

# EXAMINATION PAPER

Mechanical engineer 2020

## Mechanical engineer coal mines other than underground mines certificate of competence

### CME3 – Safety and mining legislation applicable to surface coal mines

Written examination held 24 September 2020

#### Instructions to candidates

Unless otherwise stated all references to the Act, Regulations and Standards are to the:

- *Work Health and Safety Act 2011*
- Work Health and Safety Regulation 2017
- *Work Health and Safety (Mines and Petroleum Sites) Act 2013*
- Work Health and Safety (Mines and Petroleum Sites) Regulation 2014

It is expected that candidates will present their answers in an engineering manner, making full use of diagrams, tables, and relevant schematics where applicable, and showing full workings in calculations. Consideration will be given when marking for **legibility in diagrams and handwriting**.

Provide answers in point form wherever appropriate. If you are unable to fit your answers in the available space use the three (3) blank pages included at the end of the paper. Ensure the question you are answering is clearly marked.

Electronic aids may not be used, apart from a non-programmable calculator.

**All six (6) questions are to be attempted.**

All questions are of equal value, but parts of questions may vary in value. The marks applicable to each part of a question will be indicated adjacent to the question.

This examination is a **closed book** examination – that is you cannot bring any reference material into the exam, such as copies of legislation. Reference material will be provided in the exam paper as applicable.

## Question 1

### Work Health and Safety Regulation 2017

(Total 50 marks)

#### Part A – Chapter 4, Part 4.4 Falls

##### *Clause 78 Management of risk of fall*

*(1) A person conducting a business or undertaking at a workplace must manage, in accordance with Part 3.1, risks to health and safety associated with a fall by a person from one level to another that is reasonably likely to cause injury to the person or any other person.*

*Note. WHS Act—section 19 (see clause 9).*

1. In practical terms name three (3) types of fall events identified in 78 (2)? (9 marks)

##### *Clause 78 (3)*

*A person conducting a business or undertaking must ensure, so far as is reasonably practicable, that any work that involves the risk of a fall to which subclause (1) applies is carried out on the ground or on a solid construction.*

2. In terms of Clause 78 (5) “on a solid construction” is an area that has what physical properties? Name three (3). (9 marks)

##### *Clause 79 Specific requirements to minimise risk of fall*

*(3) The person provides adequate protection against the risk if the person provides and maintains a safe system of work, including by:*

- (a) providing a fall prevention device if it is reasonably practicable to do so, or*
- (b) if it is not reasonably practicable to provide a fall prevention device, providing a work positioning system, or*
- (c) if it is not reasonably practicable to comply with either paragraph (a) or (b), providing a fall arrest system, so far as is reasonably practicable.*

*Examples.*

- (1) Providing temporary work platforms.*
- (2) Providing training in relation to the risks involved in working at the workplace.*
- (3) Providing safe work procedures, safe sequencing of work, safe use of ladders, permit systems and appropriate signs.*

*Note. A combination of the controls set out in this subclause may be used to minimise risks, so far as is practicable, if a single control is not sufficient for the purpose.*

3. In practical terms what type of “fall prevention device” would be included in Clause 79 (5)? Name three (3). (9 marks)

##### *Clause 80 Emergency and rescue procedures*

*(1) This clause applies if a person conducting a business or undertaking provides a fall arrest system as a control measure.*

4. What must be provided if 80 (1) is applicable? (9 marks)
5. In practical terms in relation to Clause 80 (5), “relevant worker” means what two types of work scenarios? (6 marks)

**Part B – Chapter 4, Part 4.1 Noise**

1. From Clause 56 Meaning of “exposure standard for noise”, identify both the nominated exposure standards? (4 marks)
2. How are you going to determine the level of noise being emitted by the plant when it is in use? (4 marks)

## Question 2

**Mechanical Engineering Control Plan (MECP)**

**(Total 50 marks)**

**Part A – WHS(MPS) Regulations clause 26**

1. With reference to WHS(MPS) Regulations Clause 26 describe in your own words what is a mechanical engineering control plan? (3 marks)
2. In your own words describe the function of the MECP? (6 marks)
3. Who has duties in relation to the MECP according to clause 26 (4)? (3 marks)

