Regional NSW

CME3 – Safety and mining legislation for open-cut mines

CANDIDATE NUMBER: _____ **(write in from your letter)**

MECHANICAL ENGINEER OF COAL MINES OTHER THAN UNDERGROUND MINES EXAMINATION FOR CERTIFICATE OF COMPETENCE

Issued under the *Work Health and Safety (Mines and Petroleum Sites) Regulation 2022*

Unless otherwise stated all references to Act and Regulations 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 2022

This Examination is held in the following location:

Region: New South Wales	**Venue:** Tocal College	**Room:** McFarlane Court
Date: 31 July 2024	**Start time:** 13:00:00	**Finish time:** 15:40:00

INSTRUCTIONS TO CANDIDATES:

10 minutes reading time is allowed prior to the start of the examination.

It is expected that candidates will present their answers in an engineering manner, making full use of diagrams, tables, and schematics as appropriate, and showing full workings in calculations. **Poor legibility in diagrams and handwriting** may affect the candidate being deemed competent.

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.

All ten (10) questions are to be attempted. All questions are of equal value.

Candidates will be marked, and determined as competent, or not yet competent. If a question is identified as **ESSENTIAL** then then the candidate must be deemed competent in that question in order to be deemed competent in the exam. If a part of a question is identified as **ESSENTIAL** then the candidate must be deemed competent in that part in order to be deemed competent in that question and the marks for that question to be counted.

This examination is a **closed book** examination and no reference material may be used during the exam. Reference material will be provided in the exam paper as applicable.

EXAMINATION BOOKLET

Question Number		Essential	Competent / not yet competent	Mark	Assessed by *Name*	Comments to justify, as necessary
1	A	Essential				
	B	Essential				
	C	Essential				
	total			/ 25		
2	A					
	B					
	C					
	total			/ 25		
3	A					
	B					
	C					
	D					
	E					
	F					
	total			/ 25		
4	A					
	B					
	C					
	D					
	total			/ 25		
5	A					
	B					
	C					
	D					
	E					

Question Number		Essential	Competent / not yet competent	Mark	Assessed by *Name*	Comments to justify, as necessary
	F					
	total			/ 25		
6	A					
	B					
	C					
	D					
	E					
	total			/ 25		
7	A					
	B					
	C					
	D					
	E					
	total			/ 25		
8	A					
	B					
	C					
	D					
	E					
	total			/ 25		
9	A					
	B					
	C					
	D					
	total			/ 25		
10	A					
	B					

Question Number		Essential	Competent / not yet competent	Mark	Assessed by *Name*	Comments to justify, as necessary
	C					
	D					
	E					
	F					
	total			/ 25		
PAPER	Verdict		TOTAL	/ 250		*Marks checked by:*

If marking is reviewed under approved processes, then examiner is to record details:

Date	Examiner	Questions reviewed	Marks changed	Details/justification, as necessary
Eg. 2/8/19	Andrew Palmer	All	Q1 – 4 (previously 5)	Found one more criteria

Question 1 – Role of Mechanical Engineer and MECP **Essential**

The candidate must be assessed as competent for this question, both Part A and Part B, in order to be considered as being competent for the entire exam.

Part A - The role of the Mechanical Engineer

A. Fill in the blanks in the extract of legislation below regarding the role of the Mechanical Engineer.

9 marks

Work Health and Safety (Mines and Petroleum Sites) Regulation

Schedule 10 Part 2 Underground coal mines

21 Mechanical engineer

(1) The statutory functions of mechanical engineer are—

(a) to _____ and _____ the standards, mechanical engineering practice and procedures for the life cycle of mechanical plant and installations at the mine, and

(b) to supervise the _____ , _____ , _____ and _____ of mechanical plant at the mine.

(2) The requirement for nomination to exercise the statutory functions is that the individual nominated must—

(a) hold a _____ (coal mines other than underground coal mines) or _____ (underground coal mines) that is in force, or

(b) have evidence of compliance with Australian Engineering Competency Standards Stage 2 for mining operations at a mine and be _____

_____

/ 9

Part B – Mechanical Engineering Control Plan

Work Health and Safety (Mines and Petroleum Sites) Regulation

30 Principal control plans

(1) The operator of a mine or petroleum site must comply with the requirements for principal control plans specified in this section and Schedule 2.

