Solution: MATH, CHEMISTRY, PHYSICS

1. (d)

$A \subseteq X$ & $B \subseteq X$ such that $A \not\subseteq B$

Such $A \not\subseteq B$ then $x \in A$ but $x \notin B$

So $x \not\in B \Rightarrow x \in B^c$

Hence $x \in A$ & $x \in B^c$

So A and complement of B (i.e. B^c) are always non-disjoint

2. **(d)**

Students numbers 1 to 140

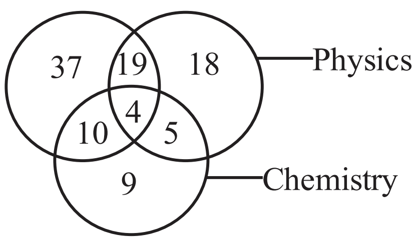
All even numbered are 70 opted mathematics

$\Rightarrow$ n(M) = 70

Numbers divisible by 3 = 46 $\Rightarrow$ n(P)=46

Divisible by 5 = 28 $\Rightarrow$ n(C) = 28

Mathematics



Divisible by 2 = 70 = n(M)

Divisible by 3 = 46 = n(P)

Divisible by 5 = 28 = n(C)

Divisible by 6 = 23 = n(M$\cap$P)

Divisible by 10 = 14 = n(M$\cap$C)

Divisible by 30 = 4 = n(M$\cap$P$\cap$C)

Total students whose opted

37 + 19 + 10 + 4 + 18 + 5 + 9 = 102

Not opted = 140 – 102 = 38

3. **(a)**

Total no. of non empty subsets = $2^{100}-1$

50 elements are odd so their product would not be even. for remaining 50 students $\Rightarrow 2^{50}-1$

Hence if products of elements in A is even = $(2^{100}-1)-(2^{50}-1) = 2^{50}(2^{50}-1)$

4. **(c)**

$A = \{x \in Z \mid 2^{(x+2)(x^2-5x+6)} = 1\}$ &

$B = \{x \in z \mid -3 < 2x-1 < 9\}$

$2^{(x+2)(x^2-5x+6)} = 2^0 = 1$ or $(x+2)(x^2-5x+6) = 0$

$(x+2)(x-2)(x-3) = 0$

$x = -2, 2, 3$

$-3 < 2x-1 < 9$

$-1 < x < 5 \Rightarrow n(B) = \{0,1,2,3,4\}$

And $n(A) = \{-2,2,3\}$, so

Number of subset A × B = 2^{15}

5. **(a)**

$3-2yi = 9^x - 7i$

$\Rightarrow$ $9^x = 3$ & $2y = 7$

$3^{2x} = 3^1$ & $y = 7/2 = 3.5$

$2x = 1 \Rightarrow x = \frac{1}{2} = 0.5$

6. **(d)**

$(1-i)^n = 2^n$ we know $(1-i)^2 = -2i$

7. **(a)**

$1 + i^2 + i^3 - i^6 + i^8$

we know $i^2 = -1, i^3 = -i, i^4 = 1$

$1-1-i-(-1)+1$

$1-1-i+1+1 = 2-i$

8. (a)

$i^n + i^{n+1} + i^{n+2} + i^{n+3}$

we know $i^1 = i, i^2 = -1, i^3 = -i, i^4 = 1$

$i^n(1+i+i^2+i^3)$

$i^n(1+i-1-i) = i^n \times 0 = 0$

9. (c)

$(1+i)^8 + (1-i)^8$

We know $(1+i)^2 = 2i$ and $(1-i)^2 = -2i$

$\left((1+i)^2\right)^4 + \left((1-i)^2\right)^4$

$(2i)^4 + (-2i)^4 = 16 + 16 = 32$

10. (d)

$(a+ib) < (c+id)$

Complex numbers are compared if imaginary part of complex number must be zero

So b & d both must be zero hence $b^2 + d^2 = 0$

11. (d)

${}^7P_4 = 840$

Permutation from set A to set B = ${}^{n(B)}P_{n(A)}$

12. (d)

Four speakers will address the meeting in 4! ways = 24 different ways in which half number of cases will be such that P speaks before Q and half number of case will be such that P speaks after Q so number of ways = 24/2 =12

