

# DMRC—Junior Engineer (Civil)

## Exam, 2015\*

### PAPER-I

#### TECHNICAL APTITUDE (CIVIL)

1. The slab is designed as one-way if the ratio of long span to short span is:
  - A. Less than 1
  - B. Between 1 and 1.5
  - C. Between 1.5 and 2
  - D. Greater than 2
2. Which of the following values of pH represents a stronger acid?
  - A. 2
  - B. 5
  - C. 7
  - D. 10
3. Consider the following statements:
 

A: The load factor for live load is greater than the dead load

R: The live loads are more uncertain than the dead loads

Of these statements:

  - A. Both A and R are true and R is the correct explanation of A
  - B. Both A and R are true but R is not the correct explanation of A
  - C. A is true but R is false
  - D. A is false but R is true
4. The shear-force and bending moment are always positive in case of:
  - A. Cantilevers
  - B. Simply supported beams
  - C. Overhanging beams
  - D. None of these
5. A short column  $20\text{cm} \times 20\text{cm}$  in section is reinforced with 4 bars whose area of cross section is  $20\text{ sq. cm}$ . If permissible compressive stresses in concrete and steel are  $40\text{ kg/cm}^2$  and  $1300\text{ kg/cm}^2$ , the safe load on the column, should not exceed:
  - A. 412 kg
  - B. 4120 kg
  - C. 41,200 kg
  - D. 412,000 kg
6. A solid circular shaft is subjected to a bending moment  $M$  and torque  $T$ . The ratio of maximum bending stress to the maximum shear stress is given by:
  - A.  $MT/2$
  - B.  $2M/T$
  - C.  $M/2T$
  - D.  $M/T$
7. The flow index in soils indicates:
  - A. Shear strength variation with water content
  - B. Rate of flow of water through the soil
  - C. Variation of liquid limit
  - D. Ratio of the liquid limit to the plastic limit
8. Sugar when added to cement will act as:
  - A. An accelerator
  - B. A retarder
  - C. A workability admixture
  - D. An air entraining agent
9. Under water concreting is done by:
  - A. Dripping method
  - B. Tremie method
  - C. Cofferdam method
  - D. All of the above
10. If in a given soil, mass void ratio is 0.67, water content is 0.188 and specific gravity is 2.68, the degree of saturation of the soils is:
  - A. 25%
  - B. 40%
  - C. 60%
  - D. 75%
11. Which bacteria is used to convert ammonia to nitrite?
  - A. Coliphage
  - B. Nitrosomonas
  - C. Nitrobacter
  - D. E. coli

\* Held on 15/03/2015

12. De-chlorination of water is achieved by adding:
- Sodium thiosulphate
  - Sodium sulphate
  - Sodium hexametaphosphate
  - Sodium bisulphate
13. Curing period required is minimum for the concrete using:
- Ordinary Portland cement
  - Portland slag cement
  - Rapid hardening cement
  - Low heat Portland cement
14. When the strain in a material increases with time under sustained constant stress, the phenomenon is known as:
- Strain hardening
  - Hysteresis
  - Creep
  - Visco-elasticity
15. Softening point of bitumen to be used for road construction at a place where maximum temperature is  $40^{\circ}\text{C}$  should be:
- Less than  $40^{\circ}\text{C}$
  - Equal to  $40^{\circ}\text{C}$
  - Greater than  $40^{\circ}\text{C}$
  - Equal to  $80^{\circ}\text{C}$
16. The deflection at the free end of a cantilever of rectangular cross-section due to certain loading is 0.8 cm. If the depth of the section is doubled keeping the width same, then the deflection at the free end of the beam due to the same loading will be:
- 0.1 cm
  - 0.4 cm
  - 0.8 cm
  - 1.6 cm
17. Bleeding can be reduced by:
- Addition of pozzolanas
  - Addition of aluminum powder
  - Increasing the fineness of the cement
  - All of the above
18. Pick up the incorrect statement:
- Centering and orientation are interrelated in a plane table survey
  - Exact centering of plane table is essential for a large scale map
  - Centering of plane table cannot be sacrificed at the cost of orientation for a small scale map
  - Plane table survey is most suited for filling in details if the country is open with good inter visibility
19. A critical activity has:
- Maximum float
  - Minimum float
  - Zero float
  - Average float
20. The property of a soil which is of great importance in finding settlement of structures, is:
- Permeability
  - Shear strength
  - Consolidation
  - Compressibility
21. The pressure measured with the help of a piezometer tube is in:
- $\text{N/mm}^2$
  - $\text{N/m}^2$
  - Head of liquid
  - $\text{N/cm}^2$
22. Stretcher bond is possible only in:
- Half brick wall
  - One brick wall
  - One & half brick wall
  - Wall of any thickness
23. Orifice meter is used to measure:
- Discharge
  - Average velocity
  - Max velocity
  - Pressure at a point
24. IS:1498 – 1978 relates to:
- Soil classification
  - Building measurement
  - Concrete
  - Cement
25. Longitudinal stress is expressed as:
- $\text{Pd/t}$
  - $\text{Pd/2t}$
  - $\text{Pd/3t}$
  - $\text{Pd/4t}$
26. Rise and fall method is used to measure:
- Horizontal angle
  - Vertical angle
  - Relative elevation
  - Length
27. In Water Bound Macadam (WBM) roads, binding material used is:
- Sand
  - Stone dust
  - Cement
  - Brick dust

