



## **Qualifications**

# **General Certificate in Distilling**

## **Examination Syllabus 2021**

## Unit 1: Overview

### Lesson: Introduction to Distilling

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Introduction to distilling	<ul style="list-style-type: none"><li>• Definitions of the main spirits derived from cereal, molasses, grape and agave</li><li>• The basic process flows for the production of the major spirits categories</li></ul>

## Unit 2: Raw Materials

### Lesson: Cereal

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Cereals for whisk(e)y production	<ul style="list-style-type: none"><li>• Why we use cereals for distilling</li><li>• The key characteristics/qualities of the main distilling cereals</li></ul>

### Lesson: Malting Process

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Cereals and the malting process	<ul style="list-style-type: none"><li>• Key structures within a barley kernel</li><li>• Key stages within the malting process and associated technology</li><li>• The structural changes that occur in the barley kernel during the malting process</li><li>• The key enzymes active during the malting process</li><li>• The production of peated malt</li><li>• Key malt analytical parameters</li></ul>

## Lesson: Molasses

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Sugar cane and how it is processed to make molasses for rum production	<ul style="list-style-type: none"><li>• The origin of molasses: sugar cane</li><li>• Sugar cane properties, areas of sugar cane production and geographical impact on quality</li><li>• Differences between sugar cane juice and molasses, based on quality and composition</li><li>• Sugar cane processing methods, and the technology used to make molasses</li><li>• The various types of molasses</li><li>• Molasses storage requirements</li><li>• The chemical and biological properties of molasses</li><li>• Use of the Brix hydrometer and measurement of sugar content: sugar % (w/w) and degrees Brix (°Brix)</li><li>• Key molasses analytical parameters</li></ul>

## Lesson: Grape

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Grapes for brandy production	<ul style="list-style-type: none"><li>• Grapevine cultivation<ul style="list-style-type: none"><li>○ general description of a grapevine</li><li>○ growth and care from planting to harvest</li><li>○ what constitutes terroir</li></ul></li><li>• Factors that affect the choice of grape varieties for distillation</li><li>• Grape and juice composition</li><li>• Grape selection criteria for distillation</li><li>• Other fruit brandy</li></ul>

## Lesson: Agave

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Agave for tequila production	<ul style="list-style-type: none"><li>• Agave basic anatomy and composition</li><li>• Cultivation and growth cycle</li><li>• Harvesting and where it is grown</li><li>• Alcoholic beverages from Agave including tequila, mezcal and sotol</li></ul>

## Lesson: Botanicals

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Botanicals for gin production	<ul style="list-style-type: none"><li>• The cultivation, selection, and use of the four primary gin botanicals (juniper, coriander, citrus peel and orris root)</li><li>• Secondary gin botanicals</li><li>• Botanicals storage requirements</li></ul>

## Lesson: Water

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Water for use in distilling	<ul style="list-style-type: none"><li>• The various sources of water including borehole, surface, municipal/public</li><li>• Product water, in terms of:<ul style="list-style-type: none"><li>○ colour, clarity, taste, odour, and pH</li><li>○ contaminants, including microbiological and taints</li></ul></li><li>• Dissolved salts and their importance</li><li>• The categories of water and their attributes</li><li>• Water conservation and the reliability and consistency of supply and their importance</li></ul>

## Lesson: Yeast

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Distiller's yeast	<ul style="list-style-type: none"><li>• The major components of the yeast cell and how they function.</li><li>• The process by which yeast cells multiply.</li><li>• The various types of yeast used in distilling (cream, pressed and dried)</li><li>• Yeast selection and storage requirements.</li><li>• Pure culture yeast for natural fermentation.</li></ul>

