching group within a Centre, to be assessed on exactly the same practical work, although teachers may well wish to make use of work that is undertaken by all of their candidates.

When an assessment is carried out on group work, the teacher must ensure that the individual contribution of each candidate can be assessed.

Skill A may not generate a written product from the candidates. It will often be assessed by watching the candidates carrying out practical work.

Skills B, C and D will usually generate a written product from the candidates. This product will provide evidence for moderation.

Raw scores for individual practical assessments may be given to candidates as part of the normal feedback from the teacher. The final, internally moderated, total score, which is submitted to MEG, should not be given to the candidate.

MODERATION

(a) ***Internal Moderation***

When several teachers in a centre are involved in internal assessment, arrangements must be made within the centre for all candidates to be assessed to a common standard.

It is essential that within each centre the marks for each skill assigned within different teaching groups (e.g., different classes) are moderated internally for the whole centre entry. The centre assessments will then be subject to external moderation.

(b) ***External Moderation***

Assessment sheets *(see Appendix A)* are to be submitted to MEG no later than the specified date in the year of the examination. For external moderation MEG will require, for a specified sample, evidence which must include for skills A to D inclusive, information about the tasks set and how the marks were awarded. In addition, for skills B, C and D a specified sample of candidates' written work will be required. A further sample may be required. All records and supporting written work should be retained until after publication of results.

Centres may find it convenient to use loose-leaf A4 file paper for assessed written work. This is because samples will be sent through the post for moderation and postage bills are likely to be large if whole exercise books are sent.

The samples sent to the moderator should have the sheets stapled together in the top left-hand corner and should be clearly labelled with the centre number and the candidate's name and number. On each piece of work the skill(s) assessed and the mark awarded to each skill must be stated. Authenticated photocopies of the sample required would be acceptable.

Midland Examining Group

Appendix A

MEG MODE 1 SCIENCE SYLLABUSES
(excluding 1377, 1751 and 1752)
COURSE WORK ASSESSMENT FORM
GCSE EXAMINATIONS 1994

CENTRE NUMBER	
CENTRE NAME	
SYLLABUS CODE	
SYLLABUS TITLE	

CANDIDATE NUMBER	CANDIDATE NAME	TEACHING GROUP/ SET	INTERNALLY MODERATED MARKS FOR EACH SKILL								TOTAL MARK (out of 48)	COMMENTS (if necessary)
			SKILL A (out of 6)		SKILL B (out of 6)		SKILL C (out of 6)		SKILL D (out of 6)			

MEH

INSTRUCTIONS FOR TEACHERS

A. Marking and Internal Moderation

1. This form must be used for recording Course Work marks for the following MEG Mode 1 Science syllabuses: Biology **1325**, Biology (Human) **1327**, Chemistry **1375**, Physics **1700** and Physics (Nuffield) **1701**.
2. Separate Course Work Assessment Forms should be used for the following MEG Mode 1 Science syllabuses: Chemistry (Salters) **1377**, Electronics **1751**.
3. Complete the information at the head of the form. The syllabus title should be given in full e.g. Chemistry.
4. List the candidates in an order which will allow ease of transfer of information to a computer-printed mark sheet at a later stage (i.e., in candidate index number order, where this is known). The teaching group/set should also be shown.
5. Mark each skill for each candidate according to the criteria and the notes for guidance given in the appropriate 1994 syllabus booklet.
6. Enter marks in the appropriate spaces.
7. Carry out the addition required, to produce a total mark out of 48.
8. Carry out internal moderation to ensure that the total mark awarded to each candidate reflects a single valid and reliable rank order **for each syllabus.**
9. Include in the column headed 'Comments':
   (i) reference to the nature of the assessment.
   (ii) brief mention of particular aspects of the candidate's performance where assessment is based on observation or discussion and not on written work.
   (iii) an indication of the source of any permanent record of the candidate's work.
10. Retain all forms for external moderation.

B. External Moderation

Documents will be sent to you in April 1994 for the purposes of external moderation.

MATHEMATICAL REQUIREMENTS

Calculators may be used in all components of the assessment.

Candidates should be able to

(a) add, subtract, multiply and divide;

(b) understand averages, decimals, fractions, percentages, ratios and reciprocals;

(c) recognise and use standard notation;

(d) use direct and inverse proportion;

(e) use positive, whole number indices;

(f) draw charts and graphs from given data;

(g) interpret charts and graphs;

(h) select suitable scales and axes for graphs;

(i) make approximate evaluations of numerical expressions.

NOTES

It is intended that an experimental approach to the syllabus material be adopted. The development of safe techniques and an awareness of chemical hazards should be encouraged. As far as possible specification of discrete materials to illustrate the syllabus content has been avoided. Teachers are free to select their own examples, having regard to their particular interests, to the demands of other syllabus sections and to the range of facilities available in their Centre. Accurate observations and the recording of observations in description, tabular and graphical format are required. In describing chemical changes emphasis should be placed on the physical state, colours and essential reaction conditions. Candidates will be given clear instructions in the question papers whenever they are required to give an equation. When equations are required candidates may be asked to write the 'word' equation on one line and, if they are able, a chemical or ionic equation on the next line.

A copy of the Periodic Table will be printed, as shown on page 19, and which will be attached to each of the written papers. In setting questions the nomenclature and units used will be that indicated in the syllabus and will be consistent with the ASE proposals in 'Chemical Nomenclature, Symbols and Terminology for use in school science (1985)' but the over-riding consideration will be clarity and lack of ambiguity.

Glossary of some terms used in question papers.

1 *Define (the term(s) ...)* is intended literally, only a formal statement or equivalent paraphrase being required.

2 *State* implies a concise answer with little or no supporting argument, e.g. a numerical answer that can readily be obtained 'by inspection'.

3 *State and explain* normally also implies conciseness: *explain* may imply reasoning or some reference to theory, depending on the context.

4 *Describe* is often used with reference either to particular phenomena or to particular experiments. In the former instance, the term usually implies that the answer should include reference to (visual) observations associated with the phenomena.

5 *Outline* implies brevity, i.e., restricting the answer to giving essentials.

6 *Predict* implies that the candidate is not expected to produce the required answer by recall but by making a logical connection between other pieces of information. Such information may be wholly given in the question or may depend on answers extracted in an early part of the question.

Predict also implies a concise answer with no supporting statement required.

7 *Suggest* is used in two main contexts, i.e., either to imply that there is no unique answer, (e.g., in chemistry, two or more substances may satisfy the given conditions describing an 'unknown'), or to imply that candidates are expected to apply their general knowledge to a 'novel' situation, one that may formally be 'not in the syllabus'.

8 *Find* is a general term that may variously be interpreted as *calculate, measure, determine.*

9 *Calculate* is used when a numerical answer is required. In general, working should be shown, especially where two or more steps are involved.

The Periodic Table of the Elements

Group I	Group II										Group III	Group IV	Group V	Group VI	Group VII	Group 0
					1 H Hydrogen 1											4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4										11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12										27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35·5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

*58-71 Lanthanum series

†90-103 Actinium series

Key: a X b — a = relative atomic mass; X = atomic symbol; b = atomic number