

# **IFE Level 2 Certificate in Fire Science, Operations and Safety**

## **Qualification Specification**

Qualification Number: 500/5925/7

## About the Institution of Fire Engineers (IFE)

The IFE is the professional institution for those working in the fire sector. The IFE is a registered charity working for societal benefit. Founded in 1918, the IFE's mission is to promote, encourage and improve the science, practice and professionalism of fire engineering with the overall aim of protecting and saving lives.

Members of the IFE share a commitment to ensuring that the fire profession remains relevant and valued, protecting people, property and the environment from fire.

### The IFE Awarding Organisation

The IFE's awarding organisation is non-profitmaking.

The aim of the of the awarding organisation is to encourage those who work in the sector to engage with, and develop, the critical understanding needed to operate effectively and safely and to best professional standards so that they can protect and save lives. In doing this, the awarding organisation contributes to three of the IFE's (six) over-arching strategic priorities ie:

- ◆ *Facilitate awareness of fire issues and developments through the communication of ideas, knowledge and information.*
- ◆ *Foster professionalism by establishing and maintaining pathways and recognised standards of fire professionalism and competency.*
- ◆ *Increase knowledge in the science, practice and professionalism of fire engineering.*

All of the IFE's qualifications are designed for those working in the fire sector and to meet the above aims. Qualifications and their associated assessments (examinations and practical activities/assignments) provided by the IFE are designed, assessed and quality assured by experts with extensive experience of working within the fire sector.

### Contact Details

Email: [exams@ife.org.uk](mailto:exams@ife.org.uk)

IFE House, 64-66 Cygnet Court, Timothy's Bridge Road, Stratford-upon-Avon, CV37 9NW  
Tel: +44 (0)1789 261463

## IFE Level 2 Certificate in Fire Science, Operations and Safety

### Introduction

The IFE Level 2 Certificate in Fire Science, Operations and Safety has been developed by the Institution of Fire Engineers (IFE), representatives of Fire and Rescue Services and other fire professionals. The content and structure of the qualification has been established to reflect best professional practice and covers key knowledge and understanding in the areas of fire science, fire service operations and fire safety.

### Aims of the Qualification

The qualification has been designed to enable individuals to demonstrate a wide range of critical knowledge and understanding relevant to the role of firefighter. Success in the qualification will enable individuals to demonstrate that they can apply their knowledge and skills to provide solutions to a range of fire-related activities.

### Target Audience

The qualification will meet the needs of:

- ◆ those employed, or preparing for employment, as firefighters who wish to develop and demonstrate knowledge and understanding relevant to the role
- ◆ those undertaking training courses leading to the role of firefighter eg apprenticeships
- ◆ those operating in specialist contexts such as aviation fire operations or fire safety inspection roles and who wish to demonstrate knowledge and understanding relevant to the role and the wider sector
- ◆ other fire professionals who wish to demonstrate knowledge and understanding of fire science, operations and fire safety
- ◆ those who wish to extend their underpinning knowledge and understanding in order to undertake fire safety and/general fire safety roles.

### Learning Outcomes

Candidates who achieve this qualification should be able to:

- ◆ carry out mathematical calculations accurately and understand basic scientific principles in relation to fire and the methods of extinguishing fire
- ◆ understand basic firefighting and rescue procedures and know how to use equipment in firefighting operations
- ◆ understand the safety precautions and prevention methods used to protect individuals and the built environment

## Qualification Structure

The content of the qualification is divided into three sections:

- ◆ Fire Engineering Science
- ◆ Fire and Rescue Operations
- ◆ Fire Safety

The detail of the content of the qualification is set out in the section entitled “Content” below. This section provides information on the range of topics that must be studied including the way that candidates need to show their understanding (Assessment Criteria) and the scope/range/contexts in which they can be tested (Knowledge, Understanding and Skills).

The syllabus content is very broad and therefore not all topics can be tested in all examinations. Candidates are advised to prepare for the examination by covering all topics so that they are able to respond to the full range of questions that could be presented.

## Assessment

The assessment takes the form of one three-hour examination. The examination contains 120 multiple choice questions. The examination is divided into three sections, reflecting the three sections of the qualification content. Examination papers are structured as follows:

Section 1: Fire Engineering Science - 45 questions

Section 2: Fire and Rescue Operations – 45 questions

Section 3: Fire Safety - 30 questions

Examinations are designed to ensure that all sections of the content are tested in each examination.

Examinations are provided in English only.

## Certification

Successful candidates will be awarded a Pass. Outcomes are not graded.

In order to achieve a Pass, candidates must achieve at least 50% of the marks available ie 60 correct responses.

Candidates do not need to achieve a minimum number of marks in each of the sections of the examination. The total number of correct answers from across the whole paper is used to determine whether or not candidates have met the minimum requirement to achieve a Pass.

## Entry Requirements

There are no formal entry requirements. However, candidates are advised that mathematical skills will be required in order to carry out and complete calculations in section 1 of the examination. As the examination is provided in English only, candidates will need to be able to read English fluently in order to access the examination questions.

## Qualification Level

This qualification has been designed to enable candidates to demonstrate that they have attained skills and knowledge at Level 2. Other types of qualifications that are set at Level 2 include Level 2 NVQs, Level 2 Functional Skills and GCSE - grades 9, 8, 7, 6, 5, 4 or grades A\*, A, B, C.

The qualifications regulator, Ofqual, has provided the following descriptors to illustrate the knowledge and understanding expected from those who hold qualifications at Level 2.

