



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

Qualification Number: 500/5925/7

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

## Target Audience

The qualification will meet the needs of:

- those employed, or preparing for employment, as firefighters who wish to develop and demonstrate their knowledge and understanding relevant to the role
- those operating in specialist contexts, such as aviation fire operations or fire safety inspection roles and who wish to demonstrate their knowledge and understanding relevant to the role
- other fire professionals who wish to demonstrate their knowledge and understanding of fire science, operations and fire safety

## 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 qualification consists of one unit: Fire Science, Operations and Fire Safety (Ofqual Unit Reference number R/505/5748).

The unit is divided into three sections:

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

## Form of Assessment

The assessment takes the form of one written three-hour examination. The examination contains 120 multiple choice questions.

The examination is divided into three sections, reflecting the three sub-sections of the unit. The Fire Engineering Science and Fire and Rescue Operations sections of the paper each contain 45 questions and the Fire Safety section contains 30 questions.

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

## Grading and 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. (Note: Grade boundaries are reviewed and confirmed following each examination session in line with best practice awarding procedures.)

Candidates do not need to achieve a minimum number of marks in each of the sub-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.

## 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.

## Recommended Reading

Candidates preparing for the examinations are advised to refer to the IFE's recommended reading list. This list can be found at: <http://www.ife.org.uk/Preparing-for-Examinations>

## Progression

Candidates who are successful in achieving the Level 2 Certificate will have developed the knowledge and understanding to enable them to undertake further study and progress to qualifications at Level 3, such as the IFE Level 3 Certificate and/or the IFE Level 3 Diploma. At Level 3, rather than achieving the full qualification, candidates may extend specific aspects of their knowledge and understanding by studying specific units eg Fire Safety.

## 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.

# Unit 1: Fire Science, Operations and Fire Safety

Unit Reference Number: R/505/5748

## Section 1: Fire Engineering Science

### 1. Mathematics

Assessment Objective	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 Demonstrate an understanding of 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 Objective	Knowledge, Understanding and Skills
2.1 Define and understand the basic physical properties of matter	<ul style="list-style-type: none"> <li>Matter</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>Matter and energy</li> <li>Melting, boiling and evaporation</li> </ul>

### 3. Mechanics

Assessment Objective	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 Objective	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 by evaporation</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

Assessment Objective	Knowledge, Understanding and Skills
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> </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

Assessment Objective	Knowledge, Understanding and Skills
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 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

Assessment Objective	Knowledge, Understanding and Skills
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 Objective	Knowledge, Understanding and Skills
1.1. Understand and explain the key principles of Incident Command	<ul style="list-style-type: none"> <li>• Roles and responsibilities:                             <ul style="list-style-type: none"> <li>○ Command</li> <li>○ Communications</li> <li>○ Situational awareness</li> <li>○ Shared understanding and expectations</li> </ul> </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>○ No overall mode</li> <li>○ Emergency evacuation and tactical withdrawal</li> <li>○ Firefighter emergency</li> </ul> </li> <li>• Investigations</li> <li>• Closure and handover</li> <li>• Debriefing</li> </ul>

### 2. Search and Rescue

Assessment Objective	Knowledge, Understanding and Skills
2.1 Understand the basic principles involved in search and rescue	<ul style="list-style-type: none"> <li>• Persons at risk</li> <li>• Definition of the terms 'Search' and 'Rescue'</li> <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 at fires</li> </ul>



	<ul style="list-style-type: none"> <li>• Rescues from road vehicles</li> <li>• Manual handling</li> <li>• Rescues using ladders and aerial appliances</li> </ul>
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### 3. Firefighting

Assessment Objective	Knowledge, Understanding and Skills
3.1 Understand the phases of fire growth and 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>• Time/temperature curve</li> <li>• Flashover</li> <li>• Backdraught</li> </ul>
3.2 Demonstrate an understanding of operational planning and procedures	<ul style="list-style-type: none"> <li>• Operational planning and procedures:                             <ul style="list-style-type: none"> <li>○ Pre-planning</li> <li>○ Initial response to a fire</li> <li>○ Assessing the incident</li> <li>○ Safety considerations</li> <li>○ Environmental considerations</li> <li>○ Speed of intervention</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> <li>○ Cutting away</li> <li>○ Damping down and turning over</li> <li>○ Fire investigation</li> <li>○ Debriefing</li> </ul> </li> </ul>

### 4. Compressed Air Breathing Apparatus (BA)

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 Demonstrate an understanding of the operational control procedures adopted when using breathing apparatus at an incident	<ul style="list-style-type: none"> <li>• Operational control procedures:                             <ul style="list-style-type: none"> <li>○ Stage 1 BA Entry Control</li> <li>○ Stage 2 BA Entry Control</li> <li>○ BA Sector Command</li> </ul> </li> <li>• Deploying BA wearers:                             <ul style="list-style-type: none"> <li>○ BA teams</li> <li>○ Initial/rapid deployment</li> <li>○ Withdrawal and re-entry</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>○ Guidelines</li> </ul>
4.3 Understand the general BA search and rescue principles in structures	<ul style="list-style-type: none"> <li>○ Search and rescue 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> </li> </ul>
4.4 Explain the purpose, types and use of guidelines	<ul style="list-style-type: none"> <li>○ BA guidelines:                             <ul style="list-style-type: none"> <li>○ Purpose</li> <li>○ Types - Main, Branch, Personal</li> <li>○ Use and options</li> </ul> </li> </ul>

