GA - General Aptitude

Q1 - Q5 carry one mark each.

Q.No. 1 Rajiv Gandhi Khel Ratna Award was conferred_____Mary Kom, a six-time world champion in boxing, recently in a ceremony_____the Rashtrapati Bhawan (the President's official residence) in New Delhi.

(A) with, at
(B) on, in
(C) on, at
(D) to, at

Q.No. 2 Despite a string of poor performances, the chances of K. L. Rahul's selection in the team are_____.

(A) slim
(B) bright
(C) obvious
(D) uncertain

Q.No. 3 Select the word that fits the analogy:

Cover : Uncover :: Associate : _____

(A) Unassociate
(B) Inassociate
(C) Misassociate
(D) Dissociate

Q.No. 4 Hit by floods, the kharif (summer sown) crops in various parts of the country have been affected. Officials believe that the loss in production of the kharif crops can be recovered in the output of the rabi (winter sown) crops so that the country can achieve its food-grain production target of 291 million tons in the crop year 2019-20 (July-June). They are hopeful that good rains in July-August will help the soil retain moisture for a longer period, helping winter sown crops such as wheat and pulses during the November-February period.

Which of the following statements can be inferred from the given passage?

(A) Officials declared that the food-grain production target will be met due to good rains.
(B) Officials want the food-grain production target to be met by the November-February period.
(C) Officials feel that the food-grain production target cannot be met due to floods.
(D) Officials hope that the food-grain production target will be met due to a good rabi produce.

Q.No. 5 The difference between the sum of the first $2n$ natural numbers and the sum of the first n odd natural numbers is _____.

(A) $n^2 - n$
(B) $n^2 + n$
(C) $2n^2 - n$
(D) $2n^2 + n$

Q6 - Q10 carry two mark each.

Q.No. 6

Repo rate is the rate at which Reserve Bank of India (RBI) lends commercial banks, and reverse repo rate is the rate at which RBI borrows money from commercial banks.

Which of the following statements can be inferred from the above passage?

(A) Decrease in repo rate will increase cost of borrowing and decrease lending by commercial banks.

(B) Increase in repo rate will decrease cost of borrowing and increase lending by commercial banks.

(C) Increase in repo rate will decrease cost of borrowing and decrease lending by commercial banks.

(D) Decrease in repo rate will decrease cost of borrowing and increase lending by commercial banks.

Q.No. 7 P, Q, R, S, T, U, V, and W are seated around a circular table.

I. S is seated opposite to W.
II. U is seated at the second place to the right of R.
III. T is seated at the third place to the left of R.
IV. V is a neighbour of S.

Which of the following must be true?

(A) P is a neighbour of R.

(B) Q is a neighbour of R.

(C) P is not seated opposite to Q.

(D) R is the left neighbour of S.

Q.No. 8 The distance between Delhi and Agra is 233 km. A car P started travelling from Delhi to Agra and another car Q started from Agra to Delhi along the same road 1 hour after the car P started. The two cars crossed each other 75 minutes after the car Q started. Both cars were travelling at constant speed. The speed of car P was 10 km/hr more than the speed of car Q. How many kilometers the car Q had travelled when the cars crossed each other?

(A) 66.6

(B) 75.2

(C) 88.2

(D) 116.5

Q.No. 9 For a matrix $M = [m_{ij}];\ i,j = 1,2,3,4$, the diagonal elements are all zero and $m_{ij} = -m_{ji}$. The minimum number of elements required to fully specify the matrix is_____.