### Level 2 Knowledge descriptor

The holder of a qualification at level 2:

- ◆ Has knowledge and understanding of facts, procedures and ideas in an area of study or field of work to complete well-defined tasks and address straightforward problems.
- ◆ Can interpret relevant information and ideas.
- ◆ Is aware of a range of information that is relevant to the area of study or work.

## Qualification Learning Time

The length of time needed to prepare for this examination will vary depending upon the starting point for each individual.

Research suggests that candidates should spend around 180 hours preparing for the examination. This equates to around 60 hours for each section of the syllabus although candidates may need to allocate a higher proportion of their preparation time to one of more of the sections depending upon their pre-existing knowledge and understanding.

Total qualification time is 183 hours.

- ◆ 180 hours of study. For most candidates, this will be self-study. However, it may also include some relevant training.
- ◆ 3 hours of assessment (directed time) ie one three-hour examination.

Most candidates prepare for IFE examinations via self-study or by drawing on training provided by their employer that covers aspects of the syllabus. Candidates are advised to cross-map their study/training against the content of the qualification as set out below to ensure that all

parts of the content have been covered in their study. Recommended reading materials are listed below.

### Recommended Reading

Candidates should be aware that this reading list is advisory rather than definitive. Candidates should use the content areas set out below as their guide in deciding what reading materials they need to help them prepare for the examination – please see the section on Content below. The IFE recommends that all candidates should read widely in order to extend the depth and breadth of their knowledge and understanding.

The IFE has applied the following criteria in determining which resources should be included on this recommended reading list:

- ◆ the resource provides information which will be of benefit to the candidate in their professional life, providing depth and breadth of understanding;
- ◆ the resource contains some information that will be relevant to part of the syllabus;
- ◆ the resource is recognised by industry professionals as providing valuable information.

Candidates preparing for the examinations are advised to refer to the list below:

- ◆ Elementary Fire Engineering Handbook (IFE 50), Elementary Fire Engineering Handbook (IFE 50), version issued 2017. This book, which has been developed to cover the content of the syllabus, can be ordered via the IFE Shop - <https://www.ife.org.uk/Online-Shop>
- ◆ Firefighting equipment - [Firefighting equipment knowledge sheets | NFCC CPO \(ukfrs.com\)](#)
- ◆ Incident Command: Knowledge, Skills and Competence - [Incident command: Knowledge, skills and competence | NFCC CPO \(ukfrs.com\)](#)
- ◆ Foundation for Hazardous Materials, Section 1 only, available to download - <https://www.ukfrs.com/guidance/knowledge-base>
- ◆ Foundation for Environmental Protection - [Foundation for environmental protection | NFCC CPO \(ukfrs.com\)](#)
- ◆ Fire Dynamics for Firefighters by Ben Walker, Pavilion Publishing

*Candidates may also refer to the sample questions which are available on the IFE's website - <https://www.ife.org.uk/Qualifications/Past-Papers-and-Exam-Reports>.*

### Reasonable Adjustments

The IFE permits reasonable adjustments to be made where candidates have disabilities (including medical conditions and learning disabilities such as Dyslexia). The IFE's policy on reasonable adjustments aims to enable candidates with disabilities and other difficulties to access the IFE qualifications without comprising the assessment process or the validity of the qualification certificate.

The policy, which includes the types of arrangements that may be made (eg additional time, use of technology) and the procedure for applying for reasonable adjustments, is published on the IFE's website - <https://www.ife.org.uk/Qualification-FAQs>. The IFE will consider all requests for reasonable adjustments. All requests for reasonable adjustments must be submitted to the IFE as all decisions on reasonable adjustments rest with the IFE.

### **Progression**

Candidates who are successful in achieving the Level 2 Certificate will have developed the knowledge and understanding necessary to enable them to undertake further study and progress to qualifications at Level 3, such as the IFE Level 3 Certificate in Fire Science, Operations, Fire Safety and Management and/or the IFE Level 3 qualifications (Certificates) in specialist subject areas such as Fire Engineering Science, Fire Safety, Passive Fire Protection and Fire Service Operations and Incident Command.

### **Further Information**

Further information on examination conditions is available in the IFE booklet, *Rules and Information for Candidates Taking IFE Examinations*. This booklet can be downloaded from the IFE's website.

## Content

### Section 1: Fire Engineering Science

#### 1. Mathematics

Assessment Criteria	Knowledge, Understanding and Skills
1.1 Apply an understanding of mathematics to solve problems	<ul style="list-style-type: none"> <li>The four basic processes - addition, subtraction, multiplication and division</li> <li>Processes in respect of fractions, decimals, percentages, ratios and proportions</li> </ul>
1.2 Understand basic geometry	<ul style="list-style-type: none"> <li>Two- dimensional shapes – square, rectangle, quadrilateral, parallelogram, rhombus, trapezium, triangle, circle</li> <li>Three-dimensional objects – cube, cuboid, pyramid, prism, cylinder, cone, sphere</li> </ul>
1.3 Undertake calculations in respect of various geometrical shapes and objects	<ul style="list-style-type: none"> <li>Area and perimeter of regular and irregular shapes</li> <li>Volume and capacity of rectangular and circular tanks</li> <li>Volume and capacity of hose and pipelines</li> </ul>