**Part B – WHS(MPS) Regulations Schedule 2 Clause 2 Mechanical Engineering Control Plan**

1. In subclause (1) the operator of a mine or petroleum site must, in preparing a mechanical engineering control plan, take what into account? (14 marks)
2. In subclause (2) a mechanical engineering control plan must set out the control measures for the following risks to health and safety associated with the mechanical aspects of plant and structures at the mine or petroleum site taking into account the matters set out in subclause (3). In your own words list all seven (7). (14 marks)
3. In subclause (4) matters must be taken into account when developing a control measure referred to in subclause (2) in respect of a belt conveyor. In your own words list all five (5) (10 marks)

## Question 3

**Fill in the blanks, 2 marks each**

**(Total 50 marks)**

1. Work Health and Safety Regulation Clause 37 Maintenance of control measures (12 marks)  
A duty holder who implements a control measure to \_\_\_\_\_ or minimise risks to health and safety must ensure that the control measure is, and is \_\_\_\_\_ so that it remains, \_\_\_\_\_, including by ensuring that the control measure is and remains:  
a) \_\_\_\_\_, and

- b) Suitable for the \_\_\_\_\_ of the work, and  
 c) Installed, \_\_\_\_\_ correctly

2. WHS(MPS) Regulation Clause 128 Duty to notify the Regulator of certain incidents (24 marks)

- (1) The operator of a mine or petroleum site must take all reasonable steps to ensure that the regulator is notified in accordance with this clause after becoming aware of an incident (other than a notifiable incident) arising out of the carrying out of mining operations or petroleum operations at the mine or petroleum site, but only if the incident:
- results in illness or injury that requires \_\_\_\_\_ within the meaning of clause 13 of Schedule 9, or
  - is a high potential incident.
- (2) The notification must also be made to an \_\_\_\_\_ in the case of an incident at a coal mine.
- (5) In this clause high potential incident means any of the following:
- an event referred to in clause 179(a) that would have been a \_\_\_\_\_ if a person were reasonably in the vicinity at the time when the incident or event occurred and in usual circumstances a person could have been in that vicinity at that time,
  - the detection of a concentration of methane in the general body of the air at an underground coal mine (other than in a sealed area or goaf) that is greater than 2% by volume,
  - an unplanned fall of ground, roof or sides that impedes passage, extends beyond the bolted zone or disrupts production or ventilation,
  - a failure of ground support where persons could potentially have been present,
  - the burial of machinery such that it \_\_\_\_\_
  - progressive pillar failure or creep,
  - a sudden pillar collapse,
  - an electric arc occurring in the hazardous zone at an underground coal mine that is directly observed or that leaves visible evidence on an electric cable,
  - the failure of the explosion protected characteristics of explosion protected plant while that plant is in service at an underground coal mine,
  - a misfire or unplanned explosion of an explosive or explosive precursor (but not in the case of a misfire at a mine or petroleum site other than a coal mine if the misfired explosive can be fired without any significant risk to a person),
  - an unplanned event that \_\_\_\_\_ of more than one person from the mine or petroleum site or part of the mine or petroleum site,
  - an unplanned event that causes less than 2 exits from an underground mine to be available for use,

