SCHOLASTIC APTITUDE TEST (SAT)_HINTS & SOLUTIONS

15. In M_2O_3 valency of metal M^{+3}
So the formula of metal nitride will be

$M_3N_3 \Rightarrow MN$

Ans. (2) is correct

16. Alloys are the homogeneous mixture of metals or metals & non metals Brass is an alloy of copper and zinc

Brass $\Rightarrow$ Cu Zn
70% 30%

- Alloys are solid-solid solution

Ans. (3) is correct

17. Given data
mass of glucose = 1.80 gm
Molecular mass of glucose ($C_6H_{12}O_6$) = 180 gm

no. of moles = $\frac{1.80}{180} = 10^{-2}$ moles

Number of molecules of glucose = $10^{-2} \times 6.023 \times 10^{23}$
$= 6.023 \times 10^{21}$ molecules of $C_6H_{12}O_6$

Total number of oxygen atoms present in glucose
$= 6 \times 6.023 \times 10^{21}$

Number of moles of water = $\frac{36g}{18g} = 2$ moles

Number of H_2O molecules = $2 \times 6.023 \times 10^{23}$ H_2O molecules
so no. of oxygen atoms in water = 12.046×10^{23}
Total number of oxygen atoms present in solution i.e.(water + glucose)
$12.46 \times 10^{23} + 36.138 \times 10^{21}$
$\Rightarrow 12.046 \times 10^{23} + 0.36 \times 10^{23}$
$= 12.406 \times 10^{23}$ oxygen atoms

Ans. (1) is correct

18. Given data
$^{35}Cl \rightarrow 25\% \rightarrow x_1$
$^{37}Cl \rightarrow 75\% \rightarrow x_2$

$\Rightarrow$ average atomic mass = $\frac{p_1x_1 + p_2x_2}{p_1 + p_2}$

$= \frac{35 \times 25 + 37 \times 75}{100}$

$\Rightarrow 36.5$ u

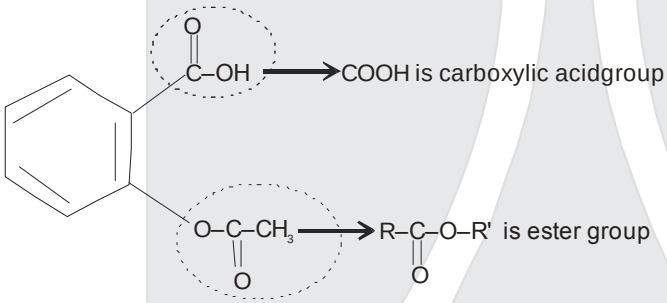
Ans. (4) is correct

19. Turmeric solution gives reddish brown colour in basic medium
From (1) potassium acetate (CH_3COOK) -salt of strong base and weak acid
From (2) copper sulphate($CuSO_4$)-salt of strong acid & weak base
From (3) sodium sulphate(Na_2SO_4)-salt of strong acid and strong base
From (4) ferric chloride($FeCl_3$)-salt of weak base & strong acid so
Ans. (1) is correct.

20. $2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2$
Metal M is copper
X is cuprous sulphide (Cu_2S) & Y is Cuprous oxide (Cu_2O)
$2Cu_2O + Cu_2S \rightarrow 6Cu + SO_2$
This is an self reduction reaction.
Ans. (1) is correct

21. Allotropes (Graphite & diamond) having same chemical properties but different physical properties.
Ans (4) is correct

22.



Ans. (2) is correct

23.
- A,E,G are alkali metal they always form ionic compound with 16 & 17 group member
- J is alkaline earth metals & they form ionic compound with 16 & 17 group member
- 16^{th} group elements (R & Q) form covalent compounds

Ans. (1) is correct

24. When acid reacts with metal carbonate or bicarbonates gives CO_2 gas which is colourless and odourless gas & turn lime water milky.
Metal carbonate + $CH_3COOH \rightarrow$ Salt + CO_2
(x)

$$CH_3COOH + CH_3OH \xrightarrow{Conc.H_2SO_4} CH_3COOCH_3 + H_2O$$
(X) ester
(Methyl ethanoate, sweet smell)

Ans. (2) is correct ($C_2H_4O_2$ i.e. CH_3COOH)

25.

$$\underset{\text{(solid)}}{NH_4Cl} \underset{\text{Cooling}}{\overset{\text{heating}}{\rightleftharpoons}} \underset{\text{(vapour)}}{NH_3} + \underset{\text{(vapour)}}{HCl}$$

