AVIRAL
JEE | NEET | FOUNDATIONS

FINAL TEST SERIES JEE MAIN -2020
TEST-01 ANSWER KEY
Test Date :08-12-2019

[PHYSICS]

1. $f = \mu \times 250 = 0.3 \times 250 = 75$ N

2. From given graphs :-

$$F_x = \frac{3}{4}x + 10,\ F_y = -\frac{4}{3}y + 20,\ F_z = \frac{4}{3}z - 16$$

$$W = \int \vec{F}\cdot \vec{dr} = \int_0^8 F_x\,dx + \int_5^{20} F_y\,dy + \int_{12}^{0} F_z\,dz$$

$W = 104 + 50 + 96 = 250$ J

3. $\frac{dr}{dt} = 0.1$ $\quad A = \pi r^2$

$$\frac{dA}{dt} = 2\pi r \cdot \frac{dr}{dt} = \frac{2\pi \times 5}{11} \times 0.1$$
$= 0.29\ cm^2/sec$

4. For equilibrium :- $\quad f \geq mg$

$\mu Kd \geq mg \qquad K \geq \frac{mg}{\mu d}$

Hence $\qquad K_{min} = \frac{mg}{\mu d}$

5.
$$a = \sqrt{a_c^2 + a_t^2} = \sqrt{\left(\frac{V^2}{r}\right)^2 + a_t^2}$$

$$a = \sqrt{\left(\frac{900}{450}\right)^2 + (2)^2} = 2.8\ m/s^2$$

6. $x = 3t^2 - 6t \qquad y = t^2 - 2t$

$v_x = \frac{dx}{dt} = 6t - 6 \qquad v_y = \frac{dy}{dt} = 2t - 2$

at t = 1 sec $\rightarrow$ $v_x = 0$ and $v_y = 0$

hence $\qquad v = \sqrt{v_x^2 + v_y^2} = 0$

7. $\vec{F_A} + \vec{F_B} + \vec{F_C} + \vec{F_D} + \vec{F_E} = (100 \times 3)\,\hat{i} = 300\,\hat{i}$ ---- (1)

$\vec{F_B} + \vec{F_C} + \vec{F_D} + \vec{F_E} = (100 \times 1)\left(-\hat{i}\right) = -100\,\hat{i}$ ---- (2)

$\vec{F_A} + \vec{F_C} + \vec{F_D} + \vec{F_E} = (100 \times 24)\,\hat{j} = 2400\,\hat{j}$ ---- (3)

From (1) & (2) $\Rightarrow \vec{F_A} = 400\,\hat{i}$

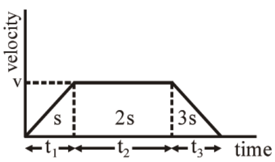
From (1) & (3) $\Rightarrow \vec{F_B} = 300\,\hat{i} - 2400\,\hat{j}$

So, when A & B pulling the cart then acceleration

$$\vec{a} = \frac{\vec{F_A} + \vec{F_B}}{m} = \frac{700\,\hat{i} - 2400\,\hat{j}}{100} = \left(7\,\hat{i} - 24\,\hat{j}\right) m/s^2$$

$|\vec{a}| = 25\ m/s^2$

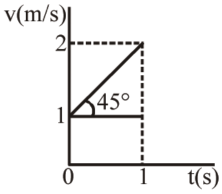
8.
$$v_{avg} = \frac{6s}{t_1 + t_2 + t_3}$$



$$v_{avg} = \frac{6s}{\frac{2s}{v} + \frac{2s}{v} + \frac{6s}{v}}$$

$$v_{avg} = \frac{6s \times v}{10s} \Rightarrow \frac{v_{avg}}{v} = \frac{3}{5}$$

9. $v_{avg} = \dfrac{\text{distance}}{\text{time}}$



$v_{avg} = \dfrac{\frac{1}{2}(1+2)\times 1}{1}$

$= \dfrac{3}{2} = 1.5 \text{ m/s}$

10. $3m(200 \cos 60°)\,\hat{i} = (m\times 100)\,\hat{j} + (m\times 100)\left(-\hat{j}\right) + m\vec{v}$

$\vec{v} = \left(300\,\hat{i}\right) \text{ m/s}$

300 m/s in the horizontal direction.

