Monthly Progressive Test

Class: X

Subject: PCMB (S)

Test Booklet No.: MPT05	Test Date: 22082024
Time: 180 mins	Full Marks: 200

Solutions

Physics

1. Ⓐ

$R = 5\Omega$ $I = 2A$

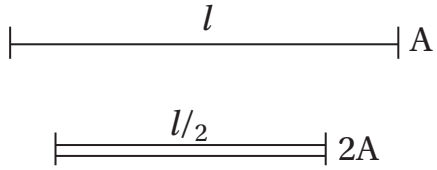
Using Ohm's $V = RI = 5 \times 2\ V = 10\ V$

2. Ⓓ

Ohm's law suggests V = RI where V vs I graph will be a shaight line. So Non-ohmic conduction is given in option D.

3. Ⓑ

$R = 2\ \Omega$



$$R = \rho\frac{l}{A}$$

$$R' = \rho\cdot\frac{l/2}{2A} = \rho\cdot\frac{l}{A}\cdot\frac{1}{4}$$

$$R' = \frac{R}{4} = \frac{2}{4} = 0.5\Omega$$

doubled onitself in area means it is folded half the length to get end area doubled.

4. Ⓒ

Both the alloy – constant and Manganin are used to prepare standard resistor that does not show much change with temperature.

Cont.. 2

5. Ⓑ

Area under i–t graph is the charge flown. Hence total charge flown 2s to 4s is given by

$2\,(4–2)\,C = 2 \times 2\,C = 4\,C$

6. Ⓐ

$1\,(4-2)\,C = 1 \times 2C = 2C$

7. Ⓓ

$$\frac{1}{2} \times 4 \times 3 = 6\,C$$

8. Ⓐ

$R_2+R_3 = 3 + 3 = 6\Omega$

$$R = \frac{R_4(R_2+R_3)}{(R_2+R_3)+R_4} = \frac{3\times 6}{6+3} = \frac{18}{9} = 2\Omega$$

$R_1+R+R_5 = 3 + 2 + 3 = 8\Omega$

$$I = \frac{V}{8} = \frac{12}{8} = \frac{3}{2} = 1.5A$$

9. Ⓒ

$$\frac{R_2R_3R_4}{R_2R_3+R_2R_4+R_4R_2} = \frac{1\times 2\times 3}{1\times 2+2\times 3+1\times 3}$$

$$\frac{6}{2+6+3} = \frac{6}{11}$$

total resistance $\quad 2+\frac{6}{11}+2$

$$= 4+\frac{6}{11}$$

$$= \frac{44+6}{11} = \frac{50}{11}$$

$$\therefore I = \frac{V}{R} = \frac{9}{\frac{50}{11}} = \frac{99}{50} \simeq 2A$$

