



THE INSTITUTION OF FIRE ENGINEERS
FOUNDED 1918 • INCORPORATED 1924

2006 Examination Markers Report

This document contains the report on the 2006 Membership examinations by the Chair of the Examinations Committee, W C Cox, who was assisted in this task by comments from the individual markers.

It is my pleasure as Chair of the Examinations Committee to present the report for the Institution's Membership examinations held in March 2006.

In so doing I hope that the comments made will help to prepare future candidates for their attempts at the Institutions examinations.

However candidates should bear in mind the following points

- ? These comments are not intended to be a definitive answer. There could be many variations in detail from different countries around the world and each one answer needs to be, and is, considered on its merits.
- ? The comments do contain details of "suggested answers" but they do not represent a full or complete answer and are only intended as a guide for students studying for these examinations.
- ? Any comments that are made are general to the question as a whole and should not be read in the context of any one individual script.

The examiners are looking to see that the candidate understands the topic being asked. A script that contains references to something not relevant to the answer will not be awarded any marks and in fact it only serves to illustrate a lack of understanding by the candidate.

A politician recently said to an interviewer "You are not asking the question that I have answered" and he was judged and found wanting in his answer. An examination candidate is also. Marks cannot be gained by presenting an answer to the question that you would like to see instead of the one that is actually asked.

Two of the biggest failings from candidates and those that still lose them the most marks are

- ? A lack of detail and explanation especially in calculations.
- ? Vague and general statements. It is not the task of the marker to try to interpret any answer to make sense of it.

The comments made on the Member Paper 6 Fire Service Operations should be treated with a certain amount of caution. The number sitting the examination was disappointingly low so any comments made may not be representative of the examination as a whole.

However there are many good scripts presented.

Finally I must record my thanks to the markers, the question setters, IFE staff and all who gave their time and energy to making the whole process possible

W C Cox MEd BSc CEng MIE FIFireE
Chair – Examinations Committee

Member Examinations

Paper 1 Fire Engineering Science

Question 1

- (a) *Define an "ideal gas" in terms of its pressure, temperature and volume relationship.*
- (b) *Does the gas in a cylinder of liquified petroleum gas behave as an ideal gas? Explain the reason for your answer.*
- (c) *The cylinder of a compressed air breathing set has a volume of 9 litre. For an average consumption of 40 litre/min. calculate at what pressure the warning whistle must be set so that it sounds when 10 minutes air remains. Explain fully any assumptions made.*

Most candidates defined an ideal gas in terms of its combustion.

Many knew the Gas Law but were unfamiliar with Charles Law and Boyles Law. Of those who correctly identified an ideal gas many went on to describe L.P.G. properties and then identify it wrongly as an ideal gas.

Virtually all candidates failed to consider the effect of temperature on an L.P.G. cylinder. Many correctly calculated the whistle pressure, but did so by using an assumption based on operational experience, rather than Boyles Law

Question 2

- (a) *Describe the special characteristics and conditions necessary for the formation of a deep seated fire in bulk fibrous or granular materials.*
- (b) *List the materials which are likely to be involved in such fires.*
- (c) *Describe the difficulties encountered in fighting this type of fire.*

In part (a) many candidates failed to consider lack of visible smoke as an indicator or that fine grains would exclude oxygen and make smouldering more likely.

In part (b) most candidates scored well for identifying materials susceptible to deep-seated fires e.g. hay stacks, grain silos.

Rather than discussing the difficulties of extinguishing this type of fire, many focussed on the hazards to the Fire Service and the need for P.P.V.

A few took deep seated to refer to basement fires or similar

Question 3

- (a) *Discuss the fire resistance of reinforced concrete mentioning:*
 - (i) *effect of type of aggregate,*
 - (ii) *effect of depth of concrete over reinforcing.*
- (b) (i) *What is meant by the "standard time/temperature curve" for tests on elements of construction?*
 - (ii) *Sketch the curve.*

In this question candidates confused the effect of aggregates, lightweight aggregates cause less spalling, not more. They also failed to mention the effects of concrete coverage on fire resistance.

Most failed to appreciate that standard curves are just that, a carefully controlled standard to compare samples with, not an attempt to produce a real fire.

Many curves sketched were concave not convex and showed extremely short durations.

Question 4

Discuss the fire extinguishing action of dry powders including in your answer both the chemical and the physical effects which combine to extinguish the flame.

Many candidates discussed types of powder and fire classification. The question expected a discussion of chemical effects, mentioning free radicals. Marks were lost by not showing the inhibition reaction and that the powder remained available to react again. A discussion of the physical effects should have included formation of a flame trap, heat radiation barrier, powder acting as a diluent. Most candidates failed to mention or consider the quenching effect of the powder.

Question 5

- (a) *Describe the process of ionisation brought about by radiation from a radio active source.*
- (b) *Sketch and describe the operation of an ionisation smoke detector and in so doing explain the types of combustion products for which ionisation detectors are most sensitive.*

The first part of this question required an explanation of ionisation i.e. radiation causes neutral atoms to lose electrons and form positive ions. Many candidates discussed radioactive particles and radiation not the ionisation process. Good marks were achieved in the second part of the question, with good use of schematic diagrams, but some drew pictures of specific detectors

Question 6

A foam generator consists of a tube which tapers from 70mm internal diameter to 20mm internal diameter. 600 litres per minute of water is passing through the generator and the pressure at the input end is 10 bar. What is the pressure at the point at which the diameter is 20mm? (The generator is horizontal).

This question was well answered by those who understood and could manipulate Bernoulli's equation. Many mid range scores were achieved by the use of Fire Service approximate formulae but these are not accurate enough for full marks at this level. Nor does their use illustrate a sufficient depth of understanding. Odd marks were lost by not stating the units and a small number of candidates appeared to have answered this question out of desperation.

Question 7

Explain what is meant by the "incubation phase" of a fire and give three, detailed examples of how it may vary and provide approximate timescales for each case.

Candidates did not explain the incubation phase, many described standard fire growth from ignition to decay, failing to appreciate that incubation is pre-ignition. Factors affecting the incubation could include temperature, vapour/air mixtures, and combustible solids. Most candidates did not score well on this topic.

