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

EXAMINATION:	MECHANICAL ENGINEERING MANAGER
EXAM PAPER:	CME1 – Mechanical engineering practices applicable to underground coal mines
DATE:	Wednesday 9th August, 2023 – 8:50 am to 12:00 pm
DURATION:	3 hours (excluding 10 minutes reading time)

EXAMINATION FOR CERTIFICATE OF COMPETENCE TO BE A MECHANICAL ENGINEERING MANAGER OF UNDERGROUND COAL MINES

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

INSTRUCTIONS TO CANDIDATES:

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

Candidates shall be seated in the exam room no later than 8:40 am for exam instructions.
10 minutes reading time is allowed prior to the start of the examination. Candidates can use a **highlighter only** to mark points of importance during the reading time, but may not begin answering the questions. You must NOT use any other writing item during the reading time such as a pen.

After reading time is over place your identification number only, **NOT** your name, on the cover of this paper at the commencement of the exam. Electronic aids may not be used, apart from a non-programmable calculator.

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					
	B					
	C					
	D					
	total			/ 25		
2	A					
	B					
	C					
	D					
	E					
	F					
	total			/ 25		
3	A					
	B					
	total			/ 25		
4	A					
	B					
	C					
	D					
	E					
	F					
	total			/ 25		

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

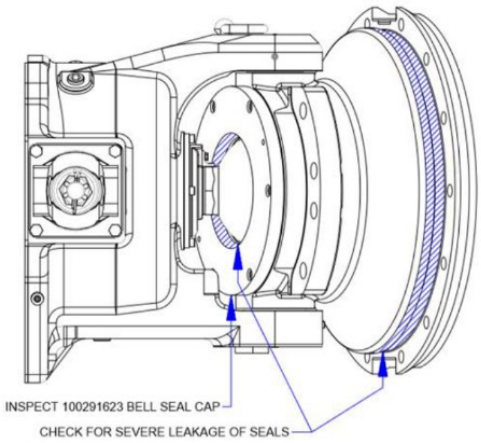
Question Number		Essential	Competent / not yet competent	Mark	Assessed by *Name*	Comments to justify, as necessary
10	A					
	B					
	total			/ 25		
PAPER	Verdict		TOTAL	/ 250		*Marks checked by:*

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 – Scenario

You are the Mechanical Engineering Manager of an underground coal mine, and you receive a global safety alert from an Original Equipment Manufacturer (OEM) in relation to the steering system of shuttle cars fitted with suspension systems. The alert indicates a number of in service wheel units failed to perform to design specifications. At this time, the specific cause of the failure is unknown, but appears to be related to the premature release or failure of the bearing nut that retains the main planetary gear set that may allow the wheel to detach from the shuttle car during operation.



Several months later the OEM releases a second global safety alert in relation to failures of wheel units in shuttle cars fitted with suspension. It lists shuttle cars that are affected by manufactured serial numbers, as well as wheel units with certain serial numbers that may have affected parts installed in them.

A. As the Mechanical Engineering Manager describe three (3) management system actions you would take in relation to the alerts. 6 marks

	/ 6

B. Through your initial investigation you have determined that your mine does not operate shuttle cars with suspension fitted. What actions would you take if any and why? 6 marks

	/ 6

C. 12 months later a wheel unit fails in service where the outer half of the wheel unit separated from the inner half segment that remains attached to the shuttle car frame. No one was injured at the time of the incident. Is this a notifiable event, and if so what section description(s) would you notify this under? 3 marks

	/ 3

D. As the Mechanical Engineering Manager describe what actions you would take to investigate this incident. 10 marks

	/ 10

Question 2 – Conveyors

Conveyor drive heads have many different configurations, each with advantages and disadvantages

A. List three (3) mechanical impacts to the operation of the conveyor drive when the drive pulley diameter is increased. 3 marks

	/ 3

B. What are three (3) mechanical benefits of increasing the drive pulley lagging coefficient of friction? 3 marks

	/ 3

C. What effect does LTU tension have on drive power? 3 marks

	/ 3

D. Draw a symbolic picture of a clean side clean side drive that also utilises two snub pulleys, indicating the location of the jib pulley, drive pulleys, snub pulleys, belt reeving, belt wander switches, belt direction of travel, and the top cover of the belt. 8 marks

	/ 8

E. List five (5) monitoring items you would incorporate in your conveyor drive head, not including belt wander switches. 5 marks

	/ 5

F. List three (3) automated methods that could be used to protect the mine in the event of a drive head fire. 3 marks

	/ 3

Question 3 – Multiple choice and Acronyms

A. Multiple Choice – identify the most appropriate answer(s) 15 marks

a) What factors influence the braking capacity of rubbered tyred mobile plant?
   i. Tyres with aggressive tread pattern
   ii. Increasing brake system pressure
   iii. Decreasing load carrying capacity
   iv. Dust suppression watering on roads
   v. All of the above

b) Hydraulic brake systems rely on what factor(s) to correctly apply?
   i. Disc rotor not contaminated with oil, grease, or brake fluid
   ii. Brake pads have sufficient contact area of friction material
   iii. Air is bled out of the hydraulic lines
   iv. Master cylinder and calliper piston seals are not leaking
   v. All of the above

c) A non destructive rope test report does NOT include which of the following?
   i. Origin of rope manufacture
   ii. Date of test
   iii. Date of rope installation
   iv. Test equipment used

d) The Factor of Safety (FoS) for a balance rope shall be not less than what?
   i. 6
   ii. 5
   iii. 4
   iv. None of the above