10. ©

$$2+\frac{3\times6}{3+6}=2+\frac{18}{9}=2+2=4\Omega$$

11. Ⓓ

In parallel combination

$$\frac{1}{R}=\frac{1}{4}+\frac{1}{8}+\frac{1}{12}+\frac{1}{24}$$

$$=\frac{6+3+2+1}{24}=\frac{12}{24}=\frac{1}{2}$$

$R = 2\Omega$

12. Ⓓ

$V = 20V$ $Q = 2C$ $W = 20 \times 2 = 40J$

13. Ⓑ

$P = 40W$

$V = 220\ V$

$$P = VI \Rightarrow I=\frac{P}{V}=\frac{40}{220}=0.18\ A$$

14. Ⓑ

100W – 220 V $\quad R_1 = \dfrac{V^2}{P_1}=\dfrac{220\times220}{100}$

$\Rightarrow R_1 = 484\Omega$

60W – 220 V $\quad R_2 = \dfrac{V^2}{P_2}=\dfrac{220\times220}{60}$

$\Rightarrow R_2 = 807\Omega$

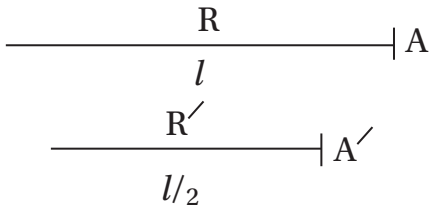
Equivalent resistance

$$R=\frac{R_1R_2}{R_1+R_2}=\frac{484\times807}{484+807}$$

$\Rightarrow R = 302.5\Omega$

Hence, $I = \frac{V}{R} = \frac{220}{302.5} = 0.72\ A$

15. Ⓐ



Volume will be same

$lA = \frac{l}{2}A'$

$\Rightarrow A' = 2A$

$R = \rho\frac{l}{A}$

$\rho\frac{l}{2A'}$

$= \rho.\frac{l}{2.2A}$

$= \rho\frac{l}{A}.\frac{1}{4}$

$= \frac{R}{4}$

16. Ⓐ

$f = 20$ cm. $\quad \upsilon = 20$ cm

$f = \upsilon$ means $\quad u = \infty$

17. Ⓑ

$V_A = 10V$, $\quad V_B = 6V$

$V_A - V_B = 10V - 6V = 4V$

18. Ⓐ

19. Ⓑ

20. Ⓑ

$R = 2\Omega$ $\quad V = 10$ volt

$I = \frac{V}{R} = \frac{10}{2} = 5A$

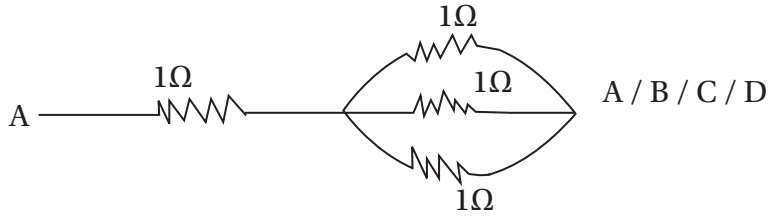
21. Ⓒ

22. Ⓓ

23. Ⓐ

24. Ⓑ

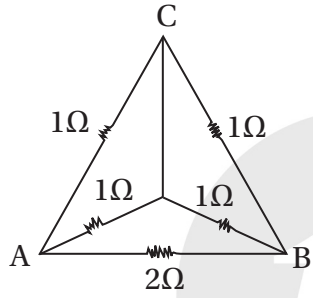
Equivalent network :



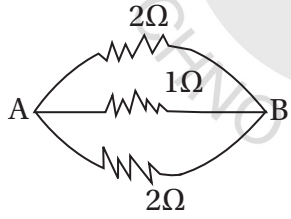
$$1+\frac{1}{3}=\frac{4}{3}$$

25. Ⓑ

Equivalent network :



CD will not comprise anything due to symmetry no current will flow through CD.



$$\frac{1}{R}=\frac{1}{2}+\frac{1}{2}+\frac{1}{2}=\frac{3}{2}$$

$$R=\frac{2}{3}\Omega$$

Chemistry

26. Ⓑ

Carbon forms carbon monoxide (CO) and carbon dioxide (CO_2)

Sulphur forms sulpher dioxide (SO_2) and sulpher trioxide (SO_3)

Iron forms ferric oxide (Fe_2O_3) and ferrous oxide (FeO)

Boron forms only one oxide boron trioxide (B_2O_3)

27. Ⓓ

The structure of nitrogen is $: N \equiv N :$

So, X = 2 and Y = 3

So,(X + Y) = 5

28. Ⓐ

Aluminium (Al), copper (Cu), iron (Fe) are strong metals and mercury (Hg) is a weak metal

29. Ⓐ

Nitrogen (N_2) is a very stable molecule and less reactive. Hence it is used as a food preservative

30. Ⓐ

Sodium is placed at group 1 of periodic table and hence it can release electron more easily than iron (a transitional element). Sodium is a soft metal and it can be easily cut by knief while the structure of iron is too compact and for that reason it is harder than sodium. Melting point of sodium is 98°C and that for iron is 1538°C.

31. Ⓒ

Both sodium and potassium are placed at the group 1 of the periodic table and sodium is at 3rd period while potassium is at 4th period. Radius of potassium is higher than sodium and hence potassium can release electron more easily than sodium.

Electronic configuration of fluorine is 2. 7 and it receives its nearest noble gas (neon) configuration when it accepts one electron. Hence fluorine always form anion.