Question 8

*The specification for the electrical equipment of a flour mill suggests the use of **flameproof** electrical equipment because the mill is a **Zone 1 area**:*

- (a) Define the terms underlined;*
- (b) Comment on the specification in relation to the definitions you have given and the hazard involved.*

The first part of this question required straight forward definitions which the candidate either did or did not know. Apart from one candidate most discussed fire safety in the mill or explained the nature of dust explosions, which was not required. In part (b) candidates were expected to appreciate that this specification specific to gases and not dusts, for which there is a new European standard.

Paper 2 Fire Safety

Question 1

Discuss

- a) the purpose of fire drills*
- b) the reasons why such drills are not always taken seriously and*
- c) how a fire drill should be conducted to ensure that it is effective?*

A popular question attempted by everyone except one candidate. The quality of answers was disappointing with some candidates referring to "Fire drills" for operational Fire Fighters, when they are sitting a "Fire Safety". paper.

Parts (a) and (b) were reasonably answered, but (c) How a fire drill should be conducted---etc was poor.

Answers could have included

- ? All participants including management and disabled persons to take part
- ? No pre-warning.
- ? Simulation of a fire, block off common exit route.
- ? Calling the fire Brigade.
- ? Observations, timing, debrief.
- ? Representative the Fire Brigade to attend and oversee

Question 2

- a) Outline the purpose of carrying out fire risk assessments*
- b) Explain a quantitative approach to risk assessment listing the sequence of steps taken.*

The "Risk Assessment" has been well covered in the Journal in various articles. At Membership level candidates are expected to display a broader depth of knowledge in the subject areas asked.

Many struggled to explain a "Quantitative approach to risk assessment", which suggests a lack of preparation for the exam.

In a quantitative approach, calculations are made of the level of risk, which is then compared to a tolerance level of risk. This comparison allows decisions to be made about the adoption of safety measures to ensure that those prescribed levels of tolerable risk are not exceeded

Steps are

- ? Identify the hazard.
- ? Estimate the frequency of the hazard occurring.

- ? Estimate the seriousness of the consequences.
- ? Calculate the risk.
- ? Compare calculated risk to prescribed levels.
- ? Make judgement about the acceptability and tolerability.
- ? Action plan.
- ? Communicate results.
- ? Review

Question 3

When considering the convective heat transfer mechanism, describe in detail the main factors that influence the operation of a sprinkler head.

The key words in the question are “heat transfer”, “factors that influence the operation” and “sprinkler head”. Those candidates who described heat detectors gained few marks.

The influences apart from the obvious are: -

- ? Thermal capacity of the parts, which activate the system.
- ? Height and shape of the ceiling.
- ? Distance of the head from the fire and ceiling.
- ? Rate of rise of the air temperature around the head.

Question 4

Describe the method of operation of an analogue addressable system and identify their advantages.

There was a big divide in the answers given, between those who knew what an “Addressable Alarm System” is against those who purely guessed!!

Those candidates taking Members level exams must study and be aware of new and recent advances in Fire Alarm Technology. The description should have included reference to, loop device, protocol, and fixed thresholds. A discussion of advantages should have mentioned flexibility, cuts potential for false alarms and provides information upon the exact location of where the alarm was activated.

The subject of alarm Systems including analogue addressable systems, has been covered in the Journal and other publications.

Question 5

A school head teacher has asked for advice on preparing a contingency/recovery plan to minimize the effects of a major fire and to ensure that, if an incident does occur, the school can recover as quickly as possible.

Detail the points that are to be considered when preparing such a contingency (recovery) plan.

This was a case of reading the question carefully, identifying the key words and what was being asked, i.e. “contingency/recovery”, effects of major fire” and “recover as quickly as possible”.

Too many candidates concentrated on Evacuation Procedures, Means of escape, and Fire Training etc when the areas that should have been considered were Security, salvage, alternative accommodation, services, records and contact lists.

Question 6

- a) *Define the term 'occupancy factor' and*
- b) *Discuss the use of occupancy factors and how they may assist in the assessment of the numbers of persons that may safely use a building.*

This was a popular question, which was well answered by most candidates. Additional marks were awarded where examples were given on how to calculate the number of occupants and associated exits and widths.

Question 7

Detail the three main factors which need to be taken into account by designers in designing a smoke control system for any building/complex

This again was a popular question which unfortunately produced few good answers. Too many scripts described the different types of ventilation systems, pressurisation, and surprisingly detection.

Again it is a case of reading the question and identifying the key words, i.e. "3 main factors" "by designers", "designing a smoke control system"

Answers should have included discussions around the topics of : -

- ? Anticipated amount of heat to be produced by fire.
 - Fire Size
 - Heat Output
- ? Anticipated amount of smoke to be produced by the fire
 - Temperature
 - Depth of smoke layer
- ? Size of compartment/building to be protected
 - Amount of air available
 - Restriction of fire and smoke spread.

Question 8

Design a fire alarm commissioning test aide-memoir

Surprisingly not a popular question, however there were some very good answers, mostly in the form of checklists or flow charts.

On reflection most candidates could have attempted the question if they considered what checks should be made on a newly installed Fire Alarm system before acceptance.

For example : -

- ? Visual check of wiring, indicator panels, batteries.
- ? Fail mains supply to check back up - observe fault indicator light on panel
- ? Initiate fire condition; on call point(s) check zone(s) on panel - same with detector(s).
- ? Audibility Test.
- ? Silence and Reset.
- ? Complete logbook and copy of test sheet.

Paper 5 Human Resource Management

Question 1

Describe how information technology can be used to improve information sharing within organisations.

Candidates drew widely on their own experiences of the introduction of I.T. into their organisation, and generally achieved a reasonable mark for their efforts. The highest marks were awarded to those who took a more strategic or holistic view and were able to explore aspects beyond those that they had day-to-day experience of. Time was wasted by some who went to some lengths to describe the importance of good communications in general, without concentrating on the I.T. aspect that was the key to the question.

Question 2

Discuss how planning methods can be adopted to achieve success for the organisation.

This question was all about how to plan. Where candidates provided information about planning methods, such as organisation/departmental/unit planning or long and short term planning, reasonable marks were obtained. The question was not about why to plan or what specifically to plan for. Candidates who used up valuable time exploring these avenues gained few or no extra marks.

