ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	2	4	3	1	4	4	2	1	1	4	4	2	1	2	3	1	1	4	4	2
Que.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	4	1	2	2	4	3	3	4	1	2	3	4	1	4	4	2	2	3	2	1
Que.	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	1	1	4	2	2	3	1	1	4	1	1	2	3	2	1	3	4	4	3	4
Que.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
Ans.	2	3	1	1	2	1	2	2	4	1	2	4	3	1	1	2	2	4	1	2
Que.	81	82	83	84	85	86	87	88	89	90										
Ans.	4	4	2	3	4	3	2	1	2	3										

HINT – SHEET

1. $I_{net} = I_0 + I_0 + 2I_0\cos\phi = \frac{I_{max}}{2} = 2I_0$

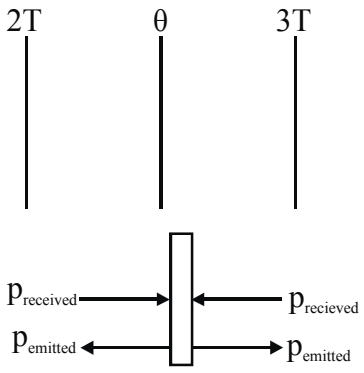
$\Rightarrow \cos\phi = 0 \Rightarrow \phi = n\pi + \frac{\pi}{2} = \frac{2\pi}{\lambda}\Delta x$

$\Rightarrow \Delta x = (2n+1)\frac{\lambda}{4}$

2. $P = \frac{\rho}{M}RT$

$\Rightarrow \frac{P_1}{P_2} = \frac{\rho_1 M_2}{\rho_2 M_1} = \frac{4}{3} \Rightarrow \frac{\rho_1}{\rho_2} = \frac{4}{3}\times\frac{2}{3} = \frac{8}{9}$

3.



For steady state, $P_{net\ received} = P_{net\ emitted}$

$\sigma A\left(\theta^4 - (2T)^4\right) = \sigma A\left[(3T)^4 - \theta^4\right]$

$\Rightarrow \theta^4 - 16T^4 = 81T^4 - \theta^4 \Rightarrow \theta = \left(\frac{97}{2}\right)^{1/4} T$

4. $R_1 = \frac{\ell}{kA} = 2R$ $\qquad$ $R_2 = \frac{\ell}{2kA} = R$

in configuration 1 ; equivalent R = 3R

in configuration 2 ; equivalent R = $\frac{2}{3}$R

$\Delta Q_1 = \frac{\Delta T}{3R}t_1$; $\Delta Q_2 = \frac{\Delta T}{\frac{2R}{3}}t_2$

$\Rightarrow \frac{\Delta T}{3R}t_1 = \frac{3\Delta T}{2R}t_2 \Rightarrow t_2 = \frac{2}{9}t_1 = 2\,\text{sec}.$

5. $v_{rms} = \sqrt{\frac{3RT}{M}}$

$\Rightarrow \quad \frac{(v_{rms})_{He}}{(v_{rms})_{Ar}} = \sqrt{\frac{M_{Ar}}{M_{He}}} = \sqrt{\frac{40}{4}} = \sqrt{10} = 3.16$

6. $\Delta Q = \Delta U + \Delta W = \frac{f}{2} nR\Delta T + P\Delta V = \left(\frac{f}{2}+1\right) nR\Delta T$

$= \left(\frac{3}{2}+1\right)(2\times 8.31)(5) = 208 \text{ J}$

7. In resonance column experiment $\frac{\lambda}{4} = \ell_1 + e$ so,

$\ell_1 = \frac{\lambda}{4} - e = \frac{v}{4f} - 0.3d$

$= \frac{336\times 100 \text{ cm}}{4\times 512} - (0.3)(4 \text{ cm}) = 16.4 - 1.2 = 15.2 \text{ cm}$

8. No. of moles = $n = \frac{5.6}{22.4} = \frac{1}{4}$

$TV^{\gamma-1}$= constant $\Rightarrow T_1 (5.6)^{2/3} = T_2 (0.7)^{2/3}$

$\Rightarrow T_1(8)^{2/3} = T_2 \Rightarrow 4T_1 = T_2$

$W_{gas} = \frac{-nR\Delta T}{\gamma - 1} = -\frac{(1)R(3T_1)\times 3}{4\times 2} = -\frac{9}{8}RT_1$.

Therefore $W_{external} = \frac{9}{8}RT_1$

9. $f' = \left(\frac{v}{v - v_s}\right)\left(\frac{v + v_0}{v}\right) f$

$\Rightarrow \quad f' = \left(\frac{320}{320-10}\right)\left(\frac{320+10}{320}\right)\times 8$

$\Rightarrow \quad f' \approx 8.50 \text{ kHz}$

11. By principle of calorimetry

$m \times 2100 \times 5 + 10^{-3} \times 3.36 \times 10^5 = 420$

$\therefore m = 8$ gm

12. Apparent frequency of sound reflected from car

$f = \left(\frac{v + v_0}{v - v_0}\right) f_0 \approx \left(1 + \frac{2v_0}{v}\right) f_0$

$\because \frac{\Delta f}{f_0}\times 100 = 1.2 \therefore \frac{2v_0}{v} = \frac{1.2}{100}$

$\Rightarrow v_0 = 2 ms^{-1} = 2\times\frac{18}{5} km/h \approx 7 km/h$

13. $A = \sqrt{A_1^2 + A_2^2}\left(\because \Delta\phi = \frac{\pi}{2}\right) \Rightarrow A = \sqrt{4^2 + 3^2} = 5$

14. $C_p - C_v = R$ Always constant

$\frac{C_p}{C_v} = \gamma$ decreases with atomicity

$(C_p + C_v)$ depends on degree of freedom therefore. It will be more for diatomic gas.