32. Ⓐ

BeO, SnO, PbO can react with both acids and alkali. Hence they are amphoteric oxides. The equations are given below (M = Be, Sn, Pb).

$$MO + 2HCl \longrightarrow MCl_2 + H_2O$$

$$MO + 2NaOH \longrightarrow Na_2MO_2 + H_2O$$

Fe_2O_3, BaO, Na_2O are basic oxides. They can react with acids not with alkalies

33. Ⓑ

Balanced equation is $Al_2O_3 + 2NaOH \longrightarrow 2NaAlO_2 + H_2O$

So, x = 1, y = 2, z = 2, p = 1

Hence, (x + y + z + p) = 6

34. Ⓑ

Copper (Cu), tin (Sn), zinc (Zn), nickel (Ni) are purified by electrolytic purification method

35. Ⓒ

Metal 'X' can release electron(s) most easily and henceit can react with both $FeSO_4$ and $CuSO_4$. Now, metal 'Y' does not react with either $FeSO_4$ or $CuSO_4$ hence it is the weakest metal

36. Ⓐ

The reaction is $4Al + 3MnO_2 \xrightarrow{\Delta} 2Al_2O_3 + 3Mn$

As aluminium is stronger metal than manganese. Hence manganese dioxide is reduced by aluminium

37. Ⓓ

For rusting of iron, some oxidising agent is needed along with water. Hence, pure water is not enough to create rust over iron surface. Rusting is an oxidation reaction and iron forms Fe_3O_4 after rusting

38. Ⓐ

To form an alloy it is the fact that all components must be in solid state. As oxygen is a gaseous element, hence it cannot be used to form alloy

39. Ⓒ

Homogeneous mixture means all components are in same physical state. In case of alloy, all metals are mixed in proper ratio and generate a solid alloy

40. Ⓓ

Stainless steel contains iron, chromium, carbon, molybdenum, silicon, aluminium, etc

41. Ⓓ

The equation is $Zn + H_2SO_4 \longrightarrow ZnSO_4 + H_2 \uparrow$

Hydrogen is a colourless and odourless gas

42. Ⓑ

The equation is $Ca(OH)_2 + CO_2 \longrightarrow \underset{\text{(white)}}{CaCO_3\downarrow} + H_2O$

43. Ⓐ

The equation is $NaCl + NH_3 + CO_2 + H_2O \longrightarrow NaHCO_3 + NH_4Cl$

So, X = 1, Y = 1, Z = 1, P = 1

Hence, Q = 4

If pH = 4, the medium is acidic

44. Ⓓ

pH value	Medium
pH > 7	Basic
pH = 7	Neutral
pH < 7	Acidic

45. Ⓐ

Correct equation of ionization is $CH_3COOH \longrightarrow CH_3COO^- + H^+$

Only one H^+ ion is released. Hence it is a monobasic acid

46. Ⓓ

Main ore of copper is copper sulphide

At the time of electrorefining of copper, concentration of copper sulphate does not change

Zinc can produce hydrogen gas after reacting with dilute acid but copper cannot

47. Ⓒ

Fe_3O_4 is a mixed oxide. It is a mixture of following two salts

FeO ferrous oxide and charge of iron is + 2

Fe_2O_3 ferric oxide and charge of iron is + 3

48. Ⓑ

With the change of some external factors, the allotropic forms change and the factors are pressure, temperture, light

49. Ⓑ

X = 3 carbon, silicon, sulpher

Y = 2 copper, silver

Z = 4 copper, silver, nickel, cobalt

P = 2 magnesium, aluminium

Now, Q = (3 + 2 + 8 + 2) = 15

So, atomic number = 15

The element of atomic numer 15 will receive 3 electrons to achieve its nearest noble gas configuration

50. Ⓒ

So, X = 1, Y = 2, Z = 1, P = 2

So, (X + Y + 2Z + P) = 7 = Q

7 is the atomic number of nitrogen and the said compound is ammonia (NH_3)

where the central atom (nitrogen) obeys octate rule while 3 hydrogen atoms obey duplate rule and ammonia is a covalent molecule.