Question 3

Detail the factors you would take into account in developing a strategic/corporate plan for your organisation.

Overall quite well answered with the high scoring scripts giving consideration to both internal and external factors. The question did ask candidates to detail the factors, e.g. mission, set objectives analyse strategies. One word lists even if they did address the relevant point, tended to score lower than those that gave more detail. Scripts that went beyond developing this plan to cover implementation and review did not attract additional marks. Candidates must read the question with care.

Question 4

Discuss the importance of having a clear and concise disciplinary procedure

Those candidates who gained most marks were able to apply a structure to the answer. This normally comprised of an introduction describing the scope and purpose of the procedure, followed by a description of the underpinning principles, e.g. counselling, disciplinary action, appeals etc. The use of structured answers helps to concentrate thought and avoids the repetition of information.

Question 5

Discuss the essential features of the processes involved in "change management".

This was not a popular question with only a few attempts by candidates.

Most marks were achieved when the candidate adopted a logical approach to the question, starting by identifying why change is necessary, by describing the effects of change, timetable for change and the evaluation of the effects of change. Additional marks were awarded to those who explored the human reactions to the change such as acceptance or resistance.

Question 6

Describe in detail the role that leadership plays in the development of effective teams.

This question was not answered well. The question was specifically about the “ role of leadership in developing teams”.

Too many candidates saw the word “ leadership” in the question and this triggered a cascade of information on every piece of leadership theory they had ever read.

The question was not about leadership theory or styles, it was about leadership development.

Answers could have included comments on, creating autonomous working groups, team values that are consistent, appropriate training, setting objectives and targets for different teams.

Question 7

Examine the Managers role in determining the effective use of resources

This type of question benefits from a systems approach to present the required information without repetition or omission.

An introduction should discuss the range and diversity of the available resources, e.g. staff, finance, buildings, equipment.

This is followed by a brief description of each of the essential managerial functions i.e. forecasting, Planning, organising, co-ordinating, commanding, controlling, motivating.

Question 8

Identify and explain the factors you would take into account before delegating work and the methods you would use to monitor the performance.

Generally a quite well answered question, with some good marks being achieved.

An initial discussion of factors such as identifying work suitable for delegation, all or parts of a task to be delegated, competence etc.

The second part of the question was about monitoring the performance in relation to the delegated task.

Candidates lost marks here by wrongly interpreting the question and discussing performance in general

Paper 6 Fire Service Operations

Question 1

Discuss the factors to be considered when equipping a Fire Service vehicle designed primarily for protecting the environment.

Most candidates failed to discuss a vehicle carrying equipment for environmental protection; instead they discussed the features required for it to be environmentally friendly. Some candidates said what processes needed to be carried out to select a vehicle. The majority discussed the need to consider types of pollution, safe systems of work, personal safety, and that equipment selected should be able to be integrated with existing equipment

Question 2

- a) When fighting fires in ships, maintaining the ship's stability is a safety critical factor. Detail those factors which may affect stability, and*
- b) Discuss the relationship between centre of gravity, centre of buoyancy and metacentric height in relation to the stability of a ship.*

Few candidates attempted this question. Most failed to appreciate the factors that affect ship stability in relation to fire fighting. The second part required the three elements to be defined and then discuss the inter-relationship of them and their effect on the stability.

Question 3

Discuss the statement that "Radio bearer systems should be used for both inter and intra working".

This was not attempted by the few candidates who entered for this paper.

Question 4

Discuss the factors to be considered when fighting fires in buildings which have fire engineered solutions

Many candidates failed to appreciate the design complexity and the interaction between fire protection measures and fire fighting. It should be supported by an analysis of facilities installed and each needed to be discussed.

Question 5

- a) With respect to compartment fires, describe the following forced ventilation techniques:*
 - i: positive pressure ventilation*
 - ii: negative pressure ventilation*
- b) Discuss the employment of forced ventilation techniques as part of firefighting tactics*

Most candidates defined Positive Pressure Ventilation and Negative Pressure Ventilation adequately and scored well. They then proceeded to discuss the advantages of ventilation for fire fighting rather than a comparison with other ventilation systems.

Question 6

Discuss the factors to be considered when formulating a strategy for dealing with extensive wildfire incidents

Many candidates failed to consider planning at a National level and the management of woodlands and the environmental impact of wildlife. Thee training of community volunteers and the management of visitors needed to be mentioned

Question 7

Describe the factors that need to be considered when pre-planning arrangements for dealing with very tall high rise buildings

Candidates produced insufficient detail on response to an incident or the preparation for incidents in high-rise buildings. No answers considered the recovery phase.

Question 8

Discuss the risks associated with fighting fires in buildings used for the production of pharmaceuticals.

Whilst most candidates identified the hazards including contamination risk many failed to detail control measures e.g. establishment of a cordon, use of minimum numbers of personnel.

Several answers became bogged down with considering the possible presence of animals for testing and the risks they pose.

Paper 7 Aero Fire Studies

Question 1

- a) *Define the terms Low speed accident and high speed accident.*
- b) *Discuss the factors to be considered for aircraft accidents off airfields*

A very popular question but poorly answered. Candidates lost marks for failing to mention items such as: -

Low speed accidents.

- ? Chances of survival high.
- ? Damage to aircraft low, aircraft usually intact.
- ? Fire may or may not be involved.
- ? Conditions for rescue are favourable.

High-speed accidents.

- ? Chances of survival low.
- ? Aircraft usually destroyed.
- ? Debris scattered over large area.
- ? Many involve oceans, rivers, mountains, cities etc.

Candidates lost marks for failing to mention areas such as: -

- ? Locating the incident.
- ? Post accident management.
- ? Fire fighting procedures.

- ? Candidates need to research and read the relevant material for this level of examination.

Question 2

Discuss in detail the number of ways you think it may be possible to reduce incident response times

Again a very popular question. However the standard of answers was extremely disappointing for this level of examination.

This subject has been covered in many books and journals. Candidates lost marks by not mentioning

- ? Faster vehicles.
- ? Rockets filled with extinguishing media.
- ? Remote controlled vehicles.
- ? Use of new technology, especially in aircraft safety.
- ? Runway standby points
 - Locations
 - Distances
 - Splitting resources.

