



IFE Level 2 Certificate in Fire Science, Operations and Safety (VRQ)

Qualification Number: 500/5925/7

Introduction

The IFE Level 2 Certificate in Fire Science, Operations and Safety (VRQ) 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 engineering science, fire service operations and fire safety.

Aims of the Qualification

The IFE Level 2 Certificate in Fire Science, Operations and Safety (VRQ) 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 in diverse fire and rescue situations.

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 operating in specialist contexts, such as aviation fire operations or fire safety inspection roles, who wish to demonstrate knowledge and understanding relevant to the role;
- Other fire professionals who wish to demonstrate their knowledge and understanding of fire engineering science, fire operations and fire safety.

Learning Outcomes

Candidates who achieve this qualification should be able to:

- Carry out mathematical calculations accurately
- Understand scientific principles in relation to fire and the methods of extinguishing fire
- Understand basic procedures and 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 Service 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 Service Operations sections of the paper each contain 45 questions and the Fire Safety section contains 30 questions.

Grading and Certification

Successful candidates will be awarded a Pass Certificate. 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 by an expert panel review 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.

Progression

Candidates who are successful in achieving the Level 2 Certificate will have developed knowledge and understanding that will prepare them to undertake further study. Candidates may wish to progress to qualifications at Level 3 such as the IFE Level 3 Certificate and/or the IFE Level 3 Diploma. Candidates may choose to progress to specific units only at Level 3 (eg Fire Safety) if they prefer to extend specific aspects of their knowledge and understanding rather than achieving full qualifications.

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 Carry out calculations to determine the area, volume and capacity of various shapes	<ul style="list-style-type: none"> • Shapes including: square, triangle, rectangle, trapezium, rhombus, circle, cylinder, cube, irregularly shaped objects • How to calculate area, volume, capacity • Units of measurement for different purposes • Presentation of calculations
1.2 Calculate the capacity of hose and/or pipelines	How to calculate capacity

2. Physical Properties of Matter

Assessment Objective	Knowledge, Understanding and Skills
2.1 Define, understand and use terms	<ul style="list-style-type: none"> • Mass • Density • Vapour density • Liquids of different density • Gases of different density • Matter and energy • Melting point, boiling point and evaporation

3. Mechanics

Assessment Objective	Knowledge, Understanding and Skills
3.1 Define and understand basic terms and be able to carry out basic calculations involving physical mechanics	<ul style="list-style-type: none"> • Motion • Momentum • Force • Work • Energy • Power • Friction • Weight • Pressure • Mass • Velocity

4. Heat

Assessment Objective	Knowledge, Understanding and Skills
4.1 Define the terms “heat” and “temperature” and explain the relationship between them	<ul style="list-style-type: none"> • Definition of heat • Definition of temperature • Relationship between heat and temperature
4.2 Demonstrate an understanding of how temperature is measured	<ul style="list-style-type: none"> • Liquid thermometers • The air or gas thermometer • Using solids to measure temperature • Thermocouples • Electrical resistance • Thermistors • Comparison by brightness • Infra red • Thermometric scales • The Celsius or Centigrade scale • The Fahrenheit scale • The Kelvin scale
4.3 Define and use units of heat	<ul style="list-style-type: none"> • The Joule(J) • The Calorie • The British Thermal Unit (Btu)
4.4 Define and apply terms that apply to heat and heat and heat transfer	<ul style="list-style-type: none"> • Specific heat • Change of state and latent heat • Latent heat of vaporisation • The effect of change of pressure on the boiling point and latent heat • Latent heat of fusion • Cooling by evaporation
4.5 Describe the processes of heat transmission	<ul style="list-style-type: none"> • Conduction • Convection • Radiation
4.6 Understand the principles of thermal expansion	<ul style="list-style-type: none"> • The thermal expansion of solids • The coefficient of linear expansion • Thermostats • The coefficient of superficial and cubical expansion of solids • Thermal expansion of liquids • Cubical expansion • The effect of expansion on density • The expansion of gases • Temperature, pressure, volume
4.7 Define and understand the Gas Laws	<ul style="list-style-type: none"> • Boyle’s Law • Charles’s Law • Law of Pressures • The General Gas Law
4.8 Understand the basic principles of the liquefaction of gases	<ul style="list-style-type: none"> • Critical temperature and pressure • Liquefied gases in cylinders • Sublimation

5. Hydraulics

Assessment Objective	Knowledge, Understanding and Skills
5.1 Know and understand the properties and reactions of water	<ul style="list-style-type: none"> • Density • Mass • Boiling point • Freezing point
5.2 Describe and understand how pressure is measured	<ul style="list-style-type: none"> • SI unit - Newton per square metre (N/m²) • Bar • Relationship between different units
5.3 Describe the effects of pressure	<ul style="list-style-type: none"> • The principle characteristics of pressure • The relationship between pressure and head of water • The loss of pressure due to friction • That energy changes in water streams

