

2021

Q.1	Tricone roller bit is used with
(A)	down-the-hole hammer.
(B)	Jack hammer.
(C)	rotary-percussive drill.
(D)	rotary drill.

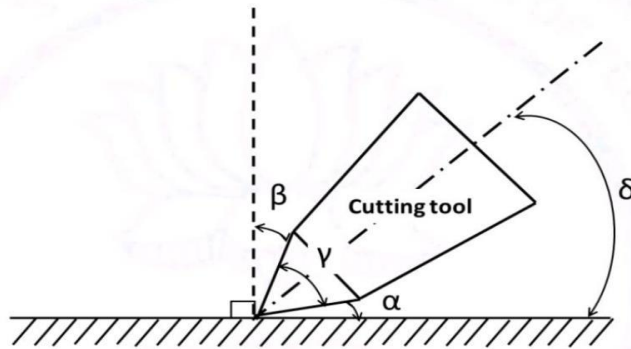
Q.5	Induced blasting enhances production in
(A)	sublevel stoping.
(B)	block caving.
(C)	cut and fill mining.
(D)	shrinkage stoping.

Q.7	NONEL is used as down-the-hole initiator to
(A)	avoid generation of air overpressure.
(B)	provide precise delay.
(C)	avoid deflagration of column charge.
(D)	reduce ground vibration.

Q.27

With reference to the figure related to rock cutting by point attack tool, match the angle with corresponding name.

Angle	Name
P. α	1. Cutting angle
Q. β	2. Clearance angle
R. δ	3. Wedge angle
S. γ	4. Rake angle



(A) P-2, Q-4, R-1, S-3.

(B) P-4, Q-2, R-1, S-3.

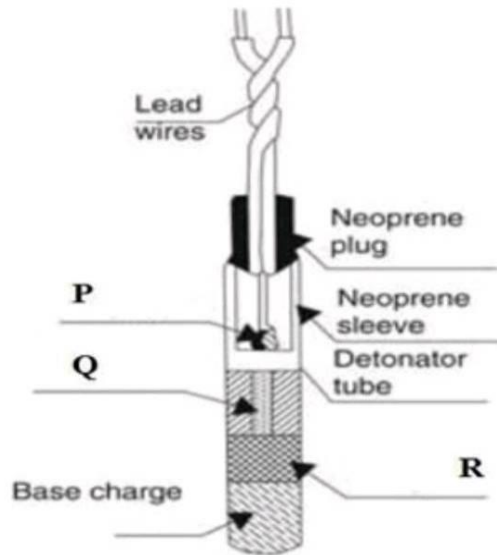
(C) P-2, Q-4, R-3, S-1.

(D) P-4, Q-2, R-3, S-1.

MINE DEVELOPMENT

2020

Q.No. 2 For the electric delay detonator shown in the figure, the components P, Q and R, respectively, are



- (A) fuse head, delay element, priming charge
- (B) fuse head, priming charge, delay element
- (C) priming charge, delay element, fuse head
- (D) delay element, fuse head, priming charge

Q.No. 32 An explosive mixture has 80 g of ammonium nitrate (NH_4NO_3) and 14 g of fuel oil ($\text{C}_{10}\text{H}_{20}$). The oxygen balance in the mixture is

- (A) surplus by 32 g
- (B) deficient by 24 g
- (C) surplus by 16 g
- (D) deficient by 32 g

The equation for peak particle velocity (PPV) from blast induced ground vibration is given by

$$PPV = k \left(\frac{D}{\sqrt{Q}} \right)^B, \text{ where } k \text{ and } B \text{ are site constants.}$$

In a field study, the following readings are recorded.

Sensor No.	PPV in mm/s	Sensor distance from blast site (D) in m	Charge per delay (Q) in kg
1	5.5	200	100
2	3.4	300	100

The value of B is _____ (round off to 3 decimal places).

