

Gem-A Foundation in Gemmology Specifications

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Introduction

This course is designed to:

- create and sustain interest in and enjoyment of gemmology both for those students not studying beyond this stage and for those continuing their studies in gemmology and related fields
- broaden students' knowledge of gemmology and make a contribution towards life-long learning for students working in and around gemstone- and jewellery-related jobs.

Students require no prior knowledge of gemmology to study this course.

Course aims

The aims of this course are to encourage and enable students to:

- develop an interest in and awareness of gemstones, their properties and uses
- develop essential knowledge and understanding of the different aspects and the principles of gemmology
- gain an appreciation for the characteristic and identifying features of the gemstones found commonly within the gem trade
- appreciate the gemstone pipeline from origin to cut stone
- improve their knowledge of commercially important features of gemstones
- handle confidently rough, cut and set gem materials
- report clearly results and conclusions
- take the Association's Certificate Examination in Gemmology.

Certification title

This course leads to Gem-A's Certificate in Gemmology.

Assessment objectives

Students should be able to demonstrate that they can:

A01 Knowledge and understanding

- recognize, recall and show understanding of specific gemmological knowledge
- describe the various stages of the gemstone pipeline
- describe the properties and uses of gem materials

- explain and know about the processes of common treatments of gem materials and the production of synthetics.

A02 Application of knowledge and understanding

- demonstrate the use of basic gem testing equipment and report on the observations and results of tests on gemmological specimens
- identify common gem materials
- compare and contrast the features and properties of common gem materials, treatments and synthetics
- apply knowledge of gemstones to their care and commercial use
- explain the value and price factors of gemstones.

Scheme of assessment

The course will contain coursework and an end of course examination*:

| Title | Mode of assessment | Duration | Weighting |
|-----------------------|---------------------|----------|---------------------|
| Assessed coursework | Coursework | - | 10% |
| Practical endorsement | Coursework | - | Completion required |
| Foundation paper 1 | Written examination | 2 hrs | 45% |
| Foundation paper 2 | Written examination | 2.5 hrs | 45% |

*This scheme of assessment is for the 2017 edition of the course and related examinations from 2018, students still completing examinations prior to 2018 and their related examinations should contact Gem-A for the scheme applicable to them.

Assessed coursework

Assessment of students' coursework is made by a Gem-A approved Foundation tutor and/or practical provider and moderated externally by Gem-A.

The coursework is broken into four blocks of study and a practical endorsement. Each study block is assessed through an end of block assessment.

This assessment comprises short questions including multiple choice and questions requiring more open-ended responses. These assessments include on-line computer marked work and tutor assessment.

Block F1 – Introducing gems and gemmology

Content:

- Section 1 - Gems and Gemmology
- Section 2 - Observation and Magnification
- Section 3 - Materials and Structure

At the end of Block F1, students should be able to:

- demonstrate and show an understanding of what a gemstone is and the purpose of gemmology
- recognize, recall and show understanding of the structure of gem materials
- demonstrate the use of observation and magnification tools, explaining their use in gemmology
- select, organize and present relevant information clearly and logically using appropriate specialist vocabulary where relevant.

Block F2 - Understanding and communicating the physical properties of gem materials

Content:

- Section 4 - Durability
- Section 5 - Weight, Density and Specific Gravity
- Section 6 - Light and Optics
- Section 7 - Colour
- Section 8 - Other Gem Properties

At the end of Block F2, students should be able to:

- describe, explain and interpret phenomena and effects in terms of gemmological principles and concepts, presenting ideas clearly and logically, using specialist vocabulary where appropriate
- explain the use of standard gemmological instruments
- make observations and measurements with appropriate precision and record these accurately and methodically.

Block F3 - Introducing and explaining the gemstone pipeline from geology to jewellery

Content:

- Section 9 - The Geology of Gems
- Section 10 - The Gemstone Pipeline
- Section 11 - Fashioning Gemstones
- Section 12 - Gems and Jewellery

At the end of Block F3, students should be able to:

- demonstrate and show a knowledge and understanding of the ethical, social, economic, environmental and technological implications of the gemstone pipeline
- demonstrate the use of written communication skills to explain gemmological principles.

