AVIRAL CLASSES
IIT-JEE | NEET | FOUNDATIONS

ULTIMATE TEST SERIES JEE MAIN -2020

XII TEST-02 ANSWER KEY

Test Date :20-03-2020

[PHYSICS]

1. **A**

2. There will be excess pressure $\Delta p = \frac{4T}{R}$ inside the soap bubble. As $R_B > R_A > R_C$ so $P_C > P_A > P_B$. Therefore the air will flow from A and C towards B

3. $Y = 2\eta(1 + \sigma)$

4. **C**

5. MI of disc about diametric axis will be minimum.

6. $P = \frac{2T}{r}$

$= \frac{2\times4.65\times10^{-1}}{6\times10^{-3}} = 155$ Pa

7. $B = \frac{\Delta P}{\frac{\Delta V}{V}}$

$\frac{\Delta V}{V}\% = \frac{\Delta P}{B}\times 100\%$

8. $v = \frac{2r^2}{9\eta}(\rho-\sigma)q$

$\frac{v_1}{v_2} = \left[\frac{\rho_1-\sigma}{\rho_2-\sigma}\right]$

$\frac{0.2}{v_2} = \left[\frac{19.5-1.5}{10.5-1.5}\right]$

$v_2 = 0.1$ m/s

9. **C**

10. $I_{net} = I_{disc} - I_{removed}$

$= \frac{1}{2}(9M)R^2 - \frac{1}{2}M\left(\frac{R}{3}\right)^2 = \frac{40}{9}MR^2$

11. Additional kinetic energy = $TE_2 - TE_1$

$= -\frac{GMm}{2R_2} - \left(-\frac{GMm}{2R_1}\right) = \frac{1}{2}GmM\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

12. option (c) and (d) are incorrect because option (c) is true only for spherically symm. bodies option (d) radius of gyration is irrelevant with C.G.

13. According to question and by using COME

$-\frac{GMm}{R+R} + \frac{1}{2}m(fv)^2 = 0 + 0$

$\Rightarrow fv = \sqrt{\frac{GM}{R}}$ but $v = \sqrt{\frac{2GM}{R}}$

Therefore $f\sqrt{\frac{2GM}{R}} = \sqrt{\frac{GM}{R}} \Rightarrow f = \frac{1}{\sqrt{2}}$

14. **D**

15. Here $\frac{dv}{dt}$ = constant = a (say)

Use $v^2 = u^2 + 2as$ where

$s = 2 \times 2\pi r = 80$ m, $u = 0$, $v = 80$ m/s

16. **B**

17. **A**

18. **A**

19. $-\frac{GMm}{2R^3}\left(3R^2 - \frac{R^2}{4}\right) + \frac{1}{2}mv_e^2 = 0$

$v_e = \sqrt{\frac{11}{4}\frac{GM}{R}}$

20. $A_1V_1 = A_2V_2$

$= \pi\left(\frac{3}{2}\right)^2 \times 4 = \pi\left(\frac{6}{2}\right)^2 \times v$

$= v = 1$ m/s

INTEGER

21. 2

22. 2

23. Sphere compresses the spring untill its all K.E. is converted to P.E. of spring

$$\frac{1}{2} MV^2 \left(1+\frac{K^2}{r^2}\right) = \frac{1}{2}Kx^2$$

24.

$$Q = \frac{\pi}{8}\frac{pr^4}{\eta\ell}$$

$$\frac{Q_1}{Q_2} = \left(\frac{r_1}{r_2}\right)^4 \times \frac{\ell_2}{\ell_1} = 32$$

$$Q_2 = \frac{Q}{32}$$

25. $k = yr_0$

$$r_0 = \frac{k}{y} = \frac{3.6\times10^{-9}}{1.2\times10^{11}} = 3 \times 10^{-20}\text{m}$$

[CHEMISTRY]

26.

$$E^\circ_{MnO_4^-|Mn^{2+}}{}^{(5)} = 1.51 \text{ V}$$

$$E^\circ_{Mn^{2+}|MnO_2}{}^{(2)} = -1.23 \text{ V}$$

$$E^\circ_{MnO_4^-|MnO_2}{}^{(3)} = \frac{1.51\times5 - 1.23\times2}{3}$$

$$= \frac{7.55-2.46}{3} = 1.69 \text{ V}$$

27. A

28. D

29. Given $CuSO_{4(s)} + aq \rightarrow CuSO_4 \cdot 5H_2O$ (aq)

$\Delta H = -15.9$ kcal ....(1)

$CuSO_{4(s)}.5H_2O + aq \rightarrow CuSO_4 \cdot 5H_2O$ (aq)

$\Delta H = +2.8$ kcal ....(2)

Subtracting equation (2) from equation (1)

$CuSO_{4(s)} + 5H_2O \rightarrow CuSO_4 \cdot 5H_2O_{(s)}$

$\Delta H = -15.9 - 2.8$

$= -18.7$ kcal

30. D

31. B

32. $Ag^+ + 2NH_3 \rightarrow [Ag(NH_3)_2]^+$; k' = ?