## Unit 3: Raw Material Processing

### Lesson: Cereal – Milling and Mash Conversion

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Overview	<ul style="list-style-type: none"><li>• The principles of milling</li><li>• The principles of mashing</li></ul>
Process: Milling	<ul style="list-style-type: none"><li>• The key steps of grain intake and the accompanying safety risks</li><li>• Calculating the amount of grain required for a batch of whisk(e)y</li><li>• Important parameters for successful milling</li><li>• The appearance of milled grain and grist sieve analyses</li></ul>
Technology: Milling	<ul style="list-style-type: none"><li>• Types of milling systems and basics of operation</li></ul>
Process: Mashing and cereal cooking	<ul style="list-style-type: none"><li>• Key mashing process parameters</li><li>• Key biochemical changes in the grain during mashing and factors that affect this</li><li>• The role of malt enzymes and factors that affect their efficiency</li><li>• The use of exogenous enzymes</li><li>• The purpose and process of grain cooking</li></ul>
Technology: Mashing and cereal cooking	<ul style="list-style-type: none"><li>• Mashing system technology</li><li>• Grain cooking technology</li></ul>

## Lesson: Cereal – Wort Separation and Cooling

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Overview	<ul style="list-style-type: none"> <li>• The principles of wort separation</li> <li>• The principles of wort cooling</li> </ul>
Process: Wort separation	<ul style="list-style-type: none"> <li>• Overview of the wort separation process and the key process parameters. Note – this process is optional for grain whiskey and grain neutral spirit production</li> <li>• The impact of secondary conversion</li> <li>• Key wort composition requirements</li> </ul>
Technology: Wort separation	<ul style="list-style-type: none"> <li>• Wort separation systems</li> <li>• Wort separation system selection based on milling system</li> </ul>
Process: Wort cooling	<ul style="list-style-type: none"> <li>• Purpose of wort cooling and an overview of the process</li> </ul>
Technology: Wort cooling	<ul style="list-style-type: none"> <li>• Wort cooling systems</li> </ul>

## Lesson: Molasses

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Overview	<ul style="list-style-type: none"> <li>• Why we need to pre-treat molasses</li> </ul>
Process	<ul style="list-style-type: none"> <li>• Various pre-treatment methods for molasses</li> <li>• Sugar content adjustments needed for downstream production stages</li> <li>• How fermentation can be adjusted via the use of stillage or dunder</li> </ul>
Technology	<ul style="list-style-type: none"> <li>• Removal of solids and scale by centrifugation</li> <li>• Use of heat treatment (pasteurisation or sterilisation) and/or antibiotics to reduce microbial count</li> </ul>

## Lesson: Grape

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Overview	<ul style="list-style-type: none"><li>• Choosing when to harvest for optimum yield and quality</li></ul>
Process	<ul style="list-style-type: none"><li>• Common grape harvesting methods</li><li>• Choosing when to press the grapes</li><li>• Key grape processing stages: sorting, destemming and crushing</li></ul>
Technology	<ul style="list-style-type: none"><li>• Pressing systems</li></ul>

## Lesson: Agave

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Overview	<ul style="list-style-type: none"><li>• The purpose of processing agave prior to fermentation</li><li>• Inulin and why it is important to the process</li></ul>
Process	<ul style="list-style-type: none"><li>• Agave cooking process</li><li>• Milling process</li><li>• Mix to tequila and how it changes the process stream</li></ul>
Technology	<ul style="list-style-type: none"><li>• Agave cooking systems, including pits, ovens, autoclaves and diffusers</li><li>• Milling systems, including tahona and modern mills</li></ul>

## Unit 4: Fermentation

### Lesson: Fermentation Theory and Technology

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Overview	<ul style="list-style-type: none"><li>• The principles of alcoholic fermentation including key fermentable sugars</li></ul>
Process	<ul style="list-style-type: none"><li>• Typical phases of fermentation</li><li>• The role of other organisms that may be present during fermentation</li><li>• Factors affecting fermentation</li><li>• The products of fermentation with emphasise on alcohol yields and flavour congeners</li><li>• Key flavour compounds developed during fermentation</li></ul>
Technology	<ul style="list-style-type: none"><li>• Fermentation systems and their materials of construction</li><li>• Key requirements for a typical fermenter</li></ul>

### Lesson: Cereal

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Overview	<ul style="list-style-type: none"><li>• Key stages of a cereals-based wort fermentation</li><li>• Nutritional requirements of distilling yeast, to be provided by wort: sugars, amino acids, mineral salts, vitamins</li><li>• Impact of regulations on cereal-based wort fermentation</li></ul>
Process	<ul style="list-style-type: none"><li>• Calculation of yeast inoculation rate</li><li>• Key stages of a cereals-based wort fermentation cycle</li><li>• The importance of secondary conversion</li><li>• Key analytical fermentation parameters</li></ul>
Technology	<ul style="list-style-type: none"><li>• Fermentation systems for cereal-based wort</li></ul>