11. $R = 2a\cos\dfrac{\theta}{2}$ $\qquad 1 = 2 \times 1 \cos\dfrac{\theta}{2}$

$\theta = 120°$

$R^1 = 2a \sin\dfrac{\theta}{2} = 2 \times 1 \sin 60° = \sqrt{3}$

12. $v\cos 45° = 150 \cos 60° \Rightarrow v = 75\sqrt{2}$ m/s

$v_y = u_y + a_y t \Rightarrow v\sin 45° = 150 \sin 60° - g \times t$

$t = \dfrac{150\sin 60° - v\sin 45°}{10} = 7.5\left(\sqrt{3}-1\right)\text{sec}$

13. $W = \dfrac{mg\ell}{2n^2}$ where $n = \dfrac{200}{60} = \dfrac{10}{3}$

$W = \dfrac{4\times 10\times 2\times 9}{2\times 10\times 10} = 3.6 \text{ J}$

14. $(2\times 3)\,\hat{i} + (1\times 4)\left(-\hat{i}\right) = (2+1)\,\vec{v}$

$2\hat{i} = 3\vec{v}$

$\vec{v} = \dfrac{2}{3}\hat{i}$ m/s

15. $v = u + at \Rightarrow 1000 = 0 + a \times 10$

$a = 100 \text{ m/s}^2$

$m = \dfrac{F}{a} = \dfrac{10^5}{100} = 10^3 \text{ kg}$

16. **A**

17. $m_1 g = \mu m_2 g$ $\qquad m_1 \to$ mass of hanged part

$m_2 \to$ mass of remaining part

$\mu = \dfrac{m_1}{m_2} = \dfrac{\frac{M}{L}\times\ell}{\frac{M}{L}(L-\ell)} = \dfrac{\ell}{L-\ell}$

18. $\because F \propto V$

$\because P = V^2\dfrac{dm}{dt}$ $\qquad \boxed{\sqrt{P} \propto V}$

19. **C**

20. $W = \Delta K \Rightarrow O = \int_0^S \left(mg\sin\theta - \mu mg\cos\theta\right) dx$

$(mg \sin\theta)S = (mg\cos\theta)\dfrac{KS^2}{2}$

$S = \dfrac{2\tan\theta}{K}$

INTEGER

21. Number of significant figures are 3, because 10^3 is decimal multiplier.

22. $s \propto u^2$ *i.e.* if speed becomes three times then distance needed for stopping will be nine times.

23. $W = \vec{F}.\vec{s} = (6\hat{i} + 2\hat{j} - 3\hat{k}).(2\hat{i} - 3\hat{j} + x\hat{k}) = 0$

$12 - 6 - 3x = 0 \Rightarrow x = 2.$

24. Opposing force $F = u\left(\dfrac{dm}{dt}\right) = 2 \times 0.5 = 1\text{ N}$

So same amount of force is required to keep the belt moving at 2 *m/s*

25. If monkey move downward with acceleration *a* then its apparent weight decreases. In that condition Tension in string $= m(g-a)$

This should not be exceed over breaking strength of the rope *i.e*

$360 \geq m(g-a) \Rightarrow 360 \geq 60(10-a) \Rightarrow$

$a \geq 4\text{ m/s}^2$

[CHEMISTRY]

26. $E = \frac{hc}{\lambda}$

$\lambda = \frac{hc}{E}$

$\lambda = \frac{h}{p}$

$\frac{hc}{E} = \frac{h}{p}$

$p = \frac{E}{C}$

27. $(\bar{\nu}_1)_{He^+} = y = R_H\, 2^2\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$ .....(i)

$(\bar{\nu}_2)_{Li^{2+}} = R_H \times 3^2\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$ ......(ii)

(ii) $\div$ (i)