Overall a disappointing response to a well documented subject.

Question 3

Discuss the minimum requirement for Rescue and Fire fighting vehicle communication systems and the types of other alerting /communication systems provided for the mobilization of other parties and agencies.

There was a reasonable standard of answers to this question.

Candidates lost marks for failing to mention items such as

- ? The use of the phonetic alphabet.
- ? Radios must be fixed in appliances
- ? Must be in contact with other appliance

Candidates scored better in the second part of the question.

Question 4

What are the specifications of exits on aircraft and how are they classified?

Not a popular question and the standard of answers clearly identified why. Candidates must understand what is expected of them in relation to this level of exam.

Specification of doors means

- ? Type of doors.
- ? Size of door in millimetres
- ? Location of doors i.e. over wing, main door, or floor level.

Classification of doors means the number of doors provided on each side of the fuselage in relation to the number of passengers.

Candidates must read and research the appropriate material.

Question 5

- A) *What are the main properties of firefighting foam*
- B) *What factors influence the performance of firefighting foam?*

A disappointing response from what was a popular question.

Candidates lost marks for failing to mention items such as

- ? Stability
- ? Expansion.
- ? Fluidity.
- ? Resistance to contamination.
- ? Resistance to burn back
- ? Must have a quick knock down effect

In Part (b) candidates did not grasp the intent of the question, items covered should have been

- ? Foam application techniques.
- ? Quality of water used.
- ? Rate of foam application.
- ? Type of foam concentrate.
- ? Type of foam making equipment.

Valuable and easy marks were missed from a very basic subject area.

Question 6

- A) *Define the term major incident*
- B) *Give five reasons to plan for major incidents/emergencies*

A popular question which provided a wide range of fanciful answers.

Candidates could have scored easy marks by including items such as

For (a)

- ? A major incident is any incident beyond the immediate resources available, and which may include one or more of the emergency services, medical services or local authorities.

For (b)

- ? Prepare for unusual circumstances
- ? Control the actions of others.
- ? To protect the organisation and the individuals.
- ? To help delivery of the pre-planned response.

Question 7

- A) *What are the response times for elevated and surface heliports*
- B) *What is the critical area for helicopters?*
- C) *What are the heliport categories for the provision of firefighting facilities?*

Candidates understood the question and what was required. Some excellent marks were gained by including a “legend” to explain the $L (W+W_1)$ formula thereby gaining easy marks.

Question 8

- a) *The magnitude of aviation fuel fires depends on several factors, what are they*

- b) *Describe in detail the physical properties of fuels*
- c) *What are the hazards associated with hydraulic fuels?*

A popular question with candidates, however many failed to understand the requirements. Candidates did not mention items such as

- ? Fuel vapours are twice as heavy as air
- ? A table is used to show fuel types, flash points, auto-ignition, and temperature etc.

If candidates had read and studied the relevant material, this would have been an easy question

Paper 8 Fire Investigation

Question 1

Discuss in detail the characteristics of a flaming fire.

Not a popular question. The keyword in the question is “characteristics”. Answers, which contained details about

- ? The flame
- ? Colour emissions
- ? Gas, carbon or other solids.
- ? Effects of oxygen concentration

And diagrams covering,

- ? Fuel Pyrolysis zone
- ? Radiant heat
- ? Convective plume
- ? Chemical makeup and entrainment of air.

Attracted most marks.

Question 2

Discuss the statement “Petrol/Gasoline is the best ignitable liquid with which to initiate and accelerate a deliberate fire”.

Whilst a popular question on a subject that is well associated with fire and its investigation, the level of knowledge displayed by candidates, at Membership level was disappointing.

Too many just agreed with the “statement” and did not analyse the properties and use of petrol/gasoline in igniting and accelerating deliberate fires.

Question 3

Discuss the role of the Expert Witness

Some really good scripts which explained the role of the “expert witness” in a court. Unfortunately many mixed up “Expert” with “Experienced” witness and concentrated on Lay and Experienced witness at the fire scene.

Question 4

Identify a comprehensive list of equipment you consider should be included in an evidence collection kit used for investigating fires and discuss your reasons for including each item .

A popular question, and it is pleasing to say that the majority of candidates included the reason for inclusion of items, rather than write a list. As a consequence some good marks were obtained.

Question 5

Discuss extremism as a motive for arson.

The keyword in the question was “extremism” as a motive. There were some excellent scripts, with good examples of extremist activity and motivation

Question 6

Discuss how laboratory services may be utilised in your country to assist the investigation of fires.

The question asked how laboratory services were utilised not purely the process of sending/taking and testing samples, but also

- ? How are laboratory services provided, i.e. police, state, and private?
- ? How and who requests their attendance.
- ? How long to get scientific results.
- ? Who pays?

Question 7

Explain how to conduct a detailed scene search following an explosion.

A very poor response to what was a very straightforward question. Nearly all candidates gave details of the effects of an explosion rather than “ how to conduct a detailed scene search.” It is important to read the question with care.

Good answers included; _

- ? Preliminary search.
- ? Distance of fragments from scene.
- ? Cordon and secure scene.
- ? Determine search sectors, start outside work inwards.
- ? Four “R”s : Recognition, Recovery, Reassembly, Reconstruct.
- ? Physical evidence

At member level it is important to demonstrate that candidates have a good understanding and knowledge.

Question 8

Detail three incendiary mixtures and highlight their properties explaining how they might be used to start a deliberate fire.

How are the signs of their use recognised?

Not a popular question, it is an either “knows it” or “don’t know it”, unfortunately in most cases the latter applied.

The key word in the question is "Incendiary Mixtures" therefore Petrol bombs are not an appropriate answer in this instance. The model answer was looking for examples which included; _

- ? Black powder (gunpowder) mixture of potassium nitrate, charcoal and sulphur.
- ? Flash powders a mixture of oxidisable metal with an oxidiser.
- ? Matches Sulphur fuel, potassium chloride.
- ? Safety flare of fuses sulphur, wax, sawdust, plus oxidiser.
- ? Thermite mixture of powdered aluminium and iron oxide.
- ? Cadweld mixture of powdered aluminium-copper alloy and iron powder

Graduate Examinations

Paper 1 Fire Safety

Question 1

Briefly discuss the principles associated with the positioning and siting of smoke detectors within buildings.