(A) 0

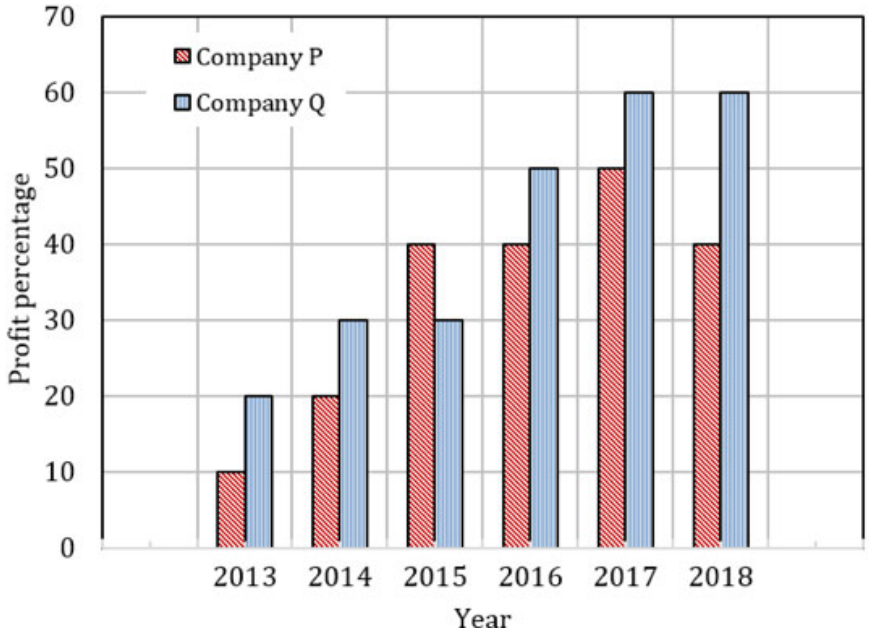
(B) 6

(C) 12

(D) 16

Q.No. 10

The profit shares of two companies P and Q are shown in the figure. If the two companies have invested a fixed and equal amount every year, then the ratio of the total revenue of company P to the total revenue of company Q, during 2013 - 2018 is_____.



(A) 15 : 17
(B) 16 : 17
(C) 17 : 15
(D) 17 : 16

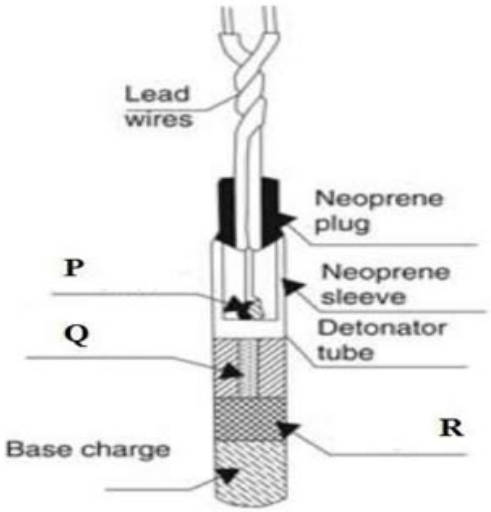
MN: Mining Engineering

Q.No. 1 The eigenvalues of the matrix

$A = \begin{bmatrix} 1 & 4 \\ 3 & 2 \end{bmatrix}$ are

(A) 6, 4
(B) 4, 5
(C) -2, 5
(D) -4, 5

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. 3 Match the following safety arrangements for a surface-to-underground shaft hoist with their corresponding safety functions.

Hoisting safety arrangement		**Safety function**	
P	Detaching hook	1	Over-winding safety on surface
Q	Narrowing rigid guides	2	Resting cages
R	Keps	3	Over-winding safety at underground

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

Q.No. 4 The fore bearings and back bearings of the lines of an open compass traverse are given below.

Line	**Fore bearing**	**Back bearing**
PQ	132°30′	313°30′
QR	123°30′	303°30′
RS	182°30′	2°15′
ST	288°45′	108°0′

The stations that are free from local attraction are
(A) P and Q
(B) Q and R
(C) R and S
(D) S and T

Q.No. 5 The plane stress condition is given by
(A) $\varepsilon_{zz} = 0, \gamma_{yz} = 0, \gamma_{zx} = 0$
(B) $\sigma_{zz} = 0, \tau_{yz} = 0, \tau_{zx} = 0$
(C) $\sigma_{zz} \neq 0, \tau_{yz} \neq 0, \tau_{zx} \neq 0$
(D) $\varepsilon_{zz} \neq 0, \gamma_{yz} \neq 0, \gamma_{zx} \neq 0$

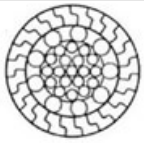
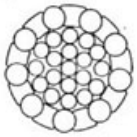
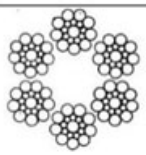
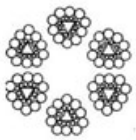
Q.No. 6

Match the following metals with their corresponding minerals.

