



Regional
NSW

CANDIDATE NUMBER: _____ (write in from your letter)

EXAMINATION: Mining engineering manager of underground mines
other than coal mines

EXAM PAPER: PAPER 1

DATE: Wednesday 21 February 2024

EXAMINATION

BOOKLET



**Regional
NSW**

(PAPER 1)

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

**EXAMINATION FOR CERTIFICATE OF COMPETENCE
Mining engineering manager of underground coal mines**

Wednesday 21 February 2024
12:00pm to 3:30pm (3 hours 30 minutes)
Venue: Online

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

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.

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

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

Part A Section: 1

QNo 1. What is the maximum amount of Division 1.1 explosives permitted to be in a Category 1 magazine? 1 Mark

- A. 5kg
- B. 10kg
- C. 3t
- D. 10t

QNo 2. What is the minimum distance required between an underground detonator and explosives magazine? 1 Mark

- A. 8.0m
- B. 8.5m
- C. 9.5m
- D. 10m

QNo 3. Who is the Regulatory Authority for explosives on a mine site in NSW? 1 Mark

- A. NSW Police
- B. NSW Resources Regulator
- C. Safework NSW
- D. Planning NSW

QNo 4. Under section 13 of the NSW Explosives Regulations, for how many years is a security clearance for a natural person to handle explosives granted for? 1 Mark

- A. 2
- B. 3
- C. 4
- D. 5

QNo 5. Which of the answers is not correct.

According to Section 23(2) WHS Act 2011, The manufacturer of plant must ensure, so far as is reasonably practicable, that the plant, substance or structure is manufactured to be without risks to the health and safety of persons.....1 Mark

- A. who store the plant or substance at a workplace?
- B. who construct the structure at a workplace?
- C. who, at a workplace service, maintain, or repair?
- D. who handle the substance at a workplace?

QNo 6. As per Section 36, WHS Act 2011, which of the following is not a serious injury or illness? 1 Mark

- A. Any serious eye injury
- B. Any serious head injury
- C. A fractured limb
- D. A spinal injury

QNo 7. Insert the correct answer:

According to Section 104, WHS Act 2011, A person must not engage in discriminatory conduct for _____ reason?1 Mark

- A. a prohibited
- B. any
- C. any specific
- D. a reported

QNo 8. As per Section 15, WHS (M&PS) Regulation 2022, which of the following is not correct regarding when a mine operator must review a control measure? 1 Mark

A. an audit of the effectiveness of the safety management system for the mine or petroleum site

indicates a deficiency in a control measure

B. every 2 years for a control measure used in the management of risk of a Principal Hazard

C. a worker is moved from a hazard or assigned to different work in response to a recommendation

contained in a health monitoring report provided under Part 3

D. an incident referred to in clause 124 occurs

QNo 9. According to Section 39(2) WHS (M&PS) Regulation 2022, regular inspections of the work environment must occur. In the making of the arrangements for inspections, which of the following is not required to be taken into account? 1 Mark

- A. the procedures for conducting inspections
- B. when inspections are to be carried out
- C. the persons competent to conduct inspections
- D. OH&S rep

QNo 10. As per Section 50 WHS (M&PS) Regulation 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

Part A Section: 2

QNo 11. For this question and the following 4, you are Mining Engineering Manager (MEM) at a large hard rock open cut gold/copper mine that is currently under construction.

As the plant and mine are being developed, what High Risk Activity would need to be submitted? 1Mark

QNo 12. As per section 125(3) WHS (M&PS) Regulation 2022, a mine operator must inform the regulator when mining operations commence. Name 4 of the details a notification must include. 6 Marks

Number your answers a) to d)

QNo 13. What options does Section 35 WHS (M&PS) Regulation 2022 provide the mine operator, if you need the High Risk Activity notification approved inside the minimum time described in the previous question? 1 Mark

QNo 14. As per Section 40 WHS (M&PS) Regulation 2022, what must the mine operator consider regarding the temperature and moisture content of the air for an open cut mine? 1 Mark

QNo 15. You have established an air monitoring procedure which involves both static and personal monitoring of the mining operation on a quarterly basis. For how long must these records be maintained as per Section 61(3) WHS (M&PS) Regulation 2022? 1 Mark

Part A Section: 3

QNo 16. The mine referred to in Question 2 has a Safety Management System (SMS). Section 20 WHS (M&PS) Regulation 2022 requires performance standards and audits of the SMS. Provide 2 details the SMS must contain regarding this requirement? 2 Marks

List as a) & b).

