



mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

Learners/Examiners Guide

for the

Assessment and Certification

of

Blasting Certificate

HOLDERS for Fiery Mines

February 2017

TABLE OF CONTENTS

SECTION 1	:	Introduction	Page 3
SECTION 2	:	Syllabi	Page 4
		Module 1 Generic Section	Page 4 - 6
		Module 2 Blasting Section	Page 6 - 8
		Module 3 Continuous Miner Section	Page 8 - 9
		Module 4 Long-Wall Mining Section	Page 10 - 11
SECTION 3	:	Assessment Guidelines (MQA Principles)	Page 12
SECTION 4	:	Assessment Score Sheets	Page 13
		4.1 Compulsory Questions	Page 13
		4.2 Choice Questions	Page 13
SECTION 5	:	Questions and Model Answers	Page 14
		Module 1: Generic Section	Page 15
		1. Flameproof equipment	Page 16 - 21
		2. Mine gases	Page 21 - 25
		3. Ventilation and dust	Page 25- 33
		4. Mine Health and Safety Act	Page 33 - 37
		5. Belt conveyors	Page 37 - 42
		6. Start of shift procedures	Page 42 - 48
		7. Strata control	Page 48 - 54
		Module 2: Blasting Section	Page 55
		1. Coal cutting	Page 56 - 58
		2. Electric drilling	Page 58 - 66
		3. Explosives	Page 66 - 72
		4. Blasting procedure	Page 72 - 79
		5. Loading	Page 79 - 81
		6. Pillar extraction (stooping)	Page 81 - 85
		Module 3: Continuous Miner Section	Page 86
		1. Legal requirements	Page 87 - 88
		2. Environmental control	Page 88 - 92
		3. Mining	Page 92 - 99
		4. General	Page 99 - 103
		5. Pillar extraction	Page 103 - 108
		Module 4: Long-Wall Mining Section	Page 109
		1. Equipment	Page 110 - 113
		2. Initial examination and ventilation	Page 113 - 115
		3. Mining Techniques	Page 116 - 120
		4. Legal requirements	Page 120 - 121

SECTION 1

INTRODUCTION

PURPOSE

The purpose of this guide is to assist examiners/assessors and training service providers towards implementing a structured, fair and consistent method of assessment. It also attempts to bring about uniformity across the various Regions of the Department of Mineral Resources.

SYLLABI

The syllabi is clearly defined so that the learners, training service providers and examiners/assessors are fully aligned with the study, assessment/examination material for the Blasting Certificate of Competency for Fiery Mines. The syllabi is contained in section 2 of this guide.

ASSESSMENT GUIDELINES

This section has been included to guide the learners and examiners/assessors on the assessment principles, which have been implemented. The assessment guidelines are contained in section 3 of this guide.

ASSESSMENT SCORE SHEET

This section has been included for assessment purposes. There are two types of assessment score sheets namely score sheet for compulsory questions and score sheet for choice questions. The two types of assessment score sheets are referred to in section 4 of this guide.

QUESTIONS AND MODEL ANSWERS

Questions and model answers that are relevant to the Blasting Certificate for Fiery Mines are contained in section 5 of this guide.

GENERAL RULES FOR EXAMINATION/ASSESSMENT

Examinations/Assessments are to be conducted in accordance with this guide.

IMPORTANT INFORMATION

This Examiners/Learners Guide for the assessment and certification of Holders of Blasting Certificate for Fiery Mines has been made available to all the Examiners/Assessors, Employers Representatives, Employees' Representatives, Training Service Providers, Mining Qualifications Authority (MQA) and other interested parties.

Copies of this Examiners/Learners Guide for the assessment and certification of Blasting Certificate Holders for Fiery Mines can be obtained from the Department of Mineral Resources.

SECTION 2

SYLLABI

BLASTING CERTIFICATE FOR FIERY MINES

This syllabi includes the relevant provisions of the Mine Health and Safety Act, 1996 (Act 29 of 1996) as amended and the regulations under the Minerals Act, 1991 (Act 50 of 1991) still in force in terms of schedule 4 of the Mine Health and Safety Act, 1996 (Act 29 of 1996) as amended.

MODULE 1: GENERIC SECTION

1 FLAMEPROOF

- 1.1 Hazardous area
- 1.2 Define different type of apparatus
- 1.3 Intrinsically safe equipment
- 1.4 Duties of the competent persons
- 1.5 Dangers associated with damaged cables
- 1.6 Electrical protection mechanisms
- 1.7 Electrical interlocking
- 1.8 Diesel engines
- 1.9 Construction of flameproof enclosures
- 1.10 Reasons for using flameproof equipment
- 1.11 Causes of overheating
- 1.12 Types of flameproof joints
- 1.13 Intrinsically safe apparatus
- 1.14 Legal requirements regarding flexible trailing cables
- 1.15 Electrical protection mechanisms
- 1.16 Examination of flameproof lights

2 MINE GASES

- 2.1 Oxygen, Nitrogen, Hydrogen, Methane, Carbon dioxide, Carbon monoxide, Hydrogen sulphide, and Nitrous fumes
- 2.2 Relative density
- 2.3 Composition in the air
- 2.4 Minimum quantity of oxygen
- 2.5 Flammable gases
- 2.6 Noxious gases
- 2.7 Combustible ranges of methane
- 2.8 Causes of methane ignitions
- 2.9 Sources of carbon monoxide
- 2.10 Maximum allowable quantity of carbon monoxide
- 2.11 Sources of hydrogen sulphide
- 2.12 Sources of nitrous fumes
- 2.13 Gases in old/abandoned workings
- 2.14 Headings under which mine gases are studied and the reasons for studying mine gases
- 2.15 Eight common gases and their symbols
- 2.16 Liberation of methane
- 2.17 Sources of hydrogen
- 2.18 Effects of carbon dioxide on a human body
- 2.19 Effects of carbon monoxide on a human body
- 2.20 Smell of hydrogen sulphide
- 2.21 Maximum allowable quantity of hydrogen sulphide
- 2.22 Maximum allowable quantity of nitrous fumes

3 VENTILATION AND DUST

- 3.1 Quality of mine air
- 3.2 Ventilation district
- 3.3 Quantity and velocity
- 3.4 Section electric fans
- 3.5 Ventilation appliances
- 3.6 Basic ventilation plans
- 3.7 Coal dust explosions
- 3.8 Incombustible dust
- 3.9 Reasons for ventilation
- 3.10 Managers duties regarding ventilation

4 MINE HEALTH AND SAFETY ACT

- 4.1 Objectives
- 4.2 Employees' rights to health and safety
- 4.3 Rights and powers of health and safety representatives
- 4.4 Appointment of Chief Inspector of Mines
- 4.5 Functions of Chief Inspector of Mines
- 4.6 Assistance during inspections
- 4.7 Offences
- 4.8 Convictions
- 4.9 Definitions
- 4.10 Employer's duties regarding code of practice
- 4.11 Employees' duties
- 4.12 Employers' responsibilities
- 4.13 Employees right regarding dangerous working place
- 4.14 Appointment of Health and Safety Representatives
- 4.15 Purpose of Mining Qualification Authority
- 4.16 Definitions
- 4.17 Exit medical examination

5 BELT CONVEYORS

- 5.1 Manager's responsibilities
- 5.2 Legal requirements
- 5.3 Examination of conveyor and feeder equipment
- 5.4 Dust allaying
- 5.5 Precautions before any work may be carried out
- 5.6 Causes and solutions for possible problems on a belt conveyor
- 5.7 Firefighting equipment
- 5.8 Conveyors in series
- 5.9 Material used for manufacturing conveyor belts
- 5.10 Components of conveyor feeder system
- 5.11 Physical conditions at drive unit
- 5.12 Accumulation of dust

6 START OF SHIFT PROCEDURES

- 6.1 Change house
- 6.2 Appointment to search persons for prohibited articles
- 6.3 Duties of a Lampsman
- 6.4 Waiting place
- 6.5 Initial examination
- 6.6 Gas Detection Instrument
- 6.7 Reporting of gases
- 6.8 Miner's responsibilities regarding safety of persons
- 6.9 Re-examinations of working places during the shift

- 6.10 Section giving off flammable gas freely
- 6.11 Clothes for risk work
- 6.12 Appointment and duties of a banksman
- 6.13 Minimum number of Gas Measuring Instruments
- 6.14 Contraband
- 6.15 Waiting place layout
- 6.16 Miner's duties at waiting place
- 6.17 Persons to accompany a miner during early entry examination
- 6.18 Safe Declaration of working places
- 6.19 Procedures for relieving a miner
- 6.20 Working place that is idle for more than 6 hours
- 6.21 Charge of working place during pillar extraction

7 STRATA CONTROL

- 7.1 Systematic support system
- 7.2 Action if attempt to take down ground unsuccessful
- 7.3 Precautions when withdrawing support
- 7.4 Causes of fall of ground accidents
- 7.5 Appearance of correctly installed roof-bolt
- 7.6 Dangers when intersecting dykes
- 7.7 Deviation from systematic support
- 7.8 Functions of breaker line
- 7.9 Factors influencing stability of joints
- 7.10 Reasons for poorly installed roof-bolt
- 7.11 Signs of horizontal stress
- 7.12 Support of slip
- 7.13 Actions when encountering poor roof conditions
- 7.14 Special support
- 7.15 Dangerous ground
- 7.16 Terminology
- 7.17 Slips
- 7.18 Resin
- 7.19 Position when sounding the roof
- 7.20 Timber packs
- 7.21 Occupational categories at higher risk to falls of ground accidents
- 7.22 Support of fault
- 7.23 Stabilizing coal pillars

MODULE 2: BLASTING SECTION

1 COAL CUTTING

- 1.1 Holding props
- 1.2 Appointment of operators
- 1.3 Dust suppression
- 1.4 Reasons for having two faces
- 1.5 Effects of faces incorrectly cut
- 1.6 Physical conditions before cutting commences
- 1.7 Reasons for cleaning a cut
- 1.8 Different trailing cables
- 1.9 Precautions when holing into two adjacent roadways

2 ELECTRIC DRILLING

- 2.1 Definitions
- 2.2 Marking off shot holes
- 2.3 Requirements before shot holes are marked off

- 2.4 Physical examination prior marking off holes
- 2.5 Visual examination prior to marking off shot holes
- 2.6 Misfires that cannot be dealt with immediately
- 2.7 Method of marking off holes
- 2.8 Distance from any socket
- 2.9 Holes that deviate
- 2.10 Depth of shot hole
- 2.11 Deepening of existing shot hole
- 2.12 Removal of socket plugs
- 2.13 Metal implements
- 2.14 Removal of explosives from charged-up holes
- 2.15 Report on misfires
- 2.16 Drilling in a confined space in the presence of a misfire
- 2.17 Dust control
- 2.18 Tools and equipment needed to drill holes
- 2.19 Inspection of equipment
- 2.20 Inspection of equipment
- 2.21 Loose clothing
- 2.22 Safety precautions
- 2.23 Effects of incorrectly drilled holes
- 2.24 Benefits of correctly drilled holes
- 2.25 Causes of misfires
- 2.26 Hazards associated with misfires
- 2.27 Holes drilled to correct depth
- 2.28 Mobile face drill

3 EXPLOSIVES

- 3.1 Storage
- 3.2 Transportation
- 3.3 Use of explosives
- 3.4 Charging up
- 3.5 Equipment to be used for charging up
- 3.6 Breaking of blasting cartridge
- 3.7 Safe guarding assistants
- 3.8 When to charge up
- 3.9 What holes to be charged up?
- 3.10 Precautions when a charged up face cannot be blasted
- 3.11 Preparation of a primer
- 3.12 Old or damaged explosives
- 3.13 Sequence in which explosives must be used
- 3.14 Taking and relinquishing charge of explosives
- 3.15 Blasting and explosives keys
- 3.16 Hiding or burying of explosives
- 3.17 Definitions
- 3.18 Identification of permitted explosives
- 3.19 Two detonators per charge
- 3.20 Charging rod
- 3.21 Old explosives

4 BLASTING PROCEDURE

- 4.1 Conducting of blasting operations
- 4.2 Flammable gas
- 4.3 Firing of explosive charges
- 4.4 Firing cable
- 4.5 Actions immediately after firing

- 4.6 Shot firing apparatus
- 4.7 Driving through a dyke
- 4.8 Environmental control after firing
- 4.9 Precautions after firing
- 4.10 Misfires
- 4.11 Instructions to guards
- 4.12 Blasting accidents
- 4.13 Drive in advance of 50 metres
- 4.14 Geological disturbances when approaching a dyke
- 4.15 Quantity of explosives per shot hole in stone
- 4.16 Safety precautions

5 LOADING

- 5.1 Examination of trailing cables
- 5.2 Joints on trailing cables
- 5.3 Hazardous area
- 5.4 Flame proofing
- 5.5 Efficiencies
- 5.6 Operator's duties
- 5.7 Dust allaying
- 5.8 Electrical apparatus in hazardous area
- 5.9 Shuttle car anchor points

6 PILLAR EXTRACTION

- 6.1 Description
- 6.2 Hazards associated with stooping
- 6.3 Controls to minimize risks
- 6.4 Extra support
- 6.5 Ventilation
- 6.6 Typical stooping methods
- 6.7 Procedure to extract a pillar
- 6.8 Section layout (45°)

MODULE 3: CONTINUOUS MINER SECTION

1 LEGAL REQUIREMENTS

- 1.1 Appointment of operators
- 1.2 Re-testing of operators
- 1.3 Joints on trailing cables
- 1.4 Operator's duties regarding flammable gas
- 1.5 Detection of flammable gas (operator's duties)
- 1.6 Dust control
- 1.7 Operator's duties regarding flexible trailing cables
- 1.8 Examinations of flexible trailing cables
- 1.9 Supply of water

2 ENVIRONMENTAL CONTROL

- 2.1 Influence of ventilation layout on dust suppression
- 2.2 Causes of dust
- 2.3 Dangers of insufficient ventilation
- 2.4 Daily inspections on scrubber box
- 2.5 Mine standards applicable to ventilation fans
- 2.6 Calibration of on-board CH₄ monitor
- 2.7 Terminology
- 2.8 Factors that will influence air utilization

- 2.9 Reasons for ventilation
- 2.10 Effect of cutting sequence on dust suppression
- 2.11 Dangers of coal dust
- 2.12 Stoppage of main fan
- 2.13 Types of dust suppression systems
- 2.14 Air utilization
- 2.15 Reasons for ventilation measurements

3 MINING

- 3.1 Positioning of machine prior to cutting
- 3.2 Safety tasks prior to cutting
- 3.3 Marking of 90 split using a laser
- 3.4 Pre- requisites for a pre-use checklist
- 3.5 End of shift procedures
- 3.6 Risk assessment
- 3.7 Safety precautions when parking a machine on a slope
- 3.8 Precautions when changing picks
- 3.9 Causes of damage to the continuous miner
- 3.10 Causes of damaged trailing cables
- 3.11 Shuttle car anchor points
- 3.12 Support system
- 3.13 Cutting sequence
- 3.14 Factors that will influence cutting rate
- 3.15 Mining sequence
- 3.16 Safety rules for board and pillar mining
- 3.17 Safety precautions during tramming operations of a continuous miner
- 3.18 Installation of a laser beam
- 3.19 Cutting cycle
- 3.20 Miner's task at end of shift
- 3.21 Special safety procedures during repairs
- 3.22 Important points when installing temporary support
- 3.23 Purpose of the stab jack
- 3.24 Purpose of the cutter head and picks
- 3.25 Cycles of operation
- 3.26 Reasons for holing splits before headings are advanced

4 GENERAL

- 4.1 Advantages of using a continuous miner
- 4.2 Services and facilities required
- 4.3 Terminology
- 4.4 Changing picks
- 4.5 Effects when mining offline
- 4.6 Steps to rectify a heading that is offline
- 4.7 Advantages of using a continuous miner over normal conventional blasting method
- 4.8 Labour compliment
- 4.9 Power supply
- 4.10 Terminology
- 4.11 Suspension of laser

5 PILLAR EXTRACTION

- 5.1 Explanation
- 5.2 Hazards associated with stooping
- 5.3 Control to reduce hazards
- 5.4 Stopping methods

MODULE 4: LONG-WALL MINING SECTION

1 EQUIPMENT

- 1.1 Description and operation of shearer
- 1.2 Description of Armored Flexible Conveyor (AFC)
- 1.3 Purpose of AFC
- 1.4 Chain speed on the AFC
- 1.5 Chain tension on the AFC
- 1.6 Description of the face support
- 1.7 Spacing and attachment of face support to the pan line
- 1.8 Advancing of the face support
- 1.9 Description of the stage loader
- 1.10 Function of the stage loader
- 1.11 Explanation of the tail-end attachment to the stage loader
- 1.12 Description of the typical pantechnicon
- 1.13 Equipment required to operate a long-wall section
- 1.14 Function of the pantechnicon
- 1.15 Starting up of the AFC
- 1.16 Shearer motor
- 1.17 The primary function of AFC
- 1.18 Main function of the stage loader
- 1.19 Hydraulic fluids used to power support

2 INITIAL EXAMINATION AND VENTILATION

- 2.1 Miner's duties in the main gate
- 2.2 The importance of ventilation control
- 2.3 Typical ventilation layout

3 MINING TECHNIQUES

- 3.1 Terminology
- 3.2 The controls exercised when cutting a web
- 3.3 The importance of horizon controls
- 3.4 Methods of controlling horizons
- 3.5 Face alignment
- 3.6 Face creep
- 3.7 Control of face creep
- 3.8 Methods of face creep
- 3.9 Efficiencies
- 3.10 Advantages of retreat mining methods
- 3.11 The main disadvantage of the retreat mining method
- 3.12 Face layout
- 3.13 Services
- 3.14 Power supply
- 3.15 Location of the main electrical switchgear
- 3.16 Description of the pantechnicon
- 3.17 Sequence of face operations
- 3.18 Typical labour complement
- 3.19 Factors that would influence the rate of production

4 LEGAL REQUIREMENTS

- 4.1 Appointment of operators
- 4.2 Re-testing of operators
- 4.3 Joints on trailing cables
- 4.4 Operator's duties
- 4.5 Dust control

4.6 Examination of flexible trailing cables

4.7 Water supply

SECTION 3

ASSESSMENT GUIDELINES

WHAT IS ASSESSMENT?

Assessment is a process of gathering evidence and making judgment about a person's knowledge and skills. There are various purposes and forms of assessment. In the case of the Blasting Certificate, the candidate's knowledge and skills is assessed, using the syllabi, questions and model answers contained in this guide.

During the assessment, evidence is collected that is used as the basis on which to make judgment about the person's knowledge and skills. Assessment should be as close as possible to the way that knowledge and skills are applied.

ASSESSMENT PRINCIPLES

It is envisaged that Blasting Certificate assessment process will be based on the principles listed below:

PRINCIPLES	DEFINITIONS
Access to assessment	Be conveniently available to all employees.
Developmental	Yield results that candidates, programme planners and others can use as part of development processes to improve the performance of learners and the services of programmes, such as career counseling.
Fairness	Use methods, instruments and processes which are sensitive to various forms of bias and discrimination, such as cultural values, language, etc.
Integrative	Assess the skills, knowledge and value outcomes of learning in an integrative manner and not in isolation from each other.
Multi-lingualism	Be conducted in accordance with the Directive for Blasting Certificate for Fiery Mines so that language must not be a barrier to demonstrating one's competence. Candidates have the right to assessment in the language of their choice, whenever possible.
Outcomes-based assessment	Be based on learning outcomes stated in the Directive for Blasting Certificate for Fiery Mines.
Relevance	Focus on skills, knowledge and values that are relevant to the learning outcomes; and be appropriate and close to the ways in which people learned and how they will use or apply the skills and knowledge which are being assessed.
Reliability	Be reliable, i.e. the assessment must produce similar results consistently, regardless of assessor or context.
Transparency and democracy	Be clear and understandable to the candidates.

SECTION 4

The examination/assessment consists of two types of questions namely compulsory questions and choice questions.

4.1 COMPULSORY QUESTIONS

- a) The score sheet to compulsory questions attached as DMR 312 must be used in preparing for, and assessing a candidate
- b) The examiner must assess/examine the candidate on a minimum of five compulsory questions in each subject (All candidates must be examined/assessed on equal number of questions).
- c) The pass mark on compulsory questions is 100%.
- d) Questions asked under the compulsory section relate to core knowledge that a miner is required to have.
- e) The intention of the compulsory question is to ascertain whether the candidate has the knowledge of issues that may impact on the health and safety of employees under his/her control.
- f) The candidate must answer all questions asked that may impact on the health and safety of employees by demonstrating an understanding of the associated risks to the satisfaction of the examiner in the abovementioned part of the examination/assessment.
- g) The examiner must record all questions asked and complete the 'Assessor Remarks' section on the score sheet if the candidate gives an unsatisfactory answer.

4.2 CHOICE QUESTIONS

- a) The score sheet for choice questions attached as DMR 313 must be used in preparing for, and assessing a candidate.
- b) The examiner must assess/examine the candidate on a minimum of five choice questions in each subject (All candidates must be examined/assessed on equal number of questions).
- c) The pass mark on choice questions is 60%.
- d) The examiner is not restricted to only the abovementioned questions, provided that the question he/she may ask are still within the boundaries of the syllabus and remain relevant to the Blasting Certificate of Competency for Scheduled Mines.
- e) The examiner must record all the questions asked and completes the "Assessor Remarks" section on the choice questions score sheet if the candidate gives an unsatisfactory answer.

SECTION 5

QUESTIONS AND MODEL ANSWERS

MODULE 1: GENERIC SECTION

8. Flameproof equipment
9. Mine gases
10. Ventilation and dust
11. Mine Health and Safety Act
12. Belt conveyors
13. Start of shift procedures
14. Strata control

MODULE 2: BLASTING SECTION

7. Coal cutting
8. Electric drilling
9. Explosives
10. Blasting procedure
11. Loading
12. Pillar extraction (stooping)

MODULE 3: CONTINUOUS MINER SECTION

6. Legal requirements
7. Environmental control
8. Mining
9. General
10. Pillar extraction

MODULE 4: LONG-WALL MINING SECTION

5. Equipment
6. Initial examination and ventilation
7. Mining Techniques
8. Legal requirements

COAL MINER'S CERTIFICATE

MODULE 1

GENERIC SECTION



1 FLAMEPROOF EQUIPMENT

A COMPULSORY QUESTIONS

Question 1

Define a hazardous area and state the legal responsibility regarding a hazardous area.

Answer

[MA Definitions]

Hazardous area means:

- a) In respect of a coal mine
 - i. a return airway; or
 - ii. an area within 180 metres of any working face, or
- b) Any area in or at a mine or at a works in addition to an area referred to in (a) where there may be a risk of igniting gas, vapour, or any other explosive material
- c) Any hazardous area in or on a mine, identified by the manager and recorded on a plan or in a register provided for that purpose.

Question 2

Define the following terms:

- a) Explosion protected apparatus
- b) Flameproof apparatus
- c) Intrinsically safe apparatus
- d) Increase safety apparatus

Answer

[Code of Practice]

- a) **Explosion protected apparatus** means any apparatus designed for use in a hazardous area and includes flameproof apparatus, intrinsically safe apparatus and increased safety apparatus.
- b) **Flameproof apparatus** means apparatus of which the enclosure will withstand, without damage, any explosion of any flammable gas or vapour that may occur within it under practical conditions of operation within the designed rating of the apparatus (recognized overload, if any, associated with rating) and will prevent the transmission of flame such as will ignite any flammable gas or vapour which may be present in surrounding atmosphere.
- c) Components that produce incendiary sparks during normal operations must be housed in flameproof enclosures. Components which do not produce sparks during normal operation but which may on occasion be expected to fail and produce sparks under faulty conditions, such as conventionally designed motors and transformers, must also be housed in flameproof enclosures.
- d) **Intrinsically safe apparatus** means electric apparatus constructed in such a manner that, when connected and used, any sparking that may occur under any service or faulty condition is not capable of igniting flammable gas.
- e) **Increase safety apparatus** means apparatus in which special precautions have been taken to prevent sparking, arcing and the occurrence of temperatures high enough to ignite gas.

Question 3

Give four examples of intrinsically safe equipment.

Answer

- a) Blasting circuit tester
- b) Telephone
- c) Flammable gas measuring instrument
- d) Flammable gas warning device

Question 4

State the duties of the component person in charge of a production section regarding the use of flameproof equipment.

Answer**[Code of Practice]**

It is the duty of the miner or competent person in charge to ensure that only flameproof equipment, which is maintained to the exact standards under which it was certified, is used in the production section and all other hazardous area. If there is any doubt about equipment being in a fully flame-proofed condition, the inner or competent person in charge must immediately report the fact to an official.

Question 5

Name three possible dangers that can arise from damaged cables.

Answer**[Code of Practice]**

- a) Danger to human life by contact with the damage cable
- b) Sparks igniting gas or coal dust resulting in either fire or explosion
- c) Poisonous gases being formed when cables burns
- d) Production losses

Question 6

Name the three most important electrical mechanisms.

Answer**[Code of Practice]**

- a) Overload protection
- b) Earth leakage protection
- c) Electrical interlocking protection (no volt protection)

Question 7

Explain the method or electrical interlocking used between the trailing cable and the section switch.

Answer**[Code of Practice]**

- a) In the case of apparatus supplied with power from the section switch by means of trailing cable, electrical interlocking must be provided and so arranged that the plug at the section switch or at the apparatus cannot be withdrawn without the section switch cutting the power supply.
- b) It must not be possible to close the switch without the trailing cable plug at the section switch and the apparatus first having been fully inserted in their respective plug sockets.
- c) In trailing cables the pilot circuit conductors are embodied in the cable as one of the cores and is recognizable in that the plug pin is shorter than the phase pins.
- d) Earth continuity between the switch and machine casing must be made before the pilot circuit can be operated to energize the pilot relay.

Question 8

State three reasons why a diesel engine can ignite a flammable atmosphere.

Answer

- a) Flames or sparks emitted from exhaust or from the air inlet if a backfire occurs. A backfire may cause flame emission through joints or deformed components
- b) Excessive temperature of the exhaust system or engine components
- c) Excessive temperature of exhaust gases

Question 9

State which type of internal combustion engine is legally permitted to work underground in any mine.

Answer**[Code of Practice]**

No internal combustion engine other than an approved diesel engine must be used underground in any mine.

Question 10

State when the operation of diesel engines must be discontinued underground.

Answer**[MHTA Regulation 8.8(5)(a)]**

The employer must take reasonably practicable measures to ensure that when a compression ignition engine system is found to have any defects which may cause a significant risk to the safety or health of persons, the use of such engine systems is discontinued immediately. The operation of the diesel engine underground must be discontinued until conditions have been remedied.

- a) If the air at any place where it is being used is found to contain more than hundred parts of carbon monoxide or 5 parts of oxides of nitrogen per 1 00 000 by volume; or
- b) If the engine is found to have any defect which may cause danger to persons;
- c) If the air at any place where such diesel engine is being used contains flammable gas of more than one comma four parts per hundred by volume;
- d) If the ventilation flow where such diesel engine is being used stops, weakens noticeably or reverses.

Question 11

Name the safety devices on the inlet system of a diesel engine.

Answer

- a) Air cleaner
 - i. The intake air system must be fitted with an air cleaner to ensure that the air entering the engine is cleaned.
- b) Intake flame arrester
 - i. The intake air system must be fitted with the flame arrester that will prevent a flame caused by a back fire or other explosion within the system from escaping and igniting flammable mixture that may be present in the surrounding atmosphere.
 - ii. The intake flame arrester must be positioned between the air cleaner and the intake manifold, attached by means of shrouded bolts and constructed that it is capable of withstanding repeated explosions within the intake system.
 - iii. The flame arrester must be inspected and cleaned fortnightly.

Question 12

State the legal requirement for use of diesel engines in a fiery mine with regards to:

- a) Idling
- b) Fuel storage
- c) Filling station
- d) Refuelling
- e) Fire extinguishers
- f) Authorized entry
- g) Notices
- h) Service and repair stations
- i) Garaging

Answer**[MHTA Regulations 8.8(5)(b), (c), 8.8(6) & 8.8(7) and Code of Practice]****a) Idling**

- i. The engine of a diesel powered unit underground must not be kept running idling except while being tested or during brief halts while in use.

b) Fuel storage

- i. Diesel engine fuel must be delivered underground in such a manner that no spillage can take place during delivery.
- ii. When the fuel is piped underground the pipes must be drained each time after use.
- iii. The fuel must be stored underground only in robust containers which do not leak.
- iv. The quantity of diesel fuel stored underground must not exceed three (3) days estimated consumption.
- v. The employer must take reasonable practicable measures to ensure that all areas where diesel fuel is stored are clearly indicated on the mines rescue plans contemplated in regulation 17(19).

c) Filling station

- i. Every underground filling station, where diesel powered units are refuelled, must be adequately ventilated, constructed of non-flammable materials and have a smooth impervious floor which at all times must be kept clean.

d) Refuelling

- i. Refuelling of diesel powered mobile units underground must be carried out only at such properly established filling stations.

e) Fire extinguishers

- i. An effective system for extinguishing fire must be installed and kept in proper working order at every place where diesel engines are refuelled.

f) Unauthorized entry

- i. No unauthorized person must enter any filling station and no person must smoke or use an open light in the vicinity of any filling station.

g) Notices

- i. In every mine, other than fiery mine, suitable notices prohibiting persons from smoking or using any light within the vicinity of a filling station, must be kept posted up and maintained at the entrances to the filling station.

h) Service and repair stations

a) Every station used for servicing or repairing a diesel powered unit underground must:

- i. Be adequately ventilated
- ii. Be constructed of non-flammable materials and have an impervious concrete floor;
- iii. Be provided with active means other than a pit for inspecting the unit from below, and
- iv. Be provided with equipment for extinguishing fire.

b) All services, maintenance and repairs to diesel-powered equipment are performed by a competent person.

i) Garaging

- i. The employer must take reasonably practicable measures to ensure that every mobile diesel engine powered unit, when not in use, is kept at a location that is sufficiently ventilated to prevent a build up of diesel fumes in the air at that location sufficient to cause a significant risk when starting up that engine.

1 FLAME PROOF EQUIPMENT

B CHOICE QUESTIONS

Question 1

Explain how flameproof enclosures must be constructed.

Answer

[Code of Practice]

- a) **Flameproof apparatus** means apparatus of which the enclosure will withstand, without damage, any explosion of any flammable gas or vapour that may occur within it under practical conditions of operation within the designed rating of the apparatus (and recognized overloads, if any, associated with the rating) and will prevent the transmission of flame such as will ignite any flammable gas or vapour which may be present in the surrounding atmosphere.
- b) Components that produce incendiary sparks during normal operations must be housed in flameproof enclosure.
- c) Components which do not produce sparks during normal operation but which may on occasion be expected to fail and produce sparks under fault condition, such as conventionally designed motors and transformers, must be also be house in flameproof enclosures.

Question 2

Name the reasons for using flameproof equipment.

Answer

- a) Equipment used in a hazardous area of a fiery mine must not have a surface temperature sufficiently high to cause a fire. It must produce incendiary sparks or if it does produce such sparks or flame capable of

igniting methane, the sparks or flames must be contained within an enclosure capable of withstanding a methane explosion and capable of cooling the hot gasses resulting therefrom.

- b) The principal safeguard against methane explosions is the provision of adequate ventilation to ensure that methane concentration can never build up to an explosive level.
- c) The use of approved equipment must be considered to be a secondary protection to cover the possibility of ventilation failure.
- d) If the ventilation is not sufficient to dilute the methane concentration to safe levels, the electric power supply to the affected area should be isolated and all diesel engines stopped.

Question 3

Name three causes of overheating in flameproof equipment.

Answer

- a) Overload settings which are not in accordance with the rated capacity of the cable and equipment
- b) Accumulations of coal dust, oil and dirt on flameproof equipment
- c) Lack of ventilation
- d) When two banks of gate-and boxes are coupled in series, overloading of busbars can take place

Question 4

Name four types of flameproof joints.

Answer

- a) External flange joint
- b) Internal flange joint
- c) Spigot joint
- d) Screwed joint

Question 5

Explain what is meant by the term "intrinsically safe apparatus".

Answer

"Intrinsically safe apparatus" means electric apparatus constructed in such a manner that, when connected and used, any sparking that may occur under any service or fault condition (either in the apparatus or in a circuit associated with the apparatus) is not capable of igniting flammable gas.

Question 6

Name three types of cables used in coal mines and give examples where each is used.

Answer

[Code of Practice]

The cables used underground can be grouped into three main categories of flexibility depending on the mobility and frequency of moving a machine during its normal operation. These categories apply to cables of all voltage ratings. The categories are:

- a) General purpose cables are not very flexible and their use should be restricted to fixed installations which are not moved frequently, e.g. cables used from surface to underground main substations.
- b) Semi-flexible cables for use with machinery which is stationary during their operating period but are removed regularly to cater for face advance, e.g. cables supplying section transformers and section switchgear.
- c) Flexible trailing cables for use with mobile and portable machines which are continually moving about under power during their operation e.g. coal cutters, loaders, drills etc.

Question 7

State the legal requirement regarding a flexible trailing cable and cable reel connection.

Answer**[MHSA Regulation 3.23 and Code of Practice]**

- a) The employer must take reasonably practicable measures to ensure that all flexible cables or trailing cables may only be used in connection with the operation of:
 - i. any self-propelled mobile machine which requires electric power to operate such machine;
 - ii. movable electric apparatus; or
 - iii. Portable electric apparatus.
- b) Any cable reel used in connection with a self-propelled mobile machine must be provided with a device which must interrupt the power supply to the cable before the complete cable is unreeled. At least one complete turn of the cable must remain on the reel when the interruption of the power supply has been effected, unless the machine's maximum range of travel is limited to less than the permitted by the cable on the reel for reason other than the length of the cable.

Question 8

State the legal requirement regarding the joints in a trailing cable.

Answer**[MHSA Regulation 3.25]**

The employer must take reasonably practicable measures to ensure that no flexible cable or trailing cable must have more than fifteen joint repairs, including sheath patches over a length of 200 metres and no joint repair or patch must be closer than 5 metres to an adjacent joint, repair or patch and no joint, repair or patch must be closer than 3 metres to the cable plug or its terminal connection at the machine or apparatus.

Question 9

Name the three most important electrical mechanisms.

Answer

- a) Overload protection
- b) Earth leakage protection
- c) Electrical interlocking protection (No volt protection)

Question 10

Explain how to examine the lights on mining equipment.

Answer**[Code of Practice]**

- a) Check that light fittings are securely fastened to the machine
- b) Check the cable entry gland for any obvious damage
- c) Check the glass to ensure that it is not broken, cracked or chipped or dirty with mud or grease or any other material
- d) Check that all shrouded bolts are securely in position, are visibly tight and that no obvious gaps appear in the enclosure
- e) Check whether the IA number or GME approval stamp (old terminology), is evidence

Question 11

Name the safety devices on the exhaust system of a diesel engine.

Answer

- a) Flame arrestor (scrubber box)
- b) Heat sensor
- c) Low water float level
- d) Terminal cut-out

2 MINE GASES**A COMPULSORY QUESTIONS**

Question 1

Define the relative density of a gas.

Answer

The relative density of a gas is the ratio of the mass of a given volume of gas to that of an equal volume of air.

Question 2

List the gases which comprise normal air and state their proportions.

Answer

- a) +/-21% oxygen (O₂)
- b) +/-79% Nitrogen (N₂)
- c) +/-0.03% Carbon dioxide (CO₂)

Question 3

State the minimum quantity of oxygen in mine air.

Answer

[Code of Practice]

The oxygen content of mine air must not be less than 19 parts per 100 of air by volume.