Metal		Mineral	
P	Copper	1	Galena
Q	Tungsten	2	Sphalerite
R	Lead	3	Chalcopyrite
S	Zinc	4	Wolframite

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

Q.No. 7 Match the wire rope types with their corresponding cross-sectional diagrams.

Rope type		Diagrams	
P	Round strand	1	
Q	Half-locked coil	2	
R	Flattened strand	3	
S	Full locked coil	4	

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

Q.No. 8 The 'ratchet and pawl' mechanism in a jack hammer drill
(A) forces down the piston
(B) provides a twisting force to the drill steel
(C) engages rifle bar with rifle nut
(D) prevents reverse rotation of rifle bar

Q.No. 9 Post-pillar method of stoping is a variant of
(A) cut and fill stoping
(B) sublevel stoping
(C) vertical crater retreat method
(D) sublevel caving

Q.No. 10 'Cross-measure borehole method' is used for

(A) rock slope monitoring
(B) methane drainage
(C) connecting two drifts
(D) subsidence monitoring

Q.No. 11 The dry and wet bulb temperatures at the inlet of the airstream are 30 °C and 25 °C, respectively. The corresponding values at the outlet of the airstream are 26 °C and 25 °C, respectively. The psychrometric process that occurs in the airstream is described as

(A) latent cooling
(B) sensible cooling
(C) condensation
(D) evaporative cooling

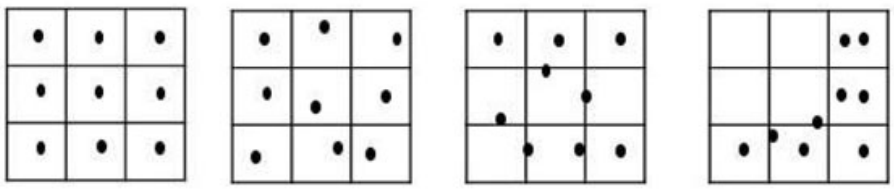
Q.No. 12 For a mixture of inflammable gases, the lower and upper explosibility limits can be computed using

(A) Dalton's law
(B) Graham's law
(C) Le Chatelier relation
(D) Boyle's law

Q.No. 13 The code for the lowest category of mineral resources under United Nations Framework Classification (UNFC) system is

(A) 444
(B) 123
(C) 334
(D) 111

Q.No. 14 Match the following sampling patterns with the corresponding sampling types.



Sampling Pattern	Sampling Type	
P	1	Regular
Q	2	Biased
R	3	Stratified random
S	4	Random

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

Q.No. 15 In the context of gas testing using flame safety lamp, the correct statement is

(A) Each accumulation test has to be necessarily followed by percentage test

(B) Accumulation test is always done after percentage test

(C) Either percentage test or accumulation test can be done first

(D) Percentage test is done only in the event of accumulation test giving negative result

Q.No. 16 For x in the range of [-3, 3], the maximum value for the function

$f(x) = x^3 - 6x^2 + 9x + 15$ is _____ (*round off to 1 decimal place*).

Q.No. 17 A rock sample has coefficient of thermal diffusivity 1.282×10^{-6} m^2/s, specific heat 900 J/(kg °C) and density 2600 kg/m^3. The coefficient of thermal conductivity of the rock sample in W/(m °C) is _____ (*round off to 1 decimal place*).

Q.No. 18 A random variable X has the following probability mass function.

x	3	6	8	12
$f(x)$	1/2	1/4	1/8	1/8

The expected value of the variable X is _____ (*round off to 1 decimal place*).

Q.No. 19 A random sample has five observations as shown below.

11	14	15	13	12

The coefficient of variation of the sample is _____ (*round off to 3 decimal places*).

Q.No. 20 Rock strata has unit weight of 25 kN/m^3 and Poisson's ratio 1/3. At a depth of 200 m, the horizontal stress in MPa is _____ (*round off to 1 decimal place*).

Q.No. 21 A shovel of bucket capacity 4.2 m^3 makes 900 passes per day with a fill factor of 0.8. If the swell factor of the rock is 1.4, then *in-situ* volume handled by the shovel in a month of 24 working days in m^3 is _____ (*round off to 1 decimal place*).

Q.No. 22 A cylindrical sample of granular material has the following measurements:

Length: 10 cm

Diameter: 5 cm

Weight: 350 g

Assume the sample is completely dry with specific gravity of solid grains 2.8. The void ratio of the sample is _____ (*round off to 3 decimal places*).

