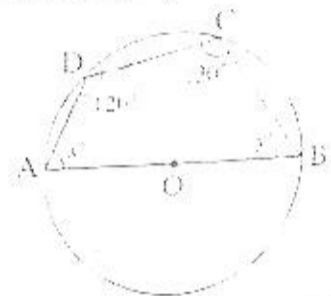


2016

Section-I
Mathematics

1. Use the following figure to find x° and y° .



- (A) $x = 50^\circ, y = 30^\circ$ (B) $x = 30^\circ, y = 50^\circ$
 (C) $x = 50^\circ, y = 60^\circ$ (D) $x = 55^\circ, y = 65^\circ$

2. $\frac{2}{x} + \frac{5}{y} = 1$ and $\frac{60}{x} - \frac{20}{y} = 13$

For these equations, the value of x and y will be—

- (A) $x = 4, y = 10$
 (B) $x = 10, y = 4$
 (C) $x = \frac{1}{4}, y = 5$
 (D) None of these

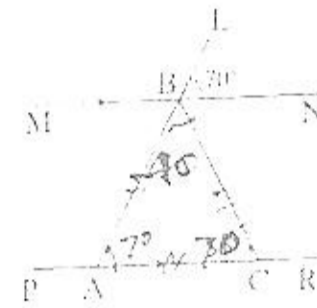
3. In an election of Sarpanch, there were two candidates. A total of 9791 votes were polled. In which 116 votes were declared invalid. The successful candidate got 5 votes in the place of 4 votes of his opponent got. The margin of won of successful candidate is—

- (A) 2000 (B) 775
 (C) 1075 (D) None of these

4. The value of $[\log_2 (\log_2 (\log_2 16))]$ is—

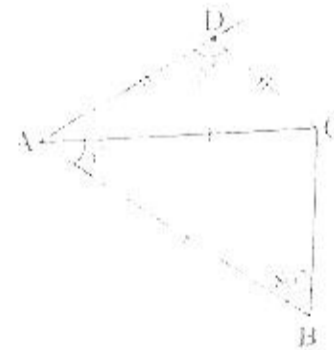
- (A) $\frac{1}{2}$ (B) $\frac{1}{3}$
 (C) $\frac{1}{4}$ (D) 1

5. In the given figure, MN is parallel to PR, $\angle LBN = 70^\circ$ and $AB = BC$. The value of $\angle ABC$ will be—



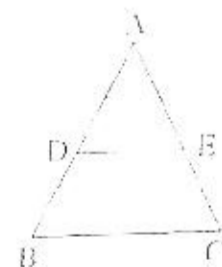
- (A) 70° (B) 40°
 (C) 110° (D) None of these

6. In the figure, AC is bisector of $\angle A$ and $AB = AC, AD = DC$. The values of angles x and y are—



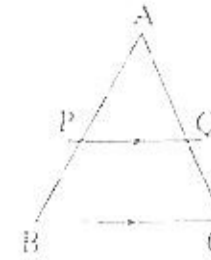
- (A) $x = 30^\circ, y = 120^\circ$
 (B) $x = 40^\circ, y = 100^\circ$
 (C) $x = 20^\circ, y = 140^\circ$
 (D) None of the above

7. In triangle ABC, D and E are midpoints of AB and AC respectively. The value of DE will be—



- (A) $\frac{1}{2} BC$ (B) $\frac{1}{3} BC$
 (C) $\frac{2}{3} BC$ (D) None of these

8. If the line PQ is parallel to line BC of triangle ABC, then



- (A) $\frac{AP}{PB} = \frac{AQ}{QC}$ (B) $\frac{AP}{AQ} = \frac{PQ}{BC}$
 (C) $\frac{AB}{AP} = \frac{AC}{AQ}$ (D) $\frac{BC}{PQ} = \frac{AB}{AC}$

9. If the difference between the two sides of a right-angled triangle is 2 cm and the area of the triangle is 24 cm². The perimeter of the triangle will be—

- (A) 20 cm (B) 24 cm
 (C) 30 cm (D) 15 cm

10. A chord of length 24 cm is at a distance of 5 cm from the centre of the circle. The length of the chord of the same circle which is at a distance of 12 cm from the centre is—

- (A) 12 cm (B) 10 cm
 (C) 5 cm (D) 24 cm

11. The line $4x - 3y + 12 = 0$ meets x-axis at A. The co-ordinates of A are—

- (A) (4, 0) (B) (4, 3)
 (C) (-3, 0) (D) (3, 12)

12. The value of $7^2 \times (25)^{-3/2} \times 5^{-3}$ is—

- (A) 7 (B) 35
 (C) $5^{-3/2}$ (D) 0

13. Two straight lines $3x - 2y = 5$ and $2x + ky + 7 = 0$ are perpendicular to each other. The value of k is—

- (A) 3 (B) $\frac{1}{3}$
 (C) $-\frac{4}{3}$ (D) $\frac{3}{2}$

14. The co-ordinates of A and C are (3, 6) and (-1, 2) in a rhombus ABCD. The equation of BD is—

- (A) $2x + 4y = 5$
 (B) $2x + 4y = 0$
 (C) $x + 4y = 12$
 (D) $x + y = 5$

$$\begin{aligned} y - 6 &= \frac{2-6}{-2-3} (x-3) \\ y - 6 &= x - 3 \\ x + y &= -3 \end{aligned}$$

15. The value of $(\operatorname{cosec} A - \sin A)(\sec A - \cos A)(\tan A + \cot A)$ is—

- (A) 1 (B) 2
 (C) $\sqrt{3}$ (D) $\frac{1}{2}$

16. A rocket is fired vertically upward from launching pad P. It first rises 40 km vertically upwards and then 40 km at 60° to the vertical. The height attained by the rocket from launching pad P is—

- (A) 80 km (B) 60 km
 (C) 65 km (D) 85 km

17. The value of

$$\frac{2}{3} \operatorname{cosec}^2 58^\circ - \frac{2}{3} \cot 58^\circ \tan 32^\circ - \frac{5}{3} \tan 13^\circ \tan 37^\circ \tan 45^\circ \tan 53^\circ$$

is—

- (A) 1 (B) -1
 (C) 2 (D) -2

18. The angle of elevation of a hill at the foot of the tower is 60° and the angle of elevation of the top of the tower from the foot of the hill is 30° . If the tower is 20 m high, then the height of the hill is—

- (A) 60 metres (B) 80 metres
 (C) 40 metres (D) 30 metres

19. If $\angle A = 30^\circ$, then the value of $\sec^2 A - \tan^2 A$ is—

- (A) 0 (B) -1
 (C) 2 (D) 1

20. A cylindrical tube open at both ends is made of metal. The internal diameter of the tube is 11.2 cm and its length is 21 cm. If the metal thickness is 0.4 cm, then the volume of metal will be—

- (A) 2067.87 cm³ (B) 306.24 cm³
 (C) 1922.81 cm³ (D) 1033.94 cm³

21. A rectangular tin foil of size 22 cm by 16 cm is wrapped around to form a cylinder of height 16 cm. The volume of cylinder is—

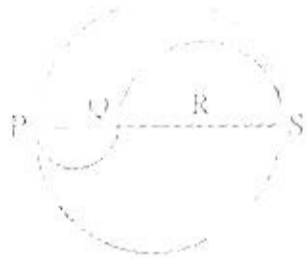
- (A) 616 cm³ (B) 416 cm³
 (C) 308 cm³ (D) 832 cm³

22. In the given diagram of semicircle, O is centre.



The area of the shaded portion is—
 (A) 56 cm^2 (B) 19.2 cm^2
 (C) 62 cm^2 (D) 61.1 cm^2

23. In the given figure, PS is a diameter of a circle and is of length 6 cm. Q and R are points on the diameter such that PQ, QR and RS are equal. Semicircles are drawn with PQ and QS as diameter.