(2) A principal control plan must—

(a) be documented, and

(b) as far as reasonably practicable, be set out and expressed in a way that is readily understandable by persons who use it.

(3) The operator of a mine or petroleum site must prepare a health control plan for the mine or petroleum site that sets out the means by which the operator will manage the risks to health associated with mining operations or petroleum operations at the mine or petroleum site in accordance with section 14.

(4) The operator of a mine or petroleum site at which there is a risk to health and safety associated with the mechanical aspects of plant and structures at the mine or petroleum site must—

B. With regard to section 30 (4) what must the operator ensure? 8 marks

	/ 8

Work Health and Safety (Mines and Petroleum Sites) Regulation

Schedule 2 Principal control plans

2 Mechanical engineering control plan

(4) The following matters must be taken into account when developing a control measure referred to in subsection (2) for a belt conveyor—

C. WHS(MPS)R Schedule 2 (2) (4) refers to matters that must be taken into account when developing control measures for belt conveyors. Identify all five (5). 8 marks

	/ 8

Question 2 – WHS Act – Primary duty of care

Work Health and Safety Act

19 Primary duty of care

(1) A person conducting a business or undertaking must ensure, so far as is reasonably practicable, the health and safety of--

(a) workers engaged, or caused to be engaged by the person, and

(b) workers whose activities in carrying out work are influenced or directed by the person,

(2) while the workers are at work in the business or undertaking.

(3) A person conducting a business or undertaking must ensure, so far as is reasonably practicable, that the health and safety of other persons is not put at risk from work carried out as part of the conduct of the business or undertaking.

(4) Without limiting subsections (1) and (2), a person conducting a business or undertaking must ensure, so far as is reasonably practicable--

A. With respect to Section 19 (3) the mine operator as PCBU, as well as any other PCBUs at a mine, have a primary duty of care to ensure, so far as is reasonably practicable, that workers and other people are not exposed to health and safety risks arising from the business or undertaking. This duty in relation to the mechanical aspects of plant and structures includes ensuring what, so far as is reasonably practicable? 13 marks

	/ 13

B. You are reviewing the Mechanical Engineering Control Plan (MECP) for your mine. List six (6) subordinate systems or Standards of Engineering Practice (SEP) you plan to have in place that specifically address the requirements of WHS Act Section 19 (3) (b) **over the lifecycle of plant and structures?** 6 marks

	/ 6

C. The safety management system requires a hierarchal structure of documents to effectively manage hazards at mines. List six (6) tiers of mechanical documents from highest to lowest that you will use to manage WHS Act Section 19 (3) (c) **with respect to mechanical plant and structures** 6 marks

	/ 6

Question 3 – Airborne contaminants

Work Health and Safety Regulation 2017
Division 7 Managing risks from airborne contaminants

49 Ensuring exposure standards for substances and mixtures not exceeded

A person conducting a business or undertaking at a workplace must ensure that no person at the workplace is exposed to a substance or mixture in an airborne concentration that exceeds the exposure standard for the substance or mixture.

50 Monitoring airborne contaminant levels

(1) A person conducting a business or undertaking at a workplace must ensure that air monitoring is carried out to determine the airborne concentration of a substance or mixture at the workplace to which an exposure standard applies if—
   a) the person is not certain on reasonable grounds whether or not the airborne concentration of the substance or mixture at the workplace exceeds the relevant exposure standard, or
   b) monitoring is necessary to determine whether there is a risk to health.

(2) A person conducting a business or undertaking at a workplace must ensure that the results of air monitoring carried out under subclause (1) are recorded, and kept for 30 years after the date the record is made.

(3) A person conducting a business or undertaking at a workplace must ensure that the results of air monitoring carried out under subclause (1) are readily accessible to persons at the workplace who may be exposed to the substance or mixture.