Question 4

Name the flammable gasses found underground.

Answer

- a) Hydrogen (H₂)
- b) Methane (CH₄)
- c) Carbon monoxide (CO)
- d) Hydrogen sulphide (H₂S)

Question 5

Name the noxious gases found underground.

Answer

- a) CO - Carbon monoxide
- b) H₂S – Hydrogen sulphide
- c) NO and NO₂ – Nitrous fumes

Question 6

What are the combustibility ranges of methane?

Answer

- a) Up to 5% it burns but does not support combustion
- b) From 5% to 15% it explodes
- c) At 10% the mixture reaches its greatest potential explosive intensity
- d) Above 15% the mixture will not explode due to an oxygen deficiency

Question 7

Name eight causes of methane ignitions underground.

Answer

- a) Brown-out shots
- b) Faulty electrical equipment
- c) Underground fires
- d) Use of smoking materials
- e) Lightning strikes

- f) Sparks from cutting picks
- g) Flame cutting, welding etc.
- h) Static electricity

Question 8

State the sources of carbon monoxide underground.

Answer

- a) Blasting operations
- b) Underground fires
- c) Underground explosions
- d) Spontaneous combustion of coal resulting from the slow oxidation of coal
- e) Exhaust gases from diesel engines
- f) Overheating of compressors (CO in compressed air)

Question 9

State the maximum quantity of carbon monoxide.

Answer

The amount of carbon monoxide must not exceed 100 parts per million of air per volume, i.e. 0, 01%

Question 10

State two sources of hydrogen sulphide underground.

Answer

- a) Formed by reaction of acid water on iron pyrites and, therefore, often found in solution in stagnant water in old workings
- b) Inherent is in coal seams and expelled from the coal strata by heating

Question 11

State the source of nitrous fumes underground.

Answer

- a) Produced by blasting operations underground
- b) Exhaust gases from diesel engines

Question 12

What gases would you expect to find in the old workings that have been sealed off for a period of time? Also state why you would expect to find these gases.

Answer

- a) Deficiency of oxygen due to the oxidation process
- b) Carbon monoxide due to:
 - i. Oxidation of coal
 - ii. Underground fire
 - iii. Underground explosions
 - iv. Spontaneous Combustion of coal
- c) Carbon dioxide due to:
 - i. Underground fires
 - ii. Underground explosions
 - iii. Spontaneous Combustion of coal
 - iv. Oxidation of coal
 - v. Decay of timber
- d) Methane due to no ventilation
- e) Hydrogen sulphide due to:

- i. Stagnant water- reaction of acid water and iron pyrites
- ii. Inherent in coal seams

2 MINE GASES

B CHOICE QUESTIONS

Question 1

List the headings under which the mine gases are studied.

Answer

- a) Source
- b) Properties
- c) Effects on human body
- d) Detection methods
- e) Amount allowed by law

Question 2

Name eight common gases that may be found underground in a fiery coal mine and state their chemical symbols.

Answer

- a) Oxygen - O₂
- b) Nitrogen - N₂
- c) Hydrogen - H₂
- d) Methane - CH₄
- e) Carbon monoxide - CO
- f) Carbon dioxide - CO₂
- g) Hydrogen sulphide - H₂S
- h) Nitrogen fumes - NO and NO₂, N₂, and O₃ etc.

Question 3

State three ways in which methane is liberated from the coal strata underground and briefly explain each.

Answer

- a) *Gradual exudation* which is slow seeping of escaping gas and is easily diffused by good ventilation.
- b) *Blowers* which are jets of gas released generally through slips and faults. The gas is blown out under pressure, and is only diffused by large quantities of air.
- c) *Outburst* which occur when large quantities of gas under pressure are released from the coal by bursting forth. A very dangerous condition will result.

Question 4

State the sources of hydrogen both underground and on surface.

Answer

- a) In underground battery charging stations are being charged, hydrogen may be liberated in dangerous quantities when accumulators are put on charge and constitutes a serious hazard in the charging station.
- b) In surface lamp rooms where cap lamp batteries are being charged, hydrogen may also be present in dangerous quantities if the lamproom is not properly ventilated.

Question 5

State the effects that an atmosphere containing carbon monoxide will have on a human body.

Answer

- a) The red blood cells in the bloodstream has a great affinity for carbon monoxide (300 times greater than oxygen). It causes muscle paralysis and a small percentage causes death in a short time because the blood cannot supply oxygen to the brain.
- b) 0,1% (1000ppm) carbon monoxide will cause death to a human being in two (2) hours.
- c) 1% carbon monoxide will cause death to human beings in five (5) minutes.

Question 6

What percentage is **carbon dioxide** in the air that we breathe constitutes a threat to life?

Answer

8%

Question 7

Explain why the “smell” test for hydrogen sulphide is not reliable.

Answer

Small quantities can be detected by smell. The “smell” test is not reliable because hydrogen sulphide can destroy or dull the sense of smell and if ignored can lead to a serious case of gassing. If you suspect that your sense of smell has been dulled, immediately evacuate the area, call for a second opinion and make a positive test for the gas.

Question 8

State the maximum quantity of hydrogen sulphide in the air.

Answer

The amount of hydrogen sulphide must not exceed 20 parts per million of air volume, i.e. 0,002%

Question 9

State the maximum quantities of nitrous fumes in the air.

Answer

The amount of nitrous fumes must not exceed 5 parts per million of air by volume, i.e. 0, 0005%.

3 VENTILATION AND DUST

A COMPULSORY QUESTIONS

Question 1

State the legal requirements regarding the quality of mine air.

Answer

[Code of Practice]

The air supplied to the underground workings of a mine must be:

- a) Free from dust, fumes and other impurities
- b) Able to maintain safe and healthy conditions for the workers
- c) Able to dilute and render harmless any gasses and dust in the ambient air

Question 2

Define ventilation district

Answer

[MA Regulations Definitions]

A ventilation district must mean such part of a mine having its own independent intake air way commencing from the main intake air way and its own independent return air way terminating at a main return air way.

Question 3

Explain what is meant by the term “recirculation of air” at a fan.

Answer

Recirculation of air means that the air delivered to the faces by the fan, or any other return air, returns to the intake side of the fan and is passed through the fan again.

Question 4

State two reasons that could cause recirculation of air by fan.

Answer

- a) Insufficient air available for the capacity of air by a fan
- b) The fan is situated in-bye of the last through ventilation opening

Question 5

State the legal requirements regarding the operating conditions for fans underground.

Answer**[MHSa Regulation 9.1(3) and Code of Practice]**

- a) The employer must ensure that polymer underground ventilation control devices or appliances, which have a potential for electrical static discharge:
 - i. Comply with SABS standards specifications 1287; Part I & Part II
 - ii. Are of anti-static characteristics when used in working places where there is a risk of igniting gas, dust or vapour.
- b) The fan must be operated according to instructions given by the manager or mine overseer.
- c) Record of authorization and the safety instructions to be kept in a special book.
- d) The manager or mine overseer are responsible to see that the shift boss and miner in charge are made aware of the safety instructions referred in paragraph (c) above.

Question 6

State the legal requirements for ventilation doors.

Answer**[Code of Practice]**

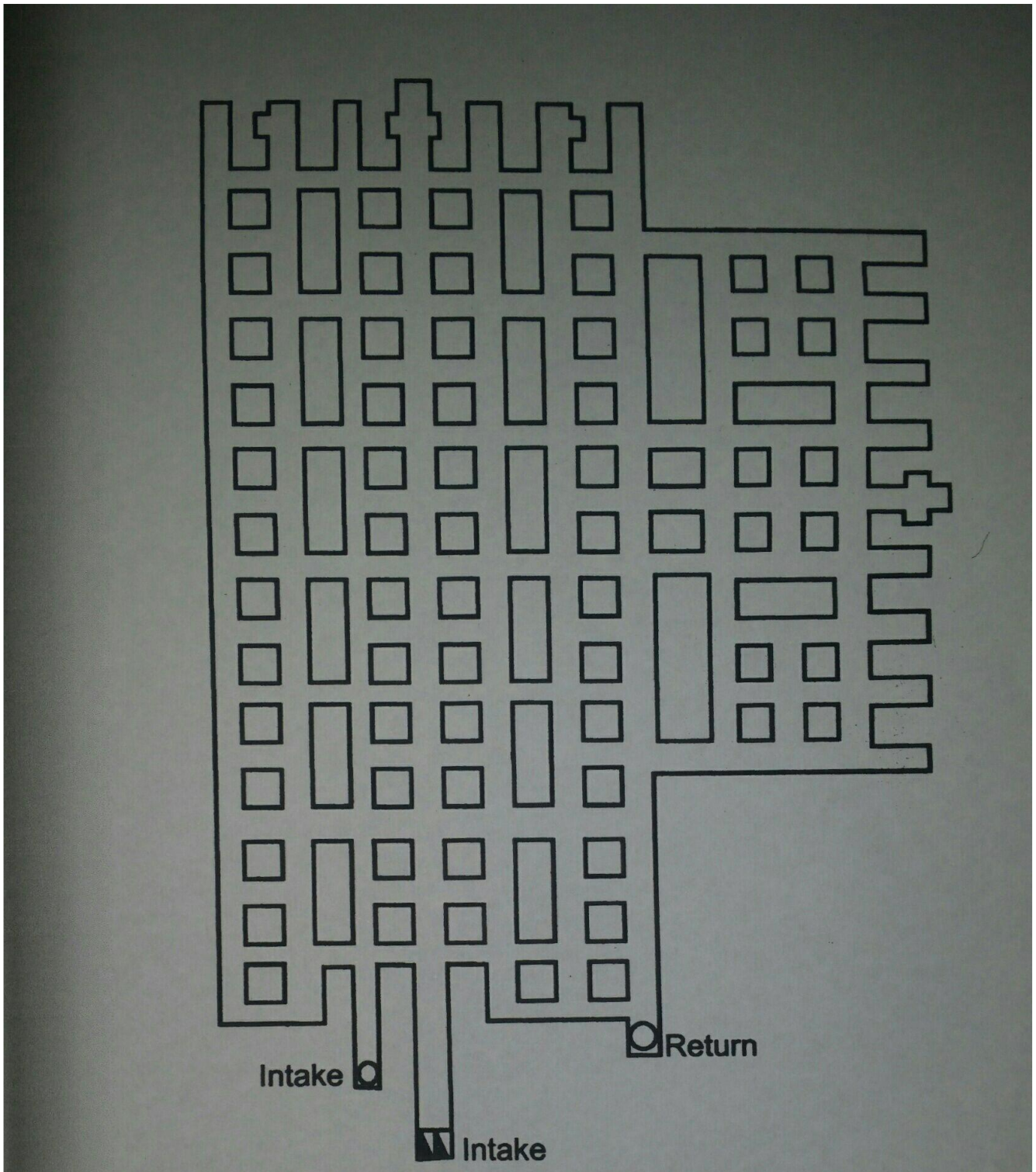
- a) Doors must be self-closing or operated by an attendant.
- b) Doors must be of a strong construction.
- c) Double doors must be installed in an area where the main intake airway connects with the main return airway.
- d) When doors are closed they must be airtight.

Question 7

Ventilate the workings shown on the given plan by making use of the conventional signs and the mine’s ventilation code of practice where applicable.

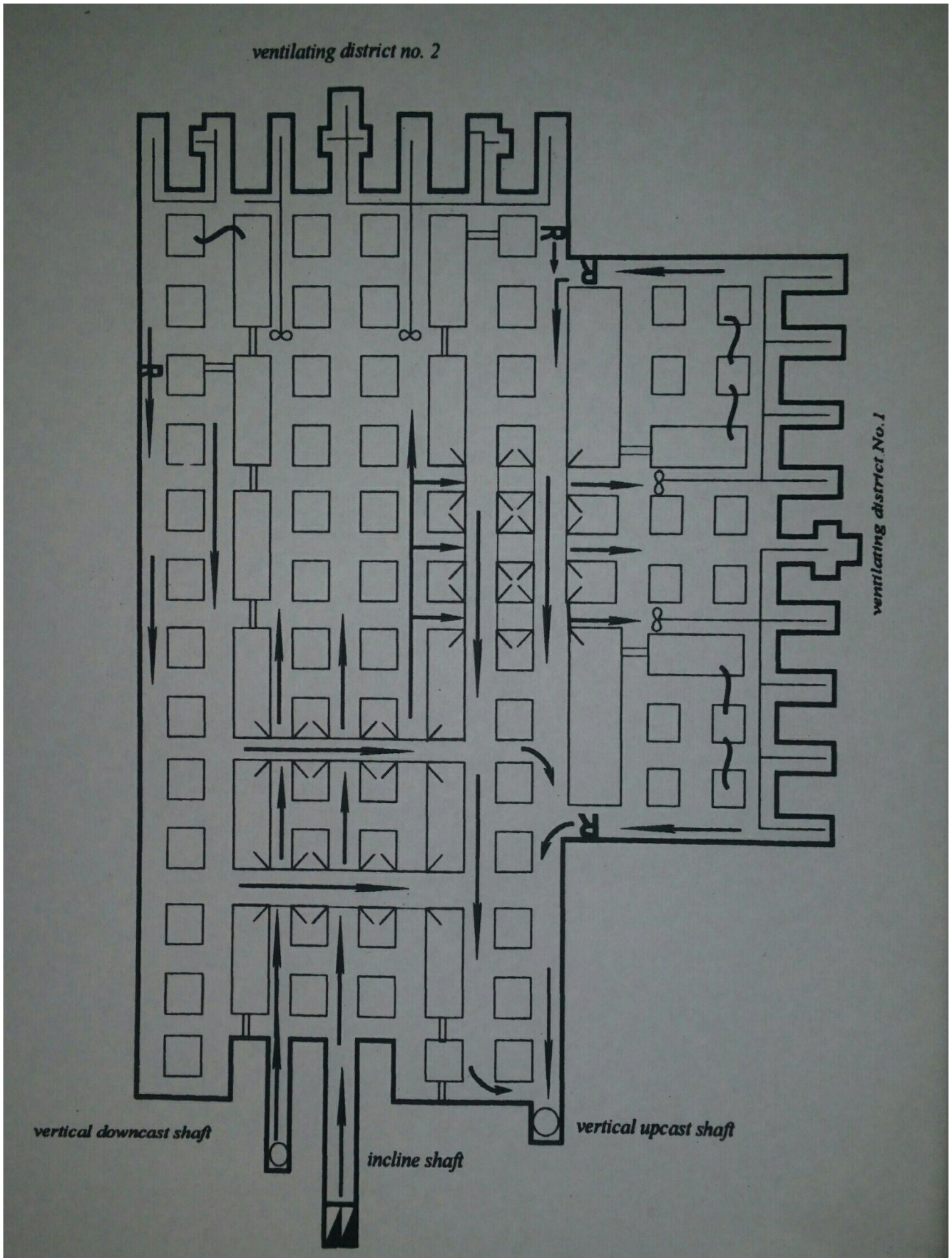
Show two ventilating districts.

Use force fans and ducting where necessary.



Answer

Use three intake airways commencing at the vertical and incline downcast shaft and the return air up-casting via the vertical fan shaft.



Question 8

By making use of the plan in the previous Question:

- a) Explain how you would inspect the ventilation appliances;
- b) State which ventilation system is used and explain its advantages and disadvantages;

- c) Explain how you would measure the:
- i. velocity of the air in the last through road
 - ii. quantity of the air
 - iii. air utilisation
- d) Explain the differences between a scoop and a line brattice and state the reasons for their use.

Answer **[Code of Practice]**

a) Inspecting ventilation appliances

- i. Cross brattices**
 - Made of none-flammable material
 - Installed in the correct position
 - Checked for excessive leakage
- ii. Scoop brattice**
 - Correct distance from rib side
 - Correct distance from face
 - Installed where required
 - Checked face velocity
 - Ensure no person between rib side and scoop brattice
- iii. Line brattice**
 - Correct distance from rib side
 - Correct distance from face
 - Installed where required
 - Checked for leakage
- iv. Brick stoppings**
 - Build of robust material
 - Checked accessibility for inspection purpose
 - Checked for leakages
- v. Doors**
 - Checked if self-closing or manned by attendant
 - Made of robust construction
 - Checked if doors are in series where required
- vi. Air crossings**
 - Made of robust construction
 - Checked for leakage
 - Built in accordance with mine's code of practice
- vii. Section electric fan**
 - Ensured that the fan is installed at a correct position.
 - Checked if in compliance with operating conditions as stipulated in fan book
 - Test for flammable gas
 - Test for recirculation of air

b) Split ventilation system

- i. Advantages**
 - Re-use of air is reduced.
 - One side of the section is independent of the other side. (i.e. fewer people exposed to blasting fumes, dust, etc.)
 - Methane contamination maybe isolated to only one half of the section.
- ii. Disadvantages**
 - Air velocities are generally low in the last through road.
 - Air tends to bypass panel centres.

c) Calculations

- i. Velocity**

- Establish two points namely A and B,
- Point A must be on the upstream and point B must be on the downstream
- Point A and point B must be 3m apart
- The person who is in possession of the smoke tube must be positioned at point A (upstream)
- The person who is in possession of a stop watch must be positioned at point B (downstream)
- Smoke from the smoke tube must be released from point A to point B
- The time it takes for the smoke to travel from point A to point B must be recorded by the person who is in possession of the stop watch.
- Velocity is equal to the distance travelled by the smoke from point A to point B divided by the time taken by the smoke to travel from point A to point B (m/s)

ii. Quantity

- Calculate the area of the roadway by multiplying the width by the height roadway (m²).
- Quantity of air is equal to the velocity of air multiplied by the area of the roadway (m³/s).

iii. Air utilisation

- Air Utilisation is equal to intake air quantity divided by return air quantity multiplied by 100.

d) Differences between a scoop and a line brattice and reasons for use

Scoop brattice

- Directs the air from last through road into the face.
- To keep the face positively ventilated.

Line brattice

- Installed in line with the direction of mining and perpendicular to the cross brattice.
- It directs the flow of air into the section.

Question 9

Explain briefly how a coal dust explosion is propagated underground

Answer

For a coal dust explosion to take place the fine dust from the sides, roof and floor must be raised into the air in a cloud and the ignited. The resulting explosion will raise subsequent clouds of dust, which will in turn explode, giving a chain reaction effect, which may spread throughout the mine

Question 10

State six measures to be taken to prevent coal dust explosions.

Answer

[Code of Practice]

- Good ventilation to remove fine dust
- Application of water, e.g. to wash dust off sides and roof, water down travelling ways and tipping points
- Effective application of stone dust
- Erecting stone dust barriers
- Preventing spillage from belt conveyors
- Reducing dust creation, e.g. using sharp picks and drill bits

Question 11

State five legal requirements regarding the quality of stone dust

Answer

[MHSa Regulation 5.1(1)(a) and Code of Practice]

- The employer must ensure that a competent person reports to the employer, at appropriate intervals determined in accordance with the mine's risk assessment, on:
 - The effectiveness of the precautionary measures taken to prevent or suppress explosions of coal dust or flammable gas.
- The manager must ensure that the supply of incombustible dust equivalent to at least one week's requirements must always be available in the workings for distribution and use and that such incombustible dust must:

- i. Contain not less than 95 per cent by mass of incombustible matter
- ii. Be of such fitness, that, when dry, all will pass through a sieve of 600 micrometres aperture and at least 50 per cent by mass through a sieve of 75 micrometres aperture
- iii. Be a limestone dust that does not contain more than five per cent by mass of free silica, or be some other dust that has been approved for the purpose by the Chief Inspector
- iv. Be light in colour and of such character that, unless directly wetted by water, it does not cake and will readily disperse into the air when blown upon, and
- v. Be tested at intervals not exceeding three months for its incombustible matter content and fitness

3 VENTILATION AND DUST

B CHOICE QUESTIONS

Question 1

State four reasons for ventilating a mine

Answer

[Code of Practice]

- a) To supply fresh air underground
- b) To dilute gases
- c) To render dust and fumes harmless
- d) To reduce underground temperature

Question 2

Whose duty is it to see that a sufficient quantity of ventilating air is continuously supplied to all accessible underground workings of a coal mine?

Answer

The employer

Question 3

State the requirements for the installation of a fan elsewhere than in the return airway from a ventilating district

Answer

[Code of Practice]

Each such fan must be installed at a site personally selected and authorised by the manager or mine overseer.

Question 4

State the requirements for stoppings

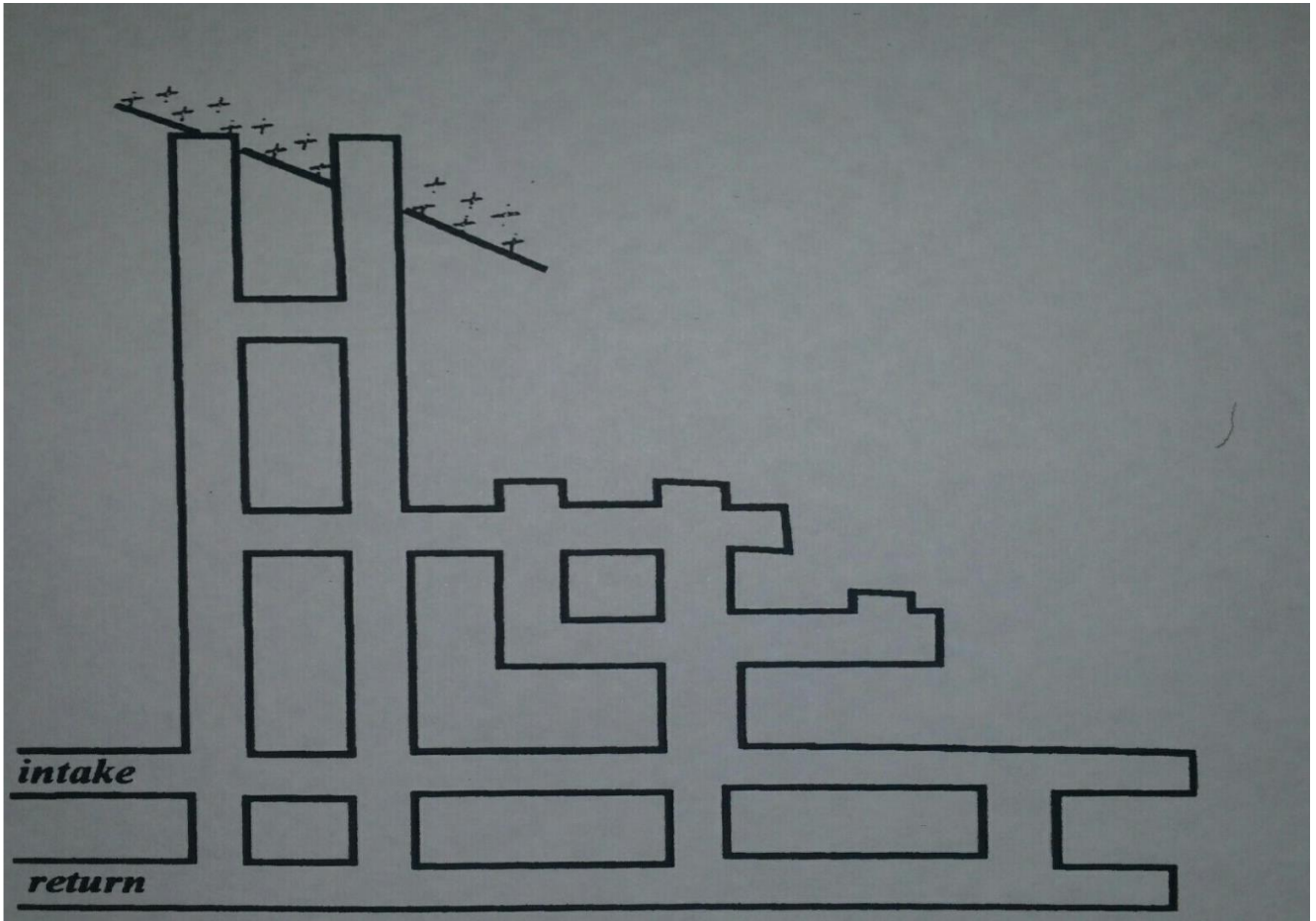
Answer

- a) All stoppings must be strongly built so as to prevent leakages.
- b) One side of every stopping must be kept accessible for inspection.

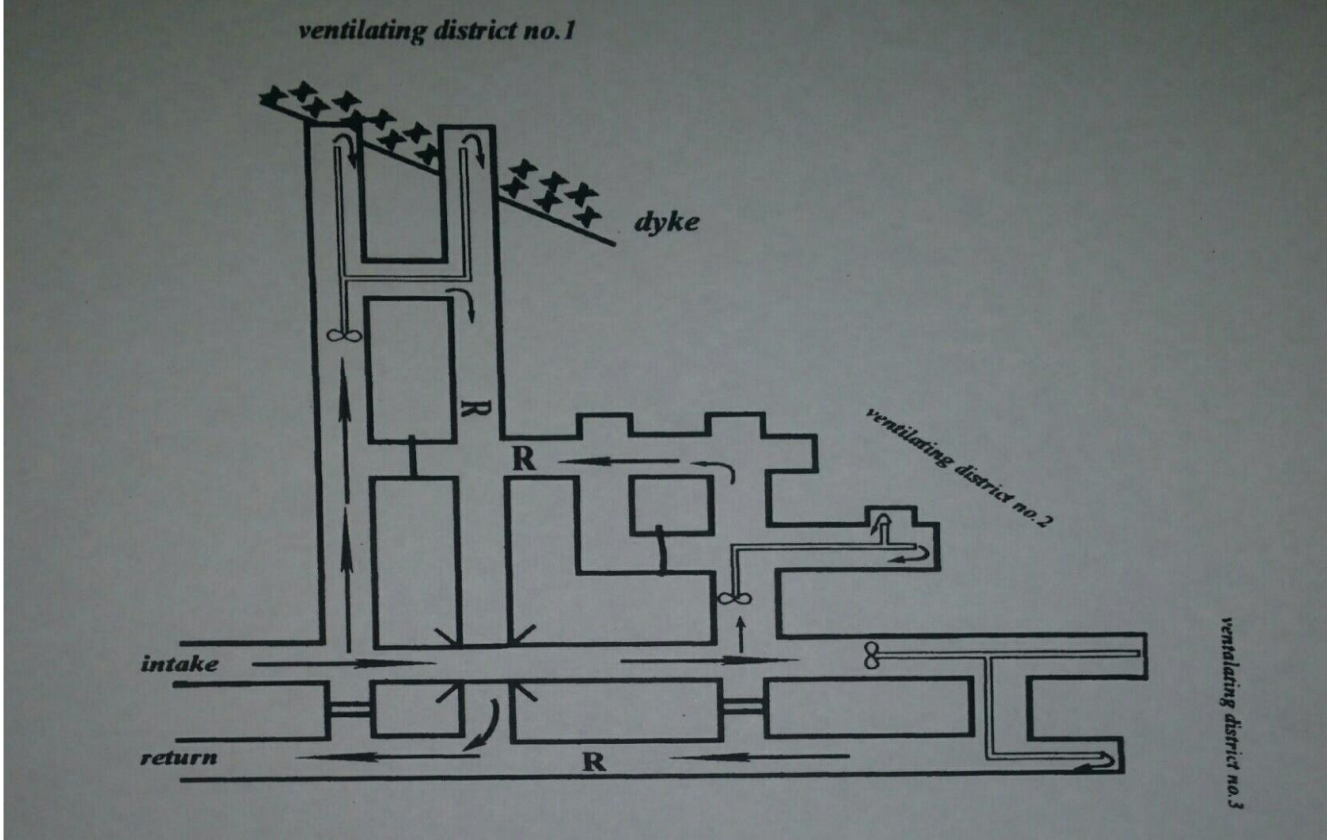
Question 5

Ventilate the workings shown on the given plan by making use of the conventional signs and the mine's ventilation code of practice where applicable, and

- a) Using a single intake airway
- b) Showing three ventilating districts
- c) Using force fans and ducting where necessary



Answer



Question 6

State three possible causes of coal dust explosions.

Answer**[Code of Practice]**

- a) Methane explosions
- b) Faulty electrical equipment
- c) Shot-firing

Question 7

State conditions whereby electrical equipment could cause a coal dust explosion.

Answer**[Code of Practice]**

- a) The arching of electrical equipment in faulty flameproof enclosures
- b) Arching due to damaged trailing cables
- c) Arching may cause a methane explosion which in turn could initiate a coal dust explosion

Question 8

State four causes of a blown-out shot

Answer

- a) The shot-hole being drilled deeper than the undercut
- b) Inefficient tamping
- c) The burden on shot-hole being too big
- d) Exceeding the maximum limit of explosives in the hole

Question 9

State which workings underground must be treated with stone dust.

Answer**[Code of Practice]**

The roof, rib sides and floor of every road or accessible working must be treated with stone dust to within a safe distance to the working face determined by the risk assessment.

4 MINE HEALTH AND SAFETY ACT**A COMPULSORY QUESTIONS****Question 1**

List the objects of the Mine Health and Safety Act.

Answer**[MHSA Section 1]**

- a) To protect the health and safety of persons at mines
- b) To require employers and employees to identify hazards and eliminate, control and minimise the risk relating to health and safety at mines
- c) To give effect to the public international law obligations of the Republic that concern health and safety at mines.
- d) To provide for employee participation in matters of health and safety through health and safety representatives and committees at mines
- e) To promote the effective monitoring of health and safety conditions at mines
- f) To provide for enforcement of health and safety measures at mines
- g) To provide for investigations and inquiries to improve health and safety at mines
- h) To promote:
 - i. culture of health and safety in the mining industry
 - ii. training in health and safety in the mining industry
 - iii. Co-operation and consultation on health and safety matters between the state, employers, employees and their representatives.

Question 2

What are the employee's duties with regard to health and safety?

Answer [MHSa Section 22]

Every employee at a mine, while at that mine, must:

- a) Take a reasonable care to protect their own health and safety
- b) Take reasonable care to protect the health and safety of other persons who may be affected by any act or omission of that employee
- c) Use and take proper care of protective clothing and other health and safety facilities and equipment
- d) Report promptly to their immediate supervisor any situation which the employee believes presents a risk to the health or safety of that employee or any other person, and with which the employee cannot properly deal with
- e) Co-operate with any person to permit compliance with the duties and responsibilities placed on that person in terms of this Act
- f) Comply with the prescribed health and safety measures

Question 3

What rights do employees have with regards to leaving a dangerous working place and what must the employer do to enable the employees to exercise this right?

Answer [MHSa Section 23]

- a) An employee has the right to leave any working place whenever:
 - i. Circumstances arise at the working place which, **with reasonable justification**, appear to the employee to pose a serious danger to that employees' health and safety;
 - ii. The health and safety representative responsible for that working place directs that employee to leave that working place.
- b) The employer, after consultation with the health and safety committee or representatives, must determine effective procedures to enable employees to exercise this right. These procedures must provide for:
 - i. Notification of supervisor and health and safety representative
 - ii. Participation of management and employee representative to solve the issue
 - iii. Participation, if necessary, of inspector or technical advisors to resolve the issue

Question 4

What are the rights and powers of a health and safety representative?

Answer [MHSa Section 30]

A health and safety representative may:

- a) Represent employees on all aspects of health and safety
- b) Directs any employees to leave a dangerous working place
- c) Assist any employee who has a dangerous working place
- d) Identify potential hazards and risks to health or safety
- e) To make recommendations to the employer or health and safety committee on any matter affecting the health or safety of employees
- f) Inspect any relevant document which must be kept in terms of this Act
- g) Be allowed to meet with the workers he/she represents
- h) Request an inspector to investigate any matter regarding health and safety that he/she is concerned about
- i) Be informed whenever there is an accident and when and where there is an inspection (he/she may partake in any health and safety inspection)
- j) Be allowed time off, with pay, to attend training courses

Question 5

Name the person that the Minister of Mineral Resources must appoint to assist him/her.

Answer [MHSa Section 48(1)]

Chief Inspector of Mines.

Question 6

State three functions of the Chief Inspector of Mines.

Answer **[MHSA Section 49(1)]**

- a) Administer the Act and Mine Health and Safety Inspectorate
- b) Appoint Inspectors to assist him/her
- c) Advise the Minister on health and safety in mines

Question 7

State what the Act requires employers and employees to do with regards to inspectors.

Answer **[MHSA Section 52(1)]**

The Act requires that the employers and employees must provide an inspector with assistance and facilities that he/she may reasonably require during his/her inspections.

Question 8

State what the Act requires about Answering Questions asked by an inspector.

Answer **[MHSA Section 52(2)]**

Any person questioned by an inspector must answer each question unless the answer is self-incriminating.

Question 9

Name six offences listed under the Act.

Answer **[MHSA Section 84, 86, 88, 89, 90 and 91]**

- a) It is an offence to damage, misuse or interfere in any way with health and safety equipment that is provided to use in a mine.
- b) It is an offence if a negligent act or omission by one person endangers the safety and health of another person at a mine.
- c) It is an offence if a person hinders any other person who is performing a function in terms of the Act.
- d) It is an offence if a person attempts to obtain any certificate of competency in a dishonest or fraudulent manner.
- e) A person who fails to attend an inquiry which he was instructed or summoned to do, and who fails to Answer Questions or give false evidence, commits an offence.
- f) Any person who contravenes or fails to comply with the provision of the Act or any instructions issued under the Act, commits an offence.

Question 10

State what can happen to a person found guilty of an offence under the Act.

Answer **[MHSA Section 91(1)]**

Any person convicted of any offence in terms of Act may be fined by the court, or imprisoned as may be prescribed.

Question 11

Define the following terms:

- a) Inspector
- b) Employee
- c) Employer
- d) Hazard
- e) Risk
- f) Health and safety representative
- g) Health hazard
- h) Occupational health

Answer **[MHTA Section 102]**

Inspector means an officer appointed in terms of section 48(1)(c) of MHTA and a medical inspector appointed in terms of section 49(1)(b) of the MHTA

Employee means any person who is employed or working on a mine

Employer means any person who employs employees

Hazard means a source of, or exposure to danger

Risk means the likelihood that occupational injury or harm to persons will occur

Health and safety representative means an employee elected and appointed in terms of section 29 of MHTA

Health hazard means any physical, chemical or biological hazard to health, including anything declared to be a health hazard by the Minister

Occupational health includes occupational hygiene and occupational medicine

Question 12

State the employer's duties with regard to codes of practice at a mine.

Answer **[MHTA Section 9(1), (2) and (5)]**

The employer:

- a) May prepare and implement a code of practice on any matter regarding the health and safety of employees and other persons;
- b) Must implement a code of practice if the Chief Inspector requires it, in which case it must comply with the guidelines issued by the Chief Inspector;
- c) Must consult with the health and safety committee on the mine on the preparation and implementation of any code of practice.

4 MINE HEALTH AND SAFETY ACT

B CHOICE QUESTIONS

Question 1

List the employer's responsibilities with regard to health and safety at the mine.

Answer **[MHTA Section 5, 6, 7, 8, 11, 13 and 17]**

- a) Maintain a health and safe mine environment
- b) Ensure an adequate supply of health and safe mine equipment
- c) Staff the mine with due regard to health and safety, i.e. ensure that all employees are suitable qualified, trained and supervised
- d) Establish a health and safety policy for the mine in consultation with employees
- e) Identify hazards to health and safety and take appropriate corrective action
- f) Establish a system of medical surveillance of employees exposed to health hazards and keep a record for each employee
- g) Establish a system of medical surveillance of employees that leaves his employment and provide him with a copy of the exit certificate
- h) Arrange for an exit medical examination for each employee that leaves his employment and provide him with a copy of the exit certificate

Question 2

Name three important rights with regard to safety and health that the Act grants to mine employees.

