Sri Chaitanya IIT Academy, India

A.P, TELANGANA, KARNATAKA, TAMILNADU, MAHARASHTRA, DELHI, RANCHI

A right Choice for the Real Aspirant

ICON CENTRAL OFFICE, MADHAPUR-HYD

Sec: Sr. IPLCO **Date: 05-09-15**

Time: 9:00 AM to 12:00 Noon **RPTM-5** **Max.Marks: 360**

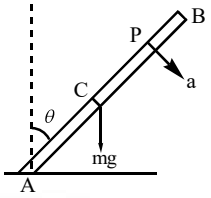
KEY SHEET

PHYSICS		MATHS		CHEMISTRY	
Q.NO	ANSWER	Q.NO	ANSWER	Q.NO	ANSWER
1	2	31	3	61	4
2	1	32	1	62	2
3	1	33	4	63	1
4	2	34	3	64	4
5	3	35	3	65	4
6	2	36	1	66	4
7	1	37	4	67	2
8	1	38	1	68	4
9	3	39	1	69	3
10	1	40	3	70	2
11	2	41	2	71	3
12	3	42	1	72	4
13	2	43	4	73	1
14	2	44	1	74	2
15	2	45	4	75	3
16	2	46	4	76	3
17	4	47	2	77	3
18	1	48	3	78	3
19	3	49	3	79	4
20	3	50	1	80	4
21	2	51	4	81	4
22	3	52	4	82	4
23	3	53	1	83	3
24	4	54	3	84	3
25	2	55	2	85	2
26	2	56	3	86	2
27	1	57	1	87	2
28	4	58	3	88	2
29	2	59	2	89	4
30	1	60	2	90	2

PHYSICS

1. Conceptual
2. Taking torque about A. when the rod has fallen through an angle θ

$$\tau = mg\frac{l}{2}\sin\theta = I\alpha = \left(\frac{1}{3}ml^2\right)\alpha$$



Or $\alpha = \frac{3g}{2l}\sin\theta$

For any point P on the rod , at a distance r from A, the liner acceleration is $a = r\alpha = \frac{3gr}{2l}\sin\theta$. P will also have centripetal acceleration.

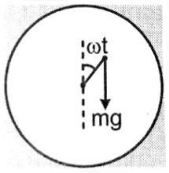
3.

$$\vec{\tau}_o = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 3 & 6 \\ 2 & -4 & 1 \end{vmatrix}$$

$$= 27\hat{i} + 10\hat{j} - 14\hat{k}$$

4.

Opposing couple is $-mgR\sin\omega t$



5.

$$F\left(\frac{a+b}{2}\right) = 2F\left(\frac{b-a}{2}\right)$$

$$\therefore \frac{a}{b} = \frac{1}{3}$$

6.

Time at which centre of mass is at highest point is

$$= \frac{u}{g} = \frac{10}{10} = 2\,\text{sec}$$

Rotation of the rod

$$= \omega t = \frac{\pi}{2} \Rightarrow a_A = \omega^2 R\hat{j} - g\hat{j}$$

7.

$$3\hat{i}+8\hat{j}=\vec{V}_{CM}+\frac{4}{\sqrt{3}}\left(\frac{\hat{i}}{2}+\frac{\sqrt{3}\hat{j}}{2}\right)$$

$$\vec{V}_A=\vec{V}_{CM}+\frac{4}{\sqrt{3}}\left(\frac{\hat{i}}{2}-\frac{\sqrt{3}\hat{j}}{2}\right)$$

$$\Rightarrow\vec{V}_A=3\hat{i}+4\hat{j}$$

$$\therefore V_A=5\ m/s$$

8. $\frac{1}{2}(1+1)mv^2+\frac{1}{2}m(2v)^2+\frac{1}{2}m(v\sqrt{2})^2+\frac{1}{2}m(v\sqrt{2})^2=5mv^2$

9. Conceptual

10.

$$k=(1+2/3)\times\frac{1}{2}MV^2+\frac{1}{2}(2M)V^2$$

$$=\frac{11}{6}MV^2$$

11. $$f_{\max}=\frac{kx_{\max}}{1+\frac{mR^2}{I}}=10N$$

12.

Let P = external force F = force of friction between A and B.

