IFE Level 4 Certificate in Fire Engineering Science

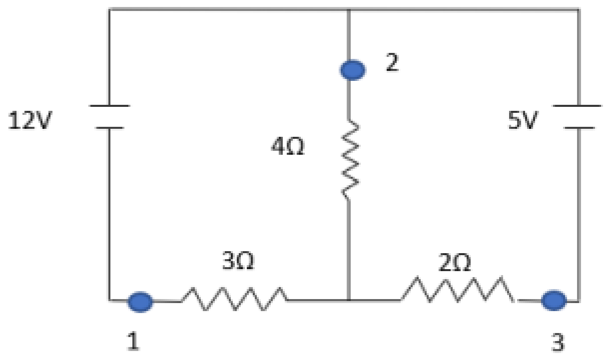
Examiner Report – March 2026

Introduction

Of the 28 candidates that attempted this examination, 14 (50%) achieved a pass mark. The best answered question on the paper was question 8 with an average score of 9.5 marks and the least well answered question was question 1 with an average score of 3.

Question 1

Consider the D.C. circuit below and calculate the currents at points 1, 2 and 3. All working should be included in your answer book. (20 marks)



Examiner Feedback

Most candidates failed to recognise this was a question about Kirchoff's Law and instead attempted to calculate the answer using Ohm's Law which is the incorrect method for this DC circuit arrangement. Those who did use Kirchoff's Law missed marks for not allocating loops or current directions. This led to candidates who tried the simultaneous equation route to incorrectly put the current equation into the loops leading to incorrect answers.

Question 2

a) *Explain what is measured in Becquerels. (2 marks)*

b) *What is the Sievert and what does it measure? (2 marks)*

c) *Explain the connection, and the difference between the Gray and the Sievert. (2 marks)*

d) *Explain the term 'effective dose' and state how it is calculated. (2 marks)*

e) *State and explain two reasons why it is not a straightforward process to calculate how much radiation is received from an isotope source of known strength. (4 marks)*

f) *Thorium 230 has a half-life, t1/2, of 8 x 104 years. Sketch a graph using four calculated data points to show how the isotope decays over time. (8 marks)*

Examiner Feedback
Performance on this question was average. Candidates who did well recognised that Part (c) was looking for how Sieverts accounting for radiation type can have a significant impact on absorption of radiation in particular that 1 Gy of Alpha radiation when absorbed is equivalent to 20 Siverts. Many candidates failed to state that a Bequerel is independent of emission type. Most candidates performed very well on Part (f). Where candidates did not achieve full marks, this was typically due to omissions such as a missing graph title, an inappropriate scale on the y-axis, or failing to recognise that the data represented an exponential curve and instead plotting it as a linear relationship.

Question 3

a) *Draw a diagram to show the main components of a bomb calorimeter. (10 marks)*

b) *Explain the purpose of a bomb calorimeter and how the purpose is achieved. (8 marks)*

c) *What method is used to allow for variations in the specific heat capacity of the components of a calorimeter. (2 marks)*

Examiner Feedback
Few candidates attempted this question but those that did answered well. Diagrams were well presented and most candidates captured all or nearly all component parts achieving high marks. Some missed the need for the water to be stirred to maintain equilibrium and most missed that volume is constant. Part c) was poorly answered as the candidates focused on component parts of the apparatus rather than how to overcome the variations caused by those component parts. Some recognised the need for calibration but failed to state how that is achieved, i.e. through the use of known materials.

Question 4

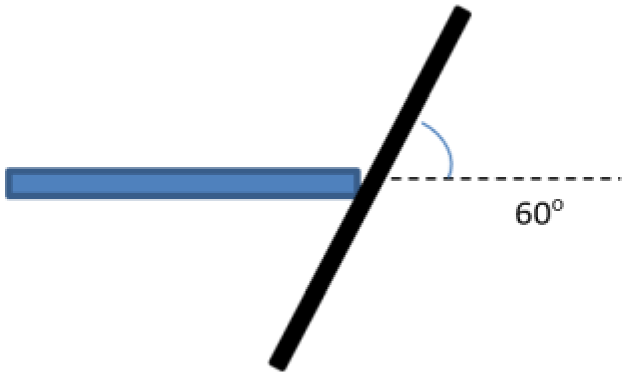
a) Explain in general terms, the Coanda Effect. Give a general example. (8 marks)

b) Explain how the Coanda Effect relates to fire behaviour, giving an example. (12 marks)

Examiner Feedback
This was an average performance question. Most candidates could define Coanda effect but few could explain in sufficient detail how it relates to fire behaviour, with candidates instead providing general compartment fire dynamics which was insufficient to explain Coanda in relation to fire behaviour. Those that did well recognised that the attachment to a surface enhances preheating, leading to increased combustibility.

