NTSE STAGE – I (HARYANA STATE)
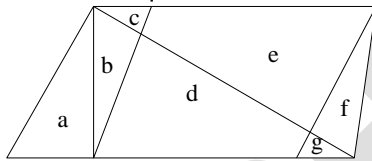## (For Class – X)
SET - C
MENTAL ABILITY TEST (MAT)
HINTS & SOLUTIONS

1.   2
1.   By observation.

2.   1
2. 1st figure + 3rd figure = 2nd figure

3.   3
3.   The pattern is bc<u>a</u>b / bc<u>a</u>b / bca<u>b</u> / bcab / bc<u>a</u>b

4.   4
4.   The time taken will be $\dfrac{30}{55} = \dfrac{60}{11} = 5\,\dfrac{5}{11}$ min.

     So, required time is 7: $5\dfrac{5}{11}$
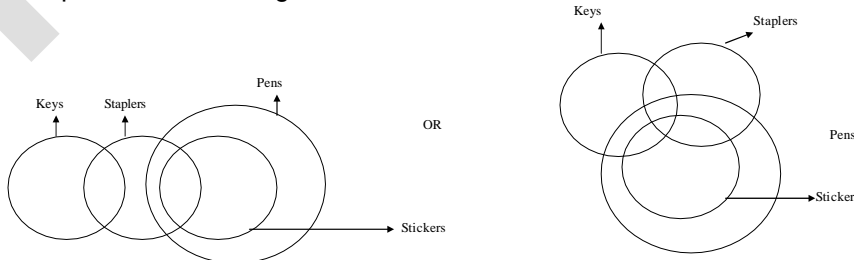
5.   4
5.   Number of quadrilaterals = 13

     Quadrilaterals are: d, e, ab, ef, de, bd, abc, abd, bcde, defg, abcde, bcdefg, abcdefg.

6.   4
6.   As per observation

7.   1
7.   F is the wife of M who is the father of K.
     F3M5K

8.   4
8.   The possible venn diagram are

     So, I and IV follows and either II or III follow.

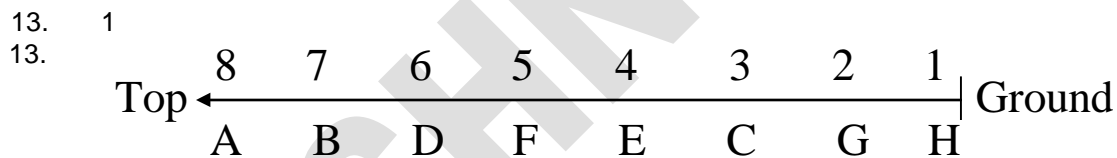9.   3 or 4

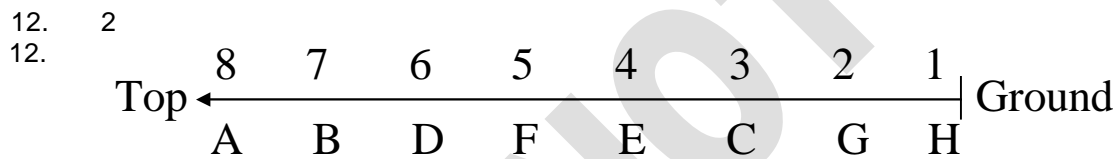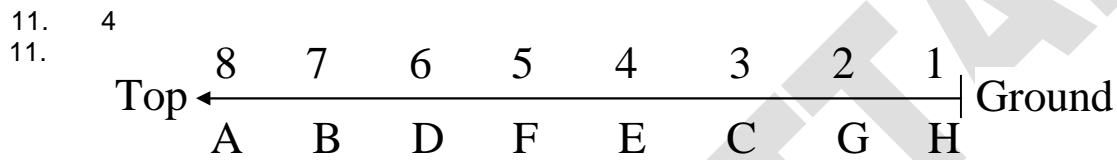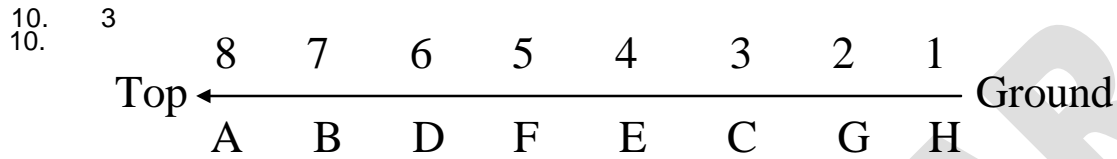9.   Two options are possible with the following logic:

$$123 = 11^2 + 2 \text{ and } 13^2 = (11+2)^2$$

$$235 = 15^2 + 10 \Rightarrow \text{answer} = (15+10)^2 = 25^2$$

Also,

$123 = (13)^2$ means (first digit / last digit) second digit

Similarly 235 will means $(25)^3$

10. 3
10.

$$\begin{array}{cccccccc} 8 & 7 & 6 & 5 & 4 & 3 & 2 & 1 \end{array}$$
Top ← ——————————————————— Ground
$$\begin{array}{cccccccc} A & B & D & F & E & C & G & H \end{array}$$

11. 4
11.