Most candidates had only limited knowledge of the subject, consequently their ability to discuss positioning and siting of smoke alarms was weak. Marks were gained when their discussion included dimensions and other working parameters, such as choice and spacing. No marks were given for those who described the principles of smoke detector construction.

Question 2

In multi-storey buildings name the three main types of filter used in a ventilation system and outline for each of them the fire hazards and precautions which are relevant.

Candidates either gained full marks for naming the filters as viscous, dry or electrostatic and detailing what they are made of e.g. viscous – oil used should have a high flash point, and a comment on maintenance. Sadly answering the question by discussing ventilation systems gained no marks.

Question 3

In relation to pre-action sprinkler system:

- a) *Define the two types used;*
- b) *Briefly describe one of them*
- c) *Outline the general method of operation and;*
- d) *List their advantages.*

A lot of candidates mis-read the question. The question specifically stated "In relation to pre-action sprinkler systems" i.e. the actions prior to the sprinklers operating. For example linking detection to electrically operated valves which will pre-fill the system prior to the sprinkler heads operating. Unfortunately candidates who described types of sprinkler systems or different sprinkler heads gained no marks.

Question 4

- a) *Detail the wording that would be included on a fire action notice that would be suitable for use and in an office building.*
- b) *Where should such notices be sited?*

Those candidates who understood the question and acted on its request for specific information gained good marks. Sadly many candidates seemed not to understand the concept of a “Fire Action Notice” which requires the presentation of essential information in short concise form.

Question 5

- When conducting a fire investigation the gathering of information is important. Witnesses fall into one of two categories;*
- a) *Name them and giving examples under each category; and*
 - b) *Given that there are a large number of witnesses to a fire, suggest an ideal method of gathering their information.*

This was a poorly answered question, which was relatively straight forward, e.g. two types of witness. Lay (i.e. the general public.) Experienced (i.e. Police, Fire Service etc).

This would have gained six marks.

The second part of the question centred on a larger number of witnesses and the method of conducting interviews e.g. Record names /addresses, take brief notes, follow up statements, separate interviews. This would have gained maximum marks.

Question 6

- Define ‘Means of Escape’ and discuss the various components within the definition.*

The definition of “Means of Escape” is fundamental to our understanding of Fire Safety. This provides the basis, or reason why we adopt specific components or systems to construct safe buildings. Unfortunately many candidates did not know the definition and only scored low marks.

Question 7

- Discuss the advantages and disadvantages of a **Central** power source against **Self Contained** power sources for Emergency Lighting*

Some marks were gained for explaining the differences between a central power source and a self-contained power source. A thorough understanding of the pros and cons of each system e.g. cost/ maintenance would have gained full marks.

Question 8

- a) *List the factors involved in the stability of a brick or stone loadbearing wall when involved in a fire.*
- b) *Draw a labelled sketch and briefly discuss how the load on a wall or column should be concentrated.*

In many scripts too much emphasis was spent on columns and beams. This is not what the question asked for.

A simple drawing of a brick wall showing how floors are attached would have gained almost 50% of the marks.

Comments on thickness, age, construction or bonding were all good points that would have achieved a pass mark.

Question 9

The manager of a hotel has asked for advice on fire safety management within his hotel. He has asked you to particularly include advice on the likely causes of fires in hotel and what he should include in his emergency plan.

Outline the considerations and advice that should be offered.

The question asked for “Advice on Fire Safety Management” for a hotel.

Most answers described in detail a lot of points regarding systems e.g. means of escape, emergency lighting, fire fighting equipment etc., this was not asked for Good marks could have been achieved by describing what should be included in this fire plan and the managing of the plan

- e.g. who attends to the fire alarm panel and determines the location of the fire?
- who calls the fire brigade?
- who assists with evacuation of the disabled etc?

Question 10

Detail the Fire Safety measures that should be required to be put in place in a multi-storey Hotel consisting of three floors

This question required a good understanding of the processes, systems and control measures to achieve a satisfactory level of safety in a hotel of three floors.

Those who were able to specify appropriate equipment standards, travel distance and periods of fire resistance, gained higher marks.

Paper 2A Fire Service Operations

Question 1

Explain in detail all of the control procedures for a protracted incident where a total of 12 or more Breathing Apparatus wearers are committed at one time.

This question was quite specific in asking for an explanation of the control procedures. Many candidates were clearly confused by the differing levels of control required for such incidents and preceded to explain daily checks, start up procedures and the role of the wearer. They should have given more time to covering the over-arching procedures

Candidates need to be aware of the level of the examination that they are sitting and provide responses commensurate with that level.

Question 2

Explain the essential points that need to be considered by the incident commander when dealing with a fire in a building where a sprinkler system is operating.

It was clear from the answers given that a large number of the candidates who attempted this question were relying on practical experience rather than an appropriate course of study. Far too many failed to mention the need to check the

main stop valve. Some confusion was also evident with the candidates referring to the fire alarm indicator panel rather than the sprinkler valve group.

Question 3

Describe the construction and operating principles of Thermal Arc cutting equipment used for heavy duty cutting during fire brigade operations.

This was not a popular question, a fact reflected in the small number of scripts presented. Few good answers were presented and it was clear that the principles of operation of “Thermal Arc cutting equipment was not well understood. Those who gave good descriptions of oxy-acetylene/propane systems failed to gain marks .

One candidate made reference to an oxy-hydrogen unit and some thought that the thermal arc equipment relied on flammable gases rather than Oxygen

Question 4

To enable the fire authority to deal successfully with a major disaster it is essential that some degree of pre-planning is carried out. Discuss the considerations that need to be implemented for control and communication as a part of any pre-planning.

A mixed response to a question that is topical in today’s climate. Candidates who gained good marks showed a clear understanding of the control measures required in co-ordinating the different agencies that would come together, and of the problems that a failure to co-ordinate communications would bring.

Marks were not given for the detailed descriptions of the “roles” different agencies would have. Reference to risk assessing buildings and having detailed knowledge of station grounds also failed to gain marks.

Finally, broad statements such as “reference to systems should be put in place” were never going to lead to success, the question asked candidates to “discuss the considerations”.

