

FUTA

**POST UTME SOLUTION
MANUAL**

MATHEMATICS

**BROUGHT TO YOU BY SKILLZ
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MATHEMATICS

1. Green = 8, blue = 4, white balls = 3
Total no of balls = $8 + 4 + 3 = 15$
after removing 1 green and 1 blue ball,
Green balls = 7
blue balls = 3
white balls = 3
Total no of balls = $7 + 3 + 3 = 13$
Prob. of blue ball = $\frac{\text{no of blue balls}}{\text{total no of balls}}$
 $= \frac{3}{3 + 7 + 3} = \frac{3}{13}$

Option A

2. $7r + 8 = 618$
 $7 \cdot 8^2 + r \cdot 8^2 + 7 \cdot 8^0 = 6 \cdot 9^2 + 1 \cdot 9^2 + 8 \cdot 9^0$
 $7 \cdot 64 + r \cdot 8 + 7 \cdot 1 = 6 \cdot 81 + 1 \cdot 9 + 8 \cdot 1$
 $448 + 8r + 7 = 486 + 9 + 8$
 $8r + 455 = 503$
 $8r = 503 - 455$
 $8r = 48$
 $r = \frac{48}{8} = 6$

Option C

3. $\left(\frac{3}{4} \cdot \frac{4}{9} + \frac{9}{2}\right) \cdot \frac{5}{19}$
 $= \left(\frac{3}{4} \cdot \frac{4}{9} + \frac{19}{2}\right) \cdot \frac{24}{19}$
 $= \left(\frac{3}{4} \cdot \frac{4}{9} + \frac{19}{2}\right) \cdot \frac{19}{24}$
 $= \frac{1}{3} \cdot \frac{2}{19} \cdot \frac{19}{24}$
 $= \frac{1}{3} \cdot \frac{1}{12} = \frac{1}{36}$

Option C

4. Actual = 1.25m
measured = 1.27m
% Error = $\frac{\text{Actual} - \text{Measured}}{\text{Actual}} \cdot 100\%$
 $= \frac{1.25 - 1.27}{1.25} \cdot 100\%$
 $= \frac{-0.02}{1.25} \cdot 100\% = 1.6\%$

Option A

5. $P = N600, I = N25, T = 5 \text{ years}$
 $I = \frac{PRT}{100}$
 $25 = \frac{100 \cdot 5}{100}$
 $R = \frac{PT}{100} = \frac{100 \cdot 25}{500 \cdot 5}$
 $R = \frac{2500}{2500} = 1\%$

Option B

6. $p:q = \frac{2}{3} : \frac{1}{6}$
 $\frac{p}{q} = \frac{2}{3} \div \frac{1}{6}$

$$\frac{p}{q} = \frac{2}{3} \div \frac{1}{6}$$

$$\frac{p}{q} = \frac{2}{3} \cdot \frac{6}{1}$$

$$\frac{p}{q} = 4$$

$$p = 4q$$

$$q:r = \frac{3}{4} : \frac{1}{2}$$

$$\frac{q}{r} = \frac{3}{4} \div \frac{1}{2}$$

$$\frac{q}{r} = \frac{3}{4} \cdot \frac{2}{1}$$

$$\frac{q}{r} = \frac{3}{2}$$

$$q = \frac{3}{2}r$$

$$r = \frac{2q}{3}$$

$$p:q:r$$

$$= 4q : \frac{3}{2}r : \frac{2q}{3}$$

$$= 4 \cdot \frac{3}{2}r : \frac{3}{2}r : \frac{2}{3} \cdot \frac{3}{2}r \quad (\text{multiplying through by } 3)$$

$$= 6r : \frac{3}{2}r : r$$

Option A

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

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

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

$$= \left(\frac{3}{2}\right)^{-1} \cdot \frac{1}{4}$$

$$= \frac{2}{3} \cdot \frac{1}{4} = \frac{1}{6}$$

Option C

8. $\log 2 = 0.3010, \log 7 = 0.8451$
 $\log 224 = \log(32 \cdot 7)$
 $= \log 2^5 + \log 7$
 $= 5 \log 2 + \log 7$
 $= 5(0.3010) + 0.8451$
 $= 1.505 + 0.8451$
 $= 2.3501$

Option B

9. $\frac{2\sqrt{5} + \sqrt{7}}{\sqrt{7} - \sqrt{5}}$
 $= \frac{2\sqrt{5} + \sqrt{7}}{\sqrt{7} - \sqrt{5}} \cdot \frac{\sqrt{7} + \sqrt{5}}{\sqrt{7} + \sqrt{5}} \quad (\text{rationalizing})$
 $= \frac{(2\sqrt{5} + \sqrt{7})(\sqrt{7} + \sqrt{5})}{(\sqrt{7})^2 - (\sqrt{5})^2}$
 $= \frac{2\sqrt{35} + 2 \cdot 5 + 7 + \sqrt{35}}{7 - 5}$
 $= \frac{10 + 7 + 2\sqrt{35} + \sqrt{35}}{2}$

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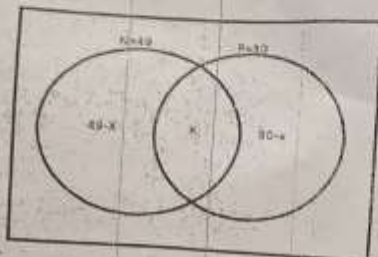
$$= \frac{17 + 3\sqrt{35}}{2}$$

10. 0.31×0.34
 $= 0.1054$
 $= 1.054 \times 10^{-1}$

Option D

11. $n(U) = 60$
 $n(N) = 49$
 $n(P) = 30$

Option A



$$n(N \cap P) = x$$

$$x + 49 - x + 30 - x = 60$$

$$79 - x = 60$$

$$x = 79 - 60 = 19$$

Don't be shocked, the provided options are not right. If you got this answer, you are cool.

12. $P = \frac{M}{5}(X + R^2) + 2$

$$\frac{M}{5}(X + R^2) = P - 2$$

$$M(X + R^2) = 5(P - 2)$$

$$MX + MR^2 = 5P - 10$$

$$MR^2 = 5P - 10 - XM$$

$$R^2 = \frac{5P - 10 - XM}{M}$$

$$R = \sqrt{\frac{5P - 10 - XM}{M}}$$

Option D and C

13. If $9x^2 + 6xy + 4y^2$ is a factor of $27x^3 - 8y^3$, then the other factor is obtained by long division

$$\begin{array}{r} 9x^2 + 6xy + 4y^2 \overline{) 27x^3 + 0x^2y + 0xy^2 - 8y^3} \\ \underline{27x^3 + 18x^2y + 12xy^2} \\ -18x^2y - 12xy^2 - 8y^3 \\ \underline{-18x^2y - 12xy^2 - 8y^3} \\ 0 \end{array}$$

Factor = $3x - 2y$

Option D

14. $\frac{x^3 + 2x^2 - 15x}{2x^2 - 18}$
 $= \frac{x(x^2 + 2x - 15)}{2(x^2 - 9)}$
 $= \frac{x(x-3)(x+5)}{2(x-3)(x+3)}$
 $= \frac{x(x+5)}{2(x+3)}$

Option B

15. $x - y = 3$ ----- 1
 $x^2 - y^2 = 9$ ----- 2
 $(x-y)(x+y) = 9$ (diff. of two squares)
since $(x-y) = 3$
 $3(x+y) = 9$
 $x+y = \frac{9}{3} = 3$
adding 1 and 2
 $x - y + x + y = 3 + 3$
 $2x = 6$
 $x = 3$
substituting in 1
 $x - y = 3$
 $3 - y = 3$
 $y = 3 - 3 = 0$
 $(x, y) = (3, 0)$

Option D and C

16. $y \propto \sqrt{x}$
 $y = k\sqrt{x}$
 $k = \frac{y}{\sqrt{x}}$
 $k = \frac{3}{\sqrt{25}} = \frac{3}{5}$
 $y = \frac{3}{5}\sqrt{x}$

at $y = 3, x = 25$

at $x = 100$
 $y = \frac{3}{5}\sqrt{100} = \frac{3}{5} \cdot 10 = 3 \cdot 2 = 6$

Option D

17. $x \propto \frac{1}{y} \therefore x = \frac{k}{y}$

$$k = xy$$

at $x = 3, \frac{1}{2} = \frac{7}{2}, y = 2$

$$k = \frac{7}{2} \cdot 2 = 7$$

$$x = \frac{7}{y}$$

at $y = 4$

$$x = \frac{7}{4} = 1\frac{3}{4}$$

Option C

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$$18. \frac{1}{3}x + \frac{1}{4} > \frac{1}{4}x + \frac{1}{3}$$

$$\frac{1}{3}x - \frac{1}{4}x > \frac{1}{3} - \frac{1}{4}$$

$$\frac{4x - 3x}{12} > \frac{2 - 1}{4}$$

$$\frac{x}{12} > \frac{1}{4}$$

$$x > \frac{12}{4}$$

$$x > 3$$

Option B

$$19. -6 \leq 4 - 2x \leq 5 - x$$

splitting the equations

$$-6 \leq 4 - 2x \quad 4 - 2x \leq 5 - x$$

$$-6 - 4 \leq -2x \quad 4 - 5 < -x + 2x$$

$$-10 \leq -2x \quad -1 < x$$

$$\frac{-10}{-2} \leq \frac{-2x}{-2}$$

$$5 \geq x$$

$$x \leq 5$$

combining the two solutions,

$$\text{ans} = -1 < x \leq 5$$

Option D

$$20. 0.2 + 0.02 + 0.002 + 0.0002 + \dots$$

$$a = 0.2, r = \frac{0.02}{0.2}$$

$$S_{\infty} = \frac{a}{1-r}$$

$$= \frac{0.2}{1-0.1} = \frac{0.2}{0.9}$$

$$= \frac{2}{9}$$

Option B

$$21. 3\text{rd term} = a + 2d = -8 \quad -1$$

$$7\text{th term} = a + 6d = -28 \quad -1$$

subtracting 1 from 2

$$a + 6d - (a + 2d) = -28 - (-8)$$

$$a - a + 6d - 2d = -28 + 8$$

$$4d = -20$$

$$d = \frac{-20}{4} = -5$$

substituting d in 1

$$a + 2d = -8$$

$$a + 2(-5) = -8$$

$$a - 10 = -8$$

$$a = -8 + 10$$

$$a = 2$$

$$10\text{th term} = a + 9d$$

$$= 2 + 9(-5)$$

$$= 2 - 45$$

$$= -43$$

Option A

$$22. x \cdot y = x - y^2$$

$$2 \cdot 3 = 2 - 3^2$$

$$= 2 - 9 = -7$$

$$(2 \cdot 3) \cdot 5 = -7 \cdot 5$$

$$= -7 - 5^2$$

$$= -7 - 25$$

$$= -32$$

Option C

$$23. 16(p+q) = (16+p)q$$

$$16p + 16q = 16q + pq$$

$$16p + 16q - 16q = pq$$

$$16p = pq$$

$$\frac{16p}{p} = \frac{pq}{p}$$

$$16 = q$$

Option D

$$24. \frac{x}{3} - \frac{4}{2} = 9$$

$$(x-7) = 18 + 4$$

$$7x = 12$$

$$x = \frac{12}{7}$$

Option D

$$25. \begin{vmatrix} 1 & 0 & 6 \\ 5 & 7 & 4 \\ 9 & 0 & 2 \end{vmatrix} = 3 \begin{vmatrix} 7 & 4 \\ 0 & 2 \end{vmatrix} - 0 \begin{vmatrix} 5 & 4 \\ 9 & 2 \end{vmatrix} + 6 \begin{vmatrix} 5 & 7 \\ 9 & 0 \end{vmatrix}$$

$$= 3(7 \cdot 2 - 0 \cdot 4) - 0(5 \cdot 2 - 9 \cdot 4)$$

$$+ 6(5 \cdot 0 - 9 \cdot 7)$$

$$= 3(14 - 0) - 0 + 6(0 - 63)$$

$$= 42 - 378$$

$$= -336$$

Option A

26. Area of frame = Total area of shape - area of picture

$$A = \left(8 + \frac{1}{2} + \frac{1}{2}\right) \cdot \left(6 + \frac{1}{2} + \frac{1}{2}\right) - (8 \cdot 6)$$

$$= (9 \cdot 7) - (8 \cdot 6)$$

$$= 63 - 48$$

$$= 15\text{cm}^2$$

Option A

27. The word "area" was intended to be "sum"

i.e sum of $3\frac{7}{8}$ and $1\frac{1}{3}$

$$\text{sum} = 3\frac{7}{8} + 1\frac{1}{3}$$

$$= \frac{31}{8} + \frac{4}{3} = \frac{93 + 32}{24}$$

$$= \frac{125}{24}$$

Difference between $\frac{3}{8}$ and $1\frac{2}{3}$

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$$= \frac{5}{3} - \frac{3}{8} = \frac{40-9}{24} = \frac{31}{24}$$

$$\text{Difference} = \frac{125}{24} - \frac{31}{24} = \frac{94}{24} = \frac{47}{12}$$

Option A

$$\begin{aligned} 28. (x+3y+5)(2x^2+5y+2) \\ = [x \cdot 2x^2 + x \cdot 5y + x \cdot 2 + 3y \cdot 2x^2 + 3y \cdot 5y + 3y \cdot 2 \\ + 5 \cdot 2x^2 + 5 \cdot 5y + 5 \cdot 2] \\ = 2x^3 + 3xy + 2x + 6x^2y + 15y^2 + 6y + 10x^2 + 25y + 10 \\ = 2x^3 + 6x^2y + 5xy + 15y^2 + 31y + 2x + 10 \end{aligned}$$

Option B

$$29. a = 1, r = \frac{1}{2} \Rightarrow x$$

$$S_n = \frac{a}{1-r}$$

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

Option A

$$30. x^2 + 4 = 0$$

$$x^2 = -4$$

$$x = \sqrt{-4}$$

$$= \sqrt{4} \cdot \sqrt{-1}$$

$$= 2i$$

Option C

31. five years ago

$$\text{father's age} = x - 5$$

$$\text{son's age} = y - 5$$

$$x - 5 = 3(y - 5)$$

$$x - 5 = 3y - 15$$

$$x - 3y = -10$$

Now!

$$x + y = 110$$

subtracting 2 from 1

$$x - 3y - (x + y) = -10 - 110$$

$$x - x - 3y - y = -120$$

$$-4y = -120$$

$$y = \frac{-120}{-4} = 30 \text{ years}$$

in 2

$$x + y = 110$$

$$x + 30 = 110$$

$$x = 110 - 30 = 80 \text{ years}$$

Father's age is 80 years. beware of Option D

$$32. y = 2x^2 + 9x - 35$$

$$y < 0$$

$$2x^2 + 9x - 35 < 0$$

$$2x^2 + 14x - 5x - 35 < 0$$

$$2x(x+7) - 5(x+7) < 0$$

$$(2x-5)(x+7) < 0$$

$$*(2x-5) < 0 \quad (x+7) > 0$$

$$x < \frac{5}{2} \text{ or } x > -7$$

MATHEMATICS

$$* 2x < 5$$

$$x < \frac{5}{2}$$

$$x > -7$$

$$-7 < x$$

$$-7 < x < \frac{5}{2}$$

Option D

$$\begin{aligned} * 33. \text{cost of living} &= x \\ \text{quantity of food} &= y \\ \text{food bill} &= \text{cost} \cdot \text{quantity of food} \\ \text{food bill} &= xy \\ 15\% \text{ increase in } x &= x + 15\%x \\ &= x + \frac{15}{100}x \\ &= \frac{115}{100}x \\ 10\% \text{ decrease in } y &= y - 10\%y \\ &= y - \frac{10}{100}y \\ &= \frac{90}{100}y \\ &= \frac{9}{10}y \end{aligned}$$

10% decrease

$$\text{new food bill} = \frac{115}{100}x \cdot \frac{9}{10}y$$

$$= \frac{115 \cdot 9}{100 \cdot 10}xy$$

$$\text{increase in food bill} = \frac{115 \cdot 9}{100 \cdot 10}xy - xy$$

$$= \frac{115 \cdot 9 - 100 \cdot 10}{100 \cdot 10}xy$$

$$\text{fractional increase} = \frac{115 \cdot 9 - 100 \cdot 10}{100 \cdot 10}xy + xy$$

$$= \frac{115 \cdot 9 - 100 \cdot 10}{100 \cdot 10}xy + xy$$

Option D

$$* 34. a + b = ab + b + a$$

$$a \cdot c = ac + c + a$$

$$\text{if } a^0c = 1 + b + a$$

$$(a \cdot b)(a \cdot c) = 1 + ab + b + a + a + ac + c + a$$

$$= ac + ab + 2a + b + c + 1$$

Option C

$$35. \text{sum of angles in a quadrilateral} = 360^\circ$$

$$p + 10 + p - 30 + 2p - 45 + p + 35 = 360$$

$$p + p + 2p + p + 10 - 30 - 45 + 35 = 360$$

$$5p - 30 = 360$$

$$5p = 390$$

$$p = \frac{390}{5} = 78^\circ$$

Option A

$$36. \frac{a-b}{a+b} = \frac{a+b}{a-b}$$

$$= \frac{(a-b)^2 - (a+b)^2}{(a+b)(a-b)}$$

$$= \frac{a^2 - 2ab + b^2 - (a^2 + 2ab + b^2)}{(a+b)(a-b)}$$

$$= \frac{a^2 - 2ab + b^2 - a^2 - 2ab - b^2}{a^2 - b^2}$$

$$= \frac{-4ab}{a^2 - b^2} = -\frac{4ab}{a^2 - b^2}$$

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$$= \frac{-4ab}{a^2 - b^2}$$

$$37. y = x^2 - 6x + 5$$

Option B

at minimum point, $\frac{dy}{dx} = 0$

$$\frac{dy}{dx} = 2x - 6 = 0$$

$$2x = 6$$

$$x = \frac{6}{2} = 3$$

$$y = x^2 - 6x + 5$$

$$= 3^2 - 6(3) + 5$$

$$= 9 - 18 + 5$$

$$x, y = 3, -4$$

Option B

$$38. 3x - \frac{1}{4} > \frac{1}{4} - x$$

$$3x + x > \frac{1}{4} + \frac{1}{4}$$

$$4x > \frac{1}{2}$$

$$x > \frac{1}{2} \times \frac{1}{4}$$

$$x > \frac{1}{8}$$

This procedure is correct; the options are not valid. If you got that answer, then you're cool.

39. The parameters provided and the pattern of the question is not sufficient to determine the solution to the question.

40. Considering the options, they are all the same values arranged differently. Simply identify the mode and get the correct arrangement.

Mode = 1 (occurring 5x)

Arrangement = 1.8, 1.5 and 1

Option B

$$41. \sec^2 \phi + \tan^2 \phi = 3$$

Recall that $\sec^2 \phi = 1 + \tan^2 \phi$

$$1 + \tan^2 \phi + \tan^2 \phi = 3$$

$$1 + 2\tan^2 \phi = 3$$

$$2\tan^2 \phi = 3 - 1$$

$$2\tan^2 \phi = 2$$

$$\tan^2 \phi = 1$$

$$\tan \phi = 1$$

$$\phi = \tan^{-1} 1 = 45^\circ$$

Option C

$$42. x^2 - y - 1 = 0$$

$$x^2 - 1 = y \text{ ----- } 1$$

$$y - 2x + 2 = 0$$

$$y = 2x - 2 \text{ ----- } 2$$

Equating the y

$$x^2 - 1 = 2x - 2$$

$$x^2 - 2x - 1 + 2 = 0$$

$$x^2 - 2x + 1 = 0$$

$$x^2 - x - x + 1 = 0$$

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

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

$$x - 1 = 0$$

$$x = 1$$

in 1

$$y = x^2 - 1$$

$$y = 1^2 - 1$$

$$y = 1 - 1 = 0$$

$$x, y = 1, 0$$

Option A

43. From Hero's Formula

$$A = \frac{\sqrt{s(s-a)(s-b)(s-c)}}{2}$$

only triangles with SAME SIDES can have equal areas.

Option B

$$44. 5^{2x-1} = 64 \left(\frac{5}{2}\right)^6$$

$$5^{2x-1} = 64 \left(\frac{5^6}{2^6}\right)$$

$$5^{2x-1} = 5^6$$

$$2x - 2 = 6$$

$$2x = 6 + 2$$

$$2x = 8$$

$$x = \frac{8}{2} = 4$$

Option B

$$45. AC^2 = AD^2 + DC^2$$

$$10^2 = x^2 + 5^2$$

$$x^2 = 10^2 - 5^2$$

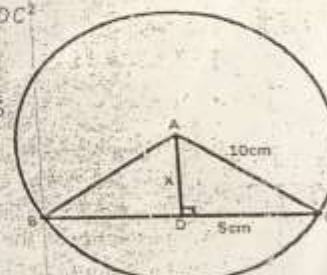
$$x^2 = 100 - 25$$

$$x^2 = 75$$

$$x = \sqrt{75}$$

$$x = 8.66 \text{ cm}$$

Option B



46. The easiest solution is to test the options with the given conditions.

test with 8

$$50 \div 8 = 6 \text{ rem } 2$$

$$60 \div 8 = 7 \text{ rem } 4$$

$$70 \div 8 = 8 \text{ rem } 6$$

$$80 \div 8 = 10 \text{ rem } 0$$

since only 70 passed the test with 8, we proceed to test with 9

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$$70 \div 9 = 7 \text{ rem } 7$$

Option B

$$\begin{aligned} 47. \int_0^{\frac{\pi}{4}} \sec^2 \theta d\theta &= [\tan \theta]_0^{\frac{\pi}{4}} \\ &= \tan \frac{\pi}{4} - \tan 0 \\ &= 1 - 0 = 1 \end{aligned}$$

Option C

$$\begin{aligned} 48. \% \text{profit} &= \frac{SP - CP}{CP} \times 100\% \\ \% \text{profit} &= 8\% \text{ S.P.} = 81 \\ \frac{81 - CP}{CP} &= \frac{8}{100} \\ 100(81 - CP) &= 8CP \\ 8100 - 100CP &= 8CP \\ 8100 &= 108CP + 8CP \\ 8100 &= 108CP \\ CP &= \frac{8100}{108} = 75 \end{aligned}$$

Option C

$$\begin{aligned} 49. 10x^2 - 13x - 3 &= 0 \\ 10x^2 - 15x + 2x - 3 &= 0 \\ 10x^2 + 2x - 15x - 3 &= 0 \\ 2x(5x + 1) - 3(5x + 1) &= 0 \\ (2x - 3)(5x + 1) &= 0 \\ 2x - 3 &= 0 & 5x + 1 &= 0 \\ 2x &= 3 & 5x &= -1 \\ x &= \frac{3}{2} & x &= -\frac{1}{5} \end{aligned}$$

$$x = -\frac{1}{5} \text{ or } \frac{3}{2}$$

Option B

50. Rearranging,

4, 4, 7, 7, 9, 10, 13, 14

$$\text{median} = \frac{7 + 9}{2} = 8$$

otherwise, 4, 9, 4, 13, 7, 14, 10, 7

$$\text{median} = \frac{13 + 7}{2} = 10$$

As the solution in the second part opposes normal procedure of finding median, discretion is advised.

$$-1 < x - 5 \leq 5$$

Separating the equation

$$-1 < 2x - 5$$

$$-1 + 5 < 2x$$

$$4 < 2x$$

$$\frac{4}{2} < \frac{2x}{2}$$

$$2 < x$$

$$2 < x$$

$$\text{range} = 2 < x \leq 5$$

$$2x - 5 \leq 5$$

$$2x \leq 5 + 5$$

$$2x \leq 10$$

$$\frac{2x}{2} \leq \frac{10}{2}$$

$$x \leq 5$$

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satisfying values include 3, 4, 5

Option C

52. Option B

$$53. \text{cost} = \text{N}400$$

$$\text{woman} = 10\% \text{ of cost}$$

$$= \frac{10}{100} \times 400 = \text{N}40$$

$$\text{remainder} = 400 - 40 = \text{N}360$$

$$\text{man} = 40\% \text{ of remainder}$$

$$= \frac{40}{100} \times 360$$

$$= \text{N}144$$

$$\text{Total amount they both have} = 40 + 144 = \text{N}184$$

Option C

$$\begin{aligned} 54. \frac{\log_{10} 8}{\log_{10} 4} &= \frac{\log_{10} 2^3}{\log_{10} 2^2} \\ &= \frac{3 \log_{10} 2}{2 \log_{10} 2} \\ &= \frac{3}{2} \end{aligned}$$

Option C

$$55. y = \frac{4x}{9} + 1 \text{ ----- } 1$$

$$z = \frac{4y}{9} + 1 \text{ ----- } 2$$

$$x = 99$$

substituting in 1

$$y = \frac{4x}{9} + 1 = \frac{4(99)}{9} + 1$$

$$= 4(11) + 1$$

$$= 44 + 1$$

$$y = 45$$

substituting for y in 2

$$z = \frac{4y}{9} + 1 = \frac{4(45)}{9} + 1$$

$$= 4(5) + 1 = 21$$

Option C

$$56. n_A = 35 \quad \bar{x}_A = 60$$

$$n_B = 40 \quad \bar{x}_B = 52.5$$

$$\bar{x} = \frac{\sum fx}{n}$$

$$\text{Mean score} = \frac{\text{Total score}}{\text{no of students}}$$

$$\sum fx = \bar{x}n$$

$$\sum fx_A = \bar{x}_A n_A$$

$$= 60 \times 35 = 2100$$

$$\sum fx_B = \bar{x}_B n_B$$

$$= 40 \times 52.5$$

$$= 2100$$



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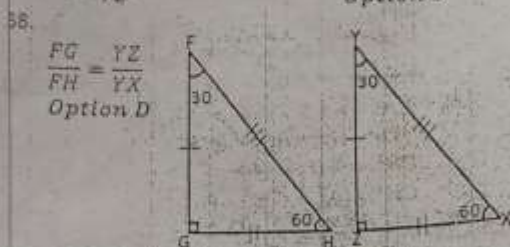
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$$\begin{aligned} \text{combined mean} &= \frac{\Sigma fx_A + \Sigma fx_B}{n_A + n_B} \\ &= \frac{2100 + 2100}{35 + 40} = \frac{4200}{75} = 56.0 \end{aligned}$$

Option B

$$\begin{aligned} 57. x^\circ &= \frac{\text{no of items}}{\text{total no items}} \times 360^\circ \\ &= \frac{26}{130} \times 360^\circ \\ &= 72^\circ \end{aligned}$$

Option D



59. let the unknown angle be x

$$\begin{aligned} x + x + x + x + 60 &= (n-2)180 \\ \text{for pentagon } n &= 5 \\ 4x + 60 &= (5-2)180 \\ 4x + 60 &= 3(180) \\ 4x &= 540 - 60 \\ 4x &= 480 \\ x &= \frac{480}{4} = 120^\circ \end{aligned}$$

Option C

60. $\left(\frac{x^a}{x^b}\right)^{a+b} + \left(\frac{x^{a+b}}{x^{a-b}}\right)^{\frac{a^2}{b^2}}$

$$\begin{aligned} &= \left(\frac{x^a}{x^b}\right)^{a+b} + \left(\frac{x^{a+b}}{x^{a-b}}\right)^{\frac{a^2}{b^2}} \\ &= (x^{a-b})^{a+b} + (x^{a-b-a+b})^{\frac{a^2}{b^2}} \\ &= x^{(a-b)(a+b)} + (x^{(a-b-a+b)})^{\frac{a^2}{b^2}} \\ &= x^{a^2-b^2} + (x^{-2b^2})^{\frac{a^2}{b^2}} \\ &= x^{a^2-b^2} + x^{-2a^2} \\ &= x^{a^2-b^2} = x^{-(a^2+b^2)} = \frac{1}{x^{(a^2+b^2)}} \end{aligned}$$

Option C

61. $kx^2 - 4x + 1 = 0$

for a quadratic equation to have equal roots $b^2 = 4ac$

$$\begin{aligned} a &= k, b = -4, c = 1 \\ (-4)^2 &= 4 \cdot k \cdot 1 \\ 16 &= 4k \end{aligned}$$

62. $k = \frac{16}{4} = 4$

$$\begin{aligned} 5^{x+1} + 5^x &= 150 \\ 5^x \cdot 5^1 + 5^x &= 150 \\ 5(5^x) + 5^x &= 150 \\ (5+1)5^x &= 150 \\ 6 \cdot 5^x &= 150 \\ 5^x &= \frac{150}{6} = 25 \\ 5^x &= 5^2 \\ x &= 2 \end{aligned}$$