QNo 17. Section 32 WHS (M&PS) Regulation 2022 details what the SMS must consider when moving mobile plant. Provide 4 of these. 4 Marks

List as a) to d).

QNo 18. You realise that the mine does not have an emergency plan as per Section 91 WHS (M&PS) Regulation 2022. What are 4 details that the emergency plan must contain? 4 Marks

List as a) to d).

Part A Section: 4

QNo 19. What are four things a survey plan submitted to the Resources Regulator as per Section 116(4) WHS (M&PS) Regulation 2022 must contain? 4 Marks

List as a) to d).

QNo 20. What are 6 reportable incidents per Section 124 WHS (M&PS) Regulation 2022? 6 Marks

List as a) to f).

Part A Section: 5

QNo 21. The gold/silver mine referred to in questions 2 and 3 uses xanthates, sulphuric acid and cyanide that are considered to be hazardous chemicals under Section 329 WHS Regulation 2017. As per Section 343 WHS Regulation 2017, what are the labelling requirements for pipework in the mill? 2 Marks

QNo 22. There is lead associated with the orebody. As per 402(2) WHS Regulation 2017, when assessing a lead process, the person must have regard to 7 variables. Provide 4 of these. 4 Marks

List as a) to d).

QNo 23. Section 376 WHS Regulation 2017 requires the PCBU to report health monitoring results to the NSW Resources Regulator if any remedial measures are recommended. Name one of those remedial measures. 2 Marks

QNo 24. What 2 x legislated documents, as per the WHS (M&PS) Regulation 2022, must detail how lead is managed at your operations? 2 Marks

List as a) & b).

Part A Section: 6

QNo 25. You are the Mining Engineering Manager (MEM) at a mine that is encountering sulphide dust explosions. What are 3 control measures that the mine operator must implement so far as is reasonably practicable, as per Section 53 WHS (M&PS) Regulation 2022? 3 Marks

List as a) to c).

QNo 26. As per Section 56(1)(a) WHS (M&PS) Regulation 2022, how often must an underground mine conduct samples and analysis of exhaust emissions from diesel engines by a qualified person? 1 Mark

QNo 27. How often must workers be trained in the use of self rescuers, as per Section 103(5)(b) WHS (M&PS) Regulation 2022? 1 Mark

QNo 28. Name 4 Control Plans required as per WHS (M&PS) Regulation 2022. List as a) - d). 2 Marks

QNo 29. Fill in the blank: According to section 3.2.1(2)(b) of the Australian Code for the Transport of Explosives by Road and Rail (Australian Explosives Code), all explosives packaging must have a _____ number? 1 Mark

QNo 30. As per AS2187 Section 5.1, name 2 of the list of things you must check for and address on your surface magazine when a thunderstorm approaches? List as a) & b). 2 Marks

Part B Section: 7

QNo 31. As mining depth increases the phenomenon of adiabatic compression/expansion becomes a consideration in designing a ventilation circuit. Assuming fresh air goes down the decline and return air travels up the return rise, what best describes this phenomenon?

1 Mark

- A. As air travels down the decline volumes increase and temperatures drop
- B. As air travels up the return air rise volumes increase and temperatures drop
- C. As air travels up the return air rise volumes decrease and temperatures drop
- D. As air travels down the decline volumes decrease and temperatures drop

QNo 32. What is the name given to the principal formula/equation used to model ventilation volumes and pressures as it considers drive length, friction losses, drive area, pressure and volume? 1 Mark

- A. Bournoulli's equation
- B. Atkinsons formula
- C. Alveolar gas equation
- D. Fan pressure formula

QNo 33. 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 un-grouted 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.