Mathematics

51. Ⓑ

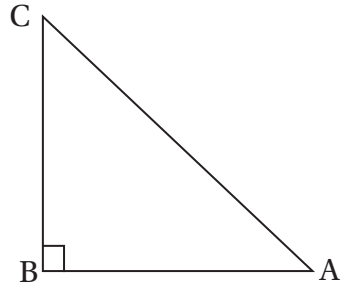
AC = 50 cm

AB = 14 cm

$\therefore$ BC $= \sqrt{(50)^2 - (14)^2}$ cm

$= \sqrt{64 \times 36}$ cm

= 48 cm



$\therefore \tan A = \frac{BC}{AB} = \frac{\cancel{48}^{24}}{\cancel{14}_{7}} = \frac{24}{7}$

52. Ⓒ

$\sin\theta = \frac{12}{13}$

$\cos\theta = \frac{5}{13}$

$\tan\theta = \frac{12}{5}$

$\therefore \frac{2\cos\theta + 8\tan\theta}{\sin\theta + \tan\theta\sin\theta} = \frac{2\times\frac{5}{13} + 3\times\frac{12}{5}}{\frac{12}{13} + \frac{12}{5}\times\frac{12}{13}}$

$= \frac{50+468}{\frac{65}{60+144}} = \frac{\cancel{518}^{259}}{\cancel{204}_{102}} = \frac{259}{102}$

53. ©

$\sin 30° + \cos 60°$

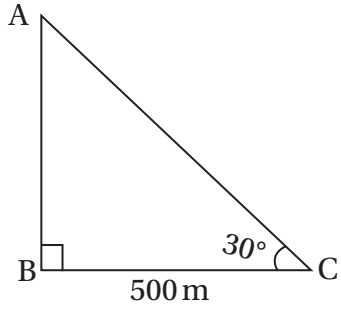
$= \frac{1}{2} + \frac{1}{2} = 1$

54. Ⓐ

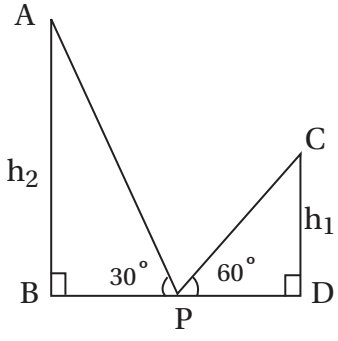
$\tan 30° = \frac{AB}{BC}$

$\Rightarrow \frac{1}{\sqrt{3}} = \frac{AB}{500\,m}$

$\therefore AB = \frac{500}{\sqrt{3}}\,m = \frac{500\sqrt{3}}{3}\,m$



55. Ⓓ



$\frac{h_2}{BP} = \tan 30^0 = \frac{1}{\sqrt{3}}$

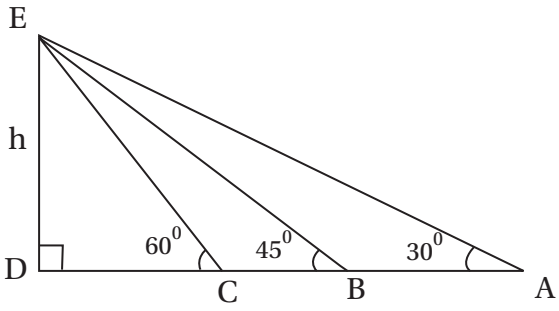
$\frac{h_1}{PD} = \tan 60^0 = \sqrt{3}$

$BP = PD$

$\therefore \frac{h_1}{h_2} = \frac{\sqrt{3}}{\frac{1}{\sqrt{3}}} = \frac{3}{1}$

$\therefore h_1 : h_2 = 3:1$

56. Ⓐ



$AD = \sqrt{3}h$

$BD = h$

$CD = \dfrac{h}{\sqrt{3}}$

$\therefore\ AB = \sqrt{3}h - h = h(\sqrt{3}-1)$

$BC = h - \dfrac{h}{\sqrt{3}} = \dfrac{h(\sqrt{3}-1)}{\sqrt{3}}$

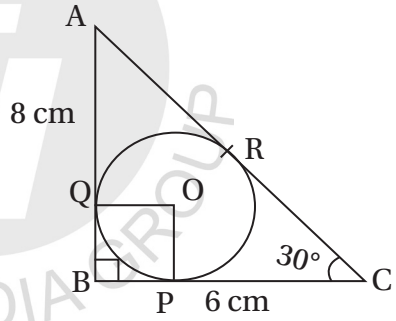
$\therefore\ AB : BC = 1 : \dfrac{1}{\sqrt{3}} = \sqrt{3} : 1$