Answer **[MHTA Sections 19, 23 & 24]**

- a) The right to Information
- b) The right to leave a dangerous working place
- c) The right not to pay for safety measures

Question 3

How is a safety representative appointed?

Answer **[MHSA Regulation 6.9(a)]**

In writing by the manager, after being elected by the employees.

Question 4

What is the purpose of the Mining Qualifications Authority?

Answer **[MHSA Section 41(3)]**

The Mining Qualification Authority was established to advise the minister on training and qualifications in the mining industry.

Question 5

Define the following terms:

- a) Medical Inspector
- b) Department
- c) Health
- d) Healthy
- e) Health and safety committee
- f) Occupational Hygiene
- g) Working place

Answer **[MHSA Section 102]**

- a) **Medical Inspector** means a medical inspector appointed in terms of section 49 (1)(b)
- b) **Department** means the Department of Mineral Resources
- c) **Health** refers to occupational health at mines
- d) **Healthy** means free from illness or injury attributable to occupation causes
- e) **Health and safety committee** means a health and safety committee established in terms of section 34
- f) **Occupation hygiene** means the anticipation, recognition, evaluation and control of conditions at the mine that may cause illness or adverse health effects to persons
- g) **Working place** means any place at a mine where employees travel or work

Question 6

State the employer's duties with regard to the medical examination of an employee leaving the employment of the mine.

Answer **[MHSA Section 17]**

If an employee leaves the employment of the mine for any reason, the employer must arrange an exit medical examination of the employee. A copy of the exit certificate must be given to the employee and a copy must be entered in his record of medical surveillance.

5 CONVEYOR BELT INSTALLATIONS

A COMPULSORY QUESTIONS

Question 1

What are the employer's responsibilities regarding the installation, operation, maintenance and patrolling of a conveyor system in the underground workings of a mine?

Answer **[MHSA Section 9(2)]**

In the underground workings of every mine where a belt conveyor is used, the employer's must prepare and implement a Code of Practice for the safe use of conveyor installations for the transportation of minerals, material or personnel.

Question 2

What do the regulations require regarding stopping a belt conveyor?

Answer

MHSA Regulation 8.9(1)(c) & (d) and Code of Practice]

- a) In compliance with regulation 8.8(1) the employer must ensure that:
 - i. Driving machinery of the conveyor belt installation can be stopped by any person from any point, along its length where access to the belt is possible
 - ii. The driving machinery of the conveyor belt installation is stopped should the belt break, jam or slip excessively.
- b) At every mine every accessible point along any belt conveyor must be equipped with some effective means for stopping the belt conveyor from any point along its length, or where an attendant is stationed at the driving head, effective means must be provided for signalling to such attendant from any point along the length of the conveyor.

Question 3

What do the regulations require regarding coal or dust accumulating on or around the moving parts of any belt conveyor?

Answer

[MHSA Regulation 8.9(4) and Code of Practice]

- a) The employer must take reasonably practicable measures to prevent persons from being injured as a result of the breaking, misalignment or damage of conveyor belting due to any mineral, material or coal dust accumulating on or around the moving parts of any conveyor belt installation.
- b) All reasonable measures must be taken to prevent coal or dust accumulating on or around the moving parts of any belt conveyor where friction is likely to cause heating.

Question 4

What do the regulations require regarding conveyor when it breaks or jams?

Answer

[MHSA Regulation 8.9(1)(d) and Code of Practice]

- a) In compliance with regulation 8.8(1) the employer must ensure that the driving machinery of the conveyor belt installation is stopped should the belt break, jam or slip excessively.
- b) Every belt conveyor must be equipped with a device which will stop the drive automatically should the belt break, jam or slip excessively.

Question 5

Name the components of a belt conveyor and feeder installation and list the items you would check when examining each component.

Answer

1	<p>DRIVE UNIT</p> <ul style="list-style-type: none"> a) The motor is not overheating b) Gearbox oil levels c) Ammeter reading for overloading of motor d) Cleanliness e) Lock-out switch is operative f) Guards in position
2	<p>BELT</p> <ul style="list-style-type: none"> a) For cleanliness under the belt b) For any tears in the belt c) That splices are in order d) That fasteners are in order e) For any holes in belt f) For belt slipping g) If belt is running off line h) For wear on belt edges i) For belt slipping
3	<p>STRUCTURE</p> <ul style="list-style-type: none"> a) That structure trustless are on line and standing vertical b) That structure pipes are straight and secure c) For sticking idlers

4	d) For worn idlers e) For noisy idlers f) For loose idler frames g) For rusted structure TAIL PULLEY UNIT
5	a) For cleanliness under UNIT b) That spill plates are in place and operational c) That guards are in place and correctly installed d) Lock-out switch is operative FEEDER (Not all collieries use a mechanical feeder) a) That the area is adequately illuminated and that the lighting is flameproof b) Flame proofing of the feeder motor and switch in order c) That sprays are in good working order d) For cleanness at tail-end and underneath the feeder and belt conveyer e) That adequate guards are in position f) That scraper on bottom belt is operative g) That the flight chain is in good condition h) That the emergency stop devices are operative i) That the lockout switch is operative j) That the necessary equipment is available and in good condition, i.e. long k) handled scraper, broom, shovel and sledge hammer

Question 6

What is the requirement regarding dust allaying where rock, coal or other mineral is discharged?

Answer

[Code of Practice]

- a) The employer must implement a Code of Practice for an Occupational health programme on personal exposure to airborne pollutants. Such code of practice must include the following measures:
 - i. Where rock, coal or other mineral is discharged into any main bin, ore-pass or at any transfer point of a conveyor belt or of an ore-pass system, a constant supply of clean water must be applied by means of efficient atomizers or sprays which must be kept in good working order at all times, or dust extraction system must be provided and operated, to prevent the escape of dust into the air while rock, coal or other mineral is being discharged into the openings of such bins or ore passes or at transfer points.

Question 7

What precautions must be taken before work may commence on a belt conveyor or before any guard may be removed?

Answer

[MHSR Regulation 8.9(1)(b)]

In compliance with regulation 8.8(1) the employer must ensure that the power supply and all sources of stored energy of a stationary conveyor belt installation isolated, made safe and locked-out during either repairs, maintenance or cleaning of spillage in the designated sections.

Question 8

States the causes and solutions for the following possible problems that may be encountered on a conveyor belt:

- a) One section of belting runs off to one side all along the conveyor
- b) Belt running off at head pulley
- c) Belt running off at tail pulley
- d) Fasteners pull out of belt

Answer

Problem	Cause	Solution
a) One section of belting runs off to one side all along the conveyor	One or more idlers not at right angles to longitudinal centre-line of belt	Advance the end of the idler to which the belt has shifted in the direction of belt travel

	Conveyor frame not lined up properly; or idler stand, or stands not centered on belt	Stretch line along edge to determine how much out of line and correct
	Sticking idlers	Replace, or free idler
	Structure not level and belt tends to climb to the high side	Level Structure
	Build-up of material on idlers	Improve maintenance Install scrapers
b) Belt running off at head pulley	Head pulley, or troughing idlers approaching the head pulley, out of alignment	Check alignment of pulley and adjacent troughing idlers
c) Belt running off at tail pulley	Build-up of material on return idlers and/or on pulley	Removal material, ensure better housekeeping
	Return pulley out of line	Adjust at right angel to frame
	Unequal loading	Adjust loading chute, to properly center the load on belt
d) Fasteners pull out of belt	Tension too high	Decrease tension
	Wrong type fasteners	Select correct fasteners for the duty. Tighten fasteners as prescribed, incorporating ant ripple fasteners tape
	Terminal pulley too small	Select correct fasteners and type of splice for the conveyor, taking and smallest pulley diameter into consideration Use more acceleration steps in starting Control feed (feeders) at loading points

5 CONVEYOR BELT INSTALLATIONS

B CHOICE QUESTIONS

Question 1

What are the requirements regarding the provision of fire-fighting equipment at a conveyor belt installation?

Answer

[MNSA Regulation 8.9(3)]

The employer must take reasonable practicable measures to prevent persons from being exposed to flames, fumes or smoke arising from a conveyor belt installation catching fire, including instituting measures to prevent, detect and combat such fires.

Question 2

What do the regulations require where two or more conveyor belt installations are in series?

Answer

[MNSA Regulation 8.9(1)(h)]

In compliance with regulation 8.8(1) the employer must ensure that where two or more conveyor belt installations are used in series, sequence interlocking is provided which will automatically:

- a) stop all other conveyor belt installations feeding a belt conveyor that has stopped
- b) prevent a conveyor belt installation from starting until the conveyor belt on to which it feeds is running

Question 3

What are the characteristics regarding the material used for manufacturing conveyor belts used in the workings of a coal mine?

Answer

[Conveyor Belt Code of Practice, paragraph 8.1.1, bullet 6 and 7]

- a) In order to prevent persons from being injured as a result of a conveyor belt installation collapsing, catching fire, a belt breaking or misalignment of the conveyor belt due to incorrect design, the COP must set out the design criteria for the belt conveyor installation, covering at least the following:
 - i. Materials of which the conveyor belt is made of in order to minimise the risk of igniting flammable gas or dust during installation or operation;
 - ii. Materials of which the conveyor belt is made of in order to minimise the risk of any part of the conveyor belt catching fire;
- b) Every conveyor belt which is installed or used in the workings of a coal mine must be of incombustible or fire resistant material.

Question 4

Name the main components of the belt conveyor systems and feeder

Answer

1	Drive Unit a) Electric motor b) Fluid coupling c) Reduction gearbox d) Drive pulley e) Snub pulley
2	Belt Structure a) Structure trestles b) Return Impact idlers c) Troughing idler frames and idlers d) Belt
3	Tail Pulley Unit a) Return pulley b) Impact idlers c) Structure frame d) Spillage plates e) Guards
4	Feeder a) Electric motor and switchgear b) (b)Reduction gear box c) (c)Flight chain d) (d)Tipping bin

Question 5

What safety precautions must be taken regarding the roof and sides in the vicinity of the drive unit?

Answer

[Code of Practice]

The roof and rib sides in the vicinity of the drive unit must be thoroughly barred down, supported and stone dusted.

Question 6

What substances may cause a fire hazard on and around electrical switchgear and motors underground, and what preventative steps must be taken?

Answer

[MHSA Regulations 3.7]

The employer must take reasonably practicable measures to ensure that all suspended electrical cables that could cause a fire due to faults or mechanical damage, in stopes, haulages or shaft either through damage by moving machinery or by fall of ground are properly protected by:

- a) A switch gear which is electrically supplied and commissioned with discrimination settings for overload and earth fault protection to prevent a fire
- b) Switchgear installed which is correctly rated to prevent a fire or explosion
- c) All cables in areas where a fire can occur must be fire retardant cables or be coated with fire retardant material at areas in close proximity with timber
- d) The employer must have a procedure to be followed in the event of such a fire

Question 7

State the causes and solutions for the following problems that may be encountered on a belt conveyor:

- a) One section of belt runs off one side all along the conveyor
- b) Excessive wear on bottom side of belt
- c) Return belt has no definite running pattern (wanders from side to side at will)

Answer

Problem	Cause	Solution
a) One section of belt runs off one side all along the conveyor	Splices not square	Re-splice, cutting end square
	Crooked or "bowed" belt	If bow is in new belt it will correct itself when belt becomes "broken in", otherwise replace with new section
b) Excessive wear on bottom side of belt	Slippage between belt and drive pulley, or pulleys	Increase tension on belt take-up device. Lag drive pulleys or renew worn-out lagging
		Increase arc of contact on drive pulley with snub pulley, or use tandem drive
	Sticking troughing idlers	Replace, or free
	Material grinding between pulley and belt	Install scrapers in front of tail pulley on the return belt
c) Return belt has no definite running pattern (wanders from side to side at will)	Insufficient friction between belt and rolls	Check idler spacing (bearing load caring capacities in mind). Open idlers spacing by removing alternate return, or by repositioning idlers

6 START OF SHIFT PROCEDURE, WAITING PLACE AND STATUTORY EXAMINATIONS

A COMPULSORY QUESTIONS

Question 1

State the legal requirements regarding the provision and facilities of a change house.

Answer

[MHSR Regulation 9.2(5)(a)]

The employer must provide and maintain suitable and adequate change houses to enable employees who perform work involving hazardous substances to change into working clothes at the start of their shift and to wash themselves and change their clothes at the end of their shift.

Question 2

State the legal requirements regarding notices at the change house, shaft head or other suitable places at the mine or works.

Answer

[MA Regulations 3.5, 3.7, 3.2 and 3.4]

- a) One or more notices setting forth the approved procedure for the immediate treatment of cases of gassing, heat stroke, heat exhaustion, and electronic shock must be posted up in a conspicuous place in every change house.

- b) A notice must be kept posted up at each shafthead showing the times within which shifts are lowered or raised at such shafthead, as well as the times of blasting in the varies section of the mine.
- c) An abstract, authorized by the Chief Inspector of the portions of the regulations directly concerning the workers must be posted up at suitable places and every abstract must be in any of the official languages as the Chief Inspector may prescribe.
- d) Every regulation relating to the prevention of a compensatable disease as defined in section (1) of the occupational Diseases in Mines and Works Act, (Act 78 of 1973), must, in so far as it concerns persons not proficient in any one of the official languages, be translated into such other language as the manager may determine and kept posted up in a conspicuous place in every change house.

Question 3

Who must be appointed to search persons for prohibited articles in the workings of a mine?

Answer

[Code of Practice and MHSa Regulations 4.1(1)]

The *employer* must take *reasonably practicable* measures to prevent persons not authorized by the *employer* from:

- a) Gaining access to *explosives*;
- b) Being in possession of *explosives*, or
- c) Removing or attempting to remove *explosives* from a mine.

Question 4

State the duties of a lamp man regarding the maintenance and issuing of portable lamps.

Answer

[Code of Practice]

At every fiery mine the manager must appoint a certificated lamp man in writing whose duties are as follows:

- a) Keep the record of all portable lamps in use. They must be numbered and record must be kept to whom they are issued so that the user can at any time be identified from the records.
- b) Ensure that all lamps, flammable gas warning devices, flammable gas measuring instruments and self-contained rescuers, are in good order and safe condition at the time of issue.
- c) Ensure that every flame safety lamp has been properly cleaned, filled with fuel, assembled and locked or sealed.
- d) See that every portable electric lamp has been properly cleaned, assemble and lock or sealed.
- e) Ensure that all portable lamp that were issued are returned to the lamp room at the end of the shift by the person to whom they were issued.

Question 5

What are the legal requirements regarding a waiting place?

Answer

[MA Regulation 2.10.6, 4.10 and Code of Practice]

- a) The manager must provide or cause to be provided underground such waiting places as may be necessary for the use of persons prior to entering their working places and must by such as the Principal Inspector may have approved in writing, prevent such persons from proceeding of their working places until they have been instructed to do so by the ganger or miner who is responsible for the safety of their working places when they enter them and must further, satisfy himself by weekly reports from the shift bosses that this regulation is being strictly observed.
- b) Every waiting place required in terms of Regulation 2.10.6 must be adequately disinfected and kept in a clean condition.
- c) The ganger or miner must report to the shift boss of his section of the mine any person unlawfully present in the working place before his arrival, or found to be unlawfully beyond the waiting place provided for in Regulation 2.10.6.
- d) At every fiery mine the ganger or miner in charge of a section of workings, or some other competent person appointed by the ganger or miner with the approval of the mine overseer or shift boss, must, immediately before any portable lamp is taken into the section of the ganger or miner by any member of his gang, examine such lamp and assure himself as far as practicable from external observation, that in the case of

a flame safety lamp, such examination must be carried out personally by the ganger or miner. No lamp which is found to be unsafe or not securely locked or sealed must be taken into the section.

Question 6

How would you conduct an initial examination, starting from the waiting place up to the working faces?

Answer

a) On Arrival at Waiting Place

- i. Select the appropriate members to assist in barring, charging-up, watering down, ventilation, support and operating the production machines
- ii. Enquired from guards - illegal entry into section
- iii. Checked on previous fireman's report (any unsafe conditions)

b) Examine section switchgear

- i. Physical conditions safe
- ii. Test for gas
- iii. Flameproofing in order
- iv. Trailing cable plugs uncoupled, clean, dry and suspended

c) Check at tail-end/feeder

- i. Physical conditions safe
- ii. Test for gas
- iii. Flameproofing in order
- iv. Lights in order
- v. Belt scraper present
- vi. Machine guards in place
- vii. Tools - shovels, brooms and scrapers present and in order
- viii. Emergency stop switch operative
- ix. Telephone - emergency numbers displayed
- x. Fire extinguisher/fire-fighting equipment present and in order
- xi. Water spray in order
- xii. Stop signs present

d) Examine the travelling way to the first face (intake side of the section):

- i. Physical conditions safe
- ii. Water supply in order
- iii. Ventilation appliances in order
- iv. No re-circulation of air

e) Examine the section auxiliary fan:

- i. Physical conditions safe
- ii. Test for gas
- iii. Examine flame-proofing
- iv. Ducting in order
- v. No re-circulation of air

f) Examine the first face

- i. Ventilation - last through road
- ii. Tested for flammable gas - entrance to face and in face
- iii. Physical conditions safe
- iv. *Overhangs and loose coal in face - corrected if necessary
- v. *Misfires and sockets - treated if necessary
- vi. Dust
- vii. Water supply available
- viii. Place signature and date on ribside or roof

NB: * In sections where explosives are used.

g) Examine all the remaining faces as above

h) Equipment: obtain operator's report on the condition of the trailing cables and machine

i) Examine the oil store

- i. Physical conditions safe
 - ii. Drip trays in use
 - iii. Fire extinguisher present and in order
 - iv. Neatness and cleanliness acceptable
- j) Drinking water:** check that an adequate supply of drinking water is available
- k) Examine latrines**
- i. Physical conditions safe
 - ii. Clean and disinfected
 - iii. Adequate number
 - iv. Easily access
- l) Examine section explosives store**
- i. Physical conditions
 - ii. Adequate storage boxes and locked
 - iii. Distance between storage boxes correct
 - iv. Area dry and clean
 - v. Check contents
- m) Examine first-aid equipment**
- i. First aid box containing first aid kit
 - ii. Two blanket and a stretcher available
- n) Fireman's report:** completed fireman's report in duplicate using a pen

Question 7

What instrument must be used to test for flammable gas during the initial examination?

Answer

[MHSR Regulations 5.1(5)]

The employer, at the any mine where the risk assessment indicate a risk of the presence of flammable gas, must ensure that all flammable gas measuring instrument and flammable gas warning devices used at the mine for the detection of methane or hydrogen or a mixture of both, comply with the SANS 1515-1:2006, Edition 2.1 "Gas measuring equipment primarily for use in mines" Part 1: battery operated portable, flammable gas measuring instrument".

Question 8

What does the Flammable Gas Code of Practice state in terms of "flammable gas – no work"?

Answer

[Code of Practice]

No further work may be done within 30m of the source and beyond the last through road and in any adjacent working place within 30m of the point of issue of the gas where the atmosphere contains more than 1% of flammable gas. Furthermore the miner must inform the mine overseer or shift boss by the quickest means available.

Question 9

What are the miner's responsibilities regarding the safety of all persons in his section?

Answer

- a) The miner must take all reasonable measures to prevent persons not required to assist him from entering any working place until he/she has examined and made safe and until he/she has given them definite instructions to enter.

Question 10

What are the legal requirements regarding the re-examination of working places during the shift?

Answer

[MHSA Regulation 14.1(5) and Code of Practice]

- a) The miner must ensure, if at any time a working place or part thereof becomes unsafe during a shift, that all persons, other than those examining and making safe, are removed from such unsafe area and are not permitted to return thereto until the working place has been declared safe by him/her.
- b) The ganger or miner in charge must, in the course of his shift, make at least three inspections at intervals not exceeding three hours of every working place in his section.

Question 11

How many working places may be under the charge of a miner in a section which is giving off flammable gas freely, and state how frequent must inspections be carried out?

Answer

[Code of Practice]

The ganger or miner must not have more than six working places under his/her charge and such working places must be inspected at intervals not exceeding one hour.

6 START OF SHIFT PROCEDURE, WAITING PLACE AND STATUTORY EXAMINATIONS

B CHOICE QUESTIONS

Question 1

State what is regarded as "clothes" for risk work.

Answer

[MHSA Section 6(2) and MA Regulation 5.8.3]

- a) Every employer must ensure that sufficient quantities of all necessary personal protective equipment are available so that every employee who is required to use that equipment is able to do so.
- b) No person must work or be present at, or near or cause or permit any other person to work or be present at or near any place where there may be danger of falling minerals or material unless he/she or such other person wears a hard hat in good condition and of a type approved by the Chief Inspector of Mines.

Question 2

Who must be appointed to be stationed at the shaft entrance?

Answer

Banksman

Question 3

What is the duty of the banksman in a coal mine?

Answer

To search any person who is about to enter the workings of a mine for prohibited articles (contraband/explosives)

Question 4

State the legal minimum number of flammable gas measuring instrument and gas warning device that must be available on a coal mine

Answer

[MHSA Regulations 5.1(5) and Code of Practice]

- a) The employer, at the any mine where the risk assessment indicate a risk of the presence of flammable gas, must ensure that all flammable gas measuring instrument and flammable gas warning devices used at the mine for the detection of methane or hydrogen or a mixture of both, comply with the SANS 1515-1:2006, Edition 2.1 "Gas measuring equipment primarily for use in mines" Part 1: battery operated portable, flammable gas measuring instrument".

- b) At every coal mine, the manager must provide a flammable gas measuring instrument to the miner and issue at least one gas warning device to each operator of an electrically driven machine for cutting, drilling, breaking or loading.

Question 5

Name the articles listed as contraband.

Answer

- a) Any device or appliance to be used for the purpose of creating of an arc, spark or flame.
b) Any pipe, cigar, cigarette or tobacco other than chewing tobacco or snuff.

Question 6

Describe a typical waiting place and miners box lay-out

Answer

[Code of Practice]

a) Waiting place

- i. Well ventilated, in intake air
- ii. Safe, supported and stone dusted
- iii. Clean, disinfected and wetted down
- iv. Latrines must be accessible
- v. Drinking water available
- vi. All entrances to section to be fenced off
- vii. Well illuminated
- viii. Notice board with relevant notices

b) Miner's box

- i. Fireman's report book
- ii. Up-to-date plan of the section
- iii. Support code of practice
- iv. Ventilation code of practice
- v. First-aid equipment
- vi. Accident report book
- vii. Daily production report
- viii. Emergency procedure

Question 7

What are the miner's duties on arrival at the waiting place?

Answer

- a) Check physical conditions.
b) Personally inspect all flammable gas measuring instruments and flammable gas warning devices.
c) Check:
i. Cap lamp examination carried out
ii. Absenteeism
iii. Injuries
iv. PPE

Question 8

Who should accompany the miner when carrying out the initial examination?

Answer

- a) Team leader
- b) Barring attendant
- c) Support attendant
- d) Ventilation attendant

- e) Watering down attendant (usually only in blasting sections)
- f) Health & Safety representative

Question 9

What proof must the miner have to indicate that he/she has examined a working place?

Answer

A work place examination declaration book

Question 10

What must the miner do if he/she finds any working place to be in an unsafe condition and which he/she cannot make safe?

Answer

The miner must immediately fence off or erect a barrier at the entrance to any working place which he/she finds to be in an unsafe condition and which he/she cannot make safe and he/she must not allow any person to enter such working place except persons that are necessary to assist him/her in making such working place safe.

Question 11

When must a relieving Miner be appointed?

Answer

[Code of Practice]

In cases of emergency, another Miner must be appointed in a Shift Boss logbook.

Question 12

What will the first duty of a relieving Miner/Ganger be?

Answer

[Code of Practice]

He/she must re-examine and where necessary make safe the working place which he/she has taken over.

Question 13

State the requirements regarding the examination of a working place which has been idle for more than six hours or any working place where blasting has taken place.

Answer

[Code of Practice]

In every coal mine, every working place which has remained idle for more than six hours and every working place in which blasting has taken place, must be examined and made safe by the certificated ganger or miner in charge of the section in which such working place is located before any work is resumed in such working place.

Question 14

How many working places may ganger or miner be in charge of during pillar extraction and what must his inspections include?

Answer

[MR Regulation 8.9.7]

Where coal pillars are extracted, the ganger or miner must not have charge of more than 12 working places and the said inspections must include all accessible portions of the goaf edge of each working place.

7 STRATA CONTROL

A COMPULSORY QUESTIONS

Question 1

What are the legal requirements regarding the introduction and specification of a systematic support system in the workings of a mine?

Answer

[MA Regulation 7.4.1, 7.4.2 and 7.4.4]

- a) If the roof, hanging or sidewalls in the workings of any mine or part of a mine are in the opinion of the Principal Inspector of Mines of a nature requiring systematic support he/she may give notice to that effect to the manager who must, after consultation with the regional mining engineer (mining), specify the support to be provided and the system according to which it must be placed.
- b) The manager must ensure that all persons concerned are made aware of such system and that notices setting out its specifications are posted up at suitable places where they conveniently be read.
If in the opinion of the Principal Inspector of Mines, the method of supporting the roof, hanging or sidewall in the workings of any mine or part of the mine is unsafe either by reason of the distances between support being excessive or for any other reason, he/she may by notice in writing require the manager to modify the method.

Question 2

What action must the miner take if an attempt to take down ground is unsuccessful?

Answer

[Code of Practice]

The ganger or miner in charge must not allow any person to work or remain where he may be endangered by ground which, to his/her knowledge, any person has attempted to take down to remove until such ground has been made safe.

Question 3

What precautions must be taken by the miner to ensure safety when withdrawing temporary support?

Answer

[Code of Practice]

- a) Every person engaged in withdrawing props or other support must stand under securely supported or other safe ground.
- b) In the operation of pillar extracting or letting down roof, props must not be withdrawn except by a ganger or miner who must be the holder of a permanent blasting certificate and who must be thoroughly experienced in withdrawing props in stooping operations, or by persons in the actual presence and under the immediate supervision of such ganger or miner.

Question 4

Name six causes of fall of ground accidents.

Answer

[Code of Practice]

- a) Inspections incorrectly done
- b) Barring down not done correctly
- c) Hazard identification not to standard
- d) Working under unsupported roof
- e) Breaking out between roof-bolts
- f) Incorrect use of temporary support

Question 5

Describe the appearance of a correctly installed point anchored roof-bolt

Answer

[Code of Practice]

- a) Roof-bolt threads protruding 20mm
- b) Washer plate flush
- c) No rounded nut
- d) Pull test = 70kN

Question 6

What are the dangers associated when intersecting dykes?

Answer**[Code of Practice]**

- a) Friable roof (burnt coal)
- b) Multiple slips
- c) Flammable gas

Question 7

May any person deviate from the prescribed pattern of systematic support?

Answer**[MA Regulation 7.4.3 and Code of Practice]**

- a) No. Any person who fails to comply with the specifications of such system will be guilty of an offence.
- b) The only time that any person may deviate from the prescribed pattern of systematic support is when the manager authorizes this in writing.

Question 8

Name three functions of a breaker line used in stooping operations

Answer**[Code of Practice]**

- a) Assists in breaking the goaf
- b) Protect people and equipment from the goaf
- c) Prevent access into the goafed area

Question 9

Name at least eight factors which can lead to some joints being more unstable than other.

Answer**[Code of Practice]**

- a) Strike
- b) Dip
- c) Roughness
- d) Infill
- e) Water
- f) Spacing
- g) Continuity
- h) Nature of contact

Question 10

Name four (4) reasons for the thread not protruding on a mechanically anchored roof-bolt installation.

Answer**[Code of Practice]**

- a) Crimp too heavy
- b) Plate pushed flush against the roof
- c) Roof-bolter torque too low
- d) Soft strata

Question 11

Name two signs of horizontal stresses.

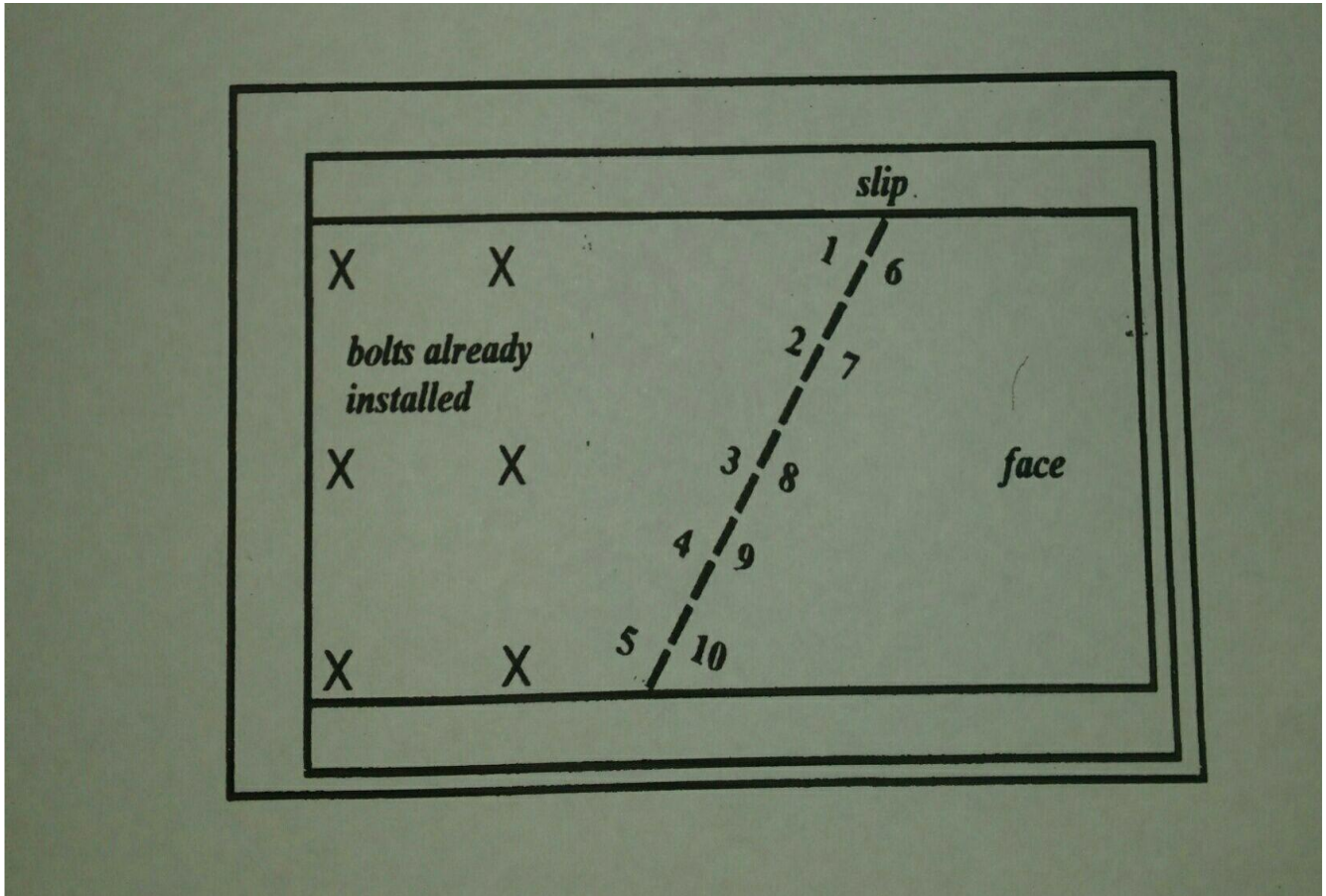
Answer**[Code of Practice]**

- a) Floor heave
- b) Guttering

Question 12

Given a sketch, show how and in which order you would support the slip.

Answer



Question 13

Name two actions which can be taken to improve strata control conditions if poor roof is encountered.

Answer

[Code of Practice]

- a) Narrow the bord widths
- b) Increase the support density

Question 14

Name any eight types of special support used in coal mines.

Answer

- a) Timber packs
- b) "W"/Oslo straps
- c) Mesh Concrete
- d) Cable anchors
- e) Steel sets
- f) Cluster stick packs
- g) Roof trusses

7 STRATA CONTROL

B CHOICE QUESTIONS

Question 1

What is the miner's duty regarding the safety of all persons when encountering dangerous ground?

Answer

[Code of Practice]

Before cutting hitches, setting props, building pigsties or packs or erecting other support in dangerous' ground, or allowing dangerous ground or rock to be drilled into with the object of rock-bolting it or blasting it down, the ganger or miner in charge must, by setting props or otherwise, adequately safeguard any person engaged in such operations.

Question 2

Describe the following strata control terminology:

- a) Slip
- b) Fault
- c) Dyke
- d) Point anchor resin roof-bolt
- e) Full column resin roof-bolt
- f) Safety factor

Answer

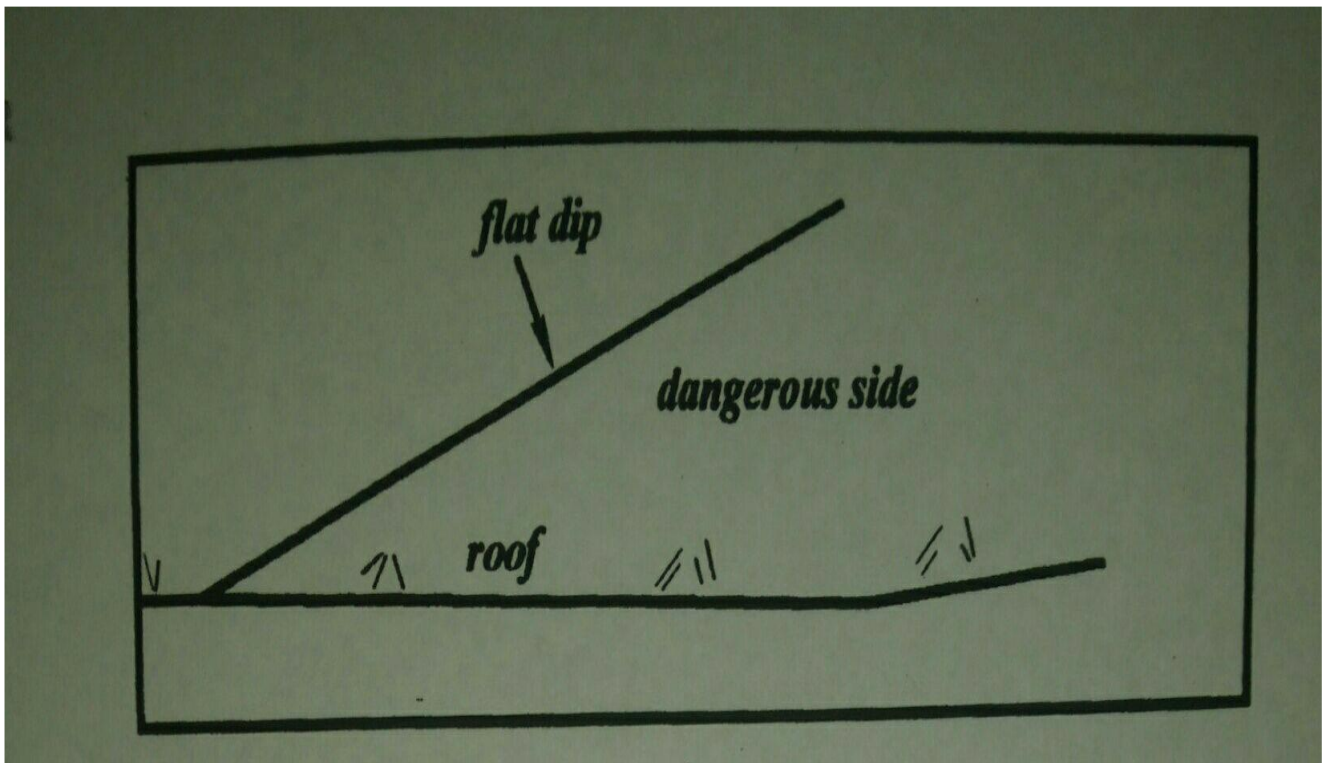
[Code of Practice]

- a) **Slip** means a break in the rock where movement has taken place
- b) **Fault** means fracture in the rock where significant movement has taken place
- c) **Dyke** is where molten lava rock has moved into a crack in the coal and then cooled down, forming solid rock in the coal
- d) **Point anchored resin roof-bolt** means the back point of the bolt is anchored into the roof by means of resin
- e) **Full column resin roof-bolt** means the whole length of the bolt is anchored into the roof by means of resin
- f) **Safety Factor** means this factor is used when designing the size of the pillars, i.e. how much stress the pillar can safely handle

Question 3

Demonstrate by means of a sketch which is the more dangerous side of a slip.