Q.No. 47 For a development heading, the blasting parameters are

Cross-section: 6.0 m × 5.0 m

Total number of holes: 72

Number of trimmer holes: 30

Depth of each hole: 3.5 m

Charge per hole (except trimmers): 3.5 kg

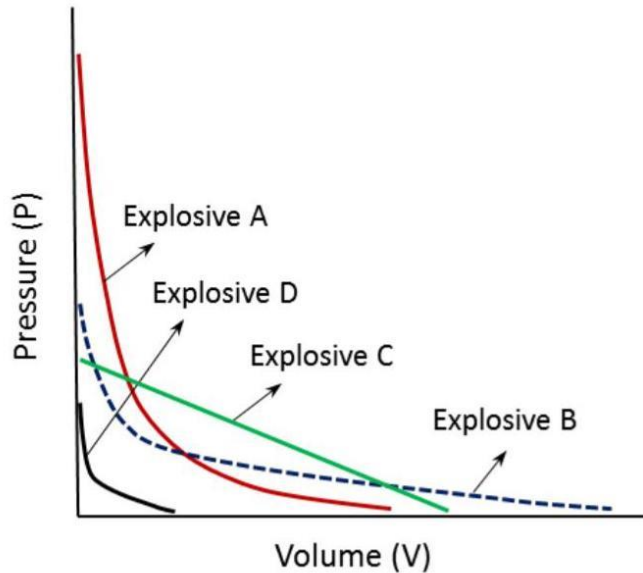
Charge per trimmer hole: 1.8 kg

Pull per round: 90% of hole depth

The powder factor for the development round in m^3/kg is _____ (round off to 2 decimal places).

2019

Q.4 The PV diagram of four explosives is given below. The preferred explosive for adequate fragmentation in hard and brittle rock is



(A) Explosive A
(C) Explosive C

(B) Explosive B
(D) Explosive D

Q.52 Data related to explosive and blasthole are given below. Assuming 1 kcal to be 4.2 kJ, the power of explosive in GW in the blasthole (*round off to one decimal place*) is _____.

Diameter of the borehole	: 200 mm
Charge length	: 8 m
Density of ANFO	: 0.8 g/cc
Heat of explosion	: 912 cal/g
VOD	: 4500 m/s
Initiation	: Bottom

2018

Q.4 Tri-cone drill bit is a type of

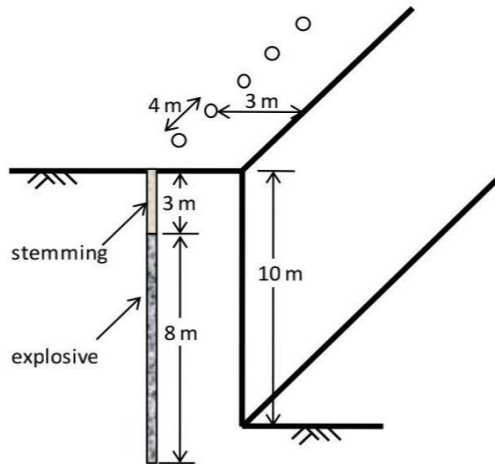
- (A) cross bit (B) button bit
(C) rotary roller bit (D) button drag bit

Q.27 Match the following blasting elements with the corresponding initiators.

	<u>Blasting Elements</u>		<u>Initiators</u>
P	Electric detonator	1	Match stick
Q	Safety fuse	2	Booster
R	Detonating fuse	3	Exploder
S	Non cap-sensitive explosive	4	Ordinary detonator

- (A) P-2, Q-3, R-4, S-1 (B) P-3, Q-1, R-4, S-2
(C) P-3, Q-1, R-2, S-4 (D) P-1, Q-4, R-2, S-3

Q.50 The following figure shows the designed blast pattern of a bench. The explosive column is charged at 18 kg/m. If the unit weight of the blasted material is 2.5 tonne/m³, the powder factor for the blast in tonne/kg is _____.



2017

Question Number : 18

Correct : 1 Wrong : 0

The operating conditions of a rotary rock drill are: applied thrust: 6.75 kN, revolution: 180 rpm, and penetration rate: 0.15 m/min. The work done per revolution in N-m is _____

Question Number : 19

Correct : 1 Wrong : 0

The Absolute amount of energy and density of a booster and ANFO are given below.