Option C

63. $2^x + y = 32$
 $2^x + y = 2^5$
 $x + y = 5$
adding 1 and 2
 $x + y + y = 5 + 3$
 $2y = 8$
 $y = 4$
substituting in 1
 $x + 4 = 5$
 $x = 5 - 4 = 1$
 $x, y = 1, 4$

Option A

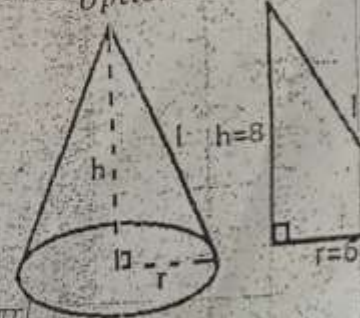
rationalizing the denominator

$$\begin{aligned} &= \frac{1 - \cos \theta}{\sqrt{1 + \cos \theta}} \\ &= \frac{(1 - \cos \theta)(1 - \cos \theta)}{\sqrt{(1 + \cos \theta)(1 - \cos \theta)}} \\ &= \frac{(1 - \cos \theta)(1 - \cos \theta)}{\sqrt{1 - \cos^2 \theta}} \\ &= \frac{(1 - \cos \theta)^2}{\sqrt{1 - \cos^2 \theta}} \\ \sin^2 \theta + \cos^2 \theta &= 1 \\ &= \frac{(1 - \cos \theta)^2}{\sin^2 \theta} \\ &= \frac{1 - \cos \theta}{\sin \theta} \end{aligned}$$

65. $l^2 = h^2 + r^2$

$$\begin{aligned} &= 8^2 + 6^2 \\ &= 64 + 36 \\ l^2 &= 100 \\ l &= \sqrt{100} = 10 \end{aligned}$$

Option A



CSA of cone = πrl

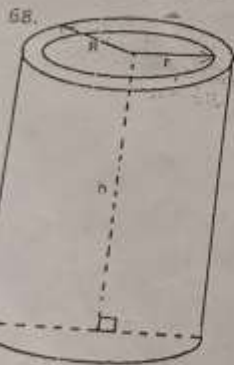
$$\begin{aligned} &= 3.142 \cdot 6 \cdot 10 \\ &= 188.57 \text{ cm}^2 \end{aligned}$$

Option B

Xpress SOLUTIONS

66. $x^3 - 4x^2 + cx + d$
 If $x + 1$ is a factor,
 $x + 1 = 0$
 $x = -1$ is a root, remainder = 0
 substituting $x = -1$ in eqn
 $x^3 - 4x^2 + cx + d = 0$
 $(-1)^3 - 4(-1)^2 + c(-1) + d$
 $-1 - 4 - c + d = 0$
 $-c + d = 5$ ----- 1
 when $x = -1$ remainder = 1
 $x^3 - 4x^2 + cx + d = 1$
 $(-2)^3 - 4(-2)^2 + c(-2) + d = 1$
 $-8 - 16 - 2c + d = 1$
 $-2c + d = 1 + 8 + 16$
 $-2c + d = 25$ ----- 2
 subtracting 1 from 2
 $(-2c + d) - (-c + d) = 25 - 5$
 $-2c + d + c - d = 20$
 $-c = 20$
 $c = -20$
 substituting for c in 1
 $-c + d = 5$
 $-(-20) + d = 5$
 $20 + d = 5$
 $d = 5 - 20 = -15$
 $c, d = -20, -15$

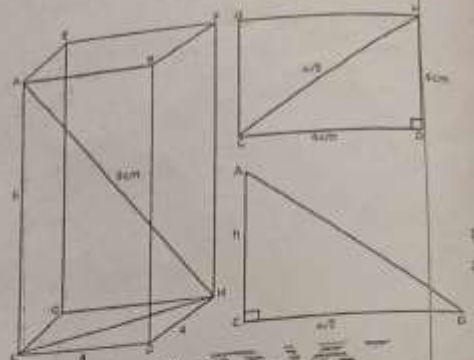
67. $f(x+1) = 3x^2 - x + 4$
 for $f(0), x + 1 = 0$
 $x = -1$
 $f(0) = 3(-1)^2 - (-1) + 4$
 $= 3 + 1 + 4$
 $= 8$



68. $D = 10, R = \frac{10}{2} = 5$
 $t = 2 \text{ cm}$
 $r = R - t = 5 - 2$
 $= 3 \text{ cm}$
 $\text{vol.} = \pi(R^2 - r^2)h$
 $= \frac{22}{7}(5^2 - 3^2) \cdot 12$
 $= \frac{22}{7} \cdot 16 \cdot 12$
 $= \frac{4224}{7} \text{ cm}^3$

Option C

Option D



69. diagonal = $AH = 5$
 from the square base $CHDC$,
 $CH^2 = CD^2 + HD^2$
 $CH^2 = 4^2 + 4^2 = 16 + 16$
 $= 32$
 $CH = \sqrt{32} = 4\sqrt{2}$
 considering $\triangle ACH$
 $g^2 = h^2 + (4\sqrt{2})^2$
 $h^2 = 81 - 32$
 $h^2 = 49$
 $h = \sqrt{49} = 7 \text{ cm}$

Option D

70. $x \propto \frac{1}{y}, y \propto \sqrt{z}, z \propto \frac{1}{w^2}$

simply treat the \propto sign as =

$$x = \frac{1}{\sqrt{z}}$$

$$x = \frac{1}{\sqrt{\frac{1}{w^2}}}$$

$$x = \sqrt{\frac{w^2}{1}}$$

$$x = \sqrt{w^2}$$

$$x \propto w$$

Option C

$$71. \frac{\sin^2 x}{1 + \cos x} + \frac{\sin^2 x}{1 - \cos x}$$

$$= \frac{\sin^2 x (1 - \cos x) + \sin^2 x (1 + \cos x)}{(1 + \cos x)(1 - \cos x)}$$

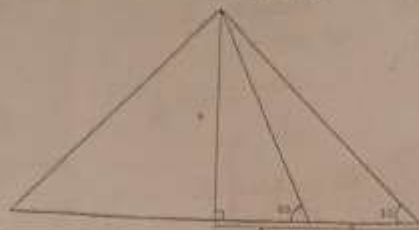
$$= \frac{\sin^2 x (1 - \cos x + 1 + \cos x)}{1 - \cos^2 x}$$

$$= \frac{\sin^2 x (2)}{\sin^2 x} = 2(1)$$

$$= 2$$

Option A

Xpress SOLUTIONS



$$72. \tan 60 = \frac{h}{x}$$

$$x = \frac{h}{\tan 60}$$

$$x = \frac{h}{\sqrt{3}}$$

$$x = \frac{h\sqrt{3}}{3}$$

equating the x's

$$\frac{h\sqrt{3}}{3} = h\sqrt{3} - 8$$

$$\frac{h\sqrt{3}}{3} - h\sqrt{3} = -8$$

$$-\frac{2\sqrt{3}}{3}h = -8$$

$$h = -8 \cdot \frac{-3}{2\sqrt{3}}$$

$$h = \frac{12}{\sqrt{3}} = \frac{12}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}}$$

$$= \frac{12\sqrt{3}}{3} = 4\sqrt{3}$$

$$73. O = 4A = 3B = 3$$

$$\text{total} = 4 + 3 + 3 = 10$$

at the first selection,

$$P(\text{banana}) = \frac{3}{10}$$

at the second selection,

$$P(\text{apple}) = \frac{3}{9}$$

$P(\text{banana})$ and $P(\text{apple})$

$$= P(\text{banana}) \cdot P(\text{apple}) = \frac{3}{10} \cdot \frac{3}{9}$$

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

Option C

$$74. \frac{nP_r}{n-1P_{r-1}} = \frac{n!}{(n-r)!} \div \frac{(n-1)!}{(n-1-(r-1))!}$$

$$= \frac{n!}{(n-r)!} \cdot \frac{(n-1)!}{(n-1-r+1)!}$$

MATHEMATICS

$$= \frac{n!}{(n-r)!} \cdot \frac{(n-1)!}{(n-r)!}$$

$$= \frac{n!}{(n-r)!} \cdot \frac{(n-1)!}{(n-r)!}$$

$$= \frac{n!}{(n-r)!} \cdot \frac{(n-1)!}{(n-r)!} \cdot \frac{2x+1}{1} = 360$$

$$= \frac{n!}{(n-r)!} \cdot \frac{(n-1)!}{(n-r)!} \cdot \frac{2x+1}{1} = 360$$

Option A

$$75. X = \frac{1}{2}, Y = \frac{1}{3}, Z = \frac{1}{4}, X' = 1 - \frac{1}{2} = \frac{1}{2}$$

Y and Z are not X and Y and Z

$$= X' \cdot Y \cdot Z$$

$$= \frac{1}{2} \cdot \frac{1}{3} \cdot \frac{1}{4}$$

$$= \frac{1}{24}$$

Option C

$$76. P = \begin{pmatrix} 2 & 1 \\ 3 & 1 \end{pmatrix}$$

$$|P| = \begin{vmatrix} 2 & 1 \\ 3 & 1 \end{vmatrix} = (2 \cdot 1) - (3 \cdot 1) = -1$$

$$P^{-1} = \frac{1}{|P|} \begin{pmatrix} 1 & -1 \\ -3 & 2 \end{pmatrix}$$

$$= \begin{pmatrix} 1 & -1 \\ -3 & 2 \end{pmatrix} = \begin{pmatrix} 1 & -1 \\ -3 & 2 \end{pmatrix}$$

Option B

$$77. x + 20 + 2x - 45 + x - 15 + 2x + 10 = 30$$

$$x + 2x + x + 2x + 20 + 10 - 45 - 15 = 30$$

$$6x - 30 = 360$$

$$6x = 360 + 30 = 390$$

$$x = \frac{390}{6} = 65^\circ$$

Well, there must have been a typographical error. Option A is our closest shot

78. The smaller sides of a right angle triangle constitute the base and height of the triangle

$$A = \frac{1}{2} b \cdot h$$

$$= \frac{1}{2} \cdot 8 \cdot 9 = 36 \text{ cm}^2$$

Option C

$$79. \theta = 60^\circ r = 6 \text{ cm}$$

$$\text{Area of sector} = \frac{\theta}{360} \pi r^2$$

$$= \frac{60}{360} \cdot \frac{22}{7} \cdot 6^2$$

Option A

$$80. \text{TSA} = \text{CSA} + \text{Area of one circular side}$$

$$= 2\pi rh + \pi r^2$$

Xpress SOLUTIONS

$$= 2\pi + 7 + 40 + \pi + 7^2$$

$$= 560\pi + 49\pi$$

$$= 609\pi$$

Option A

81. the point specified is the mid point

$$M = \frac{P+Q}{2}$$

$$M = \left(\frac{1+2}{2}\right), \left(\frac{4+5}{2}\right)$$

$$M(x_m, y_m) = \left(\frac{3}{2}, \frac{9}{2}\right)$$

$$m_1 = \frac{y_2 - y_1}{x_2 - x_1} = \frac{5 - 4}{2 - 1} = \frac{1}{1} = 1$$

The locus of the points equidistant from P QND Q is a line PERPENDICULAR to PQ

$$m_2 = -\frac{1}{m_1}$$

$$m_2 = -\frac{1}{1} = -1$$

$$m_2 = \frac{y - y_m}{x - x_m}$$

$$-1 = \frac{y - 4.5}{x - 1.5}$$

$$-1(x - 1.5) = y - 4.5$$

$$-x + 1.5 = y - 4.5$$

$$y = -x + 1.5 + 4.5$$

$$y = -x + 6$$

Option D

$$82. dist^2 = \left(-\frac{1}{3} - \frac{2}{3}\right)^2 + \left(-\frac{1}{3} - \frac{2}{3}\right)^2$$

$$= (-1)^2 + (-1)^2$$

$$= 1 + 1 = 2$$

$$dist = \sqrt{2}$$

$$83. m = \frac{y_2 - y_1}{x_2 - x_1}$$

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

Option A

$$84. y = -4x + 2 \quad m_1 = -4$$

for perpendicularity

$$m_1 m_2 = -1$$

$$m_2 = -\frac{1}{m_1}$$

$$m_2 = -\frac{1}{-4} = \frac{1}{4}$$

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

Equation of new line

$$m_2 = \frac{y - y_1}{x - x_1}$$

$$\frac{1}{4} = \frac{y - 2}{x - 3}$$

$$\frac{1}{4} = \frac{y - 2}{x - 3}$$

$$4(y - 2) = x - 3$$

$$4y - 8 = x - 3$$

$$4y - x = -3 + 8$$

MATHEMATICS

$$4y - x = 5$$

$$4y - x - 5 = 0$$

We've got another typo Error. The closest ans is

Option B

$$85. \cot \theta = \frac{7}{15}$$

$$\tan \theta = \frac{1}{\cot \theta} = \frac{1}{\frac{7}{15}}$$

$$= \frac{15}{7}$$

Option B

$$86. y = (2x - 1)^2$$

$$u = 2x - 1$$

$$\frac{du}{dx} = 2$$

$$y = u^2$$

$$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$$

$$= 2u \cdot 2$$

$$= 4u$$

$$= 4(2x - 1)$$

$$= 8x - 4$$

$$= 8x - 4$$

$$= 8x - 4$$

$$= 8x - 4$$

$$= 8x - 4$$

$$= 8x - 4$$

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$$= 8x - 4$$

Option C

$$87. y = x \cos x$$

$$u = x$$

$$\frac{du}{dx} = 1$$

$$\frac{dy}{dx} = u \frac{dv}{dx} + v \frac{du}{dx}$$

$$= x(-\sin x) + \cos x(1)$$

$$= -x \sin x + \cos x$$

$$= -x \sin x + \cos x$$

$$= -x \sin x + \cos x$$

$$= -x \sin x + \cos x$$

$$= -x \sin x + \cos x$$

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$$= -x \sin x + \cos x$$

$$= -x \sin x + \cos x$$

$$v = \cos x$$

$$\frac{dv}{dx} = -\sin x$$

$$\frac{dv}{dx} = -\sin x$$

$$\frac{dv}{dx} = -\sin x$$

$$\frac{dv}{dx} = -\sin x$$

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$$\frac{dv}{dx} = -\sin x$$

Option B

88. the proper quadratic equation is

$$y = -3 + 2x + x^2 \text{ not } 3x + 2x + x^2$$

$$\frac{dy}{dx} = 2 + 2x$$

$$\frac{dy}{dx} = 2 + 2x$$

$$\frac{dy}{dx} = 2 + 2x$$

$$\frac{dy}{dx} = 2 + 2x$$

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$$\frac{dy}{dx} = 2 + 2x$$

Option A

$$89. \int_0^3 (x^3 - x^2) dx$$

$$= \left[\frac{x^{3+1}}{3+1} - \frac{x^{2+1}}{2+1} \right]_0^3$$

$$= \left[\frac{x^4}{4} - \frac{x^3}{3} \right]_0^3$$

$$= \left[\frac{x^4}{4} - \frac{x^3}{3} \right]_0^3$$

$$= \left[\frac{x^4}{4} - \frac{x^3}{3} \right]_0^3$$

$$= \left[\frac{x^4}{4} - \frac{x^3}{3} \right]_0^3$$

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$$= \left[\frac{x^4}{4} - \frac{x^3}{3} \right]_0^3$$

$$= \left[\frac{x^4}{4} - \frac{x^3}{3} \right]_0^3$$

$$= \left[\frac{x^4}{4} - \frac{x^3}{3} \right]_0^3$$

$$= \left[\frac{x^4}{4} - \frac{x^3}{3} \right]_0^3$$

$$= \left(\frac{3^4}{4} - \frac{3^3}{3} \right) - \left(\frac{0^4}{4} - \frac{0^3}{3} \right)$$

$$= \frac{81}{4} - \frac{27}{3}$$

$$= \frac{81}{4} - 9 = 11\frac{1}{4}$$

Option D

90. $\int (\cos x + 2) dx$

$$= \sin x + 2x + k$$

Option A

91. Students who failed scored 2,3,4

$$= 4 + 2 + 5$$

$$= 11$$

Option C

92. Possible Outcomes

HHH HHT HTH HTT THH THT TTH TTT

no of outcomes = 8

$$P = \frac{1}{8}$$

Option D

93. committee = $6C_4 + 5C_3$

$$= \frac{6!}{(6-4)!4!} + \frac{5!}{(5-3)!3!}$$

$$= \frac{6!}{2!4!} + \frac{5!}{2!3!}$$

$$= \frac{6 \cdot 5 \cdot 4!}{2 \cdot 4!} + \frac{5 \cdot 4 \cdot 3!}{2 \cdot 3!}$$

$$= 15 + 10 = 25$$

Option B

94. $\bar{x} = \frac{\Sigma x}{n}$

$$\bar{x} = \frac{2+4+5+6}{4}$$

$$= \frac{17}{4} = 4.25$$

$$s = \sqrt{\frac{\Sigma(x - \bar{x})^2}{n}}$$

$$s = \sqrt{\frac{(2-4.25)^2 + (4-4.25)^2 + (5-4.25)^2 + (6-4.25)^2}{4}}$$

$$s = \sqrt{\frac{-2.25^2 + (-0.25)^2 + 0.75^2 + 1.75^2}{4}}$$

$$s = \sqrt{\frac{5.0625 + 0.0625 + 0.5625 + 3.0625}{4}}$$

$$s = \sqrt{\frac{8.75}{4}}$$

$$s = \sqrt{\frac{35/4}{4}} = \sqrt{\frac{35}{16}}$$

$$s = \frac{\sqrt{35}}{4}$$

This is the proper ans. for the que. Take note of the procedure. It will help a great deal later.

95. $y = -3x + 2, \quad m_1 = -3$

parallelism

$$m_1 = m_2$$

$$m_2 = -3$$

$$m_2 = \frac{y - y_1}{x - x_1}$$

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

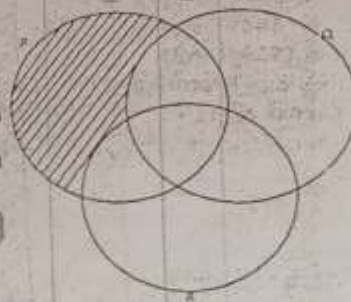
$$y - 3 = 3(x - 1)$$

$$y - 3 = 3x - 3$$

$$y + 3x - 6 = 0$$

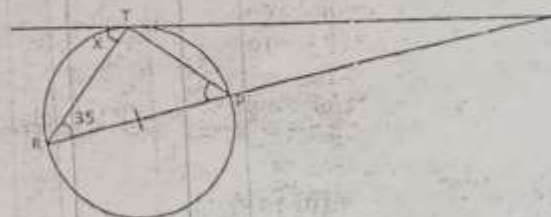
Option A

96. $P \cap Q' \cap R'$ means the set of P only



Option B

97.



$$x = \angle TRQ$$

$$x + 35 = 90$$

$$x = 90 - 35$$

$$= 55^\circ$$

Option A

98. $3x + 75 + 25 = 180$ (supplementary angles)

$$3x + 100 = 180$$

$$3x = 180 - 100$$

$$3x = 80$$

$$x = \frac{80}{3} = 26.67^\circ$$

correct procedure, invalid options

Xpress SOLUTIONS

MATHEMATICS

$$99. x^2 - 5x + 7 = 0$$

$$a = 1, b = -5, c = 7$$

$$a + \beta = -\frac{b}{a}, \quad a\beta = \frac{c}{a}$$

$$= -\frac{-5}{1}, \quad a\beta = \frac{7}{1}$$

$$a + \beta = 5, \quad = 7$$

$$a^2 + \beta^2 = (a + \beta)^2 - 2a\beta$$

$$= 5^2 - 2(7)$$

$$= 25 - 14 = 11$$

Option A

$$100. \sqrt{41830} = 204.52$$

$$= 205$$

Option A

$$101. 12^2 - 5^2 = (12^2)^2 - (5^2)^2$$

$$= (12^2 - 5^2)(12^2 + 5^2)$$

$$= (144 - 25)(144 + 25)$$

$$= (119)(169)$$

13 and 169 are factors of 169

17 is a factor of 119

49 is not a factor of any.

Option D

$$102. SP = 81$$

$$\text{Profit, } P = 8\%$$

$$CP = x$$

$$\%P = \frac{SP - CP}{CP} \times 100\%$$

$$8 = \frac{81 - x}{x} \times 100$$

$$8x = (81 - x)100$$

$$8x = 8100 - 100x$$

$$8x + 100x = 8100$$

$$108x = 8100$$

$$x = \frac{8100}{108}$$

$$x = 108 = N75$$

Option D

103. Rearranging,

$$= 4, 4, 7, 9, 10, 13, 14, 17$$

$$\text{median} = \frac{9 + 10}{2}$$

$$= \frac{19}{2} = 9.5$$

Option A

104. Same as question 51.

Ans. Option D

$$105. A = 36\pi\text{cm}^2, r = 3\text{cm}$$

Since the cylinder is closed,

$$A = 2\pi rh + \pi r^2 + \pi r^2$$

$$A = 2\pi rh + 2\pi r^2$$

$$36\pi = 2\pi \cdot 3h + 2\pi \cdot 3^2$$

$$36\pi = 6\pi h + 18\pi$$

$$6\pi h = 36\pi - 18\pi$$

$$6\pi h = 18\pi$$

$$h = \frac{18\pi}{6\pi} = 3\text{cm}$$

Option B

106. Same as Question 54

Ans. 1.5

Option A

$$107. 0.0052048 = 0.00520 \text{ 3s.f.}$$

Option D

108. Same as Question 53.

Ans. = N184

Option C

109. Same as Question 59.

Ans. = 120°

Option A

110. Same as Question 62.

Ans. = x=2

Option D

111. Same as Question 64.

$$\text{Ans.} = \frac{1 - \cos \theta}{\sin \theta}$$

Option A

112.

39

2 19 rem 1

2 9 rem 1

2 4 rem 1

2 2 rem 0

2 1 rem 0

0 rem 1

Option B

$$39_{10} = 100111_2$$

$$113. \sqrt{252} = \sqrt{36 \cdot 7} = 6\sqrt{7}$$

to make 252 a perfect square, multiply by 7

Option C

$$114. \frac{2}{\frac{1}{\frac{1}{2}}} \text{ reciprocal} = \frac{2}{\frac{1}{2}}$$

$$= \frac{2 \cdot 2}{1} = 4$$

Option B

$$115. \text{LCM OF 48, 64 AND 80} = 960$$

$$\text{HCF} = 16$$

$$\text{LCM} = 960$$

$$\frac{\text{LCM}}{\text{HCF}} = \frac{960}{16} = 60$$

Option A

FUTA POST UTME SOLUTION MANUAL



Xpress SOLUTIONS

MATHEMATICS

$$115. x - y = 6$$

$$x = 6 + y \text{ ----- } -1$$

$$xy = 187 \text{ ----- } -2$$

substituting x in 2

$$(6 + y)y = 187$$

$$6y + y^2 = 187$$

$$y^2 + 6y - 187 = 0$$

$$y^2 - 11y + 17y - 187 = 0$$

$$y(y - 11) + 17(y - 11) = 0$$

$$(y + 17)(y - 11) = 0$$

$$y + 17 = 0 \quad y - 11 = 0$$

$$y = -17 \quad y = 11$$

since age cannot be negative, $y = 11$

$$x = 6 + y$$

$$= 6 + 11 = 17$$

$$x, y = 17, 11$$

$$117. 5^{x+2}y = 5$$

$$5^{x+2}y = 5^1$$

$$x + 2y = 1 \text{ ----- } -1$$

subtracting 1 from 2

$$x + 3y - (x + 2y) = 2 - 1$$

$$x + 3y - x - 2y = 1$$

$$3y - 2y = 1$$

$$y = 1$$

substituting in 1

$$x + 2y = 1$$

$$x + 2(1) = 1$$

$$x + 2 = 1$$

$$x = 1 - 2 = -1$$

$$\text{now, } 3^{x+y}$$

$$= 3^{1-1} = 3^0 = 1$$

$$118. 16^x - 5 \cdot 4^x + 4 = 0$$

$$(4^x)^2 - 5 \cdot 4^x + 4 = 0$$

$$\text{let } y = 4^x$$

$$y^2 - 5y + 4 = 0$$

$$y^2 - 4y - y + 4 = 0$$

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

$$y = 1 \quad y = 4$$

$$4^x = 1 \quad 4^x = 4$$

$$4^x = 4^0 \quad 4^x = 4^1$$

$$x = 0, \quad x = 1$$

$$x = 0, \quad x = 1$$

$$0 \text{ and } 1$$

$$119. x^2 + 2a + ax + 2x$$

$$= (x^2 + ax) + (2a + 2x)$$

$$= x(x + a) + 2(x + a)$$

$$= (x + 2)(x + a)$$

Option D

$$120. \text{TSA for open cuboid} = lb + 2bh + 2lh$$

$$l = 4, b = 3, h = 4$$

$$= 4 \cdot 3 + 2(3 \cdot 4) + 2(4 \cdot 4)$$

$$= 12 + 24 + 32$$

$$= 68 \text{ cm}^2$$

$$\text{total cost} = 2 \cdot \text{TSA}$$

$$= 2 \cdot 68$$

$$= \text{N}136$$

$$121. 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50$$

$$\text{Probability of prime} = \frac{3}{10}$$

Option D

Option B

$$122. x \propto y^2$$

$$x = ky^2$$

$$k = \frac{x}{y^2} \quad \text{at } x = 2, y = 1$$

$$k = \frac{2}{1^2} = \frac{2}{1} = 2$$

$$k = \frac{2}{1^2} = \frac{2}{1} = 2$$

$$\text{then } x = 5$$

$$x = 2(5)^2 = 2 \cdot 25$$

$$= 250$$

Option D

$$123. \text{actual score} = 57$$

$$\text{assumed score} = 75$$

$$\text{assumed mean } \bar{x} = 60$$

$$\bar{x} = \frac{\sum fx}{n}$$

$$\sum fx = \bar{x}n$$

$$= 60 \cdot 4$$

$$= 240$$

$$\text{His assumed total score} = 240$$

$$\text{since he scored 57 not 75}$$

$$\text{Actual total score} = 240 - (75 - 57)$$

$$= 240 - 18$$

$$= 222$$

Option B

$$124. \text{black} = 6, \text{brown} = 5, \text{purple} = 7$$

$$\text{total} = 6 + 5 + 7 = 18$$

$$P(\text{purple}) = \frac{7}{18}$$

Option D

$$125. 212_3 - 121_3 + 222_3$$

$$212_3$$

$$-121_3$$

$$021_3$$

$$+222_3$$

$$1020_3$$

$$00324 \cdot 0.00064$$

$$126.$$

$$0.48 \cdot 0.012$$

$$324 \cdot 10^{-4} \cdot 64 \cdot 10^{-5}$$

$$48 \cdot 10^{-2} \cdot 12 \cdot 10^{-3}$$

Option C

FUTA POST UTME SOLUTION MANUAL

Xpress SOLUTIONS

MATHEMATICS

$$\begin{aligned} &= \frac{324 \times 64}{48 \times 12} \times \frac{10^{-4} \times 10^{-2}}{10^{-2} \times 10^{-3}} \\ &= 36 \times 10^{-4} \\ &= 0.0036 \end{aligned}$$

