AVIRAL CLASSES

IIT-JEE | NEET | FOUNDATIONS

ULTIMATE TEST SERIES NEET -2020

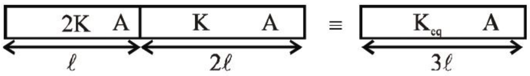
TEST-5 SOLUTION

Test Date :14-03-2020

[PHYSICS]

1. **B**

2.



$$(R_{Th})_{eq} = R_{Th_1} + R_{Th_2}$$

$$\Rightarrow \frac{3\ell}{K_{eq}A} = \frac{\ell}{2KA} + \frac{2\ell}{KA}$$

$$\Rightarrow Keq = \frac{6}{5}K$$

3. $Y = A\sin(\omega t - kx + \phi)$

4. For fundamental mode,

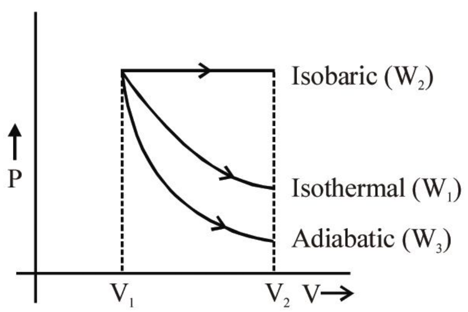
$(\lambda/2) = 100$ cm or $\lambda = 200$ cm

As n = 330 Hz, hence

$v = n\lambda = 330 \times 2 = 660$ m/s.

5. **B**

6.

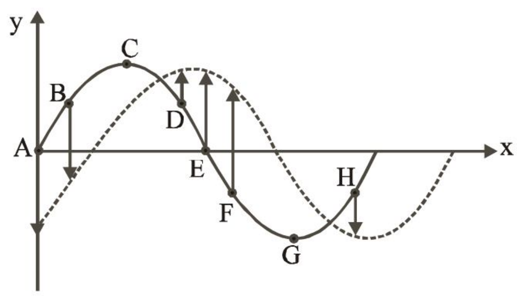


W = Area under P–V curve $\Rightarrow W_2 > W_1 > W_3$

7. Particle velocity, $\frac{dy}{dt} = v\left(\frac{dy}{dx}\right)$

or $\frac{dy}{dt}$ = wave velocity × slope of the wave

(a) For upward velocity, v_{Pa} = + ve, so slope must be negative which is at the points D, E and F.



(b) For downward velocity, v_{Pa} = –ve, so slope must be positive which is at the points A, B and H.

(c) For zero velocity, slope must be zero which is at C and G.

(d) For maximum magnitude of velocity, |slope| = maximum, which is at A and E. Hence, alternative is wrong

8. **D**

9. **D**

10. $\frac{1}{2}mv^2 = ms\Delta T$

$\Rightarrow \Delta T = \frac{V^2}{2s}$

$\Delta T = \frac{(200)^2}{2[0.03 \times 4200]} \simeq 158°C$

11.

At t = 0, $y = \frac{1}{1+x^2}$ or $x = \sqrt{\frac{1-y}{y}} = x_1$

At t = 2 sec, $y = \frac{1}{[1+(x-1)^2]}$

or $x = 1 + \sqrt{\frac{1-y}{y}} = x_2$

$\therefore\ v = \frac{x_2 - x_1}{t_2 - t_1} = \frac{1 + \sqrt{\frac{1-y}{y}} - \sqrt{\frac{1-y}{y}}}{2-0} = \frac{1}{2} = 0.5 m/s.$

12. Intensity level SL in decibel is given by:

$SL = 10 \log_{10} \frac{I}{I_0} = 10 \log_{10} 2$

$= 10 \times 0.3010 = 3.01 dB$

13. C

14. In the curves 1-2 and 3-4, we find that the pressure is directly proportional to temperature. So, the volume remains unchanged i.e., gas does not work.