Answer



Question 4

How would you know when the shelf life of a resin has expired?

Answer **[Code of Practice]**

The expiry date is indicated on the cardboard container in which the resin is packed.

Question 5

What are the dangers of using the resin after its expiry date?

Answer **[Code of Practice]**

The resin will not bond, thus resulting in an ineffective roof-bolt anchor.

Question 6

Where must you stand when sounding the roof?

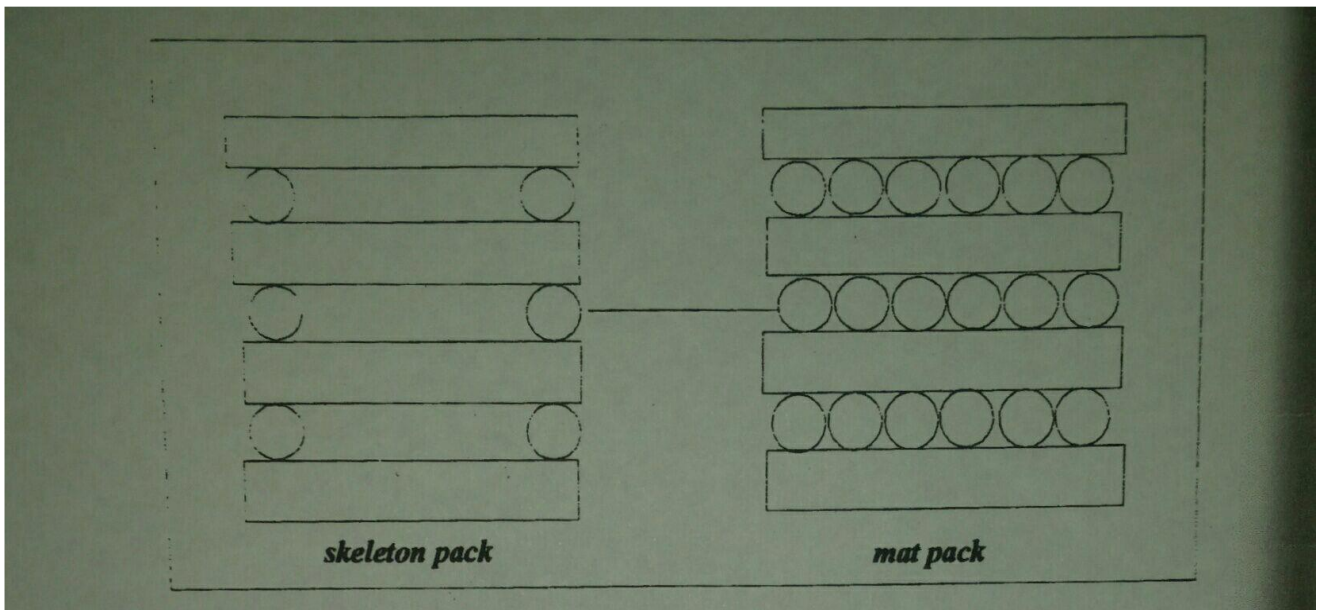
Answer **[Code of Practice]**

Always ensure that you stand under roof already sounded and found to be safe. Never sound the roof directly above yourself or anybody else.

Question 7

Sketch or describe two types of timber packs

Answer



Question 8

Name the occupational categories that are at higher risk from falls of ground.

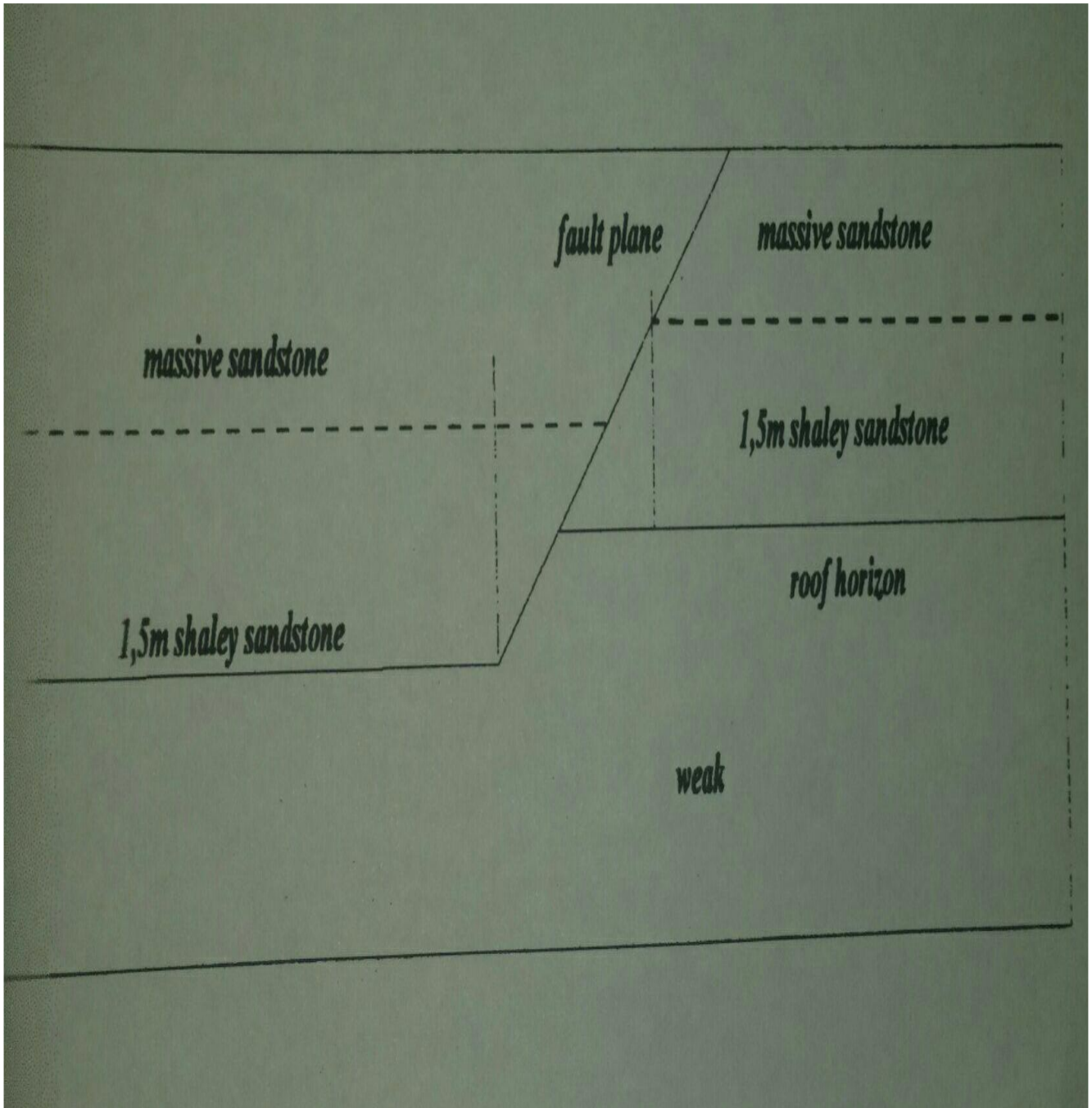
Answer

- a) Miner
- b) Roof-bolter operator
- c) Cable handler
- d) Continuous Miner operator
- e) Blasting attendant
- f) Electric drill operator

Question 9

The following sketch shows a minor fault in the roof of your section. Identify the weak side and show where you would install additional support and state what support elements you would use (type, length).

Answer



Question 10

Name any four methods of stabilizing coal pillars which are deteriorating.

Answer

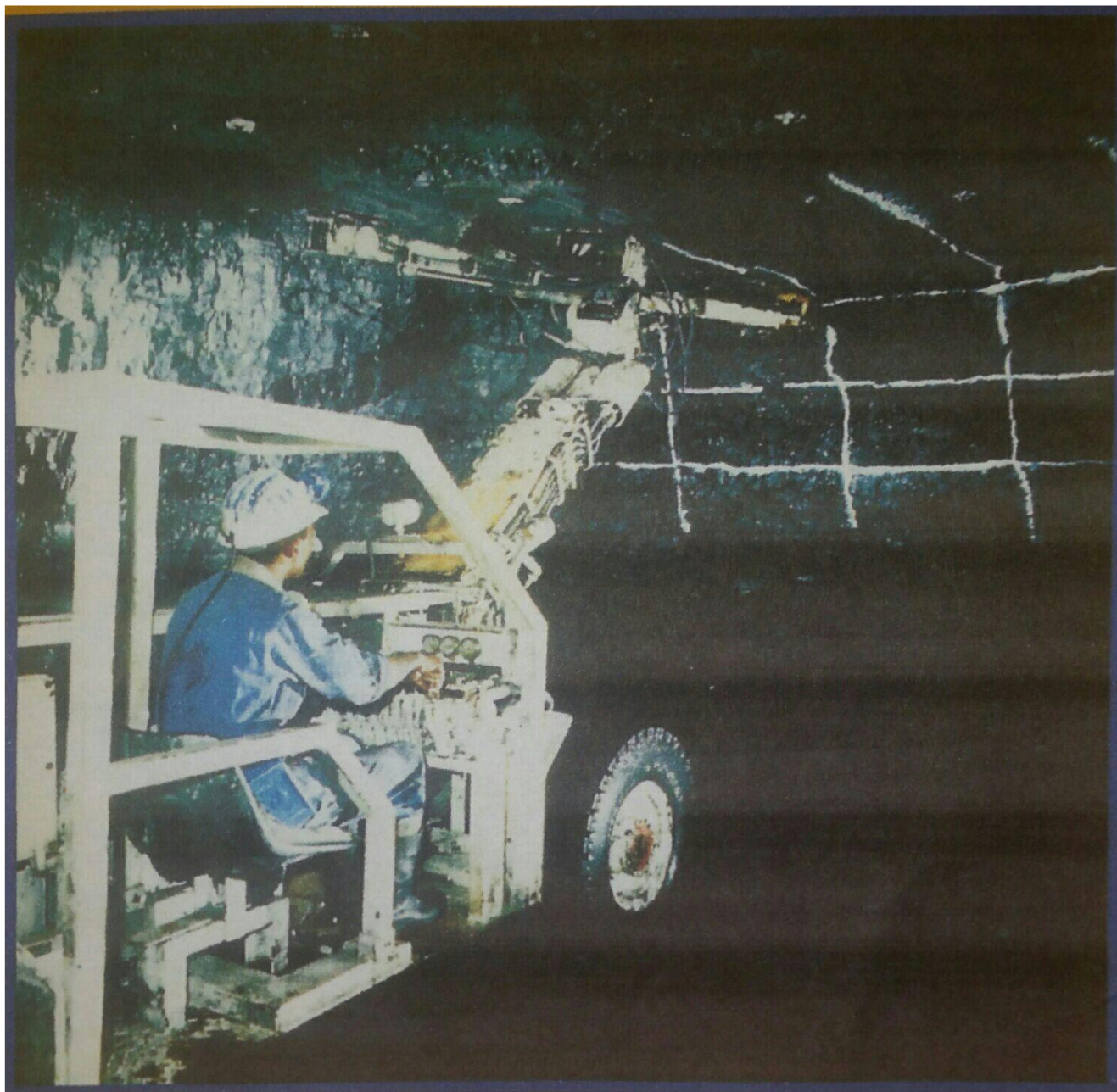
[Code of Practice]

- a) Wire mesh
- b) Roof-bolts
- c) Shot-crete
- d) Pillar wrapping

COAL MINER'S CERTIFICATE

MODULE 2

BLASTING SECTION



1 COAL CUTTING

A COMPULSORY QUESTIONS

Question 1

When must sprags or holding props be installed when undercutting is done by machinery?

Answer **[Code of Practice]**

When undercutting is done by machinery, sprags or holding props must be set not more than two metres apart as soon as the machine will permit.

Question 2

When may such sprags or holding props be removed?

Answer **[Code of Practice]**

Such sprags or holding props must not be removed until immediately before the coal is to be brought down by blasting or other means.

Question 3

What are the legal requirements regarding the appointment of self-propelled mobile machine operators?

Answer **[MHSa Section 85(1), MHSa Regulation 8.10.23.1, 8.10.28.2, 8.10.23.3, 8.10.23.4, 8.1.23.5 and 8.10.23.7]**

- a) No person may cause or permit an employee under the age of 18 years to work underground at a mine
- b) The employer must take reasonably practicable measures to ensure that procedures are prepared and implemented for the selection, training, appointment and licensing of trackless mobile machine operators, which procedures must include:
 - i. physical and psychological pre-selection criteria;
 - ii. training programme for trackless mobile machine operators, covering:
 - theoretical training in a training Centre;
 - practical training; and
 - on the job training.
 - iii. assessment of the trainee, on successful completion of the training programme, by a competent person
 - iv. that operators of trackless mobile machines are authorized in writing by their supervisor to operate trackless mobile machines. Such authorization must detail their duties, responsibilities, limitations and areas of operation.
 - v. that every operator of trackless mobile machines is issued with a license containing at least the following:
 - a photograph to positively identify the operator;
 - the trackless mobile machine types which the operator may operate;
 - date of issue and expiry date; and
 - the operator's company identification number.

Question 4

When must the operator of a self-propelled mobile machine be re-assessed and found competent?

Answer **[MHSa Regulation 8.10.23.6]**

When an operator has not operated a trackless mobile machine for a period of two years, such operator is re-assessed to be competent by a competent person prior to being issued with a new license.

Question 5

What controls should be in place to reduce dust during coal cutting?

Answer**[Code of Practice]**

- a) Effective water sprays
- b) Good ventilation
- c) Sharp picks and in a correct sequence

Question 6

What is the legal requirement with regards to having two free faces before initiating explosive charges in an underground coal mine?

Answer**[MHSR Regulation 4.6(1)(a)]**

The employer of every underground coal mine must take reasonable measures to ensure that the ganger or miner does not initiate explosive charges in an underground coal mine unless the coal to be blasted has two free faces.

Question 7

State the reasons for having two free faces

Answer**[Code of Practice]**

- a) Reduces the chances of blown-out shots
- b) Less powerful explosives can be used
- c) Fewer holes can be used to break the coal

Question 8

State the possible effects of cutting a face incorrectly

Answer**[Code of Practice]**

- a) Rib side damage (excessive bord width that will influence the safety factor)
- b) Production loss
- c) Uneven floor
- d) Overhangs

Question 9

What standards must be complied with before cutting commences?

Answer**[Code of Practice]**

- a) Roof must be made safe
- b) Rib sides must be made safe
- c) Ventilation must comply with mine standards
- d) Working face must be free of flammable gas
- e) Circulating air must be free of harmful dust
- f) Stone dust must be applied to standard
- g) Working face, rib sides and roof must be washed down for two metres (misfires)
- h) Working face to be squared off and made safe
- i) Centre line must be extended
- j) Working place must be cleared of all loose coal
- k) Misfires/sockets must have been treated according to legal requirements
- l) Mine support code of practice must be complied with

1 COAL CUTTING**B CHOICE QUESTIONS****Question 1**

Why must a cut be cleaned?

Answer

[Code of Practice]

To maximize the efficiency of the explosives when blasting the face.

Question 2

Describe the difference between a loader and coal cutter cable.

Answer

The coal cutter cable diameter is larger due to higher amperage used by the coal cutter.

Question 3

What precautions must be taken prior to a possible holing into an adjacent roadway?

Answer

- a) The adjacent face must be checked for explosives, misfires and sockets and any potential danger eliminated
- b) Persons and machinery must be removed from the adjacent roadway, and it must be fenced off or a guard placed
- c) A test for flammable gas must be carried out in the adjacent roadway

2 ELECTRIC DRILLING

A COMPULSORY QUESTION

Question 1

Define the following:

- a) Misfire
- b) Socket
- c) Shot hole

Answer

[MHSR Regulations - Chapter 4 Definitions]

- a) **Misfire** means any explosives which have failed to explode after initiation.
- b) **Socket** means any shot hole, or part of any shot hole, known not to be a misfired hole, which remains after having been charged with explosives and blasted or which, for any other reason, may be suspected of having contained explosives at any time and includes any shot hole, or part of any shot hole, from which all explosives have been extracted.
- c) **Shot hole** means any drill hole charged with or intended to be charged with explosives.

Question 2

Who may mark off holes?

Answer

[MHSR Regulation 4.4(1)(e)]

The employer must take reasonable measures to ensure, where primary or secondary blasting takes place, that a competent person is appointed in writing to mark or indicate shot holes for drilling or to authorize the drilling of shot holes marked or indicated by another person authorized to do so by the Employer, except where the shot holes were marked or indicated by means of electronic software system, including but not limited to Global Positioning System or Laser, the competent person must be required to over inspect and authorize the commencement of drilling of shot holes

Question 3

What are the Miner/Ganger's responsibility before marking any shot hole for drilling?

Answer**[MHS Regulation 4.12(1)(a)]**

- a) Removes or causes to be removed all loose or loosened rock, mineral or ground to a safe distance from the shot hole determined by a risk assessment; and
- b) Searches for any misfired hole or socket within a distance of at least two metres from the proposed position or mark.

Question 4

Describe what physical examination must be conducted before marking off drill holes.

Answer**[Code of Practice]**

Before any person points out or marks any hole for drilling he/she must:

- a) Remove or cause to remove all loosened rock, mineral or ground and must thoroughly wash over with water under a pressure of not less than 150 kilo-pascals all surfaces to a distance of at least two metres in all directions from the proposed position or mark for the purpose of exposing any misfired hole and socket or, where the ground to be examined is under water, blow it over with compressed air for the purpose of exposing any misfired hole and socket.
- b) Search for any misfired hole or socket within a distance of at least two metres from the proposed position or mark.
- c) The ganger or miner must before marking any hole with wax crayon, paint or other suitable material or before otherwise indicating to any driller working under him the position of any hole to be drilled, remove or cause to be removed all loose or loosened rock, mineral or ground from the face and immediate vicinity and must carefully examine such face in the immediate vicinity with a view to discovering misfired holes and sockets of holes.

Question 5

Describe how a socket must be treated.

Answer**[Code of Practice]**

Examine the socket to ascertain its direction and depth and whether it contains any explosives, by means of water under adequate pressure or compressed air and water under adequate pressure applied through a device of a design and material determined for that purpose by the employer in consultation with the explosive manufacturer or the supplier, or where water under adequate pressure is not available, by means of a scraper of design and material determined for that purpose by the employer in consultation with the explosive manufacturer or the supplier.

Question 6

Describe how to deal with misfires that cannot be dealt with immediately.

Answer**[MHS Regulation 4.11(1) and Code of Practice]**

- a) The employer must take reasonable measures to ensure that a written procedure is prepared and implemented, after consultation with the explosive manufacturer or supplier, to prevent persons from being exposed to the significant risk associated with misfires, sockets and old explosives. Such procedure must include measures to ensure that: no person gains inadvertent access to any misfired hole which is not immediately dealt with, and which measures should include clearly marking the misfired hole or barricading it off and requiring reporting of the misfired hole to all subsequent shifts, at the start of each such shift, until the misfired hole has been dealt with.
- b) On the discovery of any misfired hole which the miner does not immediately deal with, the miner must clearly mark, where practicable, a ring round it with wax crayon, paint or other suitable material, and plug every such socket and every such misfired hole with a plug supplied for that purpose by the manager.

Question 7

How must a drill hole be marked?

Answer**[MHS Regulation 4.12(1)(b)]**

The employer must take reasonable measures ensure that a written procedure is prepared and implemented, after consultation with the explosive manufacturer or supplier, to prevent persons from being exposed to the significant

risk associated with marking, drilling and blasting of shot holes. Such procedure must include measures to ensure that in underground mines no person drills or causes or permits to be drilled any shot hole:

- a) unless the competent person referred to in regulation 4.4(1) has clearly marked the position and direction of the shot hole with paint or other suitably visible material, or, if such marking is impracticable, has pointed out the exact position and direction of the shot hole;
- b) unless it is placed more than 150 millimeters from any socket and is drilled in such a direction that it will nowhere come nearer than 150 millimeters from any socket;
- c) unless it is placed more than two metres from any misfire and is drilled in such a direction that it will nowhere come nearer than two metres from any misfired hole; and
- d) if it deviates from the position and direction indicated as contemplated in paragraph (i) above;

Question 8

How far must a shot hole be drilled from a socket/misfired hole when in coal?

Answer

[MHS Regulation 4.11(8)(b)]

In underground coal mines the ganger or miner where a misfired hole or socket is in coal, drills or causes to be drilled in his/her presence, a relieving shot hole parallel to and not nearer than 300 millimetres to the misfired hole and he/she charges and initiates the explosives charge contained in the relieving shot hole before or at the end of the shift.

Question 9

How far must a shot hole be drilled from a socket/misfired hole when in stone?

Answer

[MHS Regulation 4.11(12)(b)(ii)]

Where a misfired hole is in stone, no person drills or causes or permits to be drilled any shot hole unless it is placed more than 150 millimeters from any socket and is drilled in such a direction that it will nowhere come nearer than 150 millimeters from any socket.

Question 10

What must the miner do when a drill hole deviates from the position or direction indicated?

Answer

[Code of Practice]

The miner must report, not later than the end of the shift, to the mine overseer or shift boss of his section or to the shift boss on duty any person drilling a hole not so indicated or deviating from the position or direction indicated.

Question 11

What is the allowable depth of a shot hole?

Answer

[MHS Regulation 4.6(1)(b)]

The end of the shot hole must be at least 150mm shorter than the back of the cut providing the second of the two free faces.

Question 12

Is a person allowed to deepen an existing hole and if so, under what conditions?

Answer

[MHS Regulation 4.12(1)(d)(i) (ii)]

No person must deepen or cause or permits any other person to deepen any hole which has been left standing or which is not completed at the end of a shift, unless:

- a) It has not been charged with explosives and, it has been clearly described by the ganger or miner in charge of the shift leaving off work to the ganger or miner in charge of the shift leaving work to the ganger or miner in charge of the shift about to commence.
- b) The ganger or miner examines such hole and finds it not to contain any explosives or causes this to be done.

Question 13

Who may remove socket plugs?

Answer **[MHS Regulation 4.11(5)]**

No person removes or causes any other person to remove the plugs that are used to plug sockets or misfired holes unless removed by the ganger or miner for the purpose of inspection or are removed at the end of the shift prior to initiating of explosive charge.

Question 14

May a person insert a metal implement into any socket or misfire?

Answer **[Code of Practice]**

Under no circumstances must an eyebolt or other metal implement other than a tool determined for that purpose by the employer in consultation with the explosives manufacturer/supplier, be inserted into any socket or misfired hole.

Question 15

Who may remove explosives from charged up holes?

Answer **[Code of Practice]**

- a) No person other than the holder of a blasting certificate must extract or attempt to extract or be caused or permitted to extract explosives from a hole which has been charged.
- b) In stone, 110 person other than the holder of a blasting certificate valid for the class of mine to which the mine belongs, must extract or attempt to extract or be caused or permitted to extract explosives from a hole which has been charged.

Question 16

When and to whom must misfired holes be reported?

Answer **[MHS Regulation 4.11(1)]**

The employer must take reasonable measures to ensure that a written procedure is prepared and implemented, after consultation with the explosive manufacturer or supplier, to prevent persons from being exposed to the significant risk associated with misfires, sockets and old explosives. Such procedure must include measures to ensure that:

- a) No person gains inadvertent access to any misfired hole which is not immediately dealt with, and which measures should include clearly marking the misfired hole or barricading it off and requiring reporting of the misfired hole to all subsequent shifts, at the start of each such shift, until the misfired hole has been dealt with.

Question 17

Under what conditions a shot hole may be drilled in a confined space in the presence of a misfire?

Answer **[MHS Regulation 4.12(1)(c)]**

In underground mines no person drills or causes or permits to be drilled any shot hole in any shaft, drive, crosscut, winze, raise, bord, stall or other similar confined space underground where there is known to be a misfired hole until the misfired hole has been dealt with.

Question 18

What difference in diameter should there be between the drill auger and the drill bit and why?

Answer **[Code of Practice]**

According to the manufacturers specifications it is recommended that the drill auger should be between 4-6 mm smaller in diameter than the drill bit to prevent the auger from gelling stuck in the hole being drilled.

Question 19

What is the correct method to carry an electric drill?

Answer**[Code of Practice]**

Loop the cable through the handle and over the chuck of the machine to ease strain on the cable entry gland.

Question 20

Why is there a difference between the plug of an electric drilling machine and that of a loader, coal cutter, etc.?

Answer

It is a different type of plug due to the difference in voltage.

Question 21

What length should the average trailing cable be?

Answer**[Code of Practice]**

Between 175 - 200 metres

Question 22

What is the purpose of the pilot circuit on an electric drilling machine?

Answer**[Code of Practice]**

When the control switch on the electric drilling machine is not activated there will be no current through the cable. It also provides pilot protection, should the plug be pulled out under load, the contact in the drill panel is broken, causing the switch to trip out.

Question 23

Why do we plug misfires and sockets?

Answer

To ensure nobody tampers with them.

Question 24

Why must the drill hole be at least 150mm shorter than the undercut?

Answer

- a) Legal requirement
- b) To prevent sockets
- c) To prevent blownout shots

Question 25

Why must the drill hole be cleaned after the hole has been drilled?

Answer

To ensure that there is no build up of duff between the explosives cartridges when charging-up, which may cause misfires.

Question 26

Name four critical points to be checked when examining drill holes?

Answer**[Code of Practice]**

- a) Direction
- b) Elevation
- c) Depth
- d) Marked position

2 ELECTRIC DRILLING

B CHOICE QUESTIONS

Question 1

How is dust controlled during drilling?

Answer

- a) Duff catchers
- b) Ventilation (scoop brattices, force fans with ducting)
- c) Sharp drill bits
- d) Augers spirals not worn
- e) Water (face drill)

Question 2

What tools and equipment are needed to drill holes?

Answer

- a) Drill auger
- b) Drill bits
- c) Hand protector
- d) Dust collector
- e) Socket plugs
- f) Electrical drilling machine with flexible cable
- g) Drill trestle
- h) Drill panel
- i) Flammable gas warning device

Question 3

How would you examine the following equipment to enhance health and safety?

- a) Drill bits
- b) Augers.
- c) Hand protector
- d) Dust collector
- e) Socket plugs
- f) Electric drill and flexible trailing cable
- g) Drill trestle

Answer

- a) The drill bits must be sharp, the cutting angles correct and the two cutting arms of equal length
- b) Generally two augers are supplied. The shorter of the two is known as a starter. The long auger is used to complete the hole which is drilled 150mm shorter than the undercut. The augers must be straight and spiral not excessively worn so that they will be able to remove the cutting from the hole efficiently
- c) The hand protector must fit loosely over the auger and be in good condition.
- d) The dust collector should consist of a cone made of belting and mounted on a pipe. The pipe may be either telescopic or be of various standard lengths to trap the dust from the drill hole at any height. The dust collector must be in good condition.
- e) Must ensure that there is sufficient supply of socket plugs on hand
- f) The electric drill and flexible trailing cable should be examined as follows:
 - i. Check the flameproofing, making sure that all bolts and nuts are intact and tight
 - ii. Switch on and see that the chuck runs freely and rotates in the correct direction
 - iii. Check that the casing and handles are undamaged
 - iv. Check the easy operation of the operators control switch
 - v. Make sure that the cable is of sufficient length to reach all faces

- vi. Check that the cable gland is tight
- vii. Examine the cable for any obvious cuts and damage
- viii. Make sure that the cable is properly suspended out of the way of moving machinery and water
- g) Examine the drill trestle for sturdiness and that it is not damaged

Question 4

What precautions must be taken with regard to clothing before drilling?

Answer

[MHSR Regulation 8.8(1) and Code of Practice]

- a) The employer must reasonable practicable measures to prevent persons from being injured as a result of them, clothes being worn by them or any equipment being held by them coming into contact with or being drawn into any moving part of any machine.
- b) The operator must not wear loose clothing when drilling as it could become entangled with the drilling equipment, causing injury.

Question 5

What precautions must be taken when handling the auger while drilling?

Answer

[Code of Practice]

The hand protector must be used when drilling holes. The hand protector consists of 50mm x 300mm polythene pipe fitted over the auger like a sheath, so that when the auger rotates the assistant holds the hand protector to guide the auger on initial penetration into the coal, thus protecting his hands from injury by the rotating auger.

Question 6

What precautions must be taken when working in water?

Answer

[Code of Practice]

The electric drilling machine and cable must not come into contact with water as it may cause the electrocution of the operator and damage to the electric drill.

Question 7

What precautions must be taken with regards to long hair?

Answer

[Code of Practice]

Long hair must be kept in a net when drilling as it could become entangled with the drilling equipment, resulting in an accident.

Question 8

Explain the effects/results of incorrectly drilled holes be with regard to the following:

- a) Roof, floor and face
- b) Rib sides
- c) A blasted face

Answer

a) Roof, floor and face

- i. Extra time spent on making safe the unsafe conditions caused by roof damage
- ii. Machinery breakdowns and tramming difficulties caused by floor damage
- iii. Overhanging faces which will have to be blasted down before the production cycle commences
- iv. Lower efficiency (less tons per hole)

b) Rib sides

- i. Incorrectly drilled holes will result in damage to pillars and rib sides which leads to unsafe conditions and takes time to make safe.
- ii. It may reduce the safety factor of the mine by causing small pillars and wider bords.

c) Blasted face

- i. Sockets which require time and labour to treat
- ii. Blown-out shots which in turn could lead to an explosion
- iii. Lower efficiency (less tons per blasted face)

Question 9

What are the benefits when holes are correctly drilled?

Answer

- a) Good safe roof and floor
- b) Solid faces
- c) Maximum tons per blast
- d) Good safe rib sides

Question 10

Name four causes of misfires

Answer

- a) Faulty detonator
- b) Detonator lead wire damaged while charging up
- c) Detonators accidentally removed from primer during charging
- d) Defective shot exploder

Question 11

Name two hazards associated with misfires.

Answer

- a) Drilling into a misfire can cause the explosives to detonate
- b) Explosives in loose coal can explode during loading operations

Question 12

How are sockets created?

Answer

- a) Blow out shots
- b) Drilling in the solid
- c) Drilling beyond the depth or the machine cut
- d) Burden too heavy for explosives used
- e) Incorrectly tamped holes
- f) Incorrect timing or delay detonators

Question 13

Name two hazards associated with sockets

Answer

- a) Holes drilled into untreated sockets containing explosives could cause the explosives to detonate.
- b) Metal objects inserted into untreated sockets containing explosives could cause the explosives to detonate.

Question 14

Explain how you would ensure that a hole is drilled to the correct depth

Answer

- a) Measure off length to be drilled by pushing the auger the back or the undercut and dropping a line from the hole position on the face to the auger

- b) Mark this position on the auger with chalk (1st mark)
- c) Remove the auger and measure 150mm less and mark the auger, this will be the drilling depth (2nd mark)
- d) The depth of each hole must be measured individually.

Question 15

What are the advantages of a mobile face drill?

Answer

- a) The operator is situated in a cab to protect him
- b) Water is supplied through the axial hole in the drill steel to the cutting bit to reduce dust
- c) The machine can maintain a high tempo
- d) Improved direction control
- e) Less labour intensive

Question 16

What are the dangers associated with a mobile face drill?

Answer

- a) Moving machinery, which can cause accidents to personnel.
- b) Electric cables, which may become damaged or faulty and cause accidents.

3 EXPLOSIVES

A COMPULSORY QUESTIONS

Question 1

Describe how explosives are stored in the section.

Answer

[MHSa Regulation 4.2(1)(a)]

- a) The employer must ensure that explosives that are not being transported or prepared for use are stored in explosive stores, silos or containers which are securely locked or, as far as reasonably practicable, designed and located so as to facilitate the safe and secure receipt, storage and issuing of explosives.
- b) The miner may store explosives in his/her section at a place convenient to the working places, in boxes or drums provided for that purpose by the employer.

Question 2

How much explosives can be kept in a section?

Answer

[MHSa regulation 4.2(1)(b)(i)(d) and Code of Practice]

- a) The employer must ensure that every container used for the storage of explosives, including old explosives, is of a capacity determined by the Employer in consultation with the explosive manufacturer or supplier; and
- b) In a fiery mine, the miner may only keep a quantity which must not exceed 24 hours estimated consumption.

Question 3

How must an explosive storage container be constructed?

Answer

[MHSa Regulations 4.2(1)(b)(i)(a), (b), (d) and (e)]

Every container used for storage of explosives must be:

- a) of robust construction
- b) provided with an effective lock and the key kept only by an authorized person
- c) spaced apart from any other explosive container used for storage of explosive

Question 4

How must the boxes or drums be marked?

Answer**[MHS Regulation 4.2(1)(b)(i)(c)]**

Explosive boxes and drums must be clearly marked to indicate the type of explosive to be placed therein.

Question 5

What do the regulations require regarding how explosives boxes or drums must be kept underground?

Answer

- a) They must be kept locked at all times by the miner while explosives are contained therein, except when:
 - i. it is necessary to place explosives in the box or drum or to remove explosives, or when such box or drum's contents are being inspected
 - ii. Provided that explosives in a sealed carton may be placed in an unlocked, empty box or drum, by any person who must snap close the lock thereof
- b) They must be kept in a safe and dry place at a distance determined by the employer in consultation with the explosive manufacturer or supplier, from any other explosive box.

Question 6

What are the miner's duties when explosives are delivered?

Answer**[MHS Regulation 4.4(2) and Code of Practice]**

- a) The employer must take reasonably practicable measures to ensure that the miner reports to the employer, whenever explosives are delivered to the working place for which that competent person is in charge, whether or not the correct quantity of explosives was delivered.
- b) As soon as is practical during the shift in which explosives have been delivered to a working place, the ganger or miner in charge must satisfy himself that all the explosives have been delivered. He must further, in a manner prescribed by the manager, report whether or not the correct quantity of explosives was delivered to his working place.

Question 7

Who may open a case of explosives?

Answer**[MHS Regulation 4.1(2)(a)]**

Only persons authorized by the employer may gain access to or attempt to gain access to explosives

Question 8

How must detonators, safety fuses, capped fuses, igniter cord, electrical initiators and fuse igniters be stored?

Answer**[Code of Practice]**

They may be stored together in boxes provided for the purpose

Question 9

Describe how explosives may be transported in workings

Answer**[MHS Regulation 4.2(1)(b)(vi) and Code of Practice]**

- a) The employer must ensure, as far as reasonably practicable, that explosives are only transported in vehicles, conveyances, unopened cases or locked containers approved in writing for that purpose by the employer.
- b) Detonators must be transported in separate locked boxes provided by the employer.
- c) Made up primers may be transported in locked boxes provided by the employer.

Question 10

Who may handle explosives?

Answer**[Code of Practice]**

- a) The miner

- b) Blasting assistant
- c) Person authorized the employer in term of regulation 4.1(2)

Question 11

Describe how to charge up a shot hole.

