

Answers to revision questions for NGC2 element 6

Answer 1 Essential elements for fire to occur or continue.

Here you should have described the fire triangle, emphasising that removing any side of the triangle will prevent the fire from starting (fire precautions) or will stop a fire that has started (fire fighting). As we have pointed out, almost any question on the prevention and fighting of fire can be answered, at least in part by appropriate mention of the fire triangle. A rich answer would explain that the heat side of the triangle is actually formed of two components - the heat to create a vapour (because it is the vapour that actually burns, not the solid or liquid itself) plus the energy to ignite the vapour. Some authorities have argued that it might thus be preferable to talk of a fire 'square' but it seems as if the triangle is now too well established to be replaced.

Answer 2 Exothermic, oxidising

- exothermic: a reaction that gives out heat as it takes place
- oxidising: the reaction consumes oxygen (strictly, chemists may provide a different definition, but this will suffice for our purposes)

Answer 3 Common causes of fire include:

- delayed discovery allowing development into a major fire
- combustible material not properly stored - or disposed of
- presence of explosive dusts, gases or vapours
- presence of flammable material (for example, flammable liquids) in unsuitable containers
- poor building design combined with lack of appropriate fire stopping measures - inadequate fire doors, roof voids and cavity walls which allow fires to develop and spread without being detected and so on
- use of combustible materials in construction
- windows and / or doors accidentally or intentionally left open
- vandalism resulting in the disabling of fire fighting systems
- arson

Imagine now that the question had asked for the 'principle sources of ignition for fires' - although there is obviously an overlap with this 'common causes' question, your answer should focus on ignition sources such as friction, static electricity and so on. (Make sure that you can indeed list and describe seven or eight sources of ignition.)

Answer 4 Basic methods of heat transfer in the spread of fire:

- conduction (for example: along pipes, through brickwork)
- convection (via the space above false ceilings, up stairwells)
- radiation (from a burning building or trees across a distance of many metres)
- direct burning ('eating' steadily along / flow of burning liquid - remember what we said about these)

Answer 5 The body may lose heat by the three basic means of heat transfer - conduction, radiation and convection plus heat loss via sweating (in many situations, the most important means of heat loss). Heat cannot be gained by sweating.

... continued ...



Answer 6 Definitions

- spontaneous ignition temperature is the lowest temperature at which a substance will ignite spontaneously without any external source of ignition: coal tips, haystacks and oil soaked rags are some examples
- lower flammable limit is the smallest concentration of flammable gas or vapour which, when mixed with air, is capable of ignition and subsequent flame propagation
- upper flammable limit is the highest concentration of flammable gas or vapour which, when mixed with air, is capable of ignition and subsequent flame propagation

Answer 7 Fire detectors are intended to detect an outbreak of fire / smouldering in its early stages by sensing one or more of the following:

- heat detectors and flame detectors have three basic operating principles:
 - » fusion (melting)
 - » expansion
 - » infra-red flame and smoke detectors
- smoke detectors generally fall into three categories:
 - » ionisation detectors
 - » light scatter detectors
 - » obscuration detectors

(Make sure that you can briefly describe all these.)

Answer 8 Sprinkler systems may be divided into two main types:

- wet systems where the pipework is fully charged with water at all times and thus there must be no danger of the water freezing
- dry installations are installed where the temperature conditions are artificially maintained close to, or below freezing, for example in cold stores; the pipes are kept charged with air under sufficient pressure to hold back the water supply

Answer 9 Classes of fire and fire extinguishers

- Class A Fires involving solid materials - paper, wood, fabrics. Cooling by water or spray foam is the most effective way of extinguishing this type of fire.
- Class B Fires involving flammable liquids such as petrol, oils, fats; foam and dry powder extinguishers should be used.
- Class C Fires which are fuelled by flammable gases such as North Sea Gas, butane and so on. Priority must be given to shutting off the source of fuel and the fire should be tackled with dry powder.
- Class D Metal fires involving metals such as aluminium and magnesium; special powders are required in such situations.
- (Formerly known as Class E Fires) in which live electrical equipment is involved. For such fires, non-conducting agents such as powder and carbon dioxide must be used; if those fighting the fire can, with certainty, disconnect all electrical power, then the fire can be treated in terms of its appropriate Class, A–D, F.
- Class F High temperature (>360 C) cooking oils used in large industrial catering kitchens, restaurants, takeaways etc; wet chemical fire extinguishers are required.

