The Bronze Syllabus

The highlighted sections can be removed. The subject areas are as shown on the current 2018 papers

The British Gliding Association

Bronze C Theoretical Examination

General Conditions and Syllabus

As part of the application for a Bronze C Endorsement, theoretical exams will need to be taken and passed in the following subject areas:

1. Air law and ATC Procedures
2. Human performance
3. Meteorology
4. Communications
5. Principles of flight
6. Operational procedures
7. Flight performance and planning
8. Aircraft general knowledge, airframes and systems
9. Navigation.
    A. Part A Knowledge of charts.
    B. Part B Flight preparation and planning.

'Sailplane' means a heavier-than-air aircraft that is supported in flight by the dynamic reaction of the air against its fixed lifting surfaces, the free flight of which does not depend on an engine.

'Powered sailplane' means an aircraft, equipped with one or more engines having, with engine(s) inoperative, the characteristics of a sailplane. These can be self-launching or self-sustaining.

The Bronze Theoretical Examination papers are issued to Chief Flying Instructors (CFI) at British Gliding Association member clubs. The CFI may appoint instructors*[2] as examiners to supervise and mark the papers. Pilots who have undergone an approved course of training may be recommended by their instructors to sit the examination.

General conditions applicable to the Bronze Theoretical Exam and exam requirements:

Questions have four possible multi-choice answers. All questions should be attempted. No credit or penalty is given for unanswered questions or incorrect answers. Candidate should indicate their answer on the grid provided by putting a cross in the appropriate box. No papers other than those provided by the invigilator should be on the work table. Where rough work is required it should be carried out on rough paper provided by the invigilator. Rough paper must be handed to the invigilator on completion of the examination.

The Bronze Syllabus

In all questions assume 1 Nautical mile = 6000feet. 1hectopascal = 30feet and variation = 5º W. When answering regulatory question assume gliders are EASA aircraft (i.e have G registrations) and all gliders are exercising the privileges of a BGA Gliding Certificate with Bronze and Cross Country endorsement or LAPL(S).

The Navigation Section requires candidates to be in possession of a maker pen, rule, protractor and a recent 1.500,000 ICAO chart, normally covering the area around your home club (Scotland, North, or Southern CAA charts).

The pass mark is 75% (9/12) for all subjects. Once the exam has been passed it is valid for 24 months. After this time if the Bronze certificate has not been issued the whole exam will need to be taken again.

If one section of the exam is failed, only the section(s) failed need be retaken. If a candidate fails a section 3 times, a fourth attempt is not allowed. In this case, the candidate and examiner must refer to the Training Standards Manager (mike@gliding.co.uk) for advice.

Note for instructors

Instructors will need to satisfy themselves that a candidate is prepared to sit the examination. The following syllabus has been prepared for the information of both student glider pilots and instructors.

The syllabus

The syllabus has been broken down into the sections governing the examination topics listed above.

All student pilots and instructors should note that the Bronze Theoretical Exam is a snapshot test of pilots knowledge across a range of flying related matters in relation to gliding and general aviation. It is not a comprehensive guide to developing soaring skills, discipline and good airmanship.

Section 1

AIR LAW AND ATC PROCEDURES - 12 questions

Syllabus / resources: BGA Laws and Rules, Air navigations Orders. CAP413 CAP 6345 The Sky Way Code

Aim: The student will refer to the BGA Laws and Rules publication as the main resource for legal and operational aspects of gliding and memorize sufficient of its content to ensure safe and legal conduct.

Knowledge

Specifically the student should be able to identify and understand:

- The international laws and conventions that control the flying of sailplane

- The requirement for aircraft registration and identification
- The documents required for registration, airworthiness reviews.
- The need for and the documents required for personal licensing and the age limits
- Understand the requirements of medical certification
- The requirement of personal record including hours and privileges.
- Understand the procedure for faults in sailplanes, damage, actual or suspected and hazardous incidents.
- Understand the content and reason for daily inspections.
- Winch launching and licensing requirements.
- Aerotow launching and licensing requirements
- Air Navigation Orders - Rules of of The Air.
- Define ‘night time’ and ‘hours of daylight’,
- Define the period during which a sailplane is in flight.
- Define the objects that may be dropped from a sailplane
- Procedures and regulations for air navigation including visual and instrument flight rules.
- The structure and classes of airspace.
- The services offered by Air Traffic Management signals used
- Describe signals using lights and pyrotechnics,
- Describe common airfield markings,
- The information available to pilots through Air Information Services.
- Landing and taking off at other airfields.
- The facilities offered by search and rescue services.
- Matters concerning National Security.
- The definitions of an accident , accident reporting and investigation,
- Incident reporting and investigation.
- How the National Law may differ from international law.