Block F4 - Identifying gemstone, synthetics and their various treatments

Content:

- Section 13 - Treatments
- Section 14 - Imitations, Simulants and Synthetics
- Section 15 - The Gemstones

At the end of Block F4, students should be able to:

- recognize, recall and show an understanding of natural, treated and synthetic gem materials and their value factors
- interpret, explain, evaluate and communicate the results of gem testing clearly and logically using gemmological knowledge and appropriate specialist vocabulary.

Practical endorsement - Demonstrating the ability to use the standard gemmological instruments

This assessment of a students' practical work is made by a Gem-A approved practical provider and moderated externally by Gem-A.

Students need to be able to demonstrate the use of standard gemmological instruments, as well as make observations and measurements with appropriate precision, and record these accurately and methodically.

Students to be assessed on the following instruments and practical tasks:

- crystal observation
- 10x loupe and microscope
- refractometer
- spectroscope
- polariscope
- dichroscope
- Chelsea colour filter (CCF)
- weight and specific gravity
- general observation and testing.

End-of-course assessment

At the end of the course, students should be able to:

- bring together principles and concepts from different areas of gemmology and apply them in a particular context, expressing ideas logically and using appropriate specialist vocabulary
- use gemmological testing skills in contexts which bring together different areas of the subject.

Foundation written examination

The question papers at the end of the Foundation course have a common format and each paper includes short questions and questions requiring more extended answers.

- Paper F1 – Practical based examination - 2 hours
- Paper F2 – Theory examination - 2 ½ hours

Sample papers can be obtained in pdf format from the Gem-A education office.

Results and grades

Markings and grades are for the assessed coursework, F1 and F2, these are added together to give one grade:

| Grade | % Limits | Result |
|-------|----------|----------------------------|
| A | 80 - 100 | Pass |
| B | 60 - 79 | Pass |
| C | 40 - 59 | Re-sit final exam |
| D | 20 - 39 | Re-sit final exam |
| E | 0 - 19 | Re-sit coursework and exam |

A and B are pass grades; C, D and E are fail grades.

If students receive a C or D grade but have received over 60% in their coursework they only need to re-sit their final written examinations, however, if they achieved less than 60% in their coursework they can choose to re-sit their coursework.

Students receiving an E grade will be required to re-sit both their coursework and written examinations.

A Certificate in Gemmology is awarded to qualifying candidates who have completed their practical endorsement.

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. See Gem-A's web site for further details on this.

Foundation syllabus

This syllabus indicates the possible areas of the subject which can be examined in the Foundation examination. Practical observation techniques and the use of the hand-held gemmological equipment forms a very important part of this examination.

Due to the specialised nature of gemmology and the need for accurate and reliable study materials Gem-A provides course notes to guide and assist students through the coursework and final examinations, however, additional reading around the subject is always recommended. For further information about the course materials available please contact Gem-A.

The specific level and amount of information required in the examination is also indicated by the potential marks printed next to each examination question.

The numbers on this syllabus relate to the relevant course section numbers.

FS1. Gems and Gemmology

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

FS2. Observation and Magnification

- General observation of gem materials without magnification: lustre and transparency.
- Magnification: the 10x lens and the microscope; lighting.
- Observation of gem materials: internal and external features.

FS3. Materials and Structure

- Minerals, atoms, elements and chemical bonding (elementary).
- The nature of crystals; crystalline materials (outline only).
- Polycrystalline (including microcrystalline) materials.
- The existence of: reference (crystallographic) axes and crystal symmetry (elementary).
- 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 materials.

FS4. Durability

- Hardness: definition and significance; testing and Mohs' scale; differential hardness.
- Toughness and stability, i.e. fracture and types of fracture.
- Cleavage: definition, description and significance.
- Durability in gemstones: care and caution factors.

FS5. Weight, Density and Specific Gravity

- Weight and its effect on value.
- Density and specific gravity (SG). Definitions of density and SG.
- SG measurement and hydrostatic weighing (elementary).
- Weight estimation of mounted gemstones.

FS6. Light and Optics

- The uses of light in gemmology.
- Wavelength and frequency.
- The electromagnetic spectrum (elementary).
- The visible spectrum of colour.
- Polarization and vibration direction.
- Reflection of light.
- Total internal reflection.
- Internal reflection effects caused by inclusions; chatoyancy and asterism.