Answer **[Code of Practice]**

- a) Check the position of the hole
- b) Check the depth, direction and elevation of the hole
- c) Check if the hole is clean
- d) Explosives inserted into shot holes, must be pressed home, not hit or rammed
- e) Quantity of explosives to be inserted into the shot hole will be determined by the employer in consultation with the explosive manufacturer or supplier
- f) Tamp to the collar

Question 12

Describe the equipment used for charging up a shot hole.

Answer **[Code of Practice]**

- a) Explosives, charging stick and tamping provided by the employer
- b) Equipment used for charging up a shot hole must be determined by the employer in consultation with the explosives manufacturer or supplier

Question 13

What are the requirements regarding the breaking of blasting cartridges?

Answer **[MHS Regulation 4.3(2)(b) and Code of Practice]**

- a) Under no circumstances must any blasting cartridge be broken or cut or a wrapper round any blasting cartridge be interfered with, except when preparing the blasting cartridge for the insertion of a detonator or detonating fuse.
- b) No person must break or cut any blasting cartridge or open or interfere or remove the wrapper around any blasting cartridge except when preparing primers.

Question 14

Who is responsible for the safeguarding of assistants?

Answer **[Code of Practice]**

The miner must take all reasonable precautions to safeguard persons assisting him in blasting operations against accidents.

Question 15

When may a face be charged up?

Answer **[MHS Regulation 4.6(3)]**

The employer of every underground mine must take reasonable measures to ensure that explosives are not brought to the working place where blasting is to be carried out unless the:

- a) drilling of shot holes have been completed;
- b) shot holes are ready to be charged with explosives; and
- c) quantity of explosives do not exceed the estimated required quantity to be used for the blast.

Question 16

Which holes may be charged?

Answer **[Code of Practice]**

The miner must only charge the holes, or prepare only the charges that are intended to be fired at the next blast and whilst explosives charges are awaiting firing, must ensure that they are not interfered with.

Question 17

If a face cannot be blasted after it has been charged with explosives, what precautions must be taken?

Answer **[MHSR Regulation 4.16(6) and Code of Practice]**

- a) The miner must ensure that the face is not tampered with.
- b) The employer must take reasonable measures to ensure that a written procedure is prepared and implemented after consultation with explosives manufacturer or supplier to ensure that sleep-over blasts are carried out safely.

Question 18

Describe how to prepare a primer

Answer **[Code of Practice]**

The miner must, when preparing a primer, make a hole of sufficient diameter and depth in the cartridge with a sharpened stick or pricker of non-ferrous material, press the detonator into the cartridge and securely fasten it to the cartridge by means of string or other suitable material so that it cannot be inadvertently withdrawn.

Question 19

What do the regulations state concerning old or damaged explosives?

Answer **[MHSR Regulation 4.2(1)(b)(ii) and Code of Practice]**

- a) The employer must implement measures to ensure, at every mine where there is a significant risk of old explosives being present, that adequate storage facilities are provided for such old explosives.
- b) Old or damaged explosives recovered in the working place from misfired holes or broken ground must be placed and kept in boxes provided for that purpose by the employer.

Question 20

Describe the sequence in which explosives must be used.

Answer **[MHSR Regulation 4.3(2)(a)]**

The employer must ensure that all explosives are used in the same sequence as they are issued.

Question 21

When may a miner relinquish charge of explosives?

Answer **[Code of Practice]**

No person in charge of explosives must relinquish such charge until some other person lawfully accepts charge thereof or such explosives are placed in a store, box, container or drum provided for the purpose and such store, box, container or drum is securely locked.

Question 22

Who may be in possession of the keys to stores, boxes, containers or drums in which explosives are kept?

Answer **[MHSR Regulation 4.1(2)]**

The miner and any person authorized in terms of regulation 4.1(2).

Question 23

What does the regulation say concerning illegal hiding or removing of explosives?

Answer

[MHS Regulation 4.1(3)]

Subject to regulation 4.2(2), no person may, or cause or permit any other person to, bury, hide, submerge or abandon any explosives.

Question 24

Why must a shot hole be tamped to the collar?

Answer

- a) To prevent blown-out shots
- b) To prevent the build up of methane gas in the shot hole

Question 25

Why must holes that have been drilled incorrectly be tamped before charging-up commences?

Answer

- a) To ensure that they are not charged-up
- b) To prevent blown-out shots
- c) To prevent the build up of methane

Question 26

Why must the blasting cable not come into contact with any electrical equipment?

Answer

Accidental detonation can take place

Question 27

Why is the blasting cable rolled out to the intake ventilation side of the section?

Answer

To ensure that persons are not exposed to dust, fumes or smoke

Question 28

Why may "old explosives" not be re-used to charge a face?

Answer

They are damaged.

3 EXPLOSIVES

B CHOICE QUESTIONS

Question 1

Define a shot hole.

Answer

[MHS Regulation Chapter 4 Definitions]

A **shot hole** means any drill hole charged with or intended to be charge with explosives.

Question 2

How are permitted explosives identified?

Answer

- a) SABS approval mark 1418.
- b) Marking on wrapper.

Question 3

Describe how explosives may be transported in the underground workings.

Answer

[MHS Regulation 4.2(1)(b)(vi) and Code of Practice]

- a) The employer must implement measures to ensure, as far as reasonably practicable, that explosives are only transported in vehicles, conveyances, unopened cases or locked containers approved in writing for that purpose by the employer.
- b) Any person may, in the underground working, convey explosives in an unopened case or container.

Question 4

When may cartridges and detonators be conveyed together?

Answer

[MHS Regulation 4.2(1)(b)(iv) and Code of Practice]

- a) The employer must implement measures to ensure that primers are kept separate from other explosives and stored in a container complying with regulation 4.2(1)(b)(i)
- b) Detonators must not be conveyed in the same conveyance or receptacle cart, provided that made-up primers may be conveyed in a receptacle provided by the manager.

Question 5

What type of explosives may be used in a charge?

Answer

Permitted explosives

Question 6

When may two detonators be used in a charge?

Answer

[MHS Regulation 4.16(8)(d)]

Except as may be necessary to re-initiate a misfired hole, the miner must not insert more than one detonator into an explosive charge, provided that in wet workings two detonators may be used only if they are both inserted into the same cartridge and securely fastened to it.

Question 7

Describe a charging rod

Answer

The charging rod must be of wood or other material determined by the employer in consultation with the explosive manufacturer or supplier for that purpose and must easily fit into the hole, and must have its end cut off square.

Question 8

Describe an old explosive box.

Answer

[MHS Regulations 4.2(1)(b)(i)(a), (b) and Code of Practice]

Every such box must:

- a) Be of robust construction and be provided with an effective lock;
- b) Be painted red and be clearly marked to indicate the type of explosives to be placed therein;
- c) Be kept locked at all times except when the explosives have to be removed for destruction; and
- d) Be kept in a safe place not less than 15m from other explosives and may be kept not less than 3m from any other old explosives box.

Question 9

Describe how old explosives boxes are cleared.

Answer

The box must be cleared daily by the miner.

Question 10

May old explosives be destroyed underground in a fiery mine?

Answer

[MHS Regulation 4.2(3)(ii)]

No.

4 BLASTING PROCEDURES

A COMPULSORY QUESTIONS

Question 1

Who may conduct blasting operations in a fiery mine?

Answer

Only the holder of a blasting certificate

Question 2

Under what conditions may the holder of a provisional fiery mine blasting certificate initiate a blast?

Answer

Only under the supervision of the holder of a permanent fiery mine blasting certificate.

Question 3

At what percentage of flammable gas may a person not fire any explosives charged?

Answer

When the percentage of flammable gas in the atmosphere exceeds 1.4%.

Question 4

What examination must the miner carry out before firing any charge in a coal mine, and what instrument must be used?

Answer

The miner must examine for flammable gas, using a flammable gas measuring or detection instrument.

Question 5

When and where must the miner examine for flammable gas before firing a charge in a coal mine?

Answer

- a) After charging up and before firing the explosive charge.
- b) At the place where the explosive charge is to be fired and at any accessible places which may be effected by the explosive charge.

Question 6

What precautions must the miner take if flammable gas was detected in his/her section in the preceding 24 hours?

Answer

If flammable gas in excess of 1.4% has been detected in the preceding 24 hours, the miner will not fire any charge unless he/she has examine not only the place where the charge is to be fired, but also all accessible places in a radius 30 meter from where the charge will be fired, and he/she has satisfied himself that no flammable gas in excess of 1.4% is present.

Question 7

What is the miner's responsibility towards person's safety whilst carrying out a blasting operation?

Answer**[MHS Regulation 4.6(3)(b)(ii) and (iii)]**

The employer must ensure that the miner does not initiate any explosive charge unless:

- a) all persons have been removed from the working place where explosive charges are to be initiated;
- b) all entrances to the working place(s) where explosive charges are to be initiated, or to places where the safety of person(s) may be endangered by such initiation, are effectively guarded so as to prevent inadvertent access to such place(s) while such explosive charges are being initiated; and
- c) the miner gives or causes to be given due warning in every direction and is satisfied that no person remains where they might be exposed to danger from the initiating of such explosive charges.

Question 8

What warning must the miner give before firing any charge?

Answer**[MHS Regulation 4.6(3)(b)(iv)]**

The employer must ensure that the miner does not initiate any explosive charge unless the miner gives or causes to be given due warning in every direction and is satisfied that no person remains where they might be exposed to danger from the initiating of such explosive charges.

Question 9

What precautions must the miner take after he has connected the firing cable to the detonator wires, and just prior to firing the charge?

Answer**[MHS Regulation 4.10(1)]**

The employer must take reasonable measures to ensure that, where initiating takes place by means of electricity, the miner after such miner has connected the blasting cable to the detonator wires of any explosive charge or charges and before such explosive charge or charges have been initiated, does not:

- a) remain or approach, or cause or permit any other person to remain or approach, within a distance where such person may be endangered by the initiating of such explosive charges, except for the purpose of examining the blasting circuit; and
- b) examine the blasting circuit, or cause or permit the blasting circuit to be examined, unless both leads are disconnected from any source of electricity, whether for initiating explosive charges or testing the blasting circuit.

Question 10

What blasting cable may a miner use when firing charges by means of electricity?

Answer**[MHS Regulation 4.10(2)(a)]**

The employer must, where initiation takes place by means of electricity, take reasonable measures to ensure that the miner only uses a blasting cable provided for that purpose and which is in good order and of sufficient length to ensure that the blasting cable cannot come into contact with any other cable or electrical apparatus.

Question 11

What must the miner do immediately after firing or attempting to fire a charge?

Answer**[MHS Regulation 4.10(2)(f)]**

except in the case of a remotely operated centralised electric blasting system, immediately after initiating or attempting to initiate the explosive charges, disconnects both leads of the blasting cable from the initiating device and then:

- a) removes the operating handle or key of the initiating device; or
- b) secures the locking arrangement of the initiating device and removes the key.

Question 12

What type of shot firing apparatus may be used?

Answer **[Code of Practice]**

No person will fire any charge except by means of an electrical shot firing apparatus determined by the employer in consultation with the explosive manufacturer or supplier.

Question 13

What precautions must be taken after driving through a dyke?

Answer **[Code of Practice]**

In any main development or exploration drive after a dyke has been driven through, no firing of charges must take place unless the manager, mine overseer or shift boss has examined the place and satisfied himself/herself that the atmosphere does not contain flammable gas in excess of 1.4%.

Question 14

What precautions must a miner take regarding environmental control before entering a face that has been blasted?

Answer **[MHSa Regulation 4.9 and Code of Practice]**

- a) The employer must take reasonable measures to ensure that after explosive charges have been initiated or misfired holes have been re-initiated, the miner does not approach, or causes or permits any other person to approach, within the range of the exploding charges until such competent person is satisfied that all the explosive charges have exploded or until a period of 30 minutes has expired, after the initiation of the charges.
- b) The ganger or miner must not, after firing has taken place, whether by electricity or in any other manner, enter or allow any person to enter the place in which such firing has occurred until the harmful smoke, gas, fumes or dust caused by the explosion have dissipated.

Question 15

What precautions must a miner take concerning misfires in a face that has just been blasted?

Answer **[MHSa Regulation 4.10(3)]**

The employer must take reasonable measures to ensure that, after the explosive charges have been initiated by means of electricity, the miner:

- a) carefully examines for misfired holes where the charges have been initiated, before permitting any person to work there;
- b) instructs any person engaged in clearing the broken rock, mineral or ground to report immediately to such competent person the finding of any wires that may lead to a misfired hole; and
- c) carefully traces any such wires to determine whether or not a misfired hole has occurred.

Question 16

How must a misfire in a coal face be treated?

Answer **[Code of Practice]**

- a) Remove tamping with approved scraper
- b) Insert charging stick to ascertain direction and elevation of hole
- c) Fasten protruding wires to prop or suitable marker
- d) Drill a relieving hole after ensuring that the depth is marked off correctly
 - i. Not closer than 300mm from misfired hole
 - ii. Parallel to misfired hole
- e) Charge the relieving hole with explosives
- f) Tests for gas
- g) Place guards

- h) Blast according to blasting procedures
- i) After firing, make a careful search for explosives
- j) As far as possible, the coal must be removed without the use of tools
- k) Explosives to be removed (except coal being moved in search for explosives) until all explosives liberated from the misfire have been recovered

Question 17

How must a misfire in a stone face treated?

Answer **[Code of Practice]**

- a) Explosives must be extracted by means of water or water with compressed air through a pipe of design and material approved
- b) No person other than the valid blasting certificate holder for the class of mine must extract explosives from a hole which has been charged up
- c) The person extracting explosives from the hole must:
 - i. Ensure that all explosives in the hole are extracted
 - ii. Recover as far as practicable all explosives
- d) This hole is now regarded as a socket and must be treated as such

Question 18

What restrictions apply in a heading in which there is a misfire?

Answer **[Code of Practice]**

No drilling allowed, except for drilling of a relieving hole to treat the misfire.

Question 19

What must be done when firing a coal face and no shot goes off?

Answer **[Code of Practice]**

- a) Notify guards to stay where they are
- b) Disconnect blasting cable from the shot exploder
- c) Test with circuit tester from a safe place
- d) Physically check detonator wire joints from faults
- e) Check for fault by elimination (from a safe place)
- f) Disconnect fault from circuit (tie lead wires to a marker)
- g) Carry out normal blasting procedure

Question 20

How must a misfire be treated in a full blasted face?

Answer **[Code of Practice]**

- a) Check for loose explosives and remove explosives as far as possible by hand and place it in old explosives box
- b) Instruct loader driver to be on lock-out for explosives
- c) If more explosives are found, call the miner immediately
- d) Send for an old explosives box
- e) If primer is found, remove the detonator
- f) Put detonators and explosive cartridges in separate old explosive boxes.

Question 21

What must be done when firing a stone face and no shot goes off?

Answer**[Code of Practice]**

- a) Notify guards to stay where they are
- b) Test with circuit tester
- c) Disconnect blasting cable from shot exploder
- d) Physically check detonator lead wires for faults
- e) Find fault by elimination
- f) If fault is in a blast hole, remove tamping and insert a fresh primer (ensure 800g is not exceeded)
- g) Connect new primer's detonator wires to circuit
- h) Blast according to blasting procedures

Question 22

Describe the blasting procedure of a face which has already been charged up with explosives

Answer**[Code of Practice]**

- a) Remove all people from the face and affected areas
- b) Place guards
- c) Get clearance from guards as per given number
- d) If all is clear, test continuity through blasting cable from a safe place
- e) Connect blasting wires up with shot exploder
- f) Shout 'fire' and blast
- g) Immediately disconnect both leads and remove the key from the shot exploder
- h) Relieve the guards closest to the blasting position first and then the rest

Question 23

What instructions must the miner give each guard?

Answer**[Code of Practice]**

- a) He/she must instruct him to be a guard and allocate him a number e.g. guard no. 1, guard no. 2 etc.
- b) He/she will define the term "nobody" to the guards and explain to him to allow nobody to enter the danger area
- c) Explain where the blast is to take place
- d) He/she will show each his area of responsibility
- e) When he calls 'No. 1', or "No. 2" etc. The guard must Answer if it is safe, otherwise he/she must keep quiet. (The miner will come to him and investigate)
- f) Guards to stay at their positions until relieved

Question 24

What is a blasting accident?

Answer

An injury to a person due to blasting or exposure to blasting fumes, gases or smoke is regarded as a blasting incident.

Question 25

What steps must be taken in case of a blasting accident?

Answer**[Code of Practice]**

- a) Get the injured person out if possible
- b) treat the injuries and notify the mine overseer or shift boss who will call for an ambulance
- c) report in preliminary accident report book, and record the time of the accident
- d) send injured person out with a witness
- e) indicate position of:
 - i. injured persons

- ii. guards
- iii. miner
- iv. witnesses
- f) fence off and leave the place where the accident occurred undisturbed

4 BLASTING PROCEDURE

B CHOICE QUESTIONS

Question 1

Describe the conditions that you would expect to encounter when approaching a dyke

Answer

- a) Burnt coal
- b) Bad roof conditions
- c) Slips
- d) Water
- e) Flammable gas

Question 2

Describe how you would treat the conditions which are encountered when approaching a dyke

Answer

[Code of Practice]

- a) Install additional support
- b) Make use of support with a bigger face area, i.e. Lager area of support such as head-boards with roof-bolts
- c) Reduce the mining width, i.e. smaller excavations
- d) Make use of the minimum number of roads when going through the dyke
- e) Leave longer pillars, i.e. staggered pillars
- f) Deal with water and flammable gas

Question 3

How much explosive may you insert per hole in a dyke?

Answer

The amount of explosives will be determined by the employer in consultation with the explosives manufacturer or supplier.

Question 4

On blasting a face, a slip (bad roof) has been exposed. Describe what precautions to take and how to load out the face.

Answer

[Code of Practice]

- a) Determine where the last safe row of roof bolts is by means of a sounding stick.
- b) Mark this position on the roof and both rib sides.
- c) Instruct the operator to load until his body is in line with the marks on the roof and rib sides, and then to withdraw the loader and call the miner.
- d) Install temporary support.
- e) Have roof-bolter install additional roof-bolts in temporary supported area.
- f) Repeat procedure until coal is loaded out.

Question 5

What extra precautions are to be taken in bad ground?

Answer**[Code of Practice]**

- a) Use long cable anchors
- b) Use timber poles together with larger head boards
- c) Use cable anchors and W-straps
- d) Use timber or steel sets

Question 6

When installing a resin bolt, what will happen if the spinning time of the bolt in the resin is:

- a) too long; or
- b) too short?

Answer

- a) **Too long:** The bondage will break and resin will turn into powder
- b) **Too short:** The bolt cannot be torque properly because the resin will not harden properly.

Question 7

Why does one install more resins and/or longer bolts at slips?

Answer

- a) More resin with longer bolts are together, because the bond area in the hole is greater
- b) To bond the loose side with the tight side

Question 8

How does one treat bad roof in the tramming road during the shift?

Answer**[Code of Practice]**

- a) Fence off
- b) Attempt to bar down
- c) If unsuccessful, install temporary support
- d) Support permanently using a roof bolter

Question 9

What would one do if a fall of ground occurs and the roof is too high for the roof bolter to support?

Answer**[Code of Practice]**

- a) Report to the shift boss
- b) Make use of fallen ground to build a ramp
- c) Put in temporary support
- d) Install roof-bolts
- e) If unsuccessful, fence or barricade off

Question 10

A dense systematic support rule is already used in a section, but still little pieces fall out between the bolts, what kind of support should be installed?

Answer**[Code of Practice]**

- a) A support system with greater area coverage
- b) "W" straps
- c) Support with headboards
- d) Wire mesh and bolting
- e) Conveyor belting and bolting

Question 11

When barring down a big piece of roof, there is a gap between the roof and the loose coal, but it still would not come down, how should it be dealt with?

Answer **[Code of Practice]**

- a) Use two or more persons (each with a proper length pinch bar) to assist
- b) If unsuccessful, barricade off
- c) Drill it and blast it down

Question 12

What precautions must a miner take if a drive has advance more than 50 metres beyond the last through road?

Answer **[Code of Practice]**

In any fiery mine where a development drive, heading or bord is more than 50 metres in advance of the general line of workings, no person will fire a charge in such a place except between shifts.

5 LOADING**A COMPULSORY QUESTIONS****Question 1**

By whom and how often must a trailing cable be examined?

Answer **[Code of Practice]**

Every electrical flexible trailing cable in use in the section must be examined at the beginning and again at least once in the course of each shift by the ganger or miner in charge or by a competent person appointed by the manager, in writing. If any such cable is damaged or becomes defective, its use must forthwith be discontinued. Such damaged or defective cable must not be further used until after it has been sent to the surface and there properly repaired.

Question 2

What do the regulations state regarding joints on a trailing cable?

Answer **[MHSR Regulation 3.25]**

The employer must take reasonably practicable measures to ensure that no flexible cable or trailing cable must have more than 15 joint repairs, including sheath patches over a length of 20 metres and no joint repair must be closer than 5 metres to an adjacent joint, repair or patch and no joint, repair or patch must be closer than 3 metres to the cable plug or its terminal connection at the machine or apparatus.

Question 3

What is a flameproof enclosure?

Answer

It is an enclosure that is strong enough to withstand an explosion within and at the same time allow the cooled down flame to escape via the flame path.

Question 4

How will you examine the flame-proofing on a mechanical loader?

Answer

- a) Bolt and nut on electrical equipment must be in position and tight
- b) Flame paths must be clean
- c) Visually examine all glands for damage

- d) Check for any external damage on flameproof enclosures

Question 5

What safety devices are built into the section switchgear?

Answer

[MHS Regulation 3.7 and Code of Practice]

- a) Earth leakage protection;
- b) Overload protection;
- c) No-volt coil;
- d) Pilot circuit; and
- e) Correctly rated.

Question 6

By making use of given figures calculate the shuttle car factor, e.g.

Tons produced	=	1000
Shuttle cars booked	=	120
Shuttle car capacity	=	8 ton

Answer

Shuttle car factor	=	$1000 \div 120$
	=	8.33 ton/shuttle car

Question 7

What is meant by the term "wait on shuttle car time"?

Answer

"Wait on shuttle car" refers to a wait at the change-out point and not at the loader, i.e. when a full shuttle car passes the change-out point on its way to the tip and an empty shuttle car is not waiting to go to the loader, the time taken for the empty car to reach the change-out point is the "wait-on-shuttle car" time.

Question 8

What are the requirements regarding the operator's duties with respect to flammable gas?

Answer

[Code of Practice]

The operator of any electrical drilling, cutting, breaking or loading machine must:

- a) be instructed and found competent in testing for flammable gas;
- b) test for the presence of flammable gas in any underground working place before such electrical machine is taken into it, and
- c) by means of a flammable gas warning device continuously monitor the atmosphere in the working place where such electrical machine is in operation.

Question 9

What are the operator's duties if a concentration of more than one comma four parts per hundred by volume of flammable gas is detected in a work place in a coal mine where any electrical machine is used?

Answer

The operator must isolate the electrical power supply to that working place forthwith, lock out and report the matter to the ganger or miner in charge, who must ensure that the situation is dealt with.

Question 10

What are the requirements regarding the operator's duties with respect to flexible trailing cables?

Answer**[Code of Practice]**

The operator must take all reasonable measures to safeguard the flexible cable against damage and he must report immediately to the ganger or miner in charge any damage or defect he may observe in the cable. He must not leave such machine while it is working and must before leaving the section, ensure that the power supply to the flexible trailing cable is isolated.

Question 11

What are the requirements regarding dust control on machines used for ripping, picking, cutting, drilling or loading rock, coal or other minerals in the workings of a mine?

Answer**[Code of Practice]**

Every machine must be fitted with means, or means must be provided, either for applying water effectively to prevent dust being created by the operation of such machine, or for effectively trapping such dust by some suitable apparatus approved by the employer.

5 LOADING**B CHOICE QUESTIONS****Question 1**

What electrical apparatus may be used in a hazardous area of a fiery mine?

Answer

Only flameproof and intrinsically safe apparatus and an enclosed and locked or sealed light or lamp.

Question 2

Describe how to install and position a shuttle car trailing cable anchor point?

Answer**[Code of Practice]**

- a) Anchor point to be situated on the same side as the cable drum.
- b) Install two roof-bolts horizontally into the rib side.
- c) Loop trailing cable through tyre ensuring that there is adequate length to reach the switch gear.
- d) Secure tyre to both roof-bolts by means of safety chain.

Question 3

How would the ventilation flow (coursing or splitting) influence the loading cycle in the conventional section?

Answer

- a) Splitting ventilation - the figure of "8" loading cycle will be used.
- b) Coursing ventilation - "barrier to barrier" loading cycle will be used.

6 PILLAR EXTRACTION (STOOPING)**B CHOICE QUESTIONS****Question 1**

Explain what is meant by pillar extraction (stooping).

Answer

It is the extraction of the coal left in pillars after primary bord and pillar development.

Question 2

Name the hazards associated with stooping.

Answer

- a) Removal of primary support pillars results in a goaf behind the last line of support
- b) The weight of the roof before it goafs is thrown over to the working area causing extra loading stresses.
- c) The goaf may breach the last line of support and run into the working area
- d) Due to the extra stressed on the working areas, slips, joints, overhangs and other poor roof conditions may require extra support to prevent roof falls
- e) Major goafs, particularly the initial goaf of a stooping panel" can cause a large blast of air over the working area. If the air contains accumulations of noxious or flammable gases and coal dust the risk of an ignition may arise
- f) Spontaneous combustion of the remaining coal may occur in the goaf area
- g) Accumulations of explosive mixtures of flammable gas may occur undetected in the goaf
- h) The collapse of the overlying strata may cause inrushes of water from the goaf

Question 3

What are some of the controls that may be put in place to eliminate or reduce the hazards associated with stooping?

Answer

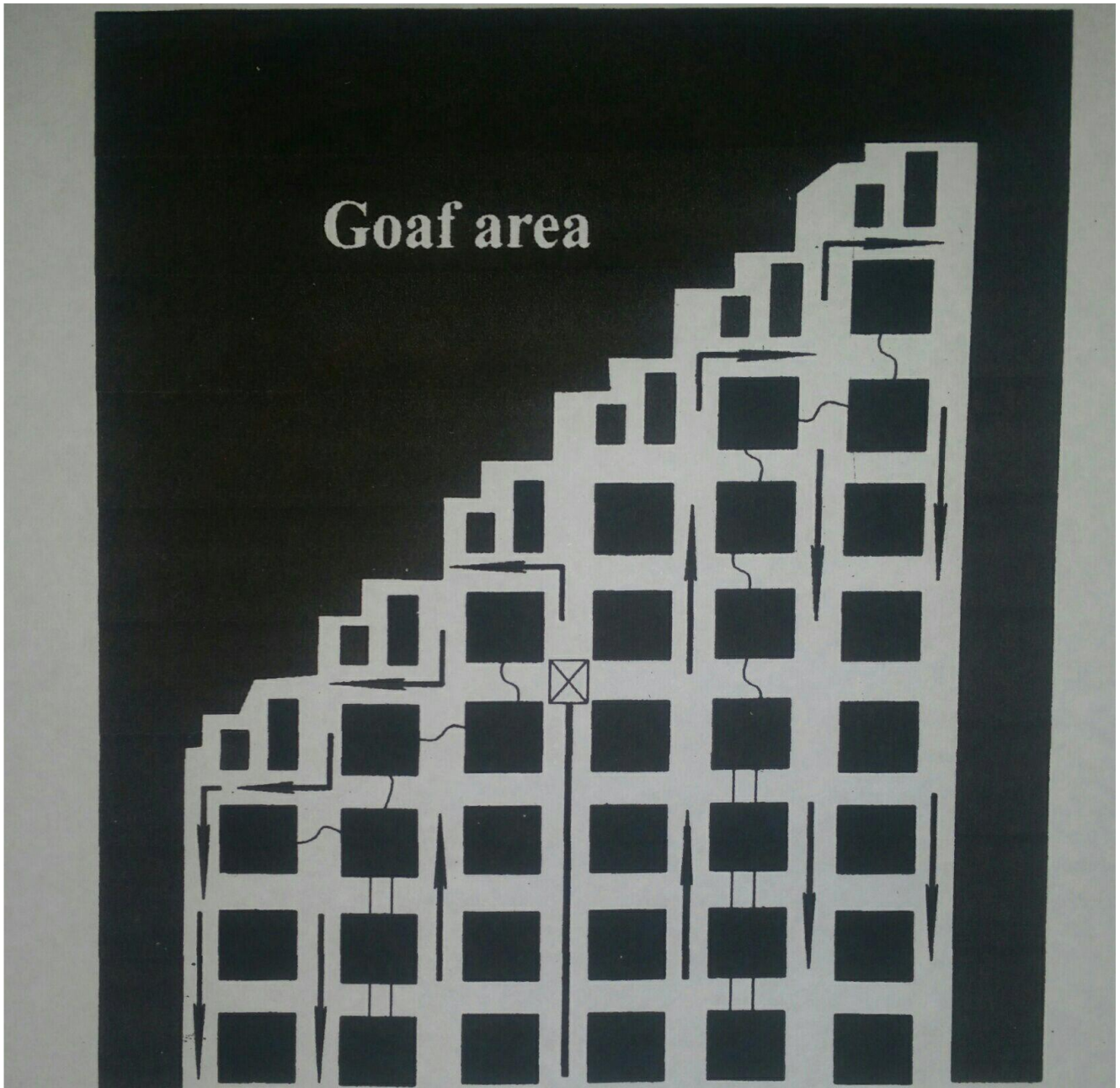
a) Extra support

During primary development the bords would have been supported with roof-bolts installed according to the systematic support system laid down for the section. The panel should be designed to a higher safety factor than normal. In the region of +2.0. During pillar extraction additional support in the form of breaker lines must be installed along the goaf edge to protect persons and machinery and to control the roof collapse. These breaker lines are generally single wooden props with headboards and according to the regulations must be a double row of props with headboards set and maintained in good order and condition between the goaf edge and all places where persons have to travel or work. The two rows of props must not be more than one metre apart, nor must the props in each row be more than one metre apart and each row must terminate not more than one metre from the solid coal pillar or the working face as the case may be. This is a minimum requirement and the support density will be increased if the roof conditions require additional support. The fenders of coal also assist in supporting the roof.

b) Ventilation

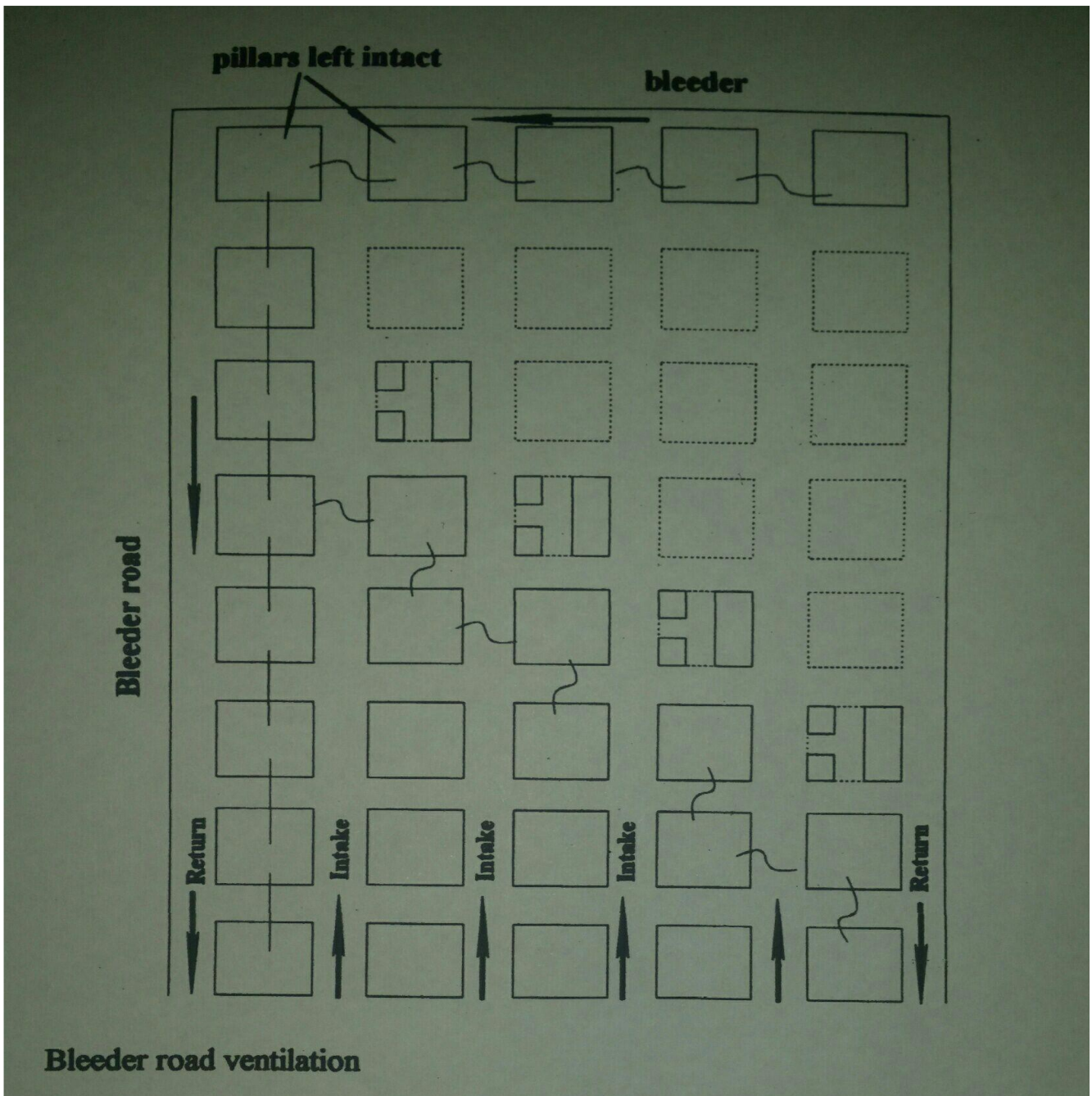
Pillar extraction actions generally require more air per ton of coal broken than development sections. Faces are more difficult to ventilate and gas emission is often increased by goafing, splitting or coursing ventilation systems are used and the faces are ventilated in three ways:

- i. Coursing the ventilation along the working faces in a similar manner to development sections
- ii. Intake air entering the section in the centre, splitting left and right, coursing along the working faces and returning via the returning airways in the left and right barrier roads.



A typical splitting ventilation layout

Bleeding the return air, or portion thereof; through the goaf itself to an established return airway behind the goaf. During development one road on either side of the panel is utilized as a return airway. When pillar extraction commences one of these return airways is turned into a bleeder road by leaving a line of pillars intact, adjacent to the barrier pillar. Approximately 15% of the section's intake air is allowed to bleed over the goaf and through the bleeder road to the return airway. The remainder of the ventilation returns via the normal section return.