Explosive type	Energy (cal/g)	Density (g/cc)
Booster	680	1.25
ANFO	912	0.81

The Relative bulk strength of booster is _____

Question Number : 43

Correct : 2 Wrong : 0

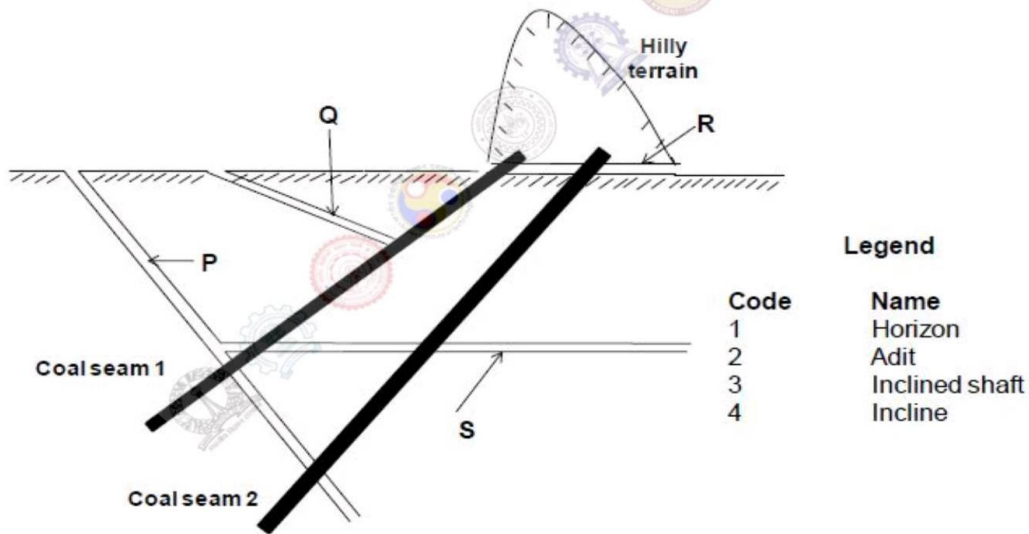
To break a volume of 300000 cubic meter of overburden per month in an open cast mine, the number of blast hole drills required for the following data is _____

Spacing and burden of blast holes: 6.0 m x 4.0 m
Hours scheduled per shift : 5
Number of shifts per day : 2
Weeks per month : 4
Drilling days per week : 5
Drilling rate : 30.67 m/h

Question Number : 44

Correct : 2 Wrong : -0.66

Two inclined coal seams with their accesses are shown in the figure. Match the labeled access (P, Q, R,S) with their corresponding names.



- (A) P-4, Q-3, R-1, S-2
- (C) P-3, Q-4, S-2, R-1

- (B) P-4, Q-3, R-2, S-1
- (D) P-3, Q-4, R-2, S-1

Question Number : 54

Correct : 2 Wrong : -0.66

Match the special methods of shaft sinking with rock mass conditions and scope of application.

Special methods	Rock mass condition	Scope of application
A. Shaft boring	P. Loose ground without intrusion of hard rocks or boulders	1. Any depth
B. Cement grouting	Q. Highly jointed rock filled with water	2. Up to 30 m from surface
C. Caisson method	R. All types of water bearing rocks	3. Up to 1000 m
D. Freezing	S. Moderately strong rocks	4. Less than 600 m from surface

- (A) A-S-3, B-R-2, C-Q-1, D-P-4
- (C) A-R-3, B-P-1, C-S-2, D-Q-4

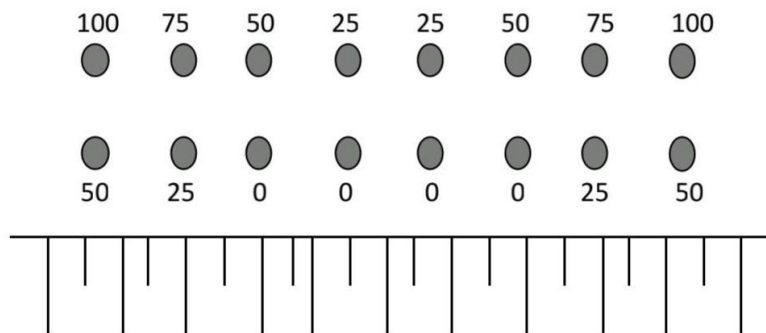
- (B) A-P-2, B-Q-1, C-S-4, D-R-3
- (D) A-S-4, B-Q-1, C-P-2, D-R-3

2016

Q.5 Identify the correct statement.
NONEL is used for surface connection of the blast holes in order to

- (A) achieve better water resistance over detonating fuse
- (B) have a precise delay timing
- (C) provide noiseless shock front movement
- (D) avoid deflagration

Q.6 Identify the pattern of surface blasting given in the figure. The values of delay time, in ms, are given against each blasthole.



- (A) V- cut
- (B) extended V- cut
- (C) row to row
- (D) en echelon

Q.7 Identify the initiation sequence which is NOT possible for surface blasting.