13. (c)

☐ ☐ ☐ [0]
$6 \times 5 \times 4 \times 1$ fix = 120

☐ ☐ ☐ [2]
$5 \times 5 \times 4 \times 1 = 100$

☐ ☐ ☐ [4]
$5 \times 5 \times 4 \times 1 = 100$

☐ ☐ ☐ [6]
$5 \times 5 \times 4 \times 1 = 100$ Total = 420

14. (c)

Greaton that 24000

[2] [4] ☐ ☐ ☐
$1 \times 1 \times 3 \times 2 \times 2 = 6$

[2] [5] ☐ ☐ ☐
$1 \times 1 \times 3 \times 2 \times 1 = 6$

☐ ☐ ☐ ☐ ☐
$3 \times 4 \times 3 \times 2 \times 1 = \underline{72}$

total numbers $= 84$

15. (a)

$1+(1+x)+(1+x)^2+(1+x)^3+....+(1+x)^n$

The coefficient of x^k in each terms

${}^kC_k + {}^{k+1}C_k + {}^{k+2}C_k + ...+ {}^nC_k$

Coefficient of $x^k = {}^{n+1}C_{k+1}$

16. (c)

Last digit in $7^{300} \Rightarrow \dfrac{300}{4} = 75$,remainder is zero so

Unit place in $7^{75\times4+0} \Rightarrow 7^0 \Rightarrow 7^4 = 2401$

Last digit = 1

17. (d)

Toal number of terms $\dfrac{n}{2}+1 = 51$, where n = 100

Odd power terms will be delete only we get even power terms

18. (b)

Total number of terms = $\dfrac{2n}{2} - 1 = n-1$

Here even power terms deleted and we get odd power terms

19. (b)

Determinants of its cofactor matrix is |C|,

But given $|A|_{3\times3} = 3$

$|C| = |A|^{n-1}$ where n is order of matrix

20. (d)

The determinant of the inverse of an invertible matrix is the inverse of the determinant of the original matrix i.e Det $(A^{-1}) = \dfrac{1}{Det\,(A)} = (\det A)^{-1}$

$|A.A^{-1}| = |A|.|A^{-1}| = Det(A).\dfrac{1}{Det(A)} = 1$

21. (d)

$S = 1 + i^2 + i^4 + i^6 + ... + i^{2n}$

$S = \dfrac{1.(1-i^{n+1})}{(1-i)}$

It is dependent on n so cannot be determined

22. (c)

$2i^2 + 6i^3 + 3i^{16} - 6i^{19} + 4i^{25} = x + iy$

$-2 + 6(-i) + 3(1) - 6(-i) + 4(i)$

$= -2 - 6i + 3 + 6i + 4i = 1 + 4i = x + iy$

So x = 1, y = 4

23. (a)

$i^{57} + \dfrac{1}{i^{125}} \Rightarrow i^{4\times14+1} + \dfrac{1}{i^{4\times31+1}}$ since $i^4 = 1$

$\Rightarrow i + \dfrac{1}{i} \Rightarrow i - i = 0$

24. (b)

$\dfrac{i^{592}+i^{590}+i^{588}+i^{586}+i^{584}}{i^{582}+i^{580}+i^{578}+i^{576}+i^{574}} - 1$

$\boxed{\because i^4 = 1}$

$= \dfrac{i^{4\times148}+i^{4\times147+2}+i^{4\times147}+i^{4\times146+2}+i^{4\times146}}{i^{4\times145+2}+i^{4\times145}+i^{4\times144+2}+i^{4\times144}+i^{4\times148+2}} - 1$

$= \dfrac{1+i^2+1+i^2+1}{i^2+1+i^2+1+i^2} - 1$

$= \dfrac{1-1+1-1+1}{-1+1+-1+1+-1} - 1 \Rightarrow \dfrac{1}{-1} - 1 \Rightarrow -2$

25. (c)

$(1+i)^4 + (1-i)^4$ We know $(1+i)^2 = 2i$

$(2i)^2 + (-2i)^2$

$-4 - 4 = -8$

26. (d)

$(A+B)^2 = (A+B)(A+B) = A^2 + AB + BA + B^2$

27. (a)