Part A - General

A. Provide descriptions for the following key terms associated with exposure standards. 4 marks
   i. Airborne contaminant
   ii. Breathing zone

	/ 4

Part B – Welding fumes

B. The Welding Fume Exposure Standard in Australia was lowered in September 2023 by SafeWork Australia. What is the current welding fume exposure standard limit? 1 mark

	/ 1

You are the Mechanical Engineer at a coal mine and have a number of welding tradespeople working in maintenance at your operation. Welding and fabrication work occurs in your maintenance workshop along with other maintenance and servicing work.

C. With the advent of the new reduced welding fume exposure standards, what controls will you put in place to protect your workforce? List five (5). 5 marks

	/ 5

Part C – Airborne dust

The NSW Health and Safety legislation defines airborne dust to include both respirable dust and inhalable dust. Long-term exposure to many dusts, including respirable coal dust and respirable crystalline silica, can cause disabling lung diseases.

D. Describe the properties of the following types of dust found in coal mining, and what their workplace exposure standard limits are. 6 marks

   i. Inhalable dust
   ii. Respirable dust
   iii. Crystalline silica respirable dust

/ 6

E. Name two (2) respiratory lung diseases caused from inhalation of respirable dust in mining and explain why these diseases are so damaging and may not be easily reversible. 2 marks

/ 2

F. What systems and controls can you implement to ensure that your “field servicing” crew remains safe from dust diseases whilst they carry out their servicing, especially on ground engaging equipment such as drill rigs and excavators? Identify seven (7) appropriate systems and / or controls. 7 marks

	/ 7

Question 4 – Falling objects

Work Health and Safety Regulation 2017
Division 10 Falling objects

54 Management of risk of falling objects

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 an object falling on a person if the falling object is reasonably likely to injure the person.

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

55 Minimising risk associated with falling objects

(1) This clause applies if it is not reasonably practicable to eliminate the risk referred to in clause 54.

(2) The person conducting the business or undertaking at a workplace must minimise the risk of an object falling on a person by providing adequate protection against the risk in accordance with this clause.

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

A. With reference to WHS Regulation Clause 55 (3) (a) and (b) what must be included in the safe system of work? 4 marks

	/ 4

B. WHS Regulation Clause 36 Hierarchy of controls identifies the duty holders requirements if risks can not be eliminated. What are these preventative requirements? 4 marks

	/ 4

C. Identify eight (8) items of infrastructure (plant or structure) on a mine site where it is reasonable to consider there is a risk of falling objects potentially injuring personnel. 8 marks

	/ 8

D. For each of three (3) items of infrastructure you have identified above describe three (3) controls you would implement to minimise the risk of falling objects. You **CAN NOT** use the same control more than once. 9 marks

	/ 9

Question 5 – Entanglement

Recent significant incidents resulting in permanently disabling injuries have highlighted the hazard of entanglement. One of the primary elements of the Mines Safety Management System to detail the preventative and mitigative strategies is the Mechanical Engineering Control Plan.

A. WHS Regulation 2017 Division 2 Duties of persons conducting business or undertakings that design plant, Clause 189 Guarding identifies specific requirements. Fill in the missing words.

11 marks

189 Guarding

1) This clause applies if a designer of plant uses guarding as a control measure.
2) The designer must ensure, so far as is reasonably practicable, that the guarding designed for

that purpose will _____ to the danger point or danger area of the plant.
3) The designer must ensure that—
   (a) if access to the area of the plant requiring guarding is not necessary during operation,

   maintenance or cleaning of the plant—the guarding is a _____ physical barrier, or
   (b) if access to the area of the plant requiring guarding is necessary during operation,

   maintenance or cleaning of the plant—the guarding is an _____ physical barrier that allows access to the area being guarded at times when that area does not present a risk and prevents access to that area at any other time, or
   (c) if it is not reasonably practicable to use guarding referred to in paragraph (a) or (b)—the guarding used is a physical barrier that can only be altered or removed by the

   _____, or
   (d) if it is not reasonably practicable to use guarding referred to in paragraph (a), (b) or (c)—

   the design includes a _____ safeguarding system that eliminates any risk arising from the area of the plant requiring guarding while a person or any part of a person is in the area being guarded.
4) The designer must ensure that the guarding is designed—

   (a) to be of_____ and _____ so as to resist impact or shock, and

   (b) to make _____ or_____ of the guarding, whether deliberately or by accident, as difficult as is reasonably practicable, and