- (A) Detonating fuse → Nonel → Electronic detonator
- (B) Electric detonator → Nonel → Detonating fuse
- (C) Electric detonator → Detonating fuse → Nonel
- (D) Electronic detonator → Detonating fuse → Nonel

Q.8 Parallel holes at right angles to the face with some holes uncharged are associated with the following shot hole pattern

- (A) drag cut
- (B) wedge cut
- (C) pyramid cut
- (D) burn cut

Q.30 Data pertaining to a surface bench blast is given below:

Burden = 3.0 m	Sub-grade drilling = 1.0 m
Spacing = 4.0 m	Collar stemming = 4.0 m
Bench height = 10.0 m	Air decking length = 1.0 m
Density of rock = 2000 kg/m ³	Linear charge concentration = 10 kg/m

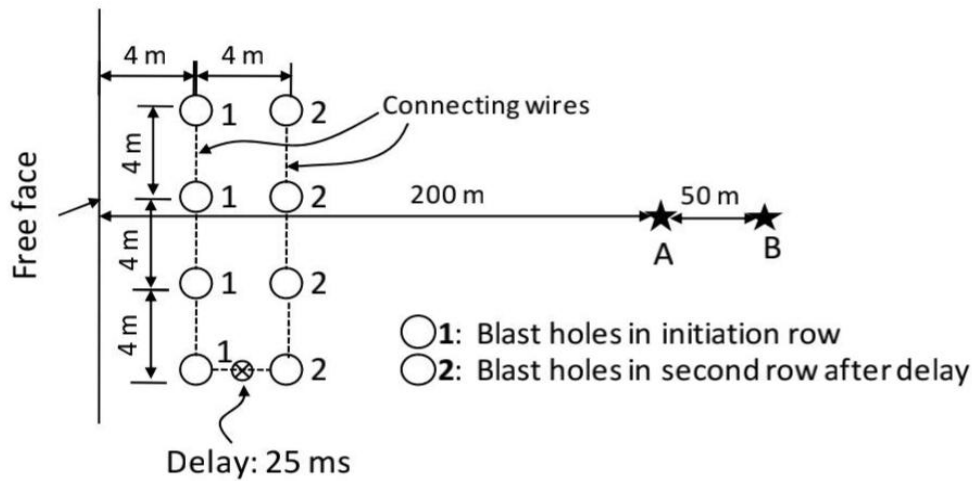
The powder factor of the blast, in kg/tonne, is _____

Q.33 Match the following for a drilling system.

Component	Function
P. Drill	1. Utilization of energy in fragmenting rock
Q. Drill rod	2. Reduction of energy loss due to regrinding
R. Drill bit	3. Conversion of original form of energy into mechanical energy
S. Flushing medium	4. Transmission of energy from prime mover to applicator

(A) P-3,Q-1,R-2,S-4 (B) P-4,Q-1,R-3,S-2 (C) P-3,Q-4,R-1,S-2 (D) P-2,Q-1,R-3,S-4

Q.51 Peak particle velocity (PPV) at points A and B are measured for a blast pattern as shown in the figure.



The relevant data are:

Amount of explosives per hole in the 1st row : 500 kg
 Amount of explosives per hole in the 2nd row : 475 kg
 PPV at point A : 18 mm/s
 PPV at point B : 10 mm/s

Considering the following relationship,

$$PPV = K \left(\frac{D}{\sqrt{Q}} \right)^{-n}, \text{ mm/s}$$

where D (in m) denotes the distance from the blast row to the measuring point and Q (in kg), maximum charge per delay. The site constants K and n respectively are

(A) 1002, 3.13 (B) 622, 2.92 (C) 823, 2.59 (D) 1245, 2.99

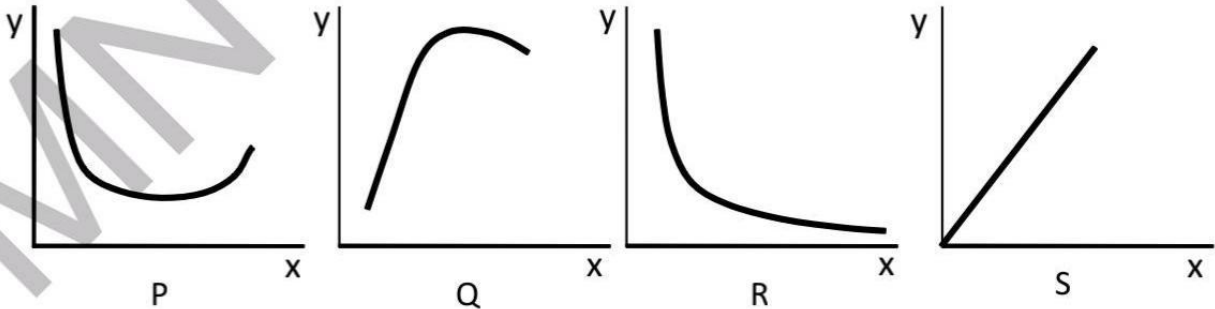
2014

Q.7 The weight strength of ANFO of specific gravity 0.8 is 912 kcal/kg. The weight strength of an emulsion explosive of specific gravity 1.2 is 850 kcal/kg. Bulk strength of the emulsion explosive relative to ANFO in percentage is _____