$(\bar{\nu}_2)_{Li^{2+}} = y \times \frac{9}{4}$

28. In a single e^- system energy of an orbital depends only upon value of n.

29. $(COOH)_2.2H_2O \longrightarrow 2C + 6O + 6H$

0.3 mol

1 mol $(COOH).2H_2O \equiv 6$ mol O

0.3 mol $(COOH).2H_2O \equiv 0.3 \times 6$ mol O

$\equiv 1.8$ mol O

30. $n\lambda = 2\pi r$

$\lambda = \frac{2\pi r}{n} = \frac{2 \times 3.14 \times 0.529 \times 10^{-8}\,cm \times 4}{2}$

31. $\frac{M \times 5}{100} = 32$

$M = 640$

32. $(I.E.)_H \doteq -(E_1)_H = x$

$E \propto Z^2$

$\Delta E = E_5 - E_2$

33. $PH_3(g) \rightarrow P(s) + \frac{3}{2} H_2(g)$

100 mL	0 mL
0 mL	150 mL

$\Delta V = 150 - 100 = 50$ mL

34. $V \propto \frac{Z}{n}$

35. $X_{O_2} = \frac{n_{O_2}}{n_{O_2} + n_{O_3}} = 0.25$

$X_{O_3} = \frac{n_{O_3}}{n_{O_2} + n_{O_2}} = 0.75$

$\% \frac{w}{w}$ of $O_2 = \frac{\text{wt of } O_2}{\text{wt of } O_2 + \text{wt of } O_3} \times 100\%$

$\frac{w_{O_2}}{w_{O_2} + w_{O_3}} \times 100 = \frac{32}{32+144} \times 100 = \frac{32}{176} \times 100 = 18.18$

36. Gram equivalents of acid = Gram equivalent of base

$\frac{17}{E_w} = .1 \times 1$

$E_w = 170$

$M_w = 2 \times 170 = 340$

37. $\Delta x = \frac{h}{4\pi \times m \times \Delta v}$

$= \frac{6.62 \times 10^{-34} \times 100}{4 \times 3.14 \times 9.1 \times 10^{-34} \times 600 \times 0.005} = 1.92 \times 10^{-3}$m

38. Nuclei containing same number of neutrons are isotones.

39. **A**

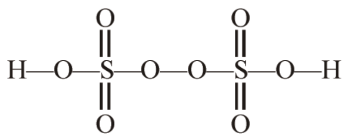
40. **D**

41. **D**

42. **B**

43. Inert gases have highest 'IE' in respective period due to full filled configuration.

44.

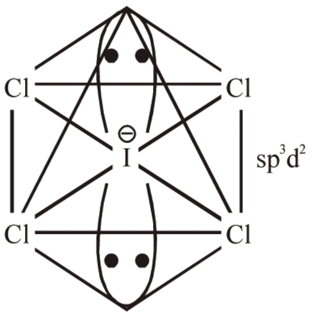


45. **D**

INTEGER

46. Maximum value of $m_l = +3$
Value of $l = 3$
Value of $n = 4$

47.



48. $Cu^{2+} + 2I^- \rightarrow CuI_2 \quad 2CuI_2 \rightarrow Cu_2I_2 + I_2$

$I_2 + 2Na2S_2O_3 \rightarrow 2NaI + Na_2S_4O_6$

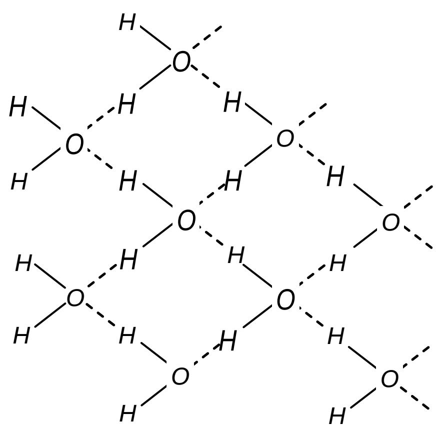
$Cu^{2+} \equiv 2Na_2S_2O_3$

49. $\bar{\nu} = \frac{1}{\lambda} = R_H\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$

$= \frac{1}{\lambda} = R_H\left[\frac{1}{3^2} - \frac{1}{n_2^2}\right] = n_2 = 3$

for Paschen series.