#### 2. Physical Properties of Matter

Assessment Criteria	Knowledge, Understanding and Skills
2.1 Define and understand the basic physical properties of matter and undertake calculations involving them	<ul style="list-style-type: none"> <li>States of matter - solid, liquid, gas</li> <li>Mass</li> <li>Density</li> <li>Relative density (specific gravity)</li> <li>Vapour density</li> <li>Liquids of different density</li> <li>Gases of different density</li> <li>Melting, boiling and evaporation</li> <li>Colour</li> <li>Odour</li> <li>Conductivity</li> <li>Hardness</li> </ul>

#### 3. Mechanics

Assessment Criteria	Knowledge, Understanding and Skills
3.1 Define and understand basic terms and undertake calculations involving physical mechanics	<ul style="list-style-type: none"> <li>Motion, including gravity, speed, velocity and acceleration</li> <li>Momentum and Force</li> <li>Work, Energy (including Potential Energy and Kinetic Energy) and Power</li> <li>Friction</li> <li>Simple machines ie levers, mechanical advantage</li> </ul>





#### 4. Heat and Temperature

Assessment Criteria	Knowledge, Understanding and Skills
4.1 Understand that heat is a form of energy and demonstrate an understanding of how temperature can be measured	<ul style="list-style-type: none"> <li>• Measuring temperature</li> <li>• Thermometric scales:               <ul style="list-style-type: none"> <li>○ Celsius or Centigrade</li> <li>○ Fahrenheit</li> <li>○ Kelvin or Absolute</li> </ul> </li> <li>• Other methods of measuring temperature:               <ul style="list-style-type: none"> <li>○ Air or gas thermometer</li> <li>○ Using solids</li> <li>○ Thermocouples</li> <li>○ Thermistors</li> <li>○ Comparison by brightness</li> <li>○ Infrared</li> </ul> </li> </ul>
4.2 Define and use units of heat	<ul style="list-style-type: none"> <li>• Joule</li> <li>• Calorie</li> <li>• The British thermal unit</li> </ul>
4.3 Define and understand the terms used in the context of heat transfer	<ul style="list-style-type: none"> <li>• Specific heat</li> <li>• Changes of state and latent heat:               <ul style="list-style-type: none"> <li>○ Latent heat of vapourisation</li> <li>○ Effect of change of pressure on boiling point and latent heat</li> <li>○ Latent heat of fusion</li> <li>○ Cooling</li> </ul> </li> </ul>
4.4 Demonstrate an understanding of thermal expansion and the liquefaction of gases and their practical applications	<ul style="list-style-type: none"> <li>• The thermal expansion of solids:               <ul style="list-style-type: none"> <li>○ Coefficient of linear expansion</li> <li>○ Nickel-iron alloy (Invar)</li> <li>○ Expansion in large metal structures</li> <li>○ Thermostats (Bi-metallic strips)</li> <li>○ Coefficients of superficial and cubical expansion of solids</li> </ul> </li> <li>• The thermal expansion of liquids:               <ul style="list-style-type: none"> <li>○ Cubical expansion</li> <li>○ The effect of expansion on density</li> </ul> </li> <li>• The expansion of gases:               <ul style="list-style-type: none"> <li>○ Temperature, pressure and volume</li> </ul> </li> <li>• The liquefaction of gases:               <ul style="list-style-type: none"> <li>○ Critical temperature and pressure</li> <li>○ Liquefied gases in cylinders</li> </ul> </li> </ul>
4.5 Define and understand the gas laws	<ul style="list-style-type: none"> <li>• Boyle's Law</li> <li>• Charles's Law</li> <li>• Law of Pressures</li> <li>• The General Gas Law</li> </ul>
4.6 Understand the processes of heat transmission	<ul style="list-style-type: none"> <li>• Conduction</li> <li>• Convection</li> <li>• Radiation</li> </ul>



## 5. Chemistry and Combustion

<b>Assessment Criteria</b>	<b>Knowledge, Understanding and Skills</b>
5.1 Define basic chemical terms and describe their structures	<ul style="list-style-type: none"> <li>• Atoms (protons, neutrons and electrons)</li> <li>• Molecules</li> <li>• Elements</li> <li>• Compounds</li> <li>• Mixture</li> <li>• Radicals</li> <li>• Atomic mass</li> <li>• Molecular mass</li> <li>• Valency</li> <li>• Reactivity</li> </ul>
5.2 Understand basic chemical formulae and equations	<ul style="list-style-type: none"> <li>• The use of symbols to write formulae</li> <li>• Nomenclature</li> <li>• Interpret simple formulae and equations</li> </ul>
5.3 Understand the basic chemistry of combustion	<ul style="list-style-type: none"> <li>• The components of the fire tetrahedron</li> <li>• Heat of reaction and calorific value</li> <li>• Types of flames and practical examples:               <ul style="list-style-type: none"> <li>○ Premixed</li> <li>○ Diffusion</li> </ul> </li> <li>• Laminar and turbulent flow</li> <li>• Flashpoint</li> <li>• Fire point</li> <li>• Sustained fires</li> <li>• Ignition:               <ul style="list-style-type: none"> <li>○ Spontaneous ignition temperature</li> <li>○ Self-heating and spontaneous combustion</li> <li>○ Smouldering</li> </ul> </li> </ul>
5.4 Understand the main factors involved in the extinction of fire	<ul style="list-style-type: none"> <li>• Starvation</li> <li>• Smothering</li> <li>• Cooling</li> <li>• Halting the chemical reaction</li> </ul>
5.5 Explain how the main fire extinguishing media extinguish fire	<ul style="list-style-type: none"> <li>• Water</li> <li>• Foam</li> <li>• Vaporising liquids</li> <li>• Carbon dioxide and inert gases</li> <li>• Dry chemical powders</li> <li>• Blanketing</li> <li>• Beating out</li> </ul>