e) A drum winding rope when hauling personnel can safely operate with a Factor of Safety (FoS) of what when new and in used condition?
   i. Not less than 6, and not less than 4
   ii. Not less than 8, and not less than 6
   iii. Not less than 10, and not less than 8
   iv. A suitable factor of safety as determined by a competent person

f) MDG12 Guide for the construction of friction winders, clause 5.2 (iii) nominates the maximum winding speed for persons approaching the top or bottom of the shaft as?
   i. 3.5 m/s
   ii. 5 m/s
   iii. 6 m/s
   iv. 9 m/s

g) According to MDG28 what are the recommended methane (CH4) detector set points for alarm and trip in reclaim tunnels?
   i. 0.25% alarm and stop coal feed, 1% trip power to non explosion protected equipment
   ii. 0.5% alarm and stop coal feed, 1% trip power to non explosion protected equipment
   iii. 0.5% alarm and stop coal feed, 1.25% trip power to non explosion protected equipment
   iv. 0.5% alarm and stop coal feed, 1.5% trip power to non explosion protected equipment

h) Which of the following risk control measures would NOT be considered appropriate to prevent a potential dozer engulfment in the reclaim draw point?
   i. GPS in dozer cab with proximity alarm
   ii. Flashing light on conveyor gantry indicating active draw point
   iii. Spotter on conveyor gantry with two way radio to dozer operator
   iv. Heavy duty grizzly cage over the coal valve

i) Which legislative mechanism details the specific requirements of a safety management system?
   i. Work Health and Safety Act
   ii. Work Health and Safety Regulation
   iii. Work Health and Safety (Mines and Petroleum Sites) Act
   iv. Work Health and Safety (Mines and Petroleum Sites) Regulation

j) Work Health and Safety Regulation Part 4.1 Noise, Clause 56, identifies an exposure standard for noise of:
   i. Average 12 hour exposure LAeq of 90 dB(A), and peak LC of 150 dB(A)
   ii. Average 12 hour exposure LAeq of 85 dB(A), and peak LC of 140 dB(A)
   iii. Average 8 hour exposure LAeq of 85 dB(A), and peak LC of 140 dB(C)
   iv. Average 8 hour exposure LAeq of 90 dB(A), and peak LC of 130 dB(C)

k) Work Health and Safety Regulation Part 4.3 Confined spaces, Clauses 66 to 77, identify a number of controls required to safely access confined spaces, and include which of the four following items:
   i. Confined space entry permit, signage, ladders, emergency procedures
   ii. Risk assessment, atmospheric monitoring, breathing apparatus, signage
   iii. Confined space entry permit, atmospheric monitoring, connected plant and services, emergency procedures
   iv. Risk assessment, air locks, communication and safety monitoring, PPE in emergencies

l) When designing a piped service firefighting system for underground coal mines what pressures would you use as minimum residual dynamic pressure, and what hydrant flow is required, in MDG 1032 section 5.3.2.2?
   i. 1700 kPa and 7 l/s
   ii. 700 kPa and 7 l/s
   iii. 700 kPa and 10 l/s
   iv. 1700 kPa and 10 l/s

m) How would you control the pipe pressure as the mine proceeded to be developed down dip
   i. Minimum 190m long branch or spur pipelines at regular intervals along the main pipe to dissipate water hammer
   ii. Short sections of reduced pipe diameter to create flow restriction
   iii. Variable orifice valves at 1500 metre centres on the main pipe ring main set to 700 kPa
   iv. Pressure reducing valve at regular intervals based on hydraulic analysis

n) MDG 1032 nominates controls of fire protection in underground parts of a coal mine, and requires at least what water storage capacity?
   i. 100,000 litres
   ii. 200,000 litres
   iii. 250,000 litres
   iv. 500,000 litres

o) According to MDG 1032 section 5.3.3.3 in preparing a site standard of engineering practice (SEP) for firefighting system how should fire hydrants be orientated in underground parts of a coal mine and reclaim tunnels?
   i. 100mm clear around the hydrant valve
   ii. Face in the direction of air flow
   iii. 1m clear in front of the hydrant valve wheel to allow safe access
   iv. All of the above

	/ 15

B. Acronyms – write the full version of the following acronyms 10 marks

Acronym	Full title
AFC	
BSL	
TRS	
RTV	
TBS	
LHD	
BLS	
BCW	
LEL	
UEL	

	/ 10

Question 4 – Safety Bulletin – Lifting and cranage

Safety Bulletin SB22-14 dated December, 2022, was released in response to a significant increase in injuries and near misses relating to lifting and cranage.

Resources Regulator
Department of Regional NSW

NSW GOVERNMENT

Safety Bulletin

December 2022

Dangerous lifting equipment incidents increase

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

Issue

A significant rise in the number of dangerous incidents involving lifting equipment has prompted the NSW Resources Regulator to review recent events in the NSW mining industry.

Within a one-month period between mid-October and mid-November, 2022, there were 7 lifting-related dangerous incidents, with 4 of these occurring over 5 days. The incidents involved cranes, chain/lever hoists and self-propelled jigs, with a range of causes and contributing factors.

Circumstances

1. Dangerous incident – 13 November (Figure 1)

   A work group at an open cut coal mine was installing a 2.7 tonne motor and gearbox assembly at the top of a reclaimer. The assembly was being lifted in with a slew crane when the job coordinator, not part of the work group, approached the task. The coordinator observed the load swinging around and instinctively reached out and grabbed the load. The coordinator's left hand index finger was caught between the load and the structure of the reclaimer, partially amputating the finger.

Figure 1: Reclaimer motor and gearbox

Figure 2: Haul truck rear axle box hole

The investigations associated with these incidents identified a range of causes and contributing factors, however, there were several common themes, including the following:

- The lack of experience of workers and supervisors affected the identification of hazards. Workers can't identify what they don't know
- The lack of implementing appropriate controls to protect workers
- Operational and maintenance documentation did not match equipment
- A lack of risk assessment, job safety analysis, or procedure being developed

- The lack of training in operating equipment
- A lack of effective supervision
- Poor attention by, or distraction of, people in control of lifting plant
- Poor selection of equipment, including lifting gear that had:
    - inadequate rating
    - was not fit for the intended purpose.

A. List three (3) immediate actions you would take in relation to your Standard of Engineering Practice (SEP) for Lifting and Slinging. 6 marks

	/ 6

B. List five (5) people or organisations you would involve in the review. 5 marks

	/ 5

C. What is your definition of a simple lift? 3 marks

	/ 3

D. What is your definition of a complex lift? 3 marks

/ 3

E. What is your understanding of the term ‘swing zone’? 3 marks

/ 3

F. What controls would you implement to manage complex lifts? 5 marks

/ 5

Question 5 – Drift sinking equipment **Essential Elements**

You commence employment at an underground coal mine that has let a contract to drive two new 1:10 access drifts using hard rock mining equipment and conventional drill and blast techniques. The existing Electrical Engineering Manager has had the Contractor convert the rubber tyre diesel Sandvik 420 face drill twin boom jumbos to electric over hydraulic, and they have just arrived on site for their site introduction.

Essential Elements

A. Describe five (5) safety systems you would check as part of the site introduction. **Two of these safety systems are considered essential answers and must be included. If they are not included the candidate will be deemed not yet competent for the question.**

10 marks

	/ 10

You inspect the Jumbo and notice the main slides on the drills are aluminium.

B. What is your understanding of the basis of the concern for aluminium components being used in underground coal mines? 2 marks

	/ 2

C. In your own words what are the legislative requirements in terms of the management of light metal alloys in underground coal mines? 5 marks

	/ 5

D. List three (3) significant issues that may arise from changing the aluminium drill slides to steel.

3 marks

	/ 3

E. Describe five (5) controls you could implement to mitigate the potential hazards from using aluminium.

5 marks

	/ 5

Question 6 – MECP - Energy

NSW Code of Practice: Mechanical engineering control plan section 3.2.1 Energy sources associated with plant and structures outlines nine (9) categories of energy, such as “radiation energy”, of which at least seven (7) are often considered to fall under the management of the statutory Mechanical Engineer.

A. Identify five (5) other energy sources. 5 marks

	/ 5

B. Using your experience, for each of the five (5) energy sources you nominated above identify:
   i. an associated mechanism or scenario likely to occur in a coal mine,
   ii. the potential consequences to people in terms of health and safety,
   iii. a critical control you would implement to effectively mitigate the risk, and
   iv. a verification process you would implement to effectively manage the critical control.

20 marks

	/ 20

Question 7 – Pumping system – Development panel dewatering

A number of mines recently have had to deal with high volumes of water ingress from overlaying strata, or permeating through the mine barrier from adjacent workings

A. Draw common services schematic symbols for the following components 6 marks

i. Schematic symbol for a gate valve at the end of a main pipe range.

	/ 1

ii. Schematic symbol for a non return valve on a branch into waste water pipe range.

	/ 1

iii. Schematic symbol for a hydrant outlet on gravity fed raw water pipeline or firefighting line.

	/ 1

iv. Schematic symbol for an inline pipe manifold with 25mm and 50mm outlets.

	/ 1

v. Schematic symbol for a 50mm diaphragm air pump with suction strainer.

	/ 1

vi. Schematic symbol for a 2000 litre fish tank with baffle and external electric pump.

	/ 1

B. Use appropriate schematic symbols, including those identified in A. above to draw an operational development panel dewatering schematic including all the required mechanical services. 8 marks

	/ 8

C. Describe how the schematic you have drawn in 2 above will operate, and where you would isolate to carry out maintenance on each of the pumps shown. 5 marks

	/ 5

Your mine has decided to drift down through a 30m throw fault to a new mining domain with around 300m total depth of cover. Exploratory boreholes indicate high permeability with suspected connectivity to overlying water bearing strata. You are tasked with developing a pumping strategy.

D. Describe the specification and operating parameters of two (2) components of the pumping system from the face to the surface. 6 marks

	/ 6

Question 8 – Haul truck front suspension strut

You are the statutory Mechanical Engineer at a mine that operates a small fleet of haul trucks. Your workshop maintenance coordinator has identified that two of the haul trucks require the front suspension struts replaced. Recently there have been three serious incidents relating to the replacement of front suspension struts on haul trucks where trades persons involved in the removal of the struts were placed at risk.

A. Identify five (5) hazards directly associated with the removal and installation of front struts.
5 marks

	/ 5

B. For the collective hazards identified above describe six (6) control measures you would implement to minimise the potential for injuries to workers involved in the task of repairing or replacing front suspension struts. 12 marks

/ 12

C. For the control measures identified above describe three (3) control verification measures that you will include in your inspection and testing scheme. 3 marks

/ 3

D. When considering your workforce, contractors, and OEM tradespersons, identify five (5) training elements you would introduce to ensure the safe replacement of front struts.
5 marks

/ 5

Question 9 – Conveyor belts

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—

(a) the risks associated with belt conveyors,

(b) the protection of persons near or travelling under a belt conveyor against the risk of being struck by falling objects,

(c) for a belt conveyor at an underground coal mine or in a reclaim tunnel …

(d) risks arising from the starting of belt conveyors,

(e) the interaction of persons and belt conveyors including provision for the safe crossing of belt conveyors by persons.

A. What is the only Australian Standard referenced in Schedule 2 (2) MECP? 2 marks

	/ 2

B. Section 6 of the above standard refers to five (5) specific tests you should be familiar with that are required to determine compliance. Identify four (4) of these tests. 4 marks

	C NYC

C. For two of the tests identified above describe how the test is performed and what are considered positive outcomes. 12 marks

	/ 12

D. Conveyor belts at mines and coal handling plants have historically resulted in many injuries and deaths, and require effective controls to manage the significant mechanical hazards. Regular belt conveyor inspections by a competent person encompasses controls for a number of areas. Identify seven (7) separate areas or aspects of inspections associated with conveyors that you would include in your mechanical inspection and testing program.

7 marks

	/ 7

Question 10 – Mechanical fundamentals

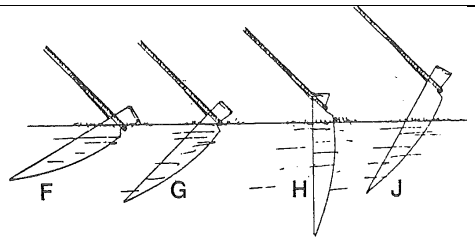
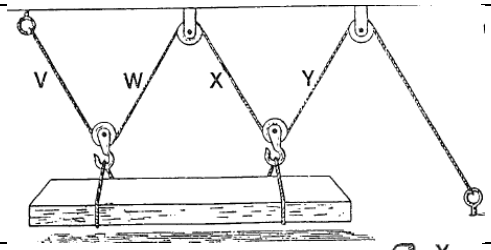
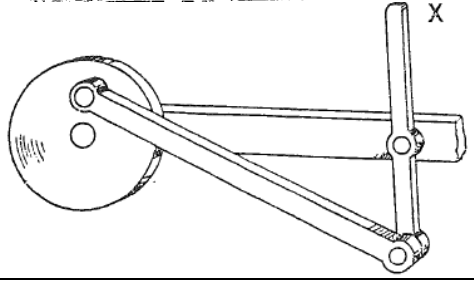
A. What are the approximate conversions for the following measured units? 5 marks

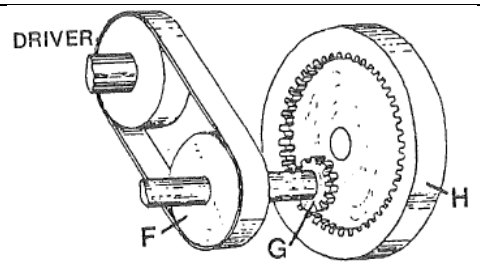
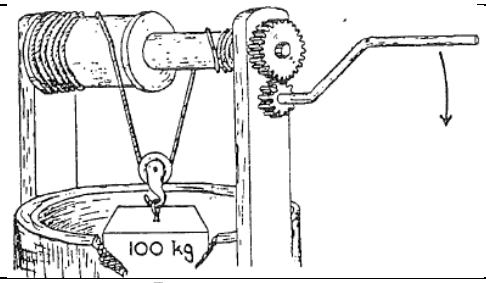
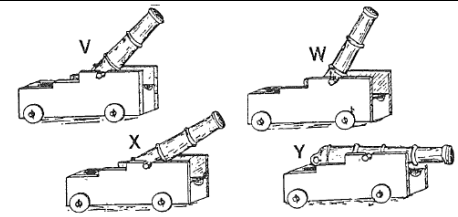
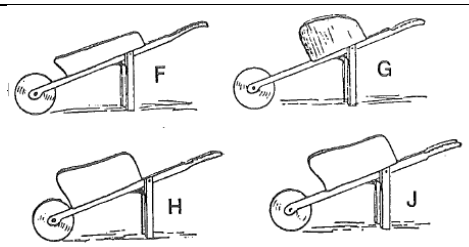
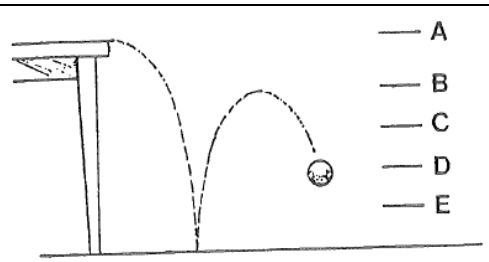
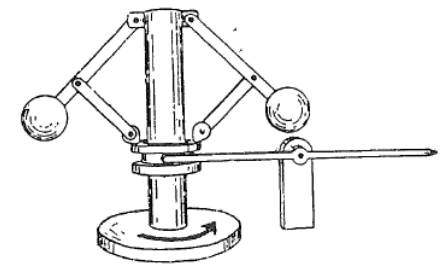
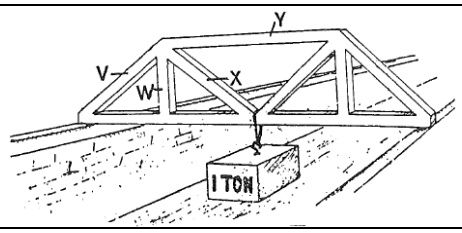
Measurement / Unit	Target unit	Converted measurement
100 psi	kPa	
1 inch	Mm	
1 thou	Mm	
1 ft lb force	Nm	
100 kPa	Bar	

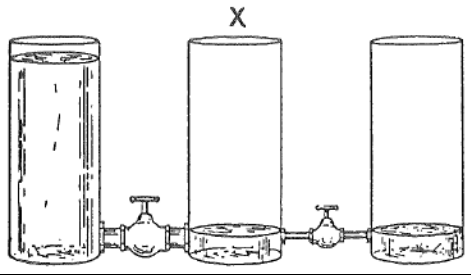
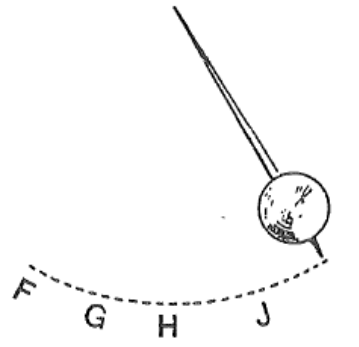
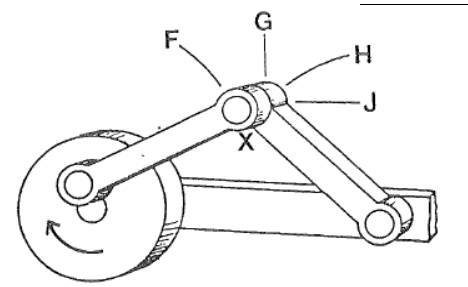
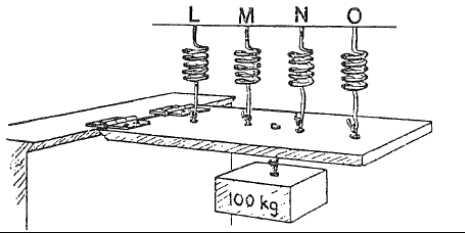
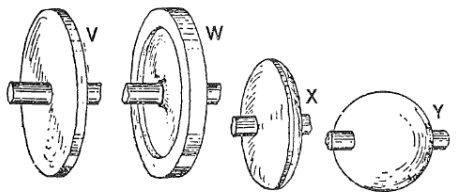
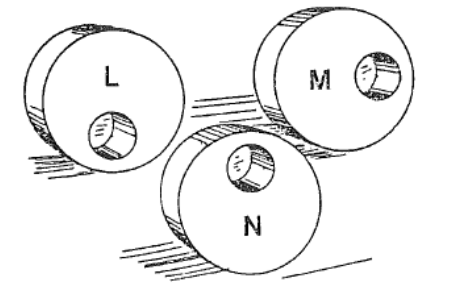
	/ 5

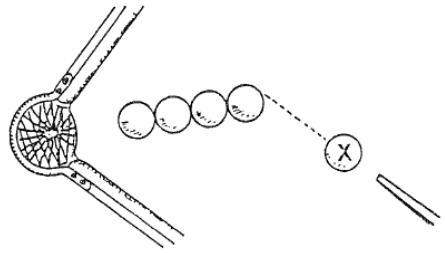
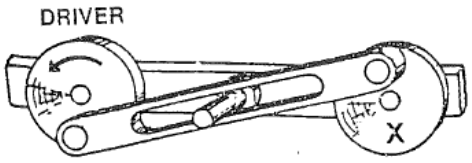
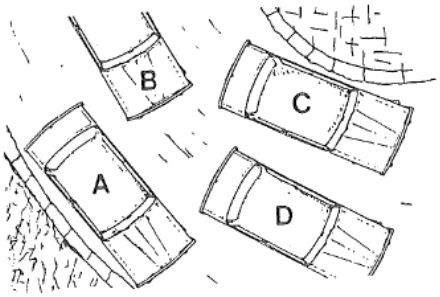
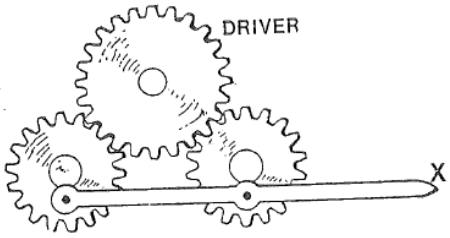
B. Interpretation of mechanical systems: 20 marks

Circle the most correct answer, or write your answer in the answer column on the right.

No.	Scenario	Question	Ans
1		Which of these tent pegs will hold firmest in soft ground? a) F b) G c) H d) J e) All equal	
2		Which part of the rope is carrying the greatest strain? a) V b) W c) X d) Y e) All equal	
3		What happens to position X on the rod when the wheel turns? a) Moves right then stops b) Stays still c) Moves to and fro d) Continues to move left e) The mechanism will jam	

4		Which of these components rotate in the same direction as the driver? a) F and G only b) G and H only c) H only d) All of them e) None of them	
5		What will happen to the weight when the handle is turned as shown? a) Rise b) Fall c) Stay still d) Move up and down e) The mechanism will jam	
6		Which canon will shoot the furthest? a) V b) W c) X d) Y e) All equal	
7		On level ground in which wheelbarrow can a person carry 100kg of sand the easiest? a) F b) G c) H d) J e) All equal	
8		To what height will the ball rise on the next bounce? a) A b) B c) C d) D e) E	
9		What will happen to the tip of the pointer when the wheel spins faster in the direction shown? a) Rise b) Fall c) Move up and down d) Stay still e) The mechanism will jam	
10		Which member of the bridge truss is carrying the least strain? a) V b) W c) X d) Y e) All equal	

11		What will happen to the water level in tank X when both taps are turned fully on? a) Rise until tank overflows b) Rise and then fall c) Fall until the tank empties d) Fall and then rise e) Rise slowly	
12		After the pendulum is released at which point is the tip moving fastest? a) F b) G c) H d) J e) All equal	
13		Which of these paths would joint X follow when the wheel turns as shown? a) F b) G c) H d) J e) None of the paths shown	
14		Which spring is carrying the greatest weight? a) L b) M c) N d) O e) All equal	
15		Which of these 100kg flywheels when spinning at the same speed would be the hardest to stop? a) V b) W c) X d) Y e) All equal	
16		Which of these steel cylinders when pushed slightly would return to its present position? a) L b) M c) N d) All of them e) None of them	

17		How many billiard balls will go into the pocket when ball X is hit very hard? a) None b) One c) Two d) Three e) Four	
18		How will wheel X turn if the driver wheel turns as shown? a) Same direction, same speed b) Same direction initially then oscillating c) Opposite direction, same speed d) Opposite direction then oscillating e) The mechanism will jam	
19		Four identical cars are racing and reach the corner at the same speed. Which car is most likely to skid? a) A b) B c) C d) D e) All equal	
20		What will happen to the pointer marked X when the driver turns a) Move up and down b) Move in a circle c) Move to and fro d) Stay still e) The mechanism will jam	
		With thanks to J.R Morrisby c1955	

	/ 20

END OF QUESTIONS

BLANK PAPER TO WRITE ANSWERS THAT YOU COULD FIT INTO THE SPACE PROVIDED – INDICATE QUESTION NUMBER AT START OF ANSWER

END OF PAPER

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

EXAMINATION:	MECHANICAL ENGINEERING MANAGER
EXAM PAPER:	CME 2 – Legislation and standards applicable to underground coal mines
DATE:	Wednesday 9th August, 2023 – 1:10 pm to 3:20 pm
DURATION:	2 hours (excluding 10 minutes reading time)

EXAMINATION FOR CERTIFICATE OF COMPETENCE TO BE A MECHANICAL ENGINEERING MANAGER OF UNDERGROUND COAL MINES

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

INSTRUCTIONS TO CANDIDATES:

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

Candidates shall be seated in the exam room no later than 1:00 pm for exam instructions.
10 minutes reading time is allowed prior to the start of the examination. Candidates can use a **highlighter only** to mark points of importance during the reading time, but may not begin answering the questions. You must NOT use any other writing item during the reading time such as a pen.

After reading time is over place your identification number only, **NOT** your name, on the cover of this paper at the commencement of the exam. Electronic aids may not be used, apart from a non-programmable calculator.

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				
	total			/ 25		
2	A					
	B					
	C					
	D					
	E					
	total			/ 25		
3	A					
	B					
	C					
	total			/ 25		
4	A					
	B					
	C					
	total			/ 25		
5	A					
	B					
	C					
	D					
	total			/ 25		

Questions continue on next page

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

Questions continue on next page

Question Number		Essential	Competent / not yet competent	Mark	Assessed by *Name*	Comments to justify, as necessary
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**

Questions continue on next page

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

The candidate must be assessed as competent for this question in order to be considered as being competent for the entire exam

The role of the Mechanical Engineering Manager

Work Health and Safety (Mines and Petroleum Sites) Regulation

Schedule 10 Part 2 Underground coal mines

5 Mechanical engineering manager

1) The statutory functions of a Mechanical Engineering Manager are:

   a. To develop, supervise, monitor, and review the mechanical engineering standards and procedures forming part of the mining operations at a mine

   b. To supervise the _____ of mechanical plant at the mine

A. What are the four (4) requirements in relation to Section 1) b above? 4 marks

	/ 4

B. Schedule 2 (2) (3) below identifies matters that must be taken into account when developing control measures for mechanical hazards. Fill in the missing words as they are identified in legislation. 21 marks

Work Health and Safety (Mines and Petroleum Sites) Regulation

Schedule 2 Principal Control Plans

(2) Mechanical engineering control plan

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

(a) the _____ and operation of plant or a structure to ensure it is fit for purpose,

(b) the _____ , _____ , _____ ,

_____, _____, and _____

of plant or structures,

(c) the _____ of plant or structures into the mine or petroleum site,

(d) safe work systems for persons dealing with plant or structures including the _____ , _____ and _____ of all mechanical energy sources from plant or structures,

(e) the inspection and testing of plant or structures including testing of _____ , _____ , _____ and other _____ functions or components,

(f) the identification, assessment, management and rectification of _____ that affect the safety of plant or structures,

(g) the risks associated with _____ , including _____ ,

(h) for underground coal mines—the arrangements for meeting and maintaining requirements for registration under this Regulation, section 187 and the WHS Regulations, Part 5.3 in relation to plant with a diesel engine,

(i) the risks associated with plant, including face machines, winding systems, mobile plant, drilling plant and dredges,

(j) the risks associated with _____,

(k) the risks associated with the transfer and storage of combustible liquids and other hazardous or volatile material associated with the use of plant or structures,

(l) the prevention, detection and suppression of fires on mobile plant and conveyors,

(m) the provision of operator protective devices on mobile plant including protective canopies on continuous miners when controlled by an on-board operator,

(n) the maintenance of explosion-protected plant in an explosion-protected state,

(o) undertaking _____ ,

(p) the use of _____ and materials in high risk underground applications.

Question 2 – Principal control plans

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 …

(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—

(a) prepare …

(b) ensure ….

A. In Section 30 (4) (a) identify what must be prepared? 4 marks

	/ 4

B. In Section 30 (4) (a) identify what must be managed? 4 marks

	/ 4

C. In Section 30 (4) (b) identify what must be ensured? 3 marks

/ 3

D. In Section 30 (4) (b) identify all persons who can fulfill these obligations? 6 marks

/ 6

E. Section 30 (2) (b) requires the document to be readily understandable by persons who use it. List four (4) practical ways of achieving this requirement. 8 marks

/ 8

Question 3 – Mechanical engineering control plan

Part of the role of the Mechanical Engineer is to set up and maintain a logical hierarchy of systems and documents to manage mechanical risks at the mine.

A. List six (6) key personnel you would include in the preparation and/or review of the MECP risk assessment. 6 marks

	/ 6

B. List nine (9) Standards of Engineering Practice (SEP) that you would include as subordinate documents to your MECP. 9 marks

	/ 9

C. When considering various plant arriving at your site, list five (5) different types of plant that would require plant specific checks in your introduction to site suite of documents, and for each type of plant describe one of these specific checks. You can NOT duplicate the specific checks for more than one type of plant. 10 marks

	/ 10

Question 4 – Principal hazard management plans

Work Health and Safety (Mines and Petroleum Sites) Regulation

4 Meaning of "principal hazard"

In this Regulation, a principal hazard is an _____ relating to the carrying out of mining operations or petroleum operations that has a reasonable potential to result in multiple deaths in a single incident or a series of recurring incidents in relation to—

(a) for mining operations—one or more of the following—

A. Section 4 identifies eight (8) categories that a principal hazard may be. Identify five (5) principal hazards, including three (3) directly relating to statutory Mechanical Engineers. 5 marks

	/ 5

B. Section 4 (a) identifies ten (10) principal hazard management plans (PHMP) that may be required for mining operations. Identify four (4) PHMPs that you consider would require input from the statutory Mechanical Engineer to identify all foreseeable hazards, and their associated controls, in order to develop comprehensive management plans. 8 marks

	/ 8

C. Choose three (3) of the PHMPs you listed above, and for each one identify four (4) aspects that must be considered by the statutory Mechanical Engineer. 12 marks

	/ 12

Question 5 – Management of risk

Work Health and Safety (Mines and Petroleum Sites) Regulation

14 Management of risks to health and safety

(1) A person conducting a business or undertaking at a mine or petroleum site must manage risks to health and safety associated with mining operations or petroleum operations at the mine or petroleum site in accordance with the WHS Regulations, Part 3.1.

(2) A person conducting a business or undertaking at a mine or petroleum site must ensure a risk assessment is conducted in accordance with this section by a person who is competent to conduct the risk assessment having regard to the nature of the hazard.

(3) In conducting a risk assessment, the person must have regard to the following—

A. With respect to Section 14 (2) what attributes do you consider a person requires in order to conduct a risk assessment having regard to the hazard? 5 marks

	/ 5

B. With respect to Section 14 (3) when considering mechanical hazards in a risk assessment there are three (3) items the statutory Mechanical Engineer must have regard to. Identify all three (3). 6 marks

	/ 6

15 Review of control measures

(1) A person conducting a business or undertaking at a mine or petroleum site must review and as necessary revise control measures implemented under section 14(5)(b) in the following circumstances—

C. There are four (4) circumstances when a review of control measures is required. Detail three (3) of these circumstances. 6 marks

	/ 6

16 Record of certain reviews of control measures—operator

(1) This section applies to an operator of a mine or petroleum site who has, under the WHS Regulations, clause 38, reviewed a control measure in response to—

(a) a notifiable incident, or

(b) an incident referred to in section 124.

(2) The operator of a mine or petroleum site must keep a record of the following—

D. Section 16 identifies what must be recorded as part of a review of control measures. As statutory Mechanical Engineer what information do you require recorded from a review of control measures? 8 marks

	/ 8

Question 6 – Mobile plant

Essential elements

Work Health and Safety (Mines and Petroleum Sites) Regulation

32 Movement of mobile plant

(1) In complying with section 14, the operator of a mine or petroleum site must manage risks to health and safety associated with the movement of mobile plant at the mine or petroleum site.

(2) In managing risks to health and safety associated with the movement of mobile plant at the mine or petroleum site, the operator must have regard to all relevant matters including the following—

A. Section 32 (2) details seven (7) areas of risk associated with all aspects of the movement of mobile plant the Operator must have regard to. As the statutory Mechanical Engineer what risks to health and safety in relation to the movement of mobile plant do you consider need to be managed. Describe five (5). 10 marks

	/ 10

B. Identify five (5) safety features on mobile plant that you consider are required for the safe operation of the plant. Note that two (2) of these safety features are considered to be safety critical systems that are ESSENTIAL ELEMENTS in your answer. 5 marks

	/ 5

C. Safety features are forms of risk controls to protect mobile plant operators, and any passengers if applicable. For two (2) of the safety features you have listed in part B above detail five (5) elements of system design, maintenance, and inspection strategy that you would implement to ensure the risk control remains effective. Elements can NOT be duplicated for the two safety features you have chosen. 10 marks

	/ 10

Question 7 – Contractor management

Work Health and Safety (Mines and Petroleum Sites) Regulation
Section 26 Contractor to prepare plan or use safety management system
(1) A contractor must not carry out mining operations or petroleum operations at a mine or petroleum site unless the contractor has—

As the statutory Mechanical Engineer at your mine site, you are required to onboard a new contracting company that will conduct contract mining, provide some small mining equipment, and carry out maintenance to this equipment.

A. Having regard to Section 26 (1) outline four (4) requirements the contract company must comply with to manage the risks to health and safety. 5 marks

	/ 5

(2) Subsection (1) does not apply if the contractor has—

B. Section 26 (2) allows for an alternative approach for the Contractor to manage risks to health and safety. Having regard to 26 (2) outline three (3) key steps you consider would constitute an alternative approach that provides equivalent levels of risk management. 3 marks

	/ 3

(3) A contractor health and safety management plan must—

C. When considering Section 26 (3) what are four (4) key requirements to manage the risks to health and safety that are to be contained in the contract company's contractor health and safety management plan? 6 marks

	/ 6

As the statutory Mechanical Engineer at the mine site, you are required to assist the contractor to compile a health and safety management plan.

D. Detail five (5) key steps you would take to ensure the development of a contractor health & safety management plan is undertaken successfully. 5 marks

	/ 5

E. Identify twelve (12) key components that you would include in the Contractor's health and safety management plan in order to manage the risks to health and safety at your mine site?

6 marks

	/ 6

Question 8 – Qualified mechanical tradespersons

The legislated requirements for a qualified mechanical tradesperson in Work Health and Safety (Mines and Petroleum Sites) Regulations Schedule 10 Sections (15) and (23) are the same for surface and underground coal mines.

A. What is the statutory function of qualified mechanical tradespersons? 5 marks

	/ 5

B. What requirements must the individual have to be authorised as a statutory mechanical tradesperson? 5 marks

	/ 5

C. Identify five (5) trades that you would consider acceptable to be authorised as a statutory mechanical tradesperson, assuming they had completed a recognised course in fluid power. 5 marks

	/ 5

D. Describe five (5) actions you would take prior to authorising a contractor as a mechanical tradesperson on site. 5 marks

	/ 5

E. Identify five (5) documents that you consider a mechanical tradesperson should review and / or complete prior to commencing a routine task. 5 marks

	/ 5

Question 9 – Falls

Work Health and Safety Regulation

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.

A. Clause 78 (2) identifies five general scenarios where falls could occur in the workplace. In practical terms describe three (3) of these different types of fall scenarios that could occur in your workplace. 6 marks

	/ 6

(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.

B. Clause 78 (3) uses the term solid construction, and Clause 78 (5) describes four (4) aspects that an area of solid construction must have. In practical terms identify three (3) parameters required for an area to be considered solid construction. 6 marks

	/ 6

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.

C. Clause 79 (3) (a) refers to fall prevention devices. In practical terms describe three (3) different types of fall prevention devices that you would implement in your workplace. You may include those referenced in Clause 79 (5). 6 marks

	/ 6

D. What is the Australian Standard for fixed platforms, walkways, stairways, ladders – design, construction, and installation? 2 marks

	/ 2

E. What are the following minimum dimensions in the standard identified above that are required for platforms? 5 marks

Hand rail height	
Knee rail height	
Toe board / kick rail height	
Width of walking surface	
Distance between hand rail and knee rail	

	/ 5

Question 10 – Gazette – Drift slope haulage winder rope

WORK HEALTH AND SAFETY (MINES AND PETROLEUM SITES) REGULATION 2022

Registration of Powered Winding Systems Design Order 2022

I, **Garvin Burns**, Chief Inspector, with the delegated authority of the Secretary, Regional NSW, pursuant to section 187(5) of the Work Health and Safety (Mines and Petroleum Sites) Regulation 2022, make the following Order.

Dated this 29th day of August 2022

5. Design requirements

5.1. Drift winding systems:

(a) except as provided in paragraphs 5.1(b) and 5.3, all winding systems used in underground mines (other than winding systems used in small gemstone mines) must be designed in accordance with the *TRG: Powered winding systems*, as identified in the following parts as amended from time to time:

(i) Part 1 'General requirements' – section 3 'Design'

(ii) Part 2 'Drift winders' – section 2 'Drift winders design and construction

(iii) Part 4 'Ropes' – section 2 'Rope design and construction'

(iv) Part 5 'Winder control systems':

- section 2 'Design – Performance requirements'
- section 3 'Design – General control system requirements'

In relation to 5.1 (a) (iii) above Work Health and Safety (Mines and Petroleum Sites) Regulation Section 51 states:

51 Ropes

(1) The mine operator of an underground mine, other than an underground small gemstone mine, must ensure—

(a) each rope used for the purposes of a winding system or slope haulage is regularly inspected and tested to ensure it is safe to use for the purposes of a winding system or slope haulage, and

(b) criteria are established to determine when a rope is no longer suitable for those purposes.

A. Inspection and testing requirements for your drift winder occur at different frequencies (weeks, months, operating hours, etc). Describe three (3) separate inspections or tests your winder management plan will require to be performed on your drift slope haulage rope to meet your obligations under section 51 (1) (a) above. Your answer for each separate inspection or test shall include:

- the time interval frequency of the inspection or test
- who will perform the inspection or test
- how it is to be performed
- the expected outcomes and / or pass / fail criteria 15 marks

	/ 15

B. List five (5) discard criteria you will include in your winder management plan to meet the obligations of section 51 (1) (b) above. 5 marks

	/ 5

C. For one of the discard criteria identified above describe how compliance with the criteria will be practically determined. 5 marks

	/ 5

END OF QUESTIONS

BLANK PAPER TO WRITE ANSWERS THAT YOU COULD NOT FIT INTO THE SPACE PROVIDED – INDICATE QUESTION NUMBER AT START OF ANSWER

END OF PAPER