The perimeter of shaded portion is—
 (A) $\frac{66}{7} \text{ cm}^2$ (B) $\frac{132}{7} \text{ cm}^2$
 (C) $\frac{66}{7} \text{ cm}$ (D) $\frac{132}{7} \text{ cm}^2$

24. A sheet is 30 cm long and 10 cm wide. Circular pieces all of equal diameters are cut from the sheet to prepare discs. If the diameter of disc is 1 cm, how many discs can be made from sheet?

(A) 300 (B) 100
 (C) 200 (D) 95

25. If $X = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, $Y = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$, then the value of XY^T is—

(A) $\begin{bmatrix} -2 \\ 4 \end{bmatrix}$ (B) $\begin{bmatrix} 0 \\ 0 \end{bmatrix}$
 (C) $\begin{bmatrix} 1 & 0 \\ 3 & 1 \end{bmatrix}$ (D) $\begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$

26. If 7 is the mean of 5, 3, 0.5, 4.5, b, 8.5, 9.5 then the value of b is—
 (A) 31 (B) 49
 (C) 12 (D) 18

27. The weight of 60 boys are as per following table—

Weight in kg	37	38	39	40	41
No. of boys	10	14	18	12	6

The median is—
 (A) 30 (B) 39
 (C) 60 (D) 78

28. Manufacturer A sells a washing machine to a trader B for ₹ 12,500. Trader B sells to a trader C at a profit of ₹ 800 and trader C sells it to a customer at a profit of ₹ 1,300. If the rate of VAT is 8%, then the amount consumer paid for the machine is—

(A) ₹ 15,768 (B) ₹ 14,600
 (C) ₹ 15,600 (D) ₹ 15,700

29. AB is a fixed line and $AB^2 = AP^2 + BP^2$

The locus of point P is—
 (A) Circle with diameter AB
 (B) Straight line
 (C) Triangle
 (D) Right angled triangle

30. If price of a TV set inclusive of sales tax of 9% is ₹ 40,221, then the marked price is—

(A) ₹ 43,850.89 (B) ₹ 36,198.90
 (C) ₹ 36,980 (D) ₹ 43,859

31. If $x + y = 4$, $z = 3$, then the value of $(5x + 8y) - (6z - 7)$ is—

(A) 4 : 3 (B) 45 : 33
 (C) 20 : 13 (D) 44 : 3

32. A man borrows ₹ 5,000 at 12% compound interest per annum, interest payable every 6 months. He pays back ₹ 1,800 at the end of every six months. The final payment he has to make at the end of 18 months in order to clear the entire loan is—

(A) ₹ 5,624.60 (B) ₹ 2,024.60
 (C) ₹ 3,824.60 (D) None of these

33. A man deposits ₹ 250 every month in a recurring deposit account of 2 years at a simple interest rate of 6% per annum. The maturity value of the deposits will be—

(A) ₹ 6,375 (B) ₹ 375
 (C) ₹ 5,360 (D) ₹ 6,370.80

34. The sum of a number and its reciprocal is $\frac{17}{4}$. The number is—
 (A) 14 (B) $\frac{1}{2}$
 (C) 24 (D) None of these

35. The sum of roots of the equation $x^2 - 3x - 28 = 0$ is—
 (A) 3 (B) -3
 (C) 4 (D) -28

36. Two numbers are in the ratio 3 : 5. If 8 is added to each number, the ratio becomes 2 : 3. The numbers are—
 (A) 15 and 24 (B) 21 and 34
 (C) 6 and 18 (D) 24 and 40

37. Numbers 4, 8, 16 and 26 will become proportional if we add number in each of them—
 (A) 4 (B) 2
 (C) 0 (D) None of these

38. The roots of equation $ax^2 + bx + c = 0$ where $a, b, c \in \mathbb{R}$ and $a \neq 0$ is equal in magnitude and opposite in sign if—
 (A) $b^2 - 4ac \geq 0$ (B) $b^2 - 4ac = 0$
 (C) $b = 0$ (D) $a = 0$

39. The value of $\frac{\cot^2 \theta (1 - \cos^2 \theta)}{\cos^2 \theta}$ is—
 (A) 1 (B) $\frac{1}{\cos^2 \theta}$
 (C) $\tan \theta$ (D) $\frac{1}{\cos^2 \theta}$

40. In the expansion of $(5x - 3)(x + 2)^2$ the coefficients of x^2 and x are—
 (A) 17 and 8 (B) 17 and 5
 (C) 5 and 8 (D) None of these

41. The solution of equation $(x - \frac{2}{x})(x^2 + 2 + \frac{4}{x^2})$ is—

(A) $x^3 + 2x + \frac{4}{x} = 8$ (B) $x^3 = \frac{8}{x^3}$
 (C) $x^3 + \frac{8}{x^3}$ (D) $x^3 = \frac{8}{x^2}$

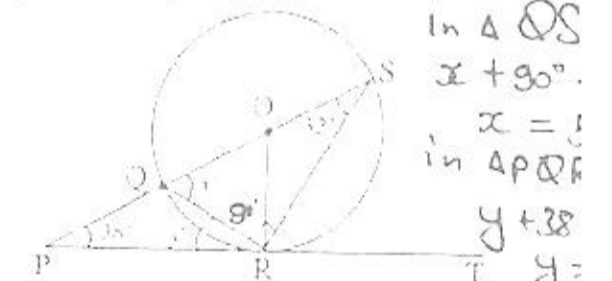
42. Rohit has ₹ 9,500 more than Deep. If gives ₹ 2,000 to Rohit, the money with will be four times the money left with. The money initially with Rohit and are—
 (A) ₹ 13,500 and ₹ 4,000
 (B) ₹ 16,500 and ₹ 6,000
 (C) ₹ 17,000 and ₹ 6,500
 (D) None of the above