Section 2

Human performance - 12 Questions

Syllabus / resources: This section covers a pilots overall fitness to fly and the possible effects of some of the environments sailplane pilots may find themselves.

Aim: To explore those areas where a pilot may possess a current medical certificate but conditions may have an effect of the pilot’s current physical state. These include ocular theory, visual acuity, pressure changes, hypoxia, hyperventilation, CO poisoning, hypothermia and nausea may affect a pilots performance.

Knowledge: Specifically the student should be able to identify:

- Medical considerations for aviators using the I’M SAFE acronym.
- The basic function and limitations of the human eye and

- Describe the limits of visual acuity in conditions of flight and appropriate measures to minimize their shortfalls.
- The effects of pressure changes and sensible precautions.
- The symptoms and remedies for hypoxia and hyperventilation.
- The causes, symptoms and precautions against carbon monoxide poisoning.
- Symptoms and effects of hypothermia.
- List the causes of nausea and possible remedies.
- Describe the law and advice regarding the use of oxygen.

Section 3

Meteorology – 12 questions

Syllabus / resources: Included in this part of the syllabus is the global movement of the atmosphere that surrounds the earth, with its air masses, pressure systems, both stable and unstable. The various cloud formations, lapse rates, tephigrams, dew points, local variations, convection, winds and how the various systems interact

Aim: The student will be able to relate the behaviour of global weather systems, to soaring weather and relate soaring weather to local topology and forecast conditions and make decisions leading to safe and successful soaring.

Knowledge: The student should be able to identify and predict weather conditions suitable for flying sailplanes for short of prolonged flights

The atmosphere its:

- Composition and structure.
- Vertical divisions.

Pressure:

- Density and temperature.
- Barometric pressure, isobars.
- Changes of pressure ambient.
- Air density and temperature with altitude.
- Altimetry terminology.
- Solar and terrestrial energy radiation.
- Temperature - diurnal variation of temperature - adiabatic process - temperature lapse rate - stability and instability, inversions.
- Effects of radiation, advection, subsidence and convergence.

Humidity and precipitation:

- water vapour in the atmosphere
- vapour pressure.
- dew point and relative humidity.
- condensation and vaporisation.
- Types of precipitation.

Pressure and wind:

- High and low pressure areas.

- Motion of the atmosphere.
- Pressure gradient.
- Vertical and horizontal motion.
- Convergence.
- Divergence.
- Surface and geostrophic wind.
- Effect of wind gradient and wind shear on take-off and landing.
- Relationship between isobars and wind, Buys Ballot's law
- Turbulence and gustiness cause and effect.
- Local winds.
- Föhn winds.
- Land and sea breezes.

Cloud formation and flying conditions produced by each cloud type:

- Cooling by advection, radiation and adiabatic expansion.
- Cloud types.
- Convection clouds.
- Orographic clouds.
- Stratiform and cumulus clouds.

Fog, mist and haze:

- Radiation.
- Advection.
- Frontal.
- Freezing fog formation and dispersal.
- Reduction of visibility due to mist.
- Snow, smoke, dust and sand.
- Assessment of probability of reduced visibility.
- Hazards in flight due to low visibility, horizontal and vertical.

Airmasses:

- Description of and factors affecting the properties of airmasses.
- Classification of airmasses.
- Region of origin.
- Modification of airmasses during their movement.
- Development of low and high pressure systems.
- Weather associated with pressure systems.

Frontology:

- Formation of cold and warm fronts.
- Boundaries between airmasses.
- Development of a warm front associated clouds and weather - weather in the warm sector - development of a cold front associated clouds and weather.
- Occlusions.
- Associated clouds and weather.
- Stationary fronts associated clouds and weather.