$A = \begin{bmatrix} 1 & -2 \\ 5 & 3 \end{bmatrix}$ so $A + A^T = \begin{bmatrix} 1 & -2 \\ 5 & 3 \end{bmatrix} + \begin{bmatrix} 1 & 5 \\ -2 & 3 \end{bmatrix} = \begin{bmatrix} 2 & 3 \\ 3 & 6 \end{bmatrix}$

28. (b)

$\begin{bmatrix} x & 0 \\ 1 & y \end{bmatrix} + \begin{bmatrix} -2 & 1 \\ 3 & 4 \end{bmatrix} = \begin{bmatrix} 3 & 5 \\ 6 & 3 \end{bmatrix} - \begin{bmatrix} 2 & 4 \\ 2 & 1 \end{bmatrix}$

$\begin{bmatrix} x-2 & 1 \\ \ldots & \ldots \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ \ldots & \ldots \end{bmatrix}$

$\Rightarrow$ $x-2=1 \Rightarrow x=3$

$y+4=2 \Rightarrow y=-2$

29. (a)

$A=\begin{bmatrix} i & 0 \\ 0 & i \end{bmatrix} B=\begin{bmatrix} 0 & -i \\ -i & 0 \end{bmatrix}$ then

$$AB=\begin{bmatrix} i & 0 \\ 0 & i \end{bmatrix}\begin{bmatrix} 0 & -i \\ i & 0 \end{bmatrix}=\begin{bmatrix} 0 & -i^2 \\ -i^2 & 0 \end{bmatrix}=\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$$

$$BA=\begin{bmatrix} 0 & -i \\ -i & 0 \end{bmatrix}\begin{bmatrix} i & 0 \\ 0 & i \end{bmatrix}=\begin{bmatrix} 0 & -i^2 \\ -i^2 & 0 \end{bmatrix}=\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$$

$(A+B)(A+B)=A^2+AB-BA-B^2$

$= A^2-B^2$ since AB = BA

30. (b)

$(AB)^T = B^T A^T$

31. (c)

We know $N_1V_1 = N_2V_2 (H_3PO_3$ is dibasic

$\therefore$ n factor = 2

n factor of KOH = 1

So

$M_{H_3PO_3} \times n_{f_{H_3PO_3}} \times V_{H_3PO_3} = M_{KOH} \times n_{f_{KOH}} \times V_{KOH}$

$20\times2\times0.1=0.1\times1\times V_{KOH}$

$V_{KOH} = \frac{20\times2\times0.1}{0.1} = 40$ ml

32. (a)

No. of moles of oxalic acid dihydrate $= \frac{6.3}{126} = 0.05$ mol

Molarlity$\frac{0.05}{250}\times100=0.2$M

Normality = Molarity $\times n_{factor}$

Normality = 0.2 × 2 = 0.4 N

Because $N_1V_1 = N_2V_2$

$0.4N\times10ml=0.1N\times V_2$

$V_2 = \frac{0.4N\times10ml}{0.1N} = 4oml$

33. (c)

$\because$ 100*ml* _____1.5 mol

1ml ______ $\frac{1.5}{1000}$

480 *ml* _______ $\frac{1.5}{1000}\times480 = 0.72$ mol in 480 ml

Similarly

1000 ml__________1.2 mol

1 ml ___________ $\frac{1.2}{1000}$

520 ml ______ $\frac{1.2\times520}{1000}$=0.624mol in 520 ml

So ,

0.72 + 0.624 = 1.344 mol

34. (c)

On increasing temperature volume of the solution will change So, molarity which depends on volume of solution will be changed

35. (c)

$CO_2 = \frac{88}{44} = 2$ mole of CO_2 = 2 mole of C

$H_2O = \frac{36}{18} = 2$mole of H_2O = 4mole of H

Mass of C + Mass of H + Mass of O = 44

24 + 4 + x = 44

x = 44 – 28 = 16

mole of 0 = 1 and molecular formula is C_2H_4O

36. (b)