6. Chemistry

Assessment Objective	Knowledge, Understanding and Skills
6.1 Define and use chemical terms	<ul style="list-style-type: none"> • Atom • Molecule • Element • Compound • Mixture • Radical
6.2 Describe atoms and molecules	<ul style="list-style-type: none"> • Components of an atom – protons, neutrons, electrons, shell • Atomic mass • Molecular mass • Valency • Reactivity
6.3 Understand the use of chemical symbols	<ul style="list-style-type: none"> • To describe elements • To write formulae • To write simple equations
6.4 Define and understand the terms flashpoint, fire point and spontaneous ignition temperatures	<ul style="list-style-type: none"> • Flashpoint • Fire point • Spontaneous ignition temperatures
6.5 Understand and apply the principles of chemistry to the extinction of fire	<ul style="list-style-type: none"> • Principles involved in the extinction of fire by: <ul style="list-style-type: none"> ○ Smothering ○ Cooling ○ Oxygen starvation • That a combustion is a type of chemical reaction • The principle of the fire “tetrahedron” • The components of the fire tetrahedron: fuel, heat, oxygen, chemical chain reaction • Types of flames
6.6 Explain the action of fire extinguishing media	<ul style="list-style-type: none"> • Water • Inert gas • Foam

	<ul style="list-style-type: none"> • Vaporising liquids • Carbon dioxide and inert gases • Dry chemical powders • Blanketing • Beating
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7. Electricity

Assessment Objective	Knowledge, Understanding and Skills
7.1 Define, understand and use basic electrical symbols and terms	Definition and use of the following in calculations: <ul style="list-style-type: none"> • Volts • Amperes • Ohms • Watts • Joules • Electrical current
7.2 Describe and carry out calculations using Ohm's Law	<ul style="list-style-type: none"> • Principles of Ohm's Law • Use Ohm's Law to solve problems
7.3 Explain the purpose and significance of conductors and insulators	<ul style="list-style-type: none"> • Purpose of conductors • Examples of conductors e.g. copper, aluminium • Examples of insulators for different purposes
7.4 Explain the reasons for providing earth connections and other protective devices to electrical circuits	<ul style="list-style-type: none"> • Short circuits • Circuit breakers • Fuses • Miniature circuit breakers (MCB) • Residual Current Device (RCD)

Section 2: Fire Service Operations

1. Incident Command

Assessment Objective	Knowledge, Understanding and Skills
1.1 Understand the stages involved in an incident and the activities undertaken	<ul style="list-style-type: none"> • Initial assessment of an incident • Development • Closing stage • Post-incident activities including debriefing
1.2 Understand the incident command system	<ul style="list-style-type: none"> • The impact of health and safety on the incident ground • Definitions relating to incident command • Incident command structure • Lines of command • Span of control • Shared responsibility and authority – roles in the incident command system • Sectorisation of incidents • Use of cordons • Levels of control: strategic, tactical, operational

2. Search and Rescue

Assessment Objective	Knowledge, Understanding and Skills
2.1 Understand the basic principles involved in evacuating and searching for casualties	<ul style="list-style-type: none"> • Basic methods of search • Basic methods of rescue • Equipment and processes used in rescue • Rescue of casualties • Evacuation

3. Firefighting

Assessment Objective	Knowledge, Understanding and Skills
3.1 Demonstrate a basic knowledge of how to tackle incidents in different situations	<ul style="list-style-type: none"> • Chimney fires • One room fires • Duct fires • Roof fires • Basement and underground fires • High rise building fires
3.2 Understand the basic principles and procedures for tactical firefighting interventions	<ul style="list-style-type: none"> • Action to be taken on initial entry • Working in smoke, heat or darkness • Identifying risks including explosion risks, signs of building collapse, hazardous materials • Evacuation procedures • Establishing bridgehead
3.3 Understand the use of breathing apparatus at an incident	<ul style="list-style-type: none"> • Precautions to be taken when donning Breathing Apparatus • Breathing Apparatus entry control procedures

	<ul style="list-style-type: none"> • Basic procedural rules to be followed by breathing apparatus wearers • Principles involved in searching while wearing breathing apparatus • Breathing apparatus line signals
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4. Ventilation and Salvage

Assessment Objective	Knowledge, Understanding and Skills
4.1 Understand the methods and value of ventilation	<ul style="list-style-type: none"> • Types of ventilation • Know why, when and how to ventilate, e.g. PPV
4.2 Understand the benefits of damage limitation and mitigation at an incident	<ul style="list-style-type: none"> • Methods of limiting and mitigating damage to a building on fire and in neighbouring premises