Q.No. 23

The following consecutive readings were taken at uniform intervals with a level and a levelling staff on continuously sloping ground.

0.405, 1.035, 1.654, 0.240, 0.615, 1.125, 0.800, 1.125

The number of change points is _____ .

Q.No. 24 The cost of a slurry pump is Rs. 50,000 and it has an estimated life of 7 years. If the salvage value is Rs. 8,000, the annual depreciation following straight-line depreciation method, in Rupees, is _____ (*round off to 1 decimal place*).

Q.No. 25 In a mine bench, the shovel loading time follows exponential distribution with a mean loading time of 5 min per dumper. The arrival rate of dumpers that are identical in capacity, follows Poisson distribution with a mean arrival rate of 8 per hour. The probability that the shovel remains idle is _____ (*round off to 2 decimal places*).

Q.No. 26 For $w=\frac{e^t-t}{e^t+t}$, the value of $\frac{dw}{dt}$ is

(A) $\frac{2e^t(t^2+1)}{(e^t-t^2)^2}$

(B) $\frac{2e^t(t-1)}{(e^t+t)^2}$

(C) $\frac{2e^t(t^2-1)}{(e^t+t^2)^2}$

(D) $\frac{2e^t(t+1)}{(e^t-t)^2}$

Q.No. 27 For the differential equation $y\sqrt{1-x^2}\,dy + x\sqrt{1-y^2}\,dx = 0$, assuming the constant of integration to be C, the general solution is

(A) $\frac{1}{\sqrt{1-x^2}}+\frac{1}{\sqrt{1-y^2}}=C$

(B) $y\sqrt{1-x^2}+x\sqrt{1-y^2}=C$

(C) $\sqrt{1-x}+\sqrt{1-y}=C$

(D) $\sqrt{1-x^2}+\sqrt{1-y^2}=C$

Q.No. 28 A belt-drive used for power transmission between two parallel shafts has a belt of mass 1.2 kg/m, and the maximum allowable belt tension is 2250 N. If the centrifugal tension is one third of the maximum allowable belt tension, the speed at which maximum power is transmitted by the belt, in m/s, is

(A) 46.48

(B) 38.73

(C) 25.00

(D) 35.36

Q.No. 29

An air receiver of a compressor, having volume 0.5 m^3, supplies air for charging ANFO in drill holes. During the charging process the absolute pressure of the air receiver falls from 900 kPa to 700 kPa. Assuming the entire process is isothermal, the volume of air supplied by the receiver at 100 kPa ambient pressure, in m^3 is

(A) 1.00
(B) 0.39
(C) 0.64
(D) 4.48

Q.No. 30 A conveyor belt consumes 60 kW power while running at a speed of 3.0 m/s. The angle of lap is 180° and the coefficient of friction between belt and pulley is 0.2. The maximum tension (kN) in the belt is

(A) 21.7
(B) 61.7
(C) 82.9
(D) 42.9

Q.No. 31 A linear programming problem is stated below.

$$Maximize \quad Z = 3x_1 + 5x_2$$

$$subject\ \text{to}, \quad 2x_1 + x_2 \leq 8$$

$$6x_1 + 8x_2 \leq 30$$

$$x_1, x_2 \geq 0$$

The objective function has

(A) infinite number of solutions
(B) unbounded solution
(C) unique solution
(D) infeasible solution

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

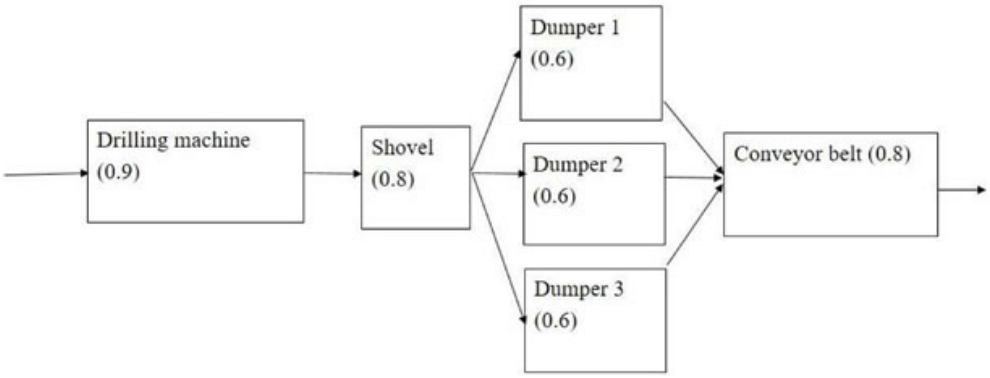
(A) surplus by 32 g
(B) deficient by 24 g
(C) surplus by 16 g
(D) deficient by 32 g

