Gem-A Diploma in Gemmology Course Specifications

Contents

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Introduction

This course is designed to:

- build upon a students existing knowledge of gemmology
- expand the specialist skills required for the testing and identification of gemstones
- develop a students ability to recognise the usefulness, and limitations, of testing methods
- support students wishing to improve their job opportunities in gemmology and related fields
- prepare students continuing their studies in specialist fields of gemmology and related studies.

Students require a foundation in gemmology to study this course. This can be provided through Gem-A's Foundation in Gemmology.

Course aims

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

- expand their knowledge of gem materials and their properties
- broaden their appreciation of the characteristic and identifying features of a wide range of gemstones
- gain an appreciation and understanding of the various topics and areas of gemmology and their importance in the study and testing of gemstones
- encourage the presentation of information and ideas appropriate for different audiences and purposes
- develop attitudes relevant to gemmology such as accuracy and precision, objectivity, integrity, enquiry, initiative and insight.

Certification title

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

Assessment objectives

Students should be able to demonstrate the following:

AO1 Knowledge and understanding

- recognise, recall and show understanding of specific gemmological facts, terminology, principles, relationships, concepts and practical techniques
- show a broad knowledge of treatments and artificial materials, their production, use, identification and the resulting implications for the gem trade
- draw on existing knowledge to show understanding of the ethical, environmental and technological implications and applications of gemmology
- select, organise and present relevant information clearly and logically, using appropriate vocabulary where appropriate

AO2 Application of knowledge and understanding

- describe, explain and interpret phenomena and effects in terms of gemmological principles and concepts, presenting ideas clearly and logically, using specialist vocabulary where appropriate
- interpret results from gem testing equipment to identify gem materials
- apply scientific principles and concepts in solving problems relating to gemmology
- demonstrate an appreciation for further testing techniques, their limitations and uses
- assess the validity, reliability and credibility of scientific information related to gemmology

AO3 Practical skills

- demonstrate a logical approach to gem testing by selecting appropriate techniques for the material under test
- demonstrate safe and skilful practical techniques
- make, record and communicate reliable and valid observations and measurements with appropriate precision and accuracy
- interpret, explain and evaluate results clearly and logically using gemmological knowledge and understanding and using appropriate specialist vocabulary.

Scheme of assessment

The course will contain coursework and end of course examinations. The course is comprised of two components the theory and practical. Students need to pass both to pass this course:

Title	Mode of assessment	Duration	Weighting
Theory component:			
Assessed coursework	Coursework	-	16%
Diploma paper 1	Written examination	2 hours & 30 mins	42%
Diploma paper 2	Written examination	2 hours & 30 mins	42%
Practical component:			
Practical endorsement	Coursework	-	Completion required
Diploma practical paper 3	Written (practical) examination	3 hours & 15 mins	100%

Assessed coursework

Assessment of students coursework is made by a Gem-A approved Diploma tutor and moderated externally by Gem-A.

The course is broken into four blocks of study. Each block is assessed through an end of block online assessment

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

Some of this is a continuation of the subject areas covered by the Foundation course.

Block D1 – The structure and physical properties of gemstones

Content:

- Section 3D - Materials and Structure
- Section 4D - Durability
- Section 5D - Weight, Density and Specific Gravity

At the end of Block D1, students should be able to:

- describe the basic structure of an atom and how they bond through ionic and covalent bonding
- explain the crystal systems and demonstrate an understanding of the terms used to describe crystal structure and symmetry
- make, record, sketch and communicate reliable and valid observations of crystalline gem materials
- explain hardness and its use in gemmology
- describe and explain the principles involved in specific gravity testing.

Block D2 - Magnification, light and colour

Content:

- Section 2D - Observation and Magnification
- Section 6D - Light and Optics
- Section 7D - Colour

At the end of Block D2, students should be able to:

- explain the use and variations of the gemmological microscope
- demonstrate evidence of knowledge and understanding of phenomena, concepts and relationships by describing and explaining the principles and use of optical properties in gem testing
- demonstrate a knowledge and understanding of the colour mechanisms in gem materials.
- explain the occurrence of absorption and emission spectra, compare and contrast the features of these spectra in gem materials
- demonstrate a comprehension of the terms needed to understand texts about the optical properties and their uses in gemmology

Block D3 - Treatments, synthetics and further testing techniques

Content:

- Section 13 - Treatments
- Section 14 - Imitations, Simulants and Synthetics
- Section 8 - Other Gem Properties (laboratory testing)

At the end of Block D3, students should be able to:

- discuss and give examples of treated gem materials and the colour mechanisms involved in the treatment process
- describe the different processes involved in the production of artificial gem materials
- explain the different testing techniques and their uses in the identification of treated and artificial gem materials including appropriate laboratory testing techniques.