The work done during the isobaric 2-3 and 1-4 are as follows:

$W_{2-3} = P_2(V_3 - V_2)$

$W_{1-4} = P_1(V_1 - V_4)$

Total work done= $P_2(V_3 - V_2) + P_1(V_1 - V_4)$

$\therefore\ W_T = P_2V_3 - P_2V_2 + P_1V_1 - P_1V_4$

Three moles has been given, so

$PV = nRT = 3RT$

$\therefore\ W_T = 3RT_3 - 3RT_2 + 3RT_1 - 3RT_4$

$= 3R[T_1 + T_3 - T_2 - T_4]$

$= 3R[400 + 2400 - 800 - 1200]$

$= 3R \times 800 = 20 \times 10^3 J = 20 kJ$

15. Bernoulli's theorem for unit mass of liquid

$\frac{P}{\rho} + \frac{1}{2}u^2 = \text{constant}$

As the liquid starts flowing, it pressure energy decreases

$\frac{1}{2}u^2 = \frac{P_1 - P_2}{\rho} \Rightarrow \frac{1}{2}u^2 = \frac{3.5 \times 10^5 - 3 \times 10^5}{10^3}$

$= \frac{2 \times 0.5 \times 10^5}{10^3} \Rightarrow u^2 = 100 \Rightarrow u = 10 m/s$

16. According to figure, $\frac{5\lambda}{2} = 20$

or $\lambda = \frac{20 \times 2}{5} = 8\text{cm}$

$\therefore \; n = \frac{v}{\lambda} = \frac{320 \times 100}{8}$ = 4000 Hz.

17. From the equation,

$y = A \sin \frac{2\pi t}{T}$,

$\frac{A}{2} = A \sin\left(\frac{2\pi t}{T}\right)$

or $t = \frac{T}{12} = 2\text{s}.$

18. At constant temperature the rms velocity does not depend on pressure because P/ρ is constant and the rms velocity is $\sqrt{3P/\rho}$

19. Rate of cooling of heat depends upon surface area, temperature difference mass and nature of material of the surface.

20. $x = a \sin\left(\omega t + \frac{\pi}{6}\right)$

$x' = a \cos \omega t = a \sin\left(\omega t + \frac{\pi}{2}\right)$

$\therefore$ Phase difference = (π/2)–(π/6) = (π/3)

21. $K = \frac{1}{2} m\omega^2 (A^2 - y^2),\; U = \frac{1}{2} m\omega^2 y^2$

$K = U$ or $\frac{1}{2} m\omega^2 (A^2 - y^2) = \frac{1}{2} m\omega^2 y^2$

i.e., $2y^2 = A^2$ or $y = \frac{A}{\sqrt{2}}$

22. At constant pressure: $W = nR\Delta T$

At constant volume: $Q = n\, C_v \Delta T$

Dividing $\frac{Q}{W} = \frac{C_V}{R} = \frac{3R/2}{R}$

$\Rightarrow Q = \frac{3W}{2}$

23. $PV = nRT = \frac{m}{M} RT$

where m is the mass of the gas

and $\frac{m}{M}$ = number of moles

$\frac{PV}{T}$ = nR is a constant for all P.

That is why ideally it is a straight line.

$\therefore \; \frac{PV}{T} = \frac{1\text{gm}}{32\text{gm}} \times 8.31$ J/mole-K

= 0.2597 = 0.256 J/K

$T_1 > T_2$ because at high temperature are approach ideal gas behaviour.

24. **A**

25. When the disc with a central hole is heated, diameter of hole as well as outer diameter of disc both increase. As a result of this, mass of the disc will be distributed more away from its axis which means that moment of inertia will increase on heating. Now according to law of conservation of angular momentum, as $I\omega$ = constant so ω will decrease.

26. Energy $= \frac{fPV}{2}$

For monoatomic total f = 3 and for diatomic gas translatory f = 3

27.

$$\frac{I_{max}}{I_{min}} = \frac{(A_1 + A_2)^2}{(A_1 - A_2)} = \frac{\left(\frac{A_1}{A_2}+1\right)^2}{\left(\frac{A_1}{A_2}-1\right)^2}$$

or $\frac{A_{max}}{A_{min}} = \frac{\left(\frac{A_1}{A_2}+1\right)}{\left(\frac{A_1}{A_2}-1\right)}$

Given that; $\frac{I_1}{I_2} = \frac{A_1^2}{A_2^2} = \frac{9}{1}$

or $\frac{A_1}{A_2} = \frac{3}{1}$

$\therefore \frac{A_{max}}{A_{min}} = \frac{3+1}{3-1} = \frac{4}{2}$

28. **C**

29. $\lambda_{max}\ \alpha\ \frac{1}{T}$ $\Rightarrow$ So λ_{max} must decrease

$(E_\lambda)_{max}\ \alpha\ T^5 \Rightarrow$ So $(E_\lambda)_{max}$ must increase

