AVIRAL CLASSES

IIT-JEE | NEET | FOUNDATIONS

ULTIMATE TEST SERIES JEE MAIN -2020

XII TEST-04 ANSWER KEY

Test Date :23-03-2020

[PHYSICS]

1. C

2. $v = at + \frac{b}{t+c} \Rightarrow [c] = [t] = T$;

$[v] = [at] \Rightarrow [a] = \frac{[v]}{[t]} = LT^{-2}$;

$[b] = (LT^{-1})T = L$

3. $PV = \mu RT$ where $\mu = \frac{5}{32}$ moles

4. $\Delta U = \mu C_V \Delta T$ & $0 = W + \Delta U$

$\Rightarrow \Delta U = -6R \quad (\because W = 6R)$

Therefore $-6R = 1\left(\frac{R}{\gamma - 1}\right)\Delta T = \frac{3}{2}R\Delta T$

$\Rightarrow \Delta T = -4 \Rightarrow T_{final} = (T-4)K$

5. Let time of flight be T then $T = \frac{u}{g}$

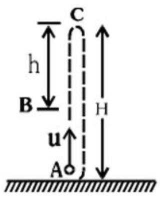
Let h be the distance covered during last 't' second of its ascent

Velocity at point B $= v_B = u - g(T-t)$

$= u - g\left(\frac{u}{g} - t\right) = gt$

$\Rightarrow h = v_B t - \frac{1}{2}gt^2$

$\Rightarrow h = gt^2 - \frac{1}{2}gt^2 = \frac{1}{2}gt^2$



6. $(\vec{A}+\vec{B}).(\vec{A}-\vec{B}) = 0$

$\Rightarrow A^2 - \vec{A}.\vec{B} + \vec{B}.\vec{A} - B^2 = 0$

$\Rightarrow A = B \; (\because \vec{A}.\vec{B} = \vec{B}.\vec{A})$

7. Source is stationary $\Rightarrow \lambda =$ constant & $f' = \frac{v+v_s}{v}$

$f = \left(1 + \frac{v_s}{v}\right)f = \left(1+\frac{1}{5}\right)f = 1.2f$

8. Use $\eta = 1 - \frac{T_2}{T_1} = \frac{W}{Q}$

9. B

10. $\frac{mv^2}{r} = \frac{Gmm}{(2r)^2} \quad v^2 = \frac{Gm}{4r}$

$v = \frac{1}{2}\sqrt{\frac{Gm}{r}}$

11. $\frac{g_h}{g} = \frac{R^2}{(R+h)^2}$

$\frac{g/16}{g} = \frac{R^2}{(R+h)^2}$

$h = 3R$

12. $\frac{1}{K_{eq}} = \frac{1}{K_1} + \frac{1}{K_2}$

$= \frac{1}{K} + \frac{1}{2K}$

$Keq = \frac{2K}{3}$

$n = \frac{1}{2\pi}\sqrt{\frac{2K/3}{M}} = \frac{1}{\pi}\sqrt{\frac{K}{6M}}$

13. $n \propto \frac{1}{\ell}$ $\frac{n_1}{n_2} = \frac{\ell_2}{\ell_1}$

$\frac{N}{N+5} = \frac{20}{20.5}$

$20.5\ N = 20\ N + 5 \times 20$

$0.5\ N = 100$

$N = \frac{100}{0.5} = 200$ Hz

$N + 5 \Rightarrow 200 + 5 = 205$ Hz

14. **C**

15. $V = \sqrt{\frac{\gamma P}{\rho}}$ $V \propto \frac{1}{\sqrt{\rho}}$ $\frac{V_1}{V_2} = \sqrt{\frac{\rho_2}{\rho_1}} = \sqrt{\frac{1}{2}} = \frac{1}{\sqrt{2}}$

16. $\frac{\theta_1 - \theta_2}{t} = K\left[\frac{\theta_1 + \theta_2}{2} - \theta_0\right]$

$\frac{70-60}{10} = K\left[\frac{70+60}{2} - \theta_0\right]$ .....(i)

$\frac{60-54}{10} = K\left[\frac{60+54}{2} - \theta_0\right]$ ....(ii)

eq (i)/(ii)