Question 5

Explain how the use of “positive pressure” ventilation at an operational incident can be effective in reducing the chances of a “backdraught” occurring.

A disappointing response to a question covering a subject which has been widely discussed in publications in recent years. A number of candidates gave good descriptions of the phenomena known as “back draft” but failed to give satisfactory explanations as to how positive pressure ventilation actually achieves the required result.

The question did not require detailed descriptions of the principles of ventilation generally. Candidates who covered these areas wasted time.

Candidates need to be fully aware of the level of examination being undertaken and realise that answers consisting of no more than 7 or 8 lines will not allow them to explain the subject in sufficient detail to gain good marks

Question 6

Describe the techniques that can be used during fire fighting to reduce the dangers of explosion in premises where dusts or powders may be encountered.

This question is straightforward in so much as it asks for a description of the techniques that can be used for fire fighting. Statements such as “The proper fire extinguisher or media should be used” are simply unacceptable and gained no marks whatsoever.

The use of gas detection equipment to assess the situation was another example of a candidate's lack of knowledge, a cause for serious concern! A distinct lack of preparation was evident in many of the scripts submitted.

Question 7

Water supplies at airports are often classified under the headings “primary” and “secondary”. Detail the requirements for these supplies.

Not a particularly popular question, but some candidates showed an understanding of the basic details required. Most lost marks due to failure to expand the points made e.g. reference was often made to “ring mains” under the “Primary” supply category but did not go on to explain the advantages of “reducing friction loss” and the fact that water will flow in either direction.

Question 8

Detail the factors that would have to be considered when carrying out a high level rescue of the operator of a “tower crane” who has collapsed in the crane control cabin.

Candidates who had studied the bibliography produced good scripts and showed a good understanding of the problems associated with high-level rescue.

Disappointingly however too many appeared to rely on general experience and as a result did not gain good marks. Marks were lost by those who failed to consider the cramped working conditions (and access) in the crane cabin.

Poor lighting in winter months and difficulties with providing good communications were points also missed frequently.

Finally, despite the question clearly stating “rescue” as its theme some candidates referred to dealing with fires and gas leaks - wasting time and not gaining any marks.

Question 9

Explain the role of the incident commander at a large factory fire and detail the key elements to be considered when assuming command of the incident?

Part (a) was well answered but Part (b) caused a bit of confusion.

The main areas for the role are,

- Responsible for overall management.

- Command/control and safety on the incident ground.

- Available resources.

- Ensure good communications with all.

- Briefing more senior officers.

The key elements, which were not generally answered well, were

- Ensure it is known to all, you are taking command.

- Confirm existing plan.

- Confirm safety arrangements.

- Check communications are suitable.

- Review operations

Question 10

- a) Explain why a risk assessment must be carried out at any incident.
- b) Detail and describe the steps of an initial risk assessment?

A risk assessment is completely different to assessing a fire. Most candidates confused these two areas. Having explained the risk assessment process, ideally the answer should have included the following.

Legal requirements—Initial assessment

Evaluate the situation-----Tactical mode---Select safe systems of work

Control measures----Gather information -----Review options available and continue to review the process.

Overall a poorly answered question.

Paper 2C Aero Fire Studies

Question 1

Describe the hazards associated with internal passenger cabin aircraft fires.

A frequently attempted question but the standard of answer was poor. Candidates failed to see outside the box i.e. consider other factors such as, internal fire situations are protracted incidents therefore items such as an extensive water supply is required. Other areas candidates failed to mention included gaining access, and aircraft location-on/off airfield etc.

Most failed to see the incident in a larger framework, other than dense toxic smoke and rapid build up of heat.

Candidates need to research and study more if they wish to increase their knowledge. Overall a poorly answered question.

Question 2

Civilian airports are categorised in a specific manner. Explain the categories and the methods used to determine them

Candidates, who scored well, understood the requirement of the question and answered correctly. Most lost marks for not including the airport category tables - easy marks missed!

Candidates lost marks by not mentioning that the category now run from 1 to 10

Question 3

- (a) Detail the potential hazards for fighting fires in military (fighter) aircraft
- (b) Describe the rescue procedures to be adopted for this type of aircraft.

A popular question but the standard of answers was disappointing.

Candidates lost easy marks by not mentioning what the armaments were, i.e. lasers, nuclear weapons, rockets, bombs, hydrazine is a specialised fuel and should have been mentioned.

Further marks were lost by not describing the correct sequence of events for rescue

- i.e. a) Gain entry/access

- b) Make seat safe.
- c) Release aircrew from ejection seat applying appropriate procedure.

Candidates need to study more and provide more detail if they are to score top marks

Question 4

Explain the various methods of gaining entry into a civilian aircraft and discuss the factors that may affect entry.

Candidates who attempted this question did well. However marks were lost by not answering the question fully. The second part of the question needed more detail e.g. wheels up, location, is fire present, escaping passengers, to name but a few.

Question 5

- a) *What are some of the roles of the helicopters?*
- b) *Compare the construction of the helicopter airframe with that of a fixed wing aircraft*
- c) *Explain the term "ADELT" in relation to a helicopter system and where it may be found.*

A relatively straightforward question that should have allowed candidates to get high marks. Marks were lost mainly in part b, candidates spent too much time and effort describing fixed wing construction, the question asked for the differences.

The answer should have included;

- Airframes on helicopters not pressurised.
- Airframes on helicopters not stressed for a mainplane.
- Composite materials used extensively to reduce weight
- Aluminium is a lighter gauge than fixed wing a/c

The standard of answers was disappointing.

Question 6

Describe the disadvantages and advantages of monitor/turret operations

This question was not popular; the standard of answers was generally poor for what is one of the most important aspects of aviation fire fighting i.e. monitor operations. Candidates need to read and study the relevant materials before the examination

Question 7

Describe the factors for consideration and responsibilities of the officer in charge for the following phases:

- (a) *En-route*
- (b) *On Arrival*

This question was not popular and was answered poorly.

Candidates need to read and study the relevant material prior to the examination.

Question 8

Halons are a permitted secondary fire fighting media, list their advantages and disadvantages and discuss their environmental impact and effective use.

This question should have been easy marks for candidates as it is "bread and butter" material.

However the question was poorly answered with many candidates concentrating on the environmental impact of BCF.