15. $F_1 = \frac{2}{2\ell}\sqrt{\frac{T}{m}}$

$F_2 = \frac{5}{4}F_1$

16. $n_1 = n_2$

$\frac{1}{2\ell}\sqrt{\frac{T_1}{m}} = \frac{2}{2\ell}\sqrt{\frac{T_2}{m}}$

$T_1 = 4T_2$

$\tau_1 = \tau_2$

$T_1 \times x = \tau_2 \times (L - x)$

$4x = \ell - x$

$x = \frac{\ell}{5}$

17. $n = \frac{3v}{4\ell} = \frac{3\times 340}{4\times\frac{75}{100}} = 340 \text{ Hz}$

Shring	Fork	Beats
340	344 or 336	4
T↑		2

18. Frequency is the characteristics of source.

19. $T_1 = 2\pi\sqrt{\frac{1}{g}} = 2 \text{ sec}$

$T_2 = 2\pi\sqrt{\frac{1.21}{g}} = 2.2 \text{ sec}$

$T_2 \times 10 = 22 \text{ sec} \quad ; \quad T_1 \times 11 = 22 \text{ sec}$

21. $\frac{d^2x}{dt^2} = -ax = -\omega^2 x$

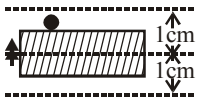
$\omega = \sqrt{a}$

$\frac{2\pi}{T} = \sqrt{a}$

$T = \frac{2\pi}{\sqrt{a}}$

22. $a_{max} \le g$

$\omega^2 A \le g$



$\omega \le \sqrt{\frac{g}{A}}$

$T \ge 2\pi \sqrt{\frac{A}{g}}$

$T \ge 2\pi\sqrt{\frac{0.01}{g}}$

$T \ge 2 \times \frac{1}{10}$

$T \ge 0.2$ sec

$$\left\langle \underset{t=0}{\overset{t=T/4}{RE}} \right\rangle = \frac{1}{4}KA^2 = \frac{1}{4}\times m\omega^2A^2$$

$$= \frac{1}{4}\times 1\times \frac{g}{A}\times A^2 = \frac{1}{4}\times 1\times 10\times 0.01$$

$$= \frac{1}{40} \text{ Joule}$$

$$\left\langle \underset{t=0}{\overset{t=T/4}{RE}} \right\rangle = 0.025 \text{ Joule.}$$

24. $P_1+\frac{1}{2}\rho V_1^2 = P_2+\frac{1}{2}\rho V_2^2$

$P_1 - P_2 = \frac{1}{2}\rho\ (V_2^2 - v_1^2)$

$h \times 13600 \times g = \frac{1}{2} \times 1000\ (V_2^2 - V_1^2)$

$A_1V_1 = A_2V_2 = \frac{d(\text{volume})}{dt}$

$V_1 = \frac{500}{5} = 100\text{cm/s} = 1\text{m/s}$

$V_2 = \frac{500}{2} = 250\,\text{cm/s} = 2.5\text{ m/s}$

$h = \frac{\frac{1}{2}\times 1000(0.25-1)}{13600\times 10}\text{m}$

$h = \frac{1}{2}\times\frac{5.25\times 100}{136}\text{cm}$

27. $x = A\sin\omega t + B\cos\omega t$

$$x = \sqrt{A^2+B}\left[\frac{A}{A^2+B^2}\sin\omega t + \frac{B}{\sqrt{A^2+B^2}}\cos\omega t\right]$$

$x = \sqrt{A^2+B^2}\ [\cos\phi\sin\omega t + \sin\phi\ \cos\omega t]$

$x = \sqrt{A^2+B^2}\sin(\omega t+\phi)$

30. $kE = \frac{1}{2}mv^2$

$\frac{\Delta kE}{kE} = \frac{\Delta m}{m} + 2\frac{\Delta v}{v}$

$\frac{\Delta kE}{kE}\times 100 = 2 + 2\times 3$

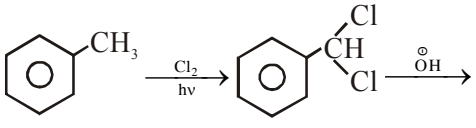
$= 8\%$

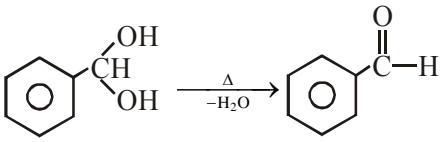
31. due to H-bonding b.p. of (II) is maximum.