$$\begin{array}{cccccccc} 8 & 7 & 6 & 5 & 4 & 3 & 2 & 1 \end{array}$$
Top ← ——————————————————— Ground
$$\begin{array}{cccccccc} A & B & D & F & E & C & G & H \end{array}$$

12. 2
12.

$$\begin{array}{cccccccc} 8 & 7 & 6 & 5 & 4 & 3 & 2 & 1 \end{array}$$
Top ← ——————————————————— Ground
$$\begin{array}{cccccccc} A & B & D & F & E & C & G & H \end{array}$$

13. 1
13.

$$\begin{array}{cccccccc} 8 & 7 & 6 & 5 & 4 & 3 & 2 & 1 \end{array}$$
Top ← ——————————————————— Ground
$$\begin{array}{cccccccc} A & B & D & F & E & C & G & H \end{array}$$

14. 1
14. The numbers are 4, 24, 40, 44, 48

15. 1
15. 1, 3, 9,; 2, 5, 6,; 4, 7, 8

16. 3
16. Mirror image will be formed on each fold, so by observation we can say 3rd image will be formed.

17. 4
17. Z = 26
ACT = 2 + 6 + 40 = 48
BAT = 4 + 2 + 40 = 46

18. 1
18. Correct order is Torque, Torrid, Torso, Tortoise, Tortuous

19. 3
19. By observation.

20. 4

20. Rapid and slow are antonyms whereas the other pairs of words are either very similar or almost same in intensity.

21. 2
21. By observation.

22. 4
22.   Math / 224   Science / 240

Sports /336
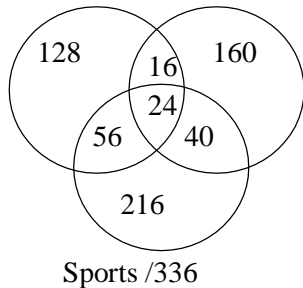
Total – 880
Who participates – 880 – (128 + 160 + 216 + 24 + 16 + 56 + 40)
880 – 640 = 240
Not participate – 240
$$\frac{240}{880} \times 100 = 27.27$$

23. 3
23. Who choose only one subject = (128 + 160 + 216) = 504
$$\frac{504}{880} \times 100 = 57.27 < 60$$

24. 1
24. Total hours → (24 x 3) + 17 = 89 hrs
$= 23 + \dfrac{44}{60}$ hrs of faulty time = 24 hrs of true time
$= \dfrac{356}{15}$ hrs → 24 hrs
1 hr → $\dfrac{24 \times 15}{356}$
89 hrs → $\dfrac{24 \times 15}{356} \times 89 = 90$hrs
So, true time is 1 hrs more than faulty time 10 pm + 1 hr = 11 pm

25. 2
25. By observation

26. 4
26. In first row 4 + 2 = 6 ÷ 2 = 3
In second row 5 + 3 + 1 + 1 = 10 ÷ 2 = 5
In third row 6 + 1 + 2 + 3 + 3 + 1 = 16 ÷ 2 = 8
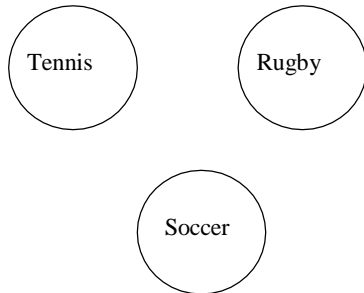
In fourth row 7 + 2 + 4 + 3 = 16 ÷ 2 = 8
So, 9 + 3 = 12 ÷ 2 = 6
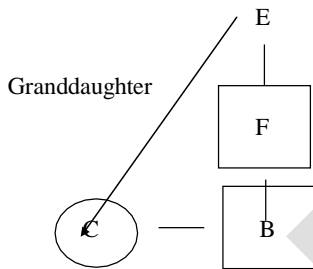
27.   3
27.   By observation

28.   3
28.   Advertisement → Application → Interview → Selection → Appointment → Probation

29.   3
29.   Malaria is a disease in a same way spear is a weapon.

30.   2
30.

31.   3
31.

32.   4
32.   □ → O O, Δ → O O O
      So, □□ → O O O O

33.   4
33.   By observation

34.   No option correct
34.   By observation

35.   3
35.   By observation

36.   3
36.   By observation

37.   3
37.   By observation.

38.   4
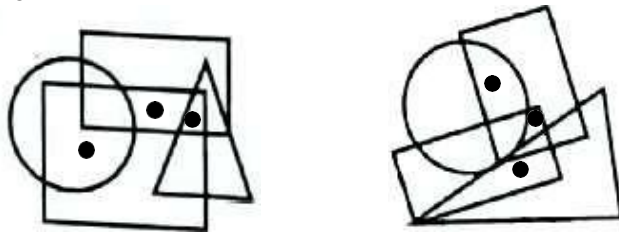38.   Let sons age 10 years age be x.
      Fathers age 10 year ago = 3x

$$2(x + 20) = (3x + 20)$$

x = 20

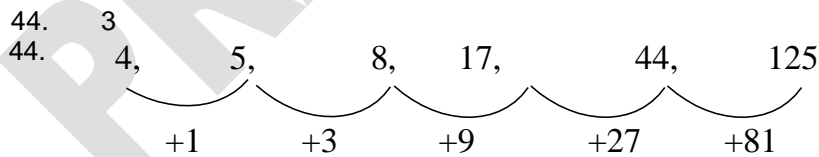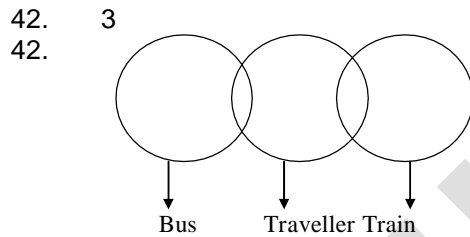10 year ago father's age = 60 years and son's age = 20 years

Ratio of their present age = 70 : 30 = 7:3

39. 1 or 4

39.