43. Factor of expression $2x^3 + 5x^2 - 11x - 6$ is—
 (A) $(2x + 7)(x + 1)(x - 2)$
 (B) $(2x + 7)(x - 1)(x - 2)$
 (C) $(x + 7)(2x + 1)(x - 2)$
 (D) None of the above

44. The values of x for equation $\sqrt{1+x} + \sqrt{1-x} = \frac{2}{3}$ where $x \neq 0$ and $x \neq 1$, are—

(A) $\frac{4}{9}$ and $\frac{6}{13}$ (B) $\frac{4}{9}$ and 1
 (C) $\frac{9}{13}$ and $\frac{4}{13}$ (D) $\frac{3}{2}$ and $\frac{4}{9}$

45. In the given figure, PT touches a circle with centre O at R. Diameter SQ produced meet PT at P. If $\angle SPR = 38^\circ$, $\angle QRP = x^\circ$, $\angle R = 32^\circ$ and $\angle SQR = y^\circ$, then the values angles x° and y° will be—



(A) $x = 58^\circ, y = 20^\circ$ (B) $x = 32^\circ, y = 22^\circ$
 (C) $x = 68^\circ, y = 34^\circ$ (D) $x = 56^\circ, y = 18^\circ$

46. $\frac{\sin 26^\circ}{\sec 64^\circ} + \frac{\cos 26^\circ}{\operatorname{cosec} 64^\circ} = a$
 The value of 'a' will be—
 (A) 2 (B) 4
 (C) 1 (D) 3

47. $\cos^2 26^\circ + \cos 64^\circ \sin 26^\circ + \frac{\tan 36^\circ}{\cot 54^\circ} = y$
 The value of 'y' will be—
 (A) 2 (B) 3
 (C) 1 (D) 0

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48. The arithmetic mean of given data will be—
67, 65, 71, 57 and 45

- (A) 62 (B) 72
(C) 71 (D) 61

49. In the given chart, the mode of the following frequency distribution is—

Number	8	9	10	11	12	13
Frequency	3	8	12	9	5	4

- (A) 8 (B) 10
(C) 13 (D) 11

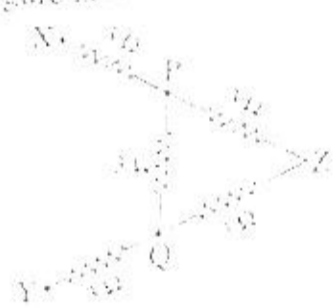
30. In the given figure, O is the centre of the circle and $\angle AOE = 150^\circ$, $\angle DAO = 51^\circ$. The values of angles x° and y° will be

- (A) $x = 51^\circ, y = 24^\circ$ (B) $x = 24^\circ, y = 48^\circ$
(C) $x = 21^\circ, y = 48^\circ$ (D) $x = 50^\circ, y = 24^\circ$

Section-II

Physics and Chemistry

51. The percentage of nitrogen in ammonium nitrate (NH_4NO_3) is, where H = 1, N = 14, O = 16—
(A) 35% (B) 25%
(C) 45% (D) 15%
52. The volume of 7.1 g of chlorine at STP is—
(A) 22.4 litres (B) 2.24 litres
(C) 4.48 litres (D) 1.12 litres
53. The compound which decomposes on passing electricity through its aqueous solution is—
(A) Sugar (B) Urea
(C) Copper sulphate (D) Ethyl alcohol
54. The flow of current in an electrolyte is due to the movement of—
(A) Electrons (B) Molecules
(C) Protons (D) Ions
55. The carbon content in stainless steel is—
(A) 0.1 – 0.25% (B) 0.5 – 1.0%
(C) 1 – 2.5% (D) More than 2.5%
56. Which of the following does not contain aluminum?
(A) Alnico (B) Duralium
(C) German silver (D) Magnalium
57. The catalyst used for making ammonia (NH_3) gas from nitrogen and hydrogen is—
(A) iron and molybdenum
(B) iron and platinum
(C) molybdenum and platinum
(D) None of the above
58. Chile saltpeter is the name of—
(A) potassium nitrate
(B) potassium sulphate
(C) sodium nitrate
(D) sodium sulphate
59. The acid used in storage batteries is—
(A) sulphuric acid (B) nitric acid
(C) phosphoric acid (D) None of these
60. Catalyst V_2O_5 is used in manufacturing of—
(A) SO_2 from S
(B) SO_3 from SO_2
(C) H_2SO_4 from SO_3
(D) None of the above
61. Which of the following is unsaturated compound?
(A) C_2H_6 (B) C_4H_8
(C) $\text{C}_2\text{H}_5\text{OH}$ (D) $\text{C}_2\text{H}_5\text{OH}$
62. IUPAC name of the C_6H_{12} is—
(A) Alkane (B) Alkene
(C) Alkyne (D) None of these
63. Halogenation is—
(A) addition reaction
(B) oxidation reaction
(C) reduction reaction
(D) None of the above
64. Which element will ionize most easily among A, B, C and D? Their electron affinities are—
A = 3.70 eV, B = 3.56 eV
C = 3.35 eV, D = 3.25 eV
(A) A (B) B
(C) C (D) D
65. An oxidation process involves—
(A) loss of electrons
(B) gain of electrons
(C) neither gain, nor loss of electrons
(D) None of the above
66. Which of the following has water of crystallization?
(A) Zinc chloride (B) Caustic soda
(C) Baking soda (D) Washing soda
67. Sodium potassium sulphate (NaKSO_4) is a/an—
(A) complex salt (B) mixed salt
(C) impure salt (D) None of these
68. Acids A, B, C and D have pH values 1, 2, 3, 4 respectively. Which one is stronger acid?
(A) A (B) B
(C) C (D) D
69. Methyl orange indicator provides yellow colour in—
(A) acidic solution (B) alkaline solution
(C) neutral solution (D) None of these
70. In the preparation of FeCl_3 , we use fused calcium chloride—
(A) for reaction
(B) as a catalyst
(C) to keep FeCl_3 dry
(D) None of the above
71. In an aqueous solution of a compound A, a reddish brown precipitate is obtained on adding NH_4OH drop by drop. The compound A is—
(A) Zinc sulphate (B) Lead nitrate
(C) Ferrous sulphate (D) Ferric chloride
72. 1 mole of compound contains 1 mole of carbon and 2 moles of oxygen. The molecular weight of the compound is—
(A) 3 (B) 12
(C) 32 (D) 44
73. Mass of oxygen in 36 g of pure water is—
(A) 16 g (B) 64 g
(C) 70 g (D) 32 g
74. Power of a pump which lifts 100 kg of water to a water tank situated at 20 m height in 10 seconds is (Take $g = 10 \text{ m/s}^2$)—
(A) 2 kW (B) 20 kW
(C) 200 W (D) None of these
75. The lever for which the mechanical advantage is always less than one has—
(A) fulcrum between load and effort
(B) load between effort and fulcrum
(C) effort between fulcrum and load
(D) load and effort acting at the same point
76. Mechanical advantage (MA), load (L), effort (E) are related as—
(A) $MA = L \times E$ (B) $L = MA \times E$
(C) $E = MA \times L$ (D) None of these
77. A ray of light is incident normally on surface of water. Its angle of refraction in water is—
(A) 90° (B) 180°
(C) 0° (D) 45°
78. The apparent depth of a pond is 9 m. What is the real depth if refractive index of water is $\frac{4}{3}$?
(A) 12 m (B) 6 m
(C) 6.25 m (D) 9 m
79. The point through which a ray of light passes without suffering deviation is called—
(A) Pole
(B) Focus
(C) Centre of curvature
(D) Optical centre
80. Lens used for projecting the image on screen is—
(A) convex lens
(B) concave lens
(C) convex and concave lens
(D) None of the above
81. A convex lens of focal length 20 cm is placed in contact with a concave lens of focal length 40 cm. The nature of the resulting lens is—
(A) convex lens
(B) concave lens
(C) plano-convex lens
(D) None of the above
82. Wavelength range for visible light is—
(A) 0.1 \AA to 100 \AA
(B) 100 \AA to 4000 \AA