Block F4 - The gemstone pipeline and the gemstones

Content:

- Section D9 - The Geology of Gems
- Section D11 - Fashioning Gemstones
- Section D15 - The Gemstones

At the end of Block D4, students should be able to:

- describe the different geological process in relation to gem materials
- give examples of how different geological process may affect the identification of gem materials
- describe the process of fashioning gem materials for use in the gem trade

- give detailed information on the different gem materials, compare and contrast their features and show an in-depth understanding of the testing process involved in gemstone identification.

Practical endorsement

Assessment of students practical work is made by a Gem-A approved practical tutor 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 need to cover the following areas:

- observation and magnification – 10x lens and microscope
- use of specialist gemmological equipment – spectroscope, dichroscope, CCF, polariscope, conoscope, refractometer, carat balance (hydrostatic weighing), gauge, diamond probes (testers)
- knowledge of the use of further testing techniques
- stones include organic, non-organic, ornamental, rough, fashioned, mounted, natural, artificial and treated.

End-of-course assessment

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

- test and identify most natural gem materials
- demonstrate the use of standard gem testing equipment
- explain the principles of gem testing
- identify synthetic, treated and simulants used within the gem trade or, if unable to identify these using standard gem testing equipment;
- advise on further testing
- explain the different areas of gemmological study, their importance and purpose.

Diploma written examinations

The question papers at the end of the Diploma course have a common format. The theory paper includes questions requiring more extended answers.

- Paper D1 — Theory examination - 2 ½ hours
- Paper D2 — Theory examination - 2 ½ hours
- Paper D3 — Practical examination – 3 ¼ hours

Sample papers can be obtained in pdf format from education@gem-a.com or Gem-A's Online Campus.

Results and grades

There are two components to this course the theory and the practical. Both components receive separate grades (for weighting of these grades see the information under *scheme of assessment*).

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	Resit Coursework and final exam

*Students with three or more stones wrong in section D of the D3 practical paper can achieve a C grade at highest for the practical component will be required to re-sit the D3 practical paper.

A and B are pass grades; C, D and E are fail grades. Students are required to pass both the theory and practical components to pass this course.

Distinctions are awarded to students with A/A grades and no stones wrong in the D3 practical paper. Merits are awarded to students with an A grade and an A or high B grade (i.e. with 75% or higher) and who have one or less stones wrong in section D of the D3 practical paper.

To be eligible for a distinction or award students must sit all their examinations within one year. More than one type of award may be given. See Gem-A's website for further details on this.

Re-sits: Students with a pass grade in the practical will have their practical grade held indefinitely and can re-sit the theory at any time. Students who pass the theory but require a re-sit in the practical component are given two years to re-sit and pass the practical component. After this time both examination components of the course must be re- sat. Following any re-sit, candidates are not eligible for a Distinction, Merit or for any award.

A Diploma in Gemmology is awarded to qualifying candidates.

Diploma syllabus

This syllabus indicates the possible areas of the subject which can be examined in the Diploma examination. The Diploma syllabus comprises the whole of the Foundation (Sections F1 to 15) as well as the Diploma (Sections D1 to D15). For details of sections F1 to F15 please see the Gem-A Foundation in Gemmology Specifications.

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.

D1. Gems and Gemmology

- No additional information to F1 required.

D2. Observation and Magnification

- The uses of the lens and microscope in gem testing; including microscope adaptations commonly used in gemmology.
- Observation of gem materials: internal and external features; immersion of gems to aid observation.
- External features; internal features and the study of inclusions, in rough and fashioned natural, artificial, treated and imitation gem materials.

D3.Materials and Structure

- Atomic-scale structure, electrons and chemical bonding.
- Crystal structures in terms of chemical bonding.
- Crystal structure; reference (crystallographic) axes and crystal symmetry; crystal habits.
- Amorphous and metamict materials; polymorphs; isomorphism.

D4. Durability

- Differential hardness.
- Hardness and its use in testing.
- Streak test.
- Parting.