## 6. Electricity

<b>Assessment Criteria</b>	<b>Knowledge, Understanding and Skills</b>
6.1 Define and understand basic electrical units and their symbols	<ul style="list-style-type: none"> <li>• Amperes</li> <li>• Volts (Electromotive Force - EMF)</li> <li>• Ohms</li> <li>• Joules</li> <li>• Watts</li> </ul>
6.2 Define, understand and use Ohm's Law	<ul style="list-style-type: none"> <li>• Principles of Ohm's Law</li> <li>• Undertake Ohm's Law calculations</li> </ul>
6.3 Describe the types of electrical supply and current flow in a circuit	<ul style="list-style-type: none"> <li>• Alternating current (AC) and direct current (DC)</li> <li>• Simple circuitry</li> <li>• The resistance of a circuit</li> </ul>
6.4 Understand the purpose, operation and significance of conductors and insulators	<ul style="list-style-type: none"> <li>• Examples of good and bad conductors</li> <li>• Examples of insulators for different purposes</li> </ul>
6.5 Understand the purpose of providing protective devices to electrical circuits	<ul style="list-style-type: none"> <li>• Understand how a short circuit occurs</li> <li>• Earthing</li> <li>• Fuses</li> <li>• Circuit breakers</li> </ul>
6.6 Demonstrate an understanding of electrical hazards and safeguards	<ul style="list-style-type: none"> <li>• Electrical causes of fire</li> <li>• Prevention of electrical causes of fire</li> </ul>

## 7. Hydraulics

<b>Assessment Criteria</b>	<b>Knowledge, Understanding and Skills</b>
7.1 Understand the properties of water and basic principles of hydraulics	<ul style="list-style-type: none"> <li>• Properties of water</li> <li>• Principal characteristics of pressure</li> <li>• Relationship between pressure and head</li> <li>• Loss of pressure due to friction</li> <li>• Energy changes in water streams</li> <li>• Water power and efficiency</li> <li>• Jet reaction</li> <li>• Water hammer</li> </ul>
7.2 Understand how pressure is measured with instruments	<ul style="list-style-type: none"> <li>• Water gauges (manometers)</li> <li>• Pressure and compound gauges</li> </ul>
7.3 Understand the influence of atmospheric pressure on suction lift	<ul style="list-style-type: none"> <li>• Atmospheric pressure</li> <li>• Suction lift</li> <li>• Siphons</li> </ul>



## Section 2: Fire and Rescue Operations

### 1. Incident Command

Assessment Criteria	Knowledge, Understanding and Skills
<p>1.1. Understand and explain the key principles of Incident Command</p>	<ul style="list-style-type: none"> <li>• Roles and responsibilities:               <ul style="list-style-type: none"> <li>○ Command</li> <li>○ Communications</li> </ul> </li> <li>• Situational awareness</li> <li>• Structuring an incident:               <ul style="list-style-type: none"> <li>○ Span of control</li> <li>○ Sectorisation</li> <li>○ Cordons</li> </ul> </li> <li>• Risk assessments at an incident:               <ul style="list-style-type: none"> <li>○ The Firefighter Safety Maxim</li> <li>○ Risk concepts (Hazard and Risk)</li> <li>○ Dynamic risk assessment</li> <li>○ Analytical assessment</li> <li>○ Personal or individual assessment</li> </ul> </li> <li>• Risk reduction:               <ul style="list-style-type: none"> <li>○ Eliminate the risk</li> <li>○ Reduce the risk</li> <li>○ Isolate the risk</li> <li>○ Control the risk</li> <li>○ Personal Protective Equipment (PPE)</li> <li>○ Safety Officers</li> </ul> </li> <li>• Tactical control:               <ul style="list-style-type: none"> <li>○ Offensive</li> <li>○ Defensive</li> <li>○ Emergency evacuation and tactical withdrawal</li> <li>○ Firefighter emergency</li> </ul> </li> </ul>
<p>1.2 Understand the procedures for closing down an operational incident</p>	<ul style="list-style-type: none"> <li>• Closure and handover</li> <li>• Purpose and content of debriefing</li> <li>• Types of debriefing: hot, cold, critical incident</li> <li>• Identifying and mitigating hazards and risks</li> <li>• Investigations that may be required post-incident</li> <li>• Identifying and preserving potential evidence to support further investigation</li> </ul>



## 2. Search and Rescue

Assessment Criteria	Knowledge, Understanding and Skills
2.1 Understand the basic principles involved in search and rescue in different contexts	<ul style="list-style-type: none"> <li>• Operating phases:               <ul style="list-style-type: none"> <li>○ Locate</li> <li>○ Access</li> <li>○ Stabilise</li> <li>○ Transport</li> </ul> </li> <li>• Rescues from the built environment, including:               <ul style="list-style-type: none"> <li>○ Entry into and searching of buildings and collapsed structures</li> <li>○ Release of trapped persons from machinery, lifts, escalators</li> <li>○ Rescues from sub-surface and confined spaces: tunnels, shafts, vat, silo, sewer, trench, pit, chimney</li> </ul> </li> <li>• Rescues from transportation incidents: vehicles, trains, aircraft, ships and boats</li> <li>• Rescues from height</li> <li>• Rescues from water and unstable ground</li> <li>• Rescues from incidents involving hazardous materials</li> </ul>