57. Ⓑ

$\therefore AC = \sqrt{8^2 + 6^2}$ cm

$= \sqrt{100}$ cm

$= 10$ cm



let OP = r cm

$\therefore$ BP = BQ = r cm

$\therefore$ CP = (6 – r) cm = CR

AQ = (8–r) cm = AR

$\therefore$ AC = (6 – r + 8 – r) cm

= (14 – 2r) cm

$\therefore$ 14 – 2r = 10

$\Rightarrow$ 2r = 4 $\Rightarrow$ r = 2

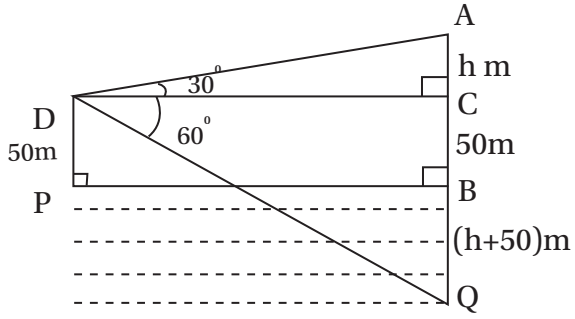
58. Ⓐ

$\dfrac{DC}{CQ} = \text{Cot}\, 60^0 = \dfrac{1}{\sqrt{3}}$

$\Rightarrow DC = \left(\dfrac{h+100}{\sqrt{3}}\right)$m

$\dfrac{DC}{AC} = \cot 30^0 = \sqrt{3}$

$\therefore DC = h\sqrt{3}$ m



$\frac{h+100}{\sqrt{3}} = h\sqrt{3} \Rightarrow 3h = h + 100$

$\Rightarrow h = 50$

$\therefore$ AB = 100 m

$\therefore$ (A) is true.

(R) : $\tan\theta = \frac{\text{Perpendicular}}{\text{Base}}$

Object distance = image distance

(R) is true and it is the correct explanation of (A) .

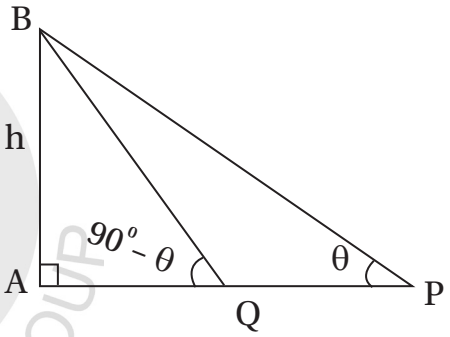
59. ©

$\tan\theta = \frac{h}{AP}, \tan(90^0 - \theta) = \frac{h}{AQ}$

$\Rightarrow \cot\theta = \frac{h}{AQ}$

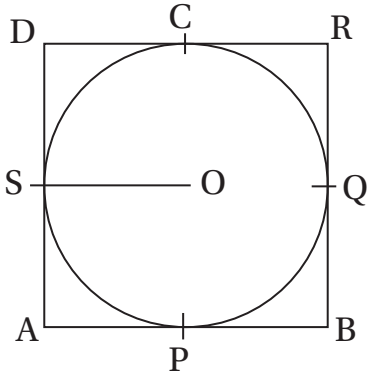
$\therefore \tan\theta \cot\theta = \frac{h^2}{AP \times AQ}$

$\Rightarrow h = \sqrt{AP \times AQ}$ True



(R) : tan θ . cot θ = 2 When ($0^\circ < \theta < 90^\circ$) False.