$\frac{10}{6} = \frac{65-\theta_0}{57-\theta_0}$

solving it $\theta_0 = 45°C$

17. **D**

18. **D**

19. **A**

20. $a = \frac{dV}{dt}$

INTEGER

21. Power $= Fv = v\left(\frac{m}{t}\right)v = v^2(\rho A v)$

$= \rho A v^3 = (100)(2)^3 =$

22. $\frac{Q}{t} = \frac{kA(T_1 - T_2)}{\ell}$

$\frac{Q'}{t} = \frac{k\left(\frac{A}{4}\right)(T_1 - T_2)}{4\ell} = \frac{1}{16}\frac{kA(T_1 - T_2)}{\ell}$

$\Rightarrow Q' = \frac{Q}{16}$

23. For given conditions $mg = m\omega^2 a = ka$

$\Rightarrow a = \frac{mg}{k} = \frac{2 \times 10}{200}$

$= 0.1$ m $= 10$ cm

24. Solar constant $= \frac{\sigma(4\pi r^2)T^4}{(4\pi R^2)}$

$= \frac{\sigma r^2 (t + 273)^4}{R^2}$

25. $\because x = a\sin\omega t$

$\therefore \frac{a}{2} = a\sin\omega t$ $\Rightarrow \omega t = \frac{\pi}{6}$

$\Rightarrow \left(\frac{2\pi}{T}\right)t = \frac{\pi}{6}$ $\Rightarrow t = \frac{T}{12}$

[CHEMISTRY]

26. $(v_{rms})SO_2 = (v_{rms})O_2$

$$\sqrt{\frac{3RT_{SO_2}}{64}} = \sqrt{\frac{3R \times 303}{32}}$$

27. [Metallic charater $\propto$ size]

28. D

29. D

30. D

31. B

32. Intermolecular attraction $\propto$ a

33. A

34. C

35. A

36. Calculated $\mu = q \times d$

$= 4.8 \times 10^{-10}$ esu $\times 187.5 \times 10^{-10}$ cm

$= 9 \times 10^{-18}$ esu cm

$= 9$ Debye (1×10^{-18} esu cm = 1 Debye)

Observed $\mu = 0.63$ Debye

$$\% \text{ Ionic character} = \frac{\mu_{observed}}{\mu_{calculated}} \times 100$$

$$= \frac{0.63}{9} \times 100 = 7\%$$

37. M.P. $\propto$ lattice energy of the crystal $\propto \frac{1}{r^+ + r^-}$

38. D

39. D

40. D

41. B

42. A

43. Option 4th is of weak base remaining all are salts of SAWB which have pH less than seven

44. D

45. B

INTEGER

46. 4

47. 4

48. 4

49. Square pyramidal geometry = sp^3d^2 (5 Bond pair + 1 lone pair)

50. 3

[MATHEMATICS]

51. **Ans. (2)**

$$\frac{1+i\cos\theta}{1-2i\cos\theta} = \frac{(1+i\cos\theta)(1+2i\cos\theta)}{(1-2i\cos\theta)(1+2i\cos\theta)}$$

$$= \frac{1-2\cos^2\theta+3i\cos\theta}{1+4\cos^2\theta}$$

is a real number only if $\frac{3\cos\theta}{1+4\cos^2\theta} = 0$

i.e. if $\cos\theta = 0$

i.e. if $\theta = (2n+1)\pi/2, n \in I$

So (b) is correct alternative.

52. **Ans. (3)**

$$m = \sum P_i.x_i = \frac{1}{2} + \frac{1}{2} = 1$$

$$\sigma^2 = \sum P_i (m - x_i)^2 = \frac{1}{3} + \frac{4}{6} = 1$$

53. **Ans. (3)**

$$\frac{4\sin 9°\sin 21°\sin 39°\sin 51°\sin 69°\sin 81°}{\sin 54°}$$

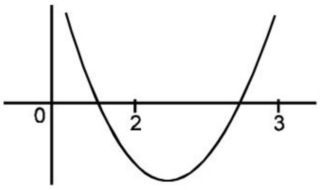
$$= \frac{4\sin 9°\cos 9° . \sin 39°\cos 39°\sin 21°\cos 21°}{\sin 54°}$$

$$= \frac{\sin 18° \ . \ \sin 78°\sin 42°}{2\sin 54°}$$

$$= \frac{\sin 18°}{4} \frac{(\cos 36° + \cos 60°)}{\sin 54°} = \frac{1}{8}$$

54 **Ans. (1)**

$$x^2 - \frac{2p}{p-5}x + \frac{p-4}{p-5} = 0$$



f(0) > 0, f(2) < 0, f(3) > 0

$f(0) > 0 \Rightarrow \frac{p-4}{p-5} > 0$...... (1)