Q.32 In a room-and-pillar stope, bench blasting is conducted using ANFO having density of 800 kg/m^3 . The specific gravity of rock is 2.5, hole diameter is 100 mm and spacing to burden ratio is 1.3. The charge length of each blast hole is 80% of the hole length. For a desired powder factor of 0.48 kg/tonne, the spacing and burden of the blast pattern in m respectively are

- (A) 2.0, 2.6 (B) 2.3, 1.8 (C) 5.2, 4.0 (D) 1.3, 1.0

Q.34 The following characteristic curves (P, Q, R, S) pertain to rotary drilling in rock.



Title of the curve

- I: Torque versus RPM
 II: Rate of penetration versus uniaxial compressive strength of rock
 III: Rate of penetration versus weight on bit
 IV: Specific energy versus weight on bit

Match the curves with their titles

- (A) P-III, Q-IV, R-II, S-I (B) P-II, Q-IV, R-I, S-III
 (C) P-IV, Q-III, R-II, S-I (D) P-I, Q-III, R-II, S-IV

Q.53 Six detonators each having resistance of 1.5 ohm are connected in parallel. A 15 V exploder is connected to the detonators by two single-core cables of resistance 3 ohm each. The current in the circuit in Ampere is _____

2013

- Q.5 For a 25 mm diameter spherical charge, the maximum allowable charge length in cm is
(A) 15.0 (B) 25.0 (C) 30.0 (D) 150.0
- Q.6 Long-hole drilling with crater blasting is used for the construction of
(A) winze (B) shaft (C) raise (D) decline
- Q.10 The rotational speed and cutting velocity of a drill are 350 rpm and 71.50 m/min respectively. The diameter of the rotary drill bit in mm is
(A) 65 (B) 67 (C) 68 (D) 70
- Q.13 Among the following options, the specific energy for rock-drilling is lowest in
(A) rotary diamond drilling
(B) rotary roller drilling
(C) percussive drilling
(D) jet piercing
- Q.15 An emulsion explosive of specific gravity 1.25 is used for blasting in an iron ore formation having P-wave velocity of 3000 m/s and specific gravity of 3.20. For an explosive impedance to rock impedance ratio of 0.5, the desired velocity of detonation of the explosive in m/s is
(A) 3840 (B) 4000 (C) 4200 (D) 7680

2012

Q.11 The equipment that is NOT used in hard rock metal mining drivage is

(A) road header

(B) drill jumbo

(C) jack hammer

(D) dint header

Q.13 Equipment used in mining of placer deposits is

(A) auger

(B) wagon drill

(C) rope saw

(D) riffle box

Q.24 The blasting technique used for controlled throw of overburden is known as

(A) cast blasting

(B) coyote blasting

(C) plaster shooting

(D) pop shooting

2011

Q.45 20 plain detonators in series, each of $2\ \Omega$ resistance, are fired by a DC exploder supplying a current of 1.25 A. If 250 mJ energy is spent to fire the detonators, the time required in millisecond after detonator initiation is

(A) 4

(B) 8

(C) 12

(D) 16

2010

Q.17 Match the following for standard diamond drill rods.

Specification	Outer diameter in mm
---------------	----------------------

P. AW	p. 34.9
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Q. BW	q. 44.4
-------	---------

R. EW	r. 54.0
-------	---------

S. NW	s. 66.7
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(A) P-r, Q-q, R-s, S-p (B) P-r, Q-p, R-s, S-q

(C) P-q, Q-r, R-p, S-s (D) P-q, Q-r, R-s, S-p

Q.46 The stroke length and pitch of the rifle bar of a percussive drill machine are 60 mm and 1/760 respectively. If the drill operates at 2000 blows/minute, the rotational speed in rpm of the drill steel is