28. In setting up a plane table at any station:
- Levelling is done first
  - Centering is done first
  - Levelling and centering is done simultaneously
  - Orientation is done first

29. Centre of the road is elevated with respect to edges. What is this:
- Super elevation
  - Camber
  - Height of pavement
  - None of these

30. The sewerage system originates from:
- House Sewers
  - Lateral Sewers
  - Branch Sewers
  - Main Sewers

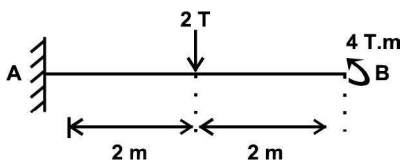
31. Los Angeles machine is used to test the aggregates for:
- Crushing strength
  - Impact value
  - Abrasion resistance
  - Water absorption

32. The modulus of elasticity of steel is assumed to be:
- 200 KN/mm<sup>2</sup>
  - 225 KN/mm<sup>2</sup>
  - 250 KN/mm<sup>2</sup>
  - 275 KN/mm<sup>2</sup>

33. The radius of gyration of a section of area 'A' and least moment of inertia 'I' about the centroidal axis is:

- $\frac{A}{I}$
- $\frac{I}{A}$
- $\sqrt{\frac{I}{A}}$
- $\sqrt{\frac{A}{I}}$

34. The B.M. of a cantilever beam at A shown in the figure is:



- Zero
- 8 T.m
- 10 T.m
- 16 T.m

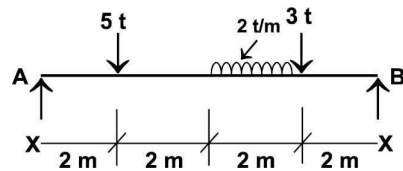
35. A simply supported beam of span L carries a uniformly distributed load W. The maximum bending moment is:

- $\frac{WL}{2}$
- $\frac{WL}{8}$
- $\frac{WL}{4}$
- $\frac{WL}{12}$

36. If Z & I are section modulus and moment of inertia, the shear force F at a section is:

- $\frac{My}{I}$
- $\frac{M}{Z}$
- $\frac{dM}{dx}$
- $\int Mdx$

37. The ratio of the reactions R<sub>A</sub> & R<sub>B</sub> of a simply supported beam shown below is:



- 0.50
- 0.40
- 0.67
- 1.00

38. The B.S. on a Bench Mark of R.L. 400 m is 2.685 m. If F.S. on a point is 1.345, the R.L. of this point is:

- 402.685 m
- 401.345 m
- 401.340 m
- 404.03 m

39. The imaginary line passing through the intersection of cross hairs and the optical centre of the objective is known as:

- Line of sight
- Line of collimation
- Axis of telescope
- None of these

40. The brick laid with its length parallel to the face of a wall is known as:

- Header
- Stretcher
- Closer
- None of these

41. Seasoning of timber is:  
 A. A process of removing sap  
 B. Creosoting  
 C. Painting with sodium silicate  
 D. Coating with tar
42. The slenderness ratio of a steel member is:  
 A. Length/minimum side dimension  
 B. Effective length /radius of gyration  
 C. Effective length/corresponding radius of gyration  
 D. Effective length/least radius of gyration
43. Spacing of main bars in an R.C.C. slab shall not exceed:  
 A. 3 times the effective depth  
 B. 3 times the overall depth  
 C. 30 times the diameter of main bar  
 D. 30 cm
44. Bending moment at a section is maximum where the shear force is:  
 A. Zero                      B. Maximum  
 C. Minimum                D. Changes sign
45. Ratio of linear stress to linear strain is called:  
 A. Modulus of rigidity  
 B. Modulus of elasticity  
 C. Bulk modulus  
 D. Poisson's ratio
46. Hook's law holds good upto:  
 A. Yield point              B. Elastic limit  
 C. Plastic limit             D. Breaking point
47. Unit of work in S.I. units is:  
 A. Newton                  B. Erg  
 C. Kg m                      D. Joule
48. The process of mixing water with quick lime is called:  
 A. Calcination of lime  
 B. Curing of lime  
 C. Slaking of lime  
 D. Cooling of lime
49. Rocks formed by solidification of molten magma are:  
 A. Sedimentary rocks  
 B. Igneous rocks  
 C. Metamorphic rocks  
 D. None of these
50. In a plate girder, the shear force in the girder at any section is taken up by:  
 A. The web only  
 B. The flange only  
 C. Part of web and part of flange  
 D. The whole section
51. The slump test helps in the determination of the following quality of concrete:  
 A. Strength                  B. Settlement  
 C. Shrinkage                D. Workability
52. The arches support the loads mainly by:  
 A. Axial tension            B. Thrust  
 C. Shear                     D. Bending
53. The slope is the deformation corresponding to:  
 A. Axial force  
 B. Bending moment  
 C. Horizontal reaction  
 D. Shear force
54. The minimum width of the riveted section should be:  
 A.  $2 \phi$                       B.  $2.5 \phi$   
 C.  $3 \phi$                         D.  $2.5 \phi_h$   
 where  $\phi$  = Diameter of rivet  
 $\phi_h$  = Diameter of rivet hole
55. If the soil at the shallow depth is not having good strength, the only alternative is the:  
 A. Pile foundation  
 B. Raft foundation  
 C. Isolated column footing  
 D. Well foundation
56. A U-tube manometer measures difference in:  
 A. Total energy            B. Pressure  
 C. Piezometric head     D. Velocity head
57. The diffusion is more vigorous when the flow is:  
 A. Laminar                  B. Turbulent  
 C. Supercritical            D. Critical