## Lesson: Molasses

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Overview	<ul style="list-style-type: none"><li>• Differences between fermentation for light and heavy rum production</li><li>• Selection criteria for different yeast types for molasses fermentation</li></ul>
Process	<ul style="list-style-type: none"><li>• Yeast pitching procedures for molasses fermentation</li><li>• Molasses fermentation process for light rum production</li><li>• Molasses fermentation processes for heavy rum production</li><li>• Yeast nutritional requirements for molasses fermentation</li><li>• Batch incremental feed fermentation process</li><li>• Benefits and challenges of yeast recycling</li></ul>

## Lesson: Grape

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Overview	<ul style="list-style-type: none"><li>• Yeast selection for grape juice fermentation to produce brandy</li><li>• Grape juice fermentation requirements</li></ul>
Process	<ul style="list-style-type: none"><li>• Yeast pitching procedures</li><li>• Addition of yeast nutrients</li><li>• Key aspects of the grape juice fermentation process, including the malolactic fermentation</li><li>• Grape juice fermentation control parameters</li><li>• The major organisms that contribute to wine spoilage</li></ul>
Technology	<ul style="list-style-type: none"><li>• Grape juice fermentation systems</li></ul>

## Lesson: Agave

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Overview	<ul style="list-style-type: none"><li>• Agave fermentation yeast selection</li></ul>
Process	<ul style="list-style-type: none"><li>• Agave fermentation requirements and control parameters</li></ul>
Technology	<ul style="list-style-type: none"><li>• Agave fermentation systems</li></ul>

## Unit 5: Distillation

### Lesson: Basics of Distillation

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Overview	<ul style="list-style-type: none"><li>• Key terminology associated with spirits distillation</li><li>• Theory of distillation, including the liquid/vapour equilibrium and volatility of components using a graphic model</li></ul>
Process	<ul style="list-style-type: none"><li>• Differences between batch pot and continuous distillation methods</li><li>• Role of copper in distilled spirits production</li></ul>
Technology	<ul style="list-style-type: none"><li>• Distillation systems available</li></ul>

### Lesson: Batch Pot Distillation

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Overview	<ul style="list-style-type: none"><li>• The purpose of pot still distillation in spirits production</li></ul>
Process	<ul style="list-style-type: none"><li>• The operation of a two-stage pot distillation process using the liquid/vapour equilibrium</li><li>• Changes to spirit cut points and the effect they can have on spirit quality</li><li>• Other styles of batch pot distillation, including triple distillation and batch distillation with plates</li></ul>
Technology	<ul style="list-style-type: none"><li>• The different types of vapour condensing systems</li><li>• Key batch distillation condensing system technology – worm tub and shell and tube</li></ul>

## Lesson: Continuous Distillation

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Overview	<ul style="list-style-type: none"><li>• The purpose of continuous distillation in spirits production</li></ul>
Process	<ul style="list-style-type: none"><li>• The basic operation of a two-column continuous distillation process</li><li>• The inputs and outputs of distillation; describe what a balanced operation is</li><li>• The material and heat balance</li><li>• The importance of composition, and of pre-heating still feed materials</li></ul>
Technology	<ul style="list-style-type: none"><li>• Continuous distillation systems</li></ul>

## Lesson: Whisk(e)y

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Overview	<ul style="list-style-type: none"><li>• Differences between malt and grain whisk(e)y processes</li></ul>
Process	<ul style="list-style-type: none"><li>• Malt whisk(e)y batch pot distillation process</li><li>• Condensate recovery</li><li>• Grain whisk(e)y Coffey still continuous distillation process</li><li>• Handling of feints</li><li>• Fusel oil removal and recovery</li></ul>
Technology	<ul style="list-style-type: none"><li>• Stripping and rectifying columns</li><li>• How the design of the pot affects product quality and process operations</li><li>• The different types of vapour condensing systems</li></ul>