$k' = k_1 \times k_2$

33. B

34. $HA + OH^- \rightleftharpoons A^- + H_2O$; k' = ?

$$k' = \frac{1}{k_h} = \frac{1}{k_w/k_a} = \frac{k_a}{k_w} = \frac{10^{-4}}{10^{-14}} = 10^{10}$$

35. A

36. Intermolecular attraction $\propto$ a

37. $S_2O_3^{2-} + Cr_2O_7^{2-} \rightarrow SO_4^{2-} + Cr^{+3}$

38. $FeO \cdot Fe_2O_3$, In $\overset{+2}{Fe}O$, In $\overset{+3}{Fe_2}O_3$

39. $H_2SO_4 + Zn \rightarrow ZnSO_4 + H_2$

$2NaOH + Zn \rightarrow Na_2ZnO_2 + H_2$

40. $\boxed{S^1 = \frac{K_{sp}}{2C}}$

$$C = \frac{10g}{111g/mol \times 1L}$$

41. B

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

43. D

44. B

45. D

INTEGER

46. **9**
47. **6**
48. **4**
49. **1**
50. **2**

[MATHEMATICS]

51 **Ans.(4)**

$|z|^2 - |z| - 2 < 0$

$\Rightarrow (|z|-2)(|z|+1) < 0 \Rightarrow |z| < 2$

Now $|z^2 + z\sin\theta| \le |z|^2 + |z\sin\theta| \le |z|^2 + |z| < 4+2=6$

52 **Ans. (2)**

p	q	p∧q	(p∧q)→p	~q	q∧~q	[(p∧q)→p] →(q∧~q)
T	T	T	T	F	F	F
T	F	F	T	T	F	F
F	T	F	T	F	F	F
F	F	F	T	T	F	F

Given compound statement is always false. So it is a contradiction.

53 **Ans. (4)**

$n_1 = 10, n_2 = 10$

average $m_1 = 60, m_2 = 40$

$\sigma_1 = 4, \sigma_2 = 6$

Standard deviation of combined series

$$\sigma = \sqrt{\frac{n_1\sigma_1^2 + n_2\sigma_2^2}{n_1+n_2} + \frac{n_1 n_2 (m_1-m_2)^2}{(n_1+n_2)^2}}$$

$$= \sqrt{\frac{10\times16 + 10\times36}{10+10} + \frac{10\times10(60-40)^2}{(10+10)^2}}$$

$$= \sqrt{8+18+100} = \sqrt{126} = 11.2$$

54 **Ans. (3)**

Problem is same as arranging 8 things out of which 5 identical i.e. $\frac{8!}{5!}$ which gives total number of ways of selecting block and distributing them away 3 children i.e. $\frac{8!}{5!}3!$.

55 **Ans. (2)**

2 cases arise (i) P_1 & P_2 are in same pair & one loses $p = \frac{1}{11}$

(ii) P_1 & P_2 are in different pairs & one loses

$\rightarrow p = \frac{10}{11}\times\left(\frac{1}{2}\times\frac{1}{2} + \frac{1}{2}\times\frac{1}{2}\right) = \frac{5}{11}$

$\therefore$ required probability = $\frac{6}{11}$.

56. **Ans. (1)**

$S = (1-\omega)(1-\omega^2) + \ldots + (2017-\omega)(2017-\omega^2)$

$$S = \sum_{n=1}^{2017}(n-\omega)(n-\omega^2) = \sum_{n=1}^{2017}(n^2+n+1)$$

$$= \frac{2017.2018.4035}{6} + \frac{2017.2018}{2} + 2017$$

$$\frac{S.\pi}{2017} = \left(\frac{2018.4035}{6} + \underbrace{\frac{1009+1}{\text{even}}}\right)$$

= (odd + even)π = odd × π

$$= \cos\left(\frac{S\pi}{2017}\right) = \cos(\text{odd}\times\pi) = -1$$

57. **Ans. (4)**

$^{2017}C_0 + {}^{2017}C_1 + \ldots {}^{2017}C_{1008} = 2^{2016} = \lambda^2$

$\lambda = 2^{1008} \Rightarrow 8.32^{201} = 8(33-1)^{201} = -8 = 25$

58. **Ans. (3)**

34 terms so mean of 17th and 18th term is median

$x_{10+n} = 148 + (n-1)(-2) = x_{17} = 136, x_{18} = 134$

hence median = 135

59. **Ans. (2)**

p	~p	q	p→q	q ∨ ~p	(p→q) ↔(q ∨ ~p)
T	F	T	T	T	T
T	F	F	F	F	T
F	T	T	T	T	T
F	T	F	T	T	T

60. **Ans. (4)**

Total cases ⇒ $^{15}C_2.2! = 15.14$

$2x = 3y \Rightarrow (3, 2),(6, 4),(9, 6),(12, 8),(15,10)$

Fovourable cases = 5

$$\text{Probability} = \frac{5}{15.14} = \frac{1}{42}$$

61. **Ans. (2)**

$\overline{\text{I}}\ \overline{\text{II}}\ \overline{\text{III}}\ \_\ \_\ \_\ \_\ \_\ \overline{\text{IX}}\ \overline{\text{X}}$