58. The method of traversing in survey is:  
 A. Measurement of all the angles only  
 B. Measurement of angles and distances  
 C. Measurement of all distances  
 D. Measurement of all bearings only.
59. The plinth area of building include:  
 A. The area of barsati and mumty  
 B. Area of loft  
 C. Cantilevered porch  
 D. Courtyards
60. The abrasion test on aggregates is carried out to determine its:  
 A. Hardness                      B. Toughness  
 C. Durability                      D. Softness
61. The soundness of Portland cement is tested by:  
 A. Le-Chatelier apparatus  
 B. Vicats needle  
 C. Sieve analysis  
 D. Specific surface analysis
62. A first class brick immersed in water for 24 hours, should not absorb water (by weight) more than:  
 A. 10%                              B. 15%  
 C. 20%                              D. 25%
63. Eutrophication of lakes is due to:  
 A. Excess nutrients in water  
 B. Excess hard ion in water  
 C. Excess turbidity in water  
 D. Excess iodine in water
64. Tintometer is used to measure:  
 A. Hardness                      B. Odour  
 C. Temperature                  D. Colour
65. Which of the following pairs is not correctly matched:  
 1. **Path lines:** Direction of motion of a particle between two given sections  
 2. **Stream lines:** Directions of motion of a particle at that instant  
 3. **Streak lines:** Lines formed by particles ejected from a nozzle  
 4. **Potential lines:** Lines joining the points of equal potential on adjacent flow line  
 A. 1                                      B. 2  
 C. 3                                      D. 4
66. Compaction of a soil is measured in terms of:  
 A. Dry density                  B. Specific gravity  
 C. Compressibility              D. Permeability
67. The law used in permeability test is  
 A. Stoke's law                  B. Pascal's law  
 C. Darcy's law                  D. Newton's law
68. The water content in the soil is:  
 A. Ratio of volume of water to volume of soil  
 B. Ratio of volume of water to volume of solids  
 C. Ratio of weight of water to volume of soil  
 D. Ratio of weight of water to weight of solids
69. The maximum compressive stress in a cantilever beam with a downward concentrated load at the free end is caused at:  
 A. Top fibre at mid span  
 B. Bottom fibre at mid span  
 C. Bottom fibre at the support  
 D. Top fibre at the support
70. The shear force in a beam (V) and the displacement (v) are related by:  
 A.  $V = EI \frac{d^2 v}{dx^2}$   
 B.  $V = EI \frac{d^3 v}{dx^3}$   
 C.  $V = EI \frac{d^4 v}{dx^4}$   
 D. Not related to each other  
 Where EI = Flexural rigidity
71. The shear force on a beam is proportional to:  
 A. Curvature of the axis  
 B. Displacement of the axis  
 C. Sum of the forces  
 D. Sum of the transversed forces
72. The setting of Portland cement may be defined as:  
 A. Setting of heat of hydration in cement paste  
 B. Change of cement paste from fluid to hardened state  
 C. Gain of strength of cement paste  
 D. None of these

73. Gypsum is added in cement manufacturing for the property of:  
 A. Cementing  
 B. Setting  
 C. Retarding the setting  
 D. Heat of hydration
74. The following soil is good for making bricks:  
 A. Weathered clay  
 B. Unexposed clay  
 C. Silted soil  
 D. Clay which is 1 metre below ground level
75. Piezometric head is the sum of:  
 A. Velocity head and pressure head  
 B. Pressure head and datum head  
 C. Datum head and velocity head  
 D. Velocity head, pressure head & datum head

### APTITUDE

76. To mark 800<sup>th</sup> anniversary of Magna Carta (1215), four surviving copies of the world most important documents of parliamentary democracy were recently brought together as a part of celebrations in:  
 A. Washington      B. Delhi  
 C. London            D. Kathmandu
77. The so called “bad” cholesterol in the serum is:  
 A. HDL                B. VLDL  
 C. LDL                D. All of these
78. The foremost cause of blindness in India, according to official data is:  
 A. Glaucoma  
 B. Diabetic Retiopathy  
 C. Cataract  
 D. Refractive error
79. Recently which ministry has launched two schemes namely—venture capital fund for S.C. and Green business scheme:  
 A. Ministry of Finance  
 B. Ministry of Social Justice & Empowerment  
 C. Ministry of Commerce & Industry  
 D. Ministry of Minority affairs
80. One of the pioneering robots, that went missing into space almost a decade ago, has been recently found on the surface of red planet. Name it:  
 A. Beagle 2  
 B. Mars-2 Prop-M. Rover  
 C. Mars Rover  
 D. Spirit (MER-A)
81. Who among the following were well known for their study on poverty in India:  
 A. V.M. Dandekar    B. Neel Kanth  
 C. Raghuram Rajan   D. Both A & B
82. Who was appointed the first chief executive officer of National Institution for transforming India:  
 A. Arvind Panagariya  
 B. Bibek Debroy  
 C. Ms Sindhushree Khullar  
 D. Ms Saraswathi Menon
83. Panchsheel agreement was signed between:  
 A. India & Bangladesh   B. India & China  
 C. India & Pakistan      D. India & America
84. International Monetary Fund is headquartered at:  
 A. Washington        B. New York  
 C. Geneva              D. Paris
85. Contour lines on a map join places of:  
 A. Equal mean atmospheric pressure  
 B. Equal average temperature  
 C. Equal rainfall  
 D. Equal height above sea level
86. A writ, which is in the nature of command issued by the court asking a public authority to perform a public duty which it is bound to perform or to refrain from performing a particular act which it should not perform, is called:  
 A. Certiorari            B. Habeas corpus  
 C. Mandamus          D. Quo warranto
87. The capillary action phenomenon of water climbing up a narrow tube dipped in water is due to:

- A. Surface friction  
B. Surface tension  
C. Atmospheric pressure  
D. Differential temperature
88. The Present strength of Rajya Sabha members is ..... out of which ..... are representatives of states and union territories of Delhi and Puducherry and ..... are nominated by president:  
A. 245, 233, 12      B. 250, 238, 12  
C. 247, 235, 12      D. 248, 236, 12
89. As per the constitution of India, the state legislature shall consist of:  
A. Governor, Legislative Council, Legislative Assembly  
B. Governor, Legislative Assembly where there is no legislative council  
C. Chief Minister, Governor, Legislative Council, Legislative assembly  
D. Either A or B
90. Garuda-V concluded recently, is a joint exercise between the air forces of India and:  
A. Japan      B. Canada  
C. Russia      D. France
91. 20 men can finish a work in 30 days. On completion of 10 days, 10 men leave work. Remaining men work for next 10 days. At the end of 20 days it is decided to complete the work in remaining 10 days. How many extra men are required:  
A. 20      B. 25  
C. 15      D. 10
92. A machinist by increasing his normal rate of work by  $12\frac{1}{2}\%$  could produce 15 items more, in a given period of time. How many items can he produce if he works at 80% of his normal rate:  
A. 100      B. 90  
C. 80      D. 96
93. The average age of 10 students is 15 years. When 5 new students joined, the average age rose by one year. The average age in years of the new students is:  
A. 18      B. 16  
C. 15      D. 17
94. In an examination a student scores 1 mark for each correct answer and 0.25 marks are deducted for each wrong answers. If he attempts all 120 questions and secures 90 marks, the number of questions he attempts correctly is:  
A. 100      B. 106  
C. 96      D. None of these
95. The difference between  $\frac{3}{4}$  of 64 and  $\frac{2}{3}$  of 48 is equal to:  
A. 24      B. 20  
C. 32      D. 16
96. Two students appeared at an examination. One of them secured 9 marks more than the other and his marks was 56% of the sum of their marks. The marks obtained by them are:  
A. 39, 30      B. 41, 32  
C. 42, 33      D. 43, 34
97. The cost price of 19 mangoes is equal to the selling price of 16 mangoes. The gain per cent is:  
A.  $3\frac{9}{17}\%$       B.  $15\frac{15}{19}\%$   
C.  $18\frac{3}{4}\%$       D. 20%
98. A hemispherical bowl of internal radius 9 cm contains a liquid. This liquid is to be filled into cylindrical shaped small bottles of a diameter 3 cm and height 4 cm. How many bottles will be needed to empty the bowl?  
A. 45      B. 54  
C. 35      D. 48
99. Which of the following is the rate percent per annum which would give difference in amount of interest equal to ₹ 20 for ₹ 1200 in 3 years and for ₹ 800 in 4 years?  
A. 2.5      B. 3  
C. 5      D. None of these
100. In a class, the ratio of boys to girls is 4 : 5. Half of the boys and half of the girls participated in the youth festival.  $\frac{1}{6}$ , ie, 30 of the total student population participated

in the NCC camp. What is the number of girl students in the class?

- A. 80                                      B. 100  
C. 120                                      D. 150

**101.** Three wheels make 60, 36 and 24 revolutions per minute. Each has a red spot on its rim, which is at the lowest position at time zero. The red spot will all be at this position again after:

- A. 2 seconds                              B. 5 seconds  
C. 4 seconds                              D. None of these

**102.** If  $2 \log_x (x - 2) = \log_x 4$ , then the value of  $x$  is:

- A. 1    B. 3  
C. 4    D. 2

**103.** Which of the following is the largest number?

- A.  $3^{1/3}$     B.  $5^{1/5}$   
C.  $2^{1/2}$     D.  $7^{1/7}$

**104.** In a throw of two dice, the probability of getting a sum of 9 or 11 is:

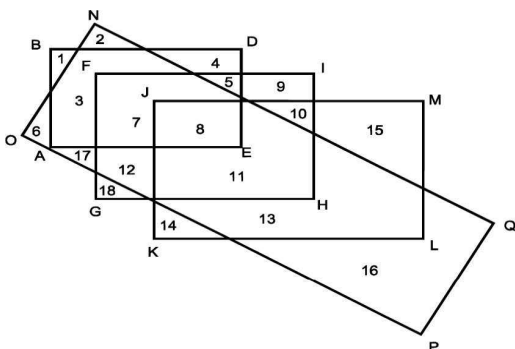
- A.  $2/9$     B.  $7/9$   
C.  $5/9$     D. None of these

**105.** The triangle joining the points (2, 7), (4, -1), (-2, 6) is:

- A. Equilateral                              B. Right angled  
C. Isosceles                                  D. None of these

**Directions:** For answering question, study diagram which is represented as follows and select the appropriate choice.

ABDE represents Artists  
FGHI represents Scientists  
JKLM represents Administrators  
OPQN represents healthy people



**106.** Scientists who are also artists but in not good state of health belong to the area:

- A. 4    B. 5  
C. 9    D. 10

**Directions:** Select the suitable alternative to satisfy the relationship in the following question.

**107.** Buffalo : Leather :: Sheep:

- A. Wool    B. Cotton  
C. Fur    D. Silk

**Directions:** Select the choice out of the given choices which gives the given words in the correct alphabetical order.