Option A

$$127. \log_2 4 + \log_2 7 - \log_2 n = 1$$

$$\log_2 \left(\frac{4 \times 7}{n} \right) = 1$$

$$\frac{4 \times 7}{n} = 2^1$$

$$n = \frac{28}{2} = 14$$

Option D

$$128. y = 2x + 1 \quad y = 2x^2 + 5x - 1$$

Intersection occurs when the y's are equal

$$2x + 1 = 2x^2 + 5x - 1$$

$$2x^2 + 5x - 2x - 1 - 1 = 0$$

$$2x^2 + 3x - 2 = 0$$

solving quadratically,

$$x = 0.5, -2$$

$$y = 2x + 1$$

$$\text{when } x = 0.5$$

$$y = 2(0.5) + 1$$

$$y = 1 + 1$$

$$y = 2$$

$$(0.5, 2), (-2, -3)$$

$$\text{when } x = -2$$

$$y = 2(-2) + 1$$

$$y = -4 + 1$$

$$y = -3$$

Option B

$$129. \cos \theta = \frac{a}{b} = \frac{\text{adj}}{\text{hyp}}$$

$$b^2 = a^2 + c^2$$

$$c^2 = b^2 - a^2$$

$$c = \sqrt{b^2 - a^2}$$

$$\tan \theta = \frac{c}{a} = \frac{\sqrt{b^2 - a^2}}{a}$$

$$\tan^2 \theta = \left(\frac{\sqrt{b^2 - a^2}}{a} \right)^2$$

$$\tan^2 \theta = \frac{b^2 - a^2}{a^2}$$

$$1 + \tan^2 \theta = 1 + \frac{b^2 - a^2}{a^2}$$

$$= 1 + \frac{b^2}{a^2} - \frac{a^2}{a^2}$$

$$= 1 + \frac{b^2}{a^2} - 1$$

$$= \frac{b^2}{a^2}$$

Option B

$$130. P = 18, Q = 21, R = -6, S = -4$$

$$\frac{(P - Q)^3}{R^3} + S^2 = \frac{(18 - 21)^3}{-6^3} + (-4)^2$$

$$= \frac{-3^3}{-6^3} + 16$$

$$= \frac{-27}{-216} + 16$$

$$= \frac{1}{8} + 16 = \frac{129}{8}$$

Correct procedure, invalid options

$$131. P = 150, T = 5, I = 55$$

$$R = \frac{100I}{PT}$$

$$= \frac{100 \times 55}{150 \times 5}$$

$$= 7.33\%$$

Option D

$$132. m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{-4 - 0}{0 - (-2)} = -\frac{4}{2}$$

$$= -2$$

Option B

$$133. y = x^2 - 2x - 3$$

$$\frac{dy}{dx} = 2x - 2$$

$$\text{at turning points, } \frac{dy}{dx} = 0$$

$$2x - 2 = 0$$

$$2x = 2$$

$$x = 1$$

Option D

$$134. (x - 2)(x - 3) = 12$$

$$x^2 - 2x - 3x + 6 = 12$$

$$x^2 - 5x + 6 = 12$$

$$x^2 - 5x + 6 - 12 = 0$$

$$x^2 - 5x - 6 = 0$$

$$x(x - 6) + 1(x - 6) = 0$$

$$(x + 1)(x - 6) = 0$$

$$x = -1 \quad x = 6$$

$$-1, 6$$

Option C

$$135. 3x + y = 8$$

$$y = 8 - 3x \text{ ----- 1}$$

$$x^2 + xy = 6$$

substituting y in 1

$$x^2 + x(8 - 3x) = 6$$

$$x^2 + 8x - 3x^2 = 6$$

$$-2x^2 + 8x = 6$$

$$-2x^2 + 8x - 6 = 0$$

dividing through by -2

$$\frac{2x^2}{-2} + \frac{8x}{-2} - \frac{6}{-2} = \frac{0}{-2}$$

$$-x^2 - 4x + 3 = 0$$

$$x^2 + 4x - 3 = 0$$

$$x = 1 \text{ and } x = 3$$

$$\text{when } x = 1$$

$$y = 8 - 3(1)$$

$$= 8 - 3$$

$$= 5$$

$$\text{when } x = 3$$

$$y = 8 - 3(3)$$

$$= 8 - 6$$

$$= 2$$

Xpress SOLUTIONS

(1,5) and (2,2)

Option A

$$136. n = 20, a = 7, l = 117$$

$$S_{20} = \frac{n}{2}(a + l) \\ = \frac{20}{2}(7 + 117) \\ = 10(124) \\ = 1240$$

Option B

$$37. 5x - 30 + 4x + 60 + 60 - x + 3x + 61 = 360$$

$$5x + 4x - x + 3x + 60 + 61 - 30 + 60 = 360$$

$$11x + 151 = 360$$

$$11x = 360 - 151$$

$$11x = 209$$

$$x = \frac{209}{11} = 19$$

determining the angles

$$5x - 30 = 5(19) - 30 = 65$$

$$4x + 60 = 4(19) + 60 = 136$$

$$60 - x = 60 - 19 = 41$$

$$3x + 61 = 3(19) + 61 = 118$$

since 41 is the least number,

60 - x is the smallest angle

Option A

$$138. g(x) = x^2 + 3x + 4$$

$$g(x+1) = (x+1)^2 + 3(x+1)$$

$$g(x+1) - g(x)$$

$$= (x+1)^2 + 3(x+1) + 4 - (x^2 + 3x + 4)$$

$$= x^2 - x^2 + 2x + 3x - 3x + 1 + 3 + 4 - 4$$

$$= 2x + 4$$

$$= 2(x+2)$$

Option D

$$139. 3n^2 = 12n$$

Dividing through by 3n

$$\frac{3n^2}{3n} = \frac{12n}{3n}$$

$$n = 4$$

$$n = 4$$

$$l = \sqrt{44} = 12\text{cm}$$

$$l = \sqrt{44} = 12\text{cm}$$

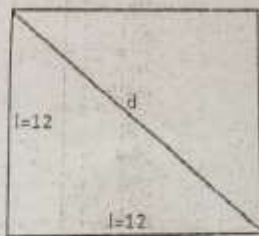
$$d^2 = l^2 + l^2$$

$$d^2 = 2l^2$$

$$d = l\sqrt{2}$$

$$d = 12\sqrt{2}\text{cm}$$

Option B



Option A

$$141. \frac{\sqrt{12}-\sqrt{3}}{\sqrt{12}+\sqrt{3}}$$

MATHEMATICS

$$\frac{\sqrt{12}-\sqrt{3}}{\sqrt{12}+\sqrt{3}} \cdot \frac{\sqrt{12}-\sqrt{3}}{\sqrt{12}-\sqrt{3}} \\ = \frac{(\sqrt{12}-\sqrt{3})^2}{(\sqrt{12})^2 - (\sqrt{3})^2} = \frac{12 - 2\sqrt{36} + 3}{12 - 3} \\ = \frac{12 - 12 + 3}{9} = \frac{3}{9} = \frac{1}{3}$$

Option D

$$142. S = \{x: x^2 = 9, x > 4\}$$

$$x^2 = 9$$

$$x = \sqrt{9} = \pm 3$$

unfortunately, $\pm 3 < 4$

$$\therefore S = \emptyset$$

Option C

$$143. 0.0014 \cdot 0.011$$

$$= 1.4 \cdot 10^{-3} \cdot 1.1 \cdot 10^{-2}$$

$$= 1.54 \cdot 10^{-5}$$

$$= 1.54 \cdot 10^{-5}$$

Option A

$$144. 4x^2 - 18xy + 9y^2$$

$$= (2x - 3y)^2$$

Obtain a perfect square.

$$= (2x - 3y)^2$$

$$= (2x - 3y)^2$$

$$= (2x - 3y)^2$$

$$= (2x - 3y)^2$$

$$= (2x - 3y)^2$$

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$$= (2x - 3y)^2$$

$$= (2x - 3y)^2$$

$$= (2x - 3y)^2$$

Xpress SOLUTIONS

$$\frac{dy}{dx} = 2x - 3 = 0$$

$$2x = 3$$

$$x = \frac{3}{2} = 1.5$$

$$y = x^2 - 3x + 2$$

$$y = (1.5)^2 - 3(1.5) + 2$$

$$y = 2.25 - 4.5 + 2$$

$$y = -0.25$$

Option C

$$148. f(x) = x^3 + 2x^2 + qx - 6$$

(if $x + 1$ is a divisor,

$$x + 1 = 0$$

$$x = -1$$

$$f(x) = (-1)^3 + 2(-1)^2 + q(-1) - 6 = 0$$

$$-1 + 2 - q - 6 = 0$$

$$q = -5$$

Option A

$$149. y = 2x(x - 3)$$

$$\frac{dy}{dx} = 4x - 6$$

$$x = 1$$

$$\frac{dy}{dx} = 4(1) - 6$$

$$= 4 - 6 = -2$$

Option B

$$150. \int \frac{1}{x} \cos x$$

$$= \ln x + \sin x + k$$

$$151. \frac{x}{\sqrt{3}} = \sqrt{3}$$

$$k = \sqrt{3} \cdot \sqrt{3} = 3$$

$$152. \frac{6!}{r!} = \frac{1}{6}$$

$$\frac{6!}{(6-r)!r!} = \frac{1}{6}$$

$$\frac{6!}{(6-r)!} = \frac{1}{6} \cdot r!$$

$$\frac{1}{r!} = \frac{1}{6}, \quad \therefore r! = 6$$

$$r! = 3!$$

$$r = 3$$

Option B

153. The possible numbers include,

$$10, 11, 12, 13$$

$$20, 21, 22, 23$$

$$30, 31, 32, 33$$

$$n = 12$$

Option D

154. The longest side of the right angle triangle is the hypotenuse $= 3x + 1$

The other two sides are the Opp. and Adj.

$$\text{Hyp}^2 = \text{Opp}^2 + \text{Adj}^2$$

$$(3x + 1)^2 = (3x - 1)^2 + x^2$$

$$9x^2 + 6x + 1 = 9x^2 - 6x + 1 + x^2$$

$$9x^2 - 9x^2 - x^2 + 6x + 6x + 1 - 1 = 0$$

$$-x^2 + 12x = 0$$

$$x^2 = 12x$$

dividing by x

$$\frac{x^2}{x} = \frac{12x}{x}$$

$$x = 12$$

Option A

$$155. y = x \sin x$$

$$\frac{dy}{dx} = x \cos x + \sin x \quad (\text{using product rule})$$

$$\text{when } x = \frac{\pi}{2}$$

$$\frac{dy}{dx} = \frac{\pi}{2} \cos \frac{\pi}{2} + \sin \frac{\pi}{2}$$

$$= \frac{\pi}{2} (0) + 1 = 1$$

Option C

$$156. PQ^2 = (6 - (-6))^2 + (6 - 1)^2$$

$$PQ^2 = 12^2 + 5^2$$

$$PQ^2 = 144 + 25$$

$$PQ^2 = 169$$

$$PQ = 13$$

PQ = DIAMETER,

$$\text{radius} = \frac{\text{diameter}}{2}$$

$$= \frac{13}{2} = 6.5$$

Option C

$$157. V = \frac{4}{3} \pi r^3$$

$$\frac{dV}{dr} = 3 \cdot \frac{4}{3} \pi r^{3-1}$$

$$\text{when } r = 1$$

$$\frac{dV}{dr} = 4\pi r^2 = 4\pi \cdot 1^2$$

$$= 4\pi$$

Correct procedure

$$158. 6P_r = 6$$

$$\frac{6!}{(6-r)!} = 6$$

$$\frac{6!}{6} = (6-r)!$$

$$\frac{6 \times 5!}{6} = (6-r)!$$

$$5! = (6-r)!$$

$$5 = 6 - r$$

$$r = 6 - 5 = 1$$

$$6P_{r+1} = 6P_{1+1}$$

$$= 6P_2 = \frac{6!}{(6-2)!}$$

Xpress SOLUTIONS

$$\frac{dy}{dx} = 2x - 3 = 0$$

$$2x = 3$$

$$x = \frac{3}{2} = 1.5$$

$$y = x^2 - 3x + 2$$

$$y = (1.5)^2 - 3(1.5) + 2$$

$$y = 2.25 - 4.5 + 2$$

$$y = -0.25$$

Option C

$$148. f(x) = x^3 + 2x^2 + qx - 6$$

(if $x = 1$ is a divisor,

$$x + 1 = 0$$

$$x = -1$$

$$f(x) = (-1)^3 + 2(-1)^2 + q(-1) - 6 = 0$$

$$-1 + 2 - q - 6 = 0$$

$$q = -5$$

Option A

$$149. y = 2x(x - 3)$$

$$\frac{dy}{dx} = 4x - 6$$

$$x = 1$$

$$\frac{dy}{dx} = 4(1) - 6$$

$$= 4 - 6 = -2$$

Option B

$$150. f\left(\frac{\pi}{2}\right) = \cos x$$

$$= \ln x + \sin x + k$$

$$151. \frac{4}{\sqrt{3}} = \sqrt{3}$$

$$k = \sqrt{3} \cdot \sqrt{3} = 3$$

Option A

$$152. \frac{6r}{6r} = \frac{1}{6}$$

$$\frac{6!}{(6-r)!r!} + \frac{6!}{(6-r)!} = \frac{1}{6}$$

$$\frac{6!}{(6-r)!r!} + \frac{6!}{(6-r)!} = \frac{1}{6}$$

$$\frac{1}{r!} = \frac{1}{6} \quad \therefore r! = 6$$

$$r! = 3!$$

$$r = 3$$

Option B

153. The possible numbers include,

$$10, 11, 12, 13,$$

$$20, 21, 22, 23$$

$$30, 31, 32, 33$$

$$\bar{n} = 12$$

Option D

154. The longest side of the right angle triangle is the hypotenuse $= 3x + 1$

The other two sides are the Opp. and Adj.

$$Hyp^2 = Opp^2 + Adj^2$$

$$(3x + 1)^2 = (3x - 1)^2 + x^2$$

MATHEMATICS

$$9x^2 + 6x + 1 = 9x^2 - 6x + 1 + x^2$$

$$9x^2 - 9x^2 - x^2 + 6x + 6x + 1 - 1 = 0$$

$$-x^2 + 12x = 0$$

$$x^2 = 12x$$

dividing by x

$$\frac{x^2}{x} = \frac{12x}{x}$$

$$x = 12$$

Option A

$$155. y = x \sin x$$

$$\frac{dy}{dx} = x \cos x + \sin x \quad (\text{using product rule})$$

$$\text{when } x = \frac{\pi}{2}$$

$$\frac{dy}{dx} = \frac{\pi}{2} \cos \frac{\pi}{2} + \sin \frac{\pi}{2}$$

$$= \frac{\pi}{2} (0) + 1 = 1$$

Option C

$$156. PQ^2 = (6 - (-6))^2 + (6 - 1)^2$$

$$PQ^2 = 12^2 + 5^2$$

$$PQ = \sqrt{144 + 25}$$

$$PQ = \sqrt{139}$$

$$PQ = 13$$

$$PQ = \text{DIAMETER,}$$

$$\text{radius} = \frac{\text{diameter}}{2}$$

$$= \frac{13}{2} = 6.5$$

Option C

$$157. V = \frac{4}{3} \pi r^3$$

$$\frac{dV}{dr} = 3 \cdot \frac{4}{3} \pi r^{3-1}$$

$$\text{when } r = 1$$

$$\frac{dV}{dr} = 4\pi r^2 = 4\pi \cdot 1^2$$

$$= 4\pi$$

Correct procedure

$$158. 6P_r = 6$$

$$\frac{6!}{(6-r)!} = 6$$

$$\frac{6!}{6} = (6-r)!$$

$$\frac{6 \cdot 5!}{6} = (6-r)!$$

$$5! = (6-r)!$$

$$5 = 6 - r$$

$$r = 6 - 5 = 1$$

$$6P_{r+1} = 6P_{1+1}$$

$$= 6P_2 = \frac{6!}{(6-2)!}$$

$$\frac{6!}{4!} = \frac{6 \times 5 \times 4!}{4!}$$

$$= 6 \times 5 = 30$$

Option B

159. There are three possibilities in a game.

- A victory
- A defeat
- A draw

Probability of a draw = $\frac{1}{3}$

Options C and B have the same content. one of them should have been $\frac{1}{3}$. but trust me, this ans is valid

160. largest = $k + 6$

least = $k - 5$

$$\text{Range} = k + 6 - (k - 5)$$

$$= k + 6 - k + 5$$

$$= 11$$

Option B

161. $A = \begin{pmatrix} 2 & 1 \\ -3 & 0 \end{pmatrix}$

$$A^2 = \begin{pmatrix} 2 & 1 \\ -3 & 0 \end{pmatrix} \begin{pmatrix} 2 & 1 \\ -3 & 0 \end{pmatrix}$$

$$= \begin{pmatrix} 2 \cdot 2 + 1 \cdot -3 & 2 \cdot 1 + 1 \cdot 0 \\ -3 \cdot 2 + 0 \cdot -3 & -3 \cdot 1 + 0 \cdot 0 \end{pmatrix}$$

$$= \begin{pmatrix} 4 - 3 & 2 + 0 \\ -6 + 0 & -3 + 0 \end{pmatrix}$$

$$= \begin{pmatrix} 1 & 2 \\ -6 & -3 \end{pmatrix}$$

$$2A = 2 \begin{pmatrix} 2 & 1 \\ -3 & 0 \end{pmatrix} = \begin{pmatrix} 2 \cdot 2 & 1 \cdot 2 \\ -3 \cdot 2 & 0 \cdot 2 \end{pmatrix}$$

$$2A = \begin{pmatrix} 4 & 2 \\ -6 & 0 \end{pmatrix}$$

$$I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}, 4I = \begin{pmatrix} 4 & 0 \\ 0 & 4 \end{pmatrix}$$

$$A^2 - 2A + 4I = \begin{pmatrix} 1 & 2 \\ -6 & -3 \end{pmatrix} - \begin{pmatrix} 4 & 2 \\ -6 & 0 \end{pmatrix} + \begin{pmatrix} 4 & 0 \\ 0 & 4 \end{pmatrix}$$

$$= \begin{pmatrix} 1 - 4 + 4 & 2 - 2 + 0 \\ -6 - (-6) + 0 & -3 - 0 + 4 \end{pmatrix}$$

$$= \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

Option A

162. $T_n = 5n$

$$a + 4d = 5(a + 4d)$$

$$a + 4d = 5 + 20d$$

$$0 = 5a - a + 20d - 4d$$

$$0 = 4a + 12d$$

$$0 = a + 3d$$

Option D

163. $y = 1 - 2x - 3x^2$

$$\frac{dy}{dx} = -2 - 6x = 0$$

$$-2 - 6x = 0$$

$$-2 = 6x$$

$$x = -\frac{2}{6} = -\frac{1}{3}$$

$$y = 1 - 2x - 3x^2$$

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

$$y = 1 - 2x - 3x^2$$

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

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

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

Option A

164. $p \cdot q = pq + p + q$

$$3 \cdot 4 = 3 \cdot 4 + 3 + 4$$

$$= 12 + 3$$

$$= 19$$

$$2 \cdot (3 \cdot 4) = 2 \cdot 12$$

$$= 2 \cdot 12 + 2 + 19$$

$$= 24 + 2 + 19$$

$$= 59$$

Option C

165. $Q = \begin{pmatrix} 6 & -2 \\ 6 & 8 \end{pmatrix}$ $P = \begin{pmatrix} 7 & -2 \\ 6 & 8 \end{pmatrix}$

$$P = (Q + P) - Q = \begin{pmatrix} 7 & -2 \\ 6 & 8 \end{pmatrix} - \begin{pmatrix} 6 & 0 \\ 4 & 5 \end{pmatrix}$$

$$P = \begin{pmatrix} 7 - 6 & -2 - 0 \\ 6 - 4 & 8 - 5 \end{pmatrix}$$

$$= \begin{pmatrix} 1 & -2 \\ 2 & 3 \end{pmatrix}$$

$$2P = 2 \begin{pmatrix} 1 & -2 \\ 2 & 3 \end{pmatrix} = \begin{pmatrix} 1 \cdot 2 & -2 \cdot 2 \\ 2 \cdot 2 & 3 \cdot 2 \end{pmatrix}$$

$$2P = \begin{pmatrix} 2 & -4 \\ 4 & 6 \end{pmatrix}$$

$$Q + 2P = \begin{pmatrix} 6 & 0 \\ 4 & 5 \end{pmatrix} + \begin{pmatrix} 2 & -4 \\ 4 & 6 \end{pmatrix}$$

$$= \begin{pmatrix} 6 + 2 & 0 - 4 \\ 4 + 4 & 5 + 6 \end{pmatrix}$$

$$= \begin{pmatrix} 8 & -4 \\ 8 & 11 \end{pmatrix}$$

$$|Q + 2P| = \begin{vmatrix} 8 & -4 \\ 8 & 11 \end{vmatrix}$$

$$= (8 \cdot 11) - (8 \cdot -4)$$

$$= 88 + 32$$

$$= 120$$

Option A

166. $2x + y = 3$

$$y = -2x + 3$$

$$m_1 = -2$$

$$3x - 2y = 5$$

$$-2y = -3x + 5$$

$$y = -\frac{3}{2}x + \frac{5}{2}$$

$$y = \frac{3}{2}x - \frac{5}{2}$$



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Xpress SOLUTIONS

$$m_2 = \frac{3}{2} = 1.5$$

$$\tan \theta = \frac{m_1 - m_2}{1 + m_1 m_2}$$

$$\tan \theta = \frac{1 - 1.5}{1 + (1.5)(-2)}$$

$$= \frac{-0.5}{1 - 3}$$

$$= \frac{-0.5}{-2}$$

$$= 0.25$$

Option D

$$167. y = 1 + 6x - 3x^2$$

$$\frac{dy}{dx} = 6 - 6x = 0$$

$$0 = 6x$$

$$x = \frac{0}{6}$$

$$x = 0$$

$$at x = 0$$

$$y = 1 + 6x - 3x^2 = 13$$

$$1 + 6\left(\frac{0}{6}\right) - 3\left(\frac{0}{6}\right)^2 = 13$$

$$1 + \frac{0^2}{6} - \frac{0^2}{12} = 13$$

$$1 + \frac{0^2}{12} = 13$$

$$\frac{0^2}{12} = 13 - 1$$

$$\frac{0^2}{12} = 12$$

$$0^2 = 12 \times 12$$

$$0 = \sqrt{12^2} = 12$$

Option A

168. Standard Deviation is a measure of dispersion; the more the difference between two successive numbers, the higher the standard deviation.

Observing the numbers, the differences in the successive numbers is 1. To obtain an S.D. a number greater than 6 must be used. Option D

$$169. \int_{-2}^1 (x^2 - 2x + 1) dx = \int_{-2}^1 (x^2 - 2x + 1) dx$$

$$= \left[\frac{x^{2+1}}{2+1} - \frac{2x^{1+1}}{1+1} + x + c \right]_{-2}^1$$

$$= \left[\frac{x^3}{3} - \frac{x^2}{2} + x + c \right]_{-2}^1$$

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

$$= \left(\frac{1}{3} - \frac{1}{2} + 1 \right) - \left(-\frac{8}{3} - 4 - 2 \right)$$

$$= \frac{1}{3} - \frac{26}{3}$$

MATHEMATICS

Option B

$$= \frac{27}{3} = 9$$

$$170. y = x(2 - x)$$

$$= 2x - x^2$$

$$\int y = \int_0^2 (2x - x^2) dx$$

$$= \left[\frac{2x^{1+1}}{1+1} - \frac{x^{2+1}}{2+1} \right]_0^2$$

$$= \left[x^2 - \frac{x^3}{3} \right]_0^2$$

$$= \left(2^2 - \frac{2^3}{3} \right) - \left(0^2 - \frac{0^3}{3} \right)$$

$$= 4 - \frac{8}{3}$$

$$= \frac{4}{3} = 1.33 \text{ sq. units}$$

Option B

$$171. P = 10x$$

$$\frac{dP}{dx} = 10 \times 1 = 10$$

$$\frac{dP}{dx} = 10$$

$$P = 10$$

$$P = 10$$

$$P = 10$$

$$P = 10$$

$$P = 10$$

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$$P = 10$$

$$P = 10$$

Option D

$$a\beta = \frac{c}{a}$$

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

Option D

$$173. P344_6 - 23P2_6 = 2PP2_6$$

$$(P.6^3 + 3.6^2 + 4.6^1 + 4.6^0) - (2.6^3 + 3.6^2 + P.6^1 + 2.6^0)$$

$$= 2.6^3 + P.6^2 + P.6^1 + 2.6^0$$

$$216P + 108 + 24 + 24 - (432 + 108 + 6P + 2)$$

$$= 432 + 36P + 6P + 2$$

$$216P + 108 + 24 + 24 - 432 - 108 - 6P - 2$$

$$= 432 + 36P - 6P - 2$$

$$216P - 6P + 108 - 108 + 24 + 24 - 432 - 2$$

$$= 36P + 6P + 432 - 2$$

$$210P - 406 = 42P + 434$$

$$210P - 42P = 434 + 406$$

$$168P = 840$$

$$P = \frac{840}{168} = 5$$

Option B

FUTA POST UTME SOLUTION MANUAL

174. $y = \frac{3}{1 - \cos \theta}$

$u = 2, \frac{du}{d\theta} = 0$

$v = 3 - \cos \theta, \frac{dv}{d\theta} = \sin \theta$

$\frac{dy}{d\theta} = \frac{v \frac{dv}{d\theta} - u \frac{du}{d\theta}}{v^2}$

$= \frac{(3 - \cos \theta) \cdot 0 - 2 \cdot \sin \theta}{(3 - \cos \theta)^2}$

$= \frac{2 \sin \theta}{(3 - \cos \theta)^2}$

at turning point, $\frac{dy}{d\theta} = 0$

$\frac{2 \sin \theta}{(3 - \cos \theta)^2} = 0$

$2 \sin \theta = 0$

$\sin \theta = 0$

$\theta = \sin^{-1} 0$

$\theta = 0, 180, 360$

substituting in y

$y = \frac{2}{3 - \cos \theta}$

$= \frac{2}{3 - \cos 0} \text{ or } \frac{2}{3 - \cos 180} \text{ or } \frac{2}{3 - \cos 360}$

$y = \frac{2}{3-1} \text{ or } \frac{2}{3-(-1)} \text{ or } \frac{2}{3-1}$

$y = \frac{2}{2} \text{ or } \frac{2}{4} \text{ or } \frac{2}{2}$

$y = 1 \text{ or } 0.5$

175. $X \text{ or } Y = P(X \cup Y) = 0.7$

$P(X) = 0.4$

$X \text{ and } Y = P(X \cap Y) = 0$ (independent events)

$P(Y) = ?$

$P(X \cap Y) = P(X) + P(Y) - P(X \cup Y)$

$0 = 0.4 + P(Y) - 0.7$

$0 = -0.3 + P(Y)$

$P(Y) = 0.3$

Option D

176. Using sine rule

$\frac{\sin 120}{r} = \frac{\sin 30}{3}$

$\frac{\sin 120}{r} = \frac{\sin 30}{3}$

$\frac{\sin 120}{r} = \frac{\sin 30}{3}$

$r = 1.73 \text{ cm}$



177.

$n(U) = 40$

$n(M) = 32$

$n(P) = 24$

$n(P \cup M) = 4$

$n(P \cap M) = x$

$32 - x + x + 24 - x + 4 = 40$

$-x + x - x + 32 + 24 - 4 = 40$

$-x + 60 = 40$

$x = 60 - 40 = 20$

Option D

178. $\frac{6^{2x-1}}{3^{2x-1}} = 1$

$3^{2(2x-1)} = 3^{2(2x-1)}$

$2(2x-1) = 2(2x-1)$

$4x - 2 = 4x - 2$

$4x - 3 = -3 + 2$

$x = 1$

Since your answer is not in the options, but

verification shows that our answer is correct. If

you got this, you're cool!