## 3. Firefighting

Assessment Criteria	Knowledge, Understanding and Skills
3.1 Understand the phases of fire growth and associated dangers	<ul style="list-style-type: none"> <li>• Fire load</li> <li>• Phases of fire growth:               <ul style="list-style-type: none"> <li>○ Incipient phase</li> <li>○ Growth phase</li> <li>○ Fully developed phase</li> <li>○ Decay phase</li> </ul> </li> <li>• Flashover</li> <li>• Backdraught</li> </ul>
3.2 Understand of operational planning and procedures	<ul style="list-style-type: none"> <li>• Initial response to a fire</li> <li>• Assessing the incident</li> <li>• Safety considerations</li> <li>• Environmental considerations</li> <li>• Methods of entry</li> <li>• Isolating utilities</li> <li>• Locating the fire</li> <li>• Selecting the correct firefighting method</li> <li>• Methods of application</li> </ul>
3.3 Understand the basic principles involved in firefighting in different contexts	<ul style="list-style-type: none"> <li>• Incidents in the built environment involving fires in:               <ul style="list-style-type: none"> <li>○ Buildings under construction or demolition</li> <li>○ Derelict buildings</li> </ul> </li> </ul>



	<ul style="list-style-type: none"> <li>○ High rise properties</li> <li>○ Buildings with atriums, basements and tunnels</li> <li>○ Roofs</li> <li>○ Commercial premises</li> <li>○ Buildings with where industrial/petrochemical processes take place</li> <li>○ Hospitals, health care and educational establishments</li> <li>○ Prisons and places of lawful detention</li> <li>○ Places of research and laboratories.</li> <li>○ Historical buildings, museums and galleries</li> <li>○ Waste, recycling and renewable energy sites</li> <li>● Fires involving transportation by road, rail, air and waterways</li> <li>● Wildfires: rural areas, forests, heath land, wildland, crops, bush etc.</li> <li>● Farms, farm buildings, processes and equipment</li> </ul>
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#### 4. Compressed Air Breathing Apparatus (BA)

<b>Assessment Criteria</b>	<b>Knowledge, Understanding and Skills</b>
4.1 Understand the composition of air, the purpose of the main components of a compressed air breathing apparatus set and duration times	<ul style="list-style-type: none"> <li>● Composition of air</li> <li>● Standard breathing apparatus set</li> <li>● Duration times</li> </ul>
4.2 Understand operational responsibilities and procedures to be followed when using breathing apparatus (BA) at an incident	<ul style="list-style-type: none"> <li>● Responsibilities and roles of personnel involved</li> <li>● Breathing apparatus entry control procedures</li> <li>● Procedural rules to be followed by breathing apparatus wearers</li> <li>● Communications</li> <li>● Standby and relief arrangements</li> <li>● Emergency arrangements</li> <li>● Testing and maintenance procedures to be adopted</li> <li>● Role of BA Entry Control</li> </ul>
4.3 Understand the general BA search and rescue principles in structures	<ul style="list-style-type: none"> <li>● Briefing, debriefing and recording</li> <li>● Compartment search procedure</li> <li>● Directional search procedure</li> <li>● Left/right hand orientation</li> <li>● Action on locating casualties</li> <li>● Emergency arrangements</li> </ul>



4.4 Explain the purpose, types and use of guidelines	<b>BA guidelines:</b> <ul style="list-style-type: none"> <li>• Purpose</li> <li>• Types - Main, Branch, Personal</li> <li>• Use and options</li> </ul>
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## 5. Ventilation

<b>Assessment Criteria</b>	<b>Knowledge, Understanding and Skills</b>
5.1 Understand the purpose and use of ventilation and the main techniques that can be adopted at a fire	<ul style="list-style-type: none"> <li>• Definition of ventilation</li> <li>• Purpose of ventilation</li> <li>• Types of ventilation:               <ul style="list-style-type: none"> <li>○ Natural</li> <li>○ Forced</li> </ul> </li> <li>• Ventilation strategies:               <ul style="list-style-type: none"> <li>○ Offensive</li> <li>○ Defensive</li> <li>○ Post-fire strategies</li> </ul> </li> </ul>

## 6. Preventable Damage (Salvage)

<b>Assessment Criteria</b>	<b>Knowledge, Understanding and Skills</b>
6.1 Understand the value of adopting preventable damage control practices, together with the tactical considerations and basic techniques that can be adopted	<ul style="list-style-type: none"> <li>• Causes of damage</li> <li>• Safety controls</li> <li>• Phases of damage control               <ul style="list-style-type: none"> <li>Phase 1:                   <ul style="list-style-type: none"> <li>○ Minimum use of firefighting media</li> <li>○ Covering goods and contents</li> <li>○ Moving goods and contents</li> <li>○ Damming and removal of water</li> </ul> </li> <li>Phase 2:                   <ul style="list-style-type: none"> <li>○ Reducing water damage</li> <li>○ Reducing smoke damage</li> <li>○ Protecting adjoining property</li> </ul> </li> <li>Phase 3:                   <ul style="list-style-type: none"> <li>○ Drying premises</li> <li>○ Removing covers</li> <li>○ Protecting items from deterioration</li> <li>○ Protection from the weather</li> <li>○ Security</li> </ul> </li> </ul> </li> </ul>