**108.** Nasal, New, Nine, Noble:

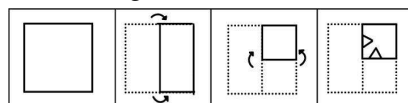
- A. Noble, New, Nasal, Nine  
B. Nine, Noble, New, Nasal  
C. Nasal, New, Nine, Noble  
D. New, Nasal, Nine, Noble

**109.** Five students participated in an examination and each scored different marks. Naina scored higher than Meena. Kamla scored lower than praveen but higher than Naina. Anuj's score was between Meena and Naina. Which of the following pairs represents the highest and the lowest scores respectively?

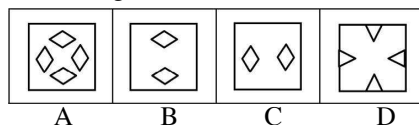
- A. Praveen, Naina                          B. Naina, Praveen  
C. Praveen, Anuj                          D. Praveen, Meena

**Directions:** In this question a piece of paper is folded and then cut as shown below. The dotted lines shown are the portion which have been folded. The curve arrow shows the directions of folding. And the number of scissors beneath the figure show the number of portions cut. From the given responses, indicate how it will appear when opened. The opening is in the same order as folding.

**110.** Question figure



Answer figure





**Directions:** At a public meeting there were 8 speakers A, B, C, D, E, F, G and H. Each spoke for some time according to the following scheme.

- I. 'A' spoke after 'F' and took more time than 'B'
  - II. 'C' spoke before 'G' and after 'B' and took less time than E but more time than G.
  - III. 'D' spoke after 'H' and before 'B' and took less time than 'H', but more time than 'E'.
  - IV. 'H' spoke after 'A' and took less time than 'B'
- 111.** Who spoke for the longest time?  
 A. A                                      B. B  
 C. C                                      D. D

**Directions:** Some words have been coded but no specific code is indicated. Use your judgement to pick the coded word which represents the given word the best.

- 112.** RECOMMEND:  
 A. 1 5 4 5 9 5 2 4 7  
 B. 1 5 6 7 2 2 5 4 3  
 C. 2 2 7 9 1 9 2 8 1  
 D. 5 6 6 6 7 1 2 8 1
- 113.** If BAT = 69 and BOOK = 172, then PEN = ?  
 A. 66                                      B. 105  
 C. 144                                     D. 183
- 114.** In a certain code language 'bring the white board' is written as 'ka na di pa' and 'white and black board' is written as 'na di sa ra'. How is 'the' written in that code?  
 A. ka                                        B. pa  
 C. ka or pa                                D. ra

**115.** If M + N means M is brother of N, M/N means M is father of N and M × N means M is sister of N. Which of the following means A is uncle of B?

- A. A / C × B                              B. C × B / A  
 C. A + D / E / B                        D. A + G / H × B

**116.** JE, LH, OL, SQ, \_\_\_\_\_

- A. WV                                      B. WX  
 C. VW                                      D. XW

**117.** 'B', the son of 'A' was wedded to 'C' where as 'D' was married to 'E'. If E is the brother of 'B', how is 'D' related to 'A'?

- A. Daughter-in-law                      B. Daughter  
 C. Sister                                    D. Cousin

**118.** Sonu starts from his home towards the South. After walking for 60 m, he turns right and goes for 40 m. He turns right again and walks for 80 m before turning left. He then walks for 30 m and reaches his school. How far is his school from his home and in which direction?

- A.  $10\sqrt{43}$  m, North East  
 B.  $10\sqrt{13}$  m, North West  
 C.  $10\sqrt{53}$  m, North West  
 D. None of these

**Directions:** In the following number series only one number is wrong. Find out the wrong number.

**119.** 4, 9, 21, 49, 101

- A. 21                                        B. 49  
 C. 101                                       D. None of these

**120.** Pick the odd one out.

- A. Copper                                    B. Tin  
 C. Zinc                                        D. Brass

## ANSWERS

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
D	A	B	D	C	B	A	B	B	D
<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>18</b>	<b>19</b>	<b>20</b>
B	A	C	C	C	A	D	C	C	C
<b>21</b>	<b>22</b>	<b>23</b>	<b>24</b>	<b>25</b>	<b>26</b>	<b>27</b>	<b>28</b>	<b>29</b>	<b>30</b>
C	A	A	A	D	C	B	B	B	A
<b>31</b>	<b>32</b>	<b>33</b>	<b>34</b>	<b>35</b>	<b>36</b>	<b>37</b>	<b>38</b>	<b>39</b>	<b>40</b>
C	A	C	A	B	C	D	C	B	B

41	42	43	44	45	46	47	48	49	50
A	C	A	A	B	B	D	C	B	C
51	52	53	54	55	56	57	58	59	60
D	B	B	D	B	B	B	B	D	B
61	62	63	64	65	66	67	68	69	70
A	C	A	D	A	A	C	D	C	B
71	72	73	74	75	76	77	78	79	80
D	B	C	A	B	C	C	C	B	A
81	82	83	84	85	86	87	88	89	90
D	C	B	A	D	C	B	A	D	D
91	92	93	94	95	96	97	98	99	100
A	D	A	C	D	C	C	B	C	B
101	102	103	104	105	106	107	108	109	110
B	C	A	D	B	B	A	C	D	A
111	112	113	114	115	116	117	118	119	120
A	B	B	C	D	D	A	C	B	D

## SOME SELECTED EXPLANATORY ANSWERS

- If the ratio of the two spans (long span/short span) of a panel exceeds two, the slab resists the moment in the shorter span essentially as a one-way slab.
- pH refers to the relative concentration of  $H^+$  ions in a solution. Low pH values indicate high concentrations of  $H^+$  ions (acids), and high pH values indicate low concentrations.