Ice accretion:

- Conditions conducive to ice formation.
- Effects of hoar frost.
- Rime ice.
- Clear ice.
- Effects of icing on aeroplane performance.
- Precautions and avoidance of icing conditions.

Power plant icing:

- Precautions.
- Prevention and clearance of induction.
- Carburettor icing.

Thunderstorms formation:

- Airmass.
- Frontal.
- Orographic - conditions required - development process - recognition of favourable conditions for formation.
- Hazards for aeroplanes.
- Effects of lightning and severe turbulence.
- Avoidance of flight in the vicinity of thunderstorms.

Flight over mountainous areas:

- Hazards.
- Influence of terrain on atmospheric processes.
- Mountain waves.
- Windshear.
- Turbulence.
- Vertical movement.
- Rotor effects.
- Valley winds.

Climatology:

- General seasonable circulation in the troposphere over Europe.
- Local seasonal weather and winds.

Altimetry:

- Operational aspects of pressure settings.
- Pressure altitude.
- Density altitude.
- Height, altitude, flight level.
- ICAO standard atmosphere.
- QNH, QFE, standard setting.

- Transition altitude, layer and level.

The meteorological organisation:

- Aerodrome meteorological offices.
- Aeronautical meteorological stations.
- Forecasting service meteorological services at aerodromes.
- Availability of periodic weather forecasts.

Weather analysis and forecasting:

- Weather charts.
- Symbols, signs.
- Significant weather charts.
- Prognostic charts for general aviation

Weather information for flight planning:

- Reports and forecasts for departure, en-route, destination and alternate(s).
- Interpretation of coded information, METAR, TAF.
- Availability of ground reports for surface wind, windshear and visibility.

Meteorological broadcasts for aviation:

VOLMET, ATIS, SIGMET

Section 4

Communications - 12 questions

SYLLABUS / RESOURCES: Based on the contents of the CAA Document CAP413

AIM: The student should understand the need for personal and equipment licensing along with the information that can be obtained using VHF radio. Together with the correct terminology used in airborne radio communications.

Knowledge:

- Use of AIP and frequency selection
- Microphone technique
- Phonetic alphabet
- Station/aeroplane/callsigns/abbreviations
- Transmission technique
- Use of standard words and phrases
- Listening out
- Required ‘readback’ instructions

Departure procedures:

- Radio checks.
- Taxi instructions.
- Holding on ground.
- Departure clearance.

En-route procedures:

- Frequency changing.
- Position.

Altitude/flight level reporting:

- Flight information service.
- Weather information.
- Weather reporting.
- Procedure to obtain bearings, headings, position.
- Procedural phraseology.
- Height/range coverage.

Arrival and traffic pattern procedures:

- Arrival clearance.
- Calls and ATC instructions during the:
    a) circuit
    b) approach and landing
    c) vacating the runway

Communications failure:

- Action to be taken.
- Alternate frequency.
- Serviceability check including microphone, headphones, loud speakers.
- In-flight procedures according to type of airspace.

Distress and urgency procedures:

- Distress (Mayday/PAN/Test pan), definition and when to use.
- Frequencies to use.
- Contents of Mayday message.

Section 5

Principles of flight

PRINCIPLES OF FLIGHT– SAILPLANE - 12 questions

Syllabus / resources: The British Gilding Association book “Gliding”. T

The Bronze Syllabus

Aim: To teach the student sailplane pilot what the air mass is and the mechanics of the way air moves around things, or conversely how the movement of the sailplane through the airmass allows it to fly. To understand the Four Forces of flight: lift, weight, thrust and drag. How changes in the movement of the air over the sailplane affects each of these forces and how changes in the shape of the sailplane affect its movement through the air.

Knowledge: The student will have knowledge of the following topics.

Atmosphere (Air) and airflow

- ICAO standard atmosphere.
- Atmospheric pressure.
- Airflow around a body, subsonic.
- Air resistance and air density.
- Boundary layer.
- Friction forces.
- Laminar and turbulent flow,
- Bernoulli's principle.
- Venturi effect.
- Airflow about a two dimensional aerofoil.
- Airflow around a flat plate.
- Airflow around a curved plate (aerofoil).
- Description of aerofoil cross section.
- Lift and drag.
- CL and CD and their relationship to angle of attack.