P + n = 45

n = P ×1.14

P + (P ×1.14) = 45

P (1 + 1.14) = 45

$P = \frac{45}{2.14} = 21$, so it is Sc whose electronic configuration is $-1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^1$

and Sc^{+3} has electronic configuration = $1s^2, 2s^2, 2p^6, 3s^2, 3p^6$

Because all electrons are paired so it wll show diamagnetic nature

37. (b)

1g = 33 J

100g = 3300 J

E = hv = $6.626 \times10^{-34} \times4.98 \times10^{14}$

E = $32.97\times10^{-20} \Rightarrow$ Total quanta

100 g ice $= \frac{3300}{32.97\times10^{-20}} \approx 10^{22}$

38. (c)

$1eV = \frac{hc}{\lambda} - hv_0$ ……(1)

$4eV = \frac{3hc}{\lambda} - hv_0$ ……(2)

On multiplying eq (1) by -3 we get

$-3eV = -\frac{3hc}{\lambda} + 3hv_0$ ……(3)

$+4eV = \frac{3hc}{\lambda} - hv_0$ ……(2)

$1eV = 2hv_0$

So the work function will be $\phi = hv_0 = 0.50eV$

39. (d)

$$E = 13.6\times\frac{z^2}{n^2} = 13.6\times\frac{(2)^2}{(1)^2} = 13.6\times4 = 54.4eV$$

Energy required to remove both electrons is 24.6 eV + 54.4 eV = 79 eV

40. (c)
Generally all transition elements are metals

41. (d)
s-block and p-block elements are known as representative elements. Because Aluminimum belongs to p-block of periodic table. So it is a representative element.

42. (b)
Atomic no. 3 and 11 have Lithium and Sodium respectively. Both belongs to 1st group of periodic table and have same valency 1

43. (b)
In the long form of periodic table p-block contains metals, non-metals and metalloids

44. (c)
In second period the valency of an element with respect to hydrogen increases in succession from group 1 to 14 and then decreases in succession from group 15 to 17

45. (c)
Because last electron enters into s-orbital in both electronic configuration 3d10, $4s^1$ and $4d^{10}$, $5s^1$. So both elements are s-block elements

46. (b)
NaCl crystal has 6 : 6 co-ordination number. When pressure is applied ions come closer to each other. This gives close packed (more compact) structure. The co-ordination number increases to 8 : 8 and the structure changes to CsCl type

47. (a)
The co-ordination no. of a metal crystallizing in a hcp structure is –12

48. (a)
Number of Fe^{+3} ion replacing × $Fe^{+2} = \frac{2x}{3}$

Vacancies of cation = $x - \frac{2x}{3} = \frac{x}{3}$

But $\frac{x}{3} = 1 - 0.94 = 0.06$ or x=0.06×3=0.18=18%

49. (c)
Let no. of Fe^{+2} and O^{-2} be 100 each
If 12% $Fe^{+2}$are replaced, 12 Fe^{+2} out of 100 will be replaced $3Fe^{+2}$ are replaced by Fe^{+3}=2 are replaced by Fe^{+3} = $\frac{2}{3} \times 12 = 8$
So, total Fe will be
Fe^{+2} = 88
Fe^{+3} = 8
$Fe_{96}O_{100}$ or $Fe_{0.96}O_{1.00}$

50. (a)
Normality of H_2SO_4 = Molarity × n-factor
= 5 ×2 = 10 N
$N_1V_1 = N_2V_2$
$10 \times 1 = N_2 \times 10$
$N_2 = 1N$

51. (d)
Sterelity is caused by manganese pollutant in water

52. (c)
The pH of acid rain water is near about 5

53. (c)
By byssinosis is a lungs disea mainly caused by cotton fibres

54. (c)
Major source of methane in india is rice Fields

55. (b)
Lead element is believed to be responsible for the fall∝ the Roman Empire

56. (d)
The statement Halogens only show covalency is incorrect about halogens

57. (c)
Number of half filled orbitals in the valence shell of the elements of group 17 is 1not 3

58. (a)
Due to hydrogen bonding HF shows less volatility

59. (b)
Among given ions CNO^-, OCN^- andN_3^- are pseudohalides but $RCOO^-$ is not pseudohalide

