JEE EXPERT

ANSWER KEY

JEE Advanced

MODULE TEST (MT - 01)

Batch : 12^{TH} Pass (Desire - A01 & A02)

Date 15.09.2019

PHYSICS

1	(C)	2	(D)	3	(C)	4	(A)	5	(D)
6	(A)	7	(C)	8	(A)				
9	(BCD)	10	(ABCD)	11	(BD)	12	(AD)		
13	(0004)	14	(0007)	15	(0004)	16	(0003)		
17	(0002)	18	(0005)						

CHEMISTRY

19	(C)	20	(B)	21	(B)	22	(C)	23	(B)
24	(D)	25	(B)	26	(D)				
27	(ABC)	28	(BC)	29	(ABCD)	30	(GRACE)		
31	(0004)	32	(0125)	33	(0007 / 0008)	34	(0006)		
35	(0001)	36	(0007)						

MATHEMATICS

37	(B)	38	(D)	39	(B)	40	(B)	41	(C)
42	(A)	43	(A)	44	(D)				
45	(AD)	46	(BC)	47	(ABC)	48	(A)		
49	(0008)	50	(0004)	51	(0)	52	(0006)		
53	(0001)	54	(0008)						

JEE EXPERT

SOLUTIONS

JEE Advanced

MODULE TEST (MT - 01)

Batch : 12^{TH} Pass (Desire - A01 & A02)

Date 15.09.2019

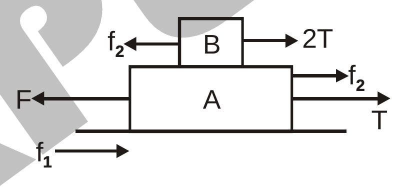
PART - 1 [PHYSICS]

1. Sol. (C)

Rate of charge of spring energy $= \dfrac{d}{dt}\left(\dfrac{kx^2}{2}\right) = \dfrac{2kx}{2}\dfrac{dx}{dt} = kx\dfrac{dx}{dt} = (200)\left(\dfrac{1}{10}\right)(4+6) = 200\ J/s$

2. Sol. (D)

f_1 and f_2 are maximum static frictions.



$2T = f_2 = 10N$

$T = 5N$

$F = f_1 + f_2 + T$

3. Sol. (C)

$ma + mg - T = ma$

$\Rightarrow \quad T = mg$

4. Sol. (A)

Let d be distance between walls and u be horizontal component of velocity.

Time from A to E

$t_1 = d/u$

t_2(From E to F)

$t_2 = \dfrac{d}{eu}$

t_3 (From F to D)

$t_3 = \dfrac{d}{e^2u}$

t_4 (From D to A)

$t_4 = \dfrac{d}{e^3u}$

$t_4 = t_1 + t_2 + t_3$

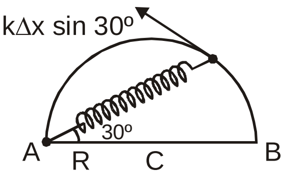
$\Rightarrow \quad e^3 + e + e = 1$

Since the vertical component of velocity during impact remain unchanged.

5. Sol. (D)

$$\Delta x = \sqrt{3}R - \frac{R}{\sqrt{3}} = \frac{2R}{\sqrt{3}}$$

$k\Delta x \sin 30^o = ma$



$$\frac{k2R}{\sqrt{3}} \times \frac{1}{2} = ma$$

$$a = \frac{kR}{\sqrt{3}\,m}$$

6. Sol. (A) $10hr = \dfrac{500}{v\cos 53^o}$

$v \sin 53^o = V_w$

7. Sol. (C)

Net momentum (at $t = 3t_0$) = $(3m)\, g\, (3t_0)\, \hat{j}$

$$m(V_1\hat{i} + V_2\hat{j}) + 2m(x\hat{i} + y\hat{j}) = (9mg\,t_0)\,\hat{j}$$

$x\hat{i} + y\hat{j}$ = Velocity of heavier block at $t = 3t_0$

$$x = -\frac{V_1}{2}$$

$$y = \frac{9gt_0 - V_2}{2}$$

$$x\hat{i} + y\hat{j} = \left(-\frac{V_1}{2}\right)\hat{i} + \left(\frac{9}{2}gt_0 - \frac{V_2}{2}\right)\hat{j}$$

Velocity at $t = t_0$ = $-\dfrac{V_1}{2}\hat{i} + \left(\dfrac{9}{2}gt_0 - \dfrac{V_2}{2}\right)\hat{j} - (2gt_0)\hat{j}$

8. Sol. (A)

F.B.D of M

Tension on the ring is horizontal vertical Mg