(A) 145

(B) 158

(C) 162

(D) 175

2009

Q.10 A non-electric detonating relay does NOT contain

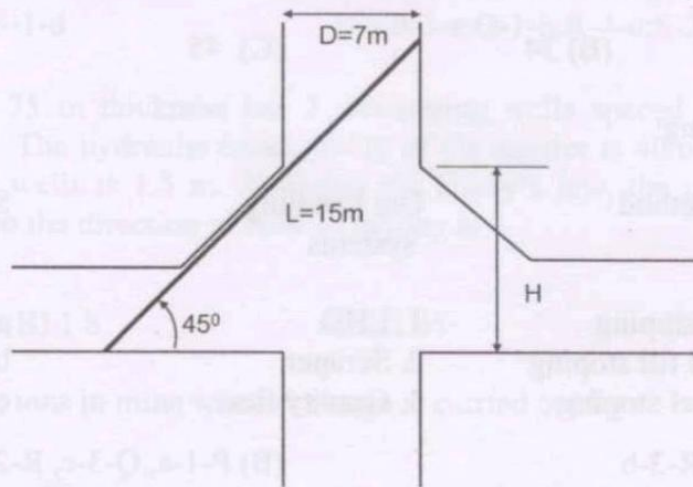
(A) delay element

(B) fuse head

(C) metal sleeve

(D) neoprene connecting tube

Q.25 A shaft inset is as shown below. To transport a 15 m long object, the height 'H' of the inset in m should be



(A) 10.5

(B) 7.0

(C) 6.5

(D) 5.9

Q.26 Match the following:

Blast Problem

Cause

P Misfire

1

Poor stemming

Q Vibration

2

Low current

R Blown-out shot

3

Excess charge

S Cut-off shot

4

Improper delays

(A) P-3, Q-2, R-4, S-1

(B) P-4, Q-1, R-2, S-3

(C) P-2, Q-3, R-1, S-4

(D) P-1, Q-2, R-4, S-3

Q.30 Match the following:

Access	Haulage	Mineralisation location
P. Shaft	1. Track	a. Moderate depth
Q. Decline	2. Trackless	b. Deep seated
R. Adit	3. Hoisting	c. Hillock

(A) P-1-a, Q-3-b, R-2-c

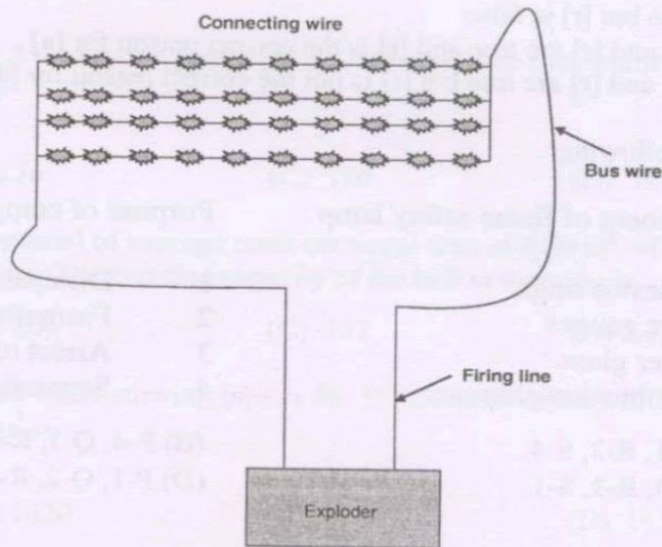
(B) P-3-b, Q-2-a, R-1-c

(C) P-2-a, Q-1-b, R-3-c

(D) P-2-b, Q-3-c, R-1-a

Q.48 A surface mine blast pattern shown below has the following details:

Accessory	Resistance (in Ohms)	Number or Length
Detonator	2 per detonator	40 nos
Connecting wire	0.5/m	100 m
Bus wire	0.5/m	100 m
Firing line	0.01/m	200 m



If the exploder supplies 440 V, the current in the blasting circuit in ampere is

(A) 5.36

(B) 3.51

(C) 4.83

(D) 2.57

Q.49 In a surface mine blast, the peak particle velocity (V in mm/s) is estimated from the equation $V = 120(\sqrt{SD})^{-1.0}$, where SD is square root scaled distance. If at a distance of 100 m from the blast site the permissible peak particle velocity is 25 mm/s, the maximum charge per delay in kg is

(A) 404

(B) 414

(C) 434

(D) 464

2007

- Q.6 The critical diameter of an explosive is defined as the diameter below which it
- (A) develops the optimum velocity of detonation
 - (B) does not involve in chemical reaction
 - (C) develops the maximum velocity of detonation
 - (D) deflagrates

Q.40 Match the following

Stope	Drill machine	Method of drilling
P Shrinkage	I Drill jumbo	1 Fan drilling
Q Room-and-pillar	J Down-the-hole hammer	2 Overhand drilling
R Sublevel	K Hand held stopper	3 Parallel drilling
S Sublevel caving	L Mechanised fan drill	4 Frontal /vertical/downward benching