## 5. Ventilation

Assessment Objective	Knowledge, Understanding and Skills
5.1 Explain the value 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>● Value 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>○ Options</li> <li>○ Location of the fire</li> <li>○ Post fire strategies</li> </ul> </li> </ul>

## 6. Preventable Damage (Salvage)

Assessment Objective	Knowledge, Understanding and Skills
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>● The value of preventable damage control</li> <li>● Causes of damage</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

Assessment Objective	Knowledge, Understanding and Skills
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> <li>○ Underground</li> </ul> </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 Objective	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>

## 9. Appliances and Equipment

Assessment Objective	Knowledge, Understanding and Skills
<p>9.1 Describe the basic operating principles of pumps and primers</p>	<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> <li>○ Water ring</li> </ul> </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>
<p>9.2 Understand how water is distributed on the fireground and explain how a pump is 'got to work'</p>	<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>
<p>9.3 Describe the construction and main characteristics of good firefighting delivery and hard suction hose and their couplings</p>	<ul style="list-style-type: none"> <li>● The construction and main characteristics of hose</li> <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>
<p>9.4 Describe the types and use of firefighting branches, nozzles and monitors</p>	<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>

<p>9.5 Describe the basic design and use of fire and rescue service portable ladders and aerial appliances</p>	<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>
<p>9.6 Understand the applications, properties, characteristics, construction, use and maintenance of fire and rescue service ropes and lines</p>	<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> <li>○ Nylon</li> <li>○ Polyester</li> <li>○ Polyolefin</li> <li>○ Aramid fibre</li> <li>○ Wire rope</li> </ul> </li> <li>• Types of construction: <ul style="list-style-type: none"> <li>○ Hawser</li> <li>○ Plaited</li> <li>○ Kernmatel</li> </ul> </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 Know 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 Know the properties of good 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>• Production of finished 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 purpose and</p>	<ul style="list-style-type: none"> <li>• Foam making equipment:</li> </ul>

<p>use of basic foam making equipment</p>	<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> <li>● Induction and injection equipment: <ul style="list-style-type: none"> <li>○ In line inductors</li> <li>○ Round the pump proportioners</li> </ul> </li> <li>● Terms used in connection with foam</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> <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> <li>○ Colour coding</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>

## Section 3: Fire Safety

### 1. Elements of Construction

Assessment Objective	Knowledge, Understanding and Skills
1.1 Demonstrate a basic knowledge of the principal types of building construction	<ul style="list-style-type: none"> <li>• 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>○ Lift slab</li> <li>○ Portal frame</li> <li>○ Prefabricated methods eg Structural Insulated Panels (SIPS) and Cross Laminated Timber (CLT)</li> <li>○ Sandwich panels</li> </ul> </li> </ul>
1.2 Understand the basic building mechanics, elements of structure and their reaction when subjected to fire	<ul style="list-style-type: none"> <li>• Basic building mechanics</li> <li>• Elements of structure:               <ul style="list-style-type: none"> <li>○ Beams</li> <li>○ Columns</li> <li>○ Floors</li> <li>○ Roofs</li> <li>○ Roof lights</li> <li>○ Stairs and stairways</li> <li>○ Trusses</li> <li>○ Walls (load-bearing and non-load-bearing)</li> <li>○ Demountable partitions</li> <li>○ Windows</li> <li>○ Doors and shutters</li> </ul> </li> </ul>
1.3 Understand the character and use to which building materials are put and their usual behaviour in fire	<ul style="list-style-type: none"> <li>• Building materials:               <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> </li> </ul>

<p>1.4 Understand the purpose and basic operation of the main types of services likely to be found in modern buildings</p>	<ul style="list-style-type: none"> <li>• Types of services:             <ul style="list-style-type: none"> <li>○ Natural ventilation</li> <li>○ Mechanical ventilation</li> <li>○ Air conditioning systems</li> <li>○ Fume extraction plants</li> <li>○ Mechanical conveyors and chutes</li> <li>○ Machinery drives</li> <li>○ Heating systems</li> </ul> </li> </ul>
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## 2. Fire Safety Practice

Assessment Objective	Knowledge, Understanding and Skills
<p>2.1 Understand the basic principles of means of escape in case of fire</p>	<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>
<p>2.2 Know the main factors to be considered when undertaking a simple fire risk assessment in the workplace</p>	<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>
<p>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</p>	<ul style="list-style-type: none"> <li>• The main factors:             <ul style="list-style-type: none"> <li>○ Provision of domestic smoke alarms</li> <li>○ In the kitchen</li> <li>○ Electrics</li> <li>○ Furniture</li> <li>○ Cigarettes</li> <li>○ Candles</li> <li>○ Planning a safe escape route</li> </ul> </li> </ul>

## 3. Automatic Fire Detection

Assessment Objective	Knowledge, Understanding and Skills
<p>3.1 Understand the basic principles of Automatic Fire Detection (AFD) and describe the types of detectors and systems</p>	<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> </ul>



	<ul style="list-style-type: none"> <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

Assessment Objective	Knowledge, Understanding and Skills
4.1 Know 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> <li>○ Dry</li> </ul> </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>