30. Using $\eta = \left(1 - \frac{T_2}{T_1}\right) \times 100$

$50 = \left(1 - \frac{500}{T_1}\right) \times 100 \Rightarrow T_1 = 1000K$

$60 = \left(1 - \frac{T_2}{1000}\right) \times 100 \Rightarrow T_2 = 400K$

31. **C**

32. **B**

33. **A**

34. $v \propto \sqrt{T}$

$\Rightarrow \frac{v_1}{v_2} = \sqrt{\frac{T_1}{T_2}} \quad \Rightarrow \quad \frac{v}{(v/2)} = \sqrt{\frac{2.06\times10^4}{T}}$

$\Rightarrow T = \frac{2.06\times10^4}{4} N = 0.515 \times 10^4 N$

35. Fundamental frequency मूल आवृत्ति
= 490 – 420 = 70 Hz

$70 = \frac{1}{2\ell}\sqrt{\frac{T}{\mu}} \quad \Rightarrow \quad 70 = \frac{1}{2\ell}\sqrt{\frac{540}{6\times10^{-3}}}$

$\ell = \frac{1}{2\times70}\sqrt{90\times10^3} = \frac{300}{140} \Rightarrow \ell \approx 2.14$ m

36. $\frac{I_1}{I_2} = 4$

$I_{min} = \left(\sqrt{I_1} - \sqrt{I_2}\right)^2 = (\sqrt{I_2})^2 = I_2$

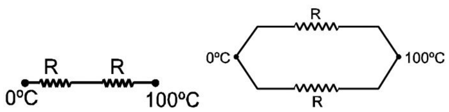
$I_{max} = \left(\sqrt{I_1} + \sqrt{I_2}\right)^2 = \left(\sqrt{4I_2} + \sqrt{I_2}\right)^2$

$\left(3\sqrt{I_2}\right)^2 = 9I_2 \quad \Rightarrow \quad \frac{I_{min}}{I_{max}} = \frac{1}{9}$

$\therefore \frac{I_{max} - I_{min}}{I_{max} + I_{min}} = \frac{9-1}{9+1} = \frac{8}{10} = \frac{4}{5}$

37. Resultant of 2 perpendicular SHM of same magnitude and phase difference of 90^0 is a circle.

38. $n_1 = \frac{3V}{4L_1}$, $n_2 = \frac{3V}{2L_2}$

39. 

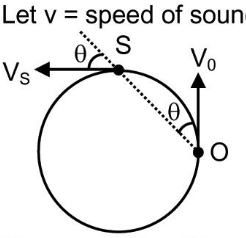
$$\frac{Q_1}{t_1} = i_{H_1} = \frac{100-0}{2R} = \frac{50}{R}$$

$$i_{H2} = \frac{100}{R/2} = \frac{200}{R} = \frac{Q_2}{t_2}$$

$Q_1 = Q_2 = 10$ cal.

$$\frac{50}{R}\times(2) = \frac{200}{R}\times t_2 \quad \Rightarrow \quad t_2 = \frac{1}{2} \text{ min.}$$

40. Let v = speed of sound, u = speed of train.



Then, $V_S = V_0 = u$

And

$$f' = f\left(\frac{v + v_0\cos\theta}{v + v_s\cos\theta}\right) = f\left(\frac{v + u\cos\theta}{v + u\cos\theta}\right) = f$$

41. $\Delta u = nC_v\Delta T = n\frac{R}{\gamma-1}\Delta T = \frac{p\Delta V}{\gamma-1} = \frac{pV}{\gamma-1}$

42. $$\frac{4\pi}{3}r^3\rho c\left(-\frac{dT}{dt}\right) = \sigma 4\pi r^2(T^4 - T_0^4)$$

or $$\left(-\frac{dT}{dt}\right) = \frac{3\sigma}{\rho rc}(T^4 - T_0^4) = H \text{ (say)}$$

Hence, ratio of fall of temperature

$$\frac{H_A}{H_B} = \frac{r_B}{r_A}.$$

43. According to Wien's displacement law

$$\lambda_m T = \text{constant}$$

or $$\frac{(\lambda_m)_1}{(\lambda_m)_2} = \frac{T_2}{T_1}$$

$$\therefore \quad (\lambda_m)_2 = \frac{4000\times10^{-10}\times3}{2}$$

$$= 6000 \times 10^{-10} \text{ m} = 6000 \text{ Å}.$$

44. $P \propto AT^4$ and $A \propto r^2$

$\therefore$ $P \propto r^2T^4$

Now, $T' = 2T$, $r' = 2r$

Hence, $P' = 4 \times 16\ P = 64\ P$.