Q.No. 33 A cylindrical sample of cross-sectional area A, length L, and Young's Modulus E, is subjected to a constant uniaxial load P. Within the elastic limit of loading, the total strain energy stored is

(A) $\frac{2P^2L}{AE}$
(B) $\frac{P^2L}{2AE}$
(C) $\frac{PL}{A^2E}$
(D)

$$\frac{P^2 L}{AE}$$

Q.No. 34 A surface mine production system along with the reliability of the individual components is shown below. The system reliability is _____ (*round off to 3 decimal places*).



Q.No. 35 The selling price of one rock bolt (in Rs.) is given as, $S = (200 - 10n^{-0.5})$, where n is the number of bolts produced. The manufacturing cost of rock bolts has a fixed component of Rs. 15000, and a variable component of Rs. 100 per bolt. The minimum break-even production, in number of rock bolts, is _____ (*round off to 1 decimal place*).

Q.No. 36 Two underground mines are separated by a horizontal coal barrier of 60 m thickness. One mine is inundated, whereas the other mine has a blind heading of dimensions 4.0 m wide and 2.5 m height terminating at the barrier. The overall *in-situ* shear strength of the coal mass is 500 kPa. Assume that the failure mode is in shear. At a factor of safety of 10, the maximum water head that can be withstood by the coal barrier, in m, is _____ (*round off to 1 decimal place*).

Q.No. 37 Air enters from ambient atmosphere into a level duct of uniform cross-section area 0.2 m^2 at a flow rate of 2.0 m^3/s and density of 1.2 kg/m^3. The entry shock loss factor is 1.0 and the resistance of the duct per meter length is 1.0 Ns^2/m^8. The static pressure measured at a distance of 20 m from the duct entrance in Pa, is _____ (*round off to 1 decimal place*).

Q.No. 38 A sealed-off area air sample consists of 16.0% O_2, 3.0% CO_2, and the rest is N_2. Assume that the standard composition of atmospheric air is 21.0% O_2 and 79.0% N_2. The percentage of blackdamp in the air sample is _____ (*round off to 2 decimal places*).

Q.No. 39 A diesel loader produces 60 *l*/s of exhaust fumes containing 5000 ppm of CO. The incoming air has 10 ppm of CO. The minimum amount of air flow in m^3/s that is needed at the loader to dilute CO to a permissible level of 50 ppm is _____ (*round off to 1 decimal place*).

Q.No. 40

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

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

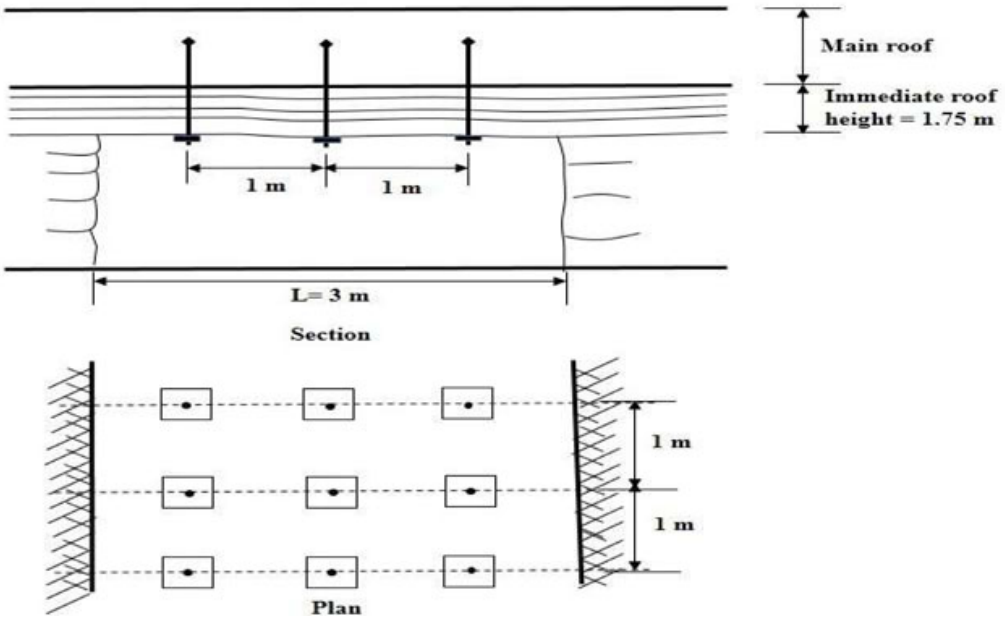
In a field study, the following readings are recorded.