$f(2) < 0 \Rightarrow \frac{p-24}{p-5} < 0$..........(2)

$f(3) > 0 \Rightarrow \frac{4p-49}{p-5} > 0$..........(3)

Intersection of (1) (2) & (3) gives $\left(\frac{49}{4}, 24\right)$

55 **Ans. (3)**

$$^nC_1.2^1 + {}^nC_2.2^2 + {}^nC_3 2^3 + ... + {}^nC_n 2^n$$

$$(1+2)^n = {}^nC_0 + {}^nC_1 2^1 + {}^nC_2.2^2 + ... + {}^nC_n 2^n$$

$$(3^n - 1) = {}^nC_1.2^1 + {}^nC_2.2^2 + ... + {}^nC_n.2^n$$

56. **Ans. (1)**

Let d_1 & d_2 are the distance of point (1, 2) from the bisector B_1 & B_2.

$$d_1 = \frac{|3+8-7|}{5} = \frac{4}{5}$$

$$d_2 = \frac{|4-6-14|}{5} = \frac{16}{5}$$

$\because d_1 < d_2$

$\therefore B_1$ is an acute angle bisector

57. **Ans. (2)**

As altitude from A is fixed and orthocentre lies on altitude hence x + y = 3 is required locus.

58. **Ans. (4)**

$\ell n(m \sin x + 4) \geq 0 \Rightarrow m \sin x + 4 \geq 1$

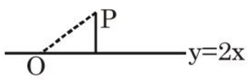
$m \sin x \geq -3 \Rightarrow m \in [-3,3]$

7 possible integral values.

59. **Ans. (2)**

P(x,y)

OP = 3PM



$$\sqrt{x^2+y^2} = 3\frac{|2x-y|}{\sqrt{5}}$$

$\Rightarrow 5(x^2 + y^2) = 9(4x^2 + y^2 - 4xy)$

$31x^2 + 4y^2 - 36xy = 0$ pair of st. line

Aliter focus is (0,0) and y = 2x directrix,

e = 3

focus lies on directrix therefore locus is pair of st. line.

60. **Ans. (2)**

$$\frac{24}{7} > -\frac{3}{4} > -3$$

$$\tan A = \frac{\frac{24}{7} + \frac{3}{4}}{1 - \frac{24}{7}.\frac{3}{4}} = -\frac{117}{51},$$

$$\tan B = \frac{-\frac{3}{4} + 3}{1 + \frac{9}{4}} = \frac{9}{13}$$

$$\tan C = \frac{-3 - \frac{24}{7}}{1 - 3.\frac{24}{7}} = \frac{45}{65} = \frac{9}{13}$$

61. **Ans. (3)**

$$\frac{bc}{(-b^3)(-c^3)}+\frac{ac}{(-a^3)(-c^3)}+\frac{ab}{(-a^3)(-b^3)}$$

$$=\frac{a^2+b^2+c^2}{a^2b^2c^2}=\frac{(a+b+c)^2-2\Sigma ab}{(abc)^2}$$

$$=\frac{0-16}{(-1)^2}=-16$$

62. **Ans. (3)**

$$\left(\frac{11}{7}\right)^2+\left(\frac{12}{7}\right)^2+\left(\frac{13}{7}\right)^2+....$$