   (c) so as not to cause a _____ in itself.
5) If the plant to be guarded contains moving parts and those parts may break or cause workpieces to be ejected from the plant, the designer must ensure, so far as is reasonably practicable, that the guarding will control any risk from those broken or ejected parts and workpieces.
6) Despite anything to the contrary in this clause, the designer must ensure—
   (a) that the guarding is of a kind that can be removed to allow maintenance and cleaning of the plant at any time that the plant is not in normal operation, and
   (b) if the guarding is removed, that, so far as is reasonably practicable, the plant cannot be

   _____ unless the guarding is replaced.

/ 11

B. Identify four (4) key controls for the management of entanglement. 4 marks

	/ 4

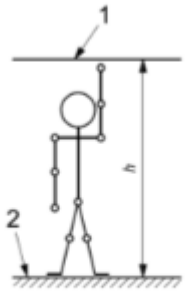


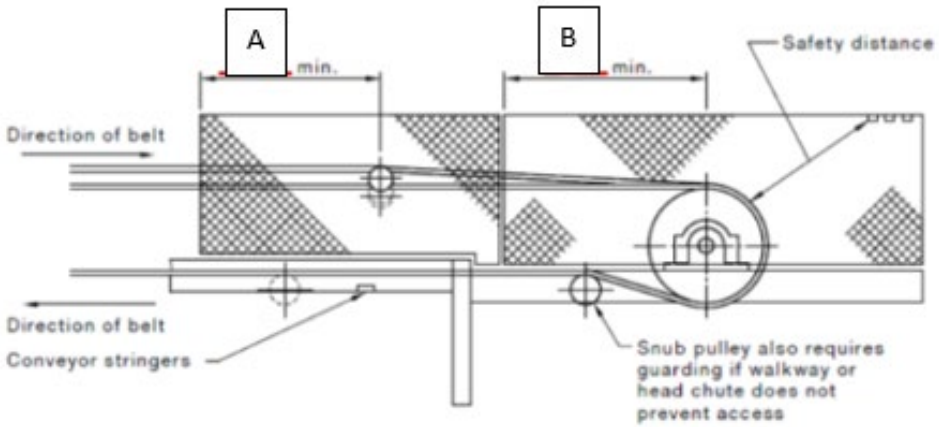
Figure 1 - Reaching Upwards (Machinery)

C. What is the minimum height (figure 1 – h above) to prevent access to a high risk hazard zone above an accessible area? 1 mark

	/ 1

The AS4024 series of Australian Standards cover safeguarding of machinery.