$P-F=ma_1$ and $P=ma_2$. $\therefore a_2>a_1$.

Let α = angular acceleration between A and B. For one rotation,

$\theta=2\pi=\frac{1}{2}\alpha T^2$ or

$T=(4\pi/\alpha)^{1/2}$ = time of travel from A to B.

Angular velocity at $B=\omega_B=\alpha T$.

For one rotation to the right to B,

$\theta=2\pi=\omega_B t$ or $t=\frac{2\pi}{\alpha T}=\frac{\frac{1}{2}T^2}{T}=\frac{T}{2}$

13. Conceptual

14.

$$Mg.R=\frac{MR^2}{2}\alpha\Rightarrow\alpha=\frac{2g}{R}=\frac{w}{t}$$

$$v=2RW\Rightarrow 4gt=\frac{ds}{dt}$$

$$\int_0^s ds=\int_0^{WR/2g}4gt\,dt\Rightarrow s=\frac{R^2W^2}{2g}$$

15

$$T + f = mg\sin\theta$$
$$T \cdot R = f \cdot R \Rightarrow T = f$$
$$\therefore f = \frac{mg\sin\theta}{2} = T$$

16. Conceptual

17.

$$U_1 = MgR$$
$$U_2 = \frac{M}{4}g\left(\frac{R}{2}\right)$$

18.

$$mg\frac{L}{2} = \frac{mL^2}{3}\alpha$$
$$\Rightarrow \alpha = \frac{3g}{2L}$$

19. Conceptual

20.

$$Mgx = \left(\frac{Ma^2 \times 4}{12 \times 4} + \frac{Ma^2}{48} + \frac{3Ma^2}{16 \times 3} + \frac{Mx^2 \times 48}{48}\right)\alpha$$
$$\Rightarrow \alpha = \frac{48gx}{8a^2 + 48x^2}\alpha\frac{x}{a^2 + 6x^2}$$
$$\frac{d\alpha}{dx} = 0 \Rightarrow x = \frac{a}{\sqrt{6}}$$

21.

$$|\tau_A| = |\tau_B| = (F\sin\theta)\frac{L}{2} = I\alpha$$
$$\therefore \alpha \propto \frac{1}{I}$$

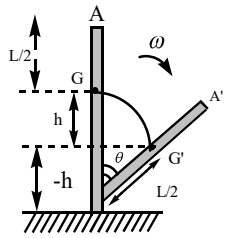
22. The distance of mass is the nearest to axis xx, hence moment of inertia is least about xx-axis.

23.

$$\frac{2}{3}ML^2\omega^2 = \frac{3}{2}MgL \qquad \therefore \qquad \omega = \frac{3}{2}\sqrt{\frac{g}{L}}$$

24. Conceptual

25.



$$Mg\frac{L}{2}(1-\cos\theta)=\frac{ML^2}{6}\omega^2$$

$$\therefore \qquad \omega=\sqrt{6g/L}\sin\left(\frac{\theta}{2}\right)$$

26.

$$2\pi=\frac{1}{2}\times\frac{\pi}{4}\times t^2$$

$$\therefore t=4$$

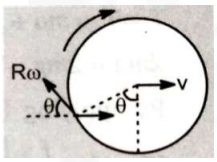
27.

$$\frac{I_1}{I_2}=\frac{1}{8}=\frac{mR^2}{m_2(nR)^2}=\frac{mR^2}{mn(nR)^2}$$

$$or \qquad \frac{1}{8}=\frac{1}{n^3} \qquad or \qquad n=2$$

28. Torque is always perpendicular to $\vec{F}$ as well as $\vec{r}\ \therefore \vec{r}.\vec{\tau}=0$ as well as $\vec{F}.\vec{\tau}=0$

29.



$$\upsilon=R\omega\cos\theta$$

$$\cos\theta=\frac{\upsilon}{R\omega}$$

$$h=R-R\cos\theta$$

30.

$$V_P=2V\cos\frac{\theta}{2}$$

$$K_{ABC}=\int\frac{1}{2}\lambda R d\theta\, V_P^2$$

$$=\int_{-\pi/2}^{\pi/2}2\lambda V^2R\cos^2\frac{\theta}{2}d\theta$$

$$=MV^2\left(\frac{\pi+2}{2\pi}\right)$$