## Lesson: Rum

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Overview	<ul style="list-style-type: none"><li>• Differences between batch and continuous distillation for rum production</li></ul>
Process	<ul style="list-style-type: none"><li>• Operation of the pot still for heavy rum production</li><li>• Operation of column stills for light rum production</li><li>• How the column still can be used for neutral spirits production</li><li>• The importance of rectification</li></ul>
Technology	<ul style="list-style-type: none"><li>• Design of the pot still for heavy rum production</li><li>• Design of column stills for light rum production</li></ul>

## Lesson: Brandy

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Overview	<ul style="list-style-type: none"><li>• The definition of neutral brandy, cognac and Armagnac</li><li>• What grappa is</li></ul>
Process	<ul style="list-style-type: none"><li>• Continuous distillation processes for producing neutral brandy</li><li>• Double distillation process for producing cognac</li><li>• Semi-continuous distillation process for producing Armagnac</li><li>• The grappa distillation process</li></ul>
Technology	<ul style="list-style-type: none"><li>• The types of stills used in brandy production, including the alembic Charentais and Armagnac stills</li><li>• The grappa vapour still</li></ul>

## Lesson: Agave Spirits

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Overview	<ul style="list-style-type: none"><li>• Agave distillation techniques</li></ul>
Process	<ul style="list-style-type: none"><li>• Continuous distillation process and its use in twice distilled tequila production</li><li>• Batch pot distillation process for tequila production</li><li>• Mezcal production methods</li></ul>
Technology	<ul style="list-style-type: none"><li>• Tequila pot still design</li><li>• Mezcal clay stills design</li></ul>

## Lesson: Neutral Spirit and Vodka

<b>Topics</b>	<b>Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:</b>
Overview	<ul style="list-style-type: none"><li>• Definition of neutral spirit</li><li>• Where neutral spirit is used within the distilling industry</li><li>• Key differences between grain whisk(e)y and neutral spirit</li><li>• Definition of vodka</li></ul>
Process	<ul style="list-style-type: none"><li>• The processes involved in the production of neutral spirit</li><li>• The processes involved in vodka production</li></ul>
Technology	<ul style="list-style-type: none"><li>• General continuous distillation technology for neutral spirit production</li></ul>

## Lesson: Gin

<b>Topics</b>	<b>Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:</b>
Overview	<ul style="list-style-type: none"><li>• Base spirit selection for gin production</li></ul>
Process	<ul style="list-style-type: none"><li>• Gin production methods – distilled and compound gin</li><li>• Key steps in the gin distillation process</li><li>• Production of flavour extracts</li><li>• Assessing gin quality</li></ul>
Technology	<ul style="list-style-type: none"><li>• The vapour basket</li></ul>

## Unit 6: Maturation

### Lesson: Maturation in Wood

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Overview	<ul style="list-style-type: none"><li>• Purpose of cask maturation</li></ul>
Process	<ul style="list-style-type: none"><li>• Reasons for using wood for spirit maturation</li><li>• Maturation in wood control parameters</li><li>• Process/changes during maturation</li><li>• Characteristics of new and mature spirit</li><li>• Alternatives to maturation in wood that will give similar flavour changes</li><li>• Reasons for blending</li><li>• The various post-maturation processes and treatments that can be carried out prior to bottling, including blending, reduction, caramel addition, filtration and filling temperature control</li></ul>
Technology	<ul style="list-style-type: none"><li>• Manufacture of casks and their use in production</li><li>• Main types of cask wood</li><li>• Use of treated casks, or casks used previously to hold another beverage (e.g. port, sherry, wine etc.) to produce whisky 'finishes'</li></ul>

### Lesson: Whisk(e)y

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Overview	<ul style="list-style-type: none"><li>• What is meant by warehousing and blending in relation to whisk(e)y</li></ul>
Process	<ul style="list-style-type: none"><li>• The term inventory</li><li>• What legislative requirements apply to Scotch whisky maturation and blending processes</li></ul>
Technology	<ul style="list-style-type: none"><li>• The various types of cask and warehouse design</li></ul>