45. When a body cools by radiation, the rate of cooling is given by :

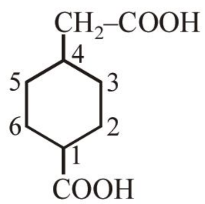
$$\frac{d\theta}{dt} = -\frac{eA\sigma}{ms}(\theta^4 - \theta_0^4)$$

–ve sign shows that temperature decreases, i.e., the body cools. s is the specific heat of material and θ_0 is the surronding temperature

or $d\theta / dt \propto 1/s$

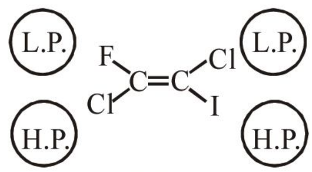
i.e. rate of cooling ($R = d\theta/dt$) is inversely proportional to the specific heat of material. For A, Rate of cooling in large, therefore, specific heat of A is smaller.

[CHEMISTRY]

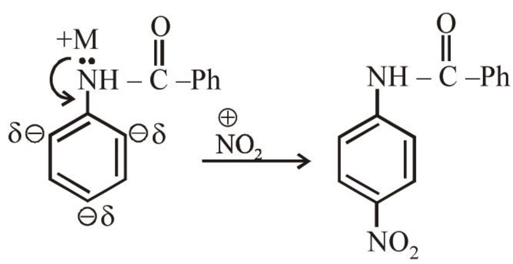
46. 

47. Kharach Effect

48. C

49. 

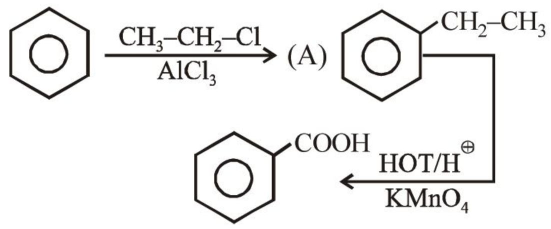
[Z] Trans

50. 

(Major)

51. A and B are Meso. Mirror Image of meso will be identical.

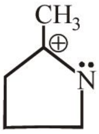
52.



53. **D**

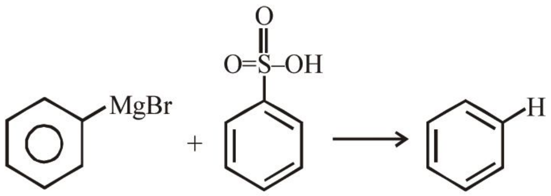
54. Picric Acid is more acidic

55.



Resonance and αH = 5

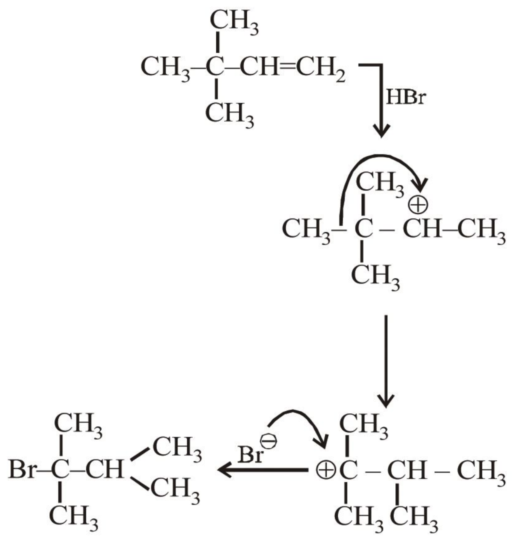
56.



57. H·O·H ∝ No. of π-Bond

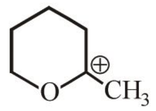
58. **C**

59.