Three dimensional flow about an aerofoil:

- Aerofoil shapes and wing planforms.
- Induced drag.
- Downwash angle, vortex drag, ground effect
- Aspect ratio.
- Parasite (profile) drag.
- Form, skin friction and interference drag.
- Lift/drag ratio.

Distribution of the four forces:

- Balance and couples.
- Lift and mass.
- Thrust and drag.
- Methods of achieving balance.

Limitations (load factor and manoeuvres)

- Placard speeds VNE VNA.

- The Flight envelope.

The flying controls:

- The three planes.
- Pitching about the lateral axis.
- Rolling about the longitudinal axis.
- Yawing about the normal axis.
- Effects of the elevators (stabilators),
- Ailerons and rudder.
- Control in pitch, roll and yaw.
- Cross coupling, roll and yaw.
- Mass and aerodynamic balance of control surfaces.

The trimming controls:

- Basic trim tab, spring aerodynamic.
- Balance tab and Anti-balance tabs purpose and function, method of operation.

Flaps and slats:

- Simple, split, slotted and Fowler flaps.
- Purpose and function.
- Operational use.
- Slats, leading edge.
- Purpose and function - normal/automatic operation.

Stability:

- Definition of static and dynamic stability.
- Longitudinal stability.
- Centre of gravity effect on control in pitch.
- Lateral and directional stability interrelationship, lateral and directional stability. Load factor and manoeuvres.
- Structural considerations.
- Manoeuvring and gust envelope.
- Limiting load factors, with and without flaps.
- Changes in load factor in turns and pull-ups.
- Manoeuvring speed limitations
- In-flight precautions

The stall:

- Stalling angle of attack
- Disruption of smooth airflow
- Reduction of lift, increase of drag.

- Movement of centre of pressure.
- Symptoms of development.
- Aeroplane characteristics at the stall.
- Factors affecting stall speed and aeroplane behaviour at the stall.
- Stalling from level, climbing, descending and turning flight.
- Inherent and artificial stall warnings.
- Recovery from the stall Avoidance of spins.
- Wing tip stall and the development of roll.
- Recognition at the incipient stage.
- Immediate and positive stall recovery.

The spin:

- The causes of a spin.
- The recovery.
- Prolonged spins.
- The dangers.

Section 6

OPERATIONAL PROCEDURES – SAILPLANE 12 questions

SYLLABUS / RESOURCES: To understand the reason for operational procedures, threat and error management along with crew resource management.

AIM: The student will understand the principles of efficient, safe airfield management and operations referring to the BGA Laws and Rules publication as the single resource for legal and operational aspects of gliding and memorize sufficient of its content to ensure safe and legal conduct.

Knowledge: Specifically the student will have knowledge of the following topics.

- Define ‘night time’ and ‘hours of daylight’.
- Define the period during which a sailplane is in flight.
- Describe best practice for ground handling of sailplanes.
- Describe best practice for launching sailplanes by winch and aero-tow.
- Describe the reporting procedure for faults in sailplanes, damage, actual or suspected and hazardous incidents.
- Explain the need for daily inspection of all operational equipment.,
- Describe basic care and inspection of parachutes.
- Describe the construction and operation of cable launching equipment,
- State regulations governing heights of sailplane winch launches.
- Describe the construction and operation of aero-towing equipment.
- Describe pre-flight control checks.
- Describe operational regulations and procedures for aero-towing.
- Describe launch signalling methods.
- Describe signals using lights and pyrotechnics.
- Describe common airfield markings.
- Explain the need for flying circuits before landing.

- Describe prelanding checks.
- Explain the procedure for out landing and the field landing code of practice.
- Describe accident reporting procedures.
- Describe sailplane radio licencing requirements and frequencies used,
- Describe pre-flight control checks.
- State why sailplanes should not be launched with ice, snow, or water on wings.
- Describe thermal protocol and techniques.
- Describe ridge soaring protocol and techniques.
- Describe wave soaring protocol and techniques.
- Understand threat and error management in relation to airfield operations.
- Understand the action to be taken in the event of an emergency and accident reporting procedures.

