



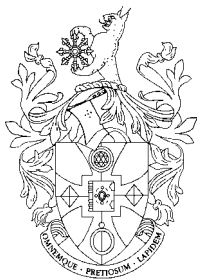
The Gemmological Association of Great Britain

Syllabus for the Foundation Examination

**Gemmological Association
and Gem Testing Laboratory of Great Britain**

27 Greville Street,
London, EC1N 8TN, UK
Tel: +44 (0)20 7404 3334
E-Mail: edu@gem-a.info

Fax: +44 (0)20 7404 8843
Web: www.gem-a.info



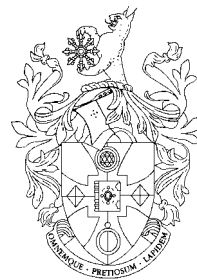
FOUNDATION SYLLABUS 1

◆ SYLLABUS FOR THE FOUNDATION EXAMINATION

Syllabus notes

- The Foundation examination consists of two theory papers, F1 and F2, taken on the same day, morning and afternoon.
- Each paper consists of five compulsory questions in three hours.
- A maximum of twenty marks is awarded for each question; the pass mark is 66%.
- Markings and grades are for F1 and F2 added together.
- Grade percentage limits are A: 100 - 80; B: 79 - 66; C+ 65 - 60; C: 59 - 50; D: 49 - 0.
- A and B are pass grades; C+, C and D are fail grades.
- A Foundation certificate is awarded to qualifying candidates who have completed their practical endorsement.
- This syllabus indicates the possible areas of the subject which can be examined in the Foundation examination.
- Practical observation techniques form a very important part of this examination.
- The maximum level of detail required is indicated in certain parts of the syllabus and you may also be guided by the level of information in the course notes.
- Additional reading is recommended.
- The specific level and amount of information required in the examination is also indicated by the potential marks printed next to each examination question.
- A letter of achievement is provided for those who, at the examiners' discretion, achieve particular merit and 95% marks or more.
- An award is made to the candidate who achieves the highest marks in the examination year. More than one type of award may be given.

2 FOUNDATION SYLLABUS



Foundation syllabus

1 Gem Materials

Nature and attributes of gems and ornamental materials; factors which influence the value of a stone: beauty, durability, rarity; acceptability.

Earth's physical activity; melting, recrystallization, sedimentation, mineralization.

2 The Nature of Gem Materials

The origin and occurrence of gem minerals (elementary).

Major types of gem deposit (general description): pegmatite; diamond pipe; placer; hydrothermal vein.

Extraction: mining and recovery methods (outline only).

Minerals, atoms, elements and chemical bonding (elementary).

3 Crystalline Materials

The nature of crystals; crystalline materials (outline only).

Polycrystalline (including microcrystalline) materials.

The existence of: reference (crystallographic) axes and crystal symmetry;

Crystal form, habit and twinning.

The names of the seven crystal systems.

The common and typical crystal forms for crystals in each of the systems.

Crystal observation

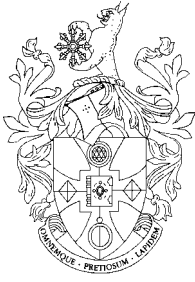
Amorphous and metamict materials; polymorphs; isomorphism.

4 Durability of Gem Materials

Hardness: definition and significance; testing and Mohs' scale; differential hardness.

Toughness and stability. Fracture; types of fracture.

Cleavage: definition, description and significance.



FOUNDATION SYLLABUS 3

5 Specific Gravity

Density and specific gravity (SG). Definitions of density and SG.

SG measurement and hydrostatic weighing.

The simple use of high-density liquids in gem testing; care and caution in use.

6 The Nature of Light

The importance of light in gemmology.

The nature of light.

Wavelength and frequency.

The electromagnetic spectrum.

The visible spectrum of colour.

Polarization and vibration direction.

7 Refraction

Refraction; refractive index (RI), definition and description.

Singly refractive materials.

Doubly refractive materials: directional properties; double refraction, polarization, optic axes.