- (A) P-I-2, Q-K-4, R-L-3, S-J-1
- (B) P-K-4, Q-I-3, R-J-2, S-L-1
- (C) P-K-2, Q-I-4, R-J-3, S-L-1
- (D) P-I-3, Q-K-4, R-J-1, S-L-2

Q.47 Match the following

	Rock mass condition		Shaft sinking method		Limiting depth (m)
P	Water bearing strata of loose sand or gravel	I	Freezing	1	40
Q	Competent rock with fissures and cracks filled with water	J	Depression of ground water level	2	150
R	Highly permeable coarse solid or gravel with heavy water flow	K	Cement grouting	3	1000
S	All types of water bearing rocks	L	Caissan	4	> 600

(A) P-L-4, Q-K-1, R-J-2, S-I-3
(C) P-L-2, Q-K-4, R-J-3, S-I-1

(B) P-L-1, Q-K-4, R-J-2, S-I-3
(D) P-L-4, Q-K-3, R-J-2, S-I-1

Mine development

2000

1.9 The location of a vertical shaft for a horizontal coal seam depends on the shaft

- (A) depth.
- (B) horizontal distance from each production location.
- (C) distance from surface fan.
- (D) depth and horizontal distance from each production location.

1.17 Select the correct order with respect to the core sizes

- (A) $AX > BX > EX > NX$
- (B) $NX > BX > AX > EX$
- (C) $AX > BX > NX > EX$
- (D) $EX > AX > BX > NX$

2.2 At a current of 0.8 A, ignition time of detonator fuse head is 7 ms. If 192 J is the D.C. Exploder power required to ignite the blasting circuit what is the total resistance of the circuit?

- (A) 38Ω
- (B) 40Ω
- (C) 43Ω
- (D) 47Ω

MN 12. In set of diamond drilling experiments on granite the torque was measured as a function of RPM for a 55 mm diameter drill bit at 500 N thrust. Determine the best fit straight line relationship between the torque and the RPM.

<u>RPM/100</u>	<u>Torque (Nm)</u>
3.00	1.2
4.75	1.4
7.50	1.8
11.80	2.7

MN 21. Three boreholes A, B, and C intersect a seam of coal at depths of 200m, 315m, and 270 m respectively. A is due south of B by 360m, and C is N 60° W of A by 255m. Calculate the direction and rate of full dip.

1999

- 1.2 Misfires in blast holes charged with LOX can be dealt by
(A) Pouring water in the blast hole to desensitize explosive.
(B) digging out the explosive carefully with a shovel.
(C) putting another detonator on the top the hole and blasting it.
(D) none of the above.
- 1.3 The formulae recommended by the Bureau of Indian Standards for calculating the peak particle velocity, in ground, due to blasting relating; peak particle velocity (U), mm/sec; constant, (K); charge per delay, (Q) kg; and distance from the blast (R), m; is
(A) $U = K (Q^2/R^2)^{1.5}$ (B) $U = K (Q^{2/3}/R)^{1.25}$
(C) $U = K (Q/R^{2/3})^{1.5}$ (D) $U = K (Q/R)^{0.5}$
- 1.20 A coal heading 4m wide and 2.5 high has an advance of 1m per cycle. The amount of explosive used in blasting is 6 kg. Taking specific gravity of coal as 1.5, the powder factor is
(A) 1.66 te/kg (B) 2.50 te/kg
(C) 2.99 te/kg (D) 3.32 te/kg
- 1.21 In an underground coal mine, 1800 workers are employed. The average production from the mine is 900 tonnes per day. The O. M. S. of the mine is
(A) 0.24 te (B) 0.60 te
(C) 0.65 te (D) none of the above
- 2.5 A vertical shaft for a mine is being sunk to a depth of 300m. The finished diameter is 6 m and the thickness of concrete lining is 30 cms. The volume of concrete required for the construction of the lining is
(A) 1293 m³ (B) 1442 m³
(C) 1538 m³ (D) 1780 m³
- 2.15 the most probable value and the error in calculating the area of a circle whose radius in metre is 25.35 ± 0.05 will be
(A) 2018, 858 + 6.04, m²
(B) 2018.858 + 5.75, m²
(C) 2018.858 + 7.96, m²
- 2.24 A coal heading 4m wide and 2.5m high has an advance of 1m per blasting round. The amount of explosive used in the blasting round is 6 kg. If the sp. gr. of coal is 1.5, the powder factor is
(A) 1.66 te/kg (B) 2.50 te/kg
(C) 2.99 te/kg (D) 3.32 te/kg

19. A bord and pillar panel in a coal mine is being developed by 5-heading development system. The average availability of working faces in the panel at any time is 9. The headings are being driven by solid blasting and have the following specifications :

width = 4.8m

height = 2.4m

pull per round = 1.2m

specific gravity of coal = 1.5

Assuming that every face undergoes one complete cycle per shift and the mine works three shifts per day for 300 days during a year, calculate the yearly production from the panel. What should be the minimum quantity of air to be circulated on production from the panel. What should be the minimum quantity of air to be circulated on production basis through this panel? If the total number of workers working in the three shifts in the three shifts in the panel is 500, calculate the O. M. S. of the panel.