40. 3

40. In a single carom tournament, there is only one winner so 79 students should be eliminated by 79 matches.

41. 2

41. In 1hr it climbs 5 m

∴ in 8 hrs it climbs 40 m

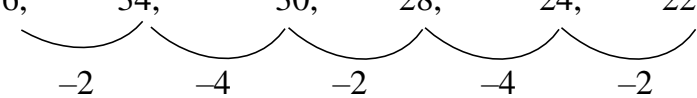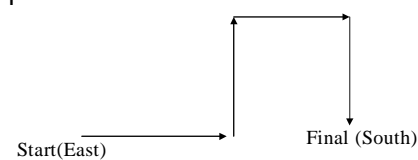∴ in 9th hr it will first touch 50 cm

42. 3

42.

Bus   Traveller Train

43. 1

43.

	Blue	
Yellow	Red	White
	Orange	
	Black	

44. 3

44. 4,   5,   8,   17,   44,   125

+1   +3   +9   +27   +81

45. 3

45. 5 x 8 = 40

6 x 8 = 48

9 x 8 = 72

46. 2

46. x → +

< → −

+ → ÷

$> \rightarrow x$
$- \rightarrow =$
$\div \rightarrow >$
$= \rightarrow <$
$5 > 2 + 2 = 10 < 4 \times 8$
$5 \times 2 \div < 10 - 4 + 8$
$5 < 14$

47.   2
47.   As per observation.
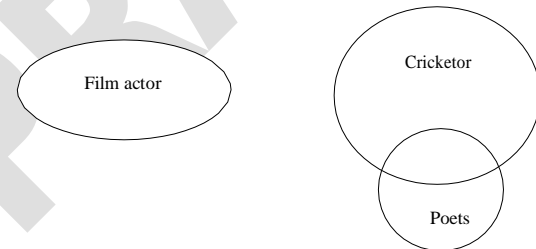
48.   2
48.

36,   34,   30,   28,   24,   22

−2   −4   −2   −4   −2

49.   1
49.

Start(East)   Final (South)

50.   1
50.   As per observation

51.   2
51.   As per observation.

52.   4
52.   As per observation.

53.   1
53. $7 + 2 + 4 + 9 = 22$
     $3 + 11 + 2 + 6 = 22$
     $5 + 5 + 6 + 6 = 22$
     $8 + 1 + 4 + 9 = 22$

54.   2
54.

Film actor   Cricketor   Poets

55.   4
55.   In 2000 years there are 0 odd days.
     From 1st Jan to 1st April total odd days = 3 + 0 + 3 + 1 = 0
     ∴ 1st April 2001 was Sunday
     ∴ 4t April was 1st Wednesday

56.   4

56.
$$10 \quad : \quad 25$$
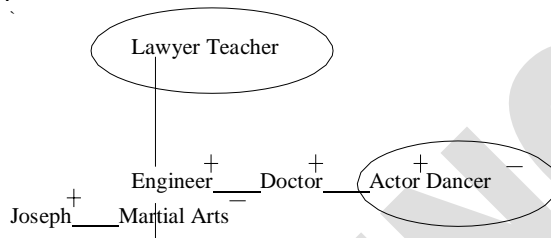
10 x 30   25 x 5.5

300   137.5

162.5

∴ Reflex angle = 197.5

57. 4
57. Monk is a person who is devoted to a god/religion. In the same way, A rover is a person who loves travelling and wanderlust is the impulse to travel.
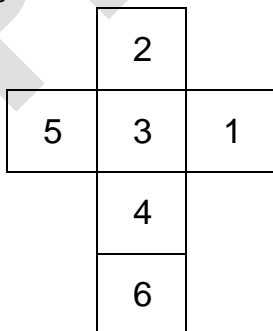
58. 4
58.