- (m) any indication from monitoring data of the development of subsidence which may result in damage to any plant or structure or a failure of ground,
- (n) an injury to a person (supported by a medical certificate) that results in or is likely to result in the person being unfit,  
\_\_\_\_\_, to perform the person's usual activities at the person's place of work,
- (o) the illness of a person (supported by a medical certificate) that is related to a work process and that results in or is likely to result in the person being unfit,  
\_\_\_\_\_, to perform the person's usual activities at the person's place of work,
- (p) the presence of energised electrical plant that is not explosion protected in a hazardous zone at an underground coal mine (except where the use of the plant is permitted under clause 79),
- (q) the detection of \_\_\_\_\_ that exceeds the level specified in clause 39(1)(a),
- (r) the detection of \_\_\_\_\_ that exceeds the exposure standard specified in the Workplace Exposure Standards for Airborne Contaminants,
- (s) electrical plant that is powered by an internal battery is lost or misplaced in an underground coal mine,
- (t) an \_\_\_\_\_ on mobile plant that is in operation (whether operated directly, remotely or autonomously),
- (u) a \_\_\_\_\_ of heavy earthmoving machinery that is operated remotely or autonomously, including any failure of braking or steering,
- (v) \_\_\_\_\_ occurring at the surface of a coal mine (including an underground coal mine).

3. WHS(MPS) Regulation Clause 178 Serious injury or illness (14 marks)

For the purposes of section 14(b) of the WHS (Mines and Petroleum Sites) Act, each of the following is prescribed as a serious injury or illness of a person:

- (a) an injury or illness requiring the person to \_\_\_\_\_ as an in-patient in a hospital,
- (b) an injury or illness requiring the person to have immediate treatment for any of the following:
  - (i) the \_\_\_\_\_ of his or her body,
  - (ii) a \_\_\_\_\_ injury,
  - (iii) a \_\_\_\_\_ injury,
  - (iv) a serious burn,

- (v) the separation of his or her skin from an underlying tissue (such as degloving or scalping),
- (vi) a \_\_\_\_\_ injury,
- (vii) the loss of \_\_\_\_\_,
- (viii) serious lacerations,

(c) an injury or illness requiring the person to have medical treatment within 48 hours of \_\_\_\_\_,

(d) a fracture to a person's bone other than a bone in the person's hand (including a finger) or foot (including a toe),

(e) a condition prescribed as a serious illness for the purposes of section 36 of the WHS Act.

## MECHANICAL

### Question 4

(50 marks)

**Part A** – Conveyor components. Draw a pictorial schematic for the following items:

- i. Pictorial schematic including belt reeving for a clean side clean side conveyor drive head, and denoting which are drive pulleys (7 marks)
- ii. Pictorial schematic including belt reeving of a clean side dirty side conveyor tripper drive head, and denoting which are drive pulleys (7 marks)
- iii. Pictorial schematic including belt reeving of a four (4) fall belt storage unit with a gravity tower and winch to set counterweight position (9 marks)

**Part B** – Conveyor system design

1. List three (3) methods you can use in situ to increase the belt speed of a conveyor (9 marks)
2. List three (3) ways you can increase the tonnage capacity of a conveyor in situ? (9 marks)
3. You want to increase the power input to a conveyor already installed at the mine conveyor. List three (3) alternative methods to minimise the potential for belt slip? (9 marks)

### Question 5

You have recently been employed as the Mechanical Engineer at a coal mine that has been closed for five (5) years, and will recommence operations in three (3) months. The mine has a 1000 tonne capacity clean coal bin, which is in excess of 20 years old. All design documentation, as well as any maintenance history, of the bin has been lost. The bin is configured to discharge coal into road registered semi-trailer style trucks through pneumatically operated clamshell doors.

You have been asked to manage the recommissioning of the bin into service.

1. What steps would you take to manage the re-commissioning, and the ongoing maintenance of the bin? List fifteen (15) items you would consider. (15 marks)
2. List five (5) major risks associated with the operation and maintenance of bins? (15 marks)

3. Describe two (2) primary control measure for each of the five (5) major risks identified above?  
(20 marks)

## Question 6

(50 marks)

Part of the Mechanical Engineer's role, at your surface coal operation, is to review and sign off the Safe Work Procedures (SWP) developed by the maintenance teams. The development of the SWP's are based on a risk assessment process carried out for the particular task.

You have been requested to review and sign off the SWP recently developed by your maintenance team for the replacement of hoist ropes on the dragline.

In the table provided, identify what are the primary steps in the task, the main hazards you would expect to be addressed in each step of the procedure, and what principal and critical controls would you expect to see to manage these hazards?

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