1998

1.5 In rock blasting the term "impedance of medium" is the product of

(A) wave pressure and Poisson's ratio

(B) wave pressure and density of medium

(C) propagation velocity and Poisson's ratio

(D) propagation velocity and density of medium

1.6 The Burnside Safety Boring Apparatus is used for

(A) drivage of tunnels in water bearing strata

(B) tapping water from water logged working

(C) drilling small holes through fire stopping

(D) exploratory drilling work in metal mines

3.5 drilling method

Principle of rock cutting

(1) Diamond drilling

(A) Impact action

(2) Percussive drilling

(B) Thermal spalling

(3) Rotary roller drilling

(C) Rotary abrasive

(4) Jet picrcing

(D) Cutting and ploughing

5. The following information is provided for overburden preparation requirement of a surface mine (5)

Spacing of drill holes	7 m
Burden of drill holes	4 m
Overburden to be rem	4,40,000 m ³
Hours of operation per shift	6
Shift per day	2
Drilling days per week	5
Drilling rate	20 m/hour

Find the total number of drills required.

1997

1.5 For an emulsion explosive

Element	Constituent
(1) Dispersion medium	(A) Several nitrate salts
(2) Strengtheners	(B) Microspheres of gas
(3) Oxidiser	(C) Diesel
(4) Sensitizer	(D) Aluminium powder

19. In one year 2.4 million m³ of overburden is proposed to be removed from a dragline operated bench. Estimate the numbers of drills required for this purpose in the absence of any provision for standby machines. The other parameters being, (5)

expected rate of drilling	= 5 m/hr
bench height	= 14 m
burden	= 8 m
spacing	= 5m
subgrade drilling	= nil
availability of drill	= 5000hr/year
utilization	= 65 % of availability

1995

- 1.4 Given below are the commercial names and their chemical compositions of the materials used in the preparation of explosives (2)
- | | |
|-------------------------------|---------------------------------|
| (1) Gun-Cotton | (A) $C_2H_4(NO_3)_2$ |
| (2) T.N.T. | (B) $C_3H_5(NO_3)_3$ |
| (3) Nitro-glycerine | (C) $C_6H_2(NO_2)_3 \cdot CH_3$ |
| (4) Ethylene glycol dinitrate | (D) $C_{12}H_4O_4(NO_3)_6$ |
- 1.5 Given below are the names of the fragmenting agents and the chemicals used for the same
- | | |
|--------------------|-----------------------|
| (1) LOX | (A) Ammonium chloride |
| (2) ANFO | (B) Oxygen |
| (3) Dtonating fuse | (C) Diesel oil |
| (4) Hydrox | (D) PETN |
- 2.11 Dust generation may be reduced by drilling with
- (A) Low RPM
 - (B) Sharp bit
 - (C) High RPM
 - (D) Low thrust
- 3.15 Explosive performance depends only on
- (A) The shock energy of the explosive
 - (B) The bubble energy of the explosive
 - (C) The velocity of detonation and detonation pressure
 - (D) The total energy
- 3.16 A shock tube initiating system, such as Nonel,
- (A) Does not need detonators for initiation
 - (B) It can not be used in under-water condition
 - (C) It is not affected by static electricity or strong currents
 - (D) It creates a lot of noise

5. A wedge-cut blasting round with eight-cut-holes is drilled to obtain a pull of 1.8 m in a 2m x 3m face, having a load factor of $0.0381 \text{ m}^3/\text{kN}$. ANFO with a specific gravity of 0.8 is to be used. Average drill hole diameter is 76 mm. Total consumption of explosives is 670 N, out of which 160 N is used in eight-cut-holes. Length of each hole to be drilled should be equal to the pull plus half the charge length of cut-hole. Holes other than the cut-holes are charged to 40 percent of the drilled length. Calculate

- (a) Length of charge in cut-holes (2)
- (b) total number of holes in the face (2)
- (c) powder factor (1)

22. What is an emulsified ANFO (or Heavy ANFO)? How is its explosive property achieved? How is it superior to ANFO? (2 + 1 + 2)