50. In ice each water molecule forms four hydrogen bond through which each water molecule is tetrahedrally attached with other water molecule.



[MATHEMATICS]

51 **B**
52 **B**
53 **B**
54 **C**
55 **C**
56 **D**

57. **Ans. (3)**
$\because$ a = 0 and y = bx² + cx + d is symmetric about $x = -\frac{c}{2b}$

$\therefore x = k = -\frac{c}{2b} \Rightarrow k + \frac{c}{2b} = 0$

$\Rightarrow a + \frac{c}{2b} + k = 0$

58. **Ans.(2)**

$\log_2\left(1+\sqrt{6x-x^2-8}\right) \ge 0$

$\Rightarrow 1+\sqrt{6x-x^2-8} \ge 1 \Rightarrow 6x-x^2-8 \ge 0$

$\Rightarrow x^2-6x+8 \le 0$

$\Rightarrow (x-2)(x-4) \le 0$

$\Rightarrow 2 \le x \le 4$.

Now $f'(x) = x^2 + 2x + 2 > 0 \ \forall \ x \in R$

$\Rightarrow$ f(x) is strictly increasing in [2, 4]

$f(x) = \frac{x^3}{3} + x^2 + 2x$

$a = f(2) = \frac{8}{3} + 4 + 4 = \frac{32}{3}$

$b = f(4) = \frac{64}{3} + 16 + 8 = \frac{136}{3}$

$a + b = 56$

59. **Ans. (4)**
Reflexive, symmetric but not transitive.

60. Ans. (1)

$$\frac{1}{2}+\frac{1}{2\sin\frac{x}{2}}2\sin\frac{x}{2}\left(\cos x+\cos 2x+\cos 3x+\cos 4x\right)=0$$

$$=\frac{1}{2}+\frac{1}{2\sin\frac{x}{2}}\left(\sin\frac{9x}{2}-\sin\frac{x}{2}\right)=0$$

$$=\frac{\sin\left(\frac{9x}{2}\right)}{\sin\left(\frac{x}{2}\right)}=0\Rightarrow x=\frac{2n\pi}{9},n\neq 9m\ m\in I$$

61. Ans. (3)

$$\cot x=\frac{1}{2}\left(\cot\frac{x}{2}-\tan\frac{x}{2}\right)$$

$$\cot x=\frac{1}{2}\left\{\frac{1}{2}\left(\cot\frac{x}{4}-\tan\frac{x}{4}\right)-\tan\frac{x}{2}\right\}$$

$$=\frac{1}{4}\cot\frac{x}{4}-\frac{1}{4}\tan\frac{x}{4}-\frac{1}{2}\tan\frac{x}{2}$$

$$=\frac{1}{8}\left(\cot\frac{x}{8}-\tan\frac{x}{8}\right)-\frac{1}{4}\tan\frac{x}{4}-\frac{1}{2}\tan\frac{x}{2}$$

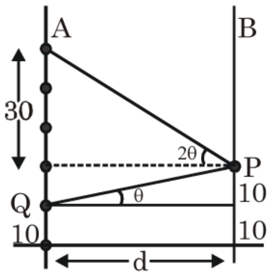
62. Ans. (2)

$$\Delta=\frac{1}{2}ah_1=\frac{1}{2}bh_2=\frac{1}{2}ch_3$$

$$h_1=\frac{2\Delta}{a}\ \text{and}\ h_2=\frac{2\Delta}{b}\ \text{and}\ h_3=\frac{2\Delta}{c}$$

$$\frac{1}{h_1}+\frac{1}{h_2}-\frac{1}{h_3}=\frac{1}{2\Delta}(a+b-c)=\frac{2\sqrt{7}}{15}$$