D5. Weight, Density and Specific Gravity

- Accurate specific gravity measurement for gem testing; hydrostatic weighing; precautions in specific gravity testing
- The use of high-density liquids in gem testing; care and caution in use.

D6. Light and Optics

- Optical properties of crystalline materials; uniaxial materials; biaxial materials.
- The systematic interaction of light with crystal structures: polarization, optic axes and optic axial interference figures; uses in gem testing.
- Refractive index, birefringence and optic sign: their measurement by refractometer and by other methods; uses in gem testing..

D7. Colour

- Colour; white light; light and electrons.
- Colour and its causes in gem materials; luminescence.
- Physical optics; optical phenomena that affect light.
- The use of colour in gem testing; spectroscope; colour filters, dichroscope.

D8. Other Gem Properties

- Gem testing techniques employed in gemmological laboratories; X-ray, infrared, ultraviolet and advanced techniques.

D9. The Geology of Gems

- The rock cycle.
- Geological processes and terms (general descriptions and outlines only).

D10. The Gemstone Pipeline

- No additional information to F10 required.

D11. Fashioning Gemstones

- Processes and stages in lapidary and diamond manufacture; lapidary and diamond manufacturing equipment (general descriptions only).

D12. Gems and Jewellery

- No additional information to F12 required.

D13. Treatments

- Details of methods of gem treatments.
- Identification of gem treatments.
- Disclosure of treatments

D14. Imitations, Simulants and Synthetics

- A brief outline of methods of production for the common artificial gem materials including: Verneuil flame fusion; Czochralski (crystal pulling); flux melt; hydrothermal; skull melting; high pressure high temperature; gel growth and ceramic methods.
- Identification of common artificial gem materials including: cubic zirconia (CZ), synthetic moissanite, glass.
- Disclosure of artificial gem materials

D15. The Gemstones

- The description and methods of identification of gem materials including as applicable: Chemical composition.
  Crystal system, crystal habit. common and characteristic crystal forms, and crystal face markings and features.
  Cleavage and fracture.
  Hardness.
  SG.
  Colour; causes of colour; pleochroism; absorption spectra; luminescence.
  Lustre.
  Internal reflection effects (including iridescence, chatoyancy and asterism);
  RI; birefringence; optical nature and optic sign.
  Dispersion (description of relative amounts only).
  Common and characteristic inclusions.
  Major geological occurrences; localities and important commercial deposits.
  Separation of gem materials from their synthetics and most common simulants.
  Detection of treatment or enhancement.
- For the following gem varieties:

Amber	Andalusite
Apatite (and copal)	Beryl
Calcite	Chrysoberyl
Coral	Corundum
Diamond	Diopside
Feldspar	Fluorite
Garnet	Glass (natural)
Gypsum	Hematite
Horn	Iolite
Ivory	Jadeite
Jet	Kyanite
Lapis lazuli	Nephrite
Malachite	Opal
Peridot	Pearls
Prehnite	Pyrite
Rhodochrosite	Rhodonite
Quartz	Scapolite
Serpentine	Shell
Sinhalite	Sodalite
Sphene	Spinel
Spodumene	Steatite (soapstone)
Topaz	Tortoiseshell
Tourmaline	Turquoise
Zircon	Zoisite (Tanzanite)

Constants of syllabus stones

This data sheet of gemstone constants is given to candidates in the Diploma examinations and is in RI order:

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 Diploma examination questions.