QNo 34. You are Mining Engineering Manager (MEM) at a very high grade lead/silver/zinc, narrow vein underground mine, where all of the development is in siltstones and sandstones that are prone to "squeezing" and "moving". You discover that there is a survey error, as the orebody is continually approximately 500mm from where you expect it to be. Which of the following would not be a likely cause of the error? 1 Mark

- A. Transferring from one grid to another
- B. Survey has not ever conducted a close out loop
- C. Sole use of wall stations
- D. When in high grade ore interference is experienced in the theodolite

QNo 35. If a drive was on an orientation so that there was no shear stress then which of the following would apply? 1 Mark

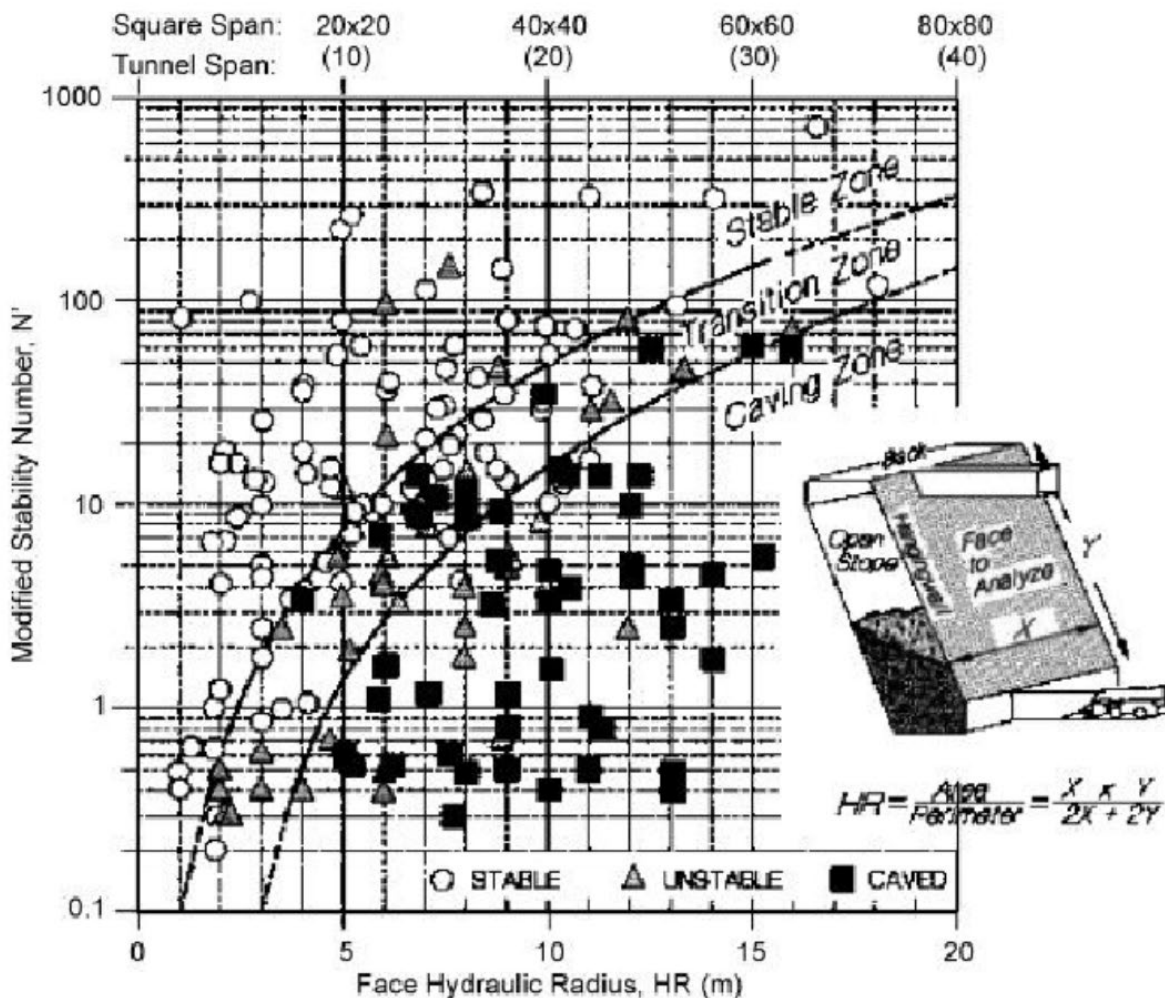
- A. The 3 normal stresses would also be the 3 principal normal stresses, σ_1 , σ_2 and σ_3 .
- B. The 3 normal stresses would be perpendicular to the 3 principal stresses σ_1 , σ_2 and σ_3 .
- C. There is no principal stress.
- D. There is no normal stress.