(A) (B)

$$\underset{\text{(aq)}}{NaOH} \xrightarrow{\text{Heat}} (NaCl + NH_3 + H_2O) \xrightarrow{\text{Conc. HCl}} \underset{\text{(D)}}{NH_4Cl} \xrightarrow[\text{Shake}]{H_2O} \underset{\text{(E)}}{\text{Acidic solution}}$$

(C)

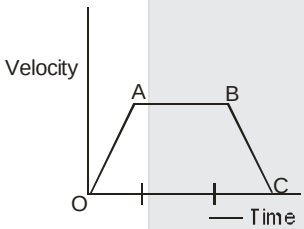
$(NH_4OH + HCl)$

Ans. (4) is correct.

26. According to reactivity series Zn is more reactive than Ag so it can displace Ag.
Ans. (2) is correct.

27. Due to latent heat, temperature. remains constant during state conversion, In case of water temperature. remains constant at 0ºC (m.p.) due to latent heat of fusion and also remains constant at 100ºC due to latent heat of vaporisation
Ans (3) is correct

28.



During OA velocity is uniform
$\therefore$ acceleration is constant and positive
During AB velocity is constant
$\therefore$ acceleration is zero
During BC velocity decreasing uniformly acceleration is constant again, and negative.

29. $u = -2m$
$V = -0.4m$

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$P = \frac{1}{f} = -\frac{1}{0.4} - \frac{1}{(-2)}$$

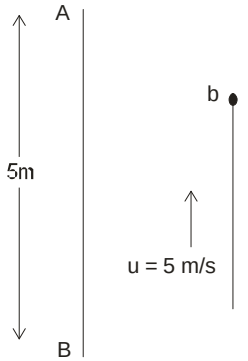
$$= -\frac{1}{0.4} + \frac{1}{(-2)}$$

$$= -\frac{10}{4} + \frac{1}{2}$$

$$= \frac{-10+2}{4} = \frac{-8}{4} = -2$$

$P = -2$ D
That means concave lens of power 2D.

30.



$V = u - gt$
$O = 5 - 10t$
$5 = 10t$
$\frac{5}{10} = 0.5 = t$
So the time taken to reach from A to B is 1.5 – 0.5 = 1 sec.

$H = ut + \frac{1}{2}gt^2$

$H = \frac{1}{2} \times 10 \times 1$

H = 5 m (Height between A & B)
Height Covered when the ball rebound

$S_1 = ut - \frac{1}{2}gt^2$

$S_1 = 5 \times 0.5 - \frac{1}{2} \times 10 \times (0.5)^2 = 1.25$ m

$\therefore$ Net displacement = 5 – 1.25 = 3.75 m

31. Since Force is equal to rate of change of momentum

$F = \frac{\Delta Mv}{\Delta t} = v\left(\frac{\Delta M}{\Delta t}\right)$

$F = v\left(\frac{\text{Volume} \times \text{density}}{\Delta t}\right)$

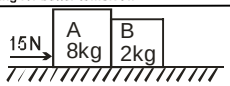
$F = v\left(\frac{A \times \ell \times \rho}{\Delta t}\right)$

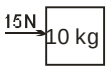
$F = v\left(\frac{A \times v \times \Delta t \times \rho}{\Delta t}\right)$

$F = v^2\rho A$ (Hint : Area = $\pi r^2 = \pi\left(\frac{D}{2}\right)^2$)

$F = \frac{\pi v^2 \rho d^2}{4}$

32.



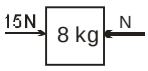


$F_{net} = Ma_{net}$

$15 = 10 \times a$

$\frac{15}{10} = a$

$a = 1.5\ m/s^2$



$15 - N = ma$

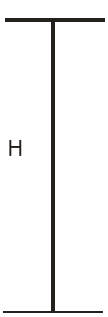
$15 - N = 8 \times 1.5$

$15 - 12 = N$

$N = 3$

33. It will show the reading of the buoyant force exerted by the liquid on the block.
Actual weight – Appr. weight = B.F.
800 g – 300g = B.F.
∴ reading of weighing machine is 500g.

34.