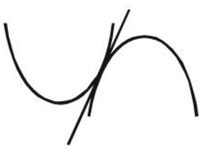
$$=\frac{1}{7^2}\left[(11)^2+(12)^2+......(21)^2\right]$$

$$=\frac{1}{7^2}\left[\frac{21.22.43}{6}-\frac{10.11.21}{6}\right]$$

$$\frac{1}{49}.\frac{21}{6}.11(86-10)=\frac{11}{14}.76=\frac{11}{7}.38$$

63. **Ans. (2)**

$$x^2+5x+\frac{17}{8}=-x^2+4x+2$$

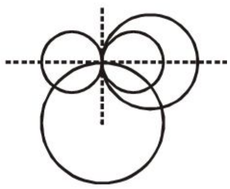


$$\Rightarrow 2x^2+x+\frac{1}{8}=0\Rightarrow x=-\frac{1}{4}$$

$\Rightarrow P_1$ and P_2 touches each other

64. **Ans. (2)**

$2x + 3y = 26$



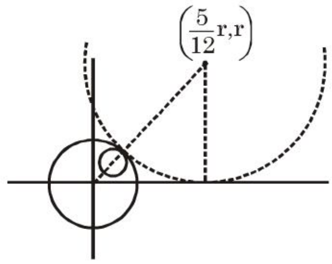
65. **Ans. (1)**

$a - 2,\ a + 2$

$a - 2 < 1$ & $a + 2 > 6$

$a < 3$ & $a > 4$ not possible

66. **Ans. (4)**



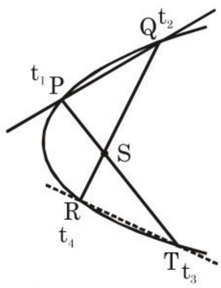
$$\frac{13}{12}r-r=20\Rightarrow r=240$$

67. **Ans. (3)**

$$\left(\frac{3x+4y}{\sqrt{3^2+4^2}}\right)^2=\frac{1}{5}\left(\frac{4x-3y}{\sqrt{4^2+3^2}}\right)$$

$$LR=\frac{1}{5}$$

68. **Ans. (3)**



$t_1t_3 = t_2t_4 = -1$

PQ : $y(t_1 + t_2) = 2x + 4t_1t_2$

$3(t_1 + t_2) = -4 + 4t_1t_2$ ......(1)

TR : $y(t_3 + t_4) = 2x + 4t_3t_4$ ......(2)

from (1) $-3\left(\frac{1}{t_3}+\frac{1}{t_4}\right)=-4+\frac{4}{t_3t_4}$

$\Rightarrow 3(t_3 + t_4) = 4t_3t_4 - 4$ ......(3)

using (2) and (3) we can say that TR passes through (–2, 3)

69. **Ans. (3)**

$X^2 = 4Y,\ X^2 + \frac{Y^2}{2} = 1$

$y = mx - m^2$

$y = mx - \sqrt{m^2 + 2}$

$m^2 = \sqrt{m^2 + 2}$

$\Rightarrow\ m^4 - m^2 - 2 = 0$

$m^2 = 2, -1 \Rightarrow m$

$m_1^2 + m_2^2 = 4$

70. **Ans. (3)**

$y = x^2,\ z = y^3 \Rightarrow\ z = x^6$

$\log_x z = 6$

INTEGER

71.

$$E = \log_{\frac{1}{4\left(1-\cos\frac{\pi}{4}\right)}}\left(\frac{1-\cos\frac{3\pi}{4}}{2}\right)$$

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

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

72.

Ellipse and circle touches each other at (2,0)

$\therefore$ Length of common chord = 0

73.

$f(a^2) - 3f(a) = 0$

$\Rightarrow (a^4 + a^2 + 1) - 3(a^2 + a + 1) = 0$

$\Rightarrow (a^2 + a + 1)(a^2 - a + 1) - 3(a^2 + a + 1) = 0$

$\Rightarrow (a^2 + a + 1)(a^2 - a - 2) = 0$

74.

$f(x) = 2$ has 3 solutions $x = -3,\ 1/2,\ \alpha$ where $(2 < \alpha < 3)$.

Now $f(x) = -3$ has no solution

$f(x) = 1/2$ has 2 solutions

$f(x) = \alpha$ has 2 solutions

So, $f(f(x)) = 2$ has 4 solutions

75.

$f(x)$ is symmetrical about the line $x = 7$. Let x_1, x_2, x_3, x_4 and x_5 are the real and distinct roots of $f(x) = 0$. Then $x_3 = 7$, $\frac{x_1 + x_5}{2} = 7$, $\frac{x_2 + x_4}{2} = 7$.

$S = x_1 + x_2 + x_3 + x_4 + x_5 = 35$

$S/7 = 5$