- (C) 4000 Å to 8000 Å
(D) Above 8000 Å
83. Source of ultraviolet light is—
(A) electric bulb
(B) red hot iron ball
(C) sodium vapour lamp
(D) carbon arc lamp
84. The frequency of electromagnetic wave which has wavelength 30 cm and velocity 3×10^8 m/s is—
(A) 5000 MHz (B) 500 MHz
(C) 50 MHz (D) None of these
85. If the amplitude of a wave is doubled, then its loudness becomes—
(A) double (B) three
(C) four times (D) unchanged
86. Intensity of sound is measured in—
(A) hertz (Hz) (B) decibel (dB)
(C) second (D) metre
87. The resistance between points X and Y in the given figure is—

(A) 8 Ω (B) 2 Ω
(C) 15 Ω (D) None of these
88. Four cells each of emf 2 V and internal resistance 0.1 Ω are connected in series. The combination is connected in series to an ammeter of negligible resistance, a 1.6 Ω resistor and an unknown resistor R. The current in the circuit is 2 A. The value of R is—
(A) 4 Ω (B) 2 Ω
(C) 6 Ω (D) 8 Ω
89. An electric heater is rated 3 kW, 250 V. The cost of electricity is ₹ 5 per unit. The cost of running the heater continuously for 5 hours is—
(A) ₹ 10.0 (B) ₹ 50.0
(C) ₹ 75.0 (D) ₹ 25.0

90. Specific heat capacity of copper is 0.1 cal/gm. Its value in $\text{J/g}^\circ\text{C}$ is—
(A) 0.84×10^3 (B) 0.42×10^3
(C) 0.24×10^3 (D) 4.2×10^3
91. Which of the following is not a greenhouse gas?
(A) CO_2 (B) H_2
(C) N_2O (D) CH_4
92. A liquid A of mass 100g and at 120°C is poured in a liquid B at 20°C . The final temperature recorded is 40°C . The initial mass of liquid B is (If heat capacity of liquid A is $0.8 \text{ J/g}^\circ\text{C}$ and of liquid B $4.2 \text{ J/g}^\circ\text{C}$)—
(A) 70 g (B) 80.0 g
(C) 75 g (D) 76.10 g
93. Among the elements Li, Na, Mg and Al, the lowest value of ionization potential of element will be—
(A) Li (B) Na
(C) Mg (D) Al
94. On moving from left to right in a period of periodic table, the number of shell—
(A) remains the same
(B) increases
(C) decreases
(D) first increases then decreases
95. 1.0 kilogram force (kgf) is equal to—
(A) 1.0 kg (B) 980 dynes
(C) 1 N (D) None of these
96. The force of friction on a body kept on the table top does not depend on—
(A) nature of force
(B) material of the body
(C) weight of the body
(D) area of contact
97. Wheels of a moving cycle
(A) have rotational and translational motion
(B) have translational motion only
(C) have rotational motion only
(D) None of the above
98. erg is unit of—
(A) work (B) force
(C) power (D) energy

99. Which one is not a fossil fuel?
(A) Coal (B) Biomass
(C) Petroleum (D) None of these
100. If a force F is applied on a body and it moves with a velocity v, then the value of the power will be—
(A) $F \times v$ (B) F/v
(C) F/v^2 (D) $F \times v^2$

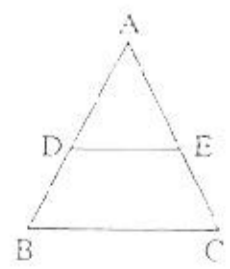
Answers with Hints

1. (C) This is an cyclic quadrilateral in which—
 $120^\circ + y^\circ = 180^\circ$
 $\Rightarrow y = 60^\circ$
Similarly $x^\circ + 130^\circ = 180^\circ$
 $\Rightarrow x = 50^\circ$
2. (A) $\frac{2}{x} + \frac{5}{y} = 1$... (i)
 $\frac{60}{x} - \frac{20}{y} = 13$... (ii)
 $\frac{8}{x} + \frac{20}{y} = 4$
 $\frac{60}{x} - \frac{20}{y} = 13$
 $\frac{68}{x} = 17$
 $x = 4$ put in equation (i)
 $\frac{2}{4} + \frac{5}{y} = 1$
 $\frac{5}{y} = \frac{1}{2}$
 $y = 10$
3. (C) Total votes polled = 9791,
Invalid votes = 116
Valid votes = $9791 - 116 = 9675$
Successful candidate's votes = $\frac{9675}{9} \times 5 = 5375$
Opponent candidate's votes = $\frac{9675}{9} \times 4 = 4300$
margin of votes = $5375 - 4300 = 1075$

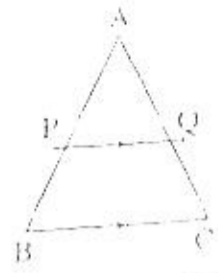
4. (D) $[\log_2 (\log_2 (\log_2 16))]$
 $= [\log_2 (\log_2 (\log_2 (2^4)))] \Rightarrow \log$
 $= [\log_2 (\log_2 (4 \log_2 2))]$
 $= [\log_2 (\log_2 (2)^2)]$
 $= [\log_2 (2)]$
 $= 1$

5. (B) In the given figure,
 $\angle \text{LBN} = 70^\circ$
and $\text{AB} = \text{BC}$
 $\therefore \angle \text{BAC} = 70^\circ$
and $\angle \text{BAC} = \angle \text{BCA}$
(By property of isosceles trian
Now in ΔABC
 $\angle \text{ABC} + \angle \text{BAC} + \angle \text{ACB} = 180^\circ$
 $\angle \text{ABC} + 70^\circ + 70^\circ = 180^\circ$
 $\angle \text{ABC} = 180^\circ - 140^\circ$
 $\angle \text{ABC} = 40^\circ$

6. (C) Given: $\text{AB} = \text{AC}$
and $\text{AD} = \text{DC}$
 $\angle \text{ACB} = \angle \text{DAC} = x^\circ$
Now $\angle \text{ABC} = \angle \text{ACB}$
(By Prop. of isosceles Triang
Now in ΔABC
 $x^\circ + 80^\circ + 80^\circ = 180^\circ$
 $x^\circ = 180^\circ - 160^\circ$
 $x = 20^\circ$
In ΔADC $\angle \text{DAC} = \angle \text{DCA} = 20^\circ$
 $\therefore y + 40 = 180^\circ$
 $y = 140^\circ$

7. (A) 
 $\therefore \text{D and E are the midpoints of AB and AC respectively.}$
So, $\text{DE} = \frac{1}{2} \text{BC}$

8. (A) If line PQ is parallel to line BC of triangle.