QNo 36. Why is confinement in the application of backfill at some mining operations so important in the management of geotechnical risk? 1 Mark

- A. Reduces strain which intern reduces stress.
- B. Reduces the Hydraulic radius of the stope.
- C. Manage abutment stresses.
- D. Reduces dilution when mining neighboring stope.

QNo 37. In relation to the picture of Mathews stability graph, what do you believe is the best description of the Mathews stability curve? 1 Mark

Image source: Geotechnical Considerations for Mining Method Selection of a Potential Underground Iron Ore Mine in Mideastern, Turkey, Tutluoglu et al 2013.



Mathew's Stability Graph

A. Uses a Monte-Carlo simulation to predict 10,000 stopes, whose performance was back analysed.

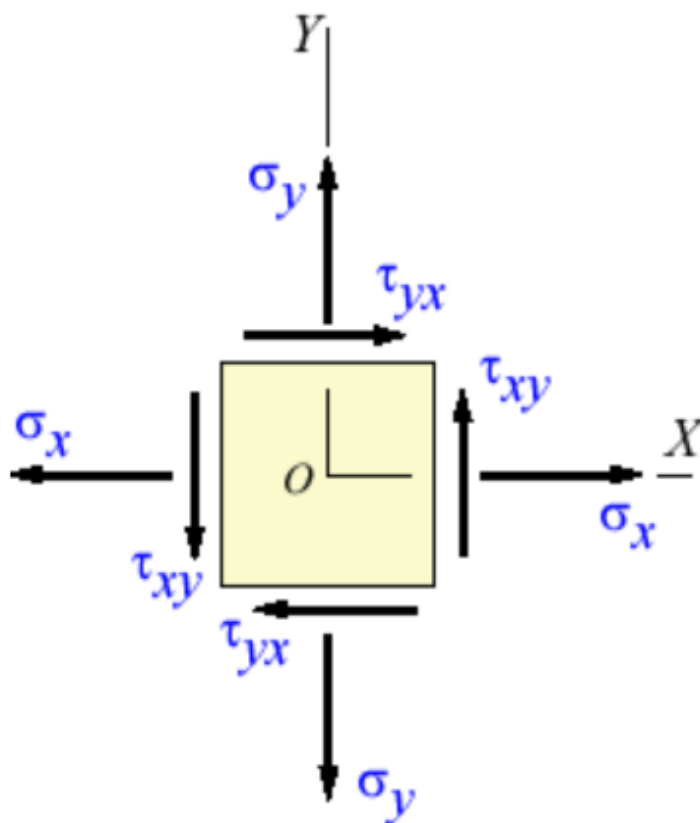
B. Relies on 10,000 finite element analysis models conducted on a series of mines and rock types to determine the Modified Stability Number. This is then plotted against the stope's hydraulic radius.

C. Is a back analysis of a series of stopes where by the "travelling salesman" algorithm to determine the Modified Stability Number and plots it against a stope's Hydraulic Radius.

D. Empirical chart based on the performance of a series of stopes and how they have performed vs their Modified Stability Number.