Question 5

a) Show that the force of a jet hitting a stationary vertical plate can be derived from the fact that force on a plate is equal to the rate of change of momentum perpendicular to the plate. (12 marks)
b) Consider the jet hitting the angled plate below. Calculate the force of a 20mm diameter jet hitting the plate with a velocity of 1.6 m/s. (8 marks)



Examiner Feedback
Part a) of this question was poorly answered, candidates failed to recognise the need for derivation of equations to achieve part of the equation used in Part b). Some candidates successfully recognised that v2 = 0 when hitting a vertical plate due to the right angle. Part b) was generally well answered, some candidates failed to use the correct angle of 30 degrees instead applying 60 degrees. Others used the sine rule instead of cosine rule.

Question 6

A pipe with diameter of 45 mm containing water runs horizontally 2 m from the ground at a pressure of 2 bar and velocity 2 m/s. The pipe then rises to run horizontally 10 m off the ground before descending vertically to then run 5 m off the ground where its diameter increases to 60 mm. There is a leak in the pipe in the descending section causing it to lose 25% of its flow.
Use Bernoulli's equation to calculate:

a) *The pressure in the elevated section 10 m off the ground. (7 marks)*

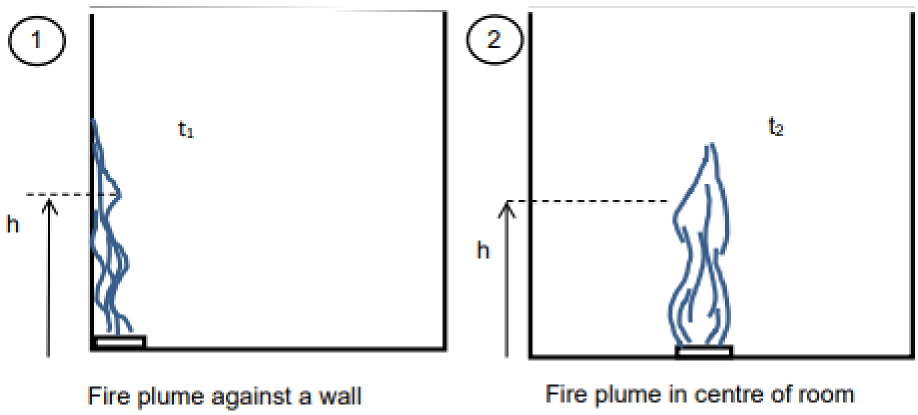
b) *The pressure in the final section 5 m off the ground. (13 marks)*

Examiner Feedback
Candidates either did very well on this question with minor errors or very poorly using the wrong arrangement of equations. Many missed the need to account for the leak in Part b). Most marks in those answers that utilised correct equations were lost through simple arithmetic errors.

Question 7

a) *Orientation is one factor that affects the rate of spread of flame in solids. Identify and explain six additional factors. (18 marks)*

b) *Consider the two situations in the diagram below. They each show the free burning of identical materials in identical rooms. Situation 1 shows burning against a non-combustible wall, situation 2 shows the fire is in the centre of the room. There is no limit to the amount of oxygen available for combustion. Compare the temperatures t1 and t2 of the flame taken at the same height h and at the same time in the fire's development in each case. Explain your answer. (2 marks)*



Examiner Feedback
Candidates appeared to misinterpret what Part a) was asking with answers focussing on basic compartment fire dynamics rather than spread of flame on solids which was the focus of this question. Those who did well recognised this question was looking at thickness of fuel, density, thermal conductivity and geometry to name a few factors. Whilst candidates recognised the factors their descriptions of the same were inaccurate not realising the inverse

relationships that exist with many of these factors. Nearly all candidates failed to recognise the effect of atmospheric pressure.
In relation to Part b) many candidates recognised that T1 was greater than T2 but their comparison did not explain why this was the case. Others recognised the orientation of the fuel packages influencing the temperatures but incorrectly assumed T2 was greater than T1.

Question 8

a) *Draw a graph to show the course of a well-ventilated compartment fire expressed as the rate of heat release as a function of time. (6 marks)*

b) *Label three distinct phases of the fire on your graph. (3 marks)*

c) *Indicate on your graph where flashover occurs. (1 mark)*

d) *Indicate on your graph what would occur if, instead of this being a well-ventilated fire, either ventilation is limited, or fuel is depleted. (3 marks)*

e) *RSET (Required Safe Egress Time) may be expressed with reference to the following aspects of t (time): tp + ta + trs ≤ tu, where tp is time from ignition to detection. What are the terms ta, trs, and tu?(3 marks)*

f) *Redraw your original graph (on the same page) with a reduced value for tu. (3 marks)*

g) *Explain what effect this would have on survivability for occupants. (1 mark)*

Examiner Feedback
This was generally well answered when attempted. Very few candidates correctly indicated flashover, many indicated it as a point on the graph instead of a band which occurs before the fire is fully developed. Candidates consistently failed to give their graph a title and very few provided units for the axis'. Growth period was consistently missed on the graphs. Many candidates recognised that the underventilated fire will have a reduced HRR with a flatter curve but none recognised that flashover would fail to be achieved. Similarly in Part f) no candidates correctly marked the impact the reduced tu would have on flashover instead only recognising that the curve would be similar but shifted to the left.