Measurement of RI; the refractometer; the principle of total internal reflection; an outline of its main component parts.

The determination of birefringence using the refractometer.

8 Reflection and its Effects

External reflection: lustre. Examples of lustre.

Internal reflection effects caused by inclusions; chatoyancy and asterism.

Internal reflection effects caused by structural features.

Iridescence: interference and diffraction.

Brilliance.

9 Colour; the Visible Spectrum and the Spectroscope

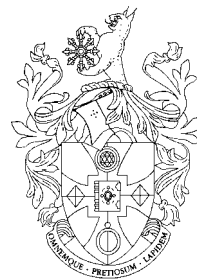
Light and body colour in gemstones.

The visible spectrum.

Dispersion, 'fire' and diffraction.

Body colour and selective absorption of light.

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Colouring elements.

The absorption spectrum and the spectroscope.

The use of the spectroscope.

The absorption spectra of the following materials:

almandine garnet emerald zircon

peridot ruby blue sapphire

red glass (selenium) red glass (gold)

blue glass (cobalt) blue Verneuil synthetic spinel (cobalt)

Use of colour filters; the Chelsea colour filter.

Colour change effect ('alexandrite effect').

10 Polarized Light; the Polariscope and the Dichroscope

The nature of polarized light.

Isotropic and anisotropic behaviour; optic axes.

The production of polarized light; the polarizing filter; 'crossed' polarizing filters.

The polariscope and its use; typical results;

Pleochroism; the dichroscope, and its use; typical results.

11 Non-visible Radiation, Energy and Fluorescence

Luminescence: fluorescence.

Use of the ultra-violet lamp (short wave and long wave).

The use of X-rays in gemmology.

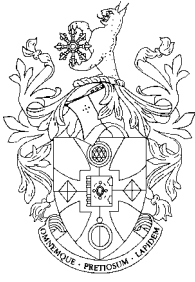
Thermal conductance and electrical conductivity probes; reflectance meters.

Summary of some important laboratory methods.

12 Optical Magnification

Magnification: the 10x lens and the microscope; lighting.

Observation of gem materials: internal and external features; immersion of gems to aid observation.



FOUNDATION SYLLABUS 5

13 Description and Elementary Methods of Identification of Natural Inorganic Gem Materials

Chemical composition.

Crystal system and crystal habit.

Common and characteristic crystal forms, and crystal face markings and features.

Cleavage and fracture.

Hardness.

Specific gravity.

Colour; causes of colour; pleochroism.

Lustre.

Internal reflection effects (including iridescence, chatoyancy and asterism);

Refractive index (with birefringence).

Dispersion (description of relative amounts only).

Common and characteristic inclusions.

Major geological occurrences.

Major world localities of commercial deposits.

of all gem varieties of the following:

beryl	garnet	quartz (including chalcedony)
chrysoberyl	iolite	spinel
corundum	jadeite	tanzanite
diamond	nephrite	topaz
feldspar	opal	tourmaline
fluorite	peridot	zircon

The absorption spectra of selected materials (see Item 9).

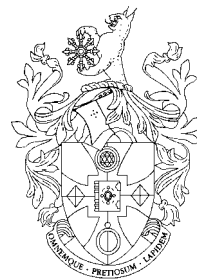
14 Natural Gem Materials of Organic Origin

The formation and structure and methods of identification of natural and cultured pearl.

An elementary knowledge of the formation, properties and methods of identification of:

amber coral ivory jet shell tortoiseshell

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15 Artificial Gem Materials

Artificial and synthetic gems: definitions.

A brief outline of methods of production and identification of materials produced by the Verneuil flame fusion, flux melt and hydrothermal methods.

Non-crystalline artificial materials: paste; plastics.

16 Imitation and Composite Gem Materials

Imitation (simulation) of gem and ornamental materials; the use of natural and artificial materials as imitations; the distinction of gem diamond from its simulants, particularly cubic zirconia (CZ).

Composite (assembled) natural and artificial stones; reconstructed materials.