59. 2
59. GNQ = 7 + 14 + 17 = 38
RBS = 18 + 2 + 19 = 39
TUA = 20 + 21 + 1 = 42
FPC = 6 + 16 + 3 = 25
OLH = 15 + 12 + 8 = 35

60. 4
60. nso ptr kli chn → sharma get marriage gift
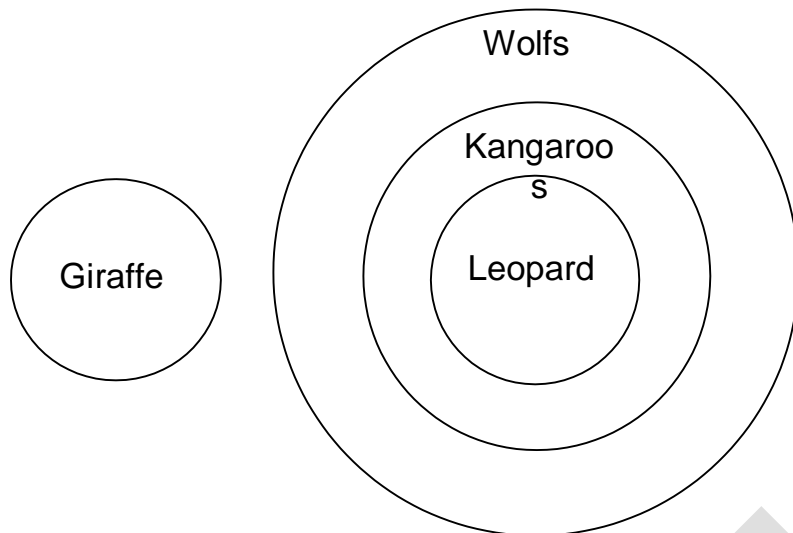ptr lnm |wop| chn → wife |gives| marriage gift
tti |wop| nhi → he |gives| nothing

61. 3
61.

62. 1

62.

63.   3
63.

	K	G	H	R	J
Intelligent	✓	✓	✓		
Hard working	✓			✓	✓
Honest			✓	✓	✓
Ambitious	✓	✓			✓

64.   4
64.

65.   4
65.   2,   2,   5,   13,   28, $\boxed{52}$

1^2-1 2^2-1 3^2-1 4^2-1 5^2-1
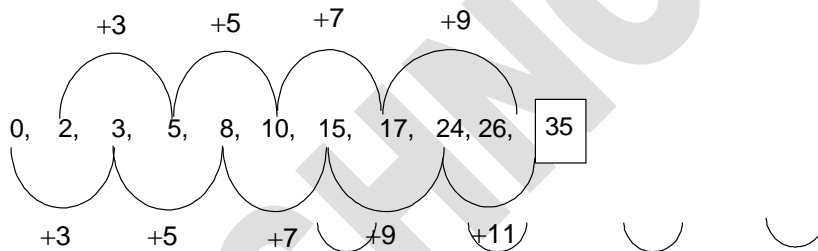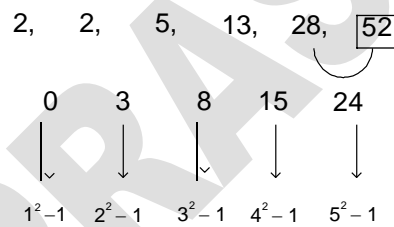
66.   1
66.   As per observation.

67.   4
67.   U N I F O R M I T Y
       R M I T Y U N I F O

68.   2
68. $\dfrac{5 \times 3 \times 4 \times 2}{10} = 12$

$$\frac{5 \times 6 \times 2 \times 3}{10} = 18$$

Similarly, $\dfrac{5 \times 2 \times 2 \times 9}{10} = 18$

69.　3
69.　$6 \times 4 = 3 \times 8$
$18 \times 3 = 2 \times 27$
$15 \times \boxed{3} = 5 \times 9$

70.　1
70.　NICE, because I is not present.

71.　2
71.　Let correct = x
　　　　Incorrect = y
∴ x + y = 75
　　4x − y = 125
⇒ $\boxed{x = 40}$

72.　3
72.　As per observation.

73.　4
73.　As per observation.

74.　4
74.　1st bunch = x
2nd bunch = y
∴ $x = y + \dfrac{1}{4}y$
∴ $x = \dfrac{5}{4}y...(1)$
& $x - y = 3 ...(2)$
∴ x = 15

75.　4
75.　$\underset{\div 2}{\overbrace{664,}} \quad \underset{+8}{\overbrace{332,}} \quad \underset{\div 2}{\overbrace{340,}} \quad \underset{+8}{\overbrace{170,}} \quad \underset{\div 2}{\overbrace{178,}} \quad 89$

76.　4
76.　$\dfrac{12}{4} = \dfrac{21}{7} = 3$
$\dfrac{10}{5} = \dfrac{4}{2} = 2$
$\dfrac{64}{8} = \dfrac{24}{3} = 8$
∴ 83

77.　1
77.　2 9 7 3 <u>1 7 3</u> 7 7 1 3 3 <u>1 7 3</u> 8 5 7 1 3 7 7 <u>1 7 3</u> 9 0 6
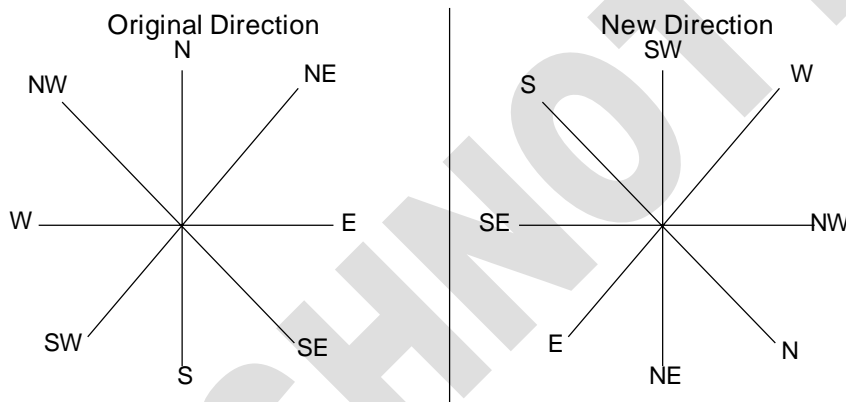
78. 2
78. As per observation.