5. Appliances and Equipment

Assessment Objective	Knowledge, Understanding and Skills
5.1 Describe the design and use of pumping appliances	<ul style="list-style-type: none"> • Advantages and disadvantages of the various pump mounting positions • General principles involved in getting pumping appliances to work
5.2 Describe the design and use of pumps and primers (N.B. a detailed knowledge of pump characteristics is not required)	<ul style="list-style-type: none"> • The three categories of pumps: <ul style="list-style-type: none"> ○ Positive displacement pumps: <ul style="list-style-type: none"> ▪ Force ▪ Lift ▪ Bucket and Plunger ▪ Rotary ○ Centrifugal ○ Ejector • The operation of the following primers: <ul style="list-style-type: none"> ○ Reciprocating ○ Exhaust gas ejector ○ Rotary – water ring • How to get a pump to work from: <ul style="list-style-type: none"> ○ a hydrant ○ open water • How to identify and rectify pump faults
5.3 Describe the design and use of delivery hose	<ul style="list-style-type: none"> • The construction and characteristics of hose • How to take care of hose • The causes of damage to hose • The advantages and limitations of using hose reels • The principles of operating with hose lines at any level, including the use of breechings and variable branches
5.4 Describe the design and use of branches and nozzles	<ul style="list-style-type: none"> • The design and operation of various hand held branches and nozzels.
5.5 Describe the design and use of ropes and lines	<ul style="list-style-type: none"> • The differences between natural and man-made ropes and lines

	<ul style="list-style-type: none"> • The lay of a rope • The causes of damage and deterioration
5.6 Describe the design and use of fire extinguishers	<ul style="list-style-type: none"> • Water type – gas cartridge • Water type – stored pressure • Foam type – stored pressure • Dry powder type – stored pressure • Dry powder type – gas cartridge • Carbon dioxide type
5.7 Describe the types and use of firefighting foams	<ul style="list-style-type: none"> • The classification of foam • The properties of foam in relation to its expansion • The uses of the following: protein, fluoroprotein, synthetic, film forming, alcohol resistant foam
5.8 Describe the design and use of foam making equipment	<ul style="list-style-type: none"> • The principles of operation of a: <ul style="list-style-type: none"> ○ low expansion foam branchpipe ○ low expansion foam generator ○ high expansion foam generator
5.9 Understand the use of breathing apparatus	<ul style="list-style-type: none"> • The composition of air before inhalation and after exhalation • The working duration of breathing apparatus • The use of a personal line and a guide line for use with breathing apparatus
5.10 Describe the design and use of ladders	<ul style="list-style-type: none"> • The construction of a 10.5 m ladder • The construction of a 13.5 m ladder • Safety precautions to be observed when handling, pitching and climbing ladders • General principles of working with ladders • Safe and unsafe working angles when pitching ladders • Acceptable alternative uses for fire service ladders
5.11 Describe and understand the types of equipment used in relation to hazardous substance incidents	<p>Types of equipment to include:</p> <ul style="list-style-type: none"> • Radiation measuring equipment • Personal protective equipment (PPE) • Decontamination equipment

Section 3: Fire Safety

1. Elements of Construction

Assessment Objective	Knowledge, Understanding and Skills
1.1 Understand the use to which the building materials are put and their behaviour in fire	Building materials to include: <ul style="list-style-type: none"> • Timber • Stone • Brick • Cement • Concrete (reinforced and pre-stressed) • Metals • Glass • Building boards and slabs • Insulating materials • Paint • Plastics • Insulating boards
1.2 Recognise elements of structure, state their function and understand their fire resistance	Elements of structure to include: <ul style="list-style-type: none"> • Columns • Beams • Walls • Floors • Roofs • Non-load bearing walls and partitions • Stairways • Doors • Windows • Roof lights • Ceilings

2. Fire Safety Practice

Assessment Objective	Knowledge, Understanding and Skills
2.1 Understand the basic principles of means of escape in case of a fire	<ul style="list-style-type: none"> • Definition of “means of escape” • Principles of the following in relation to the means of escape: <ul style="list-style-type: none"> ○ Construction ○ Time of evacuation ○ Occupancy ○ Exits ○ Travel distance ○ Place of safety ○ Management control
2.2 Describe the fire safety factors to be taken into account in domestic premises	<ul style="list-style-type: none"> • The causes of fire in the home • Common types of behaviour that lead to fires starting in the home • The actions to be included in an escape plan for the

	<p>home</p> <ul style="list-style-type: none"> • The advice that should be given about tackling a fire in the home and two types of fire extinguisher that may safely be used • Passive and active measures of protection
2.3 Understand the basic principles and operation of fire alarm systems	<ul style="list-style-type: none"> • Manual systems • Manual/Electrical systems • Restricted alarms
2.4 Understand the basic principles of Automatic Fire Detection (AFD) and describe the types of detectors and systems	<ul style="list-style-type: none"> • Definition of a detector • Ionisation smoke detectors • Optical smoke detectors • Radiation • Heat • Detector Circuits: <ul style="list-style-type: none"> ○ Open Circuit ○ Closed Circuit ○ Wiring and power supplies ○ Control and indicating equipment
2.5 Describe the design and use of domestic smoke alarms and domestic sprinklers	<ul style="list-style-type: none"> • The functions of a domestic smoke alarm • The points to consider when installing a domestic smoke alarm • The advantages of domestic sprinkler systems compared with smoke alarms

3. Fixed Installations

Assessment Objective	Knowledge, Understanding and Skills
3.1 Outline the basic design features, use and operation of different types of fixed installations	<ul style="list-style-type: none"> • Sprinkler systems • Drencher and water spray projector systems • Rising mains • Hose reels • Foam systems • Gas/vapour systems • Dry powder systems