Answers should have included advantages such as

- Does not conduct electricity
- Non-damaging to most substances
- Creates no thermal shock etc

and disadvantages such as

- No post fire security.
- Easily dispersed by wind
- Degreasant is corrosive

All the above had two marks attached to them.

Question 9

Describe a basic decontamination procedure to be applied to RFFS personnel who may become contaminated by hazardous substances when dealing with aircraft incidents.

This question was not popular with the candidates and it was evident in the answers provided. Simply drawing a sketch of a decontamination oven could have easily scored 2 marks. Candidates could have considered items for use within the zone such as, barrier tape, scrubbing brushes, labels, sponges, bags etc. Possible factors for the siting of the decontamination zone could include, the slope of the ground, water supplies, wind direction and speed, location of drains.

A poorly answered question.

Question 10

Discuss the fire fighting and rescue procedures to be adopted for incidents involving freight aircraft

This was not a well-answered question. Candidates lost marks for failing to mention hazardous cargo such as livestock, horses or bullocks

Marks were lost for failing to mention combi-configuration of aircraft - those that carry people and cargo.

Very few candidates mentioned any fire fighting actions at all

Paper 3 Fire Engineering Science

Question 1

Pressure loss through friction in hose of two different diameters d_1 and d_2 , but comparable in every other way, will vary according to the ratio $(d_2/d_1)^5$.

- (a) *Plot a graph of the pressure drop ratio for values of $d_1: d_2$ ranging from 1: 1 to 1: 3.*
- (b) *Mark on the graph the point representing the ratio for 70mm and 150mm hose.*
- (c) *How many times greater is the friction loss in 70mm hose compared with 150mm hose?*

This question obviously confused quite a large number of candidates.

Many thought they should use the friction loss formula to calculate values, when in fact they only needed the diameter relationship given.

Many lost marks by not showing their calculations from which the points on the graph were drawn.

Another common mistake was to calculate too few points. Candidates used only three points then drew a straight-line graph. The actual line was a curve.

The overall pass rate (approx 50%) was very good but almost 1/3 of all candidates failed to obtain any marks at all.

Question 2

*Explain the difference between thermosetting plastics and thermoplastics.
Discuss the specific problems raised by each in a fire situation.*

This question was not answered well at all

The candidates who described the different ways in which the two plastics were bonded gained additional marks.

Many answers referred to fire fighting. It should be obvious that in a science paper it is the knowledge of construction and behaviour of plastics that is being examined.

Question 3

A floor joist in a building is six metres long and supported at each end by the external walls. The weight of the joist is 100Kg. and it has loads of 20Kg. at 1 metre, 30Kg. at 4 metres and 40Kg. at 5 metres from one end.

The walls are designed to carry a maximum load of 180Kg. but this is reduced by 50% in the event of a fire. If a fire were to occur, what would be the result?

Most candidates used a sketch to demonstrate the loading of the beam. This enabled the following calculation to retain a logical progression.

The candidates who calculated the clockwise and anticlockwise moments were awarded marks accordingly.

A few candidates resorted to short written explanation and failed to show what would happen to the supporting walls.

It is important to remember that this is a Fire Engineering Science question and there is the expectation that the answer will be accompanied by relevant calculations.

Question 4

Two important characteristics of a radioactive source are

- (a) *the rate at which radiation is being produced,* and
(b) *the dose which a person could receive from the source.*

Name the physical units which are used to describe these characteristics and explain the connection between them.

Many candidates failed to read the question correctly.

They referred to Time, Distance and Shielding and how to decontaminate following an incident involving radiation. The question did not ask for this information.

Marks were awarded to those who identified that radioactive decay is measured in Becquerels and discussed the damage that different radiations cause

Question 5

- (a) *Define combustion.*
(b) *Describe briefly, with chemical equations, **three** types of combustion which do not involve oxygen from the air.*

A two-part question.

Part a was answered well. Most candidates were able to define combustion as a chemical reaction, or a series of reactions producing heat and light.

Part b however was poorly answered. Many candidates failed to produce a chemical equation as requested.

A lot of answers discussed the triangle /tetrahedron of fire which was not part of the question

Equations describing the combustion of halogens or nitrogen with metals, would have scored good marks

Question 6

A steel girder is 8 m long and has a cross sectional area of 0.006 m²

- (a) *How much heat must be supplied in order to cause it to expand by 0.048 m if the girder was initially at 15°C?*
- (b) *When it has expanded by this amount, what will be the temperature of the girder?*

[Coefficient of linear expansion of steel is 0.000 012/°C

Specific heat capacity of steel 450 J/kg/°C

Density of steel 7.7 x 10³ kg/m³]

The response to this question was good. A large proportion of the candidates achieved good results.

It was necessary to calculate the volume and mass of the girder, then its expansion and finally the temperature change in order to calculate the final temperature.

Question 7

A 110 volt direct current generator supplies a 1000 watt floodlight through 50 metres of two core cable. If the voltage at the lamp is not to be less than 105 volts:

- (a) *What is the current flowing?*
- (b) *What is the total power loss in the cable?*
- (c) *What is the **maximum resistance** per metre of each core of the cable?*

This question was in three parts; each segment enabled the candidate to complete the next.

Part (a) was completed by most candidates. This required the use of the power formula

$$\text{Power} = \text{Voltage}^2 \div \text{Resistance.}$$

However parts (b) and (c) were not calculated successfully by a large number of candidates. The equations for power and resistance needed to be quoted. Marks were lost because candidates failed to show how they achieved their answers. Some credit could be gained “ by showing all working ” even if there was an error in the calculation.

Question 8

A rectangular tank is 6m long, 3m wide and 4m deep and is initially full of water. 6m below the base of the tank is a turbine which is driven by the water flowing from the tank.

- (a) *Explain why the work done by the turbine will vary as the tank empties.*
- (b) *Calculate the highest and lowest values of the work done by the turbine per kilogramme of water.*
- (c) *If the water takes two hours to run through the turbine what is the average power generated?*

The majority of candidates gave a good explanation for Part (a) and were able to apply the equation Work Done = Force x Distance

The second part was not so well done. Candidates failed to calculate the mass of water and use this to calculate the highest and lowest values of work done.