$g = \frac{GM}{r^2}$

$g' = \frac{G2M}{(2r)^2}$

$g' = \frac{2GM}{4r^2}$

$g' = \frac{g}{2}$

$\frac{H}{H} = \frac{\frac{1}{2} g_e t_e^2}{\frac{1}{2} g_p t_p^2}$

$g_p \times t_p^2 = g_e \times t_e^2$

$\frac{g_e}{2} \times t_p^2 = g_e \times 50 \times 50$

$t_p^2 = 2 \times 50 \times 50$

$t_p = \sqrt{5000}$

$t_p = 70.7$ sec.

35. Since sound is traveling from water to air.
Therefore frequency remains constant it depends on source of sound.
Now $v = f\lambda$
If v will decrease then λ will also decrease as f is constant.

36. Initial volume = Final volume

$A_1 L_1 = A_2 L_2$

$\pi r_1^2 \ell_1 = \pi r_2^2 \times \ell_2$

$$\boxed{\frac{r_1^2}{r_2^2} = \frac{\ell_2}{\ell_1}}$$

$$\frac{R_1}{R_2} = \frac{\rho \ell_1}{A_1} \times \frac{A_2}{\rho \ell_2}$$

$$\frac{R_1}{R_2} = \frac{\ell_1}{\ell_2} \times \frac{\pi r_2^2}{\pi r_1^2}$$

$$\frac{R_1}{R_2} = \frac{r_2^2}{r_1^2} \times \frac{r_2^2}{r_1^2}$$

$$\frac{R_1}{R_2} = \left(\frac{r_2}{r_1}\right)^4$$

Now, $D_2 = \frac{D_1}{5}$

$r_2 = \frac{r_1}{5}$.

so $\frac{R_1}{R_2} = \left(\frac{r_1}{\frac{5}{r_1}}\right)^4$

$$\frac{R_1}{R_2} = \frac{1}{625}$$

$625R_1 = R_2$

37. According to law of conservation of momentum.

$mu = (M + m)\, v$

$$v = \frac{mu}{M+m}$$

Loss of kinetic energy = $\frac{1}{2} mu^2 - \frac{1}{2} (m + M)v^2$.

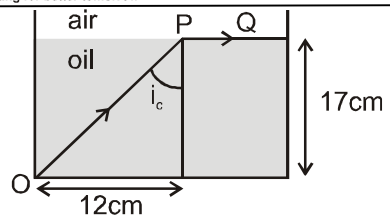
$$= \frac{1}{2} mu^2 - \frac{1}{2} (m + M) \left(\frac{mu}{M+m}\right)^2$$

$$= \frac{1}{2} mu^2 \left[1 - \frac{m}{M+m}\right]$$

$$= \frac{1}{2} mu^2 \times \frac{M}{M+m}$$

$$= \frac{1}{2} \frac{Mmu^2}{(M+m)}.$$

38.



$$\sin i_c = \frac{12}{\sqrt{(17)^2 + (12)^2}}$$

$$\sin i_c = \frac{12}{\sqrt{289 + 144}} = \frac{12}{20.80}$$

$$\text{So, } \mu = \frac{1}{\sin i_c} = \frac{20.80}{12} = 1.73.$$

39. Initial velocity u = 0

Force on charge = F = qE

F = ma

qE = ma

$$\frac{qE}{m} = a$$

$$s = ut + \frac{1}{2}at^2$$

$$d = \frac{1}{2}\frac{qE}{m}t_1^2 \qquad \text{.....(1)}$$

When charge is doubled.

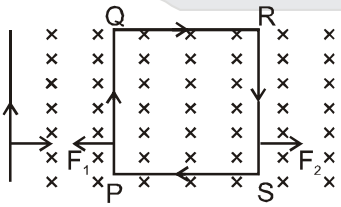
$$d = \frac{1}{2}\frac{2qE}{m}t_2^2 \qquad \text{.....(2)}$$

$$\frac{1}{2}\frac{qE}{m}t_1^2 = \frac{1}{2}\frac{2qE}{m}t_2^2$$

$$t_1^2 = 2t_2^2$$

$$\frac{t_1}{\sqrt{2}} = t_2.$$

40.



$\because$ current in wire AB and PQ are in same direction. Therefore they will attract.

$\because$ current in wire AB and RS are in opposite direction. Therefore the will repeal each other. magnetic field around PQ more than RS. So force on the arms PQ and RS will be unequal and opposite.

41. Cube of a natural number is of the form 9 m, 9m + 1, 9m + 8

So, possible remainder are 0, 1, 8
Sum = 0 + 1 + 8 = 9.
Option (4).