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*).

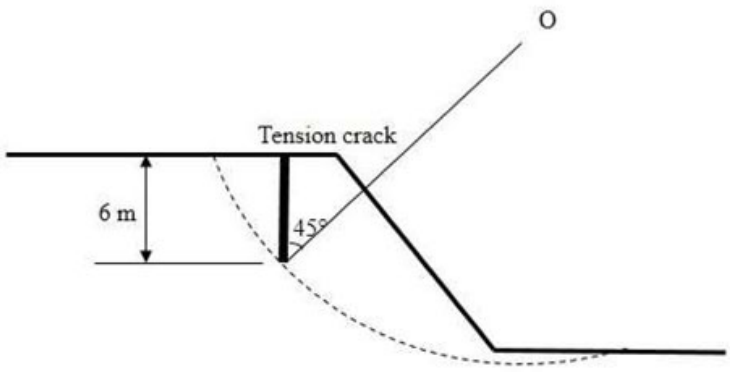
Q.No. 41 An underground copper mine sends 2500 tonnes of ore per day to the concentrator plant having an average grade of 1.2% Cu. The plant produces concentrate of 25.0% Cu with a recovery of 93.0%. The solids portion of tailings generated from the plant per day in tonnes is _____ (*round off to 1 decimal place*).

Q.No. 42 A mine gallery is supported by regularly placed roof bolts of 100 kN allowable pull force per bolt, as shown below. Assuming unit weight of the immediate roof is 25 kN /m^3, the factor of safety of the support system is _____ (*round off to 2 decimal places*).



Q.No. 43

The slip circle of radius 30.0 m in an overburden slope is shown with the centre of slip circle at point O. The tension crack is completely filled with water. For one meter width of the slope, the moment exerted by the force of water about O in kN-m is _____ (*round off to 1 decimal place*).



Q.No. 44 The function values at four points of x are shown in the table. The area under the function, using trapezoidal method, is _____ (*round off to 1 decimal place*).

x	2	4	8	9
$f(x)$	8	12	9	10

Q.No. 45 A particle starting from rest moves in a straight line such that after time, t (seconds), the acceleration becomes $(6 - t/4)$ cm/s^2. When the acceleration becomes zero, the velocity of the particle in cm/s is _____ (*round off to 1 decimal place*).

Q.No. 46 A parallelepiped has edge vectors as shown below.

$$\vec{A} = -4\hat{\imath} - 10\hat{\jmath} - \hat{k}$$
$$\vec{B} = 7\hat{\imath} + 9\hat{\jmath} - 2\hat{k}$$
$$\vec{C} = 3\hat{\imath} + 9\hat{\jmath} + 4\hat{k}$$

The volume of the parallelepiped is _____ (*round off to 1 decimal place*).

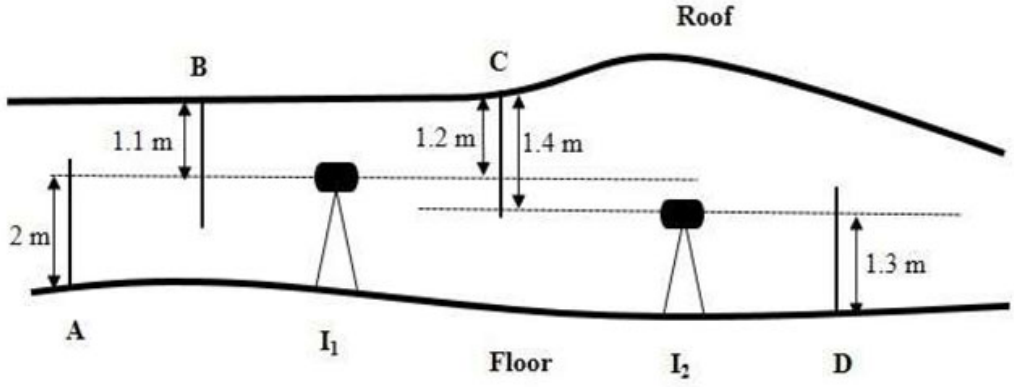
Q.No. 47 For a development heading, the blasting parameters are

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*).