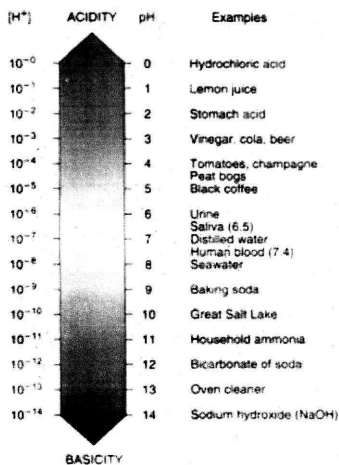


Figure: The pH scale

- A shear force (SF) is defined as the algebraic sum of all the vertical forces, either to the left or to the right hand side of the section.

A shear force which tends to rotate the beam in clockwise direction is positive and vice versa.

A bending moment (BM) is defined as the algebraic sum of the moments of all the forces either to the left or to the right of a section.

Bending Moment

$$= \text{Reaction} \times \text{moment arm}$$

The internal resistive moment at the section that would make the beam to sag (means to sink down, droop) is treated to be positive.

Based on that, cantilevers beam, simply supported beam and overhanging beam have positive shear force and banding moment.

- Flow index is the slope of flow curve obtained by plotting water content as ordinate on natural scale against number of blows as abscissa on logarithmic scale.

$$I_F = \frac{w_1 - w_2}{\log_{10} \frac{N_2}{N_1}}$$

where  $w_1$  = water content corresponding to number of blows,  $N_1$

$w_2$  = water content corresponding to number of blows,  $N_2$

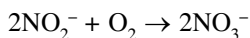
8. Sugar is widely recognized as a cement retarder by the drilling industry and has been used in cementing operations where cement returns are expected on surface.

9. The tremie concrete placement method uses a pipe, through which concrete is placed below water level.

The lower end of the pipe is kept immersed in fresh concrete so that the rising concrete from the bottom displaces the water without washing out the cement content.

11. **Nitrobacter** is a genus of mostly rod-shaped, gram-negative, and chemoautotrophic bacteria. Nitrosomonas bacteria first convert nitrogen gas to nitrite ( $\text{NO}_2^-$ ) and subsequently nitrobacter convert nitrite to nitrate ( $\text{NO}_3^-$ ), a plant nutrient.

Nitrification is carried out according to the following reactions:



13. Rapid-hardening hydraulic cement is not only a more durable alternative to portland cement on many projects, but its rapid-setting properties make it an ideal solution for today's schedule-and budget-driven projects.

14. Creep is defined as a phenomenon in which strain in a solid increases with time when the stress producing the strain is held fixed. In more practical terms, creep is the increased displacement or deflection of a structural element under a constant load. Depending on the construction material, structural design, and service conditions, creep can result in

significant displacements in a structure. Severe creep strains can result in serviceability problems, stress redistribution, and even failure of structural elements.

17. **Bleeding:** Bleeding is a form of segregation in which water in a concrete mix rises to the surface during placing it. It is because more water is present than is necessary for the cement paste to lubricate the aggregate particles and the solid constituents of the mix are not able to hold all the mixing water when they settle down. Thus the water rises up and appears on the surface of the compacted concrete.

Bleeding can be prevented by controlling the water content, using finely ground cement and controlling compaction. Addition of pozzolanas or aluminium powder reduces bleeding.

19. Critical path activities are the project tasks that must start and finish on time to ensure that the project ends on schedule.

**Float** is a measure of schedule flexibility.

P6 Web Access uses the Critical Path Method (CPM) to generate a project schedule. This method calculates four dates for each activity in the project plan: Early Start, Late Start, Early Finish, and Late Finish. If the Early Start date and Late date for an activity are the same, the activity is said to have zero float. Activities that have zero float must start on time to prevent the schedule from slipping.

21. **Piezometer:** This is the most simplest type of manometer used for measuring gauge pressure. Piezometer is simple glass tube, one end of which is connected to the point at which pressure is to be measured and the other end is open to the atmosphere. Due to pressure, the liquid rises in the piezometer and this rise is balanced by the weight and the atmospheric pressure. Therefore, the length of the piezometer should have sufficient long so that liquid can freely rise without overflowing. Let the height of liquid rise in

piezometer be  $h$ . Thus, pressure at point A will be  $P_A = \rho gh$ .