42. Given P(1) = 3
P(3) = 5
Let r(x) = ax + b
So P(x) = (x – 1) (x – 3) q(x) + ax + b
P(1) = a + b $\Rightarrow$ a + b = 3
P(3) = 3a + b $\Rightarrow$ 3a + b = 5
r(x) = ax + b = x + 2 2a = 2
r(– 2) = (– 2) + 2 a = 1
b = 2
r(– 2) = 0
Option (3).

43. px + 3y – (p – 3) = 0
12x + py – p = 0
For infinitely many solution

$$\frac{p}{12} = \frac{3}{p} = -\frac{p-3}{p}$$

From I and II

	I and II
$P^2 = 36$	p = 0
P = ± 6	p = 6

So p = 6
Option (1).

44.

$$\alpha^2 - b\alpha + 6 = 0$$

$$\alpha^2 - 6\alpha + c = 0$$

$$(6-b)\alpha + 6 - c = 0$$

$$\alpha = \frac{c-6}{6-b}$$

$$\alpha \cdot 3a = 6 \Rightarrow a = \frac{2}{\alpha}$$

$$\alpha + 4a = 6$$

$$\alpha + \frac{4\times 2}{\alpha} = 6.$$

$$\alpha + \frac{8}{\alpha} = 6$$

$$\alpha^2 + 8 - 6\alpha = 0$$

$$\alpha^2 - 6\alpha + 8 = 0$$

$$(\alpha - 4)(\alpha - 2) = 0$$

$$\alpha = 4, 2.$$

45. First term a = 2

Given

$a + a + d + a + 2d + a + 4d = \frac{1}{4}[a + 5d + a + 6d, \ldots\ldots\ldots, a + 9d]$

$5a + 10d = \frac{1}{4}(5a + 35d)$

$20a + 40d = 5a + 35d$

$15a = -5d$

$3a = -d$

$a = 2 \Rightarrow d = -6$

$S_{30} = \frac{30}{2}[2 \times 2 + 29(-6)]$

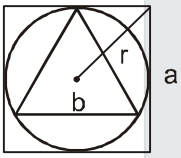
$= 15[4 + 29(-6)]$

$= 15(-170)$

$= -2550$

Option (4)

46.



$a = 2r$

$b = \sqrt{3}r$

S = K.T.

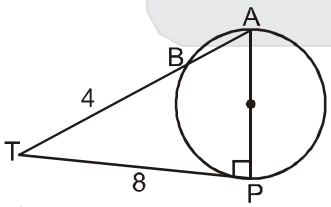
$a^2 = k \cdot \frac{\sqrt{3}}{4}b^2$

$4r^2 = k \cdot \frac{\sqrt{3}}{4}\left(\sqrt{3}r\right)^2.$

$4r^2 = \frac{k\sqrt{3} \times 3r^2}{4}$

$k = \frac{16}{3\sqrt{3}}.$

47.



$8^2 = 4 \times AT$

$AT = 16$

$\therefore \quad AB = 12$

$AP = \sqrt{16^2 - 8^2}$

$= \sqrt{256 - 64} = \sqrt{192}$

$2r = 8\sqrt{3}$

$r = 4\sqrt{3}.$

48. $\alpha + \beta = -b$

$\alpha\beta = 72$

$= 72 \times 1$ or -72×-1

$= 36 \times 2$ or -36×-2

$= 24 \times 3$ or -24×-3

$= 18 \times 4$ or -18×-4

$= 12 \times 6$ or -12×-6

$= 9 \times 8$ or -9×-8

$\therefore$ $b = 72 + 1 = 73$

$36 + 2 = 38$

$24 + 3 = 27$

$18 + 4 = 22$

$12 + 6 = 18$

$9 + 8 = 17$

$-72 - 1 = -73$

$-36 - 2 = -38$

$-24 - 3 = -27$

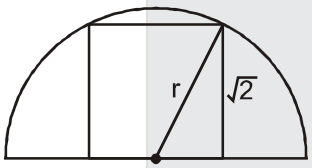
$-18 - 4 = -22$

$-12 - 6 = -18$

$-9 - 8 = -17$

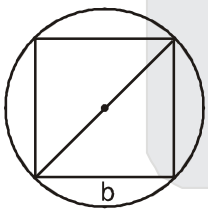
$\therefore$ Total 12 values are possible for b.