Q.No. 48

The following figure represents the observations from the level survey of an underground gallery.



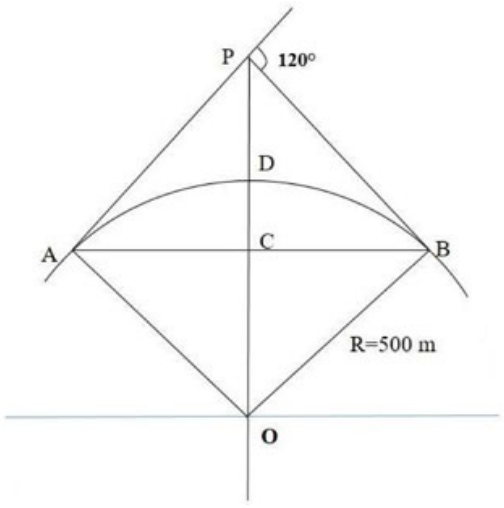
If the reduced level of station **A** is 100.0 m, the reduced level of station **D** in m is _____ (*round off to 1 decimal place*).

Q.No. 49 A tacheometer was setup at station P and the following readings were taken at two stations A and B with the staff held vertical and the line of sight horizontal.

Line	**Bearing**	**Staff intercept**
PA	210°	1.2 m
PB	135°	1.4 m

The additive and multiplying constants of the tacheometer are 0 and 100, respectively. The length of AB in m is _____ (*round off to 1 decimal place*).

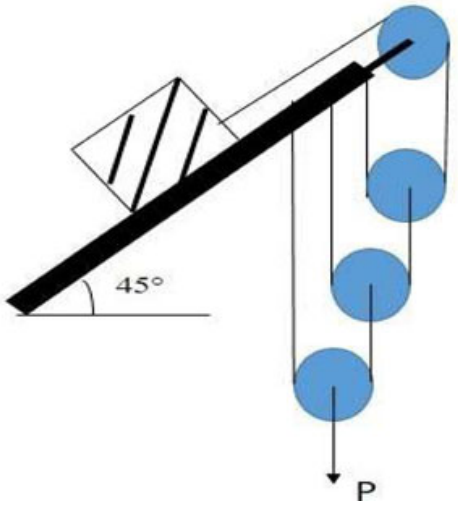
Q.No. 50 The geometry of a simple planar curve (ADB) is shown below. The value of the mid-ordinate of the curve in m is _____ (*round off to 1 decimal place*).



Q.No. 51

A steel cube of side 50 mm is subjected to a uniform pressure of 200 MPa acting on each face. The Young's modulus and Poisson's ratio of the material are 200 GPa and 0.25, respectively. The decrease in the side of the cube in mm is _____ (*round off to 3 decimal places*).

Q.No. 52 In the figure shown below, the friction coefficient between the block and the inclined plane is 0.2, and all the pulleys are weightless. The weight of the block is 10 N. The minimum force P in Newtons that is needed to slide the block up the inclined plane is _____ (*round off to 2 decimal places*).



Q.No. 53 An assignment problem is given below with the cost of assignment as shown.

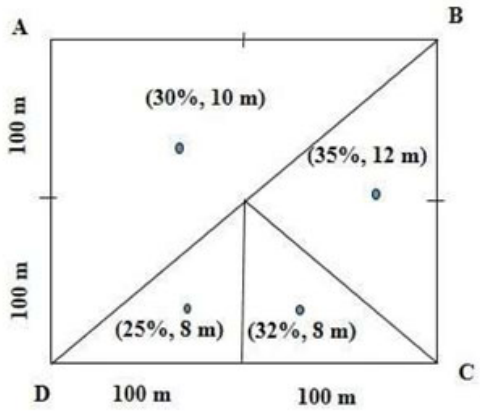
Task / Group	T1	T2	T3	T4
G1	6	10	5	4
G2	4	100	6	4
G3	6	9	6	2
G4	3	7	6	4

If only one task can be assigned to one group, the minimum cost of assignment is _____ .