Bleeder road ventilation

c) Stone dust

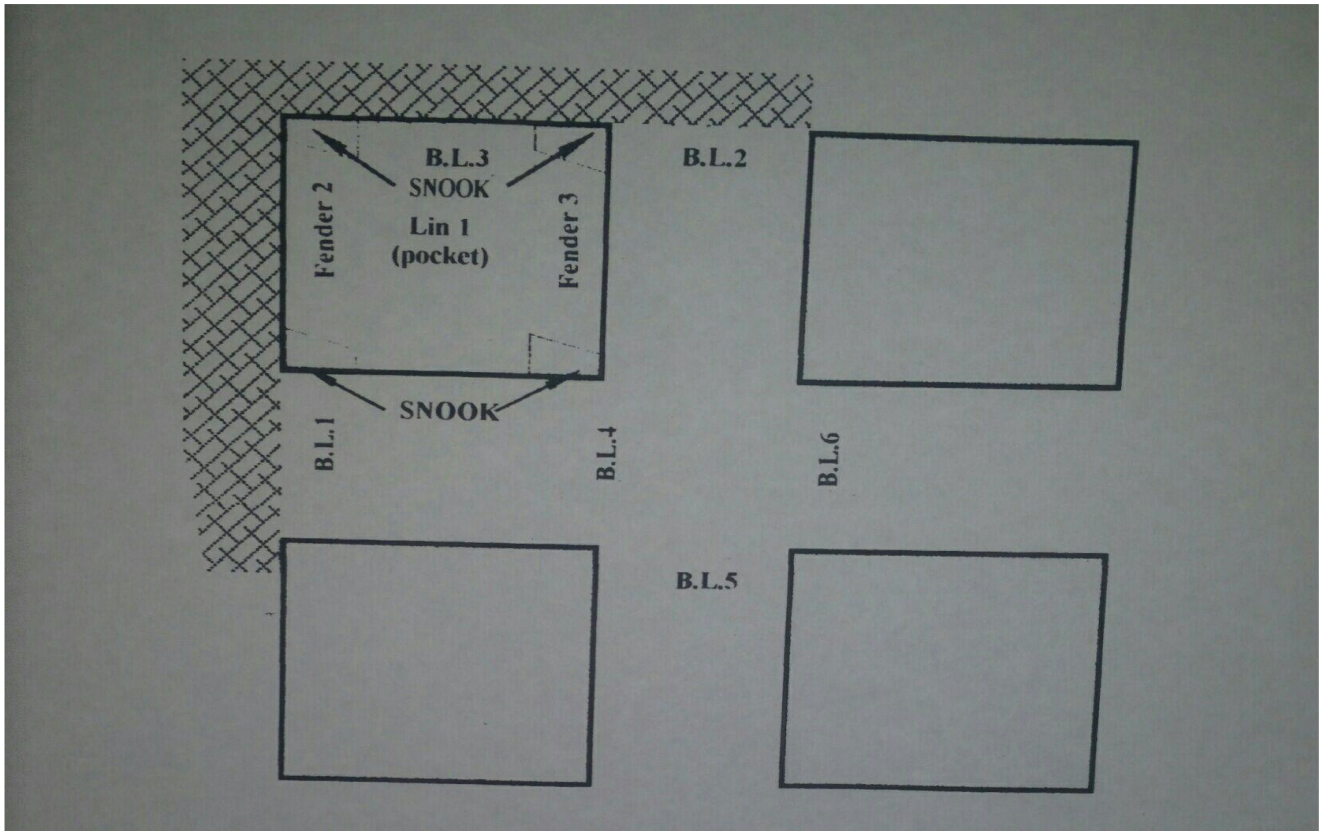
In addition to good ventilation controls stone dust must be applied and stone dust barriers erected as per mine's code of practice. Continuous gas monitoring instruments are often placed in strategic places to warn of gas accumulations

Question 4

Describe a typical method of using conventional mechanised equipment to extract a coal pillar.

Answer

In this method, which is preferred in mechanised mining, the pillar is split and reduced by pockets, leaving fenders of coal to supplement the artificial support which can be root-bolts and/or timber props. The tenders are extracted leaving four small snooks which are destroyed by blasting or crushed by the roof. It is important that these snooks are destroyed as they may hinder the complete caving of the goaf.



Pocket and fender method of extraction using conventional mechanised equipment

PROCEDURE TO EXTRACT A PILLAR

- Breaker lines BL1 and BL2 are installed once the previous row of pillars has been extracted
- Main lift 1 (the pocket) through the pillar in order to subdivide the pillar into two fenders
- Install breaker line BL3 as soon as lift 1 holes through into the goaf
- Cut, drill, blast and load fender No.2
- Install breaker line BL4
- Blast snooks from fender No 2 if necessary
- Withdraw breaker lines BL1 and BL3
- Cut, drill, blast and load fender No.3
- Install breaker lines BL5 and BL6
- Blast snooks from fender NO.3 if necessary
- Withdraw breaker lines BL2 and BL4

Question 5

Why is the layout of a conventional mechanised pillar extraction section generally done on 45° stooping line?

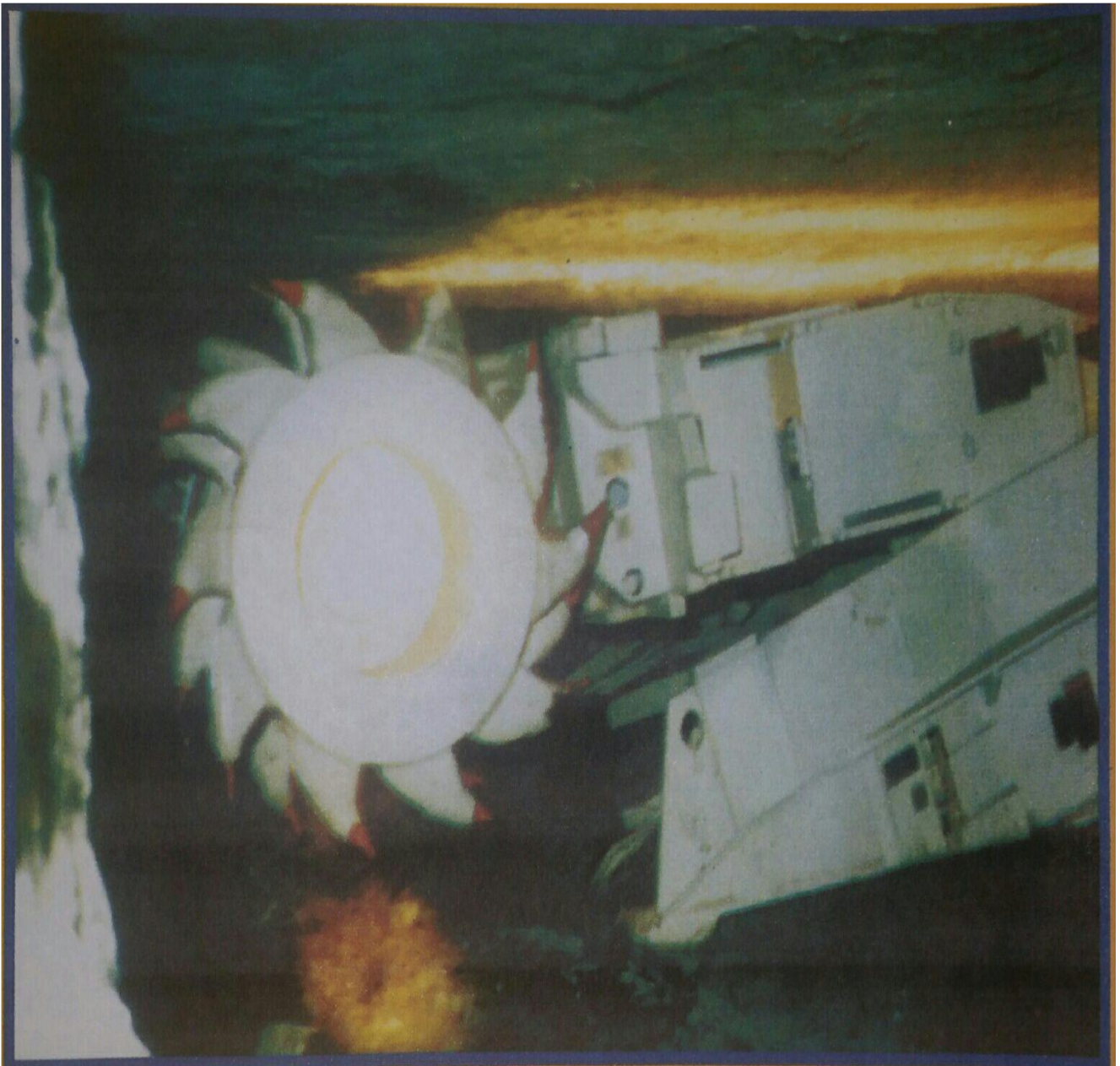
Answer

Conventional mechanised pillar extraction is generally done on a 45° stooping line. The reasons for this are that every pillar being extracted is partially protected by at least two other solid pillars. It is important that the pillar lines be kept straight in order to prevent any irregular projections into the goaf which will interfere with roof control. The 45° pillar line is preferred to a pillar line because there are a greater number of working places available. Another factor which favours the 45° pillar line is that only the corners of pillars instead of whole sides are exposed to the higher abutment stresses ahead of the goaf.

COAL MINER'S CERTIFICATE

MODULE 3

CONTINUOUS MINER SECTION



1 LEGAL REQUIREMENTS

A COMPULSORY

Question 1

What are the requirements of the Regulations regarding the appointment of an operator of self-propelled mobile machine?

Answer **[MA Regulation 18.2.1]**

No person must drive or cause or permit any other person to drive any self-propelled mobile machine which is under the control of the manager in or on a mine or works or private property in or on such a mine or at such a works, unless such a person has been authorized thereto by the manager, mine overseer or competent person appointed in terms of regulation 2.13.2.

Question 2

When does the Regulations require an operator of self-propelled mobile machine to be re-tested?

Answer **[MA Regulation 18.1.7]**

Whenever a person has been authorized to drive a self-propelled mobile machine, has for any reason whatsoever, not driven such a machine for a period of 180 days or longer, he/she may be authorized again to drive such a machine.

Question 3

What are the requirements of the Regulations regarding joints on trailing cables?

Answer **[MHSR Regulation 3.25]**

The employer must take reasonably practicable measures to ensure that no flexible cable or trailing cable must have more than fifteen joint repairs, including sheath patches over a length of 200 metres and no joint repair or patch must be closer than 5 metres to an adjacent joint, repair or patch and no joint, repair or patch must be closer than 3 metres to the cable plug or its terminal connection at the machine or apparatus.

Question 4

What are the operator duties regarding flammable gas?

Answer **[Code of Practice]**

At every fiery coal mine the operator of any electrical drilling, cutting, breaking or loading machine must:

- a) Be instructed and found competent in testing for flammable gas.
- b) Test for the presence of flammable gas in any underground working place before such an electrical machine is taken into it.
- c) By means of flammable gas warning device continuously monitor the atmosphere in the working place, where such an electrical machine is in operation. (Reg. 8.7.1)

Question 5

What are the operator's duties if a concentration of more than 1.4% of flammable gas is detected in a working place in a coal mine where electrical machines are used?

Answer **[Code of Practice]**

If the atmosphere in any underground working place in any fiery coal mine contains more than one comma four parts per hundred by volume of flammable gas either after the entry into that working place of an electrical machine or during its operation, the operator must cut off the electrical power supply to that working place forthwith and report the matter to the ganger or miner in charge.

Question 6

What are the requirements regarding dust control at machines used for ripping, picking, cutting, drilling or loading rock, coal or other minerals in the workings of a mine?

Answer **[Code of Practice]**

In the workings of every mine, every machine for ripping, picking, cutting, drilling or loading rock, coal or other minerals must be fitted with means, or means must be provided either for applying water effectively to prevent dust being created by the operation of such machine, or for effectively trapping such dust by some suitable apparatus determined by the employer in consultation with the manufacturer or supplier.

Question 7

What do the regulations require regarding the operator's duties regarding flexible trailing cables?

Answer **[Code of Practice]**

The operator of an electrically driven coal cutter or other mobile or portable electric machine served by a flexible cable must take all reasonable measures to safeguard the flexible cable against damage and must report immediately to the ganger or miner in charge any damage or defect he may observe in the cable. He must not leave such a machine while it is working and must, before leaving the section, ensure that power supply to the flexible cable is cut off.

Question 8

What are the requirements of the regulations regarding examinations of flexible trailing cables?

Answer **[Code of Practice]**

Every flexible trailing cable in use in the section must be examined at the beginning and again at least once in the course of each shift by the ganger or miner in charge or by a competent person appointed by the manager. If any such cable is damaged or becomes defective, its use must forthwith be discontinued. Such a cable must not be further used until after it has been sent to the surface and there properly repaired.

Question 9

What are the requirements regarding the supply of water in the workings of every controlled mine?

Answer **[Code of Practice]**

In the working of every mine an adequate supply of clear and odourless water must be provided for dust allaying purposes. Such water must be provided in pipes no less than 25mm in diameter at a working pressure of not less than 150 kilopascals when all sprays, jets and other appliances supplied from the same pipe are being operated. Unless exception in writing is granted by the Principal Inspector, such pipes must reach to a point within 50 metres from the face, from which point a sufficient length of hose must be provided and used to bring up to every place where it may be required for dust allaying purposes.

2 ENVIRONMENTAL CONTROL

A COMPULSORY QUESTIONS

Question 1

Explain how the ventilation layout of a section would influence dust suppression.

Answer

- a) Airflow direction in last through road to compliment the position of the scrubber fan on the continuous miner.
- b) Jet fan on ducting to be in upstream of the airflow direction in the through road in the face.
- c) The first cut into the heading must be on the jet fan or ducting side.

Question 2

What are the main causes of dust in a continuous miner section?

Answer

- a) Cutting with picks – the blunter the picks the more dust being created.
- b) Speed of the cutting drum and spacing of picks.

- c) Grinding of coal at one place.
- d) The scrubber fan on the continuous miner drawing more than 50% of the air supplied by the jet-fan.
- e) Blocked or damaged sprays on the cutting head of the continuous miner.
- f) Water pressure to the continuous miner is too low.
- g) Faulty booster pump.

Question 3

What are the dangers of insufficient ventilation?

Answer

- a) Dangerous accumulation of gasses.
- b) Excessive high dust levels.
- c) Overheating of underground atmosphere.
- d) Unhealthy and dangerous working environment.
- e) Spontaneous combustion of coal may take place

Question 4

Describe the daily inspections of the scrubber box.

Answer

- a) Rinse the scrubber sump.
- b) Check and clean the sprayer nozzles at the screens.
- c) Inspect and clean the screens.
- d) Inspect all the nozzles of all the sprayers on the continuous miner.
- e) Check and clean the de-mister.

Question 5

Explain what is the mine standard procedure for the calibration of an on-board flammable gas monitor on the continuous miner?

Answer

[Code of Practice]

- a) Person appointed to carry out the test.
- b) Frequency of test.
- c) Method of testing.
- d) Care and maintenance.

Question 6

Explain what is meant by the following terms:

- a) Heading
- b) Last through road
- c) Recirculation
- d) Primary ventilation
- e) Secondary ventilation
- f) Positive ventilation

Answer

- a) **A heading** is any road (straight or split) that has advanced more than one bord distance from a point of through ventilation.
- b) **The last through road** is the closet holing to the working faces between two headings, which carry a unidirectional flow of air from the intake to the return of the section.
- c) **Recirculation** means any amount of air which has been delivered by a particular system, ventilating a heading, re-enters the inlet of that same system.

- d) **Primary ventilation** means the ventilation that enters the ventilating district from the main ventilation and reaches the ventilation appliances in the section (i.e brattices and fans) that are used to provide secondary ventilation systems.
- e) **Secondary ventilation** means the ventilation air that flows through the working areas of a ventilating district and is controlled by means brattices, fans, line brattices and scoop brattices.
- f) **Positive ventilation** means any air current that is forced into a heading.

Question 7

Explain what is meant by the following terms:

- a) Exhaust system
- b) Force system

Answer

- a) **Exhaust system** is used when the air is drawn out via one shaft which becomes the up-cast shaft. The air pressure underground becomes less than the atmospheric pressure, resulting in the fresh air from the surface entering through the down-cast shaft into the workings. As the fan remain in operation this process exist continuously.
- b) **Force system** is used when the air is forced down the downcast shaft, through the mine workings and up the up-cast shaft.

Question 8

Name the factors that will influence air utilisation in an underground section.

Answer

- a) Leakage through permanent stoppings
- b) Condition of line and scoop brattices and fan ducting
- c) Leakage through temporary stoppings
- d) Poor installation of fan ducting
- e) Number of open roadways
- f) Fall of ground
- g) Accumulation of water
- h) Leakage through ventilation doors and air crossings

2 ENVIRONMENTAL CONTROL

B CHOICE QUESTIONS

Question 1

Name four reasons for ventilating the underground workings of mine?

Answer

- a) To maintain a healthy and safe environment for workers.
- b) To reduce underground temperatures.
- c) Dilute and remove noxious, toxic and flammable gas.
- d) Dilute and remove dust and fumes.

Question 2

What is the effect of the cutting sequence on dust suppression?

Answer

- a) If the cutting sequence is done correctly:
 - i. Most dust will be captured in face.
 - ii. There will be less dust in rest of the section.
 - iii. The visibility and safety will improve.

- b) If the cutting sequence is done incorrectly:
- i. There will be re-circulation of dust and air in the face.
 - ii. Less dust will be captured in the face.
 - iii. There will be more dust being present in the rest section.
 - iv. The visibility will be poor.
 - v. There will be an accumulation of coal dust.

Question 3

What are the dangers of coal dust?

Answer

- a) Highly explosive
- b) Danger to health
- c) Causes bad visibility
- d) Damages the machines

Question 4

Why is it unhealthy to inhale coal dust?

Answer

Respirable dust (i.e dust particles which are 7 micron and less in size) can cause lung disease (pneumoconiosis) if inhaled in sufficient quantity over a period of time.

Question 5

How will any person know that the main fan has stopped?

Answer

- a) The Code of Practice requires that every fan must have an alarm which will give a warning.
- b) Underground workers should immediately detect a difference in airflow.
- c) The control room must contain a warning device and must inform persons working underground.

Question 6

Name five types of dust suppression systems used on continuous miners?

Answer

- a) Water spray blocks with sprays
- b) Dust scrubber fan
- c) Exhaust hood system
- d) Physical cross curtain
- e) Air movers and/or blowers

Question 7

How is the flow of air in the last through road maintained?

Answer

[Code of Practice]

- a) By keeping walls and brattices up to date
- b) By allowing no recirculation of air
- c) With the aid of section fans

Question 8

Why are the ventilation measurements taken?

Answer

- a) To ensure that ventilation standards are complied with.

- b) To give regular feedback.
- c) To identify problem areas and make recommendations for improvements.

3 MINING

A COMPULSORY QUESTIONS

Question 1

How must a continuous miner be positioned in a face before cutting commences?

Answer **[Code of Practice]**

The continuous miner, when cutting the right hand side of the face, must be positioned so that the light from the laser beam (normally red) strikes that last row of cutting picks on the left hand side of the cutting drum. When cutting the left side of the face, the light from the laser beam must strike the last row of cutting picks on the right hand side of the cutting drum.

Question 2

What is a miner's safety tasks prior to cutting?

Answer **[Code of Practice]**

- a) Ensure that picks are in good condition (i.e. sharpened correct size) and all present.
- b) Ensure that there is sufficient water for dust allaying.
- c) Ensure that water sprays and jets are all open and functioning properly.
- d) Ensure that scrubber system is functioning properly.
- e) Ensure that ventilation is to standard.
- f) Ensure that cable is in good condition.
- g) Ensure that on-board gas monitoring system is tested and in order.

Question 3

Describe how you would mark off 90 split by using a laser beam and a deflection box?

Answer

The deflection box is installed in the following manner:

- a) When a split is to be started it is first necessary to box the roadway. This can either be a double or a single box. To start a box, mark off the centre of the split from the previous survey peg.
- b) Drill a short hole where the laser beam and marked off centre cross. Knock a wooden block into this hole. Where the laser beam and the centre mark cross in the wooden block knock in a nail.
- c) Suspend the laser deflection box from nail. Make a chalk mark or paint mark against the face where the laser beam strikes the face (centre of the split). Turn laser deflection box around and put a mark against the opposite ribside.
- d) Remove the deflection box and cut the box. Once the box has been completed, the deflection box is once again suspended from the centre peg. Another peg is installed approximately 1m behind the centre peg. The laser beam can now be suspended between these two pegs, and the split can be cut using normal cutting methods.

Question 4

What items should be included in the pre-use checklist for a continuous miner?

Answer **[Code of Practice]**

All pre-use checklists should have the following items in common:

- a) Pre-start alarms
- b) Flame-proofing
- c) Guards
- d) Alarms (when moving)

- e) Interlocking
- f) Cables (conditions)
- g) Brakes
- h) Emergency brakes
- i) Lock-out systems
- j) General conditions
- k) Lights
- l) Valid licence
- m) Flammable gas monitor
- n) Operator protection (canopy)
- o) Idling indicator (flashing light)
- p) Dust suppression equipment

Question 5

Describe the procedures that a miner must follow at the end of the shift?

Answer

[Code of Practice]

- a) The continuous miner must be trammed out of the face and parked in a safe place.
- b) The power supply to the continuous miner must be isolated and locked-out.
- c) The roof bolter must be trammed out of the face and parked in a safe place.
- d) The power supply to the roof bolter must be isolated and locked-out.
- e) The miner must personally ensure that each face has been fenced off to prevent unauthorized access.
- f) The water valves must be closed properly.
- g) The miner must ensure that stone dusting is up to date.
- h) The miner must complete his/her daily production reporting indicating:
 - i. The position of all the machines.
 - ii. Areas where the machines have cut during the shift.
 - iii. Any special remarks/notes pertaining to the section or the machines.
- i) Ensure that the entrance to the section is barricaded to prohibit unauthorized access.
- j) Proceed with the whole crew to surface.

Question 6

What are four steps to safety in a risk assessment program?

Answer

- a) Is this a dangerous situation?
- b) Are there tools or equipment present which are dangerous?
- c) Are the men/women doing anything dangerous?
- d) What must be done about it now?

Question 7

What are the miner's responsibilities when parking a continuous miner on a sloping surface?

Answer

[Code of Practice]

- a) Turn the machine with one end of the loader head facing or touching the left hand pillar side and swivel tail against the right hand pillar side.
- b) Lay the cutter head flat on the floor.
- c) Switch off the power supply.

Question 8

What safety precautions must be taken when changing picks?

Answer

[Code of Practice]

- a) Move the machine back to the supported roof area.

- b) Lower the cutter head to the ground.
- c) Isolate and lock-out the power supply to the machine.
- d) Ensure PPE is used
- e) Ensure that correct tools are used.
- f) Use the tools correctly.

Question 9

What damage can be done to the continuous miner when cutting into the roof and the floor unnecessarily?

Answer

- a) Damage to motors.
- b) Damage to pick and pick boxes.
- c) Damage to gear boxes.

Question 10

How can trailing cables be damaged?

Answer

- a) Cables can be damaged if not properly hung up
- b) Placed against the rib-sides, damaged by falls of rib-sides
- c) Cable lying in the water
- d) Falls of roof
- e) Cable reel tension too high
- f) Cable sheave wheel damaged.
- g) Cable anchor point not at correct height.
- h) Cable current setting too high.
- i) Wrong size cable used.

Question 11

Where and why must anchor points of shuttle cars be installed?

Answer

[Code of Practice]

- a) As close to the tip as possible.
- b) In the sidewall at the same height as the cable reels.
- c) On the same side as the cable reel.

NB: The reasons for this are to minimise cable damage and to enhance production.

Question 12

Describe, with the aid of sketches, the support system on the colliery you are employed on?

Given:

Mining parameters:

Bord width - 6 metres

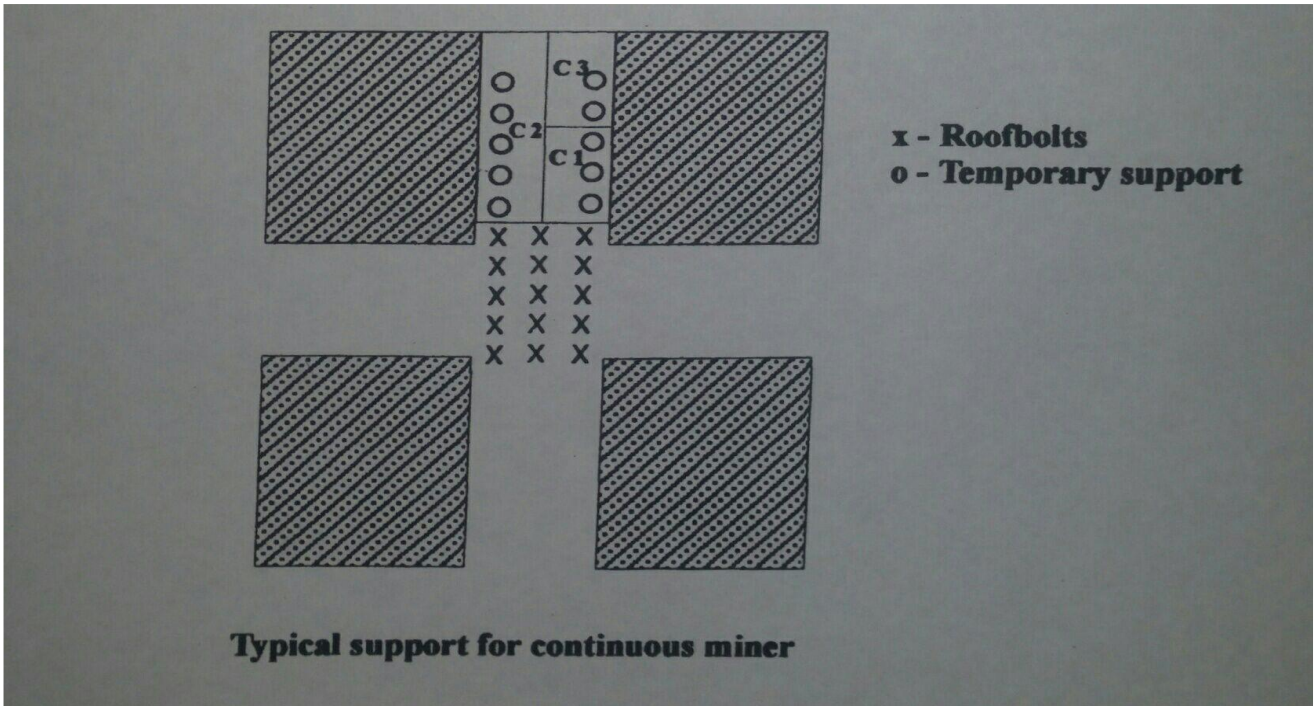
Pillar sizes – 14 metres square

Answer

Mining parameters:

Bord width - 6 metres

Pillar sizes – 14 metres square



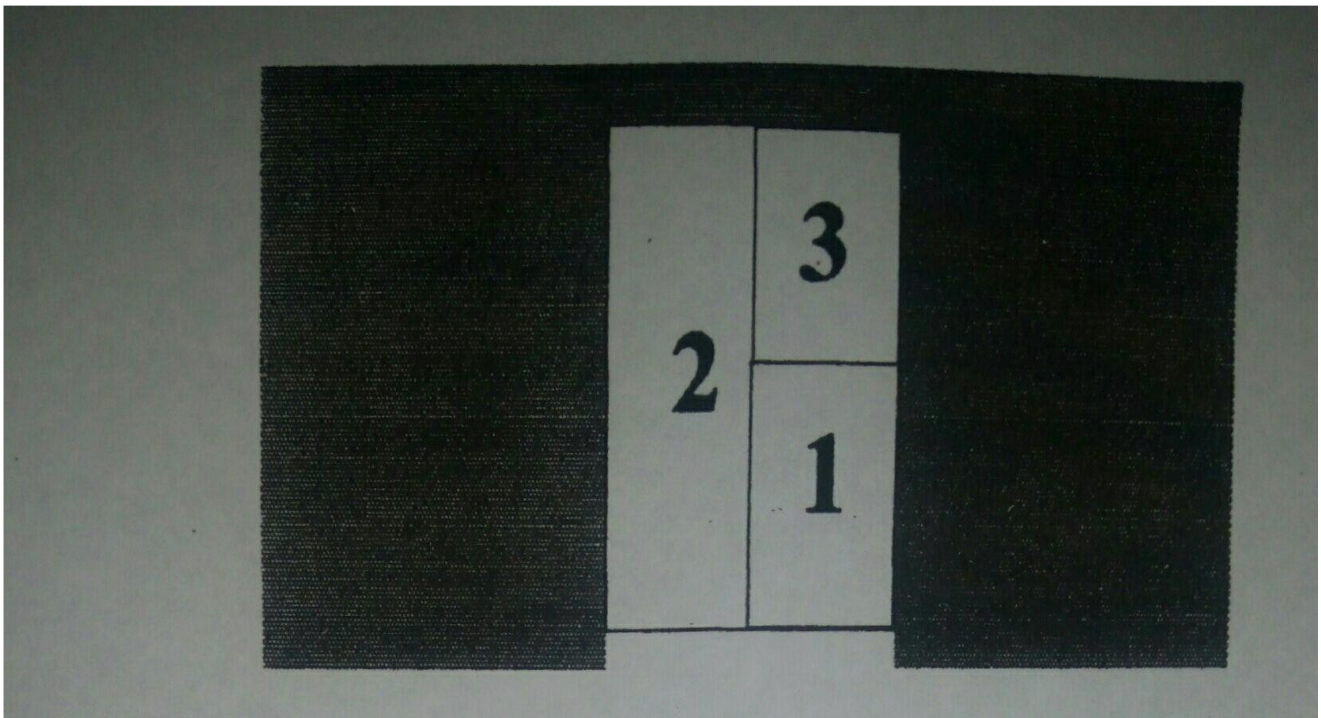
Question 13

Describe, with the aid of sketches, the cutting sequence used on the colliery that you are employed on under the following headings:

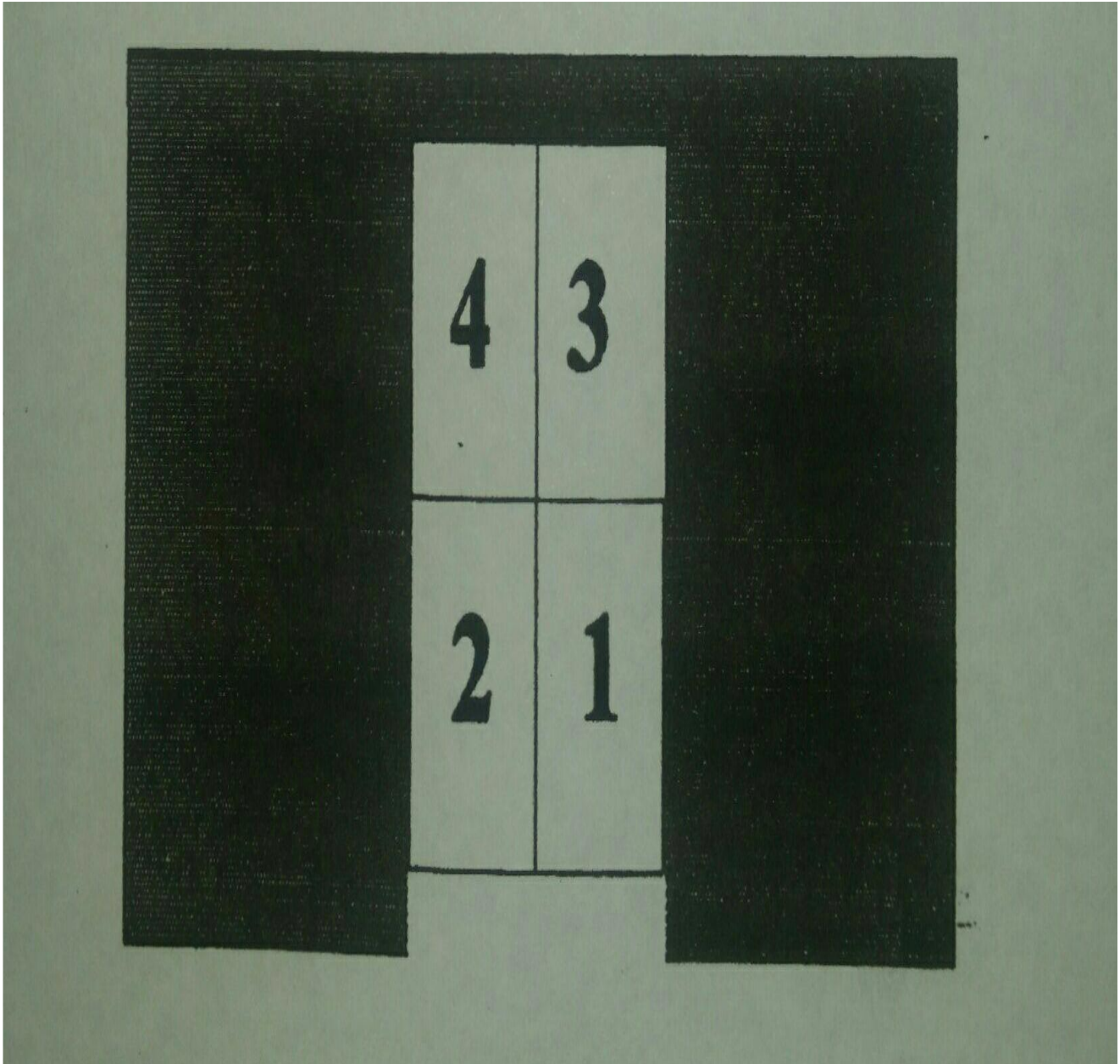
- a) Incompetent roof conditions
- b) Competent roof conditions

Answer

- a) Typical cutting sequence for competent roof conditions



- b) Typical cutting sequence for incompetent roof conditions



Question 14

Name the factors that will influence the effective cutting rate of a continuous miner.

Answer

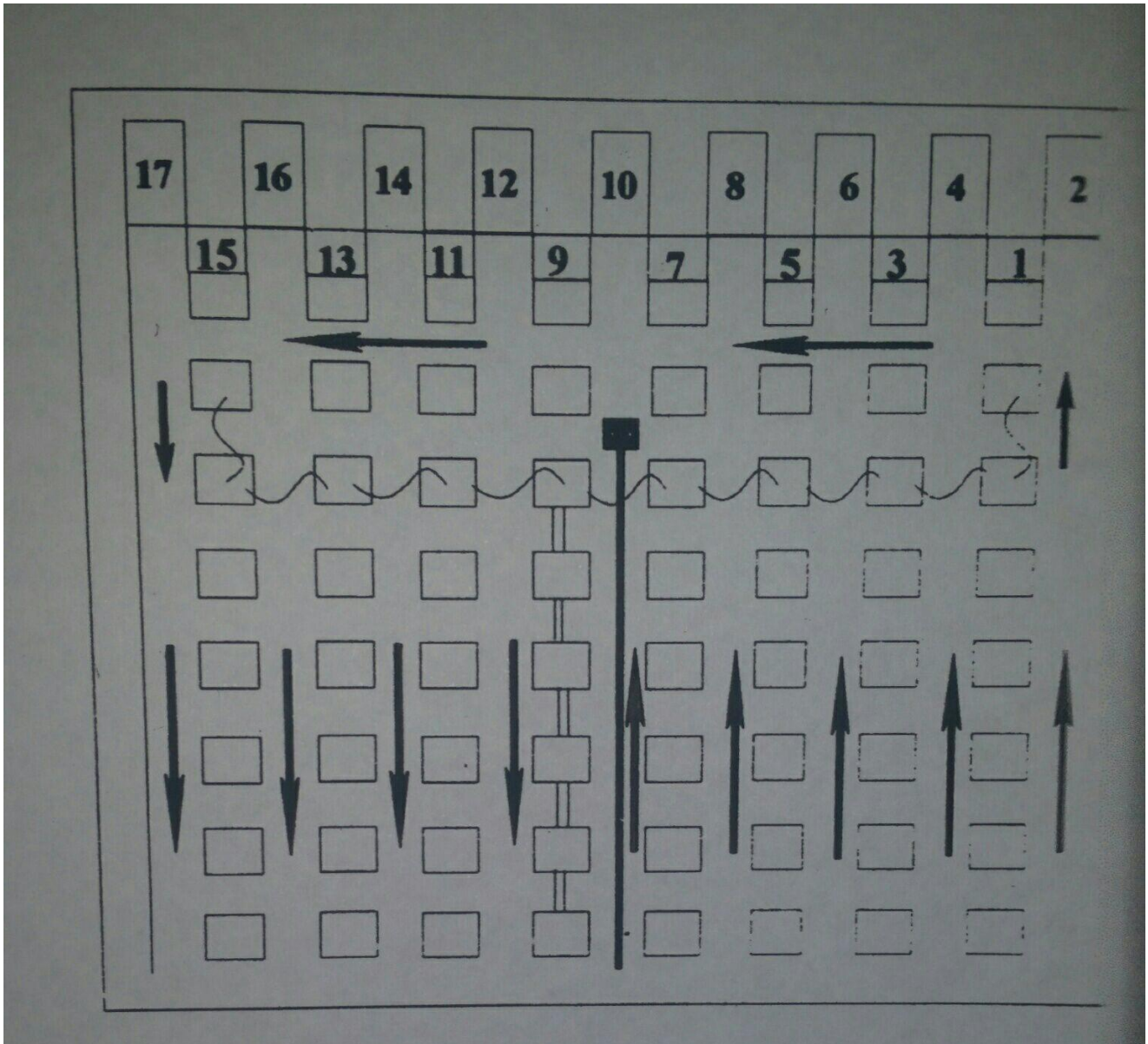
- a) The size of the continuous miner (cutting capacity) and the shuttle car payload capacity.
- b) The “wait on shuttle car” time from the change-out point to the continuous miner.
- c) Pillar centres.
- d) Number of roadways and shuttle car routes.
- e) Roof conditions (poor roof conditions will cause the CM to move from face to face more often).
- f) Floor conditions.

