

CANDIDATE EXAM PAPER

CANDIDATE NUMBER: \_\_\_\_\_

Paper 1

## MINING ENGINEERING MANAGER OF UNDERGROUND MINES OTHER THAN COAL MINES

### EXAMINATION FOR CERTIFICATE OF COMPETENCE

*Work Health and Safety (Mines and Petroleum Sites) Act 2013*  
*Work Health and Safety (Mines and Petroleum Sites) Regulation 2022*

Legislation to be assessed:

Unless otherwise stated all references to Act and Regulations are to:

*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*  
*Explosives Act 2003*  
*Explosives Regulation 2013*  
*Australian Standard 2187 Explosives – Storage, Transport and Use*  
*Australian Standard, 4326 The Storage and Handling of Oxidising Agents*  
*Australian Dangerous Goods Code and Australian Explosives Code*

This Examination is held in the following location:

Venue: Online

**Start date/time: 07 Feb 2023 12:00:00**

**Duration: 3 hours 40 minutes (including 10 minutes reading time)**

**Paper 1**

#### INSTRUCTIONS TO CANDIDATES

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

All questions are to be attempted.

Not All questions are of equal value and parts of questions may also vary in value. The marks applicable to each part of a question will be indicated adjacent to the question.

By proceeding with this, you have acknowledge that you have read the exam rules and requirements and Breach of exam rules policy on our website.

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Q #	Marks	Available Marks	Marked by <i>Initials</i>	Summary comments to justify
1		10		
2		10		
3		10		
4		10		
5		10		
6		10		
7		10		
8		15		
9		15		
<b>Paper Total</b>		<b>100</b>		<i>Marks checked by:</i>

## Question 1

A) What is the minimum distance explosives must be from a magazine ceiling? (1 Mark)

- a. 300mm
- b. 350mm
- c. 400mm
- d. 420mm

B) What is the maximum NEQ of explosive you can store in a magazine per m<sup>2</sup>? (1 Mark)

- a. 0.5
- b. 0.7
- c. 0.9
- d. 2.0

C) What is the legislated inhalable dust—exposure for an 8 hour shift? (1 Mark)

- a. 3 milligrams per cubic metre of air
- b. 2.5 milligrams per cubic metre of air
- c. 10 milligrams per cubic metre of air
- d. 15 milligrams per cubic metre of air

D) What is the legislated diesel particulate—exposure for an 8 hour shift? (1 Mark)

- a. 0.3 milligrams per cubic metre of air
- b. 0.5 milligrams per cubic metre of air
- c. 1.0 milligrams per cubic metre of air
- d. 0.1 milligrams per cubic metre of air

E) CI 76 Explosives regulations of 2003 requires an authorised supplier of explosives to maintain supply records for how many years? (1 Mark)

- a. 4
- b. 5
- c. 6
- d. 7

F) You are MEM at a mine and have received a Section 191 notice you believe is not legal. You have discussed it with the issuing inspector and are not satisfied with the response. What is your next available remedy under the WHS Act 2011? (1 Mark)

- a. Request for review by the regulator whereby the regulator will appoint another inspector to review the notice
- b. Request a formal review from the Chief Inspector
- c. Apply to the Industrial Relations Commission for an external review
- d. Call for internal review by the regulator

G) Before a worker is formally interviewed by the Resources Regulator, they are informed of their rights under the WHS Act 2011. Once this is completed, can a worker be prosecuted either civilly or criminally for answering questions from the resources regulator truthfully and potentially providing incriminating evidence? (1 Mark)

- a. No. there is a Abrogation of privilege against self-incrimination under the WHS Act 2011
- b. Yes. There is no Abrogation of privilege against self-incrimination under the WHS Act
- c. The Act does not allow a worker to be criminally prosecuted but it does allow for a worker to be prosecuted in Civil proceedings
- d. No. there is a Abrogation of privilege against self-incrimination under the WHS Act 2011, however this privilege is waived if a worker is found to have given false or misleading evidence.

H) WHS (M&PS) Act 2013 cl 68 requires the competency board to produce \_\_\_\_\_ on an annual basis.