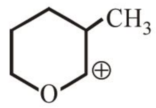


60. **D**

61. Stable carbocation



most stable

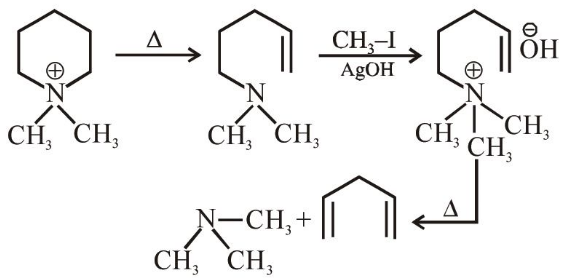


more stable

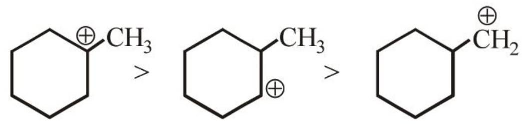
$Ph-\overset{\oplus}{C}H-\underset{H}{CH_2}$ Reso + αH = 3 Stable

$CH_3-\overset{\oplus}{C}H-CH_3$ αH = 6

62.



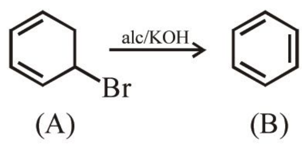
63.



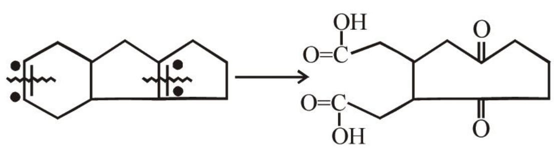
αH = 7 > αH = 3 > αH = 1

64. **B**

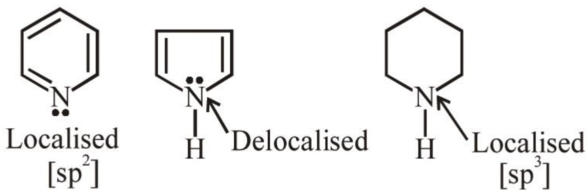
65.



66.

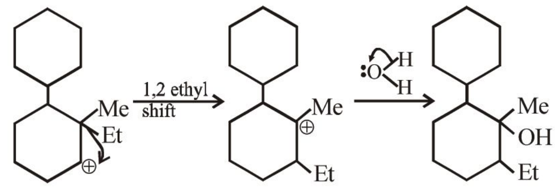


67.



68. Tert. halide will not give SN^2 reaction.

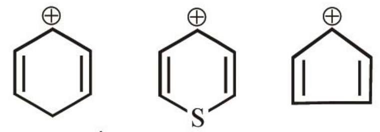
69.



70. **D**

71. **C**

72.



Non aromatic   Aromatic   Anti Aromatic

73. **D**

74. **B**

75. **D**

76. Wurtz reaction is not suitable to prepare unsymmetrical alkanes.

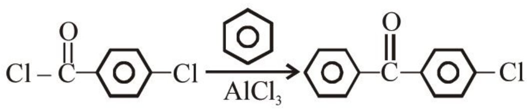
77. **D**

78. **D**

79. **A**

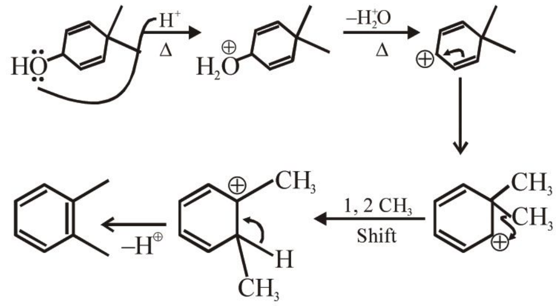
80. **A**

81.



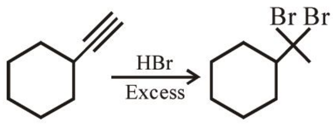
82. $CH_3COOH > HCN > HOH > C_2H_5OH$

83.

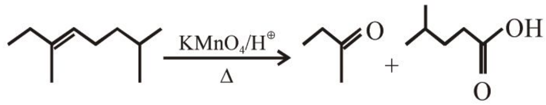


84. **A**

85.



86.



87. **C**

88. **B**

89. I[st] has POS, but II & III doesn't have symmetry

90. Nitrobenzene doesn't perform F.C.R