79. 2
79. As per observation

80. 2
80. 331, 482, 551, 263, **383**, 362, 284
    3 x 1 = 3
    4 x 2 = 8
    5 x 1 = 5
    2 x 3 = 6
    3 x 3 = 9
    3 x 2 = 6
    2 x 4 = 8

81. 2
81. Ant, fly and bee are insects. Similarly, hamster, squirrel and mouse are all rodents.

82. 2
82.

So, West becomes 'South east'.

83. 1
83. $5 + 6 \times 3 - 12 \div 2$
    $= 5 + 18 - 6$
    $= 17$
    So interchange is $\div$ and $\times$.

84. 2
84.

Similarly,

	V	I	S	I	T
	−1	+2	−1	+2	−1
	U	K	R	K	S

85. 2
85. x weeks and x days

= 7x + x = 8x

86. 4
86. Silver is the cheapest among gold, silver, ruby and emerald. Silver is called Ruby, so answer is Ruby.

87. 1
87.

R	I	P	P	L	E
↓	↓	↓	↓	↓	↓
6	1	3	3	8	2

L	I	F	E
↓	↓	↓	↓
8	1	9	2

So,

P	I	L	L	E	R
↓	↓	↓	↓	↓	↓
3	1	8	8	2	6

88. 2
88. By observation.

89. 1
89. If C is 8, A is 6, R is 4 then definitely E has to be 2. So 8640 is not possible.

90. 4
90. Monday → 1 odd day
61 days → 5 odd days
∴ 1 + 5 = 6 odd days → Saturday

91. 4
91. Q is the father of R, who is the brother of T, who is the daughter of M. so, M is the wife of Q can be represented by Q $ R @ T ∗ M.

92. 1
92. By observation.

93. 2
93. By observation.

94. 4
94. By observation.

95. 1
95. The folds act like a mirror, so figure 1 is formed.

96. 1

96.

$$3 + 9 = 31 \qquad \begin{matrix} 3 \div 3 = 1 \\ 9 \div 3 = 3 \end{matrix} \Big)$$

$$15 + 27 = 95 \qquad \begin{matrix} 15 \div 3 = 5 \\ 27 \div 3 = 9 \end{matrix} \Big)$$

Similarly $\quad 12 + 27 = 94 \qquad \begin{matrix} 27 \div 3 = 9 \\ 12 \div 3 = 4 \end{matrix} \Big)$

97.   3

97.

```
              F
              |
              |
              |
              |
  C ___ A_____G
              |
              |
      E ___ D ___ B
              |
```

98.   3

98.

```
              F
              |
  C ___ A_____G
  |           |
  |           |
  |           |
      E ___ D ___ B
```

99.   3

99.

```
              F
              ↑
  C ___ A_____G
  |           |
  |           |
  |           |
      E ___ D ___ B
```
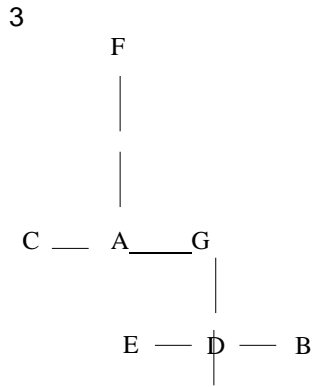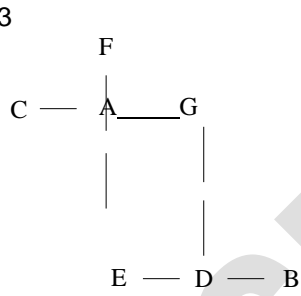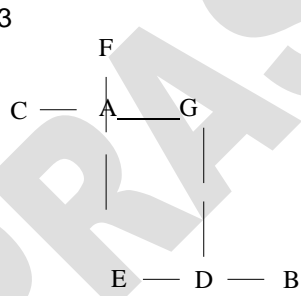
100.   1

100. The 10 triangles are a, b, c, e, f, bde, cdf, eda, fdb, adc.

1. 3
Sol. The difference between systolic and diastolic blood pressure is known as pulse pressure.

2. 4
Sol. About 1% of living species are in danger of extinction.

3. 3
Sol. Entry of water into root hairs takes place through osmosis.

4. 4
Sol. Tendons & ligaments are type of connective tissue (fibrous).

5. 1
Sol. The spider use Spinnerates to prepare web.

6. 3
Sol. Variations are the source of Evolution.

7. 3
Sol. Mode of nutrition in cuscuta is parasitic.

8. 1
Sol. Nephron is structural and functional unit of kidney.

9. 2
Sol. Lateral ventricles are found in Cerebral hemisphere.