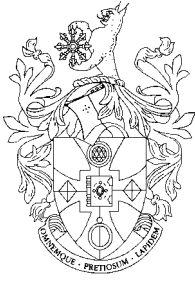
17 Treated Gem Materials

Examples of methods of treatment (enhancement) and their identification, including dyeing, bleaching, impregnation, coating, irradiation, heating, laser treatment, fracture filling and diffusion treatment.

18 Additional Gem Materials

The most important distinguishing features of the following materials:

andalusite	pyrite
apatite	rhodochrosite
calcite (Iceland spar; banded and massive ornamental varieties; marble)	rhodonite
glass - natural (included obsidian)	serpentine (including bowenite)
gypsum (including alabaster)	sodalite
hematite	spodumene
lapis-lazuli	steatite (soapstone)
malachite	turquoise



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19 Fashioning of Gemstones

Description of gemstone cuts: specifically the brilliant (with proportions for round brilliant-cut diamond); step (emerald) cut; mixed cut; cabochon cut.

A brief description of other common cuts.

Reasons for the use of various cuts.

Processes in lapidary and diamond manufacture.

20 Gems in jewellery

Gem settings in jewellery.

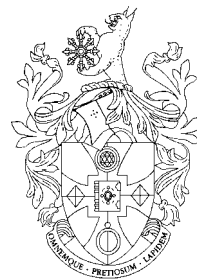
Gem identification and diamond grading reports.

The quality factors of gemstones.

Appraisal and valuation.

Testing gems in jewellery.

8 FOUNDATION SYLLABUS



◆ CONSTANTS OF SYLLABUS STONES

This data sheet of constants in alphabetical order is given to candidates at the beginning of each Foundation examination:

Material	RI	Birefringence	SG
Amber	1.54 approx.	-	1.05 to 1.10
Beryl varieties	1.56 to 1.60	0.003 to 0.010	2.65 to 2.80
Chrysoberyl	1.74 to 1.76	0.008 to 0.010	3.71 to 3.75
Corundum varieties	1.76 to 1.78	0.008 to 0.009	3.80 to 4.05
Diamond	2.42	-	3.52
Feldspar varieties	1.52 to 1.57	0.004 to 0.009	2.56 to 2.75
Fluorite	1.43 to 1.44	-	3.0 to 3.2
Garnet, almandine	1.76 to 1.81	-	3.8 to 4.2
Garnet, demantoid	1.89 approx.	-	3.8
Garnet, grossular	1.73 to 1.75	-	3.4 to 3.8
Garnet, pyrope	1.74 to 1.76	-	3.7 to 3.8
Garnet, spessartine	1.79 to 1.82	-	4.1 to 4.2
Iolite	1.54 to 1.56	0.008 to 0.012	2.57 to 2.61
Jadeite	1.66 approx.	-	3.30 to 3.36
Jet	1.66 approx.	-	1.3 approx.
Nephrite	1.62 approx.	-	2.8 to 3.1
Opal	1.40 to 1.46	-	2.0 to 2.2
Paste (artificial glass)	1.50 to 1.70	-	2.0 to 4.2
Peridot	1.65 to 1.69	0.036	3.32 to 3.37
Quartz, crystalline	1.54 to 1.56	0.009	2.65 approx.
Quartz, polycrystalline	1.53 to 1.55	-	2.6 approx.
Spinel	1.71 to 1.74	-	3.58 to 3.61
Spinel, Verneuil synthetic	1.72 to 1.73	-	3.61 to 3.67
Tanzanite	1.69 to 1.70	0.006 to 0.013	3.15 to 3.38
Topaz	1.61 to 1.64	0.008 to 0.010	3.5 to 3.6
Tourmaline	1.62 to 1.65	0.014 to 0.021	3.0 to 3.1
Zircon	1.78 to 1.99	up to 0.059	3.9 to 4.8

Each range of RI, birefringence or SG covers the typical values for that material.
Certain specimens may have values outside the ranges listed here.

More detailed information than is available on this constants sheet may be required in order to answer particular Foundation examination questions.