27. Water Bound Macadam is better quality road than the ordinary earth. A dense and compacted course of a road pavement is composed of stone aggregates bound together by a thin film of cementing medium consisting of a fine material filler. i.e. gravel (small stones) with cementing properties and containing enough moisture to impart binding properties to bind the aggregates together is called as a water bound Macadam. Binding action in WBM construction is obtained by using stone dust as a filler, in presence of water.
42. Slenderness ratio of a column is defined as the ratio of effective length to corresponding radius of gyration of the section. Thus

$$\text{slenderness ratio} = \frac{l_e}{r} = \frac{KL}{r}$$

where  $l_e$  = actual length of compression member

$l_e$  = KL, effective length

$r$  = appropriate radius of gyration.

49. Igneous rocks are the primary rocks formed by solidification of molten magma or lava. When the molten magma solidifies in the interior of the earth, intrusive rocks form. When lava solidifies on the exterior surface of earth, extrusive rocks form.
51. Slump test is used to determine the workability of fresh concrete. Slump test as per IS: 1199 - 1959 is followed. The apparatus used for doing slump test are Slump cone and Tamping rod.
56. A "U"-Tube enables the pressure of both liquids and gases to be measured with the same instrument. The fluid whose pressure is being measured should have a mass density less than that of the manometric fluid and the two fluids should not be able to mix readily - that is, they must be immiscible.

64. **Tintometer** is a measuring instrument used in colorimetric analysis to determine the quantity of a substance from the colour it yields with specific reagents.

66. The degree of compaction of a soil is measured in terms of the dry density, which is the mass of solids soil per unit volume of the soil. The degree of compaction contributes to the shear strength, permeability, compressibility, and sustainability for repeated loads.

71. **Shear Force:** It is internal resistance developed at any section to maintain free body equilibrium of either left or right part of the section.

It may be horizontal or vertical. Shear force at any section is algebraic sum of all transverse forces either from left or right of that section.

91. 20 men can finish whole work in 30 days.

$$\text{So, In 10 days work finished} = \frac{10}{30} = \frac{1}{3}$$

$$\text{Remaining work} = 1 - \frac{1}{3} = \frac{2}{3} \text{ work}$$

Work finished by 10 men in 10 days

$$\frac{10}{60} = \frac{1}{6}$$

$$\text{remaining work} = \frac{2}{3} - \frac{1}{6} = \frac{1}{2} \text{ work.}$$

Number of extra men required to finish

$$\text{remaining } \frac{1}{2} \text{ work in 10 days}$$

$$\begin{aligned} \frac{10}{\frac{1}{2}} &= 10 \times 2 \\ &= 20 \text{ mens.} \end{aligned}$$

92. Let machinist produce  $x$  items in  $y$  hours.

So, rate of production of item per hours

$$= \frac{x}{y}$$

From question, with increase in rate of production by 12.5%, item production is boosted by 15.

$$\frac{x}{y} \left( \frac{12.5}{100} \right) = 15 \Rightarrow \frac{x}{y} = \frac{15 \times 100}{12.5}$$

$$= 120.$$

So, item is produced by putting 80% of the efficiency

$$= \frac{x}{y} \times \frac{80}{100}$$

$$= 120 \times \frac{80}{100} = 96.$$

**93.** Total age of 10 students =  $15 \times 10$   
= 150 years.

When 5 new students joined,

Total age of 15 students =  $16 \times 15$   
= 240 years.

Total age of 5 new students  
=  $240 - 150$   
= 90 years.

Average age of 5 new students  
=  $\frac{90}{5} = 18$  years.

**94.** Let the student attempted  $x$  correct and  $y$  wrong questions,

Then,  $x + y = 120$  ...*(i)*

$x - 0.25y = 90$  ...*(ii)*

From *(i)* and *(ii)*, we have

$$1.25y = 30 \Rightarrow y = 24$$

$$x = 96.$$

Hence, number of questions attempted correctly = 96.

**95.**  $64 \times \frac{3}{4} - 48 \times \frac{2}{3}$   
 $16 \times 3 - 16 \times 2 = 16.$

**96.** Let one student scored  $x$  marks and other scored  $y$  marks.

$x - y = 9$  ...*(i)*

$$(x + y) \times \frac{56}{100} = x$$

$$0.56x + 0.56y = x$$

$$0.44x = 0.56y$$

$$11x = 14y.$$

$$y = \frac{11}{14}x \quad \dots\text{(ii)}$$

From *(i)* and *(ii)*, we have

$$x - \frac{11}{14}x = 9$$

$$\frac{3}{14}x = 9$$

$$\Rightarrow x = 42$$

$$y = 33.$$

**97.** Let cost price of each mango is ₹ 1.

Then, cost price of 19 mangoes = ₹19

Selling price of 16 mangoes = ₹19

Profit = cost price of 3 mangoes = ₹ 3

$$\text{Gain per cent} = \frac{3}{16} \times 100 = 18\frac{3}{4}\%.$$

**98.** Volume of hemispherical bowl

$$= \frac{2}{3} \pi r^3$$

$$= \frac{2}{3} \times \pi (9)^3$$

$$= 486 \pi.$$

Volume of each cylinder

$$= \pi r^2 \cdot h$$

$$= \pi \left( \frac{3}{2} \right)^2 \cdot 4$$

$$= 9 \pi.$$

$$\text{Number of bottle to be filled} = \frac{486\pi}{9\pi}$$

$$= 54.$$

**99.** Let Rate of interest @ annum is  $r$  %

From question,

$$\frac{1200 \times 3 \times r}{100} - \frac{800 \times 4 \times r}{100} = 20$$

$$36r - 32r = 20$$

$$4r = 20$$

$$r = \frac{20}{4} = 5\%$$

100. Total number of students in the class  
 $= 6 \times 30 = 180.$

$$\text{Number of girls in the class} = \frac{180 \times 5}{(4+5)}$$

$$= \frac{180 \times 5}{9} = 100.$$

101. Time required to Complete one revolution  
 (in sec) respectively

$$= \frac{60}{60}, \frac{60}{36}, \frac{60}{24}$$

$$= 1, \frac{5}{3}, \frac{5}{2}$$

So, number of revolution completed by each  
 in one second

$$= 1, \frac{3}{5}, \frac{2}{5}$$

So, In next 5 seconds, they will complete.