D. When considering conveyor boot ends what are dimensions A and B in the diagram below? 2 marks

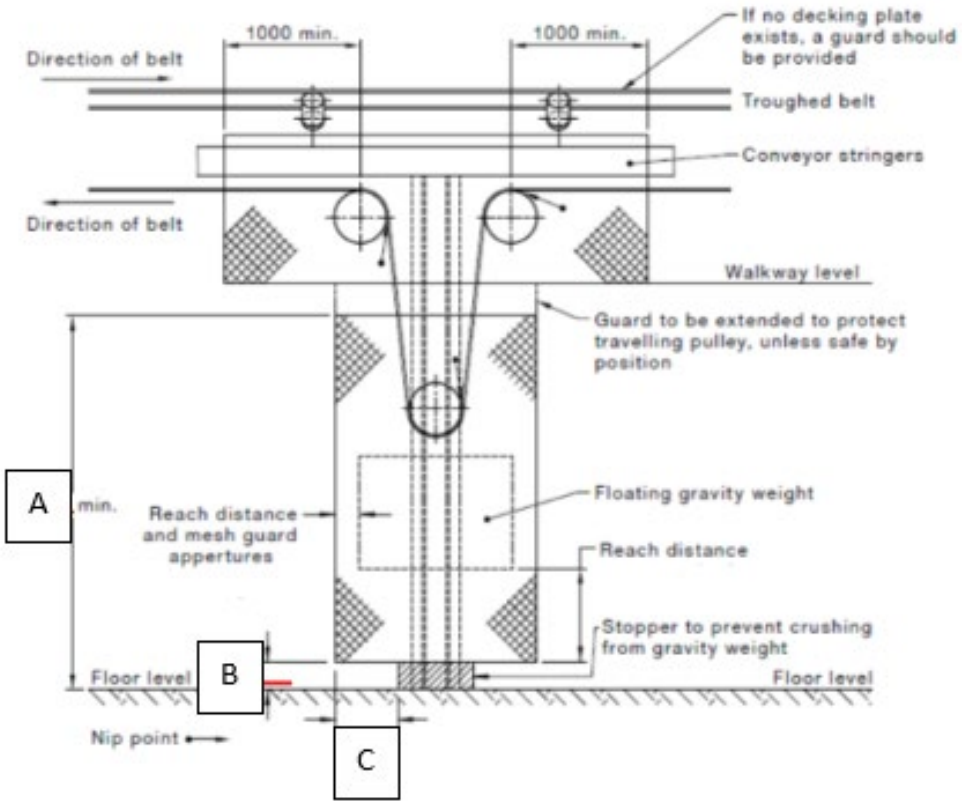


A = _____

B = _____

/ 2

E. When considering conveyor vertical loop take ups what are dimensions A, B and C in the diagram below? 3 marks



A = _____

B = _____

C = _____

/ 3

F. Polymer guards are increasingly used across the mining industry. In terms of hazards associated with poly guards describe two (2) hazards their use can reduce (Pros), and two (2) hazards their use can introduce (Cons). 4 marks

i. Pros

ii. Cons

/ 4

Question 6 – Fire suppression

You are the Statutory Mechanical Engineer at a Coal Mine and have just been advised a fire has occurred in the engine bay of a Cat D10T dozer on the edge of the stockpile. The operator has called the emergency, then tried to activate the fire suppression system (FSS), but the activator valve and panel cover have separated from the mounting bracket when trying to withdraw the safety pin.

It was a very similar type of incident to that identified in NSW Resources Regulator Safety Alert SA22-06 Operator unable to activate fire suppression system during emergency, as shown below, and your mine's dozer driver has ended up exiting the cab through the right hand side with flames licking through the deck plate, and has been forced to jump the three (3) metres to the stockpile below. Both bones in the dozer drivers left lower leg have broken in the fall.
The site emergency response team have extinguished the fire, and the dozer driver has been taken by ambulance to hospital.

Resources Regulator
Department of Regional NSW

NSW GOVERNMENT

Safety Alert

Date: October 22

Operator unable to activate fire suppression system during emergency

This safety alert provides safety advice for the NSW mining industry.

Issue

When a fire occurred on a dozer, the operator tried to activate the fire suppression system when the panel cover separated from the mounting bracket, forcing the operator to abandon the plant.

Figure 1 - Actuator panel separated from the mounting bracket

Circumstances

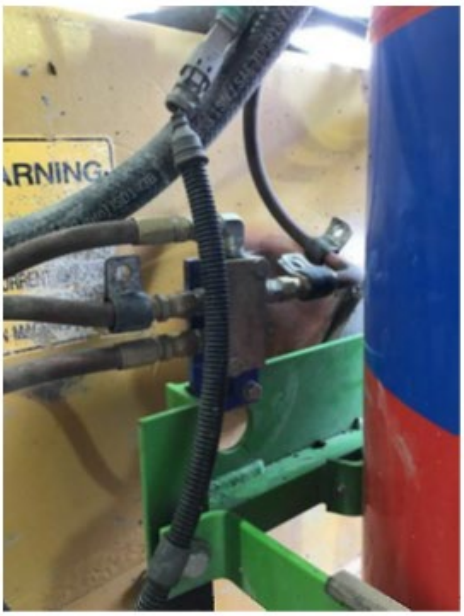
A Caterpillar D10T bulldozer was operating at an open cut coal mine when a fire occurred in the engine bay. The operator saw smoke and flames and tried to activate the fire suppression system, but the valve and panel cover separated from the mounting bracket when trying to withdraw the safety pin.