$\begin{array}{r|l} -x & 2 \\ \hline 4x & 1 \end{array} \begin{array}{l} 3 \\ 3x \\ 4 \\ -5 \end{array}$

$(-x + 1) - (4x - 2) = (3 - 5) - (4 - 3x)$

$-x - 8x = -15 - 12x$

$-9x + 12x = -15$

$3x = -15$

$x = -\frac{15}{3} = -5$

Option D

180. no. of people = x

children = 22.5%

men = 47.5%

% of women = $100 - (22.5 + 47.5)$

$= 100 - 70$

$= 30\%$

no. of women = 84

$\therefore 30\% \text{ of } x = 84$

$\frac{30}{100} \cdot x = 84$

$x = \frac{84 \cdot 10}{3}$

$x = 280 \text{ people}$

no. of men = 47.5% of x

$= \frac{47.5}{100} \cdot 280$

$= 133 \text{ people}$

Option A

Xpress SOLUTIONS

MATHEMATICS

$$181. 2y + 8x - 17 = 0$$

$$2y = -8x + 17$$

$$y = -\frac{3x}{2} + \frac{17}{2}$$

$$y = -4x + \frac{17}{2}$$

$$\therefore m_1 = -4$$

parallelism

$$m_1 = m_2$$

$$m_2 = -4$$

$$m_2 = \frac{2 - (-p)}{-2p - (-1)}$$

$$-4 = \frac{2+p}{-2p+1}$$

$$2+p = -4(-2p+1)$$

$$2+p = 8p-4$$

$$8p-p = 2+4$$

$$7p = 6$$

$$p = \frac{6}{7}$$

Option B

$$182. \theta = 30^\circ, r = 21\text{cm}$$

$$l = \frac{30}{360} \cdot 2\pi \cdot 21$$

$$l = 11\text{cm}$$

$$183. 3x^3 + 5x^2 - 11x + 4 \div x + 3$$

$$x + 3 = 0$$

$$x = -3$$

substitute $x = -3$ in the equation

$$= 3(-3)^3 + 5(-3)^2 - 11(-3) + 4$$

$$= -81 + 45 + 33 + 4$$

$$= -81 + 82 = 1$$

$$184. Q_n = 3 \cdot 2^{n-1}$$

$$Q_2 = 3 \cdot 2^{2-1}$$

$$= 3 \cdot 2^0$$

$$= 3 \cdot 1$$

$$= 3$$

$$Q_2 U_2 = 3 \cdot 6$$

$$= 18$$

$$185. p = \frac{1}{2} \sqrt{pq}$$

$$8 = \frac{1}{2} \sqrt{8 \cdot 32}$$

$$= \sqrt{256} = 16$$

$$4 \cdot (8 \cdot 32) = 4 \cdot 19$$

$$= \sqrt{4 \cdot 19}$$

$$= \sqrt{64}$$

Option A

Option B

$$186. a = \frac{1}{2}$$

$$r = \frac{1}{6} \div \frac{1}{2} = \frac{1}{6} \cdot \frac{2}{1} = \frac{1}{3}$$

$$S_m = \frac{a}{1-r} = \frac{1/2}{1-1/3}$$

$$= \frac{1}{2} \cdot \frac{2}{3}$$

$$= \frac{1}{2} \cdot \frac{3}{2}$$

$$= \frac{3}{4} = 0.75$$

$$187. \tan 30 = \frac{h}{40}$$

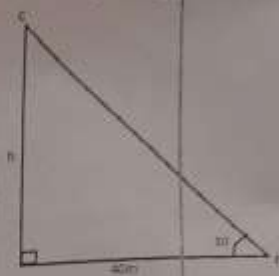
$$h = 40 \tan 30$$

$$h = 40 \cdot \frac{\sqrt{3}}{3}$$

$$h = \frac{40\sqrt{3}}{3} \text{m}$$

Option A

Option C



$$188. \tan 60 = \frac{300}{w}$$

$$w = \frac{300}{\tan 60}$$

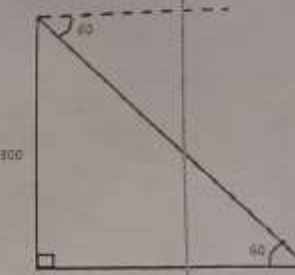
$$= \frac{300}{\sqrt{3}}$$

$$= \frac{300 \cdot \sqrt{3}}{\sqrt{3} \cdot \sqrt{3}}$$

$$= \frac{300\sqrt{3}}{3}$$

$$= 100\sqrt{3} \text{m}$$

Option C



$$189. \bar{x}_6 = 60$$

$$n = 6$$

$$\bar{x}_5 = 50$$

$$n = 5$$

$$\bar{x}_5 = \frac{\sum f x_5}{n}$$

$$\sum f x_5 = \bar{x}_5 n$$

$$= 60 \cdot 6$$

$$= 360$$

$$\text{sixth no} = \sum f x_6 - \sum f x_5$$

$$= 360 - 250$$

$$= 110$$

$$\bar{x}_5 = \frac{\sum f x_5}{n}$$

$$\sum f x_5 = \bar{x}_5 n$$

$$= 5 \cdot 50$$

$$= 250$$

Option D

$$190. \frac{x}{a+r} = \frac{a}{r}$$

$$xr = a(a+r)$$

$$xr = a^2 + ar$$

$$xr - ar = a^2$$

$$r(x-a) = a^2$$

$$r = \frac{a^2}{x-a}$$

Option B

Xpress SOLUTIONS

MATHEMATICS

$$191. y = 3x + 4$$

simply make x subject of the formula

$$y - 4 = 3x$$

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

then, replace x with y and vice versa

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

Option A

$$192. \frac{dy}{dx} = 2x - 3$$

$$dy = (2x - 3)dx$$

$$\int dy = \int (2x - 3)dx$$

$$y = x^2 - 3x + c$$

$$\text{when } x = 0, y = 3$$

$$3 = 0^2 - 3(0) + c$$

$$3 = c$$

$$y = x^2 - 3x + 3$$

Option B

$$193. r = 5\text{cm}$$

$$\frac{dr}{dt} = 0.2\text{cm/s}$$

$$A = \pi r^2$$

$$\frac{dA}{dr} = 2\pi r$$

$$\frac{dA}{dt} = \frac{dA}{dr} \cdot \frac{dr}{dt}$$

$$= 2\pi r \cdot 0.2$$

$$= 2\pi(5) \cdot 0.2$$

$$= 2\pi$$

Option C

$$194. \frac{x+2}{4} - \frac{2x-3}{3} < 4$$

multiplying through by 12

$$12\left(\frac{x+2}{4}\right) - 12\left(\frac{2x-3}{3}\right) < 4 \cdot 12$$

$$3(x+2) - 4(2x-3) < 48$$

$$3x + 6 - 8x + 12 < 48$$

$$-5x + 18 < 48$$

$$-5x < 48 - 18$$

$$-5x < 30$$

dividing through by -5 will reverse the inequality sign

$$\frac{-5x}{-5} > \frac{30}{-5}$$

Option D

$$195. 2x + 1 - 3c = 2c + 3x - 7$$

$$2x - 3x + 1 + 7 = 2c + 3c$$

$$-x + 8 = 5c$$

$$\text{when } x = -2$$

$$-(-2) + 8 = 5c$$

$$2 + 8 = 5c$$

$$10 = 5c$$

$$c = \frac{10}{5} = 2$$

Option A

$$196. (n-2)180 = 1800$$

$$n-2 = \frac{1800}{180}$$

$$n-2 = 10$$

$$n = 10 + 2$$

$$= 12$$

$$\text{Ext. Angle} = \frac{360}{n} = \frac{360}{12} = 30$$

Option C

$$197. P = 1000, T = 3, A = 1240$$

$$I = A - P = 1240 - 1000$$

$$= 240$$

$$R = \frac{100I}{PT} = \frac{100 \cdot 240}{1000 \cdot 3} = 8\%$$

Option A

$$198. l, l+1 \text{ and } m \text{ are consecutive numbers.}$$

$$l = 1$$

$$m = l + 1$$

$$l^2 = 3(l + m)$$

$$l^2 = 3(l - 1 + l + 1)$$

$$l^2 = 3(2l)$$

$$l^2 = 6l$$

$$l^2 = 6l$$

$$\frac{l^2}{l} = \frac{6l}{l}$$

$$l = 6$$

$$m = l + 1$$

$$= 6 + 1 = 7$$

Option D

$$199. \frac{\sqrt{x}}{x+\sqrt{x}} = \frac{1}{x-\sqrt{x}}$$

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

$$x + \sqrt{x} = x\sqrt{x} - 2$$

$$x - x\sqrt{x} = -2 - \sqrt{x}$$

$$x(1 - \sqrt{x}) = -2 - \sqrt{x}$$

$$x = \frac{-2 - \sqrt{x}}{(1 - \sqrt{x})}$$

$$x = \frac{-2 - \sqrt{x}}{(1 - \sqrt{x})}$$

$$\text{rationalizing}$$

$$x = \frac{-2 - \sqrt{x}}{(1 - \sqrt{x})} \cdot \frac{(1 + \sqrt{x})}{(1 + \sqrt{x})}$$

$$x = \frac{-2 - 2\sqrt{x} - \sqrt{x} - 2}{1^2 - (\sqrt{x})^2} = \frac{-4 - 3\sqrt{x}}{1 - 2}$$

$$x = \frac{-4 - 3\sqrt{x}}{-1} = 4 + 3\sqrt{x}$$

Option B

$$200. y = ax^2 + bx + c$$

$$\text{when } x = 1, y = 5$$

$$ax^2 + bx + c = 5$$

FUTA POST UTME SOLUTION MANUAL

Xpress SOLUTIONS

MATHEMATICS

$$191. y = 3x + 4$$

simply make x subject of the formula

$$y - 4 = 3x$$

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

then, replace x with y and vice versa

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

Option A

$$192. \frac{dy}{dx} = 2x - 3$$

$$dy = (2x - 3)dx$$

$$\int dy = \int (2x - 3)dx$$

$$y = x^2 - 3x + c$$

when $x = 0, y = 3$

$$3 = 0^2 - 3(0) + c$$

$$3 = c$$

$$y = x^2 - 3x + 3$$

Option B

$$193. r = 5\text{cm}$$

$$\frac{dr}{dt} = 0.2\text{cm/s}$$

$$A = \pi r^2$$

$$\frac{dA}{dr} = 2\pi r$$

$$\frac{dA}{dt} = \frac{dA}{dr} \cdot \frac{dr}{dt}$$

$$= 2\pi r \cdot 0.2$$

$$= 2\pi(5) \cdot 0.2$$

$$= 2\pi$$

Option C

$$194. \frac{x+2}{4} - \frac{2x-3}{3} < 4$$

multiplying through by 12

$$12\left(\frac{x+2}{4}\right) - 12\left(\frac{2x-3}{3}\right) < 4 \cdot 12$$

$$3(x+2) - 4(2x-3) < 48$$

$$3x + 6 - 8x + 12 < 48$$

$$-5x + 18 < 48$$

$$-5x < 48 - 18$$

$$-5x < 30$$

dividing through by -5 will

reverse the inequality sign

$$\frac{-5x}{-5} > \frac{30}{-5}$$

$$x > -6$$

Option D

$$195. 2x + 1 - 3c = 2c + 3x - 7$$

$$2x - 3x + 1 + 7 = 2c + 3c$$

$$-x + 8 = 5c$$

when $x = -2$

$$-(-2) + 8 = 5c$$

$$2 + 8 = 5c$$

$$10 = 5c$$

$$r = \frac{10}{5} = 2$$

$$196. (n - 2)180 = 1800$$

$$n - 2 = \frac{1800}{180}$$

$$n - 2 = 10$$

$$n = 10 + 2$$

$$= 12$$

Option A

$$\text{Ext. Angle} = \frac{360}{n} = \frac{360}{12} = 30^\circ$$

Option C

$$197. P = 1000, T = 3, A = 12\%$$

$$I = A \cdot P = 1240 - 1000$$

$$= 240$$

$$R = \frac{100I}{PT} = \frac{100 \cdot 240}{1000 \cdot 3} = 8\%$$

Option A

198. if k, l and m are consecutive numbers.

$$k = l - 1$$

$$m = l + 1$$

$$I = 3(k + m)$$

$$I = 3(l - 1 + l + 1)$$

$$I = 3(2l)$$

$$I = 6l$$

$$\frac{I}{l} = \frac{6l}{l}$$

$$I = 6$$

$$m = l + 1$$

$$= 6 + 1 = 7$$

Option D

$$199. \frac{\sqrt{5}}{x + \sqrt{2}} = \frac{1}{x - \sqrt{2}}$$

$$1(x + \sqrt{2}) = \sqrt{2}(x - \sqrt{2})$$

$$x + \sqrt{2} = x\sqrt{2} - 2$$

$$x - x\sqrt{2} = -2 - \sqrt{2}$$

$$x(1 - \sqrt{2}) = -2 - \sqrt{2}$$

$$x = \frac{-2 - \sqrt{2}}{(1 - \sqrt{2})}$$

$$x = \frac{-2 - \sqrt{2}}{(1 - \sqrt{2})}$$

$$\text{rationalizing}$$

$$x = \frac{-2 - \sqrt{2}}{(1 - \sqrt{2})} \cdot \frac{(1 + \sqrt{2})}{(1 + \sqrt{2})}$$

$$x = \frac{-2 - 2\sqrt{2} - \sqrt{2} - 2}{1^2 - (\sqrt{2})^2} = \frac{-4 - 3\sqrt{2}}{1 - 2}$$

$$x = \frac{-4 - 3\sqrt{2}}{-1} = 4 + 3\sqrt{2}$$

Option B

$$200. y = ax^2 + bx + c$$

when $x = 1, y = 5$

$$ax^2 + bx + c = 5$$

Xpress SOLUTIONS

MATHEMATICS

$$a(1)^2 + b(1) + c = 5$$

$$a + b + c = 5 \text{ ----- 1}$$

$$\frac{dy}{dx} = 2ax + b$$

$$\frac{dy}{dx} = 2x + 1$$

$$2ax + b = 2x + 1$$

comparing,

$$a = 1, b = 1$$

substituting a and b in 1

$$a + b + c = 5$$

$$1 + 1 + c = 5$$

$$2 + c = 5$$

$$c = 5 - 2 = 3$$

$$a, b, c = 1, 1, 3$$

$$201. \tan \theta = \frac{\text{Opp}}{\text{Adj}} = \frac{5}{4}$$

$$\text{Opp} = 5, \text{Adj} = 4$$

$$\text{Hyp}^2 = \text{Opp}^2 + \text{Adj}^2$$

$$c^2 = 5^2 + 4^2$$

$$c^2 = 25 + 16$$

$$c^2 = 41$$

$$c = \sqrt{41}$$

$$\sin \theta = \frac{\text{Opp}}{\text{Hyp}} = \frac{5}{\sqrt{41}}$$

$$\sin^2 \theta = \left(\frac{5}{\sqrt{41}} \right)^2 = \frac{25}{41}$$

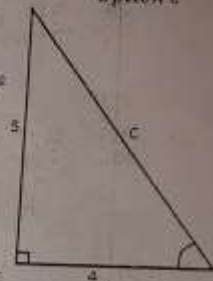
$$\cos \theta = \frac{\text{Adj}}{\text{Hyp}} = \frac{4}{\sqrt{41}}$$

$$\cos^2 \theta = \left(\frac{4}{\sqrt{41}} \right)^2 = \frac{16}{41}$$

$$\sin^2 \theta - \cos^2 \theta = \frac{25}{41} - \frac{16}{41}$$

$$= \frac{9}{41}$$

Option C



Option C

$$202. 2q3_5 = 77$$

$$2 \cdot 5^2 + q \cdot 5^1 + 3 \cdot 5^0 = 7 \cdot 8^1 + 7 \cdot 8^0$$

$$2 \cdot 25 + q \cdot 5 + 3 \cdot 1 = 7 \cdot 8 + 7 \cdot 1$$

$$50 + 5q + 3 = 56 + 7$$

$$54 + 5q = 63$$

$$5q = 63 - 54$$

$$5q = 9$$

$$q = \frac{9}{5}$$

$$q = \frac{10}{5} = 2$$

Option C

$$203. \frac{11 \cdot 5 \cdot 2}{3 \cdot 6 \cdot 3} = \frac{11 \cdot 5 \cdot 2}{3 \cdot 6 \cdot 3}$$

$$\frac{11 \cdot 5 \cdot 2}{15 \cdot 4 \cdot 27} = \frac{11 \cdot 5 \cdot 2}{15 \cdot 4 \cdot 27}$$

$$= \left(\frac{11}{3} \cdot \frac{5}{6} \cdot \frac{2}{3} \right) + \left(\frac{11}{15} \cdot \frac{3}{4} \cdot \frac{2}{27} \right)$$

$$= \frac{11}{3} \cdot \frac{5}{6} \cdot \frac{2}{3} + \frac{11}{15} \cdot \frac{3}{4} \cdot \frac{2}{27}$$

$$= 5 \cdot 5 \cdot 2$$

$$= 50$$

Option A

$$204. P = 5000, R = 4\%$$

$$T = 9 \text{ months} = \frac{9}{12} \text{ years} = 0.75 \text{ years}$$

$$I = \frac{PRT}{100} = \frac{5000 \cdot 4 \cdot 0.75}{100}$$

$$I = N150$$

Option C

$$205. M:N:Q = 5:4:3$$

$$\frac{2N - Q}{M} = \frac{2(4) - 3}{5}$$

$$= \frac{8 - 3}{5}$$

$$= \frac{5}{5} = 1$$

Option A

$$206. \left(\frac{2}{3} \right)^{\frac{1}{2}} + \left(\frac{3}{4} \right)^{\frac{1}{2}}$$

$$= \left(\frac{2}{3} \right)^{\frac{1}{2}} + \left(\frac{3}{4} \right)^{\frac{1}{2}}$$

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Option B

$$207. \log_3 18 + \log_3 3 - \log_3 x = 3$$

$$\log_3 \left(\frac{18 \cdot 3}{x} \right) = 3$$

$$\frac{18 \cdot 3}{x} = 3^3$$

$$\frac{54}{x} = 27$$

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Option A

$$208. \text{rationalize } \frac{2-\sqrt{5}}{3-\sqrt{5}}$$

$$= \frac{2-\sqrt{5}}{3-\sqrt{5}} \cdot \frac{3+\sqrt{5}}{3+\sqrt{5}}$$

$$= \frac{2 \cdot 3 + 2 \cdot \sqrt{5} - 3 \cdot \sqrt{5} - \sqrt{5} \cdot \sqrt{5}}{3^2 - \sqrt{5}^2}$$

$$= \frac{6 + 2\sqrt{5} - 3\sqrt{5} - 5}{9 - 5}$$

$$= \frac{1 - \sqrt{5}}{4}$$

Option D

$$209. \left(\sqrt{2} + \frac{1}{\sqrt{3}} \right) \left(\sqrt{2} - \frac{1}{\sqrt{3}} \right)$$

$$(a+b)(a-b) = a^2 - b^2$$

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

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

$$= \frac{5}{3}$$

Option B

210. raila's choices are 7C₁ per room

$$n = 7C_1 + 7C_1 + 7C_1$$

$$= 3 \cdot 7C_1 = 3 \cdot \frac{7!}{(7-1)!1!}$$

$$= 3 \cdot \frac{7!}{6! \cdot 1}$$

$$= 3 \cdot \frac{7 \cdot 6!}{6! \cdot 1}$$

$$= 3 \cdot 7 = 21 \text{ ways}$$

Option D

211.

$$x^2 + 1 \sqrt{\frac{x^3 - 2x^2 + 3x - 3}{x^3 - 0x^2 + x}}$$

$$-2x^2 - 2x - 3$$

$$-2x^2 - 0x - 2$$

$$2x - 1$$

$$\text{remainder} = 2x - 1$$

$$212. 9y^2 - 16x^2$$

$$= (3y)^2 - (4x)^2$$

$$= (3y - 4x)(3y + 4x)$$

$$213. -2x - 5y = 3 \quad \text{---1}$$

$$x + 3y = 0 \quad \text{---2}$$

$$x = -3y$$

substituting x in 1

$$-2x - 5y = 3$$

$$-2(-3y) - 5y = 3$$

$$6y - 5y = 3$$

$$y = 3$$

recall that x = -3y

$$x = -3(3)$$

$$x = -9$$

$$x, y = -9, 3$$

Option A

$$214. x = k\sqrt{y}$$

$$x = k\sqrt{y}$$

$$\text{when } x = 81, y = 9$$

$$81 = k\sqrt{9}$$

$$81 = 3k$$

$$k = \frac{81}{3} = 27$$

$$x = 27\sqrt{y}$$

$$\text{when } y = 1, \frac{7}{9} = \frac{16}{9}$$

$$x = 27 \sqrt{\frac{16}{9}} = 27 \cdot \frac{4}{3}$$

$$= 9 \cdot 4 = 36$$

Option C

$$215. T \propto \frac{1}{R^3}$$

$$T = \frac{K}{R^3}$$

$$K = TR^3$$

$$\text{When } T = \frac{2}{81}, R = 3$$

$$K = \frac{2}{81} \cdot 27 = \frac{2}{3}$$

$$T = \frac{2}{3} \cdot \frac{1}{R^3}$$

$$\text{when } R = 2$$

$$T = \frac{2}{3} \cdot \frac{1}{2^3} = \frac{1}{12}$$

Option B

$$216. -(x+4) \leq 4(x-2)$$

$$-x-4 \leq 4x-8$$

$$-x-4x \leq -8+18$$

$$-5x \leq 10$$

$$x \geq \frac{10}{-5}$$

$$x \geq -2$$

Option D

$$217. x^2 + 2x > 15$$

$$x^2 + 2x - 15 > 0$$

$$x^2 + 3x - 5x - 15 > 0$$

$$x(x+3) - 5(x+3) > 0$$

$$(x-5)(x+3) > 0$$

$$x-5 > 0$$

$$x+3 > 0$$

$$x > 5$$

$$x > -3$$

No Option fits

$$218. n = 18, a = 3, d = 6 - 3 = 3$$

$$S_n = \frac{n}{2} [2a + (n-1)d]$$

$$S_{18} = \frac{18}{2} [2 \cdot 3 + (18-1)3]$$

$$S_{18} = 9(6 + 51)$$

$$= 9(57) = 513$$

Option A

$$219. T_2 = ar = 4 \quad \text{---1}$$

$$T_4 = ar^3 = 16 \quad \text{---2}$$

dividing 2 by 1

$$\frac{ar^3}{ar} = \frac{16}{4}$$

$$r^2 = 4$$

$$r = \sqrt{4} = 2$$

substituting r in 1

Xpress SOLUTIONS

$$ar = 4$$

$$a(2) = 4$$

$$a = \frac{4}{2} = 2$$

$$S_n = \frac{a(r^n - 1)}{r - 1}$$

$$S_5 = \frac{2(2^5 - 1)}{2 - 1} = \frac{2(32 - 1)}{1} = 2(31) = 62$$

Option D

$$220. x + y = xy + x + y$$

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

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

Option B

$$221. \begin{vmatrix} 2 & 3 \\ 5 & 3x \end{vmatrix} = \begin{vmatrix} 4 & 1 \\ 3 & 2x \end{vmatrix}$$

$$(2 \cdot 3x) - (3 \cdot 5) = (4 \cdot 2x) - (1 \cdot 3)$$

$$6x - 15 = 8x - 3$$

$$6x - 8x = -3 + 15$$

$$-2x = 12$$

$$x = \frac{12}{-2} = -6$$

Option A

$$222. \begin{vmatrix} 4 & 2 & -1 \\ 2 & 3 & -1 \\ -1 & 1 & 3 \end{vmatrix} =$$

$$= 4 \begin{vmatrix} 3 & -1 \\ 1 & 3 \end{vmatrix} - 2 \begin{vmatrix} 2 & -1 \\ -1 & 3 \end{vmatrix} - 1 \begin{vmatrix} 2 & 3 \\ -1 & 1 \end{vmatrix}$$

$$= 4(3 \cdot 3 - 1 \cdot 1) - 2(2 \cdot 3 - (-1 \cdot -1)) - 1(2 \cdot 1 - (-1 \cdot 3))$$

$$= 4(9 - 1) - 2(6 - 1) - 1(2 + 3)$$

$$= 4(8) - 2(5) - 1(5)$$

$$= 40 - 10 - 5$$

$$= 25$$

Option D

$$223. N = \begin{pmatrix} 2 & 3 \\ 1 & 4 \end{pmatrix}$$

$$|N| = \begin{vmatrix} 2 & 3 \\ 1 & 4 \end{vmatrix} = (2 \cdot 4) - (3 \cdot 1)$$

$$= 8 - 3$$

$$= \begin{vmatrix} 4 & -3 \\ -1 & 2 \end{vmatrix}$$

Option B

$$224. \text{Int. Angle} = \frac{(n-2)180}{n}$$

$$\text{when } n = 12$$

$$= \frac{(12-2)180}{12}$$

$$= \frac{10 \cdot 180}{12}$$

$$= \frac{1800}{12} = 150^\circ$$

Option B

MATHEMATICS

$$225. C = 28\text{cm}$$

Perimeter of circle = perimeter of square

$$C = 4l$$

$$28 = 4l$$

$$l = \frac{28}{4} = 7$$

$$\text{Area} = l^2 = 7^2 = 49\text{cm}^2$$

$$226.$$

$$OB^2 = OD^2 + DB^2$$

$$7^2 = 5^2 + x^2$$

$$x^2 = 7^2 - 5^2$$

$$x^2 = 49 - 25 = 24$$

$$x^2 = \sqrt{24} = 2\sqrt{6}$$

$$AB = 2OB = 2 \cdot 2\sqrt{6} = 4\sqrt{6}$$

$$227. \text{vol of cube} = l^3$$

$$= 3^3 = 27\text{cm}^3$$

$$\text{vol of tank} = lbh$$

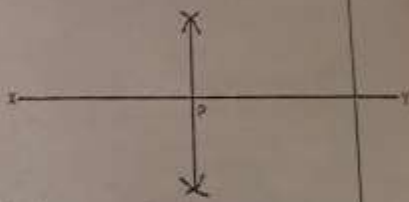
$$= 3 \cdot 4 \cdot 5 = 60\text{cm}^3$$

$$\text{Vol of water} = \text{vol of tank} - \text{vol of cube}$$

$$= 60 - 27 = 33\text{cm}^3$$

Option B

$$228.$$



P is the perpendicular bisector of X and Y and it is equidistant from X and Y i.e. $XP = PY$

Option D

$$229. P(x, y) \quad Q(8, 6) \quad \text{Midpoint}(5, 8)$$

$$M = \frac{P + Q}{2}$$

$$5 = \frac{x + 8}{2}$$

$$5 \cdot 2 = x + 8$$

$$x = 10 - 8$$

$$x = 2$$

$$(x, y) = (2, 10)$$

$$8 = \frac{y + 6}{2}$$

$$8 \cdot 2 = y + 6$$

$$y = 16 - 6$$

$$y = 10$$

Option A



Xpress SOLUTIONS

MATHEMATICS

$$230. 2y = 5x + 4$$

$$y = \frac{5}{2}x + \frac{4}{2}$$

$$m_1 = \frac{5}{2}$$

perpendicularity

$$m_1 m_2 = -1$$

$$m_2 = -\frac{1}{m_1} = -\frac{1}{\frac{5}{2}} = -\frac{2}{5}$$

$$m_2 = \frac{y - y_1}{x - x_1}$$

$$-\frac{2}{5} = \frac{y - 2}{x - 4}$$

$$-2(x - 4) = 5(y - 2)$$

$$-2x + 8 = 5y - 10$$

$$0 = 5y + 2x - 10 - 8$$

$$5y + 2x - 18 = 0$$

$$231. \tan \theta = \frac{\text{Opp}}{\text{Adj}} = \frac{3}{4}$$

$$\text{Opp} = 3, \text{Adj} = 4$$

$$\text{Hyp}^2 = \text{Opp}^2 + \text{Adj}^2$$

$$c^2 = 3^2 + 4^2$$

$$c^2 = 9 + 16$$

$$c^2 = 25$$

$$c = \sqrt{25} = 5$$

$$\cos \theta = \frac{\text{Adj}}{\text{Hyp}} = \frac{4}{5}$$

$$\sin \theta = \frac{\text{Opp}}{\text{Hyp}} = \frac{3}{5}$$

$$\cos \theta - \sin \theta = \frac{4}{5} - \frac{3}{5}$$

$$= \frac{1}{5}$$

Option B



Option C

$$232. \tan \theta = \frac{100}{100} = 1$$

$$\tan \theta = 1$$

$$\theta = \tan^{-1} 1$$

$$\theta = 45^\circ$$

bearing of X from Z

$$= 45^\circ + 90^\circ$$

$$= 135^\circ$$

Option B

$$233. (2x + 1)(3x + 1)$$

$$= 6x^2 + 2x + 3x + 1$$

$$= 6x^2 + 5x + 1$$

$$\frac{d}{dx} = 12x + 5$$

Option D

$$234. y = x^3 + x^2 - x + 1$$

$$\frac{dy}{dx} = 3x^2 + 2x - 1 = 0$$

$$3x^2 + 2x - 1 = 0$$

$$3x^2 + 3x - x - 1 = 0$$

$$3x(x + 1) - 1(x + 1) = 0$$

$$(3x - 1)(x + 1) = 0$$

$$3x - 1 = 0 \quad x + 1 = 0$$

$$x = \frac{1}{3} \text{ or } -1$$

$$\frac{d^2y}{dx^2} = 6x + 2$$

$$\text{when } x = \frac{1}{3}$$

$$\text{when } x = -1$$

$$\frac{d^2y}{dx^2} = 6\left(\frac{1}{3}\right) + 2 = 2 + 2 = 4$$

$$\frac{d^2y}{dx^2} > 0$$

minimum

at minimum point

Option A

$$235. \int (3x^2 - 2x + 1) dx$$

$$= \left[3x^2 \cdot \frac{2x^2 + 1}{1 + 1} \right]_0^1$$

$$= (3x^2 - x^2)_0^1$$

$$= (3 \cdot 1 - 1^2) - (3 \cdot 0 - 0^2)$$

$$= (3 - 1) - 0$$

$$= 2$$

Option A

$$236. \int \cos 4x dx$$

$$u = 4x$$

$$\frac{du}{dx} = 4$$

$$dx = \frac{du}{4}$$

$$\int \cos 4x dx = \int \cos u \frac{du}{4}$$

$$= \int \cos u \frac{du}{4}$$

$$= \frac{1}{4} \int \cos u du$$

$$= \frac{1}{4} (-\sin u) + k$$

$$= \frac{1}{4} (-\sin 4x) + k$$

Option B

237. let the four consecutive numbers be

$$x, x + 1, x + 2, x + 3$$

$$x + x + 1 + x + 2 + x + 3 = 34$$

$$4x + 6 = 34$$

$$4x = 28$$

Xpress SOLUTIONS

$$x = \frac{28}{7} = 7$$

Option C

$$238. n = \Sigma f$$

$$n = 1 + 4 + 3 + 8 + 2 + 5 = 23$$

$$\text{median} = \frac{23}{2} = 11.5$$

$$\text{median} = 12\text{th term} = 8$$

$$\text{Range} = 5 - 0 = 5$$

Ans: (5, 8)

Option A

$$239. \text{highest frequency} = 8$$

mode = mid class interval of modal class

$$= \frac{9 + 11}{2} = \frac{20}{2} = 10$$

Option C

240.

