1. (1)

$$\rho = \frac{m}{V} \quad ; \quad \frac{\Delta\rho}{\rho}\times 100 = \left(\frac{\Delta m}{m} + \frac{\Delta V}{V}\right)\times 100$$

$$= \frac{0.05}{5}\times 100 + \frac{0.05}{1}\times 100 = 6\%$$

2. (2)

$$h_1 = \frac{1}{2}gt_1^{\,2} = \frac{10}{2}\times(5)^2 = 125\text{m}$$

$$h_2 = \frac{1}{2}gt_1^{\,2} = \frac{10}{2}\times(3)^2 = 45\text{m}$$

$$\therefore \quad h_1 - h_2 = 125 - 45 = 80\text{m}$$

3. (3)

$$18 = F_1 + F_2$$

$$(12)^2 = F_1^2 + F_2^2 + 2F_1F_2\cos\theta$$

$$\tan 90^0 = \frac{F_2\sin\theta}{F_1 + F_2\cos\theta} \quad ; \quad F_1 + F_2\cos\theta = 0$$

$$F_2\cos\theta = -F_1$$

$$144 = F_1^2 + F_2^2 - 2F_1^2 \; ; \quad F_2^2 - F_1^2 = 144$$

$$(F_2 + F_1)(F_2 - F_1) = 144$$

$$F_2 - F_1 = \frac{144}{18} = 8$$

$$\therefore \quad F_1 = 5 \text{ and } F_2 = 13$$

4. (2)

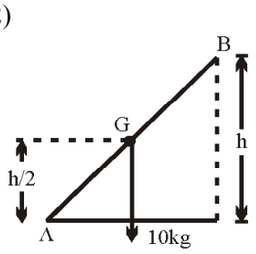
$$V = \sqrt{gr} = \sqrt{10\times 40} = \sqrt{400} = 20 \text{ ms}^{-1}$$

5. (1)

$$k = \frac{1}{2}mv^2 = \frac{1}{2}mr^2w^2$$

$$k \propto r^2, \qquad \frac{k_2}{k_1} = \left(\frac{r_2}{r_1}\right)^2$$

6. (2)



$$\text{Work done} = \frac{mgh}{2}, \quad 100 = \frac{10\times 10\times h}{2}$$

$$\therefore \qquad h = 2.0\text{m}$$

7. (2)

$$T^2 \propto r^3, \quad T \propto r^{3/2}$$

$$\frac{T_1}{T_2} = \left(\frac{r_1}{r_2}\right)^{3/2} = \left(\frac{R}{4R}\right)^{3/2} = \frac{1}{8}$$

8. (3)

$$_{17}Cl : \quad 1s^2\ 2s^2\ 2p^6\ 3s^2\ \underbrace{3p^5}_{3Px^2\ 3Py^2\ 3Pz^1}$$

For the unpaired electron in p-subshell

$n = 3, l = 1 \qquad m = 1 \quad s = \pm 1/2$

9. (4)

$$E_n = \frac{-13.6Z^2}{n^2} \text{ eV/atom}$$

I.E of 'H' atom $= E_\alpha - E_1$

$= 0\text{-}(-13.6)\text{eV}$

$= 13.6$ eV

I. E of Be^{3+} ion $= E_\alpha - E_1$

$$= 0 - \left[\frac{-13.6\text{x}\,4^2}{1^2}\right]\text{eV} = 13.6 \text{ x } 16\text{eV}$$

Now the ratio is 13.6 : 13.6 x 16 = 1:16

10. (2) $n = \dfrac{PV}{RT}$

$$n_A = \frac{2P_B\times 2V_B}{R\times 2T_B} = 2n_B$$

$$n_A : n_B = 2n_B : n_B = 2:1$$

11. (3)

12. (2)

13. (2)

$$\Delta S = \left[50 - \frac{3}{2}\text{x}\,40 - 1/2\text{x}\,60\right]$$

$JK^{-1} = -40\ JK^{-1}$

$\Delta H = -20$KJ

At equilibrium $T\Delta S = \Delta H$

$$T = \frac{\Delta H}{\Delta S} = \frac{-20\text{x}10^3\text{J}}{-40\text{JK}^{-1}} = 500\text{ K}$$

14. (2) 15. (2)

16. (4)

$$\cos\left(\log x^2\right).\cos\left(\log y^2\right) - \frac{1}{2}\left[\cos\left(\log\frac{x^2}{y^2}\right) + \cos\log x^2y^2\right]$$

$$\cos\left(\log x^2\right).\cos\left(\log y^2\right)$$

$$-\frac{1}{2}\left[\cos\left(\log x^2-\log y^2\right)+\cos\left(\log x^2+\log y^2\right)\right]$$

$$\cos\left(\log x^2\right).\cos\left(\log y^2\right)-\frac{1}{2}.2\cos\left(\log x^2\right)\cos\left(\log y^2\right)=0$$

17. (4) Given equation can be re-written as

$3x^2 - 2(a + b + c)\,x + (ab + bc + ca) = 0$

$$\Delta = 4\left\{(a+b+c)^2-3(ab+bc+ca)\right\}$$

$$=2\left\{(a-b)^2+(b-c)^2+(c-a)^2\right\}\geq 0$$

18. (3) Req. number of ways

$${}^5C_4 \times {}^8C_6 + {}^5C_5 \times {}^8C_5 = 196$$

19. (3)

$$\frac{{}^nC_1a^{n-1}b}{{}^nC_2a^{n-2}b^2}=\frac{{}^{n+3}C_2a^{n+1}b^2}{{}^{n+3}C_3a^nb^3}$$

20. (1)

Fifth term from the end has 8 terms before it = T_{8+1}

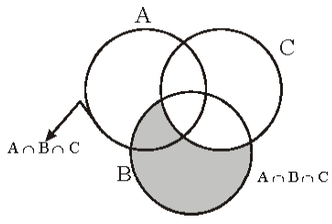
$$={}^{12}C_8\left(\frac{x^3}{2}\right)^4\left(\frac{-2}{x^2}\right)^8=\frac{12\times11\times10\times9}{1\times2\times3\times4}.\frac{2^8}{24}.\frac{1}{x^4}$$

$$=\frac{12\times11\times10\times9}{24}\times\frac{16}{x^4}$$

$$=\frac{11\times5\times9\times16}{x^4}=\frac{99\times80}{x^4}=\frac{7920}{x^4}$$

21. (1)

From Venn diagram, we can see that



$$P(B\cap C)=P(B)-P\left(A\cap B\cap\bar{C}\right)-P\left(\bar{A}\cap B\cap\bar{C}\right)$$

$$=\frac{3}{4}-\frac{1}{3}-\frac{1}{3}=\frac{1}{12}$$

22. (1)

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

$$S\alpha=\frac{a}{1-r}=\frac{\frac{\sqrt{2}+1}{\sqrt{2}-1}}{1-\frac{2-\sqrt{2}}{2}}=\frac{\frac{\sqrt{2}+1}{\sqrt{2}-1}}{\frac{\sqrt{2}}{2}}=\frac{2+\sqrt{2}}{\sqrt{2}-1}$$

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

$$=\sqrt{2}\left(\sqrt{2}+1\right)^2$$

23. (2)

$$\frac{a+b}{2}=9\Rightarrow a+b=18$$

$$\sqrt{ab}=4\Rightarrow ab=16$$

$\therefore$ req. equation is $x^2 - 18x + 16 = 0$

24. (2)

25. (3)

Required numbers = ${}^6P_4 - {}^5P_3 = 300$