60. (a)
HF gives no precipitate because AgF is formed. Which is soluble in water

61. (b)
Time perlodof pendulum $T = \frac{30 \sec}{20} = 1.5 \sec$

And $\Delta T = \frac{1}{20}$ second

L = 55cm ΔL = 1mm = 0.1 cm

We know that $T = 2\pi\sqrt{\frac{L}{g}}$ …(1)

From equation (1) we get

$g = \frac{4\pi^2 L}{T^2}$

Therefore percentage error in g is

$$\frac{\Delta g}{g}\times 100\left(\frac{\Delta L}{L}\times 100\right)+2\left(\frac{\Delta T}{T}\times 100\right)$$

$$=\frac{0.1}{55}+\frac{2\left(\frac{1}{20}\right)}{\frac{30}{20}}\times 100$$

$$\frac{\Delta g}{g}\times 100=\frac{0.1}{55}\times\left(\frac{\frac{1}{10}}{\frac{3}{2}}\right)\times 100$$

$$\frac{\Delta g}{g}\times 100 = 6.8\%$$

62. (c)

In a cylinder diameter + D=3 significant figure 12.6 + 0.1 cm

Height = 34.2 $\pm$ 0.1 cm

Volume $=\pi r^2 h$

$$=\pi\left(\frac{D}{2}\right)^2 h$$

$$V=\frac{\pi D^2 g}{4}$$

Further

$$\frac{\Delta V}{V}=\frac{2\Delta D}{D}+\frac{\Delta h}{h}$$

$$V=\frac{3.14\times(12.6)^2\times 34.2}{4}$$

= 426.2 cm^3

= 4260 cm^3 (Rounding to 3 figure)

$$\frac{\Delta V}{V}=\frac{2\Delta D}{D}+\frac{\Delta h}{h}$$

$$\Delta V = 4262.2\left(\frac{2\times 0.1}{12.6}+\frac{0.1}{34.2}\right)$$

= 4262.2 (0.016 + 0.003) =80

Ans = V + ΔV $=(4260\pm 80)\text{cm}^3$

63. (c)

To find the maximum error in determining the density

$$\int=\frac{m}{v}\text{(m=mass, v=volume)}$$

The mass error in density formula is $\frac{\Delta f}{f}=\frac{\Delta m}{m}+\frac{3\Delta l}{l}$ = 1.5 + 3 ×1

$$\frac{\Delta\rho}{\rho}=4.5$$

64. (a)

To find the mean value of time

Measured time period of 100 oscillation by the students are

90, 91, 95, 92 sec

Mean value $=\frac{90+91+95+92}{4}=92$ second

$|\Delta t_1| = |t_m t_1| = 25$

$|\Delta t_2| = 15$

$|\Delta t_3| = 35$

$|\Delta t_4| = 05$

$$\Delta t_{\text{mean}}=\frac{2+1+3+0}{4}=1.5 \text{ second}$$

But least count of measuring clock is 1s to we have to round off the mean error with be 2s

Hence mean time = (92 + 20) sec

65. (b)

From momentum conservation

$$V_m=\left(\frac{120+60}{60}\right)V_T=\frac{180\times 2}{60}$$

V_{man} = 6m/s

66. (a)

At maximum height velocity is zero therefore momentum is also zero

67. (a)

According to the laws of motion conditions for upward and donwared motions are same, only the direction is changed, therefore time remains same

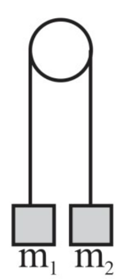
68. (b)

In case first

$$a=\frac{m_2 g - m_1 g}{m_1+m_2}$$

But $(m_2 = 2m_1)$ given

Substituting $a_1=\frac{2m_1 g - m_1 g}{3m_1}$



$$a_1=\frac{g}{8}\text{ m/s}^2$$

Case-2

$m_2 = 3m_1$

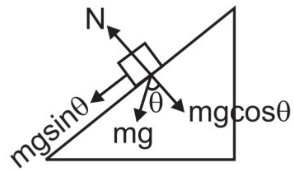
Therefore $a_1=\frac{3m_1 g - m_1 g}{4m_1}$

$$a_2=\frac{g}{2}$$

$$\frac{a_1}{a_2}=\frac{g/3}{g/2}=\left(\frac{2}{3}\right)$$

69. (c)