Interval	(X)	f	fX	X· \bar{x}	(X - \bar{x}) ²	f(X - \bar{x}) ²
3-5	4	2	8	4-7=-3	9	18
5-8	7	2	14	7-7=0	0	0
9-11	10	2	20	10-7=3	9	18
total	21	n=6	42			36

$$\bar{x} = \frac{\Sigma fX}{n} = \frac{42}{6} = 7$$

$$s = \sqrt{\frac{\Sigma f(X - \bar{x})^2}{n}}$$

$$s = \sqrt{\frac{36}{6}} = \sqrt{6} = 2.45$$

241. ELATION has 7 letters without repetition

no of arrangements = $n!$

Option D

242. circular arrangement = $(n-1)!$

$$(5-1)!$$

$$4!$$

$$24$$

Option B

243.

43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60

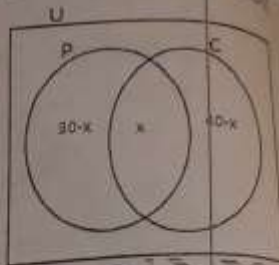
$$P(\text{prime}) = \frac{4}{10} = \frac{2}{5}$$

Option B

Be careful! 57 is a trick no. it appears to be prime whereas, it is multiple of 19. Watch out for these in the exam

MATHEMATICS

244.



$$n(U) = 60$$

$$n(P) = 30$$

$$n(C) = 40$$

$$n(P \cap C) = x$$

$$60 = 30 - x + x + 40$$

$$60 = 70 - x$$

$$x = 70 - 60$$

$$x = 10$$

$$P(P \cap C) = \frac{n(P \cap C)}{n(U)} = \frac{10}{60} = \frac{1}{6}$$

Option D

245. 72

$$7 \cdot 6^1 + 2 \cdot 6^0$$

$$= 42 + 2$$

$$= 44_{10}$$

44 to base 3

$$\frac{44}{3} = 14 \text{ rem } 2$$

$$\frac{14}{3} = 4 \text{ rem } 2$$

$$\frac{4}{3} = 1 \text{ rem } 1$$

$$\frac{1}{3} = 0 \text{ rem } 1$$

$$144$$

$$3$$

$$14 \text{ rem } 2$$

$$3$$

$$4 \text{ rem } 2$$

$$3$$

$$1 \text{ rem } 1$$

$$0 \text{ rem } 1$$

$$72_6 = 1122_3$$

$$2^2 \cdot 1^1 = \frac{8}{3} + \frac{3}{2}$$

$$246. \frac{4}{5} = \frac{24}{5}$$

$$= \frac{4}{1} + \frac{24}{5} = \frac{4}{1} + \frac{5}{24}$$

$$= \frac{5}{6}$$

$$247. \frac{21}{9} = 2.33$$

$$248. \text{Income} = 3500$$

$$\text{Children} = 15\% \text{ of income}$$

$$= \frac{15}{100} \cdot 3500$$

$$= 525$$

$$\text{Additional Expenses} = 1950$$

$$\text{total expenses} = 525 + 1950$$



Xpress SOLUTIONS

MATHEMATICS

$$\begin{aligned} &= 2475 \\ \text{change} &= 3500 - 2475 \\ &= 1025 \end{aligned}$$

Option B

$$\begin{aligned} 249. 27^{x+2} + 9^{x+1} &= 3^{2x} \\ 3^{3(x+2)} + 3^{2(x+1)} &= 3^{2x} \\ 3^{3(x+2)-2(x+1)} &= 3^{2x} \\ 3(x+2) - 2(x+1) &= 2x \\ 3x+6-2x-2 &= 2x \\ 3x-2x-2x &= 2-6 \\ -x &= -4 \\ x &= 4 \end{aligned}$$

Option B

$$250. \log_3 x^2 = -8$$

$$\begin{aligned} x^2 &= 3^{-8} \\ x^2 &= (3^{-4})^2 \\ x &= 3^{-4} \\ x &= \frac{1}{3^4} = \frac{1}{81} \end{aligned}$$

Option D

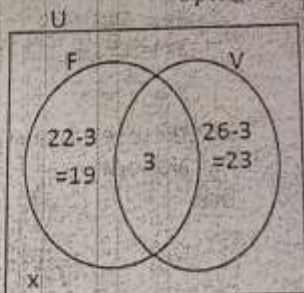
$$\begin{aligned} 251. (\sqrt{6}+2)^2 - (\sqrt{6}-2)^2 \\ &= [\sqrt{6}+2 - (\sqrt{6}-2)] [(\sqrt{6}+2) + (\sqrt{6}-2)] \\ &= (\sqrt{6}+2-6+2)(\sqrt{6}+2+\sqrt{6}-2) \\ &= 4(2\sqrt{6}) = 8\sqrt{6} \end{aligned}$$

Option C

$$\begin{aligned} 252. P &= \{2, 3, 5\} \\ Q &= \{2, 3, 6, 9\} \\ P \cap Q &= \{2, 3\} \end{aligned}$$

Option B

253.



$$\begin{aligned} n(U) &= 46 \\ n(F) &= 22 \\ n(V) &= 26 \\ n(F \cap V) &= 3 \\ n(F \cup V) &= x \\ 46 &= 19 + 3 + 23 \\ 46 &= 45 + x \\ x &= 46 - 45 \\ x &= 1 \end{aligned}$$

Option A

$$\begin{aligned} 254. w &= \frac{v(2+cn)}{1-cn} \\ w(1-cn) &= v(2+cn) \\ w - wcn &= 2v + vcn \\ w - 2v &= vcn + wcn \\ x - 2v &= (vc + wc)n \\ n &= \frac{w-2v}{vc+wc} \\ &= \frac{1}{c} \left(\frac{w-2v}{v+w} \right) \end{aligned}$$

Option A

$$255. 2x^3 - 11x^2 + 18x - 1$$

divisor is $x+3$

$$x+3=0$$

$$x=-3$$

substituting to determine remainder

$$= 2(-3)^3 - 11(-3)^2 + 18(-3) - 1$$

$$= 2(-27) - 11(9) + 18(-3) - 1$$

$$= -54 - 99 - 54 - 1$$

$$= -208$$

$$256. x^2 - y^2 = 4$$

$$(x-y)(x+y) = 4$$

$$\text{but } x+y = 2 \quad \text{---} \quad 1$$

$$2(x-y) = 4$$

$$x-y = \frac{4}{2} = 2$$

$$x-y = 2 \quad \text{---} \quad 2$$

$$\text{adding 1 and 2}$$

$$x+y+x-y = 2+2$$

$$2x = 4$$

$$x = 2$$

$$x-y = 2$$

$$2-y = 2$$

$$y = 2-2 = 0$$

$$x, y = 2, 0$$

Option C

$$257. y \propto \sqrt{n}$$

$$y = k\sqrt{n}$$

$$\text{when } y = 4 \text{ and } n = 4$$

$$4 = k\sqrt{4}$$

$$4 = 2k$$

$$k = \frac{4}{2} = 2$$

$$y = 2\sqrt{n}$$

$$\text{when } n = 16, \quad \frac{7}{9} = \frac{16}{9}$$

$$y = 2\sqrt{16} = 8$$

$$y = 2\sqrt{\frac{16}{9}} = \frac{8}{3}$$

$$y = 2\sqrt{\frac{16}{9}} = \frac{8}{3}$$

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Xpress SOLUTIONS

MATHEMATICS

$$u = \frac{648}{v^3}$$

$$\text{when } v = 3$$

$$u = \frac{648}{v^3} = \frac{648}{3^3}$$

$$= \frac{648}{27} = 24$$

Option A

$$259. \frac{1}{5}y + \frac{1}{5} < \frac{1}{5}y + \frac{2}{5}$$

$$\frac{1}{5}y - \frac{1}{5}y < \frac{2}{5} - \frac{1}{5}$$

$$y > \frac{1}{5} \cdot \frac{10}{3}$$

$$y > \frac{2}{3}$$

Option C

$$260. (m-3)(m-4) < 0$$

$$m-3 > 0$$

$$m > 3$$

$$3 < m < 4$$

$$m-4 < 0$$

$$m < 4$$

Option C

$$261. P_1(1,0) P_2(0,4)$$

$$\frac{y-y_1}{x-x_1} = \frac{y_2-y_1}{x_2-x_1}$$

$$\frac{y-0}{x-1} = \frac{4-0}{0-1}$$

$$\frac{y}{x-1} = \frac{4}{-1}$$

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

$$y = -4x + 4$$

Shaded portion

$$y \leq -4x + 4$$

$$262. nth = n^2 - 6n - 4$$

$$3rd = 3^2 - 6(3) - 4$$

$$= 9 - 18 - 4$$

$$= -13$$

$$4th = 4^2 - 6(4) - 4$$

$$= 16 - 24 - 4$$

$$= -12$$

$$3rd - 4th = -13 - (-12)$$

$$= -1$$

$$263. \frac{1}{10}a = -\frac{1}{8}r = ?$$

$$-\frac{1}{10}a = -\frac{1}{8}r$$

$$r = 1 - \frac{a}{S_{\infty}}$$

$$r = 1 - \frac{a}{S_{\infty}}$$

$$r = 1 - \left(-\frac{1}{8}\right)$$

$$r = 1 - \left(-\frac{1}{10}\right)$$

$$r = 1 - \left(-\frac{1}{8} - \frac{10}{1}\right)$$

$$r = 1 - \frac{5}{4}$$

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

Option B

$$264. p \cdot q = pq + p - q$$

$$3 \cdot 4 = 3 \cdot 4 + 3 - 4$$

$$= 12 + 3 - 4$$

$$= 11$$

$$2 \cdot (3 \cdot 4) = 2 \cdot 11$$

$$= 2 \cdot 11 + 2 - 11$$

$$= 22 + 2 - 11$$

$$= 13$$

Option B

$$265. m \cdot n = \frac{mn}{2}$$

$$m \cdot m^{-1} = \frac{m}{2}$$

$$-5 \cdot m^{-1} = \frac{2}{m}$$

$$\frac{m}{2} = \frac{2}{m}$$

$$\frac{m}{2} = \frac{2}{m}$$

$$\frac{m}{2} = \frac{2}{m}$$

$$\frac{m}{2} = \frac{2}{m}$$

Option A

$$266. \begin{vmatrix} 5 & 3 \\ 2 & 1 \end{vmatrix} = \begin{vmatrix} 3 & 5 \\ 4 & 5 \end{vmatrix}$$

$$(5 \cdot 2) - (3 \cdot 1) = (3 \cdot 5) - (4 \cdot 5)$$

$$10 - 3 = -15 - 20$$

$$10 - 3 = -5$$

$$3x = 10 + 5$$

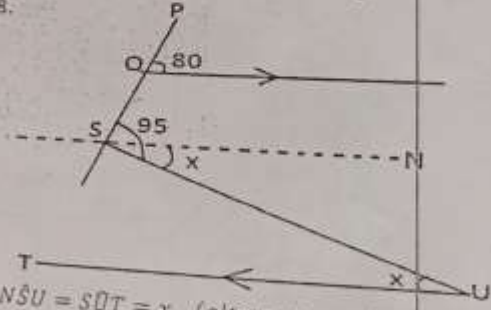
$$3x = 15$$

$$x = \frac{15}{3} = 5$$

Option C

267. The determinant of an identity matrix of any order is always 1, Option C

268.



$$N\hat{S}U = S\hat{O}T = x \text{ (alternate angles)}$$

$$P\hat{Q}R = P\hat{S}N \text{ (corresponding angles)}$$

$$= 80$$

$$P\hat{S}U = P\hat{S}N + N\hat{S}U$$

$$95 = 80 + x$$

$$x = 95 - 80$$

$$x = 15^\circ$$

Option A

Xpress SOLUTIONS

MATHEMATICS

269. $n = 5$ sides

$$x + 2x + 3x + 4x + 5x = (n - 2)180$$

$$15x = (5 - 2)180$$

$$15x = 3(180)$$

$$x = \frac{3 \cdot 180}{15}$$

$$x = \frac{540}{15} = 36^\circ$$

Option D

270. $\angle QPR = 90^\circ$ angle subtending a semicircle $= 90^\circ$

$\angle QRP = 90 - x$ (complementary with $\angle QPR$)

Option B

271. $a = 7, b = 13, h = 6$

$$A = \frac{1}{2}(a + b)h$$

$$= \frac{1}{2}(7 + 13)6$$

$$= \frac{1}{2} \cdot 20 \cdot 6 = 60 \text{ cm}^2$$

Option C

272. $\theta = 150^\circ, r = 12 \text{ cm}$

$$\text{Area of sector} = \frac{\theta}{360} \cdot \pi r^2$$

$$= \frac{150}{360} \cdot \pi \cdot 12^2$$

$$= \frac{360}{360} \cdot \pi \cdot 12^2$$

$$= 60\pi \text{ cm}^2$$

Option B

273. vol. of cuboid $= lbh$

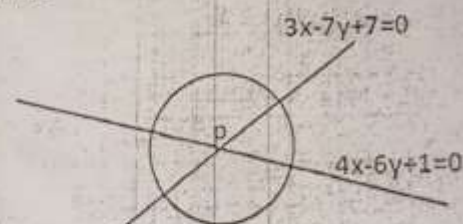
$$l = 0.76, b = 2.6, h = 0.82$$

$$V = 0.76 \cdot 2.6 \cdot 0.82$$

$$V = 1.62 \text{ Cm}^2$$

Option D

274. The intersection of two lines gives a point. The locus of point equidistant to a single point is a circle



Point P is the point of intersection of the two equations. All the points on the circle with center P are equidistant to the point.

$$275. m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-3 - (-7)}{-2 - 5}$$

$$= \frac{-3 + 7}{-7}$$

$$= \frac{4}{-7} = -\frac{4}{7}$$

Option C

276. the point of intersection of the two eqn.

$$y = 2x + 4 \text{ and } y = 7 - x$$

$$2x + 4 = 7 - x$$

$$2x + x = 7 - 4$$

$$3x = 3$$

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

$$y = 7 - x$$

$$y = 7 - 1 = 6$$

point of intersection $= (1, 6)$

$$\text{dist}^2 = (1 - 4)^2 + (6 - 3)^2$$

$$\text{dist}^2 = (-3)^2 + (3)^2$$

$$\text{dist}^2 = 9 + 9$$

$$\text{dist}^2 = 18$$

$$\text{dist} = \sqrt{18} = 3\sqrt{2}$$

Option B

277. $P_1(-2, 1), P_2(-1, 4)$

$$\frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$\frac{y - 1}{x - (-2)} = \frac{4 - 1}{-1 - (-2)}$$

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

$$1.5(y - 1) = 3(x + 2)$$

$$1.5y - 1.5 = 3x + 6$$

$$1.5y = 3x + 6 + 1.5$$

$$1.5y = 3x + 7.5$$

$$y = \frac{3x + 7.5}{1.5}$$

$$y = \frac{3x}{1.5} + \frac{7.5}{1.5}$$

$$y = 2x + 5$$

Option B

278. $\cos \theta = -\cos(180 - \theta)$

$$\cos 135 = -(\cos 180 - 135)$$

$$\cos 135 = -\cos 45$$

$$\text{but } \cos 45 = \frac{\sqrt{2}}{2}$$

$$\therefore \cos 135 = -\frac{\sqrt{2}}{2}$$

Option C

$$279. \tan 74 = \frac{150}{x}$$

$$x = \frac{150}{\tan 74}$$

$$x = \frac{150}{3.4874}$$

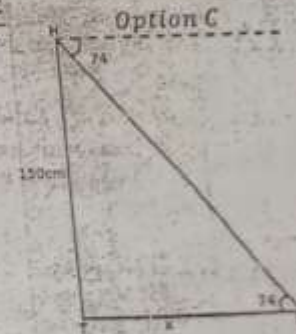
$$x = 43.01 \text{ cm}$$

$$x \approx 43 \text{ cm}$$

Option B

$$280. y = x^2 - \frac{1}{x}$$

$$y = x^2 - x^{-1}$$



$$\frac{dy}{dx} = 2 \cdot x^{2-1} - (-1 \cdot x^{-1-1})$$

$$\frac{dy}{dx} = 2x + x^{-2}$$

$$\frac{dy}{dx} = 2x + \frac{1}{x^2}$$

Option B

$$281. y = \cos x$$

$$\frac{dy}{dx} = -\sin x$$

Option A

$$282. \int_1^2 (x^2 - 4x) dx$$

$$= \left(\frac{x^{2+1}}{2+1} - \frac{4x^{1+1}}{1+1} \right)_1^2$$

$$= \left(\frac{x^3}{3} - 2x^2 \right)_1^2$$

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

$$= \left(\frac{8}{3} - 8 \right) - \left(\frac{1}{3} - 2 \right)$$

$$= -\frac{16}{3} - \left(-\frac{5}{3} \right) = -\frac{16}{3} + \frac{5}{3}$$

$$= -\frac{11}{3}$$

Option D

$$283. \int_0^{\frac{\pi}{4}} \sec^2 \theta d\theta$$

$$= [\tan \theta]_0^{\frac{\pi}{4}}$$

$$= \tan \frac{\pi}{4} - \tan 0$$

$$= 1 - 0$$

$$= 1$$

Option A

$$284. \text{angle portion of excellent}$$

$$= 360 - (120 + 80 + 90)$$

$$= 360 - 290$$

$$= 70$$

$$\text{no of students} = \frac{70}{360} \cdot 360$$

$$= 70$$

Option D

$$285. \text{total no of students}$$

$$= 2 + 3 + 4 + 5 + 4 + 6 + 5 + 1 + 3 + 1$$

$$= 40$$

$$\text{no of students failed}$$

$$= 2 + 3 + 4 + 6 + 5$$

$$= 20$$

$$\% = \frac{20}{40} \cdot 100\%$$

$$= 50\%$$

Option C

$$286. \text{mean of 1st 7 no} = \bar{x}_7, n = 7$$

$$\text{eig term} = x$$

$$\bar{x}_8 = 112, n = 8$$

$$\bar{x} = \frac{\Sigma f x}{n}$$

$$\text{mean} = \frac{\text{total}}{n}$$

$$\text{total} = \text{mean} \cdot n$$

$$\Sigma f x_7 = 96 \cdot 7 = 672$$

$$\bar{x}_8 = \frac{\Sigma f x}{n}$$

$$\text{Mean of eig 8th no} = \frac{1 \text{st 7 no} + \text{eig 8th no}}{8}$$

$$112 = \frac{672 + x}{8}$$

$$672 + x = 112 \cdot 8$$

$$672 + x = 896$$

$$x = 896 - 672$$

$$x = 224$$

option D

$$287. \text{Rearrange}$$

$$2, 2, 3, 3, 4, 4, 4, 5, 5, 5, 7, 8, 9, 9$$

$$n = 16$$

$$\text{median} = \frac{16}{2} = 8$$

$$\text{median} = \frac{8 \text{th} + 9 \text{th}}{2} = \frac{4 + 4}{2}$$

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

Option D

$$288. \text{eig 8th no} = 11$$

$$\text{least} = 2$$

$$\text{range} = 11 - 2 = 9$$

Option B

$$289. \bar{x} = \frac{2+3+8+10+12}{5} = \frac{35}{5} = 7$$

$$s = \sqrt{\frac{\Sigma (X - \bar{x})^2}{n}}$$

$$\sqrt{\frac{(2-7)^2 + (3-7)^2 + (8-7)^2 + (10-7)^2 + (12-7)^2}{5}}$$

$$= \sqrt{\frac{-5^2 + -4^2 + 1^2 + 3^2 + 5^2}{5}}$$

$$= \sqrt{\frac{25 + 16 + 1 + 9 + 25}{5}}$$

$$= \sqrt{\frac{76}{5}} = 3.9$$

Option A

$$290. n + {}^1C_{n-2}$$

$$n = 15$$

$$15 + {}^1C_{15-2}$$

$$= 16C_{13}$$

$$\begin{aligned}
 &= \frac{16!}{(16-13)!13!} \\
 &= \frac{16!}{3!13!} = \frac{16 \cdot 15 \cdot 14 \cdot 13!}{3 \cdot 2 \cdot 1 \cdot 13!} \\
 &= \frac{31360}{6} = 560
 \end{aligned}$$

Option D

291. TOTALITY,

8 letters

repeated letters

T = 3 times

$$n = \frac{8!}{3!} = \frac{8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3!}{3!}$$

$$n = 6720$$

Option A

$$292. P(\text{pass}) = \frac{2}{3}$$

$$P(\text{fail}) = 1 - \frac{2}{3} = \frac{1}{3}$$

probability of passing two tests

= 3(prob. he passes two AND fails one)

= 3(P(pass) and P(pass) and P(fail))

= 3(P(pass) \cdot P(pass) \cdot P(fail))

$$= 3\left(\frac{2}{3} \cdot \frac{2}{3} \cdot \frac{1}{3}\right)$$

$$= \frac{4}{27} \cdot 3 = \frac{4}{9}$$

Option A

293. prob. one one of them living

= prob. man lives AND wife dies OR

wife lives AND man dies OR both lives

$$P(\text{man}) = \frac{2}{3} \quad (\text{living})$$

$$P(\text{man})' = 1 - \frac{2}{3} = \frac{1}{3} \quad (\text{dies})$$

$$P(\text{wife}) = \frac{3}{5} \quad (\text{living})$$

$$P(\text{man})' = 1 - \frac{3}{5} = \frac{2}{5} \quad (\text{dies})$$

$$P = P(\text{man})' \cdot P(\text{wife})'$$

$$+ P(\text{man})' \cdot P(\text{wife})$$

$$+ P(\text{man}) \cdot P(\text{wife})$$

$$P = \frac{2}{3} \cdot \frac{2}{5} + \frac{1}{3} \cdot \frac{3}{5} + \frac{2}{3} \cdot \frac{3}{5}$$

$$= \frac{4}{15} + \frac{1}{5} + \frac{2}{5}$$

$$= \frac{13}{15}$$

Option D



FUTA

POST UTME SOLUTION

MANUAL

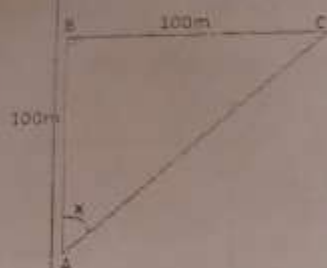
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$$\begin{aligned} 1. \quad AC^2 &= AB^2 + BC^2 \\ &= 100^2 + 100^2 \\ &= 10000 + 10000 \\ &= 20000 \end{aligned}$$

$$\begin{aligned} AC &= \sqrt{20000} \\ &= 100\sqrt{2} \text{ m} \end{aligned}$$

$$\tan x = \frac{BC}{AB}$$

$$\tan x = \frac{100}{100}$$

$$\tan x = 1$$

$$x = \tan^{-1}(1)$$

$$x = 45^\circ$$

Option D

$$2. \quad U = 400 \text{ m/s}$$

$$t = 4 \text{ s}$$

$$s = Ut$$

$$= 400 \times 4$$

$$= 1600 \text{ m}$$

Option B

$$3. \quad h = 40 \text{ m}$$

$$g = 10 \text{ ms}^{-2}$$

$$u = 0$$

$$h = ut + \frac{1}{2}gt^2$$

$$h = 0 + \frac{1}{2} \times 10 \times 4^2$$

$$= 0.5 \times 10 \times 16$$

$$= 80 \text{ s}$$

Option B

PHYSICS

$$\begin{aligned} 4. \quad l &= 0.1 \text{ m} \\ e &= 5 \text{ mm} \\ &= 5 \times 10^{-3} \text{ m} \\ F &= 80 \text{ N} \end{aligned}$$

$$\begin{aligned} \text{Strain} &= \frac{\text{extension}}{\text{length}} \\ &= \frac{0.005}{0.1} \\ &= 0.05 \end{aligned}$$

Option C

5. Option D

A fluid occupies less volume than a corresponding solid. Therefore, when the ice melts, the volume will reduce hence the water level drops

$$6. \quad M = 4 \text{ kg}$$

$$m = 45 \text{ g}$$

$$= 45 \times 10^{-3} \text{ kg}$$

$$v = 100 \text{ m/s}, V = ?$$

$$MV = -mv$$

$$V = \frac{mv}{M}$$

$$V = \frac{0.045 \times 100}{4}$$

$$V = \frac{4.5}{4}$$

$$V = 1.125 \text{ m/s}$$

Option A

7. Option C

Spring Balance measures weight

Chemical balance measures

Beam balance measures

There is no such thing as weight balance

Ref: pg. 9

8. Centripetal Force

Option B

Ref: Pg. 24

9. Option C

A solid in liquid experiences upthrust which reduces the weight and causes apparent weight. Hence the object weighs less when fully immersed than partially immersed.

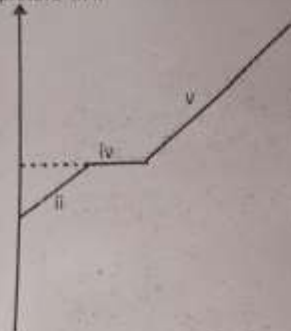
Ref: Pg. 156

PHYSICS

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10.

Temperature in K



2, 4, 5

Option A

11. This phenomenon is known as *DIFFUSION*

Option D

Ref: Pg. 92

12. $m = 100g, L_f = 800 \text{ cal g}^{-1}$

$$H = mL_f$$

$$= 100 \times 800$$

$$= 80000 \text{ cal}$$

$$= 8 \text{ kcal}$$

Option A

13. mass of bead $m_b = 1.5 \text{ kg}$

initial temp of bead $\theta_b = 300^\circ\text{C}$

initial temp of water $\theta_w = 15^\circ\text{C}$

final temp of mixture $\theta_f = 18^\circ\text{C}$

$$c_b = 0.46 \text{ J kg}^{-1} \text{ } ^\circ\text{C}^{-1}$$

$$c_w = 4200 \text{ J kg}^{-1} \text{ } ^\circ\text{C}^{-1}$$

$$m_w = ?$$

Heat loss = Heat gained

$$m_b c_b (\theta_b - \theta_f) = m_w c_w (\theta_f - \theta_w)$$

$$m_w = \frac{m_b c_b (\theta_b - \theta_f)}{c_w (\theta_f - \theta_w)}$$

$$= \frac{1.5 \times 0.46 \times (300 - 18)}{4200 \times (18 - 15)}$$

$$= \frac{194.58}{12600}$$

$$= 0.01544 \text{ kg}$$

$$= 0.01544 \times 1000 \text{ g}$$

$$= 15.44 \text{ g}$$

Option C

Be careful of the unit in Option A

14. Option D

Statements i-iii are all perfect thermometric properties.

iv and v are false.

