

IFE Level 3 Certificate in Fire Engineering Science – Zone 2

Examiner Report – March 2026

Introduction

48 candidates sat this examination and 33 (69%) achieved a pass. Candidates scored best on questions 1 and 2 with an average mark of 13.6 and did least well on question 8 with an average mark of 4.9.

Question 1

- a) *Define Charles Law and state the formula. (3 marks)*
- b) *Define the following terms and, where appropriate, state the SI units for each:*
 - i. *Endothermic reaction. (2 marks)*
 - ii. *Absolute zero. (2 marks)*
 - iii. *Thermal capacity of a body. (2 marks)*
- c) *In a fire, a steel beam is heated. Before the fire, the beam was 8.8m in length and 18°C. Calculate the length of the beam when the temperature reaches 475°C. The coefficient of linear expansion of steel is 0.000012. Show all calculations and give your answer to two decimal places. (5 marks)*
- d) *Explain three methods by which heat can transfer from one place to another. (6 marks)*

Examiner Feedback

The definitions were generally answered consistently well, although the calculation elements were less strong overall. A number of candidates incorrectly quoted Charles' Law, indicating some uncertainty in its application.

Question 2

- a) *Benzene is the simplest member of the aromatic class of organic chemistry. Describe the chemical structure of benzene and draw a diagram of the chemical structure. (5 marks)*
- b) *Explain the main properties and reactions of carbon monoxide, hydrogen and phosgene. (9 marks)*
- c) *Describe the properties and give an example of the use of:*
 - i. *Thermosetting materials. (3 marks)*
 - ii. *Thermoplastic materials. (3 marks)*

Examiner Feedback

This question was generally well answered, with overall strong performance observed in chemistry-related content. This suggests that candidates tend to prepare effectively for chemistry-based topics, and are generally able to demonstrate a sound level of understanding in this area.

Question 3

- a) *A car takes 12 seconds to accelerate from rest to 80 km/h. Calculate the acceleration of the car. (4 marks)*
- b) *Explain what is meant by SI units. State the SI units for luminous intensity, time and length. (5 marks)*
- c) *Define the following terms and, where appropriate, give the SI units for each:*
 - i. *Strain. (2 marks)*
 - ii. *Stress. (2 marks)*
 - iii. *Force. (2 marks)*
- d) *A copper wire 3.2 mm diameter, 7 m long extends 1.8 mm when carrying a mass of 25 g. Calculate the stress and strain in the wire at this load. (Take g to equal 9.8 m/s^2). (5 marks)*

Examiner Feedback

This question was generally well answered, although a number of candidates confused the definitions of stress and strain. In addition, SI units were often omitted from definitions, which resulted in lost marks.

Where stress and strain were not clearly distinguished, this sometimes also affected performance in the subsequent calculation, with incorrect formulae being applied.

Question 4

- a) *Explain what happens when a person is irradiated by a radioactive source and explain how being contaminated by radiation differs from being irradiated. (7 marks)*
- b) *If the half-life of a radioactive substance is 3 months, how much of 1 kg sample of the substance will remain after 18 months? (4 marks)*
- c) *The half-life of a radioactive substance is 3 months. If there are initially 5,000,000 radioactive nuclei in the sample, how many nuclei will remain after 18 months? (4 marks)*
- d) *Draw a graph showing how the radioactive sample described in (b) above is decaying over time. Use the graph paper provided. (5 marks)*

Examiner Feedback

Most candidates successfully calculated half-lives, some using innovative methods. The answers regarding irradiation and contamination were stronger than in previous years, with many candidates appearing to have studied the material provided in the IFE Formula Book, which now includes the 'radioactive yogurt' example. The section of the question requiring a graph presented greater difficulty for many candidates and this remains a recurring area of challenge within the examination.

Question 5

- a) *Explain what happens when a person is irradiated by a radioactive source and explain how being contaminated by radiation differs from being irradiated. (7 marks)*
- b) *If the half-life of a radioactive substance is 3 months, how much of 1 kg sample of the substance will remain after 18 months? (4 marks)*
- c) *The half-life of a radioactive substance is 3 months. If there are initially 5,000,000 radioactive nuclei in the sample, how many nuclei will remain after 18 months? (4 marks)*
- d) *Draw a graph showing how the radioactive sample described in (b) above is decaying over time. Use the graph paper provided. (5 marks)*

Examiner Feedback

The definitions in the question were generally well answered. The basic hydraulics calculation was also generally answered well. However, the part of the question relating to the effective height of a jet of water was less well answered.

Question 6

- a) *Define Ohm's Law and state the formula. (5 marks)*
- b) *A 120 volt direct current generator supplies a 1,800 watt floodlight through 80 m of two core cable. If the voltage at the lamp is not to be less than 116 volts:*
 - i. *What is the current flowing in the circuit? (2 marks)*
 - ii. *What is the total power loss in the cable? (3 marks)*
 - iii. *What is the resistance of the floodlight? (3 marks)*
- c) *A mains transformer has a primary winding of 1,750 turns which is connected to a 200 V supply. Calculate the number of turns required for two secondary windings to supply (i) 12 V and (ii) 400 V. (3 marks)*
- d) *In electrical installations, explain what surge protection devices are, what they are used for, and describe their operating principles. (4 marks)*

Examiner Feedback

Overall, this question was generally well answered, with many candidates demonstrating a good understanding of basic electrical calculations. However, a common weakness was in the calculation of voltage loss, with some candidates omitting this element and therefore not gaining marks. Part C, relating to surge protection, was also generally poorly answered, with many candidates incorrectly describing MCBs or RCDs rather than surge protection devices.

Question 7

- a) *What is the periodic table? Explain the structure of the periodic table. (7 marks)*
- b) *Write a balanced chemical equation for the complete combustion of benzene with oxygen, including the physical state of the components. (6 marks)*
- c) *Define the following terms:*
 - i. *Spontaneous ignition temperature. (2 marks)*
 - ii. *Flashpoint. (3 marks)*
 - iii. *Fire point. (2 marks)*

Examiner Feedback

This was the first time for several years that the periodic table was assessed within a question, and this section was generally answered well, with candidates demonstrating a sound level of knowledge in this area.

However, relatively few candidates demonstrated an ability to produce a balanced equation for the combustion of benzene.

Definitions were generally answered well, indicating a reasonable understanding of key terminology.

Question 8

- a) *Explain what is meant by the electromagnetic spectrum and name one type of radiation that has a wavelength less than that of visible light. (3 marks)*
- b) *Explain what is meant by a combustion fire detector and give an example. Give an example of a situation where a combustion fire detector might best be best suited. (3 marks)*
- c) *Infra-red fire detectors are sometimes used to detect fire.*
 - i. *Draw a schematic diagram of the main components of an infra-red detector. (5 marks)*
 - ii. *What characteristic of a fire is being detected? (1 mark)*
 - iii. *List the potential causes of false alarms in these detectors. (2 marks)*
- d) *Describe the operating principle and uses of thermocouples. (6 marks)*

Examiner Feedback

Responses to this question indicated limited familiarity with combustion detectors. A significant number of candidates appeared to conflate combustion detectors with smoke detectors, leading to inaccuracies in their answers. While this content is identified within the syllabus, candidate's responses indicate that it has not been consistently covered in preparation.