49.



$\frac{\sqrt{2}}{2}$

$r = \sqrt{\left(\sqrt{2}\right)^2 + \left(\frac{\sqrt{2}}{2}\right)^2} = \sqrt{2 + \frac{1}{2}} = \sqrt{\frac{5}{2}}$.



$2r = \sqrt{2}b$

$b = \sqrt{2}\, r$

$b^2 = 2r^2$

$= 2\left(\frac{\sqrt{5}}{2}\right)^2 = 2 \times \frac{5}{2} = 5.$

50. $(x - 1)(x - \alpha) = 0$ $\qquad$ $(x - 1)(x - \beta) = 0$

$x^2 - \alpha x - x + \alpha = 0$ $\qquad$ $x^2 - \beta x - x + \beta = 0$

$x^2 - x(\alpha + 1) + \alpha = 0$ $\qquad$ $x^2 - x(\beta + 1) + \beta = 0$

D is same for both the equations

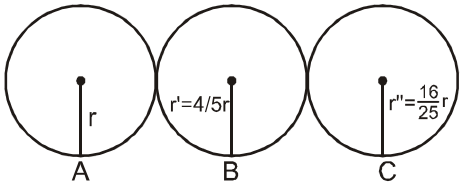
$\therefore$ $(\alpha + 1)^2 - 4\alpha = (\beta + 1)^2 - 4\beta$

$\alpha^2 + 1 - 2\alpha = \beta^2 + 1 - 2\beta$

$\alpha(\alpha - 2) = \beta(\beta - 2)$

$\alpha^2 - \beta^2 - 2\alpha + 2\beta = 0$
$(\alpha - \beta)(\alpha + \beta - 2) = 0$
$(\alpha - \beta)(\alpha + \beta - 2) = 0$
$\alpha = \beta$ or $\alpha + \beta = 2$

51.



1 min. $\rightarrow$ 32 revolution.

1 revolution $\rightarrow \frac{1}{32}$ min.

$2\pi r \rightarrow \frac{1}{32}$ min.

$1 \rightarrow \frac{1}{32 \times 2\pi r}$ min.

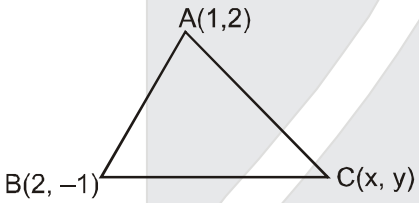
$2\pi r' \rightarrow \frac{1}{32 \times 2\pi r} \times 2\pi r'$ min.

$\rightarrow \frac{1}{32 \times 2\pi r} \times 2\pi \times \frac{16}{25}$ min.

1 revolution $\rightarrow \frac{1}{50}$ min.

1 min. $\rightarrow$ 50 revolution.

52.



CA = CB
$(x - 1)^2 + (y - 2)^2 = (x - 2)^2 + (y + 1)^2$
$x^2 + 1 - 2x + y^2 + 4 - 4y = x^2 + 4 - 4x + y^2 + 1 + 2y$
$2x - 6y = 0$
$2x = 6y$
$X = 3y$
AB = AC
$(1 - 2)^2 + (2 + 1)^2 = (x - 1)^2 + (y - 2)^2$
$1 + 9 = x^2 + 1 - 2x + y^2 + 4 - 4y$
$x^2 + y^2 - 2x - 4y - 5 = 0$
$9y^2 + y^2 - (3y) - 4y - 5 = 0$
$10y^2 - 10y - 5 = 0$
$2y^2 - 2y - 1 = 0$

$y = \frac{2 \pm \sqrt{4+8}}{4} = \frac{2 \pm \sqrt{12}}{2} = \frac{2 \pm 2\sqrt{3}}{2}$

$y = 1 \pm \sqrt{3}$.

$\therefore$ C$\left(3 + 3\sqrt{3}, 1 + \sqrt{3}\right)$ or $\left(3 - 3\sqrt{3}, 1 - \sqrt{3}\right)$

$\therefore$ C is in I or III.

53. Let the side are x, 2x, 3x

$v = (x)(2x)(3x) = 6x^3$

ATQ $6x^3 \le 400$

$x^3 \le 66\frac{2}{3}$

$\therefore$ $x = 64$.

maximum number of cubes $= 6x^3 = 6 \times 64 = 384$.