## Lesson: Rum

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Overview	<ul style="list-style-type: none"><li>• Types of rum – white, amber, dark</li></ul>
Process	<ul style="list-style-type: none"><li>• Rum maturation process and impact on flavour</li><li>• Rum blending process</li></ul>
Technology	<ul style="list-style-type: none"><li>• Barrel types for rum maturation</li></ul>

## Lesson: Brandy

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Overview	<ul style="list-style-type: none"><li>• Types of wood used in brandy maturation</li></ul>
Process	<ul style="list-style-type: none"><li>• The process of ageing brandy in barrels</li><li>• Spirit dilution method</li><li>• Basic blending practices</li><li>• Barrel warehouse control parameters</li></ul>
Technology	<ul style="list-style-type: none"><li>• How a brandy barrel is made: wood seasoning, toasting, barrel size</li></ul>

## Lesson: Tequila and other Agave Spirits

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Overview	<ul style="list-style-type: none"><li>• Types of aged tequila</li></ul>
Process	<ul style="list-style-type: none"><li>• Tequila maturation process</li><li>• Basics of tequila blending</li><li>• The additives permitted for use both during and post-blending</li><li>• Ageing other agave spirits</li></ul>
Technology	<ul style="list-style-type: none"><li>• The types of casks used for tequila</li></ul>

## Unit 7: Quality

### Lesson: Process Control

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Process and product consistency	<ul style="list-style-type: none"><li>• Variation and variability</li><li>• The purpose of a specification</li><li>• The concept of tolerance for specification ranges</li><li>• Simple statistical quality control procedures</li><li>• Simple methods for recording, reporting and the interpretation of data</li><li>• The key distilling measurable parameters and their influence on quality</li><li>• The principles of monitoring and adjustment to achieve product consistency</li><li>• Typical applications for in-line and on-line instrumental process control</li></ul>

### Lesson: Quality Management Systems

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Features of a quality system	<ul style="list-style-type: none"><li>• The definition and benefits of a quality management system</li><li>• The four main processes to implement a quality management system</li><li>• Examples of quality management systems and their key principles</li></ul>
Product safety	<ul style="list-style-type: none"><li>• The typical steps in implementing a HACCP system</li></ul>



## Lesson: Sensory Assessment

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Flavour control and sensory assessment of spirits	<ul style="list-style-type: none"><li>• Flavour: What is it and where does it come from?</li><li>• Importance of flavour control</li><li>• Role of sensory evaluation in controlling flavour</li><li>• The sensory assessor (panellist or blender)</li><li>• Preparing samples for sensory testing</li><li>• Sensory test room conditions</li><li>• Types of sensory tests and when to use them:<ul style="list-style-type: none"><li>○ Sample screening</li><li>○ Difference testing</li><li>○ Descriptive analysis<ul style="list-style-type: none"><li>▪ Flavour wheels</li><li>▪ Flavour profiling</li></ul></li></ul></li></ul>

## Unit 8: Hygiene

### Lesson: Microbiological Contamination and Control

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Microbiological contamination	<ul style="list-style-type: none"><li>• Definition of bacteria and fungi and examples of those commonly found in distilleries</li><li>• Methods for detecting microbiological contaminants</li></ul>
Microbiological control	<ul style="list-style-type: none"><li>• The principle ways to achieve microbiological control in a distillery and in particular to the following key areas:<ul style="list-style-type: none"><li>○ Yeast handling systems</li><li>○ Product and process waters</li></ul></li><li>• The types of chemical, light and heat sanitisers commonly used</li></ul>

### Lesson: Plant Cleaning

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
CIP systems	<ul style="list-style-type: none"><li>• Four key factors for efficient plant cleaning</li><li>• The different types of detergents used and the reasons for their choice</li><li>• The types of cleaning head used and reasons for their choice</li><li>• Differences between single use and recovery systems</li><li>• The operating principles of CIP systems</li></ul>
CIP cleaning cycles	<ul style="list-style-type: none"><li>• Typical cleaning programmes and cycle times</li><li>• The function of each of the cleaning cycle stages</li></ul>
CIP plant design	<ul style="list-style-type: none"><li>• Design features that minimise dirt accumulation in vessels and pipelines and encourage efficient cleaning</li><li>• Design features which promote a hygienic working environment</li></ul>