10. 4
Sol. Cessation of menstrual cycle is called Menopause.

11. 4
Sol. Alveoli is the site for exchange of gases in human.

12. 3
Sol. Jaundice (viral infection) is caused due to external factors.

13. 1
Sol. High yielding varieties of what were initially developed by an Indian scientist by cross breeding the traditional varieties with Mexican varieties.

14. 2
Sol. ILS–82 and B–77 are breeds of fowl.

15. 4
Sol. 25 g H_2O

$= \dfrac{25}{18}$ mole H_2O

= 1.38 mole H_2O

= 1.38 × 6.023 ×10²³ atoms of oxygen

= 8.31174 × 10²³ O atom
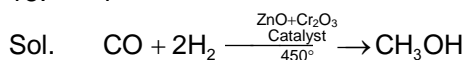
= 8.31174 × 2 × 10²³ H atom

= 16.6234 × 10²³ H atom

16.   1

Sol   Formula of Blue Vitriol is $CuSO_4 \cdot 5H_2O$

17.   2

Sol.   Approximate pH of digestive fluid in stomach is 2 (Fact based)

18.   1

Sol. $CO + 2H_2 \xrightarrow[\substack{450°}]{\substack{ZnO+Cr_2O_3 \\ Catalyst}} CH_3OH$

19.   3

The oxidation state of compounds are:

$CrO_2^- = +3$ $CrO_4^{2-} = +6$

$ClO_3^- = +5$ $MnO_4^- = +7$

20.   2

Sol.   The oxide ore is zincite (ZnO)

21.   3

Sol.   The wrong statements are: Ni placed before Co in Mandleev's Periodic table and Eka-silicon in Mandleev's periodic table is gallium.
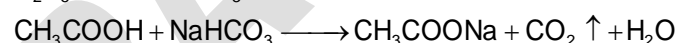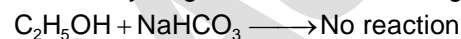
22.   4

Sol.   Magnesium do not impart colour and its ionization enthalpy is high due to small size.

23.   2

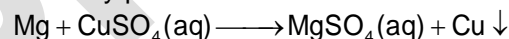Sol.   Ionisation energy of halogen is very high. (Fact based)

24.   3

Sol.   Sodium hydrogen carbonate test is given by Ethanoic acid not by Ethanol
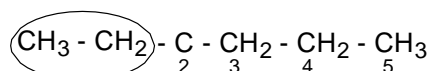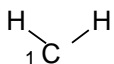
$C_2H_5OH + NaHCO_3 \longrightarrow$ No reaction

$CH_3COOH + NaHCO_3 \longrightarrow CH_3COONa + CO_2 \uparrow + H_2O$

25.   3

Sol.   The only possible reaction is

$Mg + CuSO_4(aq) \longrightarrow MgSO_4(aq) + Cu \downarrow$

26.   4

Sol.   The correct IUPAC name of compound is :

$\underset{1}{C} \overset{H}{\underset{}{\diagup}} \overset{H}{\diagup}$

$\boxed{CH_3 - CH_2} - \underset{2}{C} - \underset{3}{CH_2} - \underset{4}{CH_2} - \underset{5}{CH_3}$

2-Ethyl-1-pentene

27. 4

Sol. The balance chemical reaction is:

$$3Cu + 8HNO_3 \xrightarrow{\text{(dil)}} 3Cu(NO_3)_2 + 4H_2O + 2NO$$
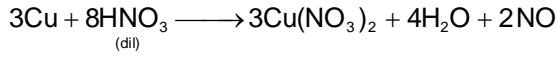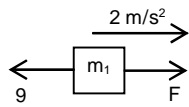
So, a = 3
   b = 8
   c = 3
   d = 4
   e = 2

28. 2

Sol.
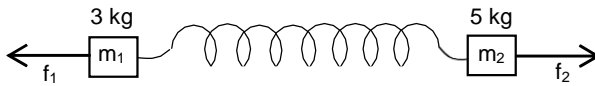
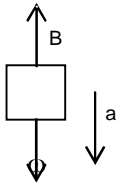$$a = \frac{\delta_2 - \delta_1}{m_1 + m_2} = \frac{16}{8} = 2 \text{ m/s}^2$$

F − 9 = 3 × 2
F = 15 N

29. 3

Sol.

$$\omega - B = ma$$
$$\omega - B = \frac{\omega}{g} a \quad \left[m = \frac{\omega}{g} \right]$$
$$\Rightarrow \quad B = \omega - \frac{\omega a}{g}$$
$$\Rightarrow \quad B = \omega \left(1 - \frac{a}{g} \right)$$

30. 4

Sol. Velocity is the slope between s − t curve.

∴ Velocity = tan θ

$$= \tan 30° = \frac{1}{\sqrt{3}}$$
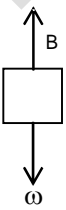
31. 3

Sol. This motion is uniform accelerated motion and initial velocity of particle is not zero.

32. 4

Sol. Velocity of sound wave in a medium does not depend on frequency. So velocity will remain same.

33. 2

Sol.

Let the volume be V.
Density of liquid = ρ
Density of block = ρ/3.