Then, $\frac{AP}{PB} = \frac{AQ}{QC}$

9. (B) If the difference between two sides = 2 cm

Let (base) - (height) = 2 cm
 $\Rightarrow b - h = 2$ cm

Now, Area of $\Delta = \frac{1}{2} \times b \times h$

$24 = \frac{1}{2} \times (h+2) \times h$

$48 = h^2 + 2h$

$0 = h^2 + 2h - 48$

$0 = h^2 + 8h - 6h - 48$

$0 = (h+8)(h-6)$

$h = 6$ cm

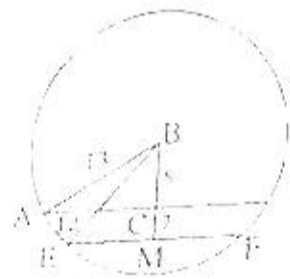
$h = 8$

$b = 8$ cm

Hypotenuse = $\sqrt{64 + 36} = 10$ cm

Perimeter of $\Delta = 8 + 6 + 10 = 24$ cm

10. (B)



Given length of chord = 24 cm

$AB = \sqrt{12^2 + 5^2} = 13$ cm

$\therefore AB = BE$ (Radii of circle)

So, in ΔBEM : $BE = 13$ cm

$ME^2 = 13^2 - 12^2 = 25$

$ME = 5$ cm

Then Chord $EF = 2 \times 5 = 10$ cm

11. (C) Line $4x - 3y + 12 = 0$ meets x-axis at A.

Then $y = 0$ put in equation of line

$4x - 3(0) + 12 = 0$

$4x = -12$

$x = -3$

Point A = (-3, 0)

12. (D) $7^x \times (25)^{x-2} - 5^{-3} = 1 \times (5^2)^{x-2} - 5^{-3}$
 $= (5)^{2x-4} - (5)^{-3} = 0$

13. (A) When two lines are perpendicular,

Then $m_1 m_2 = -1$

$\therefore m_1 = \frac{3}{2}$

$m_2 = -\frac{2}{3}$

$\frac{3}{2} \times \frac{-2}{K} = -1$

$\frac{3}{K} = 1$

$K = 3$

14. (D)



Equation of line AC

$\Rightarrow y - 6 = \frac{2-6}{-1} (x - 8)$

$y - 6 = x - 8$

$x - y = -2$... (i)

$\therefore AC \perp BD$, hence equation of line BD

$x + y = \lambda$... (ii)

\therefore diagonal AC and BD bisect each other at O(4, 4) and BD parallel through point O(4, 4)

$\therefore 1 + 4 = \lambda$

$\Rightarrow \lambda = 5$

equation of BD $\Rightarrow x + y = 5$

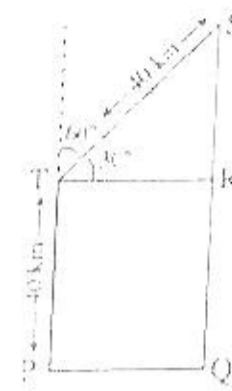
15. (A) $(\operatorname{cosec} A - \sin A)(\sec A - \cos A)$

$= \left(\frac{1 - \sin^2 A}{\sin A}\right) \left(\frac{1 - \cos^2 A}{\cos A}\right) \left(\frac{1 + \tan^2 A}{\tan A}\right)$

$= \frac{\cos^2 A}{\sin A} \times \frac{\sin^2 A}{\cos A} \times \frac{\sec^2 A}{\tan A}$

$= \frac{\sin A}{\cos A} \times \frac{\cos A}{\sin A} = 1$

16. (B)



$\therefore \angle RTS = 30^\circ$

In ΔRTS $\sin 30^\circ = \frac{RT}{RS}$

$\frac{1}{2} = \frac{RT}{40}$

$RT = 20$ km

$QS = QR + RS$ ($\because PT = QR$)
 $= 40 + 20 = 60$ km

17. (B) $\frac{2}{3} \operatorname{cosec}^2 58^\circ - \frac{2}{3} \cot 58^\circ \tan 32^\circ - \frac{5}{3}$

$\tan 13^\circ \cdot \tan 37^\circ \tan 45^\circ \cdot \tan 53^\circ \cdot \tan 77^\circ$

$= \frac{2}{3} [\operatorname{cosec}^2 58^\circ - \cot 58^\circ \cdot \tan (90 - 58^\circ)]$

$- \frac{5}{3} \tan 13^\circ \cdot \tan (90 - 53^\circ) \tan 45^\circ \cdot \tan (90 - 13^\circ) \cdot \tan 53^\circ$

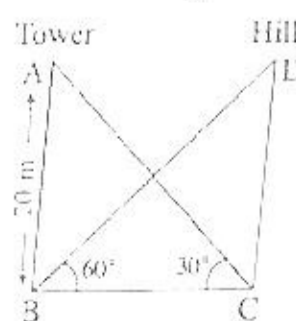
$= \frac{2}{3} [\operatorname{cosec}^2 58^\circ - \cot^2 58^\circ]$

$- \frac{5}{3} \tan 13^\circ \cdot \tan 53^\circ \cdot \tan 13^\circ \cdot \tan 53^\circ$

$= \frac{2}{3} (1) - \frac{5}{3} (1) = \frac{2-5}{3}$

$= \frac{-3}{3} = -1$

18. (A)