60. Ⓑ



$\angle OSA = 90^\circ$

61. Ⓓ

AS = AP, BP = BQ, CQ = CR

62. Ⓐ

Ad = 11 cm, DR = 7 cm

$\therefore$ DS = 7 cm

$\therefore$ AS = (11 – 7) cm = 4cm

$\therefore$ AP = 4 cm

63. ©

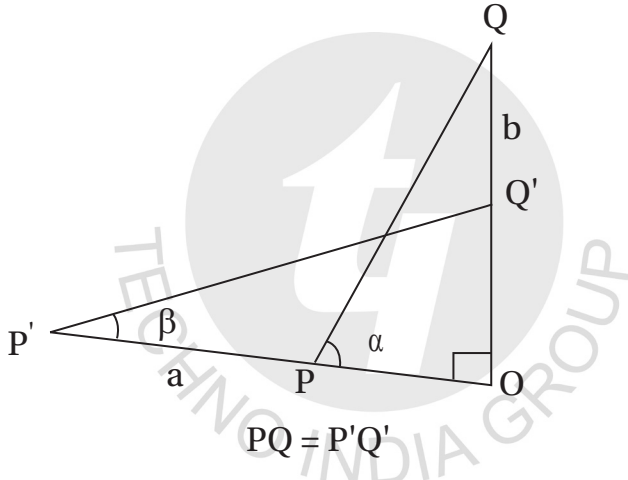
$3(\text{Sin } x - \cos x)^4 + 6(\sin x + \cos x)^2 + 4(\sin^6 x + \cos^6 x)$

$= 3(1 - 2\sin x \cos x)^2 + 6(1 + 2\sin x \cos x) + 4(1 - 3\sin^2 x \cos^2 x)$

$= 3 + 12\sin^2 x\cos^2 x - 12\sin x\cos x + 6 + 12\sin x\cos x + 4 - 12\sin^2 x\cos^2 x$

$= 13$

64. Ⓐ



PQ = P'Q'

$$\text{Sin}\alpha = \frac{OQ}{PQ}, \text{Cos}\alpha = \frac{OP}{PQ}$$

$$\text{Sin}\beta = \frac{OQ'}{P'Q'}, \text{Cos}\beta = \frac{OP'}{P'Q'}$$

$$\text{Sin}\alpha - \text{Sin}\beta = \frac{b}{PQ},\ \text{Cos}\beta - \text{Cos}\alpha = \frac{a}{PQ}$$

$$\therefore \frac{a}{b} = \frac{\text{Cos}\beta - \text{Cos}\alpha}{\text{Sin}\alpha - \text{Sin}\beta} = \frac{\text{Cos}\alpha - \text{Cos}\beta}{\text{Sin}\beta - \text{Sin}\alpha}$$

65. Ⓑ

$\angle RQP = 90^0 - x$

$\angle QRP = 90^0 - x$

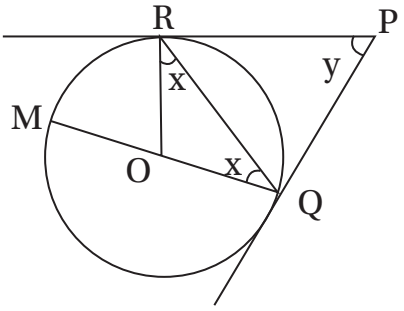
$\therefore\ \angle QRP + \angle QRP + \angle QPR = 180^0$

$\Rightarrow 90^0 - x + 90^0 - x + y = 180^0$

$\Rightarrow y = 2x$

$\Rightarrow \angle QPR = 2\angle RQM$

66. Ⓑ



In ΔABD and ΔCBD,

$\angle ABD = \angle CBD$

$\angle ADB = \angle CDB$

$\therefore \Delta ABD \sim \Delta CBD$

$\therefore \dfrac{AB}{CB} = \dfrac{AD}{CD}$

67. Ⓒ

$$\frac{S_n}{S^1_n} = \frac{3n-13}{5n+21}$$

$$\Rightarrow \frac{\frac{n}{2}\{2a+(n-1)d\}}{\frac{n}{2}\{2a^1+(n-1)d^1\}} = \frac{3n-13}{5n+21}$$

$$\Rightarrow \frac{a+\left(\frac{n-1}{2}\right)d}{a^1+\left(\frac{n-1}{2}\right)d^1} = \frac{3n-13}{5n+21}$$

$$\Rightarrow \frac{a+23d}{a^1+23d^1} = \frac{3\times 47-13}{5\times 47+21} \quad [\text{for } n = 47]$$

$$= \frac{141-13}{235+21} = \frac{\cancel{128}}{\cancel{256}} = \frac{1}{2} = 1:2$$