15. P_1

$$T_1 = 30^\circ\text{C}$$

$$= 30 + 273 = 303 \text{ K}$$

$$T_2 = 61^\circ\text{C}$$

$$= 61 + 273 = 334 \text{ K}$$

$$P_2 = ?$$

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

$$P_2 = \frac{P_1 T_2}{T_1}$$

$$= \frac{1.1 \times 334}{303}$$

$$= 1.1 P_1 \text{ Nm}^{-2}$$

Option D

16. $l_1 = 10 \text{ cm}, l_2 = 10.005 \text{ cm}$

$$\alpha = 11 \times 10^{-6} \text{ } ^\circ\text{C}^{-1}, T_1 = 50^\circ\text{C}$$

$$A = \frac{\pi D^2}{4}$$

$$A_1 = \frac{3.142 \times 10^2}{4}$$

$$= 78.55$$

$$A_2 = \frac{3.142 \times 10.005^2}{4}$$

$$= 78.63$$

$$\beta = 2\alpha$$

$$\beta = 2 \times 11 \times 10^{-6}$$

$$\beta = \frac{A_2 - A_1}{A_1 \times T}$$

$$T = \frac{A_2 - A_1}{\beta A_1} = \frac{78.63 - 78.55}{78.55 \times 22 \times 10^{-6}}$$

$$T = 45.47^\circ\text{C}$$

$$T = T_2 - T_1$$

$$T_2 = T + T_1$$

$$= 50 + 45.47$$

$$= 95.47^\circ\text{C}$$

17. Option C

Specific Heat

N.B: If the mass is not unit mass, the answer would be Heat Capacity

Ref: Pg. 217

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PHYSICS

18. For two lamps connected in series, the power dissipated

$$P = P_1 + P_2 \\ = 60W + 60W \\ = 120W$$

Option D

19. $V = 24V$

$$R_1 = R_2 = R_3 = 3\Omega$$

When resistors are connected in parallel, the voltage across them is equal

$$I = \frac{V}{R} = \frac{24}{3} = 8A$$

Option A

20. Power $P = IV$

$$I = 1.5A$$

$$V = 240V$$

$$P = 1.5 \times 240$$

$$= 360W = \frac{360}{1000} = 0.36kW$$

$$\text{Energy } E = Pt$$

$$t = 36h$$

$$E = 0.36 \times 36$$

$$= 12.96 kWh$$

$$\text{cost} = \text{tariff} \times \text{energy used}$$

$$= 25k \times 12.96$$

$$= 324k$$

$$= \frac{324}{100}$$

$$= N3.24k$$

Option C

21. Option C

Ref: Pg. 402

22. Option A

Armature: the armature is specifically for a D.C generator

Ref: Pg. 44

23. $V = 5V$

$$I = 4A$$

$$t = 4h$$

$$= 4 \times 60 \times 60 = 14400s$$

$$H = IVt$$

$$= 5 \times 4 \times 14400$$

$$= 288000J = 288 kJ \text{ oops!}$$

WAIT! If you try the question using

$$t = 4min, \text{ you'll get } H = 4800J/4.8kJ$$

Bam, we've got option B as our answer

$$24. T = \frac{5}{9}(F - 32)$$

$$F = 2T$$

$$T = \frac{5}{9}(2T - 32)$$

$$9T = 10T - 160$$

$$T = 160^\circ C$$

$$K = T + 273.15$$

$$= 160 + 273.15$$

$$= 433.15K$$

Option B

25. Option B The thermometer is designed to use zeroth's law of thermodynamics to measure temperature. There is heat exchange between the thermometer and the body until stability is reached and temp is measured

$$26. l_1 = 500m$$

$$l_2 = ?$$

$$T_1 = 20^\circ C$$

$$T_2 = 60^\circ C$$

$$\alpha = 2.3 \times 10^{-5} K^{-1}$$

$$l_2 = \alpha l_1 (T_2 - T_1) + l_1$$

$$= 2.3 \times 10^{-5} \times 500(60 - 20) + 500$$

$$= 0.46 + 500$$

$$= 500.46m$$

Option A

$$27. P = 900W$$

$$t = 3 \text{ mins} = 3 \times 60$$

$$= 180s$$

$$m = ?$$

$$L_v = 2.26 \times 10^6 J kg^{-1}$$

$$Pt = mL_v$$

$$m = \frac{Pt}{L_v} = \frac{900 \times 180}{2.26 \times 10^6}$$

$$= 0.072kg$$

Option C

28. Option B

Heat capacity

Mass was not specified as unit mass

$$29. V_1 = 100cm^3$$

$$P_1 = 1 \times 10^5 Pa$$

$$T_1 = 27^\circ C = 27 + 273$$

$$= 300K$$

$$V_2 = ?$$

$$P_2 = 2 \times 10^5 Pa$$

$$T_2 = 60^\circ C = 60 + 273$$

PHYSICS

Xpress Solutions

$$\begin{aligned} &= 333\text{K} \\ \frac{P_1 V_1}{T_1} &= \frac{P_2 V_2}{T_2} \\ V_2 &= \frac{P_1 V_1 T_2}{P_2 T_1} \\ V_2 &= \frac{1 \cdot 10^5 \cdot 100 \cdot 333}{2 \cdot 10^5 \cdot 300} \\ &= 55.5\text{cm}^3 \end{aligned}$$

Option B

30. Option B

The optical pyrometer has the capacity to measure very high temperatures up to 1000°C

$$\begin{aligned} 31. H &= 4000\text{J} \\ m &= 1.5\text{kg} \\ T_1 &= 15^\circ\text{C} \\ T_2 &=? \\ c &= 233\text{J/kg}\cdot\text{K} \\ H &= mc(T_2 - T_1) \\ T_2 &= \frac{H}{mc} + T_1 \\ T_2 &= \frac{4000}{1.5 \cdot 233} + 15 \\ &= 11.44 + 15 = 26.44^\circ\text{C} \end{aligned}$$

Option A

32. Option C

$$\begin{aligned} c &= \frac{H}{mT} \\ &\bullet \text{ Heat/Energy needed} \\ &\bullet \text{ Change in temperature} \\ &\bullet \text{ Mass of the substance} \end{aligned}$$

33. Option B

Velocity (obviously)

$$\begin{aligned} 34. d &= 2\text{mm} = 2 \cdot 10^{-3}\text{m} \\ A &= \frac{\pi d^2}{4} = \frac{3.142 \cdot (2 \cdot 10^{-3})^2}{4} \\ A &= 3.142 \cdot 10^{-6}\text{m}^2 \end{aligned}$$

$$\text{flow rate } f = \frac{\text{volume}}{\text{time}} = \frac{30\text{cl}}{\text{s}}$$

$$f = 80 \cdot 10^{-2} \cdot 10^{-3}\text{m}^3/\text{s}$$

$$f = 8 \cdot 10^{-4}\text{m}^3/\text{s}$$

$$\rho = 1000\text{kg/m}^3$$

$$f^2 = \frac{FA}{\rho}$$

$$F = \frac{f^2 \rho}{A} = \frac{(8 \cdot 10^{-4})^2 \cdot 1000}{3.142 \cdot 10^{-6}}$$

$$F = 2.04 \cdot 10^2 = 204\text{N Q.E.D}$$

$$\begin{aligned} 35. u &= 72\text{km/h} \\ &= 72 \cdot \frac{5}{18}\text{ms}^{-1} \\ &= 20\text{ms}^{-1} \\ a &= -2\text{ms}^{-2} \\ v &= 0 \\ v^2 &= u^2 + 2as \\ v^2 &= 2as \end{aligned}$$

$$s = \frac{v^2}{2a} = \frac{20^2}{2 \cdot 2} = 100\text{m}$$

Option C

$$36. P = 200\text{N}, f = 40\text{N}$$

$$m = 50\text{kg}$$

$$P - f = ma$$

$$a = \frac{P - f}{m} = \frac{200 - 40}{50} = 3.2\text{ms}^{-2}$$

Option D

$$37. m_A = 2\text{kg}, u_A = -3\text{ms}^{-1}$$

$$m_B = 1\text{kg}, u_B = 4\text{ms}^{-1}$$

$$v_A = v_B = v = ?$$

$$m_A u_A + m_B u_B = m_A v_A + m_B v_B$$

$$2 \cdot 3 - 1 \cdot 4 = 2 \cdot v + 1 \cdot v$$

$$6 - 4 = v(2 + 1)$$

$$\begin{aligned} v &= \frac{2}{3} \\ &= 0.67\text{ms}^{-1} \end{aligned}$$

Option A

38. Option A

Generally in collision, Kinetic Energy is the type of Energy that is conserved
Ref. Pg.

39.

PHYSICS

Xpress Solutions



T = horizontal Force
R = tension in the string
W = weight = 20N

$$\cos 30 = \frac{W}{R}$$

$$R = \frac{W}{\cos 30} = \frac{20}{0.5}$$

$$R = 40N$$

Option B

40. $m = 50kg$, $h_1 = 2m$, $h_2 = 5m$ the fall difference is negative, hence an impossible solution. The best formula to solve the problem

$$is v = \sqrt{2gh}$$

41. $m = 40kg$

$$v = 0.5m/s$$

$$K.E = \frac{1}{2}mv^2$$

$$= \frac{1}{2} \cdot 40 \cdot 0.5^2$$

$$= 5J$$

Option B

42. $a = 1ms^{-2}$

$$t = 1min$$

$$= 1 \cdot 60 = 60s$$

$$u = 0$$

$$s = ?$$

$$s = \frac{1}{2}at^2$$

$$= \frac{1}{2} \cdot 1 \cdot 60^2$$

$$= \frac{3600}{2} = 1800m$$

Option C

43. $h = 50m$
 $v = 0.1m^2$
 $\rho = 1000kgm^{-3}$
 $m = \rho v$
 $= 1000 \cdot 0.1$
 $= 100kg$
 $P.E = mgh$

$$= 100 \cdot 10 \cdot 50$$

$$= 50000 = 50kJ$$

Option B

44. $m = 15g = 15 \cdot 10^{-3}g$

$$v = 100m/s$$

$$M = 1kg \quad V = ?$$

$$mv = -MV$$

$$V = -\frac{mv}{M}$$

$$= -\frac{15 \cdot 10^{-3} \cdot 100}{1}$$

$$= -1.5ms^{-1}$$

Option A

45. $u = 30m/s$

$$v = 0$$

$$v^2 = 2gh$$

$$h = \frac{v^2}{2g}$$

$$= \frac{30^2}{2 \cdot 10}$$

$$= 45m$$

Option D

46. $P = 100N$, $f = 20N$

$$m = 50kg$$

$$P - f = ma$$

$$a = \frac{P - f}{m}$$

$$= \frac{100 - 20}{50} = 1.6ms^{-2}$$

Option B

47. $m = 1kg$

$$h = 150m$$

$$u = 0$$

$$v = ?$$

$$v^2 = u^2 + 2gh$$

$$v^2 = 0 + 2 \cdot 10 \cdot 150$$

$$v^2 = 3000$$

$$v = \sqrt{3000} = 54.77ms^{-1}$$

Option A

Xpress Solutions

48. $u = 16 \text{ ms}^{-1}$

$a = 1 \text{ ms}^{-2}$

$v = 20 \text{ ms}^{-1}$

$s = 7$

$v^2 = u^2 + 2as$

$s = \frac{v^2 - u^2}{2a}$

$s = \frac{20^2 - 16^2}{2 \times 1} = \frac{400 - 256}{2}$

$s = \frac{144}{2} = 72 \text{ m}$

Option D

49. $s = 100 \text{ m} = \frac{100}{1000} = 0.1 \text{ km}$

$t = 12 \text{ s}$

$\frac{12}{60 \times 60} = 0.00333 \text{ h}$

$v = \frac{s}{t}$

$= \frac{0.1}{0.00333} = \frac{30 \text{ km}}{\text{h}}$

Option C

50. Option C

The specific heat capacity of a substance is the quantity of heat required to change the temperature of a unit mass of the substance by one degree

Ref: Pg.

51. $K - 273 = \frac{5}{9}(F - 32)$

but $K = F$

$K - 273 = \frac{5}{9}(K - 32)$

$9(K - 273) = 5(K - 32)$

$9K - 2457 = 5K - 160$

$9K - 5K = 2457 - 160$

$4K = 2297$

$K = \frac{2297}{4} = 574.25 \text{ K}$

Option D

52. $c = \frac{H}{m\Delta T} = \frac{J}{\text{kg K}}$

unit of $c = \text{J kg}^{-1} \text{ K}^{-1}$

53. $S.P = 1.01 \times 10^5 \text{ Nm}^{-2}$

$\rho = 1.251 \text{ kg m}^{-3}$

$z = \sqrt{\frac{3P}{\rho}}$

Options B

$z = \sqrt{\frac{3 \times 1.01 \times 10^5}{1.251}}$

$z = \sqrt{242206.235}$

$z = 493 \text{ m/s}$

Option D

54. $T = \frac{5}{9}(F - 32)$

$F = 98.6^\circ \text{ F}$

$T = \frac{5}{9}(98.6 - 32)$

$= \frac{5}{9} \times 66.6$

$= 37^\circ \text{ C}$

Option A

55. mass of coffee $m_c = 250 \text{ g}$

initial temp of coffee $\theta_c = 90^\circ \text{ C}$

mass of milk $m_m = 20 \text{ g}$

initial temp of milk $\theta_m = 5^\circ \text{ C}$

of coffee and milk $= 1.00 \text{ Cal/g}^\circ \text{ C}$

final temp of mixture $\theta_f = ?$

Heat loss = Heat gain

$m_c c (\theta_c - \theta_f) = m_m c (\theta_f - \theta_m)$

$m_c (\theta_c - \theta_f) = m_m (\theta_f - \theta_m)$

$250(90 - \theta_f) = 20(\theta_f - 5)$

$22500 - 250\theta_f = 20\theta_f - 100$

$250\theta_f + 20\theta_f = 22500 + 100$

$270\theta_f = 22600$

$\theta_f = \frac{22600}{270} = 83.7^\circ \text{ C} \approx 84^\circ \text{ C}$

Option A

this que does'nt need solving, they are testing for your smartness with units, not ability to solve heat problems. be on the lookout for questions like this, you can save time

56. $m_i = 150 \text{ g} = 0.15 \text{ kg}$, $T_i = 0^\circ \text{ C}$

$m_w = 300 \text{ g} = 0.3 \text{ kg}$, $T_w = 50^\circ \text{ C}$

$c_w = 4200 \text{ J/kg K}$

$L_f = 33600$

$T_f = ?$

Heat loss = Heat gain

$m_w c_w (T_w - T_f) = m_i L_f + m_i c_w (T_f - T_i)$

Xpress Solutions

$$0.3 \cdot 4200(50 - T_f) \\ = 0.15 \cdot 336000 + 0.15 \\ \cdot 4200(T_f - 0)$$

$$1260(50 - T_f) = 50400 + 630T_f \\ 63000 - 1260T_f = 50400 + 630T_f \\ 1260T_f + 630T_f = 63000 - 50400 \\ 1890T_f = 12600$$

$$T_f = \frac{12600}{1890} = 6.7^\circ\text{C} \quad \text{Option B}$$

57. Option B

Radiation

Ref: Pg. 52

58. All statements are right.

Option B

Ref: Pg. 38

59. FALSE! The definition fits exactly conduction

Option B

60. Mass and Work are the only two scalar quantities. I and II

Option B

$$61. F_1 = 15i - 16j + 27k$$

$$F_2 = 0i + 23j - 40k$$

$$R = F_1 + F_2$$

$$R = (15 + 0)i + (-16 + 23)j + (27 - 40)k$$

$$= 15i - 7j - 13k$$

$$|R| = \sqrt{15^2 + (-7)^2 + (-13)^2}$$

$$= \sqrt{443}$$

$$= 21.05\text{N} \approx 21\text{N} \quad \text{Option D}$$

62. I-TRUE

II-TRUE

III-FALSE

Option A

Ref: Pg. 147

$$63. u = 90\text{km/h}$$

$$= 90 \cdot \frac{5}{18} = 25\text{ms}^{-1}$$

$$t = 10\text{s}$$

$$v = 0$$

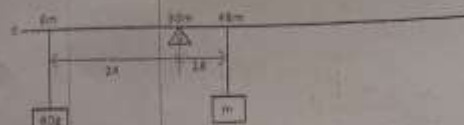
$$s = \frac{u + v}{2} t$$

$$s = \frac{0 + 25}{2} 10 = 12.5 \cdot 10 = 125\text{m}$$

PHYSICS

Option D

54.



$$\Sigma CM = \Sigma ACM$$

$$m \cdot 18 = 24 \cdot 60$$

$$m = \frac{1440}{18} = 80\text{g}$$

Option B

$$65. m_1 = 0.1\text{kg}, u_1 = 15\text{m/s}$$

$$m_2 = 0.4\text{kg}, u_2 = 0\text{m/s}$$

$$v_1 = v_2 = v = ?$$

$$m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$$

$$0.1 \cdot 15 + 0.4 \cdot 0 = 0.1 \cdot v + 0.4 \cdot v$$

$$1.5 + 0 = v(0.1 + 0.4)$$

$$1.5 = v(0.5)$$

$$v = \frac{1.5}{0.5}$$

$$= 3.0\text{ms}^{-1}$$

Option D

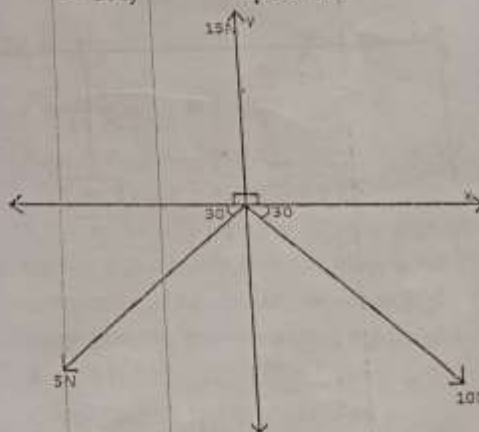
$$66. m = 2\text{kg}, v = 10\text{ms}^{-1}$$

$$K.E = \frac{1}{2}mv^2$$

$$= \frac{1}{2} \cdot 2 \cdot 10^2$$

$$= 100\text{J}$$

Option C



57.

$$\Sigma F_x = 10\cos 30 - 5\cos 30 = 4.33\text{N}$$

Xpress Solutions

$$0.3 + 4200(50 - T_f) \\ = 0.15 + 336000 + 0.15 \\ + 4200(T_f - 0)$$

$$1260(50 - T_f) = 50400 + 630T_f \\ 63000 - 1260T_f = 50400 + 630T_f \\ 1260T_f + 630T_f = 63000 - 50400 \\ 1890T_f = 12600$$

$$T_f = \frac{12600}{1890} = 6.7^\circ\text{C} \quad \text{Option B}$$

57. Option B

Radiation

Ref: Pg. 52

58. All statements are right

Option B

Ref: Pg. 38

59. FALSE! The definition fits exactly conduction

Option B

60. Mass and Work are the only two scalar quantities. I and II

Option B

$$61. F_1 = 15i - 16j + 27k$$

$$F_2 = 0i + 23j - 40k$$

$$R = F_1 + F_2$$

$$R = (15 + 0)i + (-16 + 23)j + (27 - 40)k \\ = 15i - 7j - 13k$$

$$|R| = \sqrt{15^2 + (-7)^2 + (-13)^2}$$

$$= \sqrt{443}$$

$$= 21.05\text{N} \approx 21\text{N} \quad \text{Option D}$$

62. I-TRUE

II-TRUE

III-FALSE

Option A

Ref: Pg. 147

$$63. u = 90\text{km/h}$$

$$= 90 \cdot \frac{5}{18} = 25\text{ms}^{-1}$$

$$t = 10\text{s}$$

$$v = 0$$

$$s = \frac{u + v}{2} t$$

$$s = \frac{0 + 25}{2} 10 = 12.5 \cdot 10 = 125\text{m}$$

PHYSICS

Option D

64.



$$\Sigma CM = \Sigma ACM$$

$$m \cdot 18 = 24 \cdot 60$$

$$m = \frac{1440}{18} = 80\text{g}$$

Option B

$$65. m_1 = 0.1\text{kg} \quad u_1 = 15\text{m/s}$$

$$m_2 = 0.4\text{kg} \quad u_2 = 0\text{m/s}$$

$$v_1 = v_2 = v = ?$$

$$m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$$

$$0.1 \cdot 15 + 0.4 \cdot 0 = 0.1 \cdot v + 0.4 \cdot v$$

$$1.5 - 0 = v(0.1 + 0.4)$$

$$1.5 = v(0.5)$$

$$1.5 = v(0.5)$$

$$v = \frac{1.5}{0.5}$$

$$= 3.0\text{ms}^{-1}$$

Option D

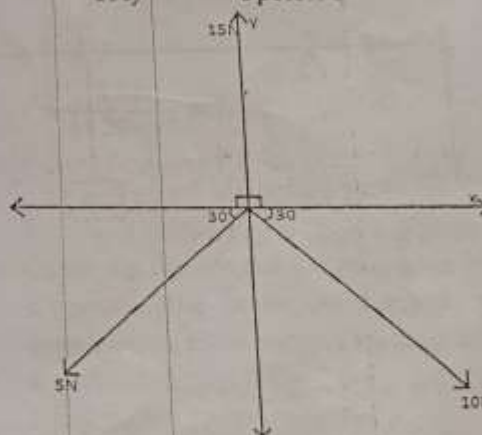
$$66. m = 2\text{kg} \quad v = 10\text{ms}^{-1}$$

$$K.E = \frac{1}{2} m v^2$$

$$= \frac{1}{2} \cdot 2 \cdot 10^2$$

$$= 100\text{J}$$

Option C



67.

$$\Sigma F_x = 10\cos 30 - 5\cos 30 = 4.33\text{N}$$

PHYSICS

Xpress Solutions

$$\sum F_y = 15 - 10\sin 30 - 5\sin 30 = 7.5\text{N}$$

$$R = \sqrt{F_x^2 + F_y^2}$$

$$R = \sqrt{4.33^2 + 7.5^2} = 8.66\text{N}$$

Option A

68. Option C

Ref: Pg. 148

$$69. F = (5i + 3j)\text{N}$$

$$r = (7i - j)\text{m}$$

$$W = F \cdot r$$

$$= (5i + 3j) \cdot (7i - j)$$

$$= (5 \cdot 7)i^2 + (3 \cdot -1)j^2$$

$$= 35 - 3$$

$$= 32\text{J}$$

Option B

$$70. F = 0.6\text{N}, m = 40\text{g} = \frac{40}{1000} = 0.04\text{kg}$$

$$a = \frac{F}{m} = \frac{0.6}{0.04} = 15\text{ms}^{-2}$$

Option C

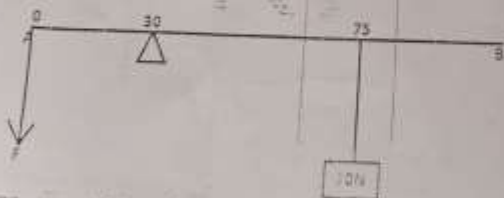
71. A is the original definition for stable equilibrium.

Options B and C have no effect on the C.G. of a body.

Option D illustrates Neutral Equilibrium

Ans: Option A

Ref: Pg. 153



$$72. u = 9.78\text{ms}^{-1}$$

$$v = 0$$

$$h = ?$$

$$v^2 = u^2 - 2gh$$

$$0 = 9.78^2 - 2 \cdot 10 \cdot h$$

$$h = \frac{9.78^2}{20} = 4.89\text{m}$$

Option B

$$73. s = 125\text{m}$$

$$u = 5\text{ms}^{-1}$$

$$a = 1.5\text{ms}^{-2}$$

$$t = ?$$

$$s = ut + \frac{1}{2}at^2$$

$$125 = 5t + 0.5 \cdot 1.5t^2$$

$$125 = 5t + 0.75t^2$$

$$0.75t^2 + 5t - 125 = 0$$

solving quadratically

$$t = \frac{-5 \pm \sqrt{5^2 - 4 \cdot 0.75 \cdot -125}}{2 \cdot 0.75}$$

$$t = 10 \text{ and } -16.667$$

since time can't be negative,

$$t = 10\text{s}$$

Option B

$$74. m = 1\text{kg}$$

$$u = 25\text{ms}^{-1}$$

$$s = 60\text{m}$$

$$v = 0$$

$$F = ?$$

$$a = \frac{u^2}{2s} = \frac{25^2}{2 \cdot 60} = 5.2\text{ms}^{-2}$$

$$f = ma$$

$$= 1 \cdot 5.2$$

$$= 5.2\text{N}$$

Option A

$$75. h = 50\text{m}$$

$$u = 0$$

$$v = ?$$

$$v^2 = u^2 + 2gh$$

$$v = \sqrt{2gh} = \sqrt{2 \cdot 10 \cdot 50}$$

$$v = 31.6\text{ms}^{-1}$$

Option C

76.

$$\Sigma \text{ACM} = \Sigma \text{CM}$$

$$F \cdot 30 = 10 \cdot 45$$

$$F = \frac{450}{30} = 15\text{N}$$

Option D

Xpress Solutions

77. For triangular lamina,

Sine rule

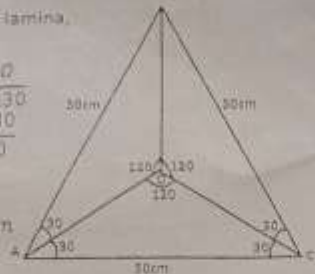
$$\frac{AC}{\sin 120} = \frac{AO}{\sin 30}$$

$$AO = \frac{AC \sin 30}{\sin 120}$$

$$= \frac{50 \cdot 0.5}{0.866}$$

$$AO = 28.86 \text{ cm}$$

Option D



78.