In ΔABC $\tan 30^\circ = \frac{AB}{BC}$

$\frac{1}{\sqrt{3}} = \frac{20}{BC}$

$BC = 20\sqrt{3}$ metre

Similarly in ΔBCD ,

$\tan 60^\circ = \frac{DC}{BC}$

$\sqrt{3} = \frac{DC}{20\sqrt{3}}$

$\Rightarrow DC = 20\sqrt{3} \times \sqrt{3} = 60$ metres

Then, height of the hill = 60 metres

19. (D) $\sec^2 A - \tan^2 A$

If $\angle A = 30^\circ$

$= \sec^2 30^\circ - \tan^2 30^\circ$

$= \left(\frac{2}{\sqrt{3}}\right)^2 - \left(\frac{1}{\sqrt{3}}\right)^2$

$= \frac{4}{3} - \frac{1}{3}$

$= \frac{4-1}{3} = 1$

20. (B) \therefore Internal diameter = 11.2 cm,

Internal radius = $\frac{11.2}{2} = 5.6$ cm

Thickness = 0.4 cm

Length = 21 cm

and

\therefore External diameter = 11.2 + 0.8

= 12 cm

External radius = $\frac{12}{2} = 6$ cm

Volume of metal = $\pi R^2 h - \pi r^2 h$

= $\pi h (R^2 - r^2)$

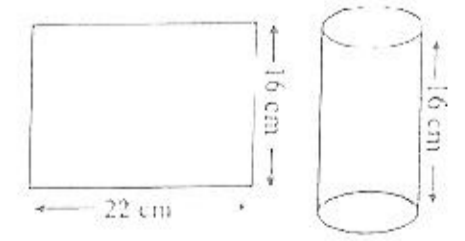
= $\frac{22}{7} \times 21 \times [(6)^2 - (5.6)^2]$

= 66 [36 - 31.36]

= 66 \times 4.64

= 306.24 cm^3

21. (A)



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∴ Height of cylinder = 16 cm
and $2\pi r = 22$ cm

$$r = \frac{11}{\pi}$$

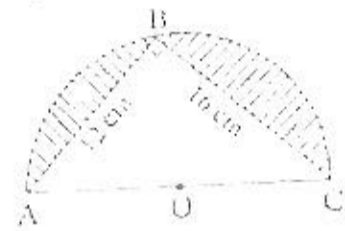
$$\text{Volume of cylinder} = \pi r^2 h$$

$$= \pi \times \left(\frac{11}{\pi}\right)^2 \times 16$$

$$= \frac{11 \times 11 \times 7 \times 16}{22}$$

$$= 616 \text{ cm}^3$$

22. (D) ∴ Angle formed at semicircle is 90°



$$AC^2 = \sqrt{144 + 256}$$

$$= \sqrt{400} = 20 \text{ cm}$$

Radius = 10 cm

Area of the shaded portion

$$= \frac{\pi}{2} \times 10^2 - \frac{1}{2} \times 12 \times 16$$

$$= 50\pi - 96$$

$$= 157.1 - 96$$

$$= 61.1 \text{ cm}^2$$

23. (B) ∴ PS = 6 cm,
PQ = QR = RS = 2 cm

Perimeter of shaded portion

$$= \pi R + \pi r_1 + \pi r_2$$

$$= \pi [3 + 2 + 1]$$

$$\left[\begin{array}{l} \because R = \frac{PS}{2} = 3 \text{ cm} \\ r_1 = \frac{QS}{2} = 2 \text{ cm} \\ r_2 = \frac{PQ}{2} = \frac{2}{2} = 1 \text{ cm} \end{array} \right]$$

$$= \frac{132}{7} \text{ cm}$$

24. (A)



Area of rectangular sheet = 30×10
= 300 cm^2

Diameter of disc = 1 cm

So, 300 discs can be made from sheet.

25. (A) $N = \begin{bmatrix} 1 & -2 \\ -3 & 4 \end{bmatrix}_{2 \times 2}$

$$Y = \begin{bmatrix} 0 \\ 1 \end{bmatrix}_{2 \times 1}$$

$$NY = \begin{bmatrix} 1 & -2 \\ -3 & 4 \end{bmatrix} \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

$$= \begin{bmatrix} 0 - 2 \\ 0 + 4 \end{bmatrix}$$

$$= \begin{bmatrix} -2 \\ 4 \end{bmatrix}$$

26. (D) mean = $\frac{5 + 3 + 0.5 + 4.5 + b + 8.5 + 9.5}{7}$

$$7 = \frac{31 + b}{7}$$

$$b = 49 - 31$$

$$b = 18$$

27. (B)

N	f	C
37	10	10
38	14	24
39	18	42
40	12	54
41	6	60
	60	

median = $\frac{30^{\text{th}} \text{ term} + 31^{\text{th}} \text{ term}}{2}$

$$= \frac{39 + 39}{2} = 39$$

28. (A) C. P. for B = 12,500

C. P. for C = 13,300

Cost of machine after profit of C

$$= 13,300 + 1300$$

$$= 14,600$$

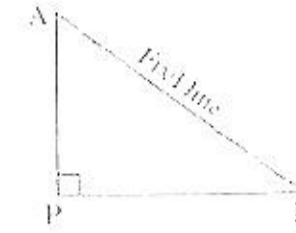
$$\text{VAT} = \frac{14600 \times 8}{100}$$

$$= ₹ 1168$$

C. P. for customers = $14600 + 1168$

$$= ₹ 15,768$$

29. (D)



From pythagoras theorem

$$AB^2 = AP^2 + PB^2$$

∴ Locus of point P is right-angled triangle.

30. (C) Let the marked price be A

$$\therefore \frac{109A}{100} = 40,221$$

$$A = \frac{40,221 \times 100}{109}$$

$$A = ₹ 36,900$$

$$\frac{x}{y} = \frac{4}{3}$$

31. (D) If

Then $\frac{5x + 8y}{6x - 7y} = \frac{y \left(\frac{x}{y} + 8 \right)}{y \left(6 \frac{x}{y} - 7 \right)}$

$$= \frac{5 \times \frac{4}{3} + 8}{6 \times \frac{4}{3} - 7}$$

$$= \frac{20 + 24}{24 - 21}$$

$$= \frac{44}{3}$$

32. (D)

$$A = 5000 \left(1 + \frac{6}{100} \right)^3$$

$$= 5000 \times \frac{53}{50} \times \frac{53}{50} \times \frac{53}{50}$$

$$= 53 \times 53 \times 53$$

$$= 25$$

$$= 5955.08$$

Remaining payment after 18 months

$$= 5955.08 - 3600$$

$$= 2355.08$$

33. (C)

$$\text{S.I.} = \frac{250 \times 6 \times 24}{100} = ₹ 360$$

Amount after two years

$$= 24 \times 250 + 360$$

$$= 6000 + 360$$

$$= ₹ 6,360$$

34. (B) Let the number = x

$$\therefore \frac{x + 1}{x} = \frac{17}{4}$$

$$\frac{x^2 + 1}{x} = \frac{17}{4}$$

$$4x^2 + 4 = 17x$$

$$4x^2 - 17x + 4 = 0$$

$$4x^2 - 16x - x + 4 = 0$$

$$4x(x - 4) - 1(x - 4) = 0$$

$$(x - 4)(4x - 1) = 0$$

$$x = 4, x = \frac{1}{4}$$

35. (A) Equation, $x^2 - 3x - 28 = 0$

$$\text{sum of roots} = \frac{-b}{a} = \frac{3}{1} = 3$$

36. (D) Let the number = x, y

$$x \cdot y = 3 \cdot 5$$

$$\frac{x + 8}{y + 8} = \frac{2}{3}$$

$$\frac{5K + 8}{5K + 8} = \frac{2}{3}$$

$$\frac{9K + 24}{10K + 16} = \frac{2}{3}$$

$$K = 8$$

$$\therefore x = 24, y = 40$$

37. (A) Let x be added in each number

$$\text{then } \frac{4 + x}{8 + x} = \frac{16 + x}{26 + x}$$

$$104 + 30x + x^2 = 128 + 24x + x^2$$

$$6x = 24$$

$$x = 4$$

38. (C)