Question 15

With the aid of a section plan, indicate a typical mining sequence for a CM section?

Answer

Typical mining sequence



3 MINING

B CHOICE QUESTIONS

Question 1

What are the five golden rules for bord and pillar mining?

Answer

- Never mind bords wider than stipulated.
- Always mine on line.
- Never exceed the stipulated mining height.
- Prevent roof falls.
- Break away correctly.

Question 2

What safety precautions must be taken during the tramming operations of a Continuous Miner?

Answer

[Code of Practice]

- No unauthorized personnel may start or operate the machine.

- b) No person must be allowed within the working range of the machine before it is started.
- c) Do not stand at or near the following places when the power supply is on:
 - i. In front of the machine.
 - ii. In the range of the gathering apron.
 - iii. In the surveillance range of the cutter boom and turret.
 - iv. In the surveillance range of the conveyor.
- d) Warn all personnel standing within the working range of the machine, before moving the machine.
- e) In a dangerous situation, the power supply to the machine must be tripped immediately via the emergency stop switch.
- f) The operator may not leave the machine while it is in operation.
- g) The power to the machine must be switched off, if the machine is stopped for the extended period of time.
- h) An attendant must remove all the material and equipment in the way of the machine.
- i) Under no circumstances should the machine be driven over any obstacle.
- j) The Cable must be hung up (Under no circumstances may the operator drive over the cables).
- k) Seek the shortest route from one working place to another, taking into consideration the route the cable must follow. Have machinery that is blocking the shortest route removed.
- l) When tramming, the operator should listen for stop signals given by the cable handler who will pay particular attention to bystanders who may be in dangerous positions (check corridors).
- m) When tramming, there must be cable handlers to hang up the water hose and the cable on cable hooks.
- n) During tramming, the cable handler must release the cable slack to enable the helpers to hang up the cable.
- o) Always tram with the cutting head leading in the direction of travel, except when tramming out of the roadway where the face was cut.
- p) Never tram past persons who are walking or standing in the roadway.
- q) The driver must always check if his second driver (assistant) is in a safe position.
- r) When tramming, the second driver must walk behind the machine at end of the swivel tail.
- s) A whistle must be blown whenever turning around corners.

Question 3

Describe the correct installation of a laser beam.

Answer

[Code of Practice]

- a) The laser beam must be suspended from the survey pegs
- b) Install a line or wire between the centre peg and direction peg.
- c) Pull the line as tight as possible and suspend the laser beam frame from this line or wire.
- d) The laser beam must throw its light onto the face, close to the roof. If it does not, then lower or raise the back or the front until the light is in the correct position.

Question 4

Describe the cutting cycle of a Continuous Miner?

Answer

- a) Sump in at the top to a depth of 800 - 950 mm
- b) Lower the stab jack to support the Continuous Miner?
- c) Shear down to floor level
- d) Lift the stab jack from the floor.
- e) Tram the Continuous Miner backwards for ± 1.5 meters to shear off any cups left on the floor.

Question 5

What are miner's duties at the end of the shift?

Answer

[Code of Practice]

- a) Ensure roof-bolting is up to date.
- b) Ensure stone dusting is up to date.
- c) Ensure ventilation is to standard.

- d) Ensure CM operator has:
 - i. Withdrawn the machine to last through ventilation road.
 - ii. Lowered the cutter head of the machine to the floor.
 - iii. Switched off the power supply to the machine.
 - iv. Removed the cable plug.
- e) Ensure main water valve to the section is turned off.

Question 6

What special safety procedures must followed when repairs are being done on a CM?

Answer

[Code of Practice]

- a) Repair and maintenance work must not be carried out during machine operations.
- b) When it is necessary to work below the cutter boom, chain conveyor, gathering apron and bridge belt conveyor, these must be secured so that they do not lower/fall unintentionally.
- c) Do not park the machine, work or carry out repairs within a dangerous face area or under unsupported roof.
- d) Work on electrical equipment must be carried out by authorized personnel only.

Question 7

What are the important points to remember points to remember when installing temporary support?

Answer

- a) Only props of a type, which is listed and approved by the employer, may be used.
- b) No person must be allowed to move beyond the last row of permanent support before temporary support has been installed.
- c) Temporary support must be installed before performing any work in unsupported area.
- d) Install props in correct sequence from permanently supported area or solid abutment towards unsupported area.
- e) Props must not be removed until the installation of the permanent support is complete.
- f) Where there is a soft roof, the props should ideally be equipped with headboards.
- g) Make sure that operators are supplied with sufficient props, which are in good working order.
- h) Always sound the roof from under permanent support before installing temporary support.

Question 8

What is the purpose of the stab jack on the Continuous Miner?

Answer

A stab jack is fitted towards the back of the machine beneath the conveyor boom for stabilizing purposes. This jack is lowered to the floor to stabilize the machine when it is cutting.

Question 9

Name three reasons for cutting the splits through, before advancing the headings.

Answer

- a) To bring the ventilation as close as possible to the face being worked.
- b) To reduce the machine and shuttle car tramping time.
- c) To reduce delays caused by cable handling.

4 GENERAL

A COMPULSORY QUESTIONS

Question 1

What are the advantages of using a CM over the normal conventional blasting method of mining?

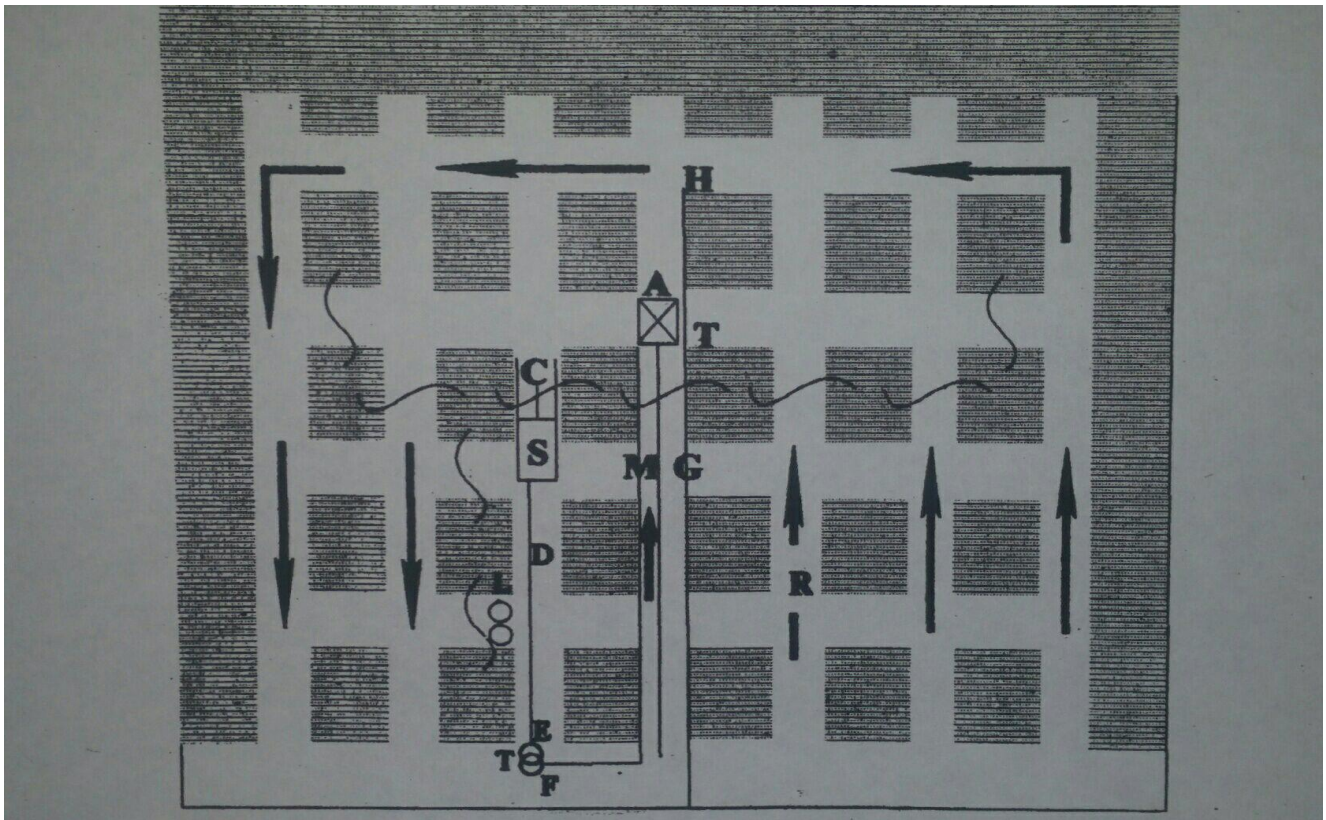
Answer

- a) Improved safety – no damaged to surrounding strata due to blasting concussion.
- b) Higher productivity – fewer people and less equipment necessary.
- c) Improved supervision – coal winning operation concentrated on one face at a time.
- d) Effective ventilation – ventilation can be concentrated on operating face.
- e) Seam heights up to 6 metres can be mined in one operation.

Question 2

On a given plan, indicate the services and facilities required in typical CM section.

Answer



LEGEND:

- | | |
|---------------------------------|--|
| A – Section conveyor and tip | G – Water pipe line |
| S – Switchgear | H – Water hoses for continuous miner & roof-bolter |
| C – Flexible trailing cable | L - Latrines |
| D – Semi-flexible armored cable | M - Lighting |
| E – Mobile transformer | R – Transport road |
| F – Armored feeder cable | T - Telephone |

Question 3

Briefly explain the meaning of the following mining technology:

- a) Barricade
- b) Boundary pillars
- c) Safety factor
- d) Mining horizon
- e) Fissure
- f) Plant yield
- g) Staple pit

Answer

- a) **Barricade** means any barrier, fence or obstruction set up prevent unauthorized entrance to unsafe underground working places or abandoned area.
- b) **Boundary pillars** are solid coal pillars, left around the boundary of a coal mine with similar functions as barrier pillars except that they separate one mine from another.
- c) **Safety factor** is ratio between pillar strength and pillar load.
- d) **Mining horizon** is the section of the coal seam that is to be mined or extracted to ensure that the required quality of coal is obtained.
- e) **Fissure** is a narrow crack or opening in the strata through which water and gas are liberated into underground workings.
- f) **Plant yield** is the portion that remains when run out-of- mine coal is washed in a coal preparation plant to get rid of the unwanted material.
- g) **Staple pit** (box hole) in an underground shaft, usually vertical, connecting two coal seams underground for transferring coal from one seam to the other.

Question 4

Briefly explain what is meant by the term "primary support" and "secondary support".

Answer

- a) **Primary support** means the support provided by the coal left in the form of pillars to support the roof where mining has taken place.
- b) **Secondary support** means the use of mechanical means to support the roof during and after mining operations (i.e. timber, roof bolts, steel, bricks, waste rock, concrete, ash, sand, etc.).

Question 5

Name the steps to be followed when changing picks on a Continuous Miner?

Answer

[Code of Practice]

- a) Withdraw the machine from the face so that the cutting head is under permanent supported.
- b) Lower the cutting head so that it is 1m above the floor.
- c) Isolate power to the machine and lock out.
- d) Change blunt picks ensuring that:
 - i. All personnel use the necessary personal PPE.
 - ii. The correct tools are used.
 - iii. Extra safety precaution is taken when the cutting head is rotated.
- e) Place the picks that have been removed (blunt picks) in designated container.
- f) Place tools away.
- g) Remove all persons between the face to be cut and cutting head
- h) Restore the power and proceed with the cutting sequence.

Question 6

Name the negative effects arising from heading being mined offline.

Answer

- a) A decrease in pillar size which will reduce the safety factor.
- b) Additional extra-ordinary support must be installed.
- c) Increased costs.

Question 7

How can a heading that has been mined off line be rectified?

Answer

[Code of Practice]

- a) Set up the laser beam in the roadway using the survey pegs.
- b) Make a mark in the face or the new centre as indicated by the laser.

- c) Mark off the bord width on the side that the face allows.
- d) Determine how much of the pillar must be slyped.
- e) Develop the heading according to the cutting sequence until it is online.
- f) Re-mark the bord width on the face on the correct centre.

4 GENERAL

B CHOICE QUESTIONS

Question 1

What are the disadvantages of using a CM over normal conventional blasting method of mining?

Answer

- a) Poor control over coal sizing.
- b) Geological disturbances can have an adverse effect on the efficient operation of the CM.
- c) Mining horizon control is difficult.

Question 2

Briefly explain how a Continuous Miner/Road Header section is manned?

Answer

The number of people required to man a Continuous Miner/ Road Header section varies from mine to mine. A typical complement of labour in a Continuous Miner/Road Header section would comprise of the following:

Miner	1
Fitter	1
Electrician	1
Artisan aides	2
CM operators	2
S/car drivers	2
Roof bolt operators	2
LHD driver	1
Tip attendant	1
General (water and ventilation)	3
Total Complement	16

Question 3

Give a brief description of the power supply to the Continuous Miner section?

Answer

The power supply to the continuous miner section is fed via the mobile section transformer which steps the 6600 volts supply down to 1000 volts for the section production equipment. A higher operating voltage is necessary because of the larger electric motors on the continuous miner.

Question 4

Briefly explain the meaning of the following mining terminology?

- a) Primary support
- b) Secondary support
- c) Safety pillar
- d) Access way
- e) Barrier pillar
- f) Virgin coal
- g) Mining yield

Answer

- a) **Primary support** means the support provided by the coal left in the form of pillars to support the roof where mining has taken place
- b) **Secondary support** means the use of mechanical means to support the roof during and after mining operation e.g. roof bolts, props, cable anchors, packs, etc.
- c) **Safety pillar** means a pillar used for the support of the surface, as well as buildings and important structures thereon. They also support permanent excavations such as shafts and shaft bottoms to prevent vertical ground movement.
- d) **Access way** means any entrance or opening through which a person can gain access to any underground area where mining operations have ceased or are still in progress.
- e) **Barrier pillar** means solid coal pillars left around the boundary of production panels, dividing the whole mine into separate production areas.
- f) **Virgin coal** means unworked and untouched areas of coal where no coal mining has yet taken place.
- g) **Mining yield** means an indication of the percentage extraction from coal winning operations.

5 PILLAR EXTRACTION (STOOPING)

B CHOICE QUESTIONS

Question 1

What is pillar extraction (Stooping)?

Answer

The extraction of the coal left in pillars after primary bord and pillar development.

Question 2

Name the hazards associated with stooping.

Answer

- a) Removal of primary support pillar results in a goaf behind the last line of support.
- b) The weight of the roof before it goafs is thrown over to the working area causing extra stress on the roof pillars in the working area.
- c) The goaf may breach the last line of support and run into the working area.
- d) Due to extra stresses on the working areas, slips joints, overhangs and other poor roof conditions may require extra support to prevent roof falls.
- e) Major goafs, particularly the initial goaf of a stooping panel, can cause a large blast of air over the working area. If the air contains accumulations of noxious or flammable gases and coal dust, the risk of an ignition arises.
- f) Spontaneous combustion of the remaining coal may occur in the goaf area.
- g) Accumulations of explosives mixtures of gas may occur undetected in the goaf.
- h) The collapse of the overlying strata may cause inrushes of water from the goaf.

Question 3

Explain, under the following headings, what precautions should be taken to eliminate or reduce these hazards:

- a) Extra support
- b) Ventilation

Answer

a) Extra support

- i. The panel should be designed to a higher safety factor than normal, in the region of +2,0 for primary development
- ii. During primary development the bords would have been supported with roof bolts installed according to the systematic support system laid down for the section.

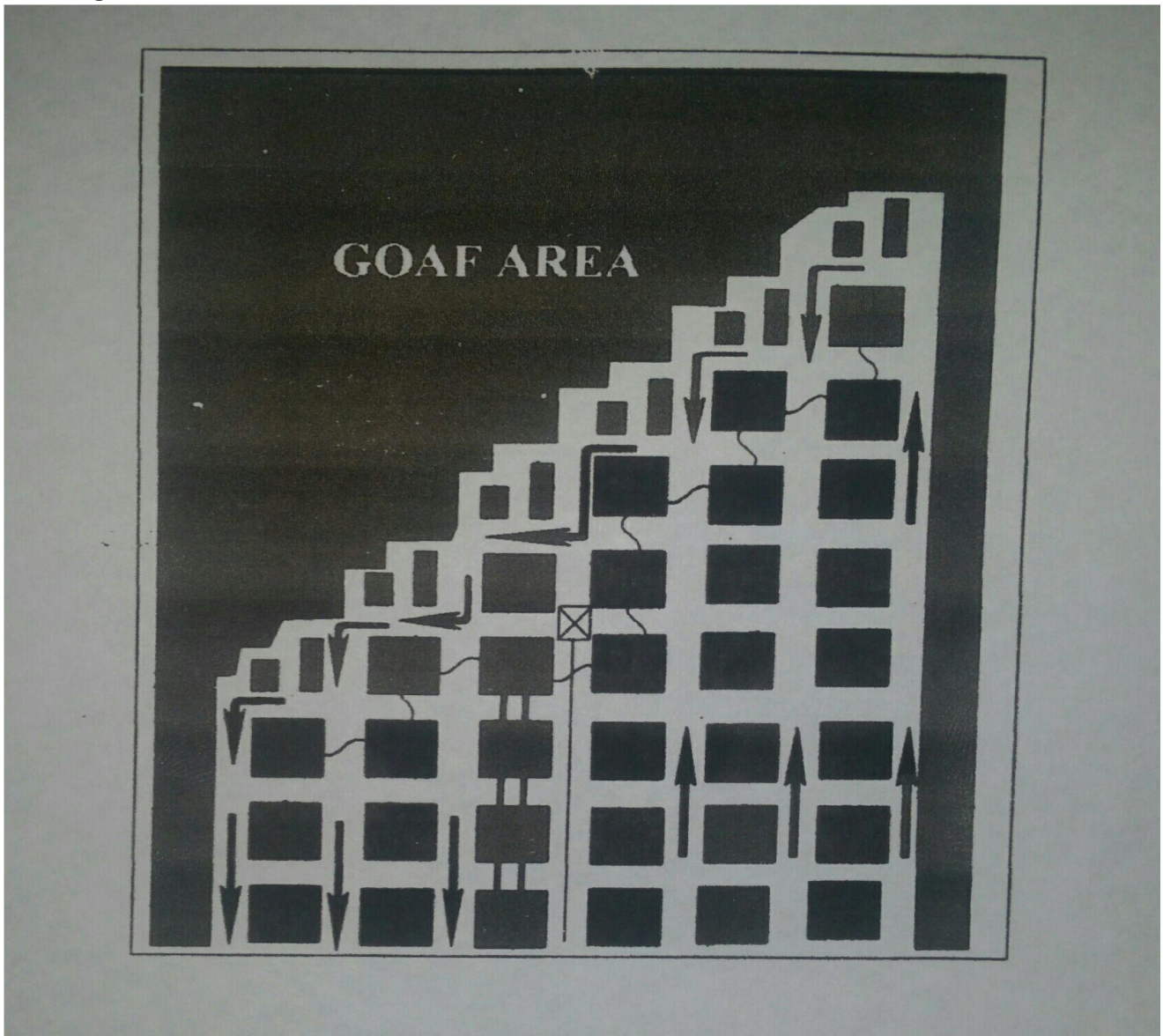
- iii. During pillar extraction additional support in the form of breaker lines must be installed along the goaf edge to protect the persons and machinery and to control the roof collapse.
- iv. These breaker lines are general single wooden props with headboard. The regulations require that it must be a double row of props with headboards set and maintained in good order and condition between the goaf edge all places where persons have to travel or work. The two rows of props must not be more than one metre apart, nor must the props in each row be more than one metre apart and each row must terminate not more than one metre from the solid coal pillar or the working face as the case may be.
- v. This is minimum requirement and support density will be increased if the roof conditions require additional support. The fenders of coal also assist in supporting the roof.

b) Ventilation

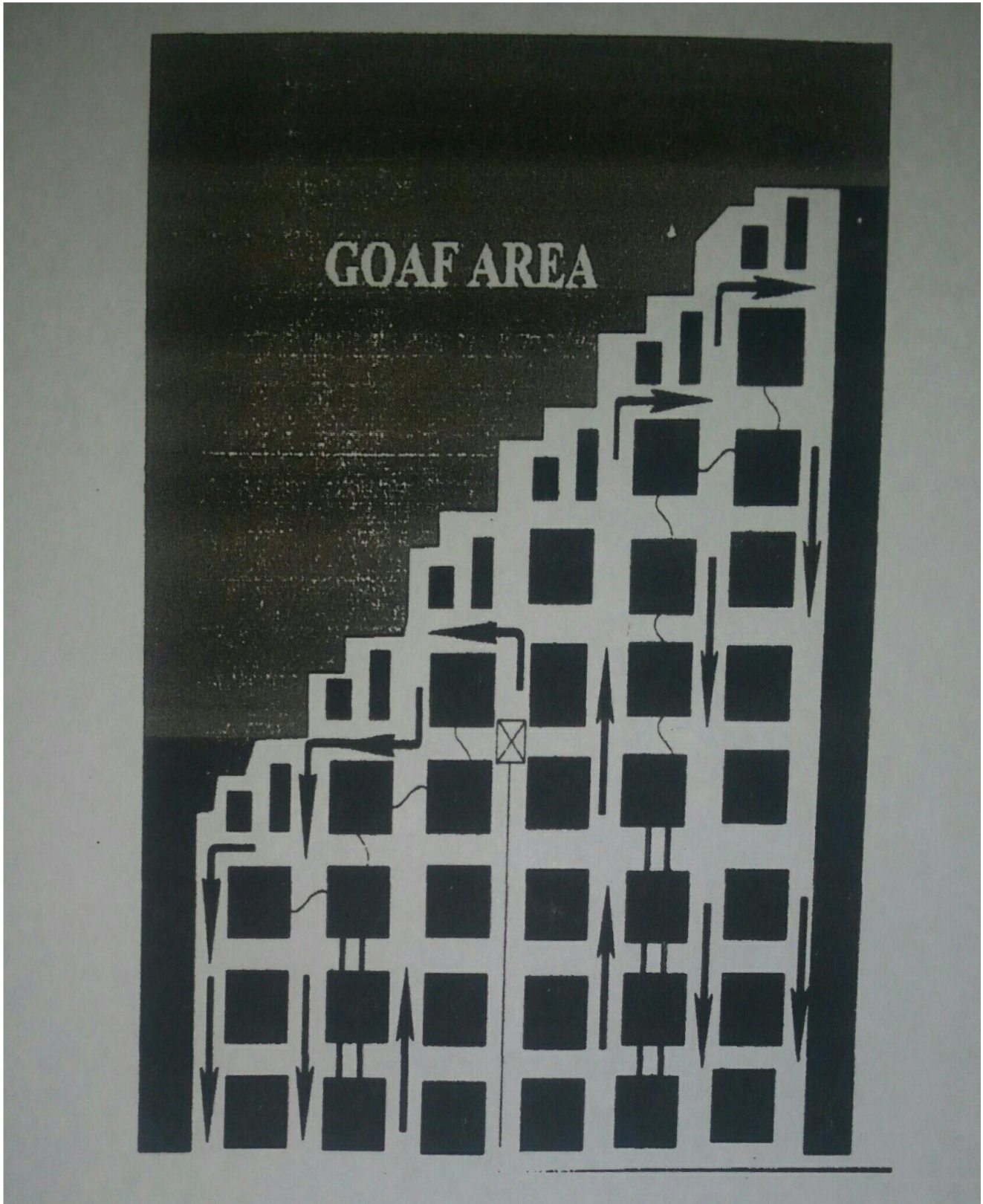
Pillar extraction sections generally require more air per ton of coal broken than developments sections. Faces are more difficult to ventilate and gas emission is often increased by goafing. Splitting or coursing ventilation systems are used and faces are ventilated in three ways:

- i. Coursing the ventilation along the working faces in similar manner to the development section.
- ii. Intake air entering the section in the centre, splitting left and right, coursing along the working faces and returning via the return airways in the left and right barrier roads.

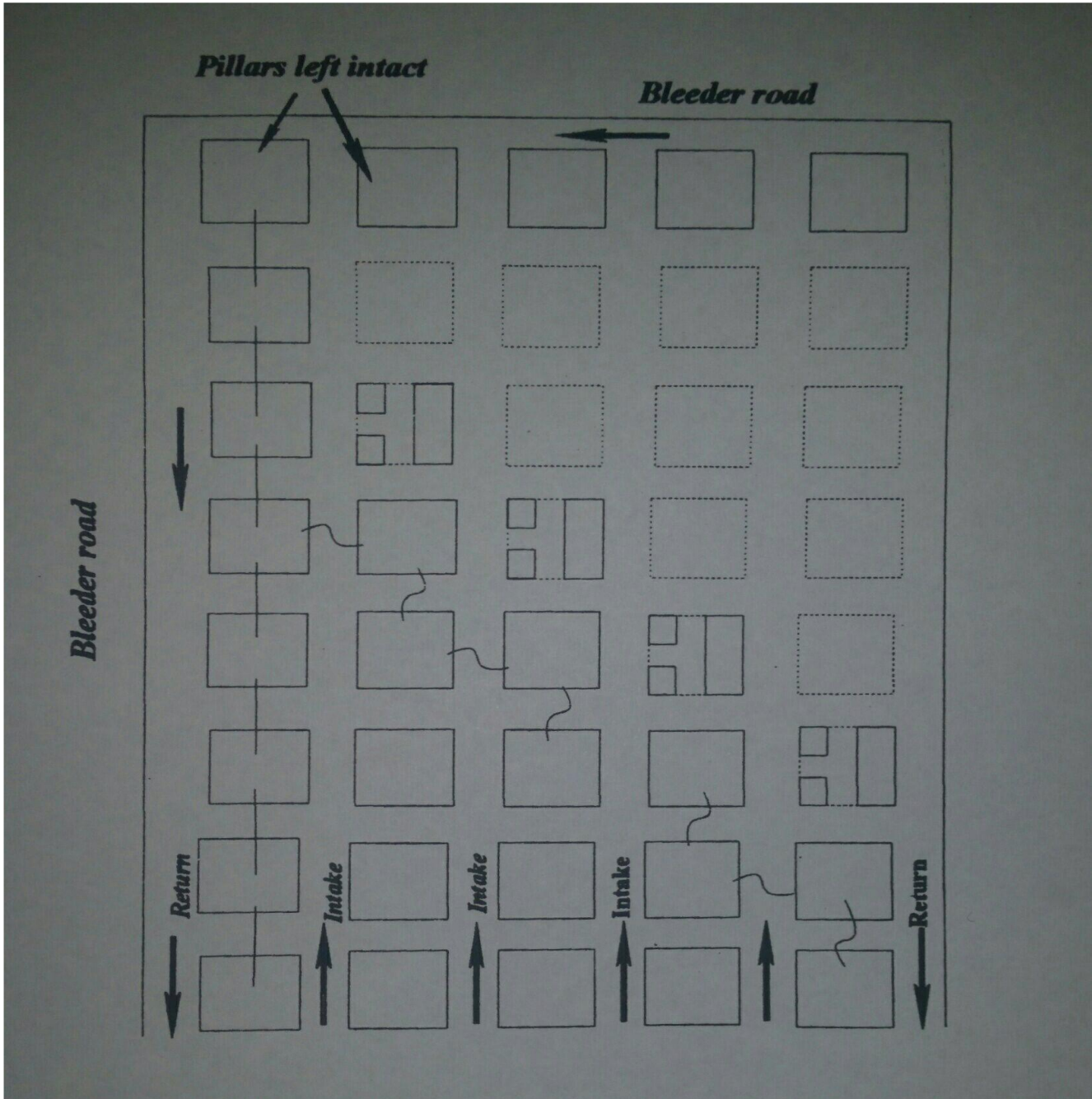
Coursing



Splitting



- iii. Bleeding the return air or portion thereof, through the goaf itself to an established return airways behind the goaf. During development one road on either side of the panel is utilized as a return airway when pillar extraction commences one of these return airways is turned into a bleeder road by leaving a line of pillars intact, adjacent to the barrier pillar.
- iv. Approximately 15% of the section intake air is allowed to bleed over the goaf and through the bleeder road to the return airway. The remainder of the ventilation returns via the normal section return.



- In addition to good ventilation controls stone dust must be applied and stone dust barriers erected as per the mine COP.
- Continuous gas monitoring instruments are often placed in strategic places to warn of any gas accumulation.

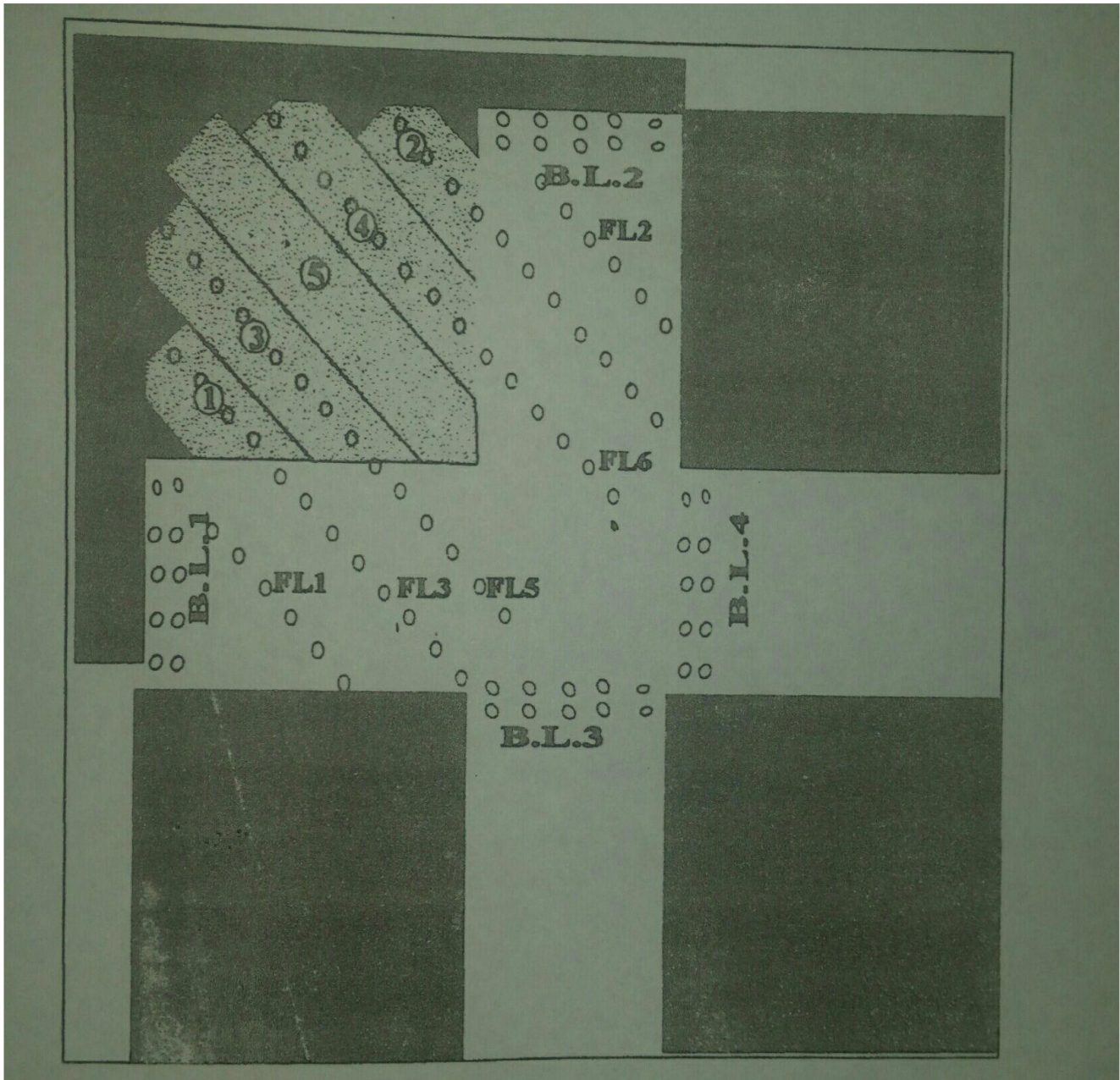
Question 4

Briefly describe the pocket and fender method of pillar extraction (stooping)

Answer

Method 1

In one method the pillar is extracted by taking oblique cuts into the pillar. In addition to breaker lines, finger lines are installed in the centre of each complete cut. A finger line consists of a single line props with head-boards, 1.5m apart, extending obliquely across the existing roadway up to 1.5m from the face.