54. 1, 2, 3, $\boxed{18}$ 19, 20, 21.

4, 5, 6, $\boxed{14}$, 15, 16, 17

7, 8, 9, $\boxed{10}$, 11, 12, 13

Mean $= \frac{18+14+10}{3} = \frac{42}{3} = 14$.

55. $N_1 = 2272$

$N_2 = 875$

when N_1 and N_2 divide by N give remainder r.

Then $N_1 - r$, $N_2 - r$ are divisible by N.

$\therefore$ $(N_1 - r) - (N_2 - r)$ is also divisible by N.

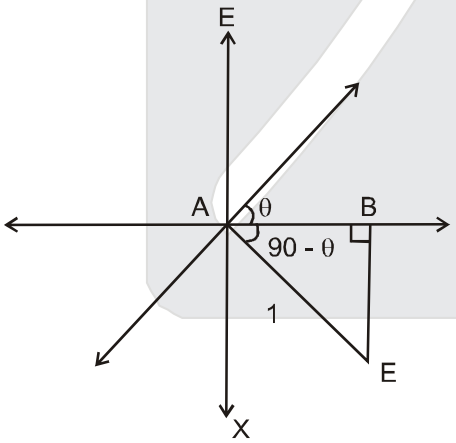
$$\frac{(2272-r)-(875-r)}{N}$$

$$\frac{1397}{N \to 11,127}$$

$\therefore$ $N = 127$

Sum of digit $= 1 + 2 + 7 = 10$.

56.



$\sin(90-\theta) = \frac{BE}{1}$

$\cos\theta = \frac{BE}{1} = \frac{4}{5}$

$BE = \frac{4}{5}$

$AB = \sqrt{1-\left(\frac{4}{5}\right)^2}$

$= \sqrt{\frac{9}{25}} = \frac{3}{5}$

$E\left(\frac{3}{5}, \frac{-4}{5}\right)$

57. $P(x) = x^2 + 5kx + k^2 + 5$
$P(-2) = 0$
$4 - 10k + k^2 + 5 = 0$
$k^2 - 10k + 9 = 0$
$k = 9, 1$ .....(1)
But $P(-3) \neq 0$
$9 - 15k + k^2 + 5 \neq 0$
$k^2 - 15k + 14 \neq 0$
$(k - 14)(k - 1) \neq 0$
$k \neq 14, 1$ .....(2)
from (1) and (2).
$k = 9$.

58. $\cos^4\theta + \sin^2\theta = m$
$(1 - \sin^2\theta)^2 + \sin^2\theta = m$
$\sin^4\theta - \sin^2\theta + 1 = m$

$\left(\sin^2\theta - \frac{1}{2}\right)^2 + \frac{3}{4} = m$

m_{min} when $\sin^2\theta - \frac{1}{2} = 0$

$\therefore \quad m_{min} = \frac{3}{4}$

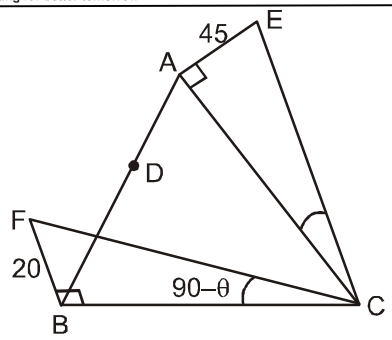
m_{max} when $\sin^2\theta = 0$

$\therefore \quad m_{max} = \left(0 - \frac{1}{2}\right)^2 + \frac{3}{4}$

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

59. $2A + 3B + 1C = 26$ .....(1)
$3A + 2B + 2C = 35$ .....(2)
$(1) \times 3 + (2) \times 2$
We get
$12A + 13B + 7C = 26 \times 3 + 35 \times 2$
$= 78 + 70.$
$= 148.$

60.



Let side of equilateral triangle is a

$\tan\theta = \frac{45}{a}$

$\tan(90 - \theta) = \frac{20}{a}$

$\cot\theta = \frac{20}{a} \Rightarrow \tan\theta = \frac{a}{20}$

$\therefore \quad \frac{45}{a} = \frac{a}{20}$

$a^2 = 45 \times 20$

$a = 30.$

Let the angle of elevation of the top of the pole from D is α. Let AD = x.

$\tan\alpha = \frac{45}{x} = \frac{20}{30 - x}$

$270 - 9x = 4x$

$270 = 13x$

$x = \frac{270}{13}$.