39. (A) $\frac{\cot^2 \theta (1 - \cos^2 \theta)}{\cos^2 \theta} = \frac{\cot^2 \theta (\sin^2 \theta)}{\cos^2 \theta}$

$$= 1$$

40. (A) $(5x - 3)(x + 2)^2$

$$= (5x - 3)(x^2 + 4 + 4x)$$

$$= 5x^3 + 20x + 20x^2 - 3x^2 - 12 - 12x$$

$$= 5x^3 + 17x^2 + 8x - 12$$

$$\text{coefficient of } x^2 = 17,$$

$$\text{coefficient of } x = 8$$

41. (B) $\left(x - \frac{2}{x}\right) \left(x^2 + 2 + \frac{4}{x^2}\right)$

$$= x^3 + 2x + \frac{4}{x} - 2x - \frac{4}{x}$$

$$= x^3 - \frac{8}{x^3}$$

42. (D) Let the initial money of Rohit and Deep respectively x and y rupees
 $\therefore x = y + 9500$... (i)
 when Deep gives ₹ 2000 to Rohit then
 $4(y - 2000) = x + 2000$
 $4y - 8000 = x + 2000$
 $4y - x = 10000$... (ii)

From equation (i) and (ii)
 $x - y = 9500$
 $-x + 4y = 10000$
 $3y = 19,500$
 $y = ₹ 6,500$
 and $x = ₹ 16,000$

43. (A) $2x^3 + 5x^2 - 11x - 14$
 $= (x+1)(2x^2 - 3x - 14)$
 $= (x+1)[2x^2 + 7x - 4x - 14]$
 $= (x+1)[(2x+7) - 2(2x+7)]$
 $= (x+1)(2x+7)(x-2)$

44. (C) $\frac{x}{\sqrt{1-x}} + \frac{1-x}{\sqrt{1-x}} = \frac{13}{6}$
 $\frac{x+1-x}{\sqrt{1-x}} = \frac{13}{6}$
 $\frac{1}{\sqrt{1-x}} = \frac{13}{6}$
 $\frac{1}{1-x} = \frac{169}{36}$
 $36 = (1-x) \cdot 169$
 $36 = 169 - 169x^2$

$169x^2 - 169x + 36 = 0$
 $\Rightarrow 169x^2 - 117x - 52x + 36 = 0$
 $13x(13x-9) - 4(13x-9) = 0$
 $(13x-9)(13x-4) = 0$
 $\therefore x = \frac{9}{13}$ and $\frac{4}{13}$

45. (A) In ΔQRS
 $\angle x + 90^\circ + 32^\circ = 180^\circ$
 $\angle x = 180 - 122^\circ$
 $\angle x = 58^\circ$
 Now in ΔPQR $\angle y + 38^\circ = 58^\circ$
 $\angle y = 58 - 38$
 $\angle y = 20^\circ$

46. (C) $\frac{\sin 26^\circ}{\sec 64^\circ} + \frac{\cos 26^\circ}{\operatorname{cosec} 64^\circ} = a$
 $\Rightarrow \frac{\sin(90^\circ - 64^\circ)}{\sec 64^\circ} + \frac{\cos(90^\circ - 64^\circ)}{\operatorname{cosec} 64^\circ} = a$
 $\frac{\cos 64^\circ}{\sec 64^\circ} + \frac{\sin 64^\circ}{\operatorname{cosec} 64^\circ} = a$
 $\sin^2 64^\circ + \cos^2 64^\circ = a$
 $a = 1$

47. (A) $\cos^2 26^\circ + \cos 64^\circ \sin 26^\circ + \frac{\tan 36^\circ}{\cot 54^\circ} = x$
 $\cos^2 26^\circ + \cos(90^\circ - 26^\circ) \sin 26^\circ$
 $+ \frac{\tan(90^\circ - 54^\circ)}{\cot 54^\circ} = x$
 $\cos^2 26^\circ + \sin^2 26^\circ + \frac{\cot 54^\circ}{\cot 54^\circ} = x$
 $1 + 1 = x$
 $x = 2$

48. (D) Arithmetic mean
 $= \frac{67 + 65 + 71 + 57 + 45}{5}$
 $= \frac{305}{5} = 61$

49. (B)
 50. (A) $\angle EOB = 180^\circ - 150^\circ = 30^\circ$
 $\therefore OE = OB = \text{Radius of circle}$
 $\therefore \angle OEB = \angle OBE = 75^\circ$
 Now $75^\circ = x^\circ + y^\circ$
 $\therefore \angle x = 51^\circ$
 $75^\circ = 51^\circ + y^\circ$
 $\angle y = 24^\circ$

51. (A) Molecular weight of Ammonium nitrate (NH_4NO_3)
 $= 14 + 4 \times 1 + 14 + 3 \times 16$
 $= 80$

Percentage of Nitrogen
 $= \frac{28}{80} \times 100 = 35\%$

52. (B) Molecular weight of Chlorine (Cl_2)
 $= 35.5 \times 2 = 71$
 At STP, the volume of 1 mole (71 gm) of Chlorine
 $= 22.4$ litres

Volume of 1 gm of Chlorine STP
 $= \frac{22.4}{71}$ litre
 Volume of 7.1 gm of Chlorine STP
 $= \frac{22.4}{71} \times 7.1$ litres
 $= 2.24$ litres

53. (C) $\text{CuSO}_4 \xrightarrow{\text{Fe}} \text{Cu} + \text{SO}_4^{2-}$
 54. (D) In an electrolyte, the flow of current is due to the movement of ions.
 55. (A) In stainless steel, the percentage of the content of carbon is 0.1 - 0.25%
 56. (C) German silver contains: Cu = 80%, Zn = 35%, Ni = 15%
 57. (A) $\text{N}_2 + 3\text{H}_2 \xrightarrow[\text{Mo}]{\text{Fe}} 2\text{NH}_3$
 58. (C) Sodium Nitrate (NaNO_3) is called Chile saltpeter
 59. (A) Sulphuric acid (H_2SO_4) is used in storage battery