All extinguishers are now to be coloured red although the old coding system (cream for foam extinguishers etc) can be retained as a coloured strip on the extinguisher.



Answer 10 The main factors to be considered when assessing a building with regard to escape in the case of fire are as follows:

- construction of building (layout and materials)
- time needed for the complete evacuation of the building
- type of occupancy
- number and location of exits
- travel distances to the exits
- management control

Answer 11 Emergency lighting may be classed as 'maintained' (in operation at all times), 'non-maintained' which is triggered when the normal lighting fails and 'stand-by lighting' which provides a full replacement system in areas such as an operating theatre or a control process control centre. Emergency lighting has three functions:

- indicate escape routes
- provide sufficient illumination along such routes to permit safe escape in case of fire
- ensure that fire alarms and fire fighting equipment situated along the escape route can be readily located

Answer 12 Fire safety legislation can broadly be divided into two categories:

- design and construction of all new buildings - architects and designers will tell you that meeting the requirements of fire legislation drives and directs the development of a new building
- the safe management of existing buildings and structures

A reminder that it is this second category with which we are concerned in the NEBOSH Certificate.

Answer 13 The main escape requirements of The Regulatory Reform (Fire Safety) Order 2005 include:

- exit routes should be marked with running man pictograms with the appropriate direction arrows; pictograms should be placed at regular intervals and at all junctions; avoidance of dead ends
- external escape door(s) must be marked as appropriate
- alarm points and extinguishers / hoses should be clearly marked
- extinguishers and fire hoses should be easily accessible but not located so that they might present an obstruction during daily work activities
- extinguishers should be positioned at regular intervals with a view to protect escape routes and to 'target' areas with particular hazards
- fire resistant materials should be used for fire doors which should have positive self-closing actions and should push open in the direction of escape
- external escape doors should never be locked when the building is occupied
- escape routes must be kept free of obstructions
- appropriate training and fire drills must be provided by management who must ensure that fire exits are kept clear and that fire equipment is maintained



Answer 14 A fire notice should encompass the information shown here:

Answer 15 Measures to reduce the risk of dust explosions include:

- good housekeeping
- engineering control by use of exhaust ventilation to gather up and dispose of excess dust
- control of electrostatic sources by the use of earthing and so on

Answer 16 The key to the prevention of liquid fires is to control the formation of vapour:

- contain the liquid so that vapour does not escape during storage
- handle the liquid so that spillages are contained and disposed of appropriately
- provide ventilation so that any vapour which is created is dispersed
- control ignition sources - static electricity, electrical equipment, cigarettes, naked flames
- treat 'empty' containers as if they were full
- keep 'immediate use' supplies in small quantities in metal cupboards
- keep bulk stocks in fire-resisting stores

Answer 17 Prevention of fires involving flammable gases such as oxygen and acetylene:

- the preferred option is to site gas cylinders outside the building and to pipe the gas through fixed pipework to where it is needed; where this is not possible, for example with mobile welding sets, it will be necessary to take the gas cylinders to the place required and protect them by chaining in racks or trolleys
- operators must be trained in the correct use of flammable gases: changing cylinders, checking valves and connectors, testing for leaks, working procedures
- ensuring good ventilation
- storage of full and empty cylinders (preferably in secure, well-ventilated stores in outside buildings, never below ground level or next to drains and similar)

Answer 18 V ... I ... C ... E ... S ... (as used in the HSE leaflet INDG 227) encompasses general good practice for working safely with flammable substances:

- ventilation
- ignition
- containment
- exchange
- separation

You should have been able to write a sentence or two under each of these - if in doubt, turn back to your copy of the leaflet.

Fire officer Room Phone number
Deputy Room Phone number

FIRE ACTION

Raise the alarm

By operating the nearest breakglass fire alarm call point

Do not be afraid to shout "FIRE"

Warn others

CALL FIRE BRIGADE

In the day phone

At night

ON HEARING THE ALARM

If time permits, put important documents in a steel cabinet

Leave via the nearest fire exit

Do not use lifts

YOUR ASSEMBLY POINT IS

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Do not stop to collect personal belongings

If you feel it is safe to do so, attack fire with available equipment

Do not re-enter building until told it is safe by the fire brigade