$5, \frac{3}{5} \times 5, \frac{2}{5} \times 5$  i.e., 5, 3, 2 revolution each  
 respectively

and hence red spot of three wheel aline in  
 next 5 seconds.

102.  $2 \log_x(x-2) = \log_x 4$   
 $\log_x(x-2)^2 = \log_x 4$   
 $(x-2)^2 = 4$   
 $(x-2) = \pm 2$   
 $x = 0, 4.$

But  $x = 0$  is not a valid answer.

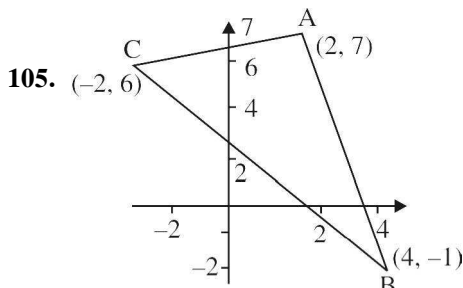
So,  $x = 4.$

104. Sum of 9 or 11 can be obtained in following  
 ways

(3, 6), (6, 3), (4, 5), (5, 4), (5, 6), (6, 5).

$$n(E) = 6, \quad n(S) = 6 \times 6$$

$$P(E) = \frac{6}{6 \times 6} = \frac{1}{6}.$$



$$\text{Slope of line } AB = \frac{7 - (-1)}{2 - 4}$$

$$= -\frac{8}{2} = -4.$$

$$\text{Slope of line } AC = \frac{7 - 6}{2 - (-2)} = \frac{1}{4}$$

$$\text{Product of slopes} = -4 \times \frac{1}{4} = -1$$

$$\therefore AB \perp AC, \angle BAC = 90^\circ.$$

Hence,  $\triangle ABC$  is a right triangle.

109. Based on the given data, arrangement of five  
 in descending order is like this:

Praveen > Kamla > Naina > Anuj > Meena

Pair of highest and lowest scorer are  
 (Praveen and Meena).

111. **Speech Order from first to last**

E, A, H, D, B, C, G

↑

↑

first

Last Spoke Person

Spoke person

**Arrangement based on duration of Speech  
 (longest to least)**

A, B, H, D, E, C, G

↑

↑

Longest time

Least time

Hence, A spoke for the longest time.

- 113.

B A T

| | |

Letter order:

2 1 20

⇒ Sum of letters = 2 + 1 + 20 = 23

Number of letters = 3

$$23 \times 3 = 69.$$

B O O K  
| | | |

Letter order: 2 15 15 11

⇒ Sum of letters = 2 + 15 + 15 + 11 = 43

Number of letters = 4

$$43 \times 4 = 172$$

P E N  
| | |

Letter order: 16 5 14

⇒ Sum of letters = 16 + 5 + 14 = 35

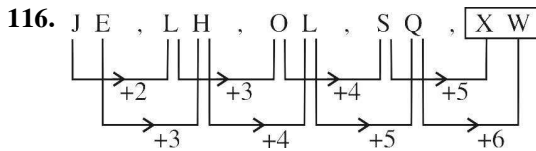
Number of letters = 3

$$35 \times 3 = 105.$$

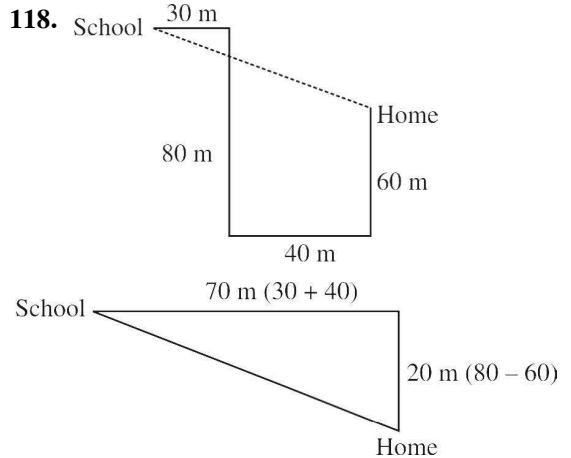
114. bring the white board — ka na di pa

white and black board — na di sa ra

Hence, code for 'the' is either 'ka' or 'pa'.



117. Here, B and E are two sons of A and D is the wife of E. So, D is daughter in law of A.

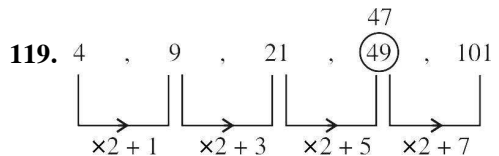


Distance of school from home

$$\sqrt{(70)^2 + (20)^2} = 72.8$$

$$= 10\sqrt{53} \text{ cm}$$

in N-W.



Hence, In place of 49 it should be 47.

120. In the given options 'Brass' is a compound, other three are metals.