60. (B) $2\text{SO}_2 + \text{O}_2 \xrightarrow[\text{V}_2\text{O}_5]{\text{Pt}} 2\text{SO}_3$
 61. (B) C_2H_4 is an unsaturated compound.
 62. (C)
 63. (B) Halogenation is an oxidation reaction.
 64. (A) If the electron affinity is low, ionization potential is also low.
 65. (A) In oxidation process, there is the loss of electrons, e.g.,
 $\text{M} \rightarrow \text{M}^{n+} + ne^-$
 66. (D) Washing soda ($\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$) contains water of crystallization.
 67. (B) Sodium potassium sulphate (NaKSO_4) is a mixed salt, because it contains two positive ions, namely, Na^+ , K^+
 68. (A) pH value: $\frac{1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7}{\text{Rising order of acidic strength}}$
 69. (B) Methyl orange indicator provides yellow colour in alkaline solution.
 70. (C) We use fused calcium chloride, in preparation of FeCl_3 to keep it (FeCl_3) dry.
 71. (D) $\text{FeCl}_3 + 2\text{NH}_4\text{OH} \rightarrow \text{Fe}(\text{OH})_3 + 3\text{NH}_4\text{Cl}$
 $\text{Reddish brown precipitate}$
 72. (D) 1 mole of carbon = 12 gm
 1 mole of oxygen = 32 gm
 Molecular weight of the compound = 44

73. (D) Molecular weight of H_2O
 $= 2 \times 1 + 16 = 18$
 Mass of oxygen in 18 gm of pure water
 $= 16$ gm
 \therefore Mass of oxygen in 36 gm of pure water
 $= \frac{16}{18} \times 36 = 32$ g

74. (A) Power (P) of pump = $\frac{W}{t} = \frac{mgh}{t}$
 $= \frac{100 \times 20 \times 20}{10}$
 $= 2000$ watts
 $= 2$ kilowatts

75. (C) The lever for which the mechanical advantage is always less than one has its fulcrum between fulcrum and load
 76. (B) Load (L) = Mechanical advantage (MA)
 77. (C) The angle of refraction in water will be zero, if a ray of light is incident normally on the surface of water.

78. (A) Real depth $h_1 = 9$
 Apparent depth $h_2 = 9$ m
 Refractive index of water with respect to air
 $n_{21} = \frac{h_1}{h_2}$
 $\frac{4}{3} = \frac{h_1}{9}$
 $3h_1 = 4 \times 9$
 $h_1 = \frac{4 \times 9}{3} = 12$

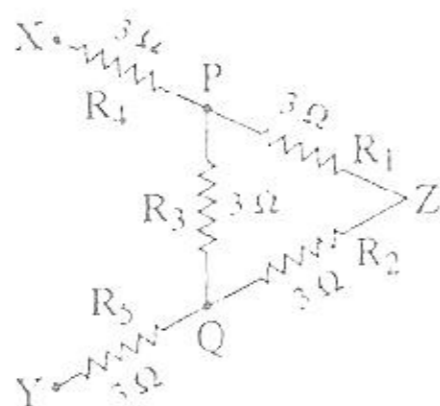
79. (D) Ray of light passes through optical centre of a lens without any deviation.
 80. (A) A convex lens is used for projecting an image on the screen.
 81. (A) The resultant lens will function as a convex lens.
 82. (C) Wavelength range of visible light is 4000 Å to 8000 Å.
 83. (B) Red hot iron ball is the source of white light.

84. (D) Frequency (ν) = $\frac{\text{Velocity}}{\text{Wavelength}}$
 $= \frac{3 \times 10^8 \text{ m/s}}{30 \times 10^{-2}}$
 $= 10^9$ Hz

85. (C) Intensity $(I) \propto a^2$.

86. (B) Intensity of sound is measured in decibel (dB).

87. (A)



Let R_1 and R_2 are in series, then

$$R' = R_1 + R_2 = 3 + 3 = 6\Omega$$

When R' and R_3 are in parallel, then

$$R_{PQ} = \frac{R' \times R_3}{R' + R_3} = \frac{6 \times 3}{6 + 3} = \frac{18}{9} = 2\Omega$$

R_4 , R_{PQ} , R_5 will be in series

Resistance between X and Y

$$R = R_4 + R_{PQ} + R_5 = 3 + 2 + 3 = 8\Omega$$

88. (B) No. of cells $(n) = 4$
 $E = 2$ volt
 $r = 0.1 \Omega$,
 $I = 2$ A

When the resistances 1.6Ω and R are connected to ammeter, they will be in series.

Hence,

$$R' = R + 1.6 \Omega$$

$$\text{Current } I = \frac{nE}{nr + R'}$$

$$\frac{2}{1} = \frac{4 \times 2}{4 \times 0.1 + R + 1.6}$$

$$\frac{1}{1} = \frac{4}{R + 0.4 + 1.6}$$

$$\frac{1}{1} = \frac{4}{R + 2.0}$$

or

$$R + 2.0 = 4$$

$$\text{Resistance } R = 4 - 2 = 2\Omega$$

89. (C) The power rated on heater 3 kW and 250 volt

$$\text{Namely Power } (P) = 3 \text{ kW} = 3 \times 10^3 \text{ W}$$

$$\text{Potential difference (V)} = 250 \text{ volt}$$

$$t = 5 \text{ hrs.}$$

Consumed electrical energy

$$= \frac{\text{Total power (in watt)} \times \text{Total time (in hrs.)}}{1000}$$

$$= \frac{3 \times 1000 \times 5}{1000} = 15 \text{ joules}$$

The cost of running the heater continuously for 5 hours

$$= 15 \times 5 = ₹ 75$$

90. (B) $1 \text{ cal/gm} = 4.2 \times 10^3 \text{ J/kg } ^\circ\text{C}$
 $0.1 \text{ cal/gm} = 0.42 \times 10^3 \text{ J/kg } ^\circ\text{C}$

91. (B) Hydrogen is not a greenhouse gas.

92. (D) Let the mass of liquid B is m_2 gm. As per the principle of calorimetry,

$$\text{Heat lost} = \text{Heat gained}$$

$$100 \times 0.8 \times (120 - 40) = m_2 \times 4.2 \times (40 - 20)$$

$$100 \times 0.8 \times 80 = m_2 \times 4.2 \times 20$$

$$\text{or } m_2 = \frac{100 \times 0.8 \times 80}{4.2 \times 20} = 76.19 \text{ gm}$$

93. (B)

Element	:	Li	Na	Mg	Al
Ionization potential (kJ mol⁻¹)	:	520.3	495.8	737.6	577.4

94. (A) On moving from left to right in a period of the periodic table, the number of shells remain the same.

95. (D)

96. (D) The force of friction does not depend on the area of contact.

97. (A) The wheels of a running cycle have both rotational and translational motions.

98. (A,D) Erg is the unit of work and energy both.

$$1 \text{ Erg} = 1 \times 10^{-7} \text{ joule}$$

99. (B) Biomass is not a fossil fuel.

100. (A) Power $(P) = F \times v$