Not knowing if the system could still be activated, the operator reversed a short distance, lowered the access ladder and pressed the red emergency button. With flames licking up through gaps around the deck plate, the operator exited the cabin via the left-hand door and jumped from the deck about 3 metres to the ground. The operator was not injured and went to the rear of the machine to shut down the engine down. The fire suppression system then activated automatically.

A. Identify four (4) potential clauses / descriptions you will consider notifying the Regulator under.
4 marks

	/ 4

Refer to the additional photos of the FSS below to assist with your the following two questions.



B. Consider the fire suppression system identified in SA22-06. Describe the suppressant type and activation method. 2 marks

	/ 2

C. For the system in SA22-06 above describe in detail the operational functionality of the Fire Suppression System (FSS) as fitted and when operated. Basically, how is it designed to work? 5 marks

	/ 5

There are a number of types of fire suppression system available to the mining industry.

D. Describe in detail the functionality of two (2) other types of mobile equipment Fire Suppression Systems (FSS's). 8 marks

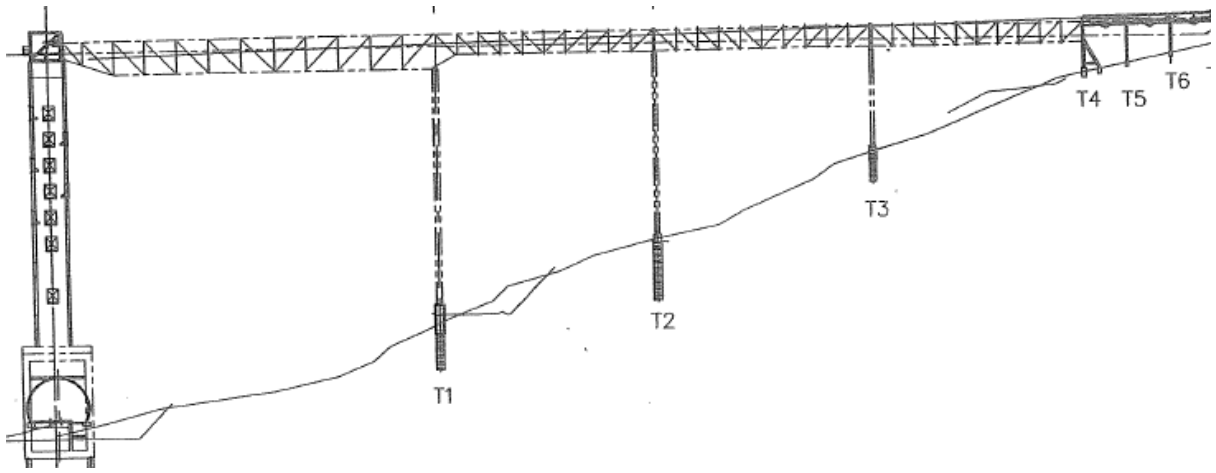
	/ 8

E. Describe the advantages and disadvantages of three (3) readily available mobile equipment Fire Suppression Systems currently available in the mining industry. 6 marks

	/ 6

Question 7 – Conveyor gantry structural integrity

You are the Mechanical Engineer of a coal mine that has an elevated gantry conveyor extending from the side of a hill, and feeding coal into a Rill tower in the centre of a coal stockpile. The maintenance Shift Engineer notifies you that a land slip has occurred at the base of the 40 metre high T2 trestle leg partially exposing the foundations. Your vessel has just docked at the wharf and coal production is required to complete the cargo. You have been advised production cannot be stopped.



A. What investigations do you undertake to ensure the short term structural integrity of the conveyor gantry assembly? Describe five (5). 10 marks

	/ 10

B. Identify three (3) external people you would consult to assist in the investigation. 3 marks

	/ 3

C. Identify four (4) potential contributing factors to the land slip beneath the conveyor? 4 marks

	/ 4

D. What monitoring could be utilised to indicate if there was ongoing movement in Trestle 2 to shut down the conveyor? 3 marks

/ 3

E. What controls could you put in place to ensure the ongoing use of the gantry conveyor prior to the land slip being remediated. Identify five (5). 5 marks

/ 5

Question 8 – Stockpile dozer

Your Mine has received a significant amount of rain in the previous 48 hours, and a stockpile dozer has become bogged on the product stockpile in proximity to a reclaim draw point. Communication with the dozer operator via their backup handheld radio indicates:

