



Unit C: Workplace and work equipment

THURSDAY 26 JANUARY 2012
3 hours, 0930 to 1230

10 minutes reading time is allowed before the start of this examination. You may not write anything during this period.

Answer both Section A and Section B

SECTION A

This section contains six questions. Answer **ALL SIX** questions.

All questions carry equal marks.

The maximum marks for each question, or part of a question, are shown in brackets.

You are advised to spend about **15 minutes** on each question.

Start each answer on a new page.

- 1** **Outline** factors to be considered when developing a planned preventive maintenance programme for safety-critical machinery. **(10)**
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- 2** A manually operated lathe is to be fitted with a Computer Numeric Control (CNC) system.
- Outline:**
- (a) additional hazards this may introduce; **(4)**
- (b) measures required to minimise the risks associated with these hazards. **(6)**
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- 3** A diesel engine is being used to power a machine in a potentially flammable atmosphere.
- (a) **Identify** sources of ignition associated with the diesel engine. **(4)**
- (b) **Outline** the protection that should be applied to the diesel engine to minimise the risk of an explosion. **(6)**

- 4 (a) **Outline** the principles of a boiling liquid expanding vapour explosion (BLEVE) **AND give** examples of actual incidents to support your answer. (8)
- (b) **Outline** the effects of a BLEVE. (2)
- 5 **Outline** the characteristic features of, and factors that promote, the following types of materials failure:
- (a) brittle fracture; (5)
- (b) ductile failure. (5)
- 6 A company intends to build a flammable solvent distribution facility as part of its chemical manufacturing premises. The facility will include three 40,000 litre storage tanks that are pump filled via pipelines from batch reactors. The storage tanks supply an outdoor road tanker filling system as well as a small container filling facility located inside a warehouse.
- Outline** the design features that should be adopted to prevent or minimise leakage and spills from the proposed installation. (10)

SECTION B

This section contains five questions. Answer **THREE** questions only.

All questions carry equal marks.

The maximum marks for each question, or part of a question, are shown in brackets.

You are advised to spend about **30 minutes** on each question.

Start each answer on a new page.

- 7 A three-storey building is situated with one side fronting on to a pedestrian walkway. The building is to undergo extensive maintenance to the external fabric which includes a sloping roof.
- Outline:**
- (a) the health and safety issues of the work that will need to be considered before work starts; (11)
- (b) the features of a scaffold designed to provide a safe place of work for working at height during the maintenance activity. (9)

- 8 Construction work is to take place in a rural area where electrical power for the site is to be gained from an existing 11kV overhead supply that cuts across the site on wooden poles.

Outline control measures that should be taken to reduce risks associated with the:

- (a) overhead supply; (8)
- (b) provision and use of electricity on the site. (12)

- 9 An insulated chemical reactor vessel has become coated internally with a sticky by-product of a chemical reaction which is interfering with the efficiency of the process. It is decided that the reactor must be cleaned of the material. The substance in question becomes liquid and mobile at 60°C. However, it decomposes exothermically at 95°C reacting with the oxygen content of air. The vessel which was an 8m long cylinder of 2m diameter, was laid on its side, adjacent to its usual plant location to facilitate entry for cleaning via a hatchway in the base. As warm water proved to be a very slow cleaning medium it was decided to use steam cleaning delivered by hand-held lances and rake out the softened material with metal rakes. Shortly after commencing the steam cleaning the operatives involved heard a rumbling and noticed a blue flame on the surface of the reactor wall. They evacuated the vessel and had just done so when a jet of flame was emitted from the hatchway which travelled 30m to the wall of the company office building and continued playing on it for 2 minutes. The resultant fire in the office building caused multiple fatalities.

- (a) **Describe** the nature of the combustion reaction involved in generating the incident. (5)
- (b) **Outline** the *technical* and *operational* failings that could account for the conditions which led to the incident and the resultant fatalities. (8)
- (c) **Outline** the controls necessary in such installations to prevent repetition in similar circumstances. (7)

- 10 A factory manufactures upholstery using fabrics, and plastic pellets. These raw materials are delivered to a warehouse. The fabrics and plastic pellets are machined to form furniture coverings and cushions. The finished product is then stored in a despatch warehouse prior to distribution. The movement of goods around the premises is carried out by Liquid Petroleum Gas (LPG) fuelled forklift trucks. The company is located on the outskirts of a small town and employs 230 people.

Outline the range of factors that must be addressed to ensure a suitable and sufficient fire risk assessment is made for the premises. (20)

- 11 (a) **Outline** the duties of designers under the Construction (Design and Management) Regulations 2007 (CDM 2007). (6)
- (b) **Outline** examples of the ways in which designers can affect the health and safety performance of a construction project. (4)
- (c) A contractor is to be engaged to demolish a disused factory.
- Outline** examples of the information that the client should provide to the tendering contractors to fulfil their duty under CDM 2007. (10)