Total number of numbers = 10^{10}

(without any restriction)

Total number of numbers = 9^{10}

(when we do not use 1)

62. **Ans. (3)**

It is always true for $n \geq 5$

63. **Ans. (1)**

$P(A) = 0.3$

$P(A \vee B) = P(A \cup B) = P(A) + P(B) - P(A)P(B)$

$\Rightarrow 0.8 = 0.3 + P(B) - 0.3\ P(B)$

$$\Rightarrow P(B) = \frac{5}{7}$$

$$P(A \to B) = 1 - P(A \cap \overline{B})$$

$$= 1 - (P(A) - P(A)P(B))$$

$$= 1 - \left(0.3 \times \frac{2}{7}\right) = \frac{32}{35}$$

64. **Ans. (4)**

$6 \times 5!$

65. **Ans. (2)**

Use : contrapositive of $p \to q$ is $(\sim q) \to (\sim p)$

66. **Ans. (3)**

$$\sum_{n=0}^{4} (1009 - 2n)^4\ {}^4C_n(-1)^n$$

$(1009)^4 - 4(1007)^2 + 6.(1005)^4 - 4(1003)^4 + (1001)^4$

$(1005 + 4)^4 + (1005 - 4)^4$

$\quad -4[(1005 + 2)^4 + (1005 - 2)^4] + 6(1005)^4$

$= 512 - 4 \times 32 = 384$

67. **Ans. (4)**

$$P = \frac{2 \times 19}{10 \times 9} = \frac{19}{45}$$

favourable : {(3,4),(3,5),.....(3,10)
(6,7), (6,8),....(6,10)
(9,10),
(1,4),(2,4)
(1,8),(2,8),(4,8),(5,8),(7,8)}

68. **Ans. (2)**

Determinant value of matrix

$= 1 - wc - aw + w^2ac = 0$

$\Rightarrow (1 - aw)(1 - wc) = 0$

$a = \frac{1}{w} = w^4 \Rightarrow$ b and c each have 4 and 4 options.

if $c = \frac{1}{w} = w^4$ and $a \neq w^4$

$\Rightarrow$ a have 3 and b have 4 options.

$\therefore$ Total matrices = $4 \times 4 + 3 \times 4 = 28$

69. **Ans. (3)**

Mean of $\omega_i = \ell$(mean of y_i) + k

$55 = \ell.48 + k$ ...(i)

standard deviation of

$\omega_i = \ell$(standard deviation of y_i)

$15 = \ell.12$ ...(ii)

$\ell = 1.25$ and $k = -5$

70. **Ans. (4)**

$np = 2$

$npq = 1 \quad \therefore p = q = \frac{1}{2}, n = 4$

$$P(x) = 1 - {}^4C_0\left(\frac{1}{2}\right)^4 - {}^4C_1\left(\frac{1}{2}\right)^4 = 1 - \frac{1}{16} - \frac{4}{16} = \frac{11}{16}$$

INTEGER

71.

$$= 12k.\frac{12^{11}}{k}\ C_{k-1}\,{}^{11}C_{k-1}$$

$$\sum_{K=1}^{n} 12.K\ {}^{12}C_K\,.\,{}^{11}C_{K-1} = 12^2\sum_{K=1}^{12}\left({}^{11}C_{K-1}\right)^2$$

$$= 12^2.\frac{22!}{11!\,11!}$$

$$= 12.\frac{21.19.17.....3}{11!}2^{12}.6 \Rightarrow p = 6$$

72.

$$\left[(n+1)n-(n-1)\right]n!$$

$$T_n = \left(n^2+1\right)\underline{|n} = n\underline{|n+1} - (n-1)\underline{|n}$$

$$\therefore S_n = n\underline{|n+1}$$

$$\frac{T_{10}}{S_{10}} = \frac{101\underline{|10}}{10\underline{|11}} = \frac{101}{110}. \quad \therefore b - a = 9$$

73.

$$\left(\frac{n(n+1)}{2}\right)^2 - \sum_{p=1}^{n}\frac{m(m+1)}{2} = 80$$

$$\frac{n^2(n+1)^2}{4} - \frac{n(n+1)(2n+1)}{12} - \frac{n(n+1)}{4} = 80$$

$$\Rightarrow \quad n = 4$$

74.

$${}^nC_{r-2} = 36,\ {}^nC_{r-1} = 84,\ {}^nC_r = 126$$

$$\frac{{}^nC_{r-1}}{{}^nC_{r-2}} = \frac{84}{36} \Rightarrow \frac{n-r+2}{r-1} = \frac{7}{3}$$

$$\Rightarrow 3n + 13 = 10r \quad ...(1)$$

$$\frac{{}^nC_r}{{}^nC_{r-1}} = \frac{126}{84} \Rightarrow \frac{n-r+1}{r} = \frac{3}{2}$$

$\Rightarrow 2n + 2 = 5r$ ....(2)

$\therefore n = 9,\ r = 4$

${}^nC_{2r} = {}^9C_8 = 9$

75.

$|z - 3 - 4i| = 4$

$||z| - 5| \le 4$

$|z| \le 9$