68. Ⓒ

One root is $3 + \sqrt{5}$

$\therefore$ Other root $= 3 - \sqrt{5}$

$\therefore$ The quadratic equation is

$x^2 - 6x + 4 = 0$

69. Ⓑ

$\frac{x}{4}+\frac{y}{3}=\frac{5}{12}$ $\qquad$ $\frac{x}{2}+y=1$

$\Rightarrow \frac{3x+4y}{12}=\frac{5}{12}$ $\quad \Rightarrow x+2y=2 \quad \Rightarrow 2x+4y=4$

$\Rightarrow 3x+4y=5$

$2x+4y=4$

$(-)\ (-)$

$x=1 \quad \therefore 1+2y=2$

$y=\frac{1}{2}$

$\therefore x+y=1+\frac{1}{2}=\frac{3}{2}$

70. Ⓐ

$8=2^3,\ 15=3\times5,\ 20=2^2\times5,\ 22=2\times11$

$\therefore$ L. C. M. $=2^3\times3\times5\times11=1320$

$\therefore$ 1320 is divisible by 8, 15, 20, 22

but it is not perfect squar.

$\therefore$ The required perfect square number

$=2^4\times9\times25\times121=435600$

71. Ⓓ

$\text{Sin}\,\theta = p, \text{Cos}\,\theta = q$

$$\frac{p-2p^3}{2q^3-q}=\frac{p(1-2p^2)}{q(2q^2-1)}$$

$$=\frac{\text{Sin}\theta(1-2\sin^2\theta)}{\text{Cos}\theta(2\cos^2\theta-1)}$$

$$=\frac{\sin\theta(\cos^2\theta+\sin^2\theta-2\sin^2\theta)}{\cos\theta(2\cos^2\theta-\sin^2\theta-\cos^2\theta)}$$

$$=\frac{\sin\theta(\cancel{\cos^2\theta-\sin^2\theta})}{\cos\theta(\cancel{\cos^2\theta-\sin^2\theta})}=\tan\theta$$

72. Ⓐ

$x = y$

$(\sec A + \tan A)(\sec B + \tan B)(\sec C + \tan C)$

$= (\sec A - \tan A)(\sec B - \tan B)(\sec C - \tan C)$

$= K$ (let)

$\therefore\ K^2 = (\sec^2 A - \tan^2 A)(\sec^2 B - \tan^2 B)(\sec^2 C - \tan^2 C)$