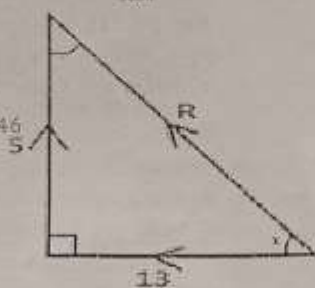
$$\tan x = \frac{5}{13}$$

$$\tan x = 0.3845$$

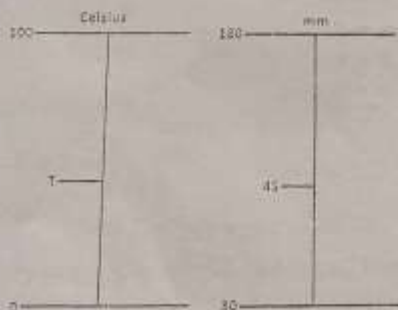
$$x = \tan^{-1} 0.3845$$

$$= 21.04^\circ$$

Option B



79.



$$\frac{T - 0}{100 - 0} = \frac{45 - 30}{180 - 30}$$

$$\frac{T}{100} = \frac{15}{150}$$

$$\frac{T}{100} = \frac{15}{150}$$

$$T = \frac{100 \cdot 15}{150} = 10.0^\circ \text{C}$$

Option A

80. $P = 400 \text{ W}, V = 220 \text{ V}, m = 0.5 \text{ kg}$

$$\frac{dT}{dt} = 2.5^\circ \text{C/s}$$

$$IVdt = mc dT$$

PHYSICS

$$c = \frac{P dt}{m dT} = \frac{P}{m} \cdot \frac{dt}{dT}$$

$$c = \frac{400}{0.5} \cdot \frac{1}{2.5} = 320 \text{ J/kg}\cdot\text{K}$$

Option B

81. $P_1 = 70 \text{ cmHg}, P_2 = 28 \text{ cmHg}$

$$T_1 = 127^\circ \text{C}$$

$$= 127 + 273 = 400 \text{ K}$$

$$T_2 = -23.3^\circ \text{C}$$

$$= -23.3 + 273 = 249.7 \text{ K}$$

$$V_1 = 1000 \text{ cm}^3, V_2 = ?$$

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$V_2 = \frac{P_1 V_1 T_2}{T_1 P_2} = \frac{70 \cdot 1000 \cdot 249.7}{400 \cdot 28}$$

$$= 1586 \text{ cm}^3$$

82. $m_1 = 44.25 \text{ g}$

$$m_2 = 42.02 \text{ g}$$

$$m = m_2 - m_1$$

$$= 44.25 - 42.02$$

$$= 2.23 \text{ g}$$

$$\theta_1 = 0^\circ \text{C}, \theta_2 = 50^\circ \text{C}$$

$$\theta = \theta_2 - \theta_1$$

$$\gamma_{\text{apparent}} = 3\alpha$$

$$= 3 \cdot 1 \cdot 10^{-5} \text{ K}^{-1}$$

$$= 3 \cdot 10^{-5} \text{ K}^{-1}$$

$$\gamma = \frac{m}{m_1 \theta}$$

$$= \frac{2.23}{44.25 \cdot 50}$$

$$\gamma = \frac{2.23}{44.25 \cdot 50} = 1.0079 \cdot 10^{-3}$$

$$\gamma_{\text{real}} = \gamma_{\text{apparent}} + \gamma$$

$$= 3 \cdot 10^{-5} + 1.0079 \cdot 10^{-3}$$

$$= 1.0079 \cdot 10^{-3} \text{ K}^{-1}$$

Option A

83. Option B is the odd one out among the listed properties. The other options and their corresponding thermometers are listed below

A - GAS THERMOMETERS

C - RESISTANCE THERMOMETERS

D - OPTICAL PYROMETER

Ans: Option B

Ref: Pg. 207, Table 8.1

PHYSICS

Xpress Solutions

84. The CONstriction or KINK is the distinct property of the clinical thermometer.
Option D

Ref: Pg. 2.11, fig 8.7

85. The heat associated with change of state is known as LATENT HEAT
Option A

Ref: Pg. 222

86. $P = 25W$,
 $dT = 10^\circ C$,
 $t = 5 \text{ mins}$
 $= 5 \times 60 = 300s$
 $Pt = CdT$
 $C = \frac{Pt}{dT} = \frac{25 \times 300}{10} = 750 J/K$
Option B

87. Slope of graph $= v + \frac{1}{p} = pv$

$pv = \text{work}$

Option B

88. Option C

Temperature is the basic condition in thermal equilibrium and heat exchange

89. $t = 3s$

$d = 510m$

$$E = \frac{2d}{t} = \frac{2 \times 510}{3}$$

$$= \frac{1020}{3} = 340m/s$$

Option C

90. object height $= O_h = 3cm$
image distance $v = 30cm$
focal length $f = 15cm$
object distance $u = ?$
Image Height $= ?$

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$$

$$\frac{1}{15} = \frac{1}{u} + \frac{1}{30}$$

$$\frac{1}{u} = \frac{1}{15} - \frac{1}{30} = \frac{1}{15}$$

$$\frac{1}{u} = \frac{1}{15}$$

$$u = 15cm$$

$$\text{magnification } M = \frac{v}{u} = \frac{I_h}{O_h}$$

$$\frac{30}{15} = \frac{I_h}{3}$$

$$I_h = \frac{30 \times 3}{15}$$

$$= 6cm$$

91. $\theta = 60^\circ$

$$n = \frac{360}{\theta} - 1$$

$$= \frac{360}{60} - 1 = 6 - 1$$

$$= 5$$

Ref: pg 282

92. $v_1 = 500cm^3$, $\rho_1 = 0.8gcm^{-3}$
 $v_2 = ?$, $\rho_2 = 0.5gcm^{-3}$

$$\rho = \frac{m}{v}$$

$$m = \rho v$$

$$\rho_1 v_1 = \rho_2 v_2$$

$$v_2 = \frac{\rho_1 v_1}{\rho_2} = \frac{0.8 \times 500}{0.5}$$

$$= 800cm^3$$

Option B

93. $m = 650kg$

$$a = 4ms^{-2}$$

$$u = 0$$

$$t = 4s$$

$$v = u + at$$

$$= 0 + 4 \times 4 = 16ms^{-1}$$

$$K.E = \frac{1}{2}mv^2$$

$$= \frac{1}{2} \times 650 \times 16^2$$

$$= 83200J$$

Option C

94. Dew point

Option B

Ref: Pg. 234

95. Only ELECTROMAGNETIC WAVES can travel through vacuum since they do not require material for propagation.

Both light waves and RADIO WAVES are ELECTROMAGNETIC WAVES

Option D

Ref: Pg. 372,373

Xpress Solutions

$$96. T = \frac{1}{2\pi} \sqrt{\frac{l}{g}}$$

$$T \propto \sqrt{l}$$

$$\frac{T_2}{T_1} = \sqrt{\frac{l_2}{l_1}}$$

$$T_1 = T, T_2 = ?$$

$$l_1 = l, l_2 = 9l$$

$$\frac{T_2}{T} = \sqrt{\frac{9}{1}}$$

$$T_2 = T\sqrt{9}$$

$$= 3T$$

The period by a factor of 3

Option A

97. Option A i.e the no. of liquid molecules turning to vapour is equal to the no. vapour molecules returning to the liquid. Hence, a dynamic equilibrium.

Option A

Ref: Pg. 232

$$98. v = 360 \text{ms}^{-1}$$

$$\lambda = 120 \text{cm} = \frac{120}{100} = 1.2 \text{m}$$

$$v = f\lambda, f = \frac{v}{\lambda}$$

$$\text{but } T = \frac{1}{f}$$

$$\text{therefore } T = \frac{\lambda}{v} = \frac{1.2}{360} = 0.0033 \text{s}$$

but note a discrepancy. If λ had been 120m,

Option B would have been correct

$$\text{i.e } T = \frac{120}{360}$$

$$= 0.33 \text{s}$$

Option B

99.

PHYSICS

$$\frac{70-0}{100-0} = \frac{h-2}{22-2}$$

$$\frac{70}{100} = \frac{h-2}{20}$$

$$h = \frac{20 \times 70}{100} + 2 = 14 + 2 = 16 \text{cm}$$

Option C

$$100. u = 45 \text{cm}, f = 15 \text{cm}, v = ?, M = ?$$

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$$

$$\frac{1}{15} = \frac{1}{45} + \frac{1}{v}$$

$$\frac{1}{v} = \frac{1}{15} - \frac{1}{45}$$

$$\frac{1}{v} = \frac{2}{45}$$

$$v = \frac{45}{2} = 22.5 \text{cm}$$

$$\frac{1}{v} = \frac{1}{45} + \frac{1}{M}$$

$$\frac{1}{22.5} = \frac{1}{45} + \frac{1}{M}$$

$$M = \frac{v}{u} = \frac{22.5}{45}$$

$$= 0.5$$

Option D

101. Power consumed

$$\text{five } 40 \text{W bulbs} = 5 \times 40 \text{W} = 200 \text{W}$$

$$\text{six } 60 \text{W bulbs} = 6 \times 60 \text{W} = 360 \text{W}$$

$$\text{two } 100 \text{W bulbs} = 2 \times 100 = 200 \text{W}$$

$$\text{total power} = 200 + 360 + 200 = 760 \text{W}$$

$$\text{total time spent} = 5 \text{h} \times 30$$

$$= 150 \text{h}$$

$$E = Pt = 760 \times 150 = 144000 \text{W}$$

$$= \frac{144000}{1000}$$

$$= 144 \text{kWh}$$

$$= 114 \text{kWh}$$

$$\text{cost} = \text{tariff} \times \text{time}$$

$$= 12 \text{k} \times 114$$

$$= 1368 \text{k} = \text{N}13.68 \text{k}$$

Option A

$$102. l = 16 \text{cm} = 0.16 \text{m}$$

$$v = 327.68 \text{ms}^{-1}$$

the frequency at the 1st resonance

position is the fundamental frequency

for a resonance tube (closed pipe)

$$f_0 = \frac{v}{4l} = \frac{327.68}{4 \times 0.16}$$

$$= 512 \text{Hz}$$

Option D

103. Option B.

FUTA POST UTME SOLUTION MANUAL

Xpress Solutions

102. $l = 16\text{cm} = 0.16\text{m}$

$v = 327.68\text{ms}^{-1}$

the frequency at the 1st resonance position is the fundamental frequency for a resonance tube (closed pipe)

$$f_0 = \frac{v}{4l} = \frac{327.68}{4 \times 0.16} = 512\text{Hz}$$

103. Option B.

Ref. 477

104. $P = 60\text{W}, V = 12\text{V}$

$R = ?$

$$P = \frac{V^2}{R}$$

$$R = \frac{V^2}{P} = \frac{12^2}{60} = 2.4\Omega$$

105. $\Delta m = 4.52 - 4.5\text{g}$

$= 0.02\text{g}$

$I = 4.5\text{A}$

$t = 1\text{h} = 1 \times 60 \times 60$

$= 3600\text{s}$

$Z = ?$

$\Delta m = Zit$

$$Z = \frac{\Delta m}{It} = \frac{0.02}{4.5 \times 3600} = \frac{0.02}{16200} = 1.23 \times 10^{-6}$$

106. Option A.

At the initial point, the total energy is completely P.E half way, it will possess an equal amount of K.E and P.E both of which are equal to the initial P.E.

Therefore, the K.E = half of the initial P.E

Ref: Pg. 35, Fig. 3.5

107. Option B

Ref. Pg. 54

108. Option B.

Ref: Pg. 375

109. Option A.

Protons and Neutrons

111. $m_w = 185\text{g } T_w = 20 - 10 = 10^\circ\text{C}$

$m_o = 140\text{g } T_o = 18 - 7 = 11^\circ\text{C}$

$$H = m_w c_w T_w = m_o c_o T_o$$

$$\frac{c_o}{c_w} = \frac{m_w T_w}{m_o T_o} = \frac{185 \times 10}{140 \times 11} = \frac{1850}{1540} = 1.201$$

closest option is B

112. Option C. Oscillatory motion

Ref: Pg. 168, Fig 5.1

113. Option A Capacitance depends on the following factors

$$C = \epsilon \frac{A}{d}$$

C = capacitance

ϵ = dielectric constant

A = area of plates

d = distance between plates

114. Option C

Gamma rays have neither mass nor charge.

Ref: Pg. 477, Table 10.1

115. $u = 10\text{cm}$

$v = 2\text{cm}$

$f = ?$

$$\frac{1}{f} = \frac{1}{u} - \frac{1}{v} \text{ (virtual image)}$$

$$\frac{1}{f} = \frac{1}{10} - \frac{1}{2} = -\frac{1}{3}$$

$f = 3\text{cm}$

116. $I = 50\text{mA}$

$r = 2.5\Omega$

$V = 50\text{V}$

multiplier resistance is given by

$$R = \frac{V - Ir}{I}$$

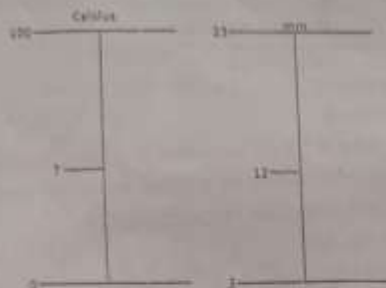
$$R = \frac{50 - 50 \times 10^{-3} \times 2.5}{50 \times 10^{-3}}$$

$$= \frac{50 - 0.125}{50 \times 10^{-3}}$$

$$= 997.5\text{V}$$

Option B

Xpress Solutions



$$117. \frac{T-0}{100-0} = \frac{12-3}{23-3}$$

$$\frac{T}{100} = \frac{9}{20}$$

$$h = \frac{100 \times 9}{20} = \frac{900}{20}$$

$$= 45^{\circ}\text{C}$$

Option D

118. Option B.

When light travels from a denser to a less dense medium, it bends away from the normal and vice versa

Ref: Pg 294

119. $V = 220\text{V}$

$P = 100\text{W}$

$R = ?$

$$P = \frac{V^2}{R}$$

$$R = \frac{V^2}{P} = \frac{220^2}{100}$$

$$= 484\Omega$$

Option C

120. Option B

Increase in pressure inside the cooker increases boiling point.

121. Power consumed

$$\text{ten } 40\text{W bulbs} = 10 \times 40\text{W} = 400\text{W}$$

$$\text{five } 60\text{W bulbs} = 5 \times 60\text{W} = 300\text{W}$$

$$1000\text{W A.S} = 1 \times 1000 = 1000\text{W}$$

$$\text{total power} = 400 + 300 + 1000$$

$$= 1700\text{W}$$

$$\text{total time spent} = 5\text{h}$$

$$E = Pt = 1700 \times 5 = 8500\text{W}$$

PHYSICS

$$\frac{8500}{1000}$$

$$= 8.5\text{kWh}$$

Option B

122. Option B.

Sound waves are longitudinal and mechanical waves.

Ref: Pg. 332, 333

123. Option A.

The focal length of the eyes changes so as to form clear images on the retina. This phenomenon is known as ACCOMMODATION.

The image distance, the distance between the lens and the retina is also fixed

Ref: Pg. 323.

124. Option B.

Myopia is corrected with a concave (diverging) lens while Hypermetropia is corrected with convex (converging) lenses

Ref: Pg. 323 fig 14.8.

125. Option B

The astronomical telescope

- > Has two converging lenses.
- > The focal length of the objective is longer than the eyepiece
- > Produces an inverted image

Ref: Pg. 327

126. Option B.

The materials needed include

- > A light source
- > Two convex lenses
- > A slit
- > A triangular prism
- > A screen

Ref: Pg. 307, Fig 13.28

127. Option C

Note the difference between B and C is the "about a point". Moment is specifically taken

Xpress Solutions

about a point. Don't rush to your answer. Be careful!

Ref: Pg. 147

128.



$$ECM = \Sigma ACM$$

$$M \cdot 30 = 90 \cdot 10 + 72 \cdot 30$$

$$30M = 900 + 2160$$

$$30M = 3060$$

$$M = \frac{3060}{30} = 102g$$

Option D

129.



taking moments about A,

$$ECM = \Sigma ACM$$

$$800 \cdot 4 = F \cdot 10$$

$$F = \frac{3200}{10} = 320N$$

Option A

130.



$$\Sigma CM = \Sigma ACM$$

$$m \cdot 18 = 24 \cdot 60$$

$$m = \frac{1440}{18} = 80g$$

Option B

131. Option B.

The material does not return to initial length after the withdrawal of stress

Ref: Pg. 97

$$132. m_1 = 10g, e_1 = 5$$

$$m_2 = 15g, e_2 = ?$$

From Hooke's law,

$$\frac{m_1}{e_1} = \frac{m_2}{e_2}$$

$$e_2 = \frac{m_2 e_1}{m_1}$$

$$= \frac{15 \cdot 5}{10} = \frac{75}{10} = 7.5cm$$

Option C

133. Option C.

Cooling a liquid increases the intermolecular attraction between surface particles. Hence, increases surface tension

Ref: Pg. 105

134. Option D

All statements are application of capillarity

Ref: Pg. 107 fig 11.8

135. Option D

The three statements are the three methods of generating electrical charges

Ref: Pg. 58

136. Option D.

The motion of Earth around the sun is rotatory and circular motion not oscillatory

137. Option B

Note; A-frequency

D-amplitude

Ref: pg. 170

$$138. u = 200ms^{-1}$$

$$\square = 60^\circ$$

$$T = ?$$

$$T = \frac{2u \sin \square}{g} = \frac{2 \cdot 200 \cdot \sin 60}{10}$$

$$= 40 \cdot 0.866 = 34.64s$$

Option A

$$139. m_1 = 20g, u_1 = 200m/s$$

$$m_2 = 380g, u_2 = 0m/s$$

$$v_1 = v_2 = v = ?$$

$$m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$$

$$20 \cdot 200 - 380 \cdot 0 = 20 \cdot v + 380 \cdot v$$

$$4000 - 0 = v(20 + 380)$$

$$4000 = v(400)$$

$$v = \frac{4000}{400}$$

$$= 10.0ms^{-1}$$

Option A



Xpress Solutions

PHYSICS

140. Option A.

$$V.R = \frac{\text{distance moved by effort}}{\text{distance moved by load}}$$

Ref: pg. 195 Eqn. 7.6

141. $V.R = 6$

$$Eff = 80\%$$

$$E = ?$$

$$L = 300N$$

$$Eff = \frac{M.A}{V.R} \cdot 100\%$$

$$M.A = \frac{Eff \cdot V.R}{100\%} = \frac{80\% \cdot 6}{100\%} = 4.8$$

$$\text{but } M.A = \frac{\text{Load}}{\text{Effort}}$$

$$\text{Effort} = \frac{\text{Load}}{M.A} = \frac{300}{4.8} = 62.5N$$

Option C

142. $l = 6m$

$$v = 340m/s$$

in the first overtone of an open pipe.

$$f = \frac{3v}{2l} = \frac{3 \cdot 340}{2 \cdot 6} = \frac{1020}{12} = 85Hz$$

Option C

143. $l = 0.5m$

$$m = 0.01kg$$

$$T = 800N$$

$$M = \frac{m}{l} = \frac{0.01}{0.5} = 0.02kg/m$$

$$f = \frac{1}{2l} \sqrt{\frac{T}{M}}$$

$$f = \frac{1}{2 \cdot 0.5} \sqrt{\frac{800}{0.02}}$$

$$f = 1 \cdot \sqrt{40000} = 200Hz$$

Option C

144. $C_1 = 8\mu F$

$$C_2 = 10\mu F$$

$$V = 100V$$

for capacitors in series

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2}$$

$$C = \frac{C_1 C_2}{C_1 + C_2}$$

$$= \frac{8 \cdot 10}{8 + 10} = \frac{80}{18} = 4.4\mu F$$

$$Q = CV$$

$$= 4.4 \cdot 10^{-6} \cdot 100$$

$$= 4.4 \cdot 10^{-4} C$$

Option D

145. $l = 5m$

$$I = 15A$$

$$B = 0.25T$$

$$\theta = 60^\circ$$

$$F = BIl \sin \theta$$

$$= 0.25 \cdot 15 \cdot 5 \cdot \sin 60^\circ$$

$$= 16.25N$$

Option C

146. Option C

The V.R of an inclined plane is $\frac{1}{\sin \theta}$

Ref: Pg. 200

147. Option B. All real images that are formed by a concave mirror are INVERTED

Ref: Pg. 286 fig. 12.30

148. $m = 8kg$

$$N = mg = 8 \cdot 10 = 80N$$

$$F_f = 50N$$

$$F_f = \mu N$$

$$\mu = \frac{F_f}{N} = \frac{50}{80} = 0.625$$

$$\mu = \tan \theta$$

$$\theta = \tan^{-1} 0.625 = 32^\circ$$

149. Torque $\Gamma = Fr$

$$= MLT^{-2} \cdot L$$

$$= ML^2T^{-2}$$

Option D

150. $m = 80kg$

$$t = 20s$$

$$h = 600cm = \frac{600}{100} = 6m$$

$$P = \frac{mgh}{t} = \frac{80 \cdot 10 \cdot 6}{20}$$

$$= 240W$$

Option B

151. Option B

Only C is the correct statement of impulse

> A is a wrong statement of the law of conservation of energy

> B is a wrong statement of the law of conservation of momentum

Xpress Solutions

> D is also a wrong condition of a perfectly elastic collision

$$152. \text{Load} = 2 \text{ tonnes} = 2 \times 1000 \text{ kg} \\ = 2000 \text{ kg} \\ = 2000 \times 10 = 20000 \text{ N}$$

$$\text{Effort} = 10 \text{ N}$$

$$M.A = \frac{L}{E} = \frac{20000}{10} = 2000$$

Option C

NOTE: Options A and B have N as their units, meanwhile, M.A and V.R do not have units. Watch out for that in your exam.

$$153. m = 4000 \text{ g} = \frac{4000}{1000} = 4 \text{ kg}$$

$$\text{height difference } h = 40 - 50 \\ = 10 \text{ cm}$$

$$\frac{10}{100} = 0.1 \text{ m}$$

$$K.E = mgh = 4 \times 0.1 \times 10 \\ = 4 \text{ J}$$

Option A

$$154. m_1 = 200 \text{ g} = 0.2 \text{ kg}, u_1 = 100 \text{ m/s}$$

$$m_2 = 2 \text{ kg}, u_2 = 0 \text{ m/s}$$

$$v_1 = v_2 = v = ?$$

$$m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$$

$$0.2 \times 100 + 2 \times 0 = 0.2 \times v + 2 \times v$$

$$20 - 0 = v(0.2 + 2)$$

$$20 = v(2.2)$$

$$v = \frac{20}{2.2}$$

$$= 9.09 \text{ ms}^{-1}$$

Option A

$$155. u = 48 \text{ km/h}$$

$$= 48 \times \frac{5}{18} = 13.33 \text{ ms}^{-1}$$

$$a = 1.8 \text{ ms}^{-2}$$

$$v = 22 \text{ km/h}$$

$$= 72 \times \frac{5}{18} = 20 \text{ ms}^{-1}$$

$$v^2 = u^2 + 2as$$

$$\frac{v^2 - u^2}{2a} = \frac{20^2 - 13.33^2}{2 \times 1.8}$$

$$= 61.67 \text{ m}$$

Option B

$$156. \rho_s = 7100 \text{ kg/m}^3$$

$$\rho_w = 1000 \text{ kg/m}^3$$

$$\text{upthrust in liquid, } U = \frac{2}{3} \rho_l V g$$

$$\rho_s = \frac{m}{V}$$

$$m = \rho_s V$$

$$W = mg = \rho_s V g$$

$$R.D = \frac{\text{weight of object in air}}{\text{upthrust in liquid}} = \frac{W}{U}$$

$$R.D = \frac{\text{density of solid}}{\text{density of water}} = \frac{\rho_s}{\rho_w}$$

$$\frac{W}{U} = \frac{\rho_s}{\rho_w}$$

$$\frac{\rho_s V g}{\frac{2}{3} \rho_l V g} = \frac{\rho_s}{\rho_w}$$

$$\frac{\rho_s}{\frac{2}{3} \rho_l} = \frac{\rho_s}{\rho_w}$$

$$\frac{2 \rho_l}{3 \rho_s} = \frac{\rho_w}{\rho_s}$$

$$\frac{2 \times 7100}{3 \times 1000} = \frac{1000}{\rho_s}$$

$$\rho_s = \frac{3 \times 7100 \times 1000}{2}$$

$$= 10650 \text{ kg/m}^3$$

Option C

$$157. m = 2125 \text{ g}$$

$$v = 250 \text{ cm}^3$$

$$\rho = \frac{m}{v} = \frac{2125}{250} = 8.5 \text{ g/cm}^3$$

$$\text{but } 1 \text{ g/cm}^3 = 1000 \text{ kg/m}^3$$

$$8.5 \text{ g/cm}^3 = 8.5 \times 1000$$

$$= 8500 \text{ kg/m}^3$$

Option C

$$158. u = 0, t = 100 \text{ s}, a = 1.5 \text{ ms}^{-2}$$

$$\text{at } t = 98 \text{ s}$$

$$v = u + at = 0 + 1.5 \times 98 = 147 \text{ ms}^{-1}$$

$$\text{the last two secs, } u = 147 \text{ m/s}$$

$$s = ut + \frac{1}{2} at^2$$

$$s = 147 \times 2 + 0.5 \times 1.5 \times 2^2$$

$$= 294 + 3 = 297 \text{ m}$$

option

$$159. m = 125 \text{ kg}, h = 80 \text{ m}$$

$$v^2 = 2gh$$

$$v = \sqrt{2gh} = \sqrt{2 \times 10 \times 80}$$

$$= \sqrt{1600} = 40 \text{ ms}^{-1}$$

$$P = mv = 125 \times 40$$

$$= 5000 \text{ kgm/s}$$

Option B

$$160. M = 1500 \text{ kg}, m = 50 \text{ kg}$$

$$v = 360 \text{ m/s}, V = ?$$

Xpress Solutions

$$mv = MV$$

$$V = \frac{mv}{M}$$

$$V = \frac{50 \times 360}{1500}$$

$$V = \frac{18000}{1500}$$

$$V = 12 \frac{m}{s}$$

$$161. m = 1000kg$$

$$u = 45km/h = 45 \times \frac{5}{18} = 12.5m/s$$

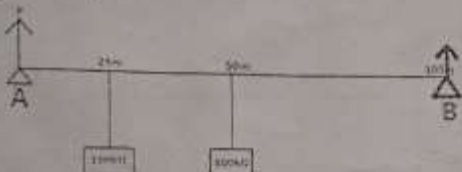
$$v = 0$$

$$t = 10s$$

$$F = \frac{m(v-u)}{t} = \frac{1000(0-12.5)}{10} = 1250N$$

Option B

162.



Taking moments about point B,
ECM = EACM

$$F \times 100 = 100 \times 75 + 500 \times 50$$

$$100F = 7500 + 25000$$

$$F = \frac{32500}{100} = 325kN$$

option D

$$163. m = 220g = \frac{220}{1000} = 0.22kg$$

$$t = 5s$$

$$h = \frac{1}{2}gt^2 = \frac{1}{2} \times 10 \times 5^2$$

$$= 125m$$

$$v = mgh = 0.22 \times 10 \times 125 = 275J$$

Option C

164-Option B

The piece of Iron needs lesser heat to heat up its unit mass unlike water.

$$165. \text{speed in air} = 3.0 \times 10^8 ms^{-1}$$

$$\text{refractive index } n = 1.65$$

$$n = \frac{\text{speed in air}}{\text{speed in glass}}$$

PHYSICS

$$\text{speed in glass} = \frac{\text{speed in air}}{n}$$

$$= \frac{3 \times 10^8}{1.65}$$

$$= 1.82 \times 10^8 ms^{-1}$$

Option D

$$166. P = 1 \times 10^5 N/m^2$$

$$\rho = 1250kg/m^3$$

$$h = ?$$

$$P = \rho gh$$

$$h = \frac{P}{\rho g} = \frac{1 \times 10^5}{1250 \times 10}$$

$$h = 8.0m$$

Option C

$$167. Y = 2 \times 10^{11} N/m^2$$

$$F = 100N$$

$$l = 3m$$

$$A = 1.5 \times 10^{-6} m^2$$

$$e = 0.25mm = 0.25 \times 10^{-3} m$$

$$Y = \frac{Fl}{AY} = \frac{100 \times 3}{1.5 \times 10^{-6} \times 2 \times 10^{11}} = \frac{300}{300} = 1 \times 10^{-3} m$$

$$e = 1mm$$

Option A

$$168. F = 50N$$

$$l = 4m$$

$$d = 2.4mm = 2.4 \times 10^{-3} m$$

$$A = \frac{\pi d^2}{4} = \frac{3.142 \times 0.0024^2}{4}$$

$$= 4.52 \times 10^{-6} m^2$$

$$e = 0.25mm = 0.25 \times 10^{-3} m$$

$$Y = \frac{Fl}{Ae} = \frac{50 \times 4}{4.52 \times 10^{-6} \times 0.25 \times 10^{-3}} = \frac{200}{1.13 \times 10^{-9}} = 1.8 \times 10^{11} N/m^2$$

169. Option C.

The question was to be on center of gravity not frictional force.