According to question



$a = g\sin\theta$

$l=\frac{1}{2}at^2$

$=\frac{1}{2}(g\sin\theta)t^2$

Case-I

$\theta = 30^o$

$l=\frac{1}{2}g\sin 30^o(2)^2$ ....(i)

Case-II

$l=\frac{1}{2}g\sin 45^o(t)^2$ ....(ii)

Eq (i) = (ii) length is same

$\frac{1}{2}g\sin 30(2^2)=\frac{1}{2}g\sin 45\, t^2$

$\frac{1}{2}\times 4=\frac{1}{\sqrt{2}}t^2$

$t=\sqrt{2\sqrt{2}}=1.688$

70. **(c)**

For equilibrium

Force acting on the body most be zero

$-\frac{dv}{dr}=0$

$\Rightarrow\ \frac{-10}{r^{11}}A+\frac{5}{r^6}B=0$

V

$r=\left(\frac{2A}{B}\right)^{1/5}$

71. **(c)**

Let initial mass of block be 3m → Break into (m_1, 2m) Given that initial mass of 3m is 4 m/s mass of m after explosion is 4 m/s From momentum conserve.

3m (40) = m(60) + 2m(v)

120 m – 60 m = 2mv

$60 = 2x \Rightarrow x = 30$ m/s

Initial kinetic energy

$K_i=\frac{1}{2}m(40)^2$

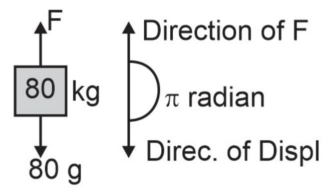
$K_f=\frac{1}{2}m(60)^2+\frac{1}{2}m(30)^2$

$\frac{K_f-K_i}{K_i}=\frac{60^2+21(30)^2-3(40)^2}{3(40)^2}$

$=\frac{3600+1000-4800}{4800}=\frac{600}{4000}=\left(\frac{1}{8}\right)$

72. **(b)**

Let F be the force applied by porter to lower The surface



Work done by the proper

$F._d = F_d \cos 180$

As the object is moving with Cons..velocity, F = 80g

$W.D_p = 80g \times 0.8 \times \cos 180^o$

= 80 ×9.8Ú0.8×(–1)= –627.2J

73. **(a)**

Kinetic energy

$k=\frac{p^2}{2m}\Rightarrow p\propto\sqrt{k}$

$\frac{P_2}{P_1}=\sqrt{\frac{4k}{k}}=\sqrt{\frac{4}{1}}=\frac{2}{1}$

P_1 = Initial momentum

P_2 = final momentum

Percent. Change in momentum

$\left(\frac{P_2-P_1}{P_1}\right)\%=\left(\frac{P_2}{P_1}-1\right)\times 100$

= (2 – 1) × 100 = 100%

74. (c)

$\mu_1 = 1$

$r_1=\frac{5}{3}$ (for monoatomic g)

$\mu_2 = 2$

$\gamma_2=\frac{7}{5}$ (for diatomic gas)

$g_{mix}=\frac{\mu_1\gamma_1}{\gamma_1-1}+\frac{\mu_2\gamma_2}{\gamma_2-1}$

$=\frac{1\times\frac{5}{3}}{\left(\frac{5}{3}-1\right)}+\frac{\left(2\times\frac{7}{5}\right)}{\left(\frac{7}{5}-1\right)}$

$=\frac{\frac{5}{2}+7}{\frac{3}{2}+5}=\left(\frac{19}{13}\right)$

75. (c)

For air inside the tube

$P_0 \times A \times 40 = P' \times A \times (60)$

$P' = \frac{2P_0}{3}$ ....(1)

Again

$P' \pm f_{\mu g}\ g \times 20 = P_0$

$\frac{2P_0}{3} + f_{\mu g}.g \times 20 = P_0$

$Pl0 = 3f_{\mu g} g \times 20 = 60\rho_{\mu g}.g$

Atomic mass pressure = 60 cm Hg

76. (d)