- They do NOT feel they are at immediate risk of the dozer being drawn in
- They stopped the reclaim conveyor from the dozer onboard controls when they first had traction issues
- Whilst trying to get traction to reverse the dozer out they have tripped the tilt switch which has stopped the engine, dropped the machine isolator, and they would have to exit the cabin onto the side platform to reset the main isolator
- The dozer is tilted forward at about 30 degrees, the stockpile material feels very loose, and the dozer feels like it is sitting on its belly plates, so even with the blade down they could potentially slide forward
- The dozer has NOT got a recovery harness in the cabin (even though they ticked it off in their electronic prestart)
- Their crib tin and water bottle are in the dozer cab along with some educational reading material

Video footage in the control room shows the dozer less than 5 metres to the side of, and 15 metres below, the stockpile aerial conveyor gantry walkway side.

A. Draw down points on stockpiles are considered hazardous to mobile plant, such as dozers, operating in proximity to them. Describe three (3) contributing factors to a dozer being caught in a draw down point. 6 marks

	/ 6

B. If a dozer were to become engulfed on a coal stockpile what factors may potentially contribute to the risks of harm / hazards to personnel. List five (5) 5 marks

	/ 5

C. What additional controls should be installed on stockpile dozers to minimise the risk to dozer drivers from operating on coal stockpiles. List five (5) 5 marks

	/ 5

D. Detail three (3) potential recovery strategies for the dozer operator and dozer that you could implement. 6 marks

	/ 6

E. Select one of the above recovery methods you detailed and describe three (3) foreseeable hazards specific to the recovery process. 3 marks

	/ 3

Question 9 – Blasting and Painting SEP

As part of your statutory mechanical role you are responsible for a relatively new coal processing plant and train loading facility. These are steel structures and some of the structural members and access systems are beginning to show signs of paint loss and surface corrosion. Your recent annual third party structural audit has identified that a blasting and painting program is required to be implemented. As your mine does not currently have a Standard of Engineering Practice (SEP) for Blasting and Painting you have been asked to develop one from scratch.

A. Outline the logical process steps you would take to develop this new standard of engineering practice. List eight (8) steps. 8 marks

	/ 8

B. List five (5) personnel or organisations you would involve in the risk assessment for blasting and painting 5 marks

	/ 5

C. List six (6) hazards that you expect to identify during the risk assessment in relation to blasting and painting 6 marks

	/ 6

D. List six (6) controls you would consider implementing to mitigate the hazards you identified 6 marks

	/ 6

Question 10 – Short Answer - Scaffolding

A. Match the class of scaffolding license to the proposed scaffolding works by drawing arrows to the most correct answer 5 marks

Proposed scaffolding works	Arrow	Class of scaffolding license
Dismantling tube and coupler scaffolds		Competent person, or SA/SB/SI
Erecting prefabricated scaffold under 4m		Basic scaffolder (SB)
Erecting modular or prefabricated scaffolds		Intermediate scaffolder (SI)
Dismantling suspended scaffold		None
Conducting 30 day inspection of a scaffold		Advanced scaffolder (SA)

/ 5

B. List five (5) pieces of information a scaffold designer would require from the mine to build a scaffold for a task 5 marks

/ 5

C. Which types of scaffold are required to be designed by an engineer? Circle all that apply. A wrong answer equates to no marks for this question 3 marks