Section 7

FLIGHT PERFORMANCE AND PLANNING - SAILPLANE - 12 questions

Syllabus / resources: To learn how a sailplane performs under differing weather and configurations

Aim: To understand how a sailplane performance is measured at different speeds, wing loadings. The difference between glide angle and glide ratio, the effects of rising and sinking air, the wind. Flying for speed or distance, adding water and using McCready settings. Flying efficiently, Task planning and setting.

Knowledge: Specifically the student will have knowledge of the following topics.

- How the forces of mass and weight interact around the centre of gravity.
- Co-ordination of the controls.
- Interpretation of polar curves for minimum sink.
- Interpretation of polar curves for best glide angle.
- Interpretation of polar curves for minimum weight.
- Interpretation of polar curves for maximum weight.
- Interpretation of weather forecast for task setting.
- Flight preparation and planning for task flying.
- Explain the BGA Field landing Code of practice.
- In flight task monitoring and replanning.
- Understanding the different requirements of flying for enjoyment, badge flying and competition flying.

Section 8

AIRCRAFT GENERAL KNOWLEDGE, AIRFRAME AND SYSTEMS AND EMERGENCY EQUIPMENT – SAILPLANE -12 questions

Syllabus / resources: The design, construction, airworthiness and ongoing maintenance of sailplanes, their performance and instrumentation.

The Bronze Syllabus

Aim: To understand how things work and are cared for.

Knowledge: Specifically the student will have knowledge of the following topics.

- Joint Airworthiness Requirments (CS 22)
- Performance in straight flight.
- Performance in accelerated flight.
- Materials used in aircraft construction (wood, cloth, metal and composite).
- The design and construction of major components.
- Structural stiffness of components.
- Washout, dihedral and anhedral, flutter.
- The forces on materials used in those components.
- Design and performance of wing shapes.
- The loads and stresses on airframes and material at rest and inflight.
- Undercarriage (landing gear), tyres wheels and brakes construction and use.
- More on manoeuvring envelopes.
- The basic flight controls elevator, ailerons, rudder and flaps.
- The secondary effects of the basic controls.
- How the Air Speed Indicator works.
- How the Altimeter works.
- How the mechanical variometer works.
- Netto and Total energy systems.
- Basic electric circuits and the need for fuses.
- Aircraft manuals, their contents and legal requirements.
- Airworthiness requirements and documentation.
- Pilot approved maintenance.
- Technical notes and directives.
- Electronic aids to navigation and aircraft awareness, moving maps and FLARM.
- The care, attention and wearing of parachutes.
- Emergency Location Transmitters (ELT's).

Section 9a

NAVIGATION - SAILPLANE Part A - 12 questions

Syllabus / resources: Airspace regulations as they apply to sailplanes in UK, interpretation of ICAO Aeronautical charts, definition of track and heading, vertical navigation, magnetic compass. The elements involved in dead reckoning, moving maps and GPS positioning.

Aim: The student will understand the relevance of the various types of airspace to sailplane navigation in the UK and the requirements for three-dimensional navigation.

In all questions assume 1 Nautical mile = 6000feet. 1hectopascal = 30feet and variation = 5º W. This Section requires candidate to be in possession of a maker pen, rule, protractor and a recent 1.500,000 ICAO chart, normally covering the area around the home club.

Knowledge: Specifically the student will have knowledge of the following topics.

Understand the basic of navigation with respect to lines of latitude and longitude

- State the types (and dimensions where appropriate) of UK airspace and associated IFR and VFR flight regulations and procedures for sailplanes,
- Interpret the legends on quarter million and half million scale ICAO aeronautical charts.
- Describe atmospheric pressure and its measurement in millibars, hectopascals and pounds per square inch.
- State the value of the ICAO Standard Atmosphere as 1013.2 mB,
- Describe use of QFE, QNH and flight level pressure settings.
- Describe the difference between true north and magnetic north.
- Describe the construction of a 'wet' compass.
- Describe the advantages and limitations of a 'wet' compass.
- Describe angle of dip and acceleration errors.
- Describe magnetic variation and the use of isogonal lines on air charts,
- Explain the limited use of a 'wet' compass and describe 'acceleration/dip free' design.
- Understand the mechanics of dead reckoning navigation.