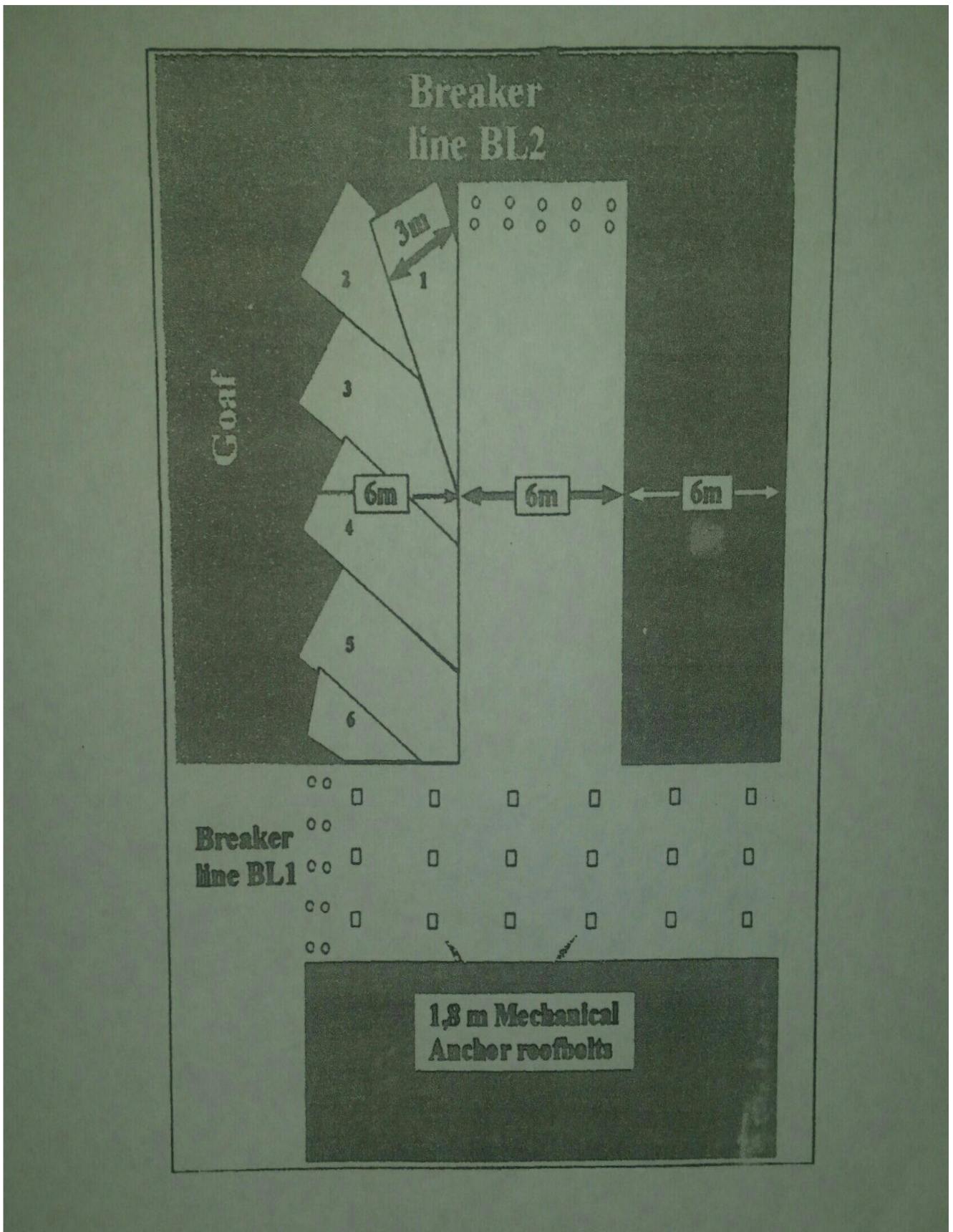


Procedure

- a) Breaker lines BL1 and BL2 are installed when the previous pillar is extracted
- b) Finger lines FL1 and FL2 are installed before extraction commences
- c) Cut 1 is made and FL3 is installed whilst cut no. 2 is being made
- d) Whilst making cut 3m FL 4 is installed and whilst making cut 4 FL5 is installed.
- e) When cut 4 is completed. The CM must wait until FL6 has been installed before making cut 5
- f) On completion of cut 5, the CM is trammed to the next pillar and breaker lines BL3 and BL4 are installed
- g) Breaker lines BL1 and BL2 and all finger lines are then removed

METHOD 2 (Typical example)

The pillar is split into two fenders by a 6m wide pocket development through the centre of the pillar. The pillars are always split perpendicular to the goaf line and fender adjacent to the goaf is extracted first. Only in cases where roof problems are experienced in the roadway parallel to the goaf line will a pillar be split and extracted parallel to the goaf line. Systematic roof support is installed in the pocket development if necessary and a breaker line is installed where the development breaks through into the goaf (BL2).

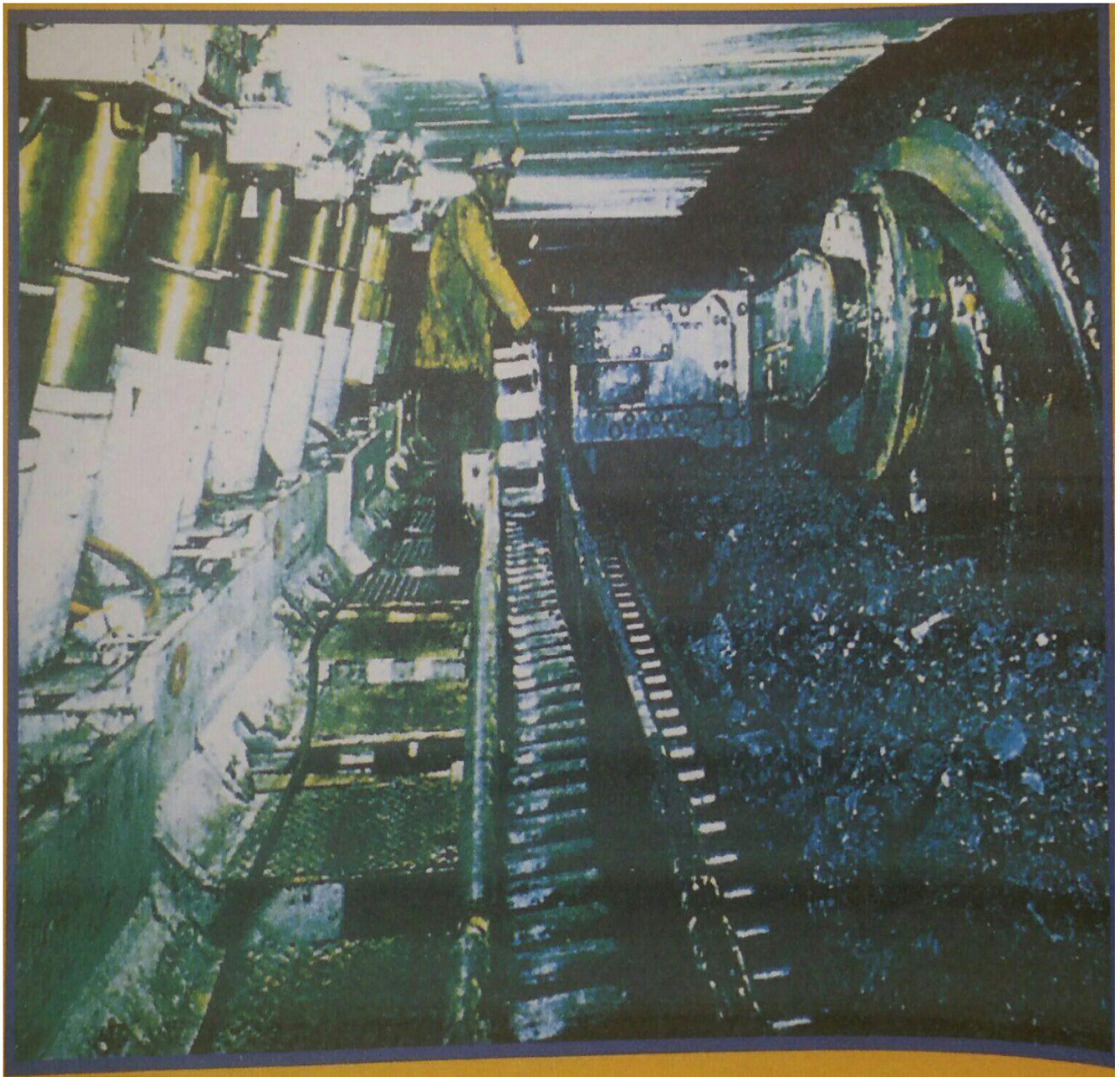


Breaker Line BL1 is installed on the extraction of the previous pillar, and BL2 is installed when the pocket development breaks through into the goaf. The fender is then extracted without installing any further breaker line. If any deterioration of the roof in the intersection occurs, additional roof bolts are installed in the intersection.

COAL MINER'S CERTIFICATE

MODULE 4

LONG-WALL SECTION



1 EQUIPMENT

A COMPULSORY QUESTIONS

Question 1

Give a brief description of a shearer and its operation

Answer

- a) A shearer is a double-ended ranging drum machine designed to cut the coal seam in one pass along the face.
- b) This pass is called a web.
- c) The two cutting drum diameters are determined by the seam height to be cut, a double rotation pick and sleeve arrangement is fitted to the pick boxes which are welded onto the vanes of the cutter drum.
- d) The vanes are designed to move the cut coal away from the face and onto the Armored Flexible Conveyor (AFC).
- e) The shearer machine is hauled along the face by the way of rack wheels driven by two traction motors fitted to the main gate and tail gate sides of the machine, the teeth of the rack wheels engage into the rack bars installed on the goaf side of the AFC on the face side of the spill plates.
- f) The trapping shoes hold the shearer in position on the pans.
- g) A modern shearer operated at full speed can obtain the cutting speeds of up to 22 meters per minute.

Question 2

Give a brief description of an Armored Flexible Conveyor (AFC)

Answer

- a) An Armored Flexible Conveyor (AFC) consist of line pans, re-router pans and ramp pans grading up to the main and tail gate drive frames.
- b) The pans are 1.5 meters long and are join together with the dog bones fitted to face the goaf sides of the pans, which allows the flexibility necessary when pushing over the AFC.
- c) Modern pans are closed at the bottom by means of a plate, which necessitates the installation of inspection pans, normally every sixth pan.
- d) The purpose of the inspection pan is to allow access in the event of the AFC chain breaking on the bottom.
- e) The AFC chain itself is driven by the main and tail drive motors and gearboxes via toothed sprockets, the teeth of which enter the link on the chain.
- f) A twin chain inboard assembly is used with the flight bars installed at 1 meter spacing.
- g) The flight bars are held in position on the pan by the top and bottom sigma sections.

Question 3

State three purposes that the AFC serves

Answer

- a) It loads and carries the coal cut by the shearer
- b) It carries the shearer used to cut the coal
- c) It acts as an anchor when advancing the face support

Question 4

What is a typical chain speed of an AFC and what peak production rates can it achieve?

Answer

A typical chain speed of an AFC is 1.3 meters per second and it is capable of peak production rates of up to 2000 tons per hour.

Question 5

Why is the chain tension on the AFC extremely important?

Answer

Incorrect chain tension can cause damage to the chain and lead to considerable production losses.

Question 6

Briefly describe the face supports used on a long-wall face?

Answer**[Code of Practice]**

- a) The roof of the long-wall face is supported by hydraulically powered supports. A typical support is designed to hold up to 875 tons and numerous design configurations are available depending on the seam height, the roof and goafing characteristics of the seam to be mined.
- b) Modern support can be electro-hydraulically operated with shearer initiation being used on some faces.

Question 7

Describe how the supports (chocks) are attached to the pan line?

Answer**[Code of Practice]**

The supports are normally spaced 1.5 meters and are attached to the pan line via a clevis pin through a nosepiece attached to the relay bar and clevises welded onto the pan line.

Question 8

Describe how the supports (chocks) are advanced to the face after the shearer has passed?

Answer**[Code of Practice]**

A relay bar is attached to a double acting ram, which pushes over the AFC after the shearer has passed. In order to advance the support, it is lowered and the double acting ram is put in the pull mode and the support is pulled in and set against the roof.

Question 9

Briefly describe the stage loader?

Answer

- a) The design is very similar to the AFC with the addition of a goose neck to elevate the discharge end of the stage loader.
- b) A crusher is often integrated onto the stage loader to deal with slabs, which typically slab from the face in high seam operations.
- c) The stage loader can either straddle the belt conveyor, or more typically on modern faces with high capacity loop take up arrangements on the belt conveyor drives.
- d) The tail pulley or tail end is hydraulically steered.

Question 10

What is the function of the stage loader?

Answer

The basic function of the stage loader is to collect the coal from the AFC, transfer the flow through 90 degrees and to lift the coal flow to a suitable height for transferring it onto the belt conveyor system.

Question 11**[Code of Practice]**

Explain how the tail end of the conveyor is attached to the stage loader?

Answer

- a) The tail end of the conveyor belt is attached to the stage loader, which allows the stage loader to be pushed over while production on the face is maintained.
- b) The tail pulley or the tail end itself is hydraulically steered to allow training of the belt as the face is advanced.
- c) Typically 50 metres of retreat is possible before slack is removed from the conveyor belt.

Question 12

Describe a typical pantehnicon on a modern long-wall face?

Answer**[Code of Practice]**

The pantehnicon on a modern long-wall face consists of the following items linked together:

- a) 4 x Cable skids
- b) 1 x Control skid
- c) 1 x LC 33 Switchgear skid
- d) 1 x TD 33 Switchgear skid
- e) 1 x Toolbox skid
- f) 1 x Lubricator skid
- g) 1 x Filtration skid
- h) 1 x Hydraulic pump skid (inbye)
- i) 1 x Soluble oil tank
- j) 1 x Hydraulic pump skid (out-bye)
- k) 1 x Tool safe skid
- l) 1 x Self Rescuer skid
- m) 1 x Spares skid
- n) 1 x Sub assembly skid
- o) 2 x Transformer skids
- p) 1 x Slack feed cable basket skid
- q) 1 x Staker unit

1 EQUIPMENT**B CHOICE QUESTIONS****Question 1**

Name the equipment required to operate a long-wall section?

Answer**[Code of Practice]**

- a) Shearer
- b) Armored Flexible Conveyor (AFC)
- c) Face supports
- d) Stage loader
- e) Pantehnicon
- f) Belt conveyor system

Question 2

What function does the pantehnicon serve?

Answer**[Code of Practice]**

The pantehnicon basically powers the face units, supplies the hydraulics for the face and houses all the necessary capacity for maintaining the face in the form of spares and the tools necessary to carry out the repairs.

Question 3

Describe what will happen when the AFC is started?

Answer

On starting the AFC, the tailgate-drive starts first in order to tighten the bottom chain and prevent slack chain from falling into the path of the stage loader chain. The main drive motor starts up at the determined delayed interval.

Question 4

What size motor is used on the main drive of the AFC?

Answer

375 – 525Kw and dual speed.

Question 5

What is the primary function of the AFC?

Answer

To convey the coal along the face to an intermediate haulage unit, called a stage loader, which is positioned in the main-gate at 90 degrees to the long-wall face.

Question 6

What is the main function of the stage loader?

Answer

The stage loader is a chain conveyor with a crusher, which sizes the coal and ensures its orderly transfer onto the section conveyor.

Question 7

What hydraulic fluid is used to power the supports (chocks)?

Answer

The hydraulic fluid used to power the supports is typically a solution of 1% to 5% soluble oil and 95% to 99% water at a pressure of 30 MPa (Mega Pascal)

NOTE:

$$\begin{array}{rclclcl} 1\text{bar} & = & 100\text{kPa} & & & \\ 300\text{ bar} & = & 30\,000\text{kPa} & = & 30\text{MPa} & \end{array}$$

Question 8

Why is a dye added to the hydraulic fluid?

Answer

The soluble solution has a dye added which allows leaks to be readily identified on the system.

2 INITIAL EXAMINATION AND VENTILATION**A COMPULSORY QUESTIONS****Question 1**

What must the miner examine in the main gate on arrival in the section?

Answer**[Code of Practice]**

- a) Examine the roof and side-wall from the pantehnicon to the face.
- b) Bar down loose coal and install support if necessary.
- c) Test for flammable gas (CH₄).
- d) Measure the ventilation flow using a velometer, the calibration of which is tested in the lamp-room prior to going underground.
- e) Check that all brattices are in position and effectively sealed.
- f) Ensure that the roof is supported according to the mine support rule.
- g) Check tail end for cleanliness and the area in front of the face for tramp metal or objects which could damage the belt.
- h) Check the position of the creep gauge relative to the painted centerline of the roadway.

Question 2

What would the miner typically delegate to his/her crew after satisfying himself/herself that the main gate area is safe?

Answer

[Code of Practice]

- a) The stage loader attendant to check the operation of the tail end and run the belt at least one full revolution to check the belt joints.
- b) Change shearer picks and the fitter to check AFC chain tension.
- c) Removal of belt structure.
- d) Check main gate cables visually for damage and clearance.

Question 3

What checks would a miner conduct in the face from the main gate through to the tail gate?

Answer

[Code of Practice]

- a) Test for flammable gas every 10 chocks with a flammable gas measuring instrument.
- b) Check the functioning of the airview velocity monitor by checking the velocity with the velometer and comparing it with the reading obtained in the control room.
- c) Check the roof throughout the face.
- d) Visually check cables for damage.
- e) On arrival in tail gate check the condition of the roof and existing support.
- f) Test for Methane and note the reading at the airview and Trollex sensor head.
- g) Check in front of the AFC for tramp metal or objects, which could be pick up by the AFC or shearer.
- h) While the miner is checking the AFC, the electrician can check the calibration on the Trollex Methane System. After completion of checking the AFC, the miner can start up the AFC and proceed to the main gate.
- i) Reports the findings of the initial examination to the control room and starts up the face.

Question 4

What velocity is considered to be adequate on a long-wall face?

Answer

[Code of Practice]

Two metres per second

Question 5

Name and describe two methods of bleeding methane from the goaf in a long-wall panel?

Answer

[Code of Practice]

- a) **Bleeder boreholes** are normally drilled 250 metres apart above the coal seam and can yield high volumes of methane. They are usually fitted with a water trap and are sealed when they downcast, or if the percentage yielded is less than 35%.
- b) **Bleeder roads** can be used to keep the tail gate area clear of methane while extracting inter panel pillars. This method uses a pre-erected double line of packs 1m apart which forms a return/bleeder road for the panel. Both the main and tail gates are intakes, with the higher intake quantity of $\pm 15\text{m}^3/\text{s}$ on the main gate side and $5\text{m}^3/\text{s}$ on the tail gate side. This ensures a face velocity of $2\text{m}/\text{s}$.

Question 6

Describe a typical methane monitoring system employed in a long-wall face other than a hand held methane monitor?

Answer

[Code of Practice]

A typical methane monitoring system is a dual system with two sensor heads located on a support canopy close to the tail gate motor, set to alarm at 0.8 to 1% of methane. One system alarms at the control skid and the other system alarms in the control room on surface.

Question 7

Why is ventilation controls so critical on a long-wall face?

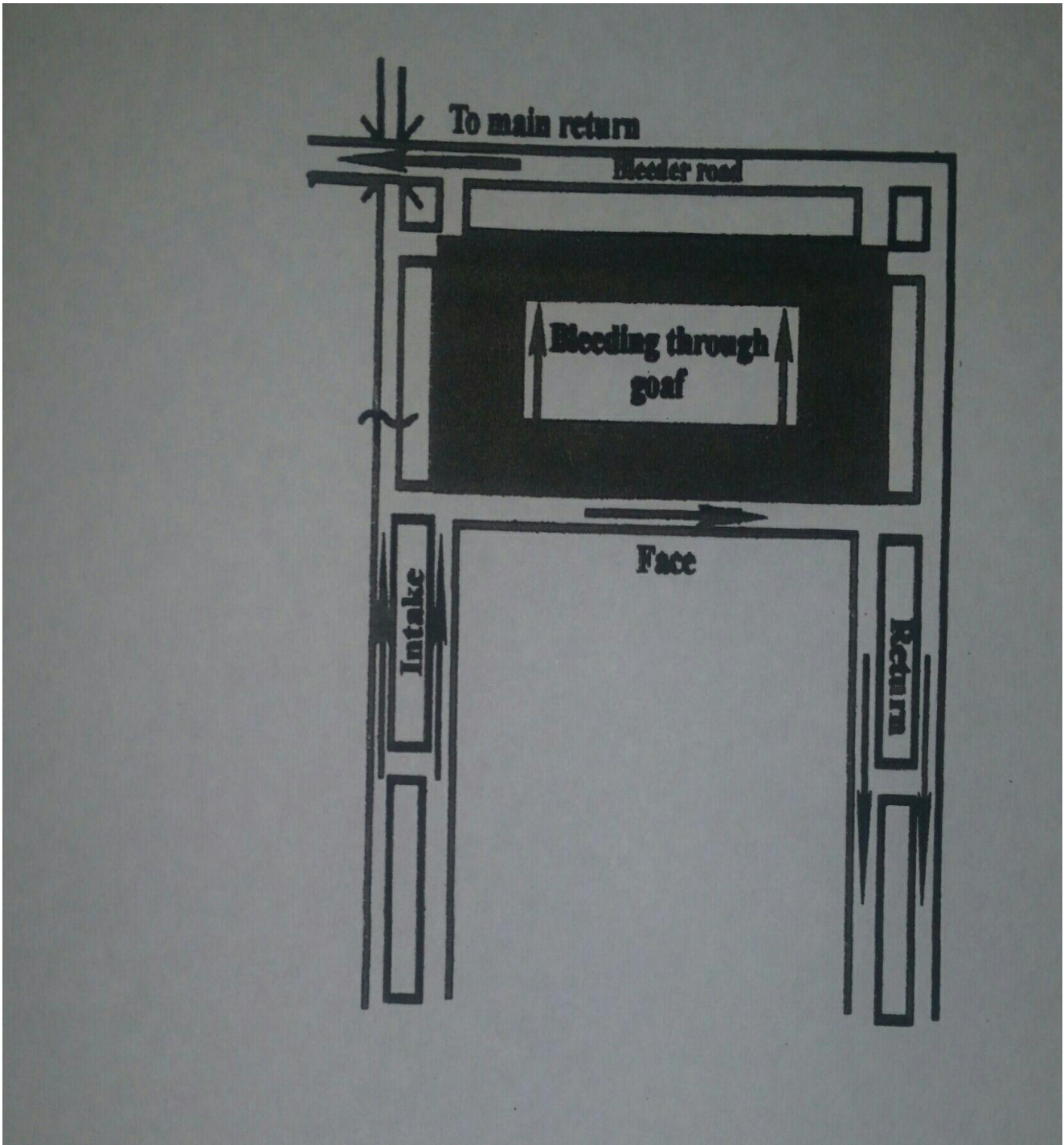
Answer

The goaf at times hang up for long distances and methane can accumulate in high concentrations in this void. When it does goaf the displacement of air pushes this gas into the working face. It is therefore very important to bleed off the gas by way of the methods mentioned above in order to ensure a safe working environment.

Question 8

With the aid of a long-wall section plan, illustrate a typical ventilation system.

Answer



3 MINING TECHNIQUES

A COMPULSORY QUESTIONS

Question 1

What is meant by the term “Bi-directional preparation (Bi-Di)” in the main gate?

Answer

- a) When the shearer cuts out in the main gate the AFC is pushed over, normally 12 supports behind the machine.
- b) The machine then cuts back towards the tail gate until the drums of the machine are fully sumped into the coal face.
- c) The pans are then pushed over between the machine and the main gate and the machine is again cut out in the main gate.
- d) The supports are then advanced and set from the tail gate side, the shearer is then cut back towards the tail gate.
- e) This prepares the face for a web to be cut from the main gate to tail gate, hence the term Bi-Di, which is short for bi-directional preparation.

Question 2

What are the most important controls to be exercised when cutting a web with a shearer?

Answer

- a) Horizon control.
- b) Face alignment control.

Question 3

Why is horizon control important?

Answer

- a) Steps cut in the floor result in the AFC pans forming humps which can be so severe that it can cause damage to the shearer and AFC pans.
- b) A step in the floor result in the supports becoming iron bound (i.e. unable to be raised or lowered or to be advanced, because they become wedged between the roof and the floor).
- c) Steps are common cause of double acting ram failures.

Question 4

Why is face alignment critical on a long-wall face?

Answer

- a) A face with bends causes excessive wear to the pans and flight bars of the AFC.
- b) The goaf on a long-wall face breaks immediately behind the support canopies if the face is bent or lagging to such an extent that a straight line encroaches onto the face side of the support. Roof falls and face breaks can occur.

Question 5

What is face creep?

Answer

It is a tendency for the face to become skew, either towards the main gate or tail gate side and, if not arrested, can cause the main gate frame to crash into the rib side either in the main gate or tail gate.

Question 6

How is face creep controlled?

Answer

By measuring from the centre line in the main gate, using a gauge attached to the main gate frame. The measurement of the distance from the centre line either to the main gate or tail gate side is plotted on a plan and the creep can be monitored and remedial action implemented before it becomes a serious problem.

Question 7

If it is necessary to creep the face towards the main gate, give two methods of doing so?

Answer

- Take wedge cuts on the tail gate side if it is necessary to creep the face quickly towards the main gate
- When pushing over the AFC do so only from the tail gate side when cutting in both directions.

Question 8

With the information given below, calculate the following:

- Tons per web
- Tons per minute
- Tons per shift

Effective cutting rate	=	240 minute/shift
Rated cutting capacity of shearer	=	12 metres/minute
Web factor	=	0.7 metres
Time taken to cut one web	=	27 minutes
Mining height	=	1.9 metres
Face length	=	200 metres
Relative density	=	1.5

Answer

- $$\begin{aligned} \text{Tons per web} &= \text{Mining Height} \times \text{Face length} \times \text{Web factor} \times \text{Relative density} \\ &= 1.9 \times 200 \times 0.7 \times 1.5 \\ &= 399 \text{ tons} \end{aligned}$$
- $$\begin{aligned} \text{Tons per minute} &= \text{Tons per web} \div \text{Time taken to cut one web} \\ &= 399 \div 27 \\ &= 14.8 \text{ tons (15 tons)} \end{aligned}$$
- $$\begin{aligned} \text{Tons per shift} &= \text{Effective cutting rate} \times \text{Tons per minute} \\ &= 240 \times 15 \\ &= 3600 \text{ tons} \end{aligned}$$

3 MINING TECHNIQUES**B CHOICE QUESTIONS****Question 1**

What are the advantages of the retreat mining method used in long-wall mining?

Answer

- Developing around the proposed mining area reduces the risk of encountering unknown geological hazards.
- Panel development is separated from the production processes, leading to a simpler face operation.
- Risk of spontaneous combustion is greatly reduced and the control and sealing off of the panel is simplified.
- Salvage of the face equipment is more rapid and complete as the face finishes close to the main transport system.

Question 2

What is the main disadvantage of the retreat mining method used in longwall mining?

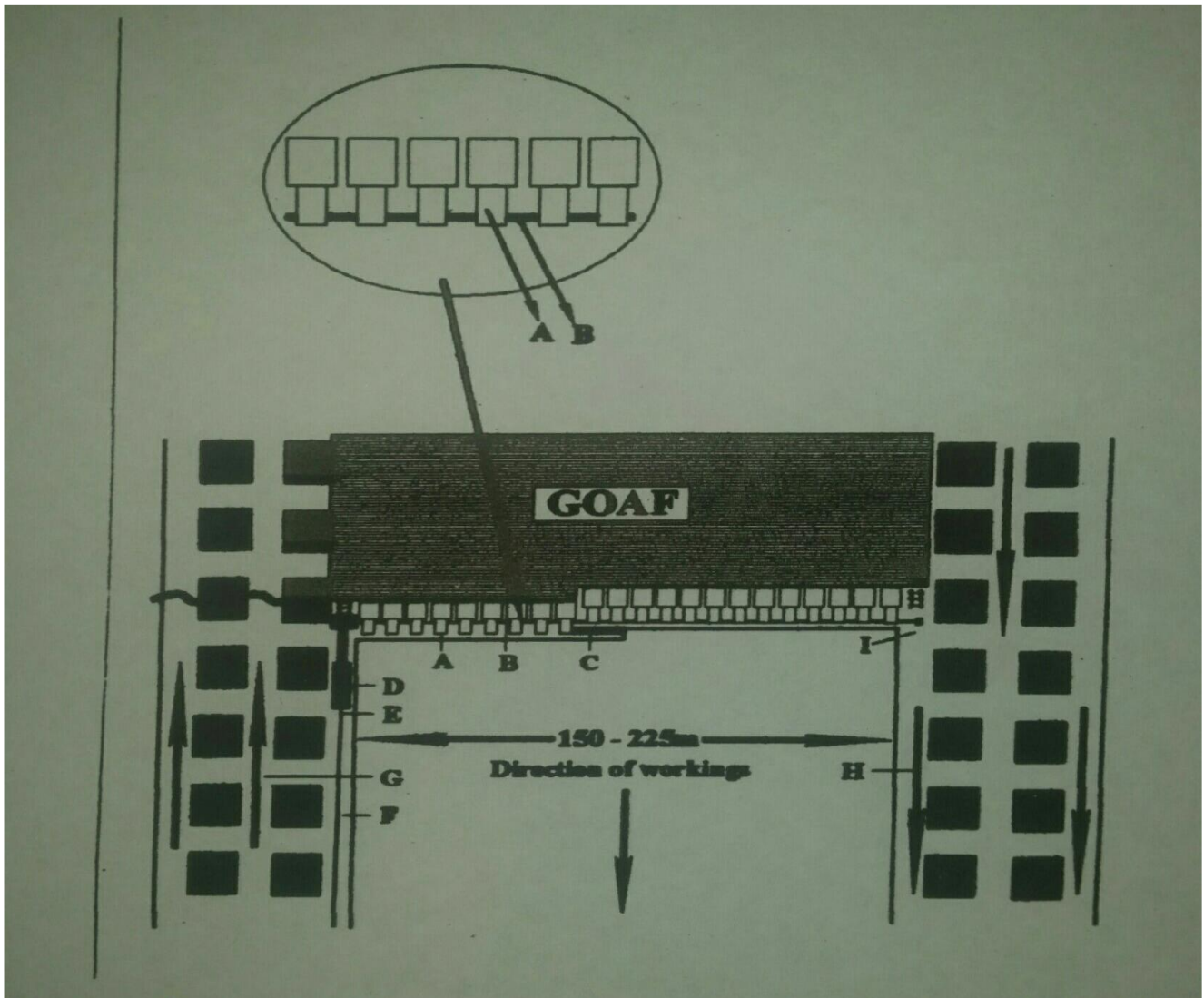
Answer

The main disadvantage is low productivity during panel development. The introduction continuous miners, capable of achieving high production rates in two or three road development sections has, however, largely overcome this problem.

Question 3

On the given plan, describe a typical retreat long-wall face?

Answer



- A – Hydraulic roof supports
- B – Armored flexible conveyor
- C - Shearer
- D – Stage loader
- E – Section Belt Conveyor
- F – Main gate
- G – Intake airway
- H – Return airway
- I – Tail gate

Question 4

Name the essential services that are required on the long-wall face?

Answer

- a) Power supply
- b) Signal and communication
- c) Hydraulic fluid supply

Question 5

Describe the power supply from the section transformer to the machines?

Answer

Power for the machines is supplied from the section transformer through to the switchgear and via separate cables to the electrically powered machines, which improves performance by reducing voltage-drop effects.

Question 6

Describe where the main electrical switchgear should be situated in a longwall section?

Answer

The main electrical switch gear is mounted on the energy and services pantechicon situated alongside the stage loader and section belt conveyor in the main gate.

Question 7

Describe a typical energy and services pantechicon?

Answer

Due to the high rate of face advance the service equipment has to be continually moved. Hence, all the equipment i.e. hydraulic pump station, switchgear, compressors etc. are mounted on a mobile energy services pantechicon situated alongside the stage loader and section belt conveyor in the main gate.

Question 8

Briefly explain the sequence of face operations in a long-wall section?

Answer

- a) The single or double drum shearer, mounted on top of the AFC, shears the coal off the face, in 0.70 to 1 meter webs, from the main gate to the tail gate and back again (bi-directional cutting).
- b) The cut coal is directed by the shearer drum onto the AFC and transported along the face and discharged onto the stage loader.
- c) The stage loader, equipped with an in-line crusher to size the coal, discharges the coal onto the section conveyor for ultimate delivery, via the underground conveyor system, to surface of the mine.
- d) The immediate roof strata are supported by hydraulic powered supports.
- e) After each web all the equipment is moved forward. In this manner the longwall face retreats back along the pre-developed chain roads, removing the block of coal between them and allowing the roof to cave behind the supports.

Question 9

Describe a typical labour complement required for a longwall face using a single or double drum shearer.

Answer

Face boss (miner, section supervisor)	1
Stage loader operator	1
Shearer operators	2
Roof support operators	3
Roof support mechanic	1

Electrician	1
Fitter	1
General worker	1
Total Complement	11

Question 10

Briefly explain the factors that would influence the rate of production in a long-wall section.

Answer

- a) Web width
- b) Cutting speed
- c) Length of face
- d) Seam height
- e) Effective production time

4 LEGAL REQUIREMENTS

A COMPULSORY QUESTIONS

Question 1

What are the requirements of the Regulations regarding the appointment of an operator of a self-propelled mobile machine?

Answer

[MA Regulation 18.2.1]

No person must drive or cause or permit any other person to drive any self-propelled mobile machine which is under the control of the manager, on private property, in or at a mine or at a works, unless such a person has been authorized thereto by the manager, mine overseer or competent person appointed in terms of regulation 2.13.1, 2.13.2 or 2.13.3.

Question 2

When do the Regulations require an operator of a self-propelled mobile machine to be re-tested?

Answer

[MA Regulation 18.1.7]

Whenever a person has been authorized to drive a self-propelled mobile machine has for any reason whatsoever, not driven such a machine for a period of 180 days or longer, such person may be authorized again to drive such a machine.

Question 3

What are the requirements of the Regulations regarding joints on trailing cables?

Answer

[MHSA Regulation 3.25]

The employer must take reasonably practicable measures to ensure that no flexible cable or trailing cable must have more than fifteen joint repairs, including sheath patches over a length of 200 metres and no joint repair or patch must be closer than 5 metres to an adjacent joint, repair or patch and no joint, repair or patch must be closer than 3 metres to the cable plug or its terminal connection at the machine or apparatus.

Question 4

What are the operator's duties regarding flammable gas?

Answer

[Code of Practice]

At every fiery coal mine the operator of any electrical drilling, cutting, breaking or loading machine must:

- a) Be instructed and found competent in testing for flammable gas
- b) Test for the presence of flammable gas in any underground working place before such an electrical machine is taken into it

- c) By means of a flammable gas warning device continuously monitor the atmosphere in the working place, where such an electrical machine is in operation.

Question 5

What are the operators duties if a concentration of more than one comma four parts per hundred by volume of flammable gas is detected in a working place in a coal mine where electrical machines are used?

Answer **[Code of Practice]**

If the atmosphere in any underground working place in any fiery coal mine contains more than one comma four parts per hundred by volume of flammable gas either after the entry into that working place of an electrical machine or during its operation, the operator must cut off the electrical power supply to that working place forthwith and report to the ganger or miner in charge.

Question 6

What are the requirements regarding dust control at machines used for ripping, picking, cutting, drilling or loading rock, coal or other minerals in the workings of a mine?

Answer **[Code of Practice]**

In the workings of every mine, every machine for ripping, cutting, drilling or loading rock, coal or other minerals must be fitted with means, or means must be provided either for applying water effectively to prevent dust being created by the operation of such machine, or for effectively trapping such dust by some suitable apparatus approved by the employer in consultation with the manufacturer or supplier.

Question 7

What are the operator's duties regarding flexible trailing cables?

Answer **[Code of Practice]**

The operator of an electrically driven coal cutter or other mobile or portable electric machine served by a flexible cable must take all reasonable measures to safeguard the flexible cable against damage and must report immediately to the ganger or miner in charge any damage or defect such operator may observe in the cable. The operator must not leave such a machine while it is working and must, before leaving the section, ensure that the power supply to the flexible cable is cut off.

Question 8

What are the requirements regarding examinations of flexible trailing cables?

Answer **[Code of Practice]**

Every flexible trailing cable in use in the section must be examined at the beginning and at least once in the course of each shift by the ganger or miner in charge or by a competent person appointed by the manager. If any such cable is damaged or becomes defective, its use must forthwith be discontinued. Such a cable must not be further used until after it has been sent to the surface and it has been properly repaired.

Question 9

What are the requirements regarding the supply of water in the workings of every controlled mine?

Answer **[Code of Practice]**

In the workings of every mine an adequate supply of clear and odorless water must be provided for dust allaying purposes. Such water must be provided in pipes no less than 25mm diameter at a working pressure of not less than 150 kilopascals when all sprays, jets and other appliances supplied from the same pipe are being operated.