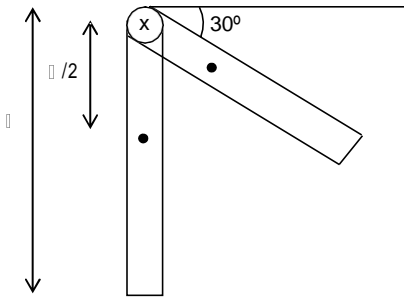$$\omega = \frac{V\rho}{3} \times g \; ; \; B = V\rho g$$

∴ Acceleration $= \dfrac{B - \omega}{m} = \dfrac{V\rho g - \dfrac{V\rho}{3} g}{\dfrac{V\rho}{3}} = 2g$

34. 1

Sol. Let the distance travelled by boy = x.

$$Mx = \frac{M}{5}(L - x)$$

$$\Rightarrow \quad 5x = L - x \quad ; \quad \Rightarrow \quad x = \frac{L}{6}$$

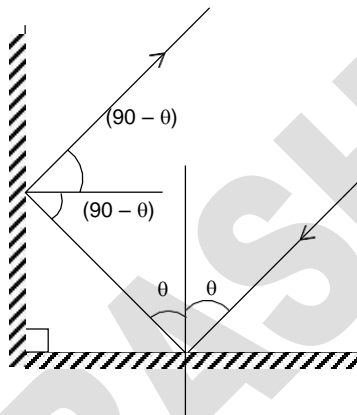**35.** 4

Sol.

Centre of mass is raised by a height of $\ell/4$.

Work done $= \dfrac{mg\ell}{4}$

36. 3

Sol. Resistance of series combination is more than each resistance.
Resistance of parallel combination is less than each resistance–
So, x_1 = series
x_4 = parallel
x_2, x_3 = individual resistance

37. 4

Sol.

From the ray diagram angle between the mirrors is 90°.

38. 3

Sol. $B = \dfrac{\mu_o I}{2r}$, so option 3 is right.

39. 1

Sol. $\dfrac{1}{V} - \dfrac{1}{u} = \dfrac{1}{f} \quad \Rightarrow \quad \dfrac{u}{V} - 1 = \dfrac{u}{f}$

$$\Rightarrow \frac{1}{m} - 1 = \frac{u}{f} \left[\text{as } m = \frac{V}{u} \right]$$

$$y = \frac{x}{f} + 1 \left[\begin{array}{l} y = \frac{1}{m} \\ x = u \end{array} \right]$$

$$\frac{1}{f} = \frac{b}{c}$$

$$f = \frac{c}{b}$$

$$\therefore \text{Power} = \frac{1}{f} = \frac{b}{c}$$

40. 4
Sol. Reading will be zero as no current will flow through A_2 and 10Ω resistance in parallel to A_1.

81. 1
Sol. Let BC = x then $AB = \frac{x}{\sqrt{3}}$ and $AC = \frac{2x}{\sqrt{3}}$
BD : DC = AB : AC = 1 : 2

82. 3
Sol. $a + b = -5$, $ab = d$, $a + c = -6$, $ac = 2d$

$$\frac{ab}{ac} = \frac{d}{2d} \Rightarrow \frac{b}{c} = \frac{1}{2} \text{ and } (a+b) - (a+c) = -5 + 6$$

$\Rightarrow b - c = 1$
Let b = k, c = 2k then $b - c = 1 \Rightarrow k = -1$
$\Rightarrow b = -1$, $a = -4$
$\Rightarrow d = 4$

83. 2
Sol. Each edge $= \frac{x}{12}$ metres

According to the question $6 \times \left(\frac{x}{12} \right)^2 = x \Rightarrow x = 24$

$\Rightarrow$ each edge = 2 metres
Volume = 8 m³

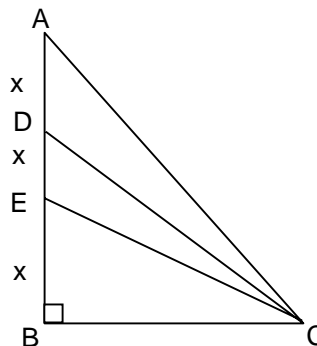**84.** 4
Sol. In given figure

$AC^2 - EC^2 = (9x^2 + BC^2) - (BC^2 + x^2)$
$= 8x^2$ and $DC^2 - BC^2 = 4x^2$
$\Rightarrow \frac{AC^2 - EC^2}{DC^2 - BC^2} = 2$

85. 1

Sol. 15th term of these AP's will form an AP in which first term = 15, common difference = 14

So, $S_{15} = \dfrac{15}{2}[30 + 196] = 1695$

86. 3

Sol. Since ABC is right angled triangle

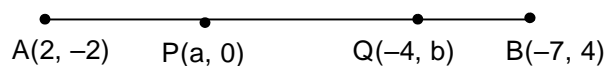$\Rightarrow DA = DB = \dfrac{1}{2} \times 26 = 13$ cm

87. 3

Sol. $\dfrac{14588}{8750} = \dfrac{1042}{5^4}$ which will terminate after 4 decimal places.