$H_2 \rightarrow 2H$

Dissociation

$\begin{array}{c|c} n & 0 \\ 0 & 2n \end{array}$ no of moles

$U_1 = \frac{n \times 5R}{2} \times T$

$U_2 = (2n) \times \left(\frac{3R}{2}\right).T = 3nRT$

$\Delta U = 3nRT - \frac{5}{2}nRT$

$= \frac{nRT}{2} = Q$

77. (c)

Total moles = 10

T = 300 K

Numbers of moles dissolved = 5

Formula = $Cv = \frac{5}{2}R$ (Diatomic)

$Cv = \frac{3}{2}R$ (Mono A)

$U_i = 10 \times \frac{5}{2}R \times 300$

$= 10 \times \frac{5}{2} \times 300 \times R = 62325$ J

$U_f = 5 \times \frac{5}{2}R \times 300 + 10V\frac{3}{2}VR \times 300$

$= 68557.5J$

$(\Delta U) = 6.232.5J =$ 750 R

78. (c)

$\gamma_{\text{mix}} = \frac{n_1Cp_1 + n_2Cp_2}{n_1Cp_1 + n_2Cp_2}$

$1 + \frac{2}{f_{\text{mix}}} = \frac{n\left(\frac{5}{2}R\right) + \frac{n}{2}\left(\frac{7}{2}R\right)}{n\left(\frac{3R}{2}\right) + \frac{n}{2}\left(\frac{5R}{2}\right)}$

$1 + \frac{2}{f_{\text{mix}}} = \frac{\frac{5}{2} + \frac{7}{3}}{\frac{3}{2} + \frac{5}{4}} = \frac{17}{11}$

$f_{\text{mix}} = \frac{11}{3}$

79. (b)

$\frac{W}{Q} = \frac{P\Delta V}{nCp\Delta T} = \frac{Q/3}{Q} = \frac{1}{3}$

$Cp = 3R = \left(\frac{1}{2} + 1\right)R$

F = 4

80. (d)

Rms velocity is function of temperature

$PV = \frac{m}{M}RT$

$P = \frac{\rho}{m}RT = 1\frac{P}{f} = \frac{RT}{M}$

$v_{rms} = \sqrt{\frac{3p}{f}} = \sqrt{\frac{3RT}{M}}$

But $\frac{P}{f}$ remains constant

Hence v_{rms} remains same

81. (c)

nuclear force

82. (c)

Nuclear

83. (b)

84. (d)

85. (a)

Change in K.E>

86. (a)

Applying W.E theorem

$W_g + W_{air} = \Delta KE$

For upward motion

$-mgh - (w_{air}) = 0 - \frac{1}{2}m(16)^2$ .....(1)

For downward motion

$(mgh) - (w_{air}) = \frac{1}{2}m\,(8)^2$ ....(ii)

(ii) and (i) we get

$2mgh = \frac{1}{2}m(8^2 + 16^2)$

$h = \frac{64 + 256}{}4g = 8m$

87. (c)

Work done is calculated as

$W = \frac{1}{2}m\Delta v^2$

Case-I V to V m/s

$W_1 = \frac{1}{2}m(v-0)^2$

$W_1 = \frac{1}{2}mv^2$

Case-II

$\frac{1}{2}m(2v)^2 - (v)^2$

$= \frac{1}{2}m(4v^2 - v^2) = \frac{3}{2}mv^2$

$\frac{w_1}{w_1} = \frac{1}{3}$

88. (c)

Resultant velocity of boat

$V_b \frac{1\,\text{km}}{15\,\text{min}} = 4km/h$

Velocity of river

$v_R = \sqrt{v_B^2 - v^2} = \sqrt{5^2 - 4^2} = 3\,\text{km/h}$

89. (d)

V_{man} in still water = 1 m/s

Shortest possible time to cross the river

$\frac{336}{1}$=336

Since time is not affected by the velocity of river

90. (d)

Distance travelled = D

Speed of Escalator

$= \frac{D}{60}$ units

Speed of person $= \frac{D}{90}$ units

Total speed = $\frac{D}{60} + \frac{D}{90} = \frac{D}{36}$ units

Time if walks on moving

Escalator = $\frac{D}{\frac{D}{36}} = \frac{36\,D}{D} = 36$ sec