$= 1 \times 1 \times 1 = 1$

$\therefore\ K = \pm 1$

$\therefore\ x = y = \pm 1$

73. Ⓐ

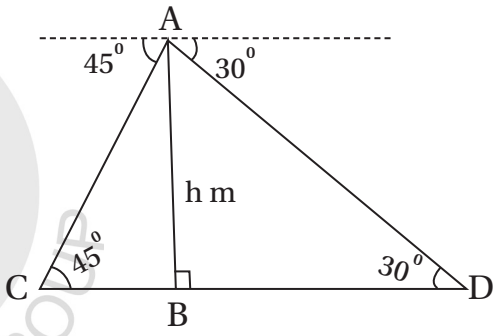
$\frac{BC}{h\,m} = \cot 45^0 = 1$

$\Rightarrow BC = h\,m$

$\frac{BD}{h\,m} = \cot 30^0 = \sqrt{3}$

$\therefore BD = \sqrt{3}\,h\,m$

$\therefore CD = (h + \sqrt{3}\,h)\,m = (\sqrt{3}+1)\,h\,m$



74. Ⓐ

Let $DE = x\,m$

$\therefore\ BC = x\,m$

$\therefore\ AB = (60 - x)\,m$

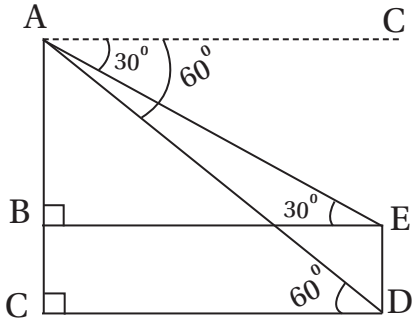
$\therefore\ \frac{BE}{AB} = \cot 30^0$

$\Rightarrow\ BE = (60 - x)\ \sqrt{3}\,m$

$\therefore\ CD = (60 - x)\ \sqrt{3}\,m$

Now, $\frac{CD}{AC} = \cot 60^0$

$\Rightarrow\ \frac{(60-x)\sqrt{3}}{60} = \frac{1}{\sqrt{3}}$

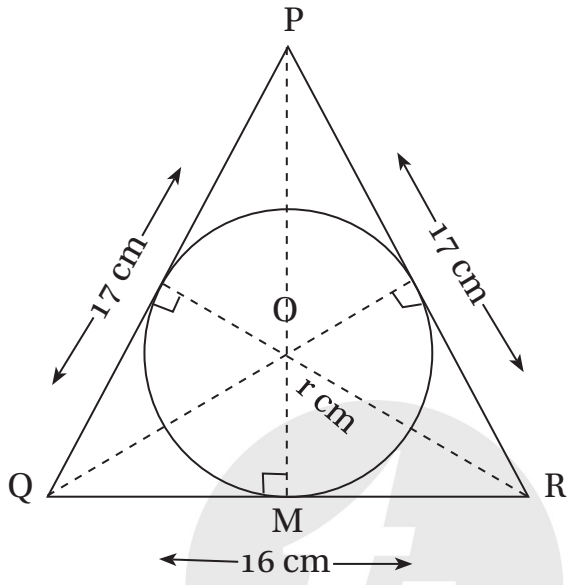


$\Rightarrow$ $180 - 3x = 60$

$\Rightarrow$ $3x = 120$

$\Rightarrow$ $x = 40$

75. ©



Area of $\Delta PQR = \frac{1}{2} \times 16 \times \sqrt{(17)^2 - \left(\frac{16}{2}\right)^2}\ cm^2$

$= \frac{1}{2} \times 16 \times \sqrt{(17)^2 - (8)^2}\ cm$

$8 \times \sqrt{25 \times 9}\ cm^2$

$= 8 \times 5 \times 3\ cm^2 = 120\ cm^2$

Again, area of $\Delta PQR = \left[\frac{1}{2} \times 16 \times r + \frac{1}{2} \times 17 \times r + \frac{1}{2} \times 17 \times r\right] cm^2$

$= \frac{1}{\cancel{2}} \times r \times {}^{25}\cancel{50}\ cm^2$

$= 25\,r\ m^2$

$\therefore$ $25\,r = 120$

$\Rightarrow$ $r = \frac{\cancel{120}^{24}}{\cancel{25}_{5}} = 4.8$

$\therefore$ radius = 4.8 cm.

76. Ⓒ

Bryophyllum

77. Ⓒ

Triploid

78. Ⓑ

Ovule

79. Ⓓ

Placenta

80. Ⓐ

Outgrowth develops earlier than nuclear division

81. Ⓐ

Blastocyst

82. Ⓒ

Virus

83. Ⓐ

Both A and R are true and R is the correct explanation of A

84. Ⓑ

Both A and R are true but R is not the correct explanation of A

85. Ⓐ

Both A and R are true and R is the correct explanation of A

86. Ⓓ

A is false but R is true

87. Ⓐ

Binary fission in *Amoeba*

88. Ⓒ

II & III

89. Ⓒ

Division of nucleus + Division of cytoplasm

90. Ⓓ

It has a whip-like flagellum at one end

91. Ⓓ

Vitamins

92. Ⓓ

All of the above

93. Ⓑ

Gall bladder

94. Ⓐ

Nasal cavity

95. Ⓐ

Pons

96. Ⓐ

Unicellular algae, bacteria and *Amoeba*

97. Ⓒ

Multiple fission in *Plasmodium*

98. Ⓒ

X- Vegetative propagule; Y- Node

99. Ⓓ

II & IV

100. Ⓓ

Ovary