88. 2

Sol. Let roots of $x^3 + 2x^2 + a$ are α, β and γ and roots of $x^5 - x^4 - 4x^3 + 3x^2 + 3x + b$ are $\alpha, \beta, \gamma, \delta$ and ψ then $\alpha + \beta + \gamma = -2$, $\alpha\beta + \beta\gamma + \gamma\alpha = 0, \alpha\beta\gamma = -a$

Also $\alpha + \beta + \gamma + \delta + \psi = 1 \Rightarrow \delta + \psi = 3$

$\Rightarrow \alpha\beta\gamma\delta + \beta\gamma\delta\psi + \gamma\delta\psi\alpha + \delta\psi\alpha\beta + \psi\alpha\beta\gamma = 3$

$\Rightarrow -a\delta + \delta\psi(\beta\gamma + \gamma\alpha + \alpha\beta) - a\psi = 3$

$\Rightarrow -a(\delta + \psi) = 3$

$\Rightarrow a = -1$

$\Rightarrow x^3 + 2x^2 + a$ reduces to $x^3 + 2x^2 - 1$ and $x = -1$ is root of $x^3 + 2x^2 - 1$

$\Rightarrow b = -2$

89. 3

Sol. Let present age of son = x years

Present age of father = 6x years

According to the question

$6x + 4 = 4(x + 4)$

$x = 6$

$\Rightarrow$ father's age = 36 years

   Son's age = 6 years

90. 4

Sol. Number = HCF (72 −7, 127 − 10) = 13

91. 2

Sol. $\dfrac{2 - 4}{2} = a \Rightarrow a = -1$

$\dfrac{0 + 4}{2} = b \Rightarrow b = 2$

A(2, −2) P(a, 0) Q(−4, b) B(−7, 4)

92. 4

Sol. $\dfrac{\cos\theta - \sin\theta + 1}{\cos + \sin\theta - 1}$

$= \dfrac{\cot\theta - 1 + \csc\theta}{\cot\theta + 1 - \csc\theta}$

$= \dfrac{\cot\theta + \csc\theta + \cot^2\theta - \csc^2\theta}{\cot\theta - \csc\theta + 1}$

$$= \frac{(\cot\theta + \cos ec\,\theta)(1 + \cot\theta - \cos ec\,\theta)}{(\cot\theta - \cos ec\,\theta + 1)}$$
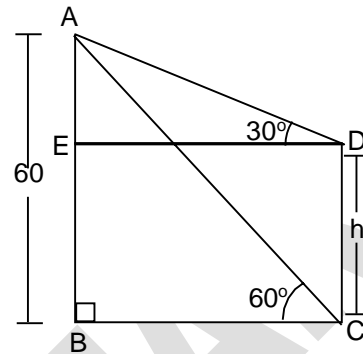
$$= \cot\theta + \cos ec\,\theta$$

93.　3

Sol.　Let AB is Tower, DC is pillar

In $\triangle ABC$, $\dfrac{60}{BC} = \tan 60 = \sqrt{3}$

$\Rightarrow BC = 20\sqrt{3}$

In $\triangle AED$, $\dfrac{60 - h}{20\sqrt{3}} = \tan 30 = \dfrac{1}{\sqrt{3}} \Rightarrow h = 40\,m$

94.　2

Sol.　Since angle between diagonals is 90°

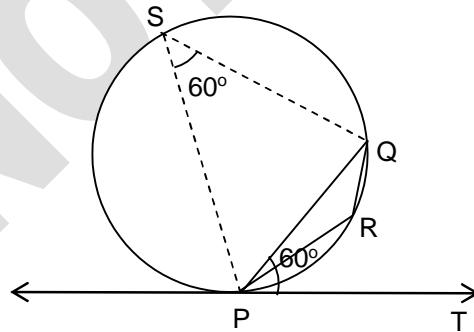$\Rightarrow$ angle between sides of quadrilateral (which is formed by joining midpoints) is also 90°

$\Rightarrow$ Quadrilateral formed will be rectangle

95.　3

Sol.　In the given figure

$\angle PSQ = \angle QPT = 60°$

$\Rightarrow \angle QRP = 120°$

96.　2

Sol.　Area $(PBCQ) = \dfrac{1}{2} \times 10 \times 10 - \dfrac{90}{360} \times \dfrac{22}{7} \times 7 \times 7$

$= 11.5\ cm^2$

97.　4

Sol.　$\dfrac{1}{3} \times \dfrac{22}{7} \times h(28^2 + 21^2 + 28 \times 21) = 28490$

$\Rightarrow h = 15\ cm$

$\ell = \sqrt{15^2 + (28 - 21)^2} = \sqrt{274}\ cm$

98.　1

Sol.　Favourable outcomes

$= \big\{(6,1),(1,6),(2,5),(5,2),(4,3),(3,4),(6,2),(2,6),(5,3),(3,5),(4,4)\big\}$

Probability $= \dfrac{11}{36}$

99. 3

Sol. Let speed of stream = x km/hr

Then according to the question $\dfrac{12}{10+x} + \dfrac{12}{10-x} = \dfrac{5}{2} \Rightarrow x = 2$

100. 2

Sol. $y + 20 + 50 = 180 \Rightarrow y = 110$ and $2x + y = 180 \Rightarrow x = 35$