Ref: Pg.150, 4.7

$$170. u = 45km/h$$

$$= 45 \times \frac{5}{18} = 12.5ms^{-1}$$

Xpress Solutions

$$t = 10s$$

at constant velocity, $v = 12.5ms^{-1}$

$$s = \left(\frac{u+v}{2}\right)t$$

$$= \frac{12.5+12.5}{2} \times 10$$

$$= 12.5 \times 10$$

$$= 125m$$

$$171. u = 9.78ms^{-1}$$

$$h = ?$$

$$g = 9.78m^{-2}$$

$$v = 0$$

$$v^2 = u^2 - 2gh$$

$$0 = 9.78^2 - 2 \times 9.78 \times h$$

$$h = \frac{9.78^2}{2 \times 9.78} = 4.89m$$

Option C

Option A

172. All statements except statements except B are true.

Ref: All other properties of frictional force are listed on Pg. 21

Option B

$$173. m = 1kg$$

Apparent weight $F = 5N$

$$W = mg = 1 \times 9.78 = 9.78N$$

$$F = W - U$$

$$5 = 9.78 - U$$

$$U = 9.78 - 5 = 4.78N$$

Option B

$$174. l = 20m$$

$$A = 8 \times 10^{-6}m^2$$

$$\rho = 4 \times 10^{-7}$$

$$R = ?$$

$$R = \frac{\rho l}{A} = \frac{4 \times 10^{-7} \times 20}{8 \times 10^{-6}}$$

$$R = 1\Omega$$

Option B

$$175. F = 0.6N$$

$$m = 40g = 40 \times 10^{-3} = 0.04kg$$

$$a = ?$$

$$F = ma$$

$$a = \frac{F}{m} = \frac{0.6}{0.04} = 15ms^{-2}$$

Option D

$$176. F = 20N$$

$$f = ?$$

$$m = 10kg$$

$$a = 1.5ms^{-2}$$

N500 ONLY

PHYSICS

$$F - f = ma$$

$$f = F - ma$$

$$= 20 - 10 \times 1.5 = 20 - 15$$

Option D

$$f = 5N$$

$$177. m_1 = 2kg, u_1 = 5m/s$$

$$m_2 = 0.5kg, u_2 = 0m/s$$

$$v_1 = v_2 = v = ?$$

$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$$

$$2 \times 5 + 0.5 \times 0 = 2 \times v + 0.5 \times v$$

$$10 - 0 = v(2 + 0.5)$$

$$10 = v(2.5)$$

$$v = \frac{10}{2.5}$$

$$= 4.0ms^{-1}$$

option B

$$178. m = 200g$$

$$c = 0.4 J/g \cdot K$$

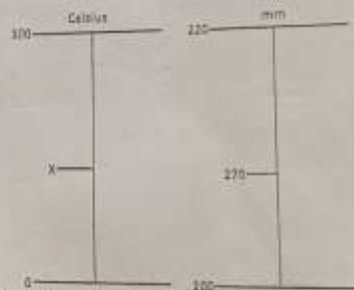
$$T = T_1 - T_2 = 37 - 31 = 6^\circ C$$

$$H = mcT$$

$$= 200 \times 0.4 \times 6 = 480J$$

option C

$$179.$$



$$\frac{X - 0}{100 - 0} = \frac{270 - 200}{220 - 200}$$

$$\frac{X}{100} = \frac{70}{20}$$

$$X = \frac{100 \times 70}{20}$$

$$X = \frac{100 \times 70}{20} = 350^\circ C$$

Option A

$$180. \alpha = 1.2 \times 10^{-4} / K$$

$$Y = 3\alpha$$

$$= 3 \times 1.2 \times 10^{-4} = 3.6 \times 10^{-4} / K$$

$$V_1 = 8 \times 10^3 cm^3$$

$$\Delta T = T_2 - T_1 = 80 - 30 = 50^\circ C$$

$$Y = \frac{\Delta V}{V_1 \Delta T}$$

$$\Delta V = V_1 \Delta T Y$$

FUTA POST UTME SOLUTION MANUAL

Xpress Solutions

$$= 8 \times 10^3 \times 50 \times 3.6 \times 10^4$$

$$181. T_2 = 0^\circ\text{C} = 0 + 273 = 273\text{K}$$

$$T_2 = ?$$

$$V_1 = V$$

$$V_2 = 3V$$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$T_2 = \frac{V_2 T_1}{V_1} = \frac{3V \times 273}{V}$$

$$= 3 \times 273 = 819\text{K}$$

$$819\text{K} = 819 - 273$$

$$= 546^\circ\text{C}$$

Option C

$$182. \alpha = 1.2 \times 10^{-5} / \text{K}$$

$$Y = 3\alpha$$

$$= 3 \times 1.2 \times 10^{-5}$$

$$= 3.6 \times 10^{-5}$$

$$V_1 = 10^{-6} \text{cm}^3$$

$$\Delta T = T_2 - T_1 = 573 - 273 = 300^\circ\text{C}$$

$$Y = \frac{\Delta V}{V_1 \Delta T}$$

$$\frac{\Delta V}{V_1} = Y \Delta T \times 100\%$$

$$= 3.6 \times 10^{-5} \times 300 \times 100\%$$

$$= 0.0108 \times 100 = 1.08$$

OPTION C

$$183. m = 2\text{kg}$$

$$I = 3\text{A}$$

$$V = 240\text{V}$$

$$c = 4.2 \times 10^3$$

$$T = T_2 - T_1 = 100 - 30 = 70^\circ\text{C}$$

$$t = ?$$

$$IVt = mcT$$

$$t = \frac{mcT}{IV} = \frac{2 \times 4.2 \times 10^3 \times 70}{3 \times 240}$$

$$= \frac{816.6}{60} = 13.6\text{mins}$$

Option C

$$184. \text{ Since the mass is not a unit mass, HEAT}$$

CAPACITY

Option C

PHYSICS

$$185. m = 50\text{g}$$

$$c = 4.2 \text{ J/g}^\circ\text{C}$$

$$L_v = 2260 \text{ J/g}$$

$$T_1 = 80^\circ\text{C}$$

$$T_2 = 100^\circ\text{C}$$

$$T = T_2 - T_1 = 100 - 80 = 20^\circ\text{C}$$

$$H = mcT + mL_v$$

$$= 50 \times 4.2 \times 20 + 50 \times 2260$$

$$= 4200 + 113000$$

$$= 117200\text{J}$$

option B

$$186. \text{ mass of copper block } m_1 = 200\text{g}$$

$$= \frac{200}{1000}$$

$$= 0.2\text{kg}$$

$$\text{mass of calorimeter } m_2 = 10\text{g} = 0.01\text{kg}$$

$$\text{mass of water } m_w = 100\text{g} = 0.1\text{kg}$$

$$\text{initial temperature of block } T_1 = 100^\circ\text{C}$$

$$\text{initial temp of calorimeter and water}$$

$$T_2 = 15^\circ\text{C}$$

$$c \text{ of copper } c_c = 400 \text{ J/kg}^\circ\text{C}$$

$$c \text{ of water } c_w = 4200 \text{ J/kg}^\circ\text{C}$$

$$\text{Final temperature of mixture } T_f = ?$$

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

$$m_1 c_c (T_1 - T_f) = m_2 c_c (T_2 - T_f) + m_w c_w (T_f - T_2)$$

$$m_1 c_c (T_1 - T_f) = (m_2 c_c + m_w c_w) (T_f - T_2)$$

$$0.2 \times 400 (100 - T_f) = (0.01 \times 400 + 4200 \times 0.1) (T_f - 15)$$

$$80(100 - T_f) = (4 + 420) (T_f - 15)$$

$$8000 - 80T_f = 424T_f - 6360$$

$$424T_f + 80T_f = 8000 + 6360$$

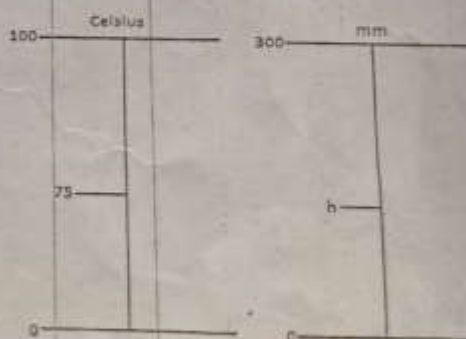
$$344T_f = 14360$$

$$T_f = \frac{14360}{344} = 28.4^\circ\text{C}$$

option C

$$187. \text{ Option D.}$$

$$188. \text{ Setting the length at ice point to be 0mm}$$



FUTA POST UTME SOLUTION MANUAL

PHYSICS

Xpress Solutions

Ref: The statements are stated on pg. 39

$$\frac{75-0}{100-0} = \frac{h-0}{300-0}$$

$$\frac{75}{100} = \frac{h}{300}$$

$$h = \frac{75 \times 300}{100} = 225\text{m}$$

189. $m = 0.55\text{kg}$

$$T_1 = 57^\circ\text{C}$$

$$T_2 = 100^\circ\text{C}$$

$$T = T_2 - T_1 = 100 - 57 = 43^\circ\text{C}$$

$$c = 380\text{ J/kg}\cdot\text{K}$$

$$H = mcT$$

$$= 0.55 \times 43 \times 380 = 8987\text{ J}$$

$$= 8.987 \times 10^3\text{ J}$$

190. $H_A = H_B = H$

$$\Delta T_A = \Delta T_B = 20 - 15 = 5^\circ\text{C}$$

$$c_A = 3c_B$$

$$m_A c_A \Delta T_A = m_B c_B \Delta T_B$$

$$\frac{m_A}{m_B} = \frac{c_B \Delta T_B}{c_A \Delta T_A}$$

$$= \frac{c_B \times 5}{3c_B \times 5} = \frac{1}{3}$$

$$m_A : m_B = 1 : 3$$

191. All three statements are correct

Option A

Ref: Pg. 38

192.



$$\frac{T-0}{100-0} = \frac{270-240}{300-240}$$

$$\frac{T}{100} = \frac{30}{60}$$

$$\frac{100}{100} = \frac{30}{60}$$

$$T = \frac{30 \times 100}{60} = 50^\circ\text{C}$$

193. Option A

It causes the loss of time in watches and serves as various advantages in other options.

Ref: Pg. 42,43

194. $P = 800\text{W}$

$$m = 2\text{kg}$$

$$T_1 = 20^\circ\text{C}$$

$$T_2 = 60^\circ\text{C}$$

$$T = T_2 - T_1 = 60 - 20 = 40^\circ\text{C}$$

$$c = 4200\text{ J/kg}\cdot\text{K}$$

$$P t = mcT$$

$$t = \frac{mcT}{P} = \frac{2 \times 4200 \times 40}{800} = 420\text{s}$$

Option B

195. Option B: Radiation: transfer of heat between two points without an intervening medium

Ref: Pg 52


Option A

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POST UTME SOLUTION

MANUAL

CHEMISTRY



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Xpress SOLUTIONS CHEMISTRY

All references in this chemistry manual are made to New School Chemistry (Ababio)

QUESTION 1

(Empirical formula) $n = \text{Molar mass}$

$$(\text{CH}_2\text{O})_n = 180$$

$$C = 12, H = 1, O = 16$$

$$(12 + (1 \times 2) + 16) \times n = 180$$

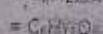
$$(12 + 2 + 16) \times n = 180$$

$$30n = 180$$

$$n = \frac{180}{30}$$

$$= 6$$

$$\text{Molecular Formula} = (\text{CH}_2\text{O})_6$$



Option A

QUESTION 2(B)

Biodegradable compounds are those which can be broken down into harmless compounds by living organisms.

Only sewage compounds fit into the description.

QUESTION 3 (A)

A is the correct option (ref. page 298/299)

Option (c) represents the removal of temporary hardness while options B & D are irrelevant to Hardness.

QUESTION 4 (A)

$$n = cv$$

$$c = 0.01 \text{M}$$

Where $n = 0.01 \text{ moles}$

$$v = 500 \text{cm}^3$$

Convert to dm^3

$$v = \frac{500}{1000}$$

$$= 0.5 \text{dm}^3$$

Recall that:

CHEMISTRY

$$n = cv$$

$$= 0.01 \times 0.5$$

$$= 0.005 \text{ moles}$$

QUESTION 5 (C)

A strong acid is that which ionizes completely in water... (pg 97)

QUESTION 6 (D)

$$P_1 = P \quad V_1 = V \quad T_1 = 273 \text{K}$$

$$P_2 = P \quad V_2 = V \quad T_2 = ?$$

From general gas equation

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

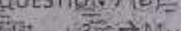
$$T_2 = \frac{P_2 T_1}{P_1}$$

$$= \frac{P \times 273}{P}$$

$$= 273 \text{K}$$

$$= 1092 \text{K}$$

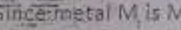
QUESTION 7 (D)



Balancing the charges;

$$x = 3$$

Since metal M is M^{3+}



QUESTION 8 (D)

Option D is the right answer, radioactivity is not used in purifying water.

Ref pg 333: Uses of radioisotopes

QUESTION 9 (D)

Only NaCl crystallizes without water of crystallization

Ref pg 333: Table 6.13

QUESTION 10 (A)

compound	cathode	Anode
NaCl	Na^+	Cl^-
H_2O	H^+	OH^-

At the anode,

H^+ will be discharged



At the cathode,

OH^- will be discharged



Hydrogen and Oxygen will be liberated

QUESTION 11 (D)

Group 7 elements are Halogens F_2, Cl_2, Br_2, I_2

- Diatomic
- Oxidizing in nature
- Highly electronegative
- Low ionization potentials

Ref pg 363, 364

1

QUESTION 12 (A)

Cathode rays

- Negatively charged
- Travel in straight lines
- Deflected away from negative plate
- Light

Ref pg 45: Discovery of electrons

QUESTION 13 (B)



The reaction above is a combustion reaction.
Therefore, its enthalpy ΔH is of combustion.

QUESTION 15 (A)

Compounds with same molecular formula but different structures are: Isomeric

Ref pg 253: Isomerism

N.B other concepts like:

- Polymers
- Isotopes
- Allotropes
- Isobars

QUESTION 16 (D)

The description fits a saturated solution where addition of a crystal does not lead to dissolution.

Ref pg 307: Solubility

QUESTION 17 (B)

- ❖ Steam over white hot coke gives water Gas, mixture of carbon (II) oxide & Hydrogen
- ❖ Producer gas: Steam + Red Hot coke $\rightarrow 2CO + N_2$

- ❖ Synthesis gas steam + methane $CO + 3H_2$

Detailed explanation in reference

(Ref page 133 & page 347)

Fuel Gases & Industrial preparation of Hydrogen

QUESTION 18 (C)

Principal Quantum no: ($n = 3$)

No of electrons = $2n^2$

$$= 2(3)^2$$

$$= 2 \times 9$$

$$= 18$$

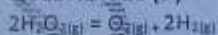
(Ref page 539, 540)

QUESTION 19 (B)

Methanol also known as wood spirit is obtained from wood by destructive distillation.

Ref. Pg 539, 540: Alkanols

QUESTION 20 (D)



- ❖ Increase in temperature increases rate of reaction
- ❖ Addition of catalyst
- ❖ Increase in Concentration of Reactants
- ❖ Dilution of reactants will reduce rate of reaction.

(Ref page 254 - 260)

QUESTION 21 (C)

Electrolysis \rightarrow chemical reaction

Hydrolysis \rightarrow chemical reaction

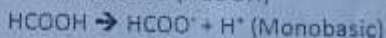
Allotropic Change \rightarrow physical reaction

Neutralization \rightarrow chemical reaction

(Ref page 9)

QUESTION 22 (C)

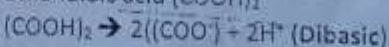
Methanoic acid ($HCOOH$)



Dioxonitrate (III) Acid (HNO_2)



Ethandioic acid ($(COOH)_2$)



Oxochlorate (I) Acid ($HOCl$)

$HOCl$ (Monobasic)

(Ref page 97, 548)

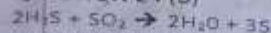
QUESTION 23 (D)

Xpress SOLUTIONS

Option D
Collision theory.

Statement is referenced at page 253

QUESTION 24 (B)

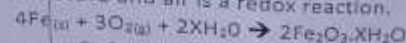


Since SO_2 donated/lost its oxygen to be reduced to $\text{S}_{(s)}$, then it is an oxidizing agent

(REF page 387)

QUESTION 25 (C)

The corrosion of iron (rusting) in presence of moisture and air is a redox reaction.



Ref page 488: Chemical properties of Iron

QUESTION 26

According to pg 110 Table 6.12. A table of solubility of salts indicates that all the named salts are soluble

QUESTION 27 (D)

Since sucrose is not a reducing sugar, it has no effect on fehling's solution

(Ref page 562: Sucrose)

QUESTION 28 (D)

- ❖ Ionic radii of metals is formed when an electron(s) is/are removed from the metal. Therefore the nuclear grip increases
- ❖ A metallic ion is formed from the removal of an electron
- ❖ It is therefore lesser than the atomic radii
- ❖ Non-metals normally have greater ionic radii to metals

(Ref page 145: Atomic & Ionic sizes)

QUESTION 31 (B)

Plastics e.g. PVC are made from the polymerization of short chain alkenes or Halo alkenes.

Only Ethane is odd

QUESTION 32 (B)

The statement matches Ionization Energy

QUESTION 33(A)

CHEMISTRY

An exothermic reaction releases heat to the surroundings. The reaction vessel becomes hotter, ΔH is negative

(ref page 232)

QUESTION 34 (D)

$\text{pH} < 7$ - Acidic

$\text{pH} = 7$ - Neutral

$\text{pH} > 7$ - Alkaline

(ref page 102: PH SCALE)

QUESTION 35 (A)

Cryolite - Na_3AlF_6

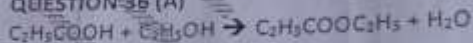
Bauxite - $\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$

Potash Alum -

Kaolin - $\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$

Cryolite is right

QUESTION 36 (A)



$\text{C}_2\text{H}_5\text{COOC}_2\text{H}_5$ is ethyl propanoate

QUESTION 37 (C)

Mobile Electrons are carriers in metals.

Mobile Ions are carriers in electrolytes

(Ref page 200: Electrolytes & non-electrolytes)

QUESTION 38(D)

The full hydrolysis of starch gives glucose.

N.B. Do not be deceived by maltose, it is only a product in the steps to glucose.

(Ref page 563: Properties of starch)

QUESTION 39(D)

The network structure of graphite contributes to its existence in layers and flakes

QUESTION 40 (C)

Electrovalent have high boiling point hence low volatility at room temperature

(Ref page 58,59)

QUESTION 41 (D)

Only ^1_1H & ^2_1H display Isotropy.

Option A is isomerism.

Option D is allotropy (pg 376)

QUESTION 42(C)

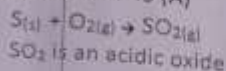
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The incomplete combustion of petrol.
This phenomenon also causes knocking of a petrol engine.

(Ref pg 510: Fuel for petrol Engines)

QUESTION 43 (A)



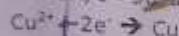
QUESTION 44 (A)

(ref page 384)

Chlorine in water treatment is a germicide

QUESTION 45 (C)

$$I = 10A, t = 965s, F = 96500C, Z = 2$$



There are 2 charges on copper

$$n = \frac{I \times t}{Z \times F}$$

$$= \frac{10 \times 965}{2 \times 96500}$$

$$= 0.05 \text{ mole}$$

QUESTION 47 (D)

The question implies the factor will favour backward reaction. The addition of conc. HCl will do just that.

QUESTION 48 (D)

$$V_1 = 400 \text{ cm}^3 \quad C_1 = 2 \text{ mol dm}^{-3}$$

$$V_2 = ? \quad C_2 = 0.2 \text{ mol dm}^{-3}$$

Recall the dilution formula: $n = C \times V$

$$C_1 \times V_1 = C_2 \times V_2$$

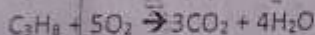
$$V_2 = \frac{C_1 \times V_1}{C_2} = \frac{2 \times 400}{0.2}$$

$$V_2 = \frac{800}{0.2} = 4000 \text{ cm}^3$$

$$\text{required vol} = 4000 - 400$$

$$= 3600 \text{ cm}^3$$

QUESTION 49 (A)



$$1 : 5 : 3 : 4$$

$$20 \quad 20 \quad - \quad - \quad \text{Initial volume}$$

$$4 \quad 20 \quad 12 \quad 16 \quad \text{after Reaction}$$

$$16 \quad 0 \quad 12 \quad 16 \quad \text{final volume}$$

$$\text{Volume of propane left unreacted} = 16 \text{ cm}^3$$

QUESTION 50 (B)

CHEMISTRY

Alkaline pyrogallol removes oxygen.

Also:

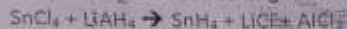
- Passing over heated copper removes O₂
- Caustic soda and lime water also remove the carbon (iv) oxide

Ref page 284: Composition of air

QUESTION 51 (D)

SnH₄ Option D

It is produced from a strong reducing agent.



Ref pg 470: Tin (iv) Hydride

QUESTION 52 (C)

Only option C has a pair of deliquescent compounds.

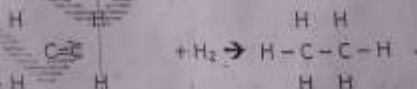
Option A & B both have just one

While option D doesn't have at all

Ref pg 114: Deliquescent

QUESTION 53 (D)

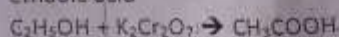
Hydrogenation converts an alkene to alkane e.g.



Ref pg 533: addition reaction of Ethene

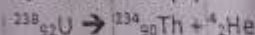
QUESTION 54 (C)

Ethanoic acid



This is the complete oxidation of ethanol.

QUESTION 55 (D)



Nuclear fission is the breaking of a large radioactive nuclei into two nuclei of almost same size

(p. 337)

The reaction above illustrates the

SPONTANEOUS DISINTEGRATION of Uranium
alpha decay

(p. 3)

Please consult text for better explanation.

QUESTION 56 (D)

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Zinc can displace copper from its own salt because it is higher in the Electro-positivity series, Hence more reactive than copper

QUESTION 57 (B)

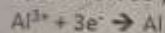
The distinct characteristic of an indicator is the colour change. To separate,

CHROMATOGRAPHY will be the best technique.

QUESTION 58 (B)

The change in-state from solid to gas skipping the liquid state is **SUBLIMATION**.

QUESTION 59 (C)



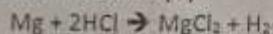
3F 1mole

If 3F = 27g of Al,

And, x = 9g,

$$\text{Then, } x = \frac{3F \times 9g}{27g} = 1F$$

QUESTION 60 (A)



1 : 2 : 1 : 1 No of moles

24 2(36.5) 105 1(2) Mass (g)

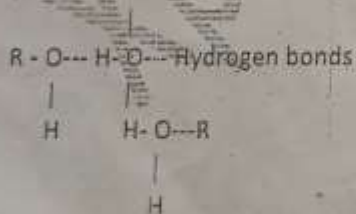
If 24g of Mg \rightarrow 2g of H_2

Then, 12g of Mg will produce:

$$\frac{12 \times 2}{24} = 1\text{g of } \text{H}_2$$

QUESTION 62 (A)

The unexpectedly high boiling points of alkanols is due to their hydrogen bonding present in their molecules.

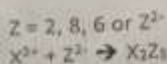


Ref page 542: physical properties of ethanol

QUESTION 63 (D)

X = 2, 8, 3 or X^{3+}

CHEMISTRY



QUESTION 64 (D)

$\text{CH}_4 \rightarrow$ Tetrahedral

$\text{H}_2\text{O} \rightarrow$ Angular

$\text{H}_2\text{S} \rightarrow$ Angular

$\text{Cl}_2 \rightarrow$ Linear (p. 318, Fig 18.8)

QUESTION 65 (A)

Mass of Cu = 64g

Mass of $\text{Cu}_2\text{O} = 2 \times 64g + 16g$

144g

$$\% \text{ composition} = \frac{64 \times 2g}{144g} \times 100\% = 88.9\%$$

QUESTION 66 (C)

Since PbCl_2 is an insoluble salt, decomposition of $\text{Pb}(\text{NO}_3)_2$ and NaCl is the best method.

Ref p. 110 (Table 6.11) & p. 111

QUESTION 67 (D)

A salt in solid state does not contain mobile ions, only, a salt in aqueous solution has.

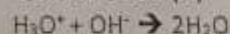
QUESTION 68 (D)

Alums are double salts e.g.

Potash Alum: $\text{K}^+\text{Al}^{3+}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$

Chrome Alum: $\text{KCr}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$

QUESTION 69 (A)



The reaction above is a **Neutralization**

Reaction. The accompanying heat is that of neutralization.

(p. 235: Heat of neutralization)

QUESTION 70 (C)

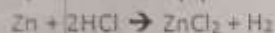
- Vulcanization is strengthening rubber by fortifying with sulphur

CHEMISTRY

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- Hydrogenation is adding hydrogen to a straight chain alkene to produce oil (or straight chain alkane)
- Polymerization is forming larger multiple units from a small unit
- Hydrolysis breaks down starch to dextrin, maltose & glucose

QUESTION 71 (C)



1 : 2 1 : 1 (No of moles)

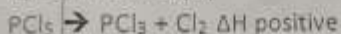
If 2 moles of HCl \rightarrow 1 mole of H_2

Then 0.6 moles $\rightarrow \frac{0.6 \times 1}{2}$
= 0.3 mole

QUESTION 72 (A)

The large scale production of Chlorine is by the industrial electrolysis of brine or chlorides of sodium, Magnesium & Calcium.
(P. 352: Industrial preparation of Chlorine)

QUESTION 73 (D)



Since reaction is **ENDOTHERMIC** and homogenous gaseous

- Increase in temperature will favour the forward reaction
- decrease in pressure will favour the forward reaction

QUESTION 74 (B)

Isotopes have the same **ATOMIC NO** but different mass nos.

(P. 48: Isotopy)

QUESTION 76 (D)

Statements A, B, & C are all correct.

D is incorrect as a catalyst doesn't have any effect on the equilibrium position of a reaction.

(P. 273: Effect of a catalyst on equilibrium)

QUESTION 77 (D)

When:

ΔG = Negative (Rxn is feasible)

ΔG = Zero (Rxn is at Equilibrium)

ΔG = positive (Rxn does not proceed)

(P. 245: Spontaneity)

QUESTION 78 (B)

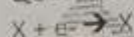
Alpha (α) particle = ${}^4_2\text{He}$ (helium particle)

Beta (β) particle = ${}^0_{-1}\text{e}$ (electron)

Gamma (γ) particle = ${}^0_0\gamma$ (no mass)

(P. 329: Types of radiation)

QUESTION 79 (B)



Atom becomes **Negatively Charged** when it gains an electron & becomes **positively Charged** when it losses an electron.

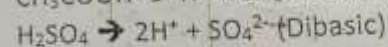
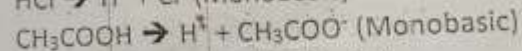
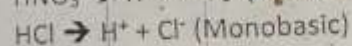
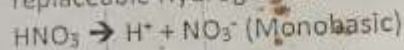
QUESTION 80 (D)

Avogadro's law

(P. 87: avogadro's hypothesis)

QUESTION 81 (D)

A monobasic acid is an acid with only one replaceable Hydrogen ion.



(P. 98: Basicity of an Acid)

QUESTION 82 (A)

Electrochemical cell (Galvanic cell)

N.B: Do not confuse with voltmeter (electrolytic cell). This utilizes electricity to decompose chemical compounds.

(P. 201: line 1, P. 215)

QUESTION 83 (B)

Using Zinc powder instead of granules. This is increasing the surface area for the reaction to occur.

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(P. 257: Effect of Surface area contact)

QUESTION 84 (A)

Fractional distillation of liquefied.

(P. 405: Industrial preparation of Nitrogen)

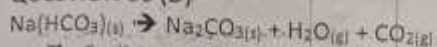
QUESTION 85 (B)

Aluminum

- Light
- Resistant to corrosion by forming a thick film of Al_2O_3 on its surface.

(p. 485: Uses of Aluminum 1)

QUESTION 86 (D)



- Sodium trioxocarbonate (iv)
- Steam
- Carbon (iv) Oxide

(p. 454: the equation is present there)

QUESTION 87 (D)

Chlorination kills harmful bacteria in water.

(Ref P. 296 & P. 237)

QUESTION 88 (C)

In Linear molecules, Bond angles = 180°



(P. 318, Fig 18.7)

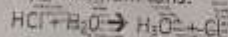
QUESTION 89 (C)

Pressure is inversely proportional to volume.
(Boyle's law)

- An increase in the pressure of a gas causes decrease in volume.

QUESTION 90 (D)

Hydroxonium ions.



(P. 101: Oxonium ions)

QUESTION 92 (A)

Only cations (+ve charged) migrate to the cathode (-ve charged) during electrolysis.

Zn^{2+} : Cation

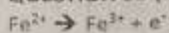
Cl^- : Anion

SO_3^{2-} : Anion

SO_4^{2-} : Anion

Option A

QUESTION 93 (D)



1mole of e^-

QUESTION 94 (B)

- Concentration,
- Temperature,
- Pressure

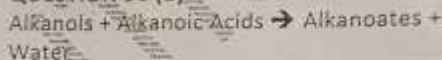
Listed is the only factors that can affect equilibrium position

QUESTION 95 (C)

Unsaturated

- Only unsaturated hydrocarbons undergo Addition reaction.

QUESTION 96 (B)



QUESTION 97 (A)

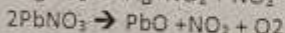
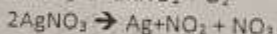
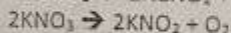
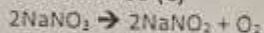
Alkanoates also known as esters have pleasant smells. (P. 551)

QUESTION 98 (A)

Bleaching powder.

(P. 459: Uses of $\text{Ca}(\text{OH})_2$ No. 5)

QUESTION 99 (C)



QUESTION 100 (B)

Double Decomposition

(Ref Page. 111)