Material	RI	Birefringence	Optical Char	SG	Hardness
Opal	1.40 to 1.46	-	I	2.0 to 2.2	6
Fluorite	1.43 to 1.44	-	I	3.0 to 3.2	4
Sodalite	1.48 approx.	-	-	2.3 approx.	5½ to 6
Calcite varieties	1.48 to 1.66	0.172	U-	2.58 to 2.75	3
Lapis lazuli	1.50 approx.	-	-	2.7 to 2.9	5½
Natural glass	1.50 approx.	-	I	2.4 approx.	5 to 5½
Paste (artificial glass)	1.50 to 1.70	-	I	2.0 to 4.2	6 approx.
Gypsum varieties	1.52 to 1.53	-	B+	2.3 approx.	2
Feldspar varieties	1.52 to 1.57	0.004 to 0.009	B+/-	2.56 to 2.75	6
Quartz, polycrystalline	1.53 to 1.55	-	-	2.6 approx.	6 to 7
Ivory, dentine	1.53 to 1.57	-	-	1.7 to 2.0	2 to 3
Amber	1.54 approx.	-	I	1.05 to 1.10	2½
Ivory, vegetable	1.54 approx.	-	-	1.4 approx.	2½
Iolite	1.54 to 1.56	0.008 to 0.012	B-	2.57 to 2.61	7 to 7½
Quartz, crystalline	1.54 to 1.56	0.009	U+	2.65 approx.	7
Scapolite	1.54 to 1.58	0.009 to 0.026	U-	2.50 to 2.74	6
Steatite	1.55 approx.	-	-	2.7 to 2.8	1
Tortoiseshell	1.55 approx.	-	-	1.29	2½
Serpentine, bowenite	1.56 approx.	-	-	2.6 approx.	5
Beryl varieties	1.56 to 1.60	0.003 to 0.010	U-	2.65 to 2.80	7½
Rhodochrosite	1.59 to 1.82	0.220	U-	3.5 to 3.7	4
Topaz	1.61 to 1.64	0.008 to 0.010	B+	3.5 to 3.6	8
Prehnite	1.61 to 1.65	0.022 to 0.033	B+	2.8 to 2.9	6 to 6½
Nephrite	1.62 approx.	-	-	2.8 to 3.1	6½
Turquoise	1.62 approx.	-	-	2.6 to 2.9	5½ to 6
Tourmaline	1.62 to 1.65	0.014 to 0.021	U-	3.0 to 3.1	7 to 7½
Andalusite	1.63 to 1.64	0.007 to 0.013	B-	3.15 to 3.20	7½
Apatite	1.63 to 1.64	0.002 to 0.006	U-	3.17 to 3.23	5
Peridot	1.65 to 1.69	0.036	B+/-	3.32 to 3.37	6½
Jadeite	1.66 approx.	-	-	3.30 to 3.36	7
Jet	1.66 approx.	-	-	1.3 approx.	2½ to 4
Spodumene	1.66 to 1.68	0.015 to 0.016	B+	3.17 to 3.19	7
Diopside	1.67 to 1.70	0.024 to 0.030	B+	3.26 to 3.32	5½
Sinhalite	1.67 to 1.71	0.037 to 0.038	B-	3.47 to 3.50	6½
Zoisite, Tanzanite	1.69 to 1.70	0.006 to 0.013	B+	3.15 to 3.38	6½
Garnet, hydrogrossular	1.70 to 1.73	-	I	3.3 to 3.6	7¼
Kyanite	1.71 to 1.73	0.017	B+	3.6 to 3.7	5 to 7
Spinel	1.71 to 1.74	-	I	3.58 to 3.61	8
Rhodonite	1.72 approx.	-	-	3.6 to 3.7	6
Spinel, Verneuil synthetic	1.72 to 1.73	-	I	3.61 to 3.67	8
Garnet, grossular	1.73 to 1.75	-	I	3.4 to 3.8	7¼
Chrysoberyl	1.74 to 1.76	0.008 to 0.010	B+	3.71 to 3.75	8½
Garnet, pyrope	1.74 to 1.76	-	I	3.7 to 3.8	7¼
Corundum varieties	1.76 to 1.78	0.008 to 0.009	U-	3.80 to 4.05	9
Garnet, almandine	1.76 to 1.81	-	I	3.8 to 4.2	7½
Zircon	1.78 to 1.99	up to 0.059	U+	3.9 to 4.8	6½ to 7½
Garnet, spessartine	1.79 to 1.82	-	I	4.12 to 4.20	7¼
YAG	1.83 approx.	-	I	4.6 approx.	8
Malachite	1.85 approx.	-	-	3.6 to 4.0	4
Sphene	1.88 to 2.05	0.105 to 0.135	B+	3.4 to 3.6	5 to 5½
Garnet, demantoid	1.89 approx.	-	I	3.82 to 3.85	6½
Cubic zirconia	2.17 approx.	-	I	5.6 to 6.0	8 to 8½
Diamond	2.42	-	I	3.52	10
Synthetic moissanite	2.65 to 2.69	0.043	U	3.22	9¼
Hematite	-	-	-	5 approx.	5½ to 6½
Pyrite	-	-	-	5 approx.	6½

Further information

Other related documents available from Gem-A:

- Sample past papers.
- Examination 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.