32. for Aldol condensation compound must have α-H.

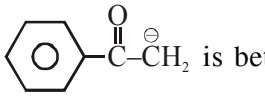
33. Zn-Hg/HCl can reduce all functional group.

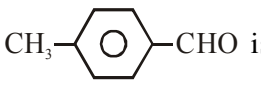
34. Oxidation of Toluene in (i) and (ii) gives benzaldehyde in (iii)

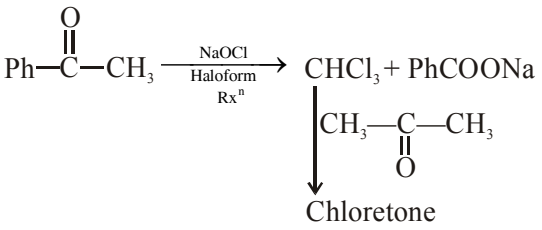




36. Reactivity $\underset{\text{Aldehyde}}{\overset{\text{Aliphatic}}{>}}\ \underset{\text{Aldehyde}}{\overset{\text{Aromatic}}{>}}$ Ketone

37.  is better enolet and

 is acceptor.

38. 

39. Aromatic Aldehyde can not reduce fehling sol^n

40. In both cases benzylic intermediate is more stable which gives major product.

43. $HgSO_4/H_2SO_4$ is KUCHEROV's Reaction.

44. $E_{cell} = E^0_{cell} - \frac{0.059}{2}\log\frac{[Zn^{+2}]}{[Cu^{+2}]}$

45. Equivalent = F = mole × V.f
= 1 × 2 = 2

47. $\alpha = \frac{i-1}{n-1} = 0.2 = \frac{i-1}{2-1}$

$i = 1.2$

$(\Delta T_f)_{obs} = (\Delta T_f)_{thero} \times i$

$= K_f \times m \times I = 1.86 \times 0.2 \times 1.2$

50. $\eta = \frac{\Delta G^\circ}{\Delta H^\circ} = \frac{-nFE^\circ}{\Delta H^\circ}$

$0.7 = \frac{-1\times 96500 \times E^\circ}{-300\times 1000}$

51. $m = \frac{1000\ M}{1000d - MM_A}$

$3 = \frac{1000M}{1000\times 1.1 - M\times 40}$

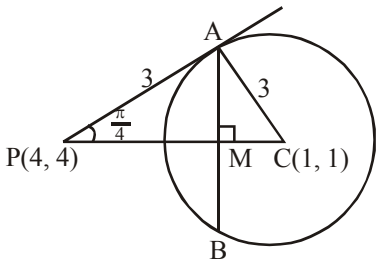
53. Gas which have maximum value of 'a' can be most easily liquefied.

58. None of given molecule can be hydrolysed but SF_6 is the only molecule which is inert towards water due to steric hinderence rest are inert due to absence of vacant orbital.

85. Area = $4 \times \frac{1}{2}\left|\begin{vmatrix} 1 & 2 & 1 \\ -1 & 1 & 1 \\ 0 & 3 & 1 \end{vmatrix}\right| = 6$

86. $C_1 \equiv (1, -2)$, $r_1 = 3$
$C_2 \equiv (4, 2)$, $r_2 = 2$
$|C_1C_2| = 5 = r_1 + r_2$
$\Rightarrow$ 3 tangents

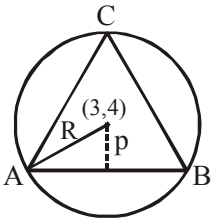
87.



$AM = 3 \sin\frac{\pi}{4} = \frac{3}{\sqrt{2}}$

$AB = 2\ AM = 2 \times \frac{3}{\sqrt{2}} = 3\sqrt{2}$

88. $R = 5,\ p = \frac{15}{5} = 3$



$\therefore$ Length of chord

$= 2\sqrt{R^2 - p^2} = 8$

Area is maximum when ΔABC is isosceles.

$A = \frac{1}{2}\times 8 \times (3+5) = 32$ sq. units

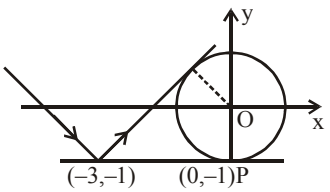
89. Let $a = p + q$; $b = p + 3q$; $c = p + 6q$
where p is first term and q is common difference.

$\therefore$ $ax + by + c = 0$

$\Rightarrow$ $p(x + y + 1) + q(x + 3y + 6) = 0$

$\therefore$ $\left.\begin{matrix} x+y+1=0 \\ x+3y+6=0 \end{matrix}\right\}$ $x = \frac{3}{2};\ y = -\frac{5}{2}$

90. $y + 1 = m(x + 3)$
$\Rightarrow mx - y + 3x - 1 = 0$
Distance from (0,0) = 1



$\Rightarrow$ $\left|\frac{3m-1}{\sqrt{1+m^2}}\right| = 1 \Rightarrow m = 0$ or $\frac{3}{4}$

$\therefore$ Reflected ray : $3x - 4y + 5 = 0$