## 7. Water Supplies and Hydrants

<b>Assessment Criteria</b>	<b>Knowledge, Understanding and Skills</b>
7.1 Know the main sources of water supplies and their distribution	<ul style="list-style-type: none"> <li>• Water sources:               <ul style="list-style-type: none"> <li>○ Rivers</li> <li>○ Reservoirs</li> </ul> </li> </ul>



	<ul style="list-style-type: none"> <li>○ Underground</li> <li>● Distribution of water supplies</li> <li>● Pressure and flow in mains: <ul style="list-style-type: none"> <li>○ Special fire mains</li> </ul> </li> </ul>
7.2 Know the main types of hydrants and their components	<ul style="list-style-type: none"> <li>● Siting and fixing</li> <li>● Types and components: <ul style="list-style-type: none"> <li>○ Sluice valve</li> <li>○ Screw down</li> <li>○ Outlets and standpipes</li> </ul> </li> </ul>
7.3 Understand various methods of supplying water to the fireground	<ul style="list-style-type: none"> <li>● Water carrying</li> <li>● Water relaying</li> <li>● Hose layers</li> <li>● High Volume Pumping units</li> </ul>

## 8. Environmental Considerations

Assessment Criteria	Knowledge, Understanding and Skills
8.1 Understand the potential damage fires and other types of incident can have on the environment	<ul style="list-style-type: none"> <li>● Damage to lakes, watercourses, drainage systems and sensitive and fragile habitats</li> <li>● Pollution caused by: <ul style="list-style-type: none"> <li>○ Fire run-off water</li> <li>○ Firefighting foam</li> <li>○ Smoke plumes</li> <li>○ Polluting materials</li> <li>○ Physical damage</li> <li>○ Underground high pressure pipelines</li> <li>○ Wildfires</li> </ul> </li> </ul>
8.2 Understand the actions that can be taken to minimise damage to the environment	Pollution control hierarchy: <ul style="list-style-type: none"> <li>● Contain at source</li> <li>● Contain close to source</li> <li>● Containment on the surface</li> <li>● Contain in the drainage system</li> <li>● Contain on, or in, the watercourse</li> </ul>

## 9. Appliances and Equipment

Assessment Criteria	Knowledge, Understanding and Skills
9.1 Describe the basic operating principles of pumps and primers	<ul style="list-style-type: none"> <li>● Non-centrifugal pumps: <ul style="list-style-type: none"> <li>○ Positive displacement pumps</li> <li>○ Ejector pumps</li> </ul> </li> <li>● Centrifugal pumps</li> <li>● Pump characteristics</li> <li>● Multi-stage pumps</li> <li>● Regenerative (peripheral) pumps</li> <li>● Vehicle mounted pumps</li> <li>● Primers for vehicle mounted pumps: <ul style="list-style-type: none"> <li>○ Reciprocating primers</li> </ul> </li> </ul>





	<ul style="list-style-type: none"> <li>○ Water ring</li> <li>● Portable pumps</li> <li>● Primers for portable pumps</li> <li>● High Volume Pumping units</li> <li>● Pump instrumentation: <ul style="list-style-type: none"> <li>○ Pressure and compound gauges</li> <li>○ Water tank contents</li> <li>○ Flowmeters</li> <li>○ Tachometer (rpm)</li> <li>○ Fuel tank contents</li> <li>○ Oil pressure</li> <li>○ Engine coolant temperature</li> </ul> </li> </ul>
9.2 Understand how water is distributed on the fireground and identify factors involved in enabling efficient operation of pumps	<ul style="list-style-type: none"> <li>● Pump operation and distribution of water on the fireground</li> <li>● How to get a pump to work from: <ul style="list-style-type: none"> <li>○ a hydrant</li> <li>○ open water</li> </ul> </li> <li>● Identification of faults and defects</li> <li>● Cavitation</li> <li>● Crackling jets</li> </ul>
9.3 Describe the construction and main characteristics of good firefighting delivery and hard suction hose and their couplings	<ul style="list-style-type: none"> <li>● Delivery hose</li> <li>● Hard suction hose</li> <li>● Storage and care of hose</li> <li>● Deterioration of hose</li> <li>● Hose couplings and fittings</li> </ul>
9.4 Describe the types and use of firefighting branches, nozzles and monitors	<ul style="list-style-type: none"> <li>● Branches without control facilities</li> <li>● Branches with control facilities</li> <li>● Hose reel branches</li> <li>● Ultra High Pressure (UHP) systems</li> <li>● Monitors: <ul style="list-style-type: none"> <li>○ Portable</li> <li>○ Trailer and appliance</li> <li>○ Fixed</li> </ul> </li> </ul>
9.5 Describe the basic design and use of fire and rescue service portable ladders and aerial appliances	<ul style="list-style-type: none"> <li>● The principal parts of portable ladders</li> <li>● The main types of portable ladders: <ul style="list-style-type: none"> <li>○ Short extension</li> <li>○ 9 and 10.5 metres</li> <li>○ 13.5 metres</li> <li>○ Roof</li> </ul> </li> <li>● Aerial appliances: <ul style="list-style-type: none"> <li>○ Turntable ladders</li> <li>○ Hydraulic platforms</li> <li>○ Aerial ladder platforms</li> </ul> </li> <li>● The terminology used with fire and rescue service ladders and aerial appliances</li> </ul>
9.6 Understand the applications, properties, characteristics, construction, use and	<ul style="list-style-type: none"> <li>● Operational applications</li> <li>● Properties and characteristics of: <ul style="list-style-type: none"> <li>○ Natural fibres</li> </ul> </li> </ul>