Choose the following option to complete the sentence. (1 Mark)

- a. Annual Report of its activities during the preceding year to the minister
- b. Publish results of its Annual General Meeting
- c. A report to gazetted industry bodies in NSW detailing the number of persons issued statutory competencies
- d. A report to the minister detailing the gender balance between each statutory function and recommendations to the minister on how any gender gap can be addressed.

I) WHS (M&PS) Act 2013 CI 77 requires the in WHS (M&PS) Act 2013 to be reviewed as soon as possible after the period of \_\_\_ years from the commencement of this Act.

Choose the following option to complete the sentence. (1 Mark)

- a. 8
- b. 7
- c. 6
- d. 5

J) As per CI 50 WHS (M&PS) R 2022, a winding system is **NOT** required by legislation to have: (1 Mark)

- a. 2 sources of braking
- b. Control measures that detect rope slip
- c. Control measures that detect unsafe balance of rope
- d. Control measures that detect rope corrosion

## Question 2

A) You are MEM at a small underground narrow vein antimony mine. The mine needs to construct a new mine entry via a 4.5m diameter raisebore that will go down 200m.

What does WHS(M&PS) R 2022 requires you to notify the Resources Regulator of before constructing the new mine entry? (1 Mark)

B) List 6 separate details that must be included in this notification as per WHS (M&PS) R 2022. (6 Marks)

C) How many days prior to commencement of works must you notify the Resources Regulator as a minimum? (1 Mark)

D) What options does WHS (M&PS) R 2022 provide the mine operator if you need the notification approved inside the minimum time described in the previous question? (1 Mark)

E) Once the raise is completed a second leg to the raisebore will be added. The development will be all underground and not require a new mine entry. The Raise will be 4.5m diameter and 180m long.

What notification - if any - will be required to be submitted to the Resources Regulator? (1 Mark)

### Question 3

A) The mine referred to in Question 3 will use an earthmoving contractor to construct the tailings dam. The mine will also use a geotechnical consultant to undertake Quality Assurance Quality Control .

What does WHS (M&PS) R 2022 require the mine operator to do before allowing the contractors to work onsite? (1 Mark)

B) According to CI 19(2)(f) WHS (M&PS) R 2022, what must the mine operator's Safety Management System state about the control measures that will be used to control risks to health and safety of contractors? (3 Marks)

C) During the works, a large crane lift is required to be completed. The contractor will organise for a crane contractor to come to site to conduct the lift. You expect a risk assessment on the lift to be conducted before the contractor comes to site. What 3 workers would you expect to be a part of the Risk Assessment at a minimum? (2 Marks)

D) How would you supervise the crane lift? (1 Mark)

E) How would you as the MEM ensure that the Crane complies with the mine's Mechanical Engineering Control Plan considering the crane operator is a sub contractor? (2 Marks)

F) What guidance from the Resources Regulator should the site Mechanical Engineering Control Plan map to? (1 Mark)

## **Question 4**

A) The mine needs to develop a Principal Hazard Management Plan (PHMP) - Ground or Strata and has engaged some geotechnical consultants to assist in its development.

What 5 hazards does the WHS (M&PS) R 2022 Schedule 1 Part 1(1) require you to consider in the PHMP– Ground or Strata? (5 Marks)

B) As per CI 29 WHS (M&PS) R 2022, when must the mine operator review the PHMP - Ground and Strata? (2 Marks)

C) As per CI 28(2)(b) WHS (M&PS) R 2022, in what way must the PHMP - Ground and Strata be expressed? (1 Mark)

D) As per CI 27(3)(b) WHS (M&PS) R 2022, what other risk(s) must the mine operator consider in the PHMP - Ground and Strata that is not directly related to ground and strata? (2 Marks)

## **Question 5**

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A) You are MEM at a new large quarry that is weeks away from commencing pre-stripping and construction of the crushing plant. Before this occurs, you must develop a new Health Control Plan and a Principal Hazard Management Plan - Air quality or dust or other airborne contaminants.