## Unit 9: Engineering and the Environment

### Lesson: Engineering and Maintenance

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Approaches and tasks	<ul style="list-style-type: none"><li>• The business motives for an effective maintenance system</li><li>• The features, advantages, disadvantages and applications of the following approaches:<ul style="list-style-type: none"><li>○ No maintenance</li><li>○ Corrective Maintenance</li><li>○ Preventative Maintenance</li></ul></li><li>• The relationship between corrective and preventative maintenance</li><li>• The contribution of routine maintenance tasks to plant safety, reliability, quality, economics and environmental impact</li></ul>
Performance improvement	<ul style="list-style-type: none"><li>• The key features of the following performance orientated maintenance systems:<ul style="list-style-type: none"><li>○ Reliability centred maintenance (RCM)</li><li>○ Total productive maintenance (TPM)</li><li>Workplace Organisation (6s)</li><li>○ Condition Monitoring</li></ul></li></ul>

### Lesson: Environment and Utilities

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Sustainability and climate change	<ul style="list-style-type: none"><li>• The guiding principles of sustainability, and the concepts of a sustainable industry</li><li>• The role of carbon dioxide and the carbon cycle</li><li>• The principal sources of carbon dioxide</li></ul>
Steam and energy	<ul style="list-style-type: none"><li>• The main uses of steam in distilling</li><li>• The difference between direct and indirect use of steam and explain the implications of steam quality</li><li>• The potential dangers of steam and steam distribution systems</li><li>• The principal energy consuming activities in a distillery</li><li>• Heat recovery systems in distilleries, e.g condensate recovery system</li></ul>

Water	<ul style="list-style-type: none"> <li>• Categories of water: product water, process water and service water</li> <li>• Basic principles of a water treatment plant</li> <li>• Prevention of <i>Legionella</i> infection in cooling towers</li> </ul>
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### Lesson: Effluent

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Sources of effluent and measurement	<ul style="list-style-type: none"> <li>• The measurement of effluent volume and strength: biological and chemical oxygen demand, suspended solids, volume, pH and temperature</li> <li>• Control methods used for reducing effluent</li> </ul>
Effluent treatment technologies	<ul style="list-style-type: none"> <li>• Aerobic and anaerobic systems and their relevant application</li> <li>• Temperature, flow, copper and pH considerations for consented discharge to sewer</li> </ul>

### Lesson: Co-products (General and Whisk(e)y)

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Co-products	<ul style="list-style-type: none"> <li>• The definition of a co-product</li> <li>• The potential value of a co-product to a distiller</li> </ul>
Range of distillery co-products and preparation of animal feed	<ul style="list-style-type: none"> <li>• Carbon dioxide recovery process</li> <li>• The recovery process of fusel oil from continuous distillation spirits production</li> <li>• Explaining why cereal residues are ideal as animal feed, or as a source of carbon for biomass</li> <li>• Cereal residue recovery processes</li> </ul>

### Lesson: Co-products (Rum)

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Range of distillery co-products	<ul style="list-style-type: none"> <li>• Bagasse and its uses</li> <li>• Waste streams from the rum fermentation and distillation process</li> </ul>

## Lesson: Co-products (Brandy)

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Range of distillery co-products	<ul style="list-style-type: none"><li>• Various uses for grape stems</li><li>• Various uses for grape seeds</li><li>• Various uses for grape skins</li></ul>

## Lesson: Health and Safety

Topics	Candidates should understand and be able to explain and describe in simple terms, or demonstrate familiarity with:
Health and safety	<ul style="list-style-type: none"><li>• Flammability and explosion risks of alcohol</li><li>• Fire and explosion dangers at stills, in storage and operations involving spirits</li><li>• Hazards and risks from dust and carbon dioxide</li><li>• The essential precautions needed in the distillery in order to make it a safe working environment</li></ul>
Detergents and sterilants	<ul style="list-style-type: none"><li>• The hazards associated with chemical cleaning and sterilising agents</li><li>• Good practices for the storage of chemicals</li><li>• Use of personal protective clothing</li><li>• Procedures in case of accidental spillage or discharge of chemicals</li></ul>