Section 9b

NAVIGATION - SAILPLANE Part B - 12 questions

Syllabus / resources: The, interpretation of ICAO Aeronautical charts, definition of track, heading, bearing, vertical navigation, magnetic compass use and problems. Pre-flight planning, preparation and execution.

Aim: The student will need to understand the relevance of the various types of airspace to sailplane pilot and will be required to prepare an out return flight, to identify hazards and navigation features along the route and the requirements for three-dimensional navigation.

In all questions assume 1 Nautical mile = 6000feet. 1hectopascal = 30feet and variation = 5º W. This Section requires candidate to be in possession of a maker pen, rule, protractor and a recent 1.500,000 ICAO chart, normally covering the area around the home club.

Knowledge: The student should with the data supplied in each question and using a current 1:500000 aeronautical chart be able to:

- Prepare an out and return cross country flight plan to a given way point taking into consideration such factors as local weather conditions, airspace, condition of fields, NOTAMs, TNWs, etc.
- Identify the magnetic and true headings in each direction.
- Measure the length of each leg.
- Describe the techniques and considerations for selecting, preparing, marking-up and using maps for cross-country navigation,
- Describe the difference in appearance of visual features under varying flight conditions,
- Identify danger, restricted and prohibited area along the route.
- Identify obstacle that may feature along the route and their respective heights.
- Relate ground features along the route as aids to visual navigation.

- Relate map symbols to the ground features along the route as aids to visual navigation.
- Identify controlled airspace en-route and its relationship to gliding.
- Relate flying heights to topograhical features such as town and cities.
- Relate flying heights and distances to features such as gas venting stations, ATZ's MTZ's CTR's
- Describe approximation of position, 'dead reckoning' methods of navigation and actions when lost.
- Describe procedures for use when uncertain of position,
- Identify likely sources of 'lift' and describe techniques for their optimal use,
- List the factors to be considered when preparing for a field landing, including identifying wind direction and effects of obstructions on field boundaries,
- Understand the use of moving maps and global positioning systems
- State the relationship between heading, track and bearing.
- State the differences between QFE, QNH and Flight Levels.
- Understand how to calculate average flight speeds and final glides.

Study Guides:

The BGA is the national governing body of sport gliding. Gliding takes place under a mix of national, European and self-regulation. The European Aviation Safety Agency (EASA) is the EU aviation regulator. The Civil Aviation Authority (CAA) is the UK aviation safety regulator. The BGA works with the CAA to achieve mutually agreed objectives.

'Laws and Rules' details BGA requirements and guidance, which complies with applicable EASA regulations, and signposts to detailed EASA & CAA regulations for those who need more information https://members.gliding.co.uk/laws-rules/

The reference quoted below were correct at the time of writing. It is the pilots responsibility to keep abreast of changes to legislation and practice.

Theoretical Knowledge:

Most trainee pilots learn faster by reading up on some theory between flying lessons. The BGA recommends the publication 'Passenger to Pilot', which includes easy to absorb text and diagrams and was written by the author of the BGA instructors manual. As a pilot progresses in training beyond solo, the BGA recommended publication is 'Bronze and Beyond', which was written by and is periodically updated by an experienced gliding instructor. Other publications by a variety of authors are shown below.

CAP 393 Air Navigation Order 2016 UK Government
CAP 413 Radio Telephony Manual CAA
CAP 523 Aircraft Markings CAA
Gliding - A Handbook of Soaring Flight: Derek Piggot
Understanding Gliding: Derek Piggot
The Glider Pilot's Manual: Ken Stewart
Gliding From Passenger to Pilot: Steve Longland
The Soaring Pilot's Manual: Ken Stewart
Bronze and Beyond: John McCullagh
Weather Photo Guide: Collins Gem
Meteorology and Flight: Tom Bradbury
BGA Gliding Manual: BGA

The Bronze Syllabus

Gliding Competitively John Delafield
I'M SAFE US Federal Aviation Safety publication
https://www.faa.gov/news/safety_briefing/2015/media/SE_Topic_15_03.pdf
Manufacturers or Type Certificate Holder Manuals for Individual sailplanes.
Manufacturers Manuals for parachutes, instruments or accessories.