63. Ans. (1)



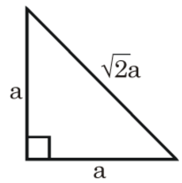
$d = 10\cot\theta;\ d = 30\cot 2\theta$

$10\cot\theta = 3\cot 2\theta$

$\Rightarrow \theta = 30^o$

64. Ans. (1)

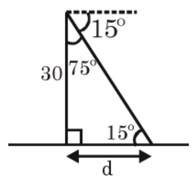
$$r=\frac{\frac{1}{2}.a^2}{a+\frac{a}{\sqrt{2}}}\Rightarrow 1=\frac{a}{2+\sqrt{2}}$$



$$\Delta=\frac{1}{2}a^2=\frac{1}{2}.\left(4+2+4\sqrt{2}\right)$$

$$=3+2\sqrt{2}$$

65. Ans. (3)



$$\tan 15^\circ=\frac{30}{d}$$

$$d=\frac{30}{2-\sqrt{3}}=\frac{30.\left(\sqrt{3}+1\right)}{\left(\sqrt{3}-1\right)}$$

66. Ans. (1)

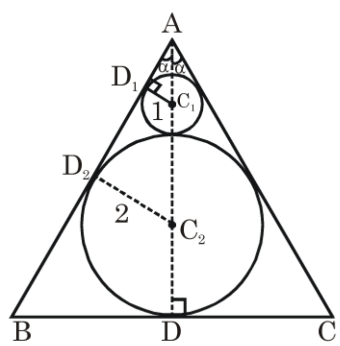
$$\sin\alpha=\frac{1}{3}$$

$\therefore AC_1 = 3$

$AC_2 = 6$

$AD = 8$

$\therefore\ BD = 2\sqrt{2}$



$$\text{Area}=\frac{1}{2}.4\sqrt{2}.8=16\sqrt{2}$$

67. Ans. (3)

$y = mx + 1$ is tangent to ellipse

$x^2 + 4y^2 = 1$ in Ist quadrant $\therefore$ $m < 0$

$\therefore\ 1 = m^2 + \frac{1}{4}$

$m = \frac{\sqrt{3}}{2}$ or $-\frac{\sqrt{3}}{2}$

(reject)

68. Ans. (2)

$a R b \Leftrightarrow a = 2^k.a$ it is true for $k = 0$

$\therefore$ reflexive

$(2,1) \in R$ but $(1,2) \notin R \Rightarrow$ it is not symmetric

if $a = 2^{k_1} b$ and $b = 2^{k_2} c$, then $a = 2^{k_1+k_2} c$

$\Rightarrow$ it is transistive.

69. Ans. (2)

LHS : $\dfrac{\cos\frac{x}{3}}{\sin\frac{2x}{3}\cos\frac{x}{3}} = \text{cosec}\frac{2x}{3} \Rightarrow k = 2$

$\tan^{-1}(\tan 2) = 2 - \pi$.

70. Ans. (3)

Given $2b = a + c \Rightarrow \frac{2b}{a} = 1 + \frac{c}{a}$ ...(i)

$\alpha + \beta = -\frac{b}{a} = 15 \Rightarrow \frac{b}{a} = -15 \Rightarrow \frac{c}{a} = -31$

$\alpha\beta = -31$.

INTEGER

71. 5

$f(x) = 2 + \dfrac{3}{x^4 - 7x^2 - 4x + 23}$

Let $h(x) = x^4 - 7x^2 - 4x + 23$

$= (x^2 - 4)^2 + (x - 2)^2 + 3$

$h(x) \geq 3$

Range of $h(x)$ is $[3, \infty)$

$\Rightarrow$ Range of $f(x)$ is $(2, 3]$

72. 4

73. 0

$x^2 - \sqrt{2}x + 1 = 0$

$\therefore\ \alpha = \frac{1}{\sqrt{2}} + i\frac{1}{\sqrt{2}}, \beta = \frac{1}{\sqrt{2}} - i\frac{1}{\sqrt{2}}$

$= e^{i\pi/4}$ $\quad$ $= e^{-i\pi/4}$

$\alpha^{50} + \beta^{50} = e^{i25\pi/2} + e^{-i25\pi/2} = i + (-i) = 0$

74. 5 Do your self

75. 4