<p>maintenance of fire and rescue service ropes and lines</p>	<ul style="list-style-type: none"> <li>○ Nylon</li> <li>○ Polyester</li> <li>○ Polyolefin</li> <li>○ Aramid fibre</li> <li>○ Wire rope</li> <li>● Categories of rope: <ul style="list-style-type: none"> <li>○ General purpose</li> <li>○ Rescue or personal fall protection</li> <li>○ Floating</li> </ul> </li> <li>● Storage and maintenance</li> </ul>
<p>9.7 Describe the purpose and use of breathing apparatus ancillary equipment</p>	<ul style="list-style-type: none"> <li>● Entry Control board</li> <li>● Entry Control tally</li> <li>● Personal lines</li> <li>● Guidelines and identification tallies</li> </ul>
<p>9.8 Describe the properties of firefighting foam, the main types of concentrate and their uses</p>	<ul style="list-style-type: none"> <li>● The main properties of firefighting foam</li> <li>● Expansion ratios</li> <li>● Typical uses of Low, Medium and High expansion foams</li> <li>● The main types of Protein based concentrate: <ul style="list-style-type: none"> <li>○ Protein (P)</li> <li>○ Fluoroprotein (FP)</li> <li>○ Film-forming fluoroprotein (FFFP)</li> <li>○ Alcohol resistant (AR-FFFP)</li> </ul> </li> <li>● The main types of Synthetic based concentrate: <ul style="list-style-type: none"> <li>○ Synthetic detergent (SYNDET)</li> <li>○ Aqueous film forming foam (AFFF)</li> <li>○ Alcohol resistant (AR-AFFF)</li> <li>○ Fluorine free foam (FF &amp; AR-FF)</li> <li>○ Class A foam</li> <li>○ Training foam</li> </ul> </li> </ul>
<p>9.9 Understand the types and operation of different foam making equipment</p>	<ul style="list-style-type: none"> <li>● Foam making equipment: <ul style="list-style-type: none"> <li>○ LX hand held foam making branches</li> <li>○ LX foam generators</li> <li>○ LX foam monitors</li> <li>○ Compressed air foam systems (CAFS)</li> <li>○ MX hand held foam making branches</li> <li>○ MX foam pourers</li> <li>○ HX foam generators</li> </ul> </li> <li>● Induction and injection equipment: <ul style="list-style-type: none"> <li>○ In line inductors</li> <li>○ Round the pump proportioners</li> </ul> </li> </ul>
<p>9.10 Know the purpose of basic types of equipment that may be used for rescue purposes at Road Traffic Collisions (RTCs) or similar incidents</p>	<ul style="list-style-type: none"> <li>● Safety equipment: <ul style="list-style-type: none"> <li>○ Personal Protective Equipment (PPE)</li> <li>○ Hard protection</li> <li>○ Soft protection</li> <li>○ Windscreen sheet</li> <li>○ Ram supports</li> <li>○ Airbag restraint</li> </ul> </li> </ul>



	<ul style="list-style-type: none"> <li>• Vehicle stabilisation:             <ul style="list-style-type: none"> <li>○ Step blocks</li> <li>○ Cribbing blocks</li> <li>○ Side stability systems</li> <li>○ Jacks</li> <li>○ Ropes/lines</li> <li>○ Ratchet straps</li> </ul> </li> <li>• Extrication equipment:             <ul style="list-style-type: none"> <li>○ Pneumatic equipment</li> <li>○ Hydraulic tools</li> <li>○ Electrical saws</li> <li>○ Lifting and pulling equipment</li> <li>○ Power tools</li> <li>○ Hand tools</li> </ul> </li> </ul>
<p>9.11 Understand the purpose and use of portable fire extinguishers</p>	<ul style="list-style-type: none"> <li>• Extinguisher standards:             <ul style="list-style-type: none"> <li>○ Performance requirements</li> <li>○ Information display</li> </ul> </li> <li>• Types of extinguishers:             <ul style="list-style-type: none"> <li>○ Water</li> <li>○ Foam</li> <li>○ Dry powder</li> <li>○ Carbon dioxide (CO<sub>2</sub>)</li> <li>○ Wet chemical</li> </ul> </li> </ul>
<p>9.12 Understand the purpose and use of drones</p>	<ul style="list-style-type: none"> <li>• Use of drones in fire and rescue operations</li> <li>• Facilities provided by drones:             <ul style="list-style-type: none"> <li>○ Camera to provide live feedback</li> <li>○ detection of heat sources</li> <li>○ detection of temperature</li> <li>○ loudspeaker to communicate to people below</li> <li>○ spotlights over scene</li> </ul> </li> </ul>