The final part required the use of the previous calculations to work out the average power using the equation Power = work done / time.

Few candidates completed this section correctly.

Question 9

- (a) *By writing down the chemical formulae for*
 - (i) *Carbon burning in Oxygen*
 - (ii) *Magnesium burning in Oxygen**demonstrate **and state clearly what is meant by “balancing chemical equations”.***
- (b) *State and give a brief explanation of the factors that a simple chemical equation does not tell you about the reaction which it represents.*

This question required the candidate to write down the chemical formula for carbon (C) burning in oxygen (O) and Magnesium (Mg) also burning in oxygen

Most managed to complete the formulae, but many failed to explain the need to balance the formulae i.e. have the same number of atoms on either side of the equals sign. There also appeared to be some confusion between using the words, atoms and molecules

Part (b) was well answered; candidates were able to list factors such as temperature and pressure, which a simple formula does not indicate

Question 10

Water at 10°C is being applied to a fire in a building at the rate of 600 litres/minute. Residual water at 90°C is flowing out of the building at 550 litres/minute. What percentage of the heat removed from the fire is due to water being vaporised into steam:

(specific heat capacity of water = 4200 J/kg/°C

latent heat of vaporisation of water = 2260 000 J/kg)

This question required the candidates to calculate the heat absorbed from the fire. This was a three-step calculation. The majority of answers were good, however marks were lost because the formulae used and the calculations were not shown.

When answering examination questions it is important to show all calculations so that credit can be given for each stage.

Paper 4 Human Resource Management

Question 1

- (i) Explain the term SMART objectives.
- (ii) Good practice **principles** in delegating tasks are the use of objectives to clarify the task being delegated and indicate the standard of performance that is required. List the **practical** reasons for delegating tasks.

In general a well answered question. Candidates who had clearly studied and understood the SMART objectives attracted high marks. Many however merely gave a single word answer as an explanation for SMART and did not follow it up with even a brief explanation

Most candidates managed to answer the second part of the question well. It was however clear again that those who had studied the subject received high marks whilst those who relied on practical experience alone did not score as well.

Once again reading the question is very important as a number of candidates wasted time by detailing a definition of delegation when the question actually asked for “ list the practical reasons for delegating a tasks.

Question 2

- List the advantages and disadvantages of decentralisation of activities in an organisational structure.*

A reasonably well answered question with most candidates managing to obtain marks by listing the advantages and disadvantages

A number of candidates wasted time by describing what decentralisation is or by sketching elaborate flow charts of their organisation. This was not asked for in the question.

It was obvious from the answers presented which candidates had studied the subject and which were answering from personal or practical experience. Those who had studied clearly gained the higher marks.

Question 3

- Describe the practical steps that could be taken at an organisational level to provide a fairer framework of working conditions that give greater opportunities for promotion and career development to parents and carers.*

Not many candidates attempted this question and of those that did only a few received good marks. The main reason for poor answers was that the candidate did not read the question carefully and missed the key points.

The question asked for practical steps at organisational level and opportunities for promotion and career development for parents and carers e.g. Part time opportunities, flexible working hours, job sharing and training opportunities.

It is important to take time to fully read and understand the question.

Question 4

- Identify the options for responding to poor performance in your team and briefly describe your actions within each option.*

The question attracted many attempts, unfortunately the vast majority failed to read or understand the question.

Most candidates identified the reasons for poor performance instead of identifying the options for responding to poor performance i.e. support and development plans or discipline and grievance procedures.

The few who had clearly studied the subject attracted good marks.

Question 5

- a) *Discuss the keeping of a time diary as a method of obtaining information about a job process and*
- b) *Describe elements, which contribute to time wasting and the reduction of an individual's personal effectiveness*

In general a poorly answered question, the majority of candidates misunderstood the meaning of a time-diary.

A detailed time-diary is where the individual records his or her work activities every day for a week or a month. For example the simplest form is one listing the day in half hour intervals.

In Part (b) the correct answer should include prolonged or unnecessary meetings, interruptions from staff, idle conversation, and unnecessary memos.

Prior study enabled candidates to gain good marks.

Question 6

Describe the procedural items required for a meeting and detail the responsibilities of the chairperson.

Generally those candidates who were able to draw on their experience of attending a structured meeting were able to pick up some marks on this question. However overall the question was poorly answered. Not reading the question was amongst the contributing factors.

The question paper asked the candidate to describe the procedures and detail the responsibilities. Too many scripts contained just lists of procedures and responsibilities, which attracted lower marks than those with a full description. Candidates should have recognised the words “procedural items” and “responsibilities of the chairperson” The structure and conventions governing the running of more formal meetings should be described in detail.

One of the main procedural items of any meeting is to manage the proposal and seconding of any motion and the subsequent voting. This aspect was missing from the majority of the scripts and resulted in a corresponding loss.

Finally, few or no extra marks were gained for lengthy descriptions of different types of meeting or the purpose and benefits of meetings

Question 7

Health education can make an important contribution to occupational health and safety. Explain the benefits for employers and employees.

This question asked for an explanation of the benefits of Health Education. Not what a Health Education policy needs to cover. A lot of time was wasted by candidates who did not read the question.

Similarly the question asked candidates to explain the benefits. Answers in the form of lists, even though they covered the relevant topics did not attract as many marks as those who provided a detailed explanation

Question 8

Describe the steps usually included in a market research study.

Many candidates either failed to read the question correctly or misunderstood the question.

These candidates gave detailed answers describing how to market a product, when the question asked for the steps usually included in a marketing research study.

Candidates need to study the subject, and read the question with more care.

Question 9

Examine the long and short-term personnel requirements, which should be considered when planning the workforce needs of an organisation.

A very poorly answered question, most listed qualities of staff required or factors to consider when deciding if it is necessary to recruit.

Those who examined the five areas recruitment, training, career planning, pay and productivity, and retirement achieved much higher scores.

Question 10

Identify the basic steps in the control process, as a managerial function, and explain the key considerations in each step.

Candidates had not prepared for the question. Several candidates could list the basic steps i.e.

set standards of performance.

Measure performance.

Compare results obtained with standards.

Initiate corrective action where required

However they could not explain the key considerations of each of the above.

Consequently high marks could not be achieved.