a) A scaffold that is above 30m to the top working platform height

b) a scaffold with a cantilevered platform

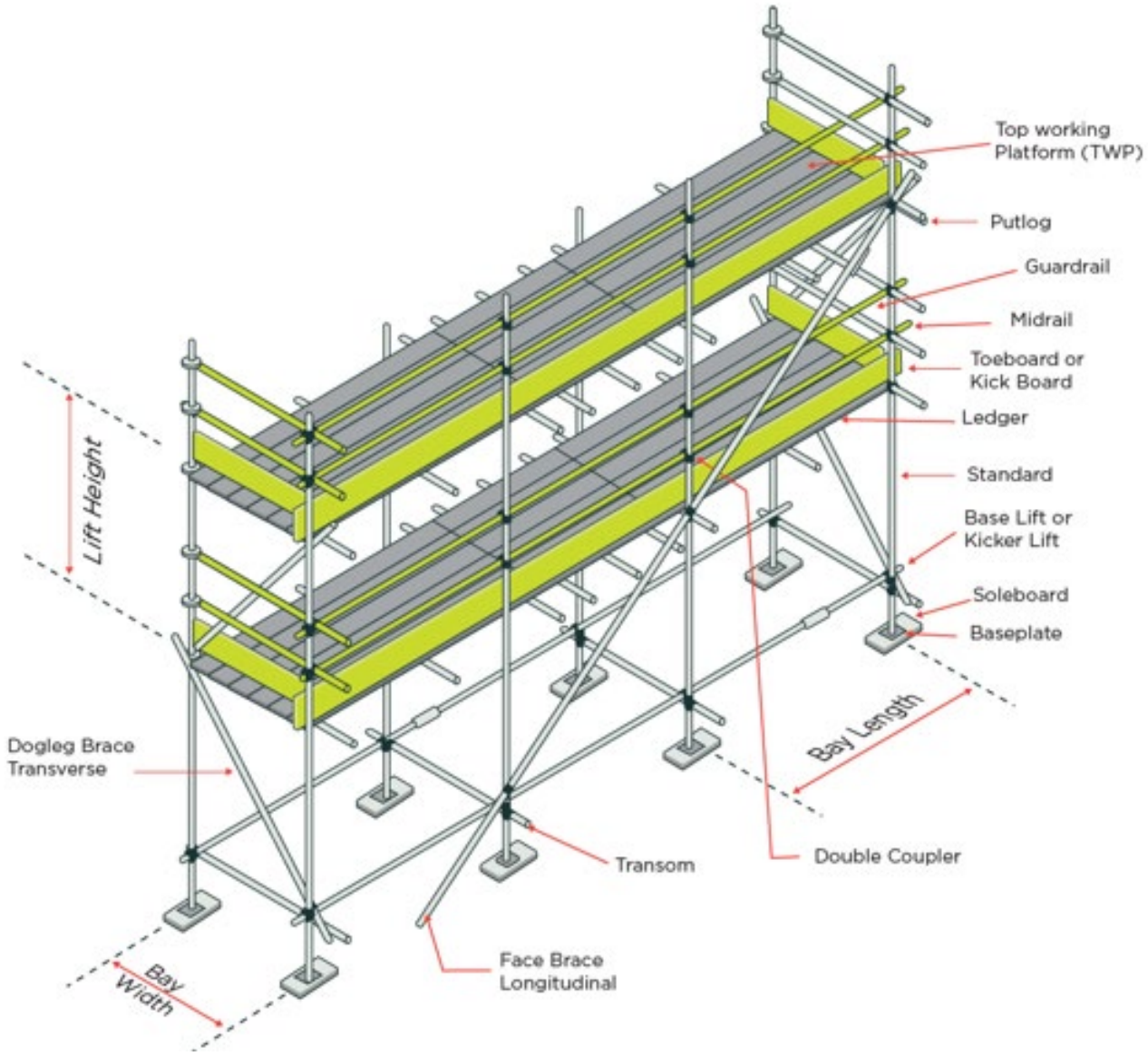
c) a scaffold that uses beam or truss elements

d) a hung scaffold

e) a scaffold that included containment (i.e. brattice or screen/mesh)

	/ 3

Consider the drawing below and answer the following questions.



D. What are the following dimensions in millimetres 5 marks

Question	Answer (mm)
What is the maximum permitted lift height?	
What is the maximum distance a putlog can be from a standard?	
What is the minimum bay width for a light duty scaffold?	
What is the maximum allowable gap between planks forming a working platform?	
How far past the landing must the ladder extend?	

/ 5

E. What are the following requirements?

a. What is the minimum and maximum slope for a scaffold access ladder? 2 marks

/ 2

b. What is the maximum height between successive ladder landings? 2 marks

/ 2

F. What three (3) components must be present on a working platform for edge protection? 3 marks

/ 3

End of Document