## Section 3: Fire Safety

### 1. Elements of Construction

Assessment Criteria	Knowledge, Understanding and Skills
1.1 Demonstrate a basic knowledge of the principal types of building construction	<ul style="list-style-type: none"> <li>• Solid or traditional</li> <li>• Structural steel frame</li> <li>• Reinforced concrete</li> <li>• Precast reinforced concrete</li> <li>• Framed and component</li> <li>• Modular</li> <li>• Portal frame</li> <li>• Prefabricated methods eg Structural Insulated Panels (SIPS) and Cross Laminated Timber (CLT)</li> </ul>
1.2 Understand the elements of structure, their behaviour in fire and the methods used to improve fire resistance	<ul style="list-style-type: none"> <li>• Beams</li> <li>• Columns</li> <li>• Floors</li> <li>• Roofs</li> <li>• Stairs and stairways</li> <li>• Walls (load-bearing and non-load-bearing)</li> <li>• Demountable partitions</li> <li>• Windows</li> <li>• Doors and shutters</li> <li>• Sandwich panels</li> <li>• External cladding</li> </ul>
1.3 Understand the use and composition of building materials, their behaviour in fire and the methods used to improve fire resistance	<ul style="list-style-type: none"> <li>• Timber</li> <li>• Masonry</li> <li>• Building blocks</li> <li>• Building slabs</li> <li>• Steel and other metals</li> <li>• Cement</li> <li>• Concrete (reinforced and pre-stressed)</li> <li>• Stone</li> <li>• Building boards</li> <li>• Glass</li> <li>• Insulating materials</li> <li>• Paint</li> <li>• Plastics</li> </ul>
1.4 Understand the passive fire protection systems and methods that support fire resistance	<ul style="list-style-type: none"> <li>• Compartment walls and floors</li> <li>• Protected shafts and protecting structures – lifts and escalators</li> <li>• Fire resisting doors and other enclosures</li> <li>• Active fire barrier systems</li> <li>• Building separation</li> <li>• Fire stopping and cavity barriers</li> <li>• Ductwork</li> </ul>



	<ul style="list-style-type: none"> <li>• Dampers</li> </ul>
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## 2. Fire Safety Practice

<b>Assessment Criteria</b>	<b>Knowledge, Understanding and Skills</b>
2.1 Understand the basic principles of means of escape in case of fire	<ul style="list-style-type: none"> <li>• To include:               <ul style="list-style-type: none"> <li>○ Means of escape</li> <li>○ Occupancy</li> <li>○ Construction</li> <li>○ Evacuation time</li> <li>○ Travel distance</li> <li>○ Escape route</li> <li>○ Places of safety (Reasonable and Total)</li> <li>○ Management control</li> <li>○ Responsible person</li> </ul> </li> </ul>
2.2 Know the main factors to be considered when undertaking a simple fire risk assessment in the workplace	<ul style="list-style-type: none"> <li>• Aims of a fire risk assessment:               <ul style="list-style-type: none"> <li>○ Identify fire hazards</li> <li>○ Identify people at risk</li> <li>○ Evaluate, remove, reduce and protect from risk</li> <li>○ Record, plan, inform, instruct and train</li> <li>○ Review</li> </ul> </li> </ul>
2.3 Know the main areas of advice to prevent fire in the home and the action to be taken in the event of fire	<ul style="list-style-type: none"> <li>• Provision of domestic smoke alarms</li> <li>• Planning a safe escape route</li> <li>• Main areas of risk including:               <ul style="list-style-type: none"> <li>○ In the kitchen</li> <li>○ Electrics</li> <li>○ Furniture</li> <li>○ Cigarettes</li> <li>○ Candles</li> </ul> </li> </ul>



### 3. Automatic Fire Detection

<b>Assessment Criteria</b>	<b>Knowledge, Understanding and Skills</b>
3.1 Understand the basic principles of Automatic Fire Detection (AFD) and describe the types of detectors and systems	<ul style="list-style-type: none"> <li>• Definition of a detector</li> <li>• Smoke detectors:               <ul style="list-style-type: none"> <li>○ Ionisation</li> <li>○ Optical</li> <li>○ Multi-sensor or combined</li> </ul> </li> <li>• Heat detectors</li> <li>• Domestic smoke alarms</li> <li>• Other types of detectors:               <ul style="list-style-type: none"> <li>○ Video</li> <li>○ Linear beam</li> <li>○ Flame</li> <li>○ Aspirating</li> </ul> </li> </ul>
3.2 Understand the operation and control of simple fire alarm systems	<ul style="list-style-type: none"> <li>• Control and indicating equipment</li> <li>• Power supplies</li> <li>• Zones</li> <li>• Alarm signals:               <ul style="list-style-type: none"> <li>○ Audio</li> <li>○ Visual</li> <li>○ Sensual</li> </ul> </li> </ul>

### 4. Fixed Installations

<b>Assessment Criteria</b>	<b>Knowledge, Understanding and Skills</b>
4.1 Describe the main types of fixed installation, their principal components and applications	<ul style="list-style-type: none"> <li>• Automatic sprinkler systems:               <ul style="list-style-type: none"> <li>○ Water supplies</li> <li>○ Fire and rescue service inlets</li> <li>○ Types of system</li> <li>○ Controls, gauges and alarms</li> <li>○ Sprinkler heads</li> <li>○ Fast response sprinklers</li> <li>○ Domestic sprinklers</li> </ul> </li> <li>• Drenchers:               <ul style="list-style-type: none"> <li>○ Roof</li> <li>○ Wall or curtain</li> <li>○ Window</li> </ul> </li> <li>• Water spray projector systems:               <ul style="list-style-type: none"> <li>○ High velocity</li> <li>○ Medium velocity</li> </ul> </li> <li>• Water mist systems</li> <li>• Foam installations:               <ul style="list-style-type: none"> <li>○ Low expansion</li> <li>○ High expansion</li> </ul> </li> <li>• Rising mains:               <ul style="list-style-type: none"> <li>○ Wet</li> </ul> </li> </ul>



	<ul style="list-style-type: none"><li>○ Dry</li><li>● Hose reels</li><li>● Private hydrants</li><li>● Extinguishing systems not using water:<ul style="list-style-type: none"><li>○ Carbon dioxide</li><li>○ Dry powder</li><li>○ Inert gas</li></ul></li></ul>
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