Q.No. 54 A vertical stoping block of length 60.0 m, height 40.0 m, and average width 1.5 m has sharp boundary walls. However, the mining width of the stoping block is 2.0 m. The tonnage factors are 3.0 tonne/m^3 for ore and 2.5 tonne/m^3 for wall rocks. The average grade of ore is 10.0%. The overall grade of ore mined on account of dilution in percentage is _____ (*round off to 2 decimal places*).

Q.No. 55

A bauxite ore body has four boreholes as shown below. For each borehole, the grade of alumina, the thickness of the ore body, and the triangular area of influence are as shown.



The average grade of ore body in the region ABCD in percentage is _____ (*round off to 1 decimal place*).

Q.No.	Session	Que.Type	Sec. Name	Key	Marks
1	3	MCQ	GA	C	1
2	3	MCQ	GA	B	1
3	3	MCQ	GA	D	1
4	3	MCQ	GA	D	1
5	3	MCQ	GA	B	1
6	3	MCQ	GA	D	2
7	3	MCQ	GA	C	2
8	3	MCQ	GA	B	2
9	3	MCQ	GA	B	2
10	3	MCQ	GA	B	2
1	3	MCQ	MN	C	1
2	3	MCQ	MN	A	1
3	3	MCQ	MN	D	1
4	3	MCQ	MN	B	1
5	3	MCQ	MN	B	1
6	3	MCQ	MN	C	1
7	3	MCQ	MN	A	1
8	3	MCQ	MN	D	1
9	3	MCQ	MN	A	1
10	3	MCQ	MN	B	1
11	3	MCQ	MN	D	1
12	3	MCQ	MN	C	1
13	3	MCQ	MN	C	1
14	3	MCQ	MN	B	1
15	3	MCQ	MN	D	1
16	3	NAT	MN	18.0 to 20.0	1
17	3	NAT	MN	2.9 to 3.1	1
18	3	NAT	MN	5.4 to 5.6	1
19	3	NAT	MN	0.120 to 0.125	1
20	3	NAT	MN	2.4 to 2.6	1
21	3	NAT	MN	51830.0 to 51850.0	1
22	3	NAT	MN	0.560 to 0.580	1
23	3	NAT	MN	2 to 2	1
24	3	NAT	MN	5990.0 to 6010.0	1
25	3	NAT	MN	0.32 to 0.34	1
26	3	MCQ	MN	B	2
27	3	MCQ	MN	D	2
28	3	MCQ	MN	C	2
29	3	MCQ	MN	A	2
30	3	MCQ	MN	D	2
31	3	MCQ	MN	C	2
32	3	MCQ	MN	D	2
33	3	MCQ	MN	D	2
34	3	NAT	MN	0.530 to 0.550	2
35	3	NAT	MN	148.0 to 154.0	2
36	3	NAT	MN	385.0 to 410.0	2
37	3	NAT	MN	-205.0 to -195.0	2
38	3	NAT	MN	22.00 to 25.00	2
39	3	NAT	MN	7.2 to 7.7	2
40	3	NAT	MN	-1.255 to -1.165	2
41	3	NAT	MN	2380.0 to 2396.0	2
42	3	NAT	MN	2.10 to 2.45	2
43	3	NAT	MN	3360.0 to 3480.0	2
44	3	NAT	MN	71.0 to 72.0	2
45	3	NAT	MN	71.0 to 73.0	2
46	3	NAT	MN	87.0 to 89.0	2
47	3	NAT	MN	0.44 to 0.50	2
48	3	NAT	MN	100.4 to 100.6	2
49	3	NAT	MN	157.0 to 161.0	2
50	3	NAT	MN	248.0 to 252.0	2
51	3	NAT	MN	0.020 to 0.030	2
52	3	NAT	MN	67.00 to 69.00	2
53	3	NAT	MN	18 to 18	2
54	3	NAT	MN	7.70 to 7.95	2
55	3	NAT	MN	30.8 to 31.6	2