- Internal reflection effects caused by structural features.
- Brilliance.
- Refraction; refractive index (RI), definition and description.
- Singly refractive materials.
- Doubly refractive materials: directional properties, double refraction, polarization, optical character.
- Measurement of RI; the refractometer.
- The determination of birefringence using the refractometer.
- 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.

FS7. Colour

- Light and body colour in gemstones.
- The visible spectrum.
- Dispersion, 'fire' and diffraction.
- Body colour and selective absorption of light.
- Colouring elements.
- The absorption spectrum and the spectroscope.
- The use of the spectroscope.
- The absorption spectra of the following materials: emerald, zircon, peridot, almandine garnet, ruby, red spinel, red glass (selenium), red glass (gold), red glass (rare earth element), blue sapphire, blue glass (cobalt), blue Verneuil synthetic spinel (cobalt).
- Use of colour filters; the Chelsea colour filter.
- Colour change effect ('alexandrite effect').
- Pleochroism; the dichroscope, and its use; typical results.
- Iridescence (elementary).

FS8. Other Gem Properties

- Luminescence: fluorescence and phosphorescence.
- Use of the ultra-violet lamp (short wave and long wave).
- The use of X-rays in gemmology.
- Summary of some important laboratory methods.
- Thermal conductance and electrical conductivity probes; reflectance meters.

FS9. The Geology of Gems

- Earth's physical activity; melting, crystallization, sedimentation.
- The origin and occurrence of gem minerals (elementary).
- Major types of gem deposit (general description): pegmatite; diamond pipe; placer; hydrothermal vein.

FS10. The Gemstone Pipeline

- Overview of the gemstone pipeline.
- Extraction: mining and recovery methods (outline only).

FS11. Fashioning 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 (outline only).

FS12. Gems and Jewellery

- Gem settings in jewellery.
- Jewellery metals.
- Gem identification and diamond grading reports.
- The quality factors of gemstones.
- Appraisal and valuation.
- Handling gemstone jewellery.
- Testing gems in jewellery.

FS13. Treatments

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

FS14. Imitations, Simulants and Synthetics

- Artificial and synthetic gems: definitions.
- Basic identification of materials produced by the Verneuil flame fusion, flux melt, hydrothermal, high pressure high temperature, skull melting and sublimation methods.
- Non-crystalline artificial materials: paste; plastics.
- Imitation (simulation) of gem and ornamental materials; the use of natural and artificial materials as imitations.
- Composite (assembled) natural and artificial stones; reconstructed materials.

FS15. The Gemstones

- The description and elementary methods of identification of gem materials including as applicable:
Chemical composition.
Crystal system and crystal habit.
Common and characteristic crystal forms, and crystal face markings and features.
Cleavage and fracture.
Hardness.
SG.
Colour; causes of colour; pleochroism.

Lustre.
Internal reflection effects (including iridescence, chatoyancy and asterism);
RI (with birefringence).
Dispersion (description of relative amounts only).
Common and characteristic inclusions.
Major geological occurrences.
Major world localities of commercial deposits.
Similar looking materials, common simulants and synthetics.

- For the following gem varieties:

| | |
|-------------|----------|
| Amber | Beryl |
| Chrysoberyl | Corundum |
| Diamond | Feldspar |

Fluorite
Iolite
Nephrite
Peridot
Quartz
Topaz
Zircon

Garnet
Jadeite
Opal
Pearls
Spinel
Tourmaline
Zoisite (Tanzanite)

- Also the most important distinguishing features of the following materials:

| | |
|-----------|----------------------------|
| Coral | Glass (natural) – Obsidian |
| Hematite | Ivory |
| Jet | Lapis lazuli |
| Malachite | Rhodochrosite |
| Rhodonite | Serpentine (Bowenite) |
| Turquoise | |

Constants of syllabus stones

This data sheet of gemstone constants is given to candidates in 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 | to 0.059 | 3.9 to 4.8 |

Note:

- 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.

Further information

Other related documents available from Gem-A:

- Sample past papers.
- Exam reports.
- Annual prospectus which includes information on fees and examination dates.
- Gem-A's student handbook which includes information on:
 - Reasonable adjustments and special considerations policy and procedures.
 - Examination enquires and appeals .
 - Malpractice procedures.
 - Equal opportunities policy.

For these documents or further information relating to any of Gem-A's courses and examinations please contact education@gem-a.com or go to www.gem-a.com.