QNo 38. Referring to the related image below used to describe a transfer of stress, by convention, which of the following is the best description? 1 Mark

Image source: https://www.efunda.com/formulae/solid_mechanics/mat_mechanics/plane_stress_principal.cfm



Stresses in given coordinate system

- A. σ represents normal stress τ represents shear stresses
- B. σ represents shear stress τ represents normal stresses
- C. σ represents compressive stress τ represents tensile stresses
- D. σ represents tensile stress τ represents compressive stresses

QNo 39. 'Moment' is measured in what unit? 1 Mark

- A. Kpa/sec
- B. sec/Kpa
- C. N/m
- D. N/m²

QNo 40. What best describes the advantages and disadvantages of an axial primary fan over a centrifical fan? 1 Mark

- A. Lower operating costs, higher Capital costs, more efficiency, less flexibility managing pressures
- B. Higher operating costs, lower Capital costs, less efficiency, less flexibility managing pressures
- C. Higher operating costs, lower Capital costs, less efficiency, more flexibility managing pressures
- D. Lower operating costs, lower Capital costs, less efficiency, less flexibility managing pressures

Part B Section: 8

QNo 41. You are the new Mining Engineering Manager (MEM) at a 1.8mtpa open stopping operation. Stopes are typically 6-8m wide, 25m high and 20m long. You have gone from contractor to owner operator mining. You have 4x crews, with each crew having 5x trucks and 2x loaders running at any one time. Whilst you have managed to retain most staff, you have lost 16x truck drivers and 4x nippers/jumbo offisders. You have decided your only realistic option is to replace these workers with employees who have never worked in the mining industry before. Use this information to answer the following 5 questions, including the following:

Use the above information as the basis for this and the following 4 questions:

You have reviewed the mine operator's truck driving onboarding programe and you are confident it adequately trains workers, it includes an induction, use of a simulator, and 2x weeks riding in the "dickie seat" with an experienced truck driver. Due to the scale of the change and the number of "green" operators who you are onboarding, provide 2x additional controls you will include beyond the current truck driver onboarding programme? 2 Marks

QNo 42. You have reviewed the mine operator's nipper/jumbo offsider training package and again you are comfortable with the programme. It includes obtaining a site based permit to drive a light vehcile, completion of the jumbo offisders ticket, manual handling specific to handling bolts, plates and mesh and the general site induction. There is only 1x nipper/jumbo offisder on each crew and all 4 will need replacing. What are 2x additional controls you will implement to the current training program? 2 Marks

Short answers only.

QNo 43. Changing over to owner operator will require the updating and development of the Safety Management System (SMS) as the mine operator will no longer be using the systems provided by the contractor. You still have access to all of the contractors policies and procedures to assist in developing your own. Explain 5 key steps you would take in the process you will use to update the SMS as the mine goes to owner/operator. 5 Marks
Dot point/short answers.

QNo 44. One of the major reasons the mine operator has decided to go owner operator is to have more control over the quality of work to reduce dilution in both ore development and stopping. Assuming all equipment and consumables will remain the same, provide 4x management strategies you will use to reduce dilution in both development and production? 4 Marks

Dot point/short answers.

QNo 45. Provide two additional health and safety risks the transition could pose to office staff, such as engineers, surveyors and geologists, who regularly go underground? 2 Marks
Dot point/short answers.

Part B Section: 9

QNo 46. You have taken over as the Mining Engineering Manager (MEM) of a large 2.5mtpa quarry that has 60% silica in its ore. The quarry uses dry processing and you observe a thick plume of dust coming from the plant, however all workers in the plant wear Respiratory Protective Equipment. Use the above information when answering this and the following 5 questions to follow: What will be the first 4x actions you would take? 5 Marks

List a) to e).

QNo 47. When you ask for both personal and static monitoring data, no-one in the business can find the results or has actioned the results. You contact the contracted hygienist who provides you with all the monitoring results they have for the mining operation. These results show large exceedences for both inhalable and respirable dust on every monitoring programme conducted in the plant. What is the first thing you will do upon discovering these records? 1 Mark

QNo 48. What are 2 of the requirements for Respiratory Protection Equipment (RPE) to be effective? 3 Marks

QNo 49. The Quarry has a 20+ year mine life. Now you have the monitoring results, what will be your actions over the next 6 weeks? List dot point/short answers. 3 Marks

QNo 50. Provide 2x higher order controls than RPE used to manage dust in mobile plant at the quarry. 2 Marks

QNo 51. Provide 2x higher order controls than RPE used to manage dust in in the quarry's processing plant. 2 Marks

END OF QUESTIONS

END OF PAPER