The crusher is very loud and Section 58 of the WHS Act 2011 requires audiometric testing of workers who work continually in loud environments. How often must this testing occur? (1 Mark)

B) What datasets will you need to develop your health control plan to determine the airborne contaminants workers are likely to be exposed to? (2 Marks)

C) A Principal Hazard Management Plan for Dust and Airborne Contaminants as per WHS (M&PS) R 2022 Cl 28(3) is required to describe how 9 separate sub clauses are managed. Describe 6 of those sub-clauses. (your answer does not need to quote the legislation exactly but paraphrase it) (6 Marks)

D) Complete the sentence. (1 Mark)

Assuming the mine identifies respirable silica dust as a hazard. As per Cl 89 and schedule 6 WHS (M&PS) R 2022, any person who carries out sampling at the mine must be \_\_\_\_\_.

## Question 6

A) Cl 78 WHS R 2017 requires the mine operator to manage the risk of a worker falling from height. How is this risk defined? (1 Mark)

B) Cl 189(4) WHS R 2017 requires that the designer of any plant or equipment that uses guarding must design the guarding so that it has 3 features. List 2 of those legislated features. (4 Marks)

C) Cl 223(2) WHS R 2017 requires that Lasers must be designed, manufactured and installed so as to prevent what? (1 Mark)

D) You are MEM at a mine that contracts a commercial diving company to clean process water tanks.

As per CI 170 WHS R 2017, what certificate for each diver must the business owner maintain onsite for 1 year once the works are completed? (1 Mark)

E) According to section 3.2.1(2)(b) of the Australian Code for the Transport of Explosives by Road and Rail, all explosives packaging must have what number? (1 Mark)

F) As per AS2187 Section 2.6.2.2, an underground magazine shall be located so it is segregated from 5 hazards.

List 2 of the 5 hazards. (2 Marks)

## Question 7

A) Total fan pressure is a total of which two pressures? (1 Mark)

- a. Velocity and static
- b. Barometric and velocity
- c. Barometric and static
- d. Bernoulli and barometric

B) Young's modulus describes the relationship between? (1 Mark)

- a. Confined Compressive Strength and Unconfined Compressive Strength
- b. Tangential strength and horizontal stress
- c. Stress and strain
- d. Horizontal stress and Confined Compressive Strength

C) By grouting a split set, the compressive load it can take typically doubles. What is the best explanation for this? (1 Mark)

- a. The grout creates confinement that reduces strain in the split set and therefore adds strength
- b. The grout buttresses the split set providing greater horizontal strength
- c. The grout stops corrosion in the split set. Therefore when pull tested after 5 years it typically has twice the strength of an ungrouted split set.
- d. The grout provides greater rigidity to the split set. This rigidity nearly triples the amount of shear stress the bolt can withstand which translates into a doubling of the compressive load it can stand.

D) When using a vane anemometer to take a reading in a 5 x 5.5m drive, what best describes the method? (1 Mark)

- a. Hold anemometer in the centre of the drive for 30 secs, with the average of this result being the airspeed through the drive.
- b. With a steady motion over 1 minute traverse the anemometer in a single plane and a wave like fashion up and down as it travels from the top right hand corner to the top left hand corner of the drive.
- c. Form a 3 x 3 grid across the drive cross section and measure the airspeed for 20 sec in each location. Then take the average of these 9 results to determine the final air speed
- d. Form a 3 x 3 grid across the drive cross section and measure the airspeed for 20 sec in each location. Then take the average of these 9 results to determine the final air speed. You then double check this result by using a smoke tube and timing it over a distance of 6m.

E) If a drive was on an orientation so that there was no shear stress then: (1 Mark)

- a. The 3 normal stresses would also be the 3 principal normal stresses,  $\sigma_1$ ,  $\sigma_2$  and  $\sigma_3$
- b. The 3 normal stresses would be perpendicular to the 3 principal stresses  $\sigma_1$ ,  $\sigma_2$  and  $\sigma_3$
- c. There is no principal stress
- d. There is no normal stress

F) As opposed to Stope Hydraulic radius, how is the hydraulic radius of a hangingwall calculated? (1 Mark)

- a. Area/Perimeter
- b. Perimeter /Area
- c. Stope Volume/Hanging wall Area
- d. Hanging wall Area/Stope Volume

G) The ANCOLD 2019 guidelines require a factor of safety to be applied to a tailings dam wall. What is the major problem with a Factor of Safety approach vs assigning a probability of failure to a dam wall? (1 Mark)

- a. It is not possible to evaluate the risks associated with the dam because the mine has not evaluated the probability of the dam failing
- b. The factor of safety only applies in a static environment and does not consider the dynamic nature of a dam where additional loads can be exerted on the walls like seismicity and rising phreatic surface.
- c. The factor of safety provides a false level of confidence as it implies a redundancy in the design.
- d. The Factor of Safety approach is used in all engineering standards so the issue is not the use of a factor of safety but how industry calculates probability of failure.

H) Assuming **no logistical, or ventilation restrictions**, what is likely the **biggest consideration** as to why a low grade 2mtpa Pb/Ag/Zn greenfields mining operation would backfill stopes with pastefill over Cemented Rock Fill? (1 Mark)

- a. It is a safer form of backfilling as a loader no longer needs to work near an open hole
- b. Typically uses less cement, increased fill rates and typically lower operational costs compared to Cemented Rock Fill
- c. Produces a more consistent and stronger fill product, steralising less ore than Cemented Rock Fill
- d. Reduces the size of any tailings dam and therefore saves in mining operating costs and mill capital costs

I) The goldfields region of Western Australia has a Poissons ratio of 2.73. This means that for mines in the district: (1 Mark)

- a. For every newton of horizontal stress there is 2.73 newtons of shear stress
- b. For every newton of horizontal stress there is 2.73 newtons of vertical stress
- c. For every newton of shear stress there is 2.73 newtons of vertical stress
- d. For each Newton of horizontal stress, there is 2.73 newtons of horizontal stress

J) Why is the sequencing of stopping so important geotechnically? (1 Mark)

- a. Manage abutment stresses
- b. Manage horizontal stresses
- c. Manages shear stresses
- d. Best way to reduce the size of the hanging wall

## Question 8

A) You are the new MEM at a 1.2mtpa open stoping operation. Stopes are typically 6-8m wide, 25m high and 20m long. The mine uses hydraulic fill.

What is the risk of using hydraulic fill vs other forms of cemented fill? (2 Marks)

B) The mine has a 10 year Life of Mine. You decide to update the Risk Assessment regarding the use of hydraulic fill. Outside of the OHS manager who will be used to co-ordinate the Risk Assessment, which 4 people would you include in the Risk Assessment? (4 Marks)

C) The Risk Assessment identifies the management of corporate memory as a control in controlling the risk of inrush and inundation from stopes filled with hydraulic fill. Currently signed backfill plans and designs are managed on a basic folder structure on the site intranet. Asbuilts for stopes and future designs are kept on the mine software. There are no well understood naming conventions and colour conventions to understand when stopes were filled, if future designs have been approved and what material was used to fill each stope. What procedural changes would you make so the status of every stope and drive is understood by relevant workers? (3 Marks)

D) You have developed the procedure discussed in the previous question. How will you implement the procedure to ensure it is used correctly across the mining operation? (2 Marks)

E) What workers will need to be trained in the convention? (2 Marks)

F) The Geology department needs to use the new convention, however they keep reverting back to the old convention. None of the geologists report to you. How will you seek to get the geology department to use the new convention? (2 Marks)

## Question 9

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A) You are the MEM of an underground mine. At 2:10am, you received a phone call to inform you that a jumbo offsider has walked into unsupported ground while carrying mesh and has been struck and killed by a rock weighing approximately 2 tonnes.

What does the WHS Mines and Petroleum Regulations and Act 2022 and 2013 respectively require you to do immediately? (2 Marks)

B) What would be your actions over the next 6 hours as the MEM beyond your answer to the previous question? (5 Marks)

C) By 3:00pm that same day, the Resources Regulator has collected relevant evidence and released the scene. What will be your actions with underground workers (ie not internal corporate requirements) before recommencing production? (6 Marks)

D) The mine is a checkerboard style open stoping operation with pastefill. What control could be put in place to eliminate worker exposure to unsupported ground in stoping areas? (1 Mark)

E) What document as per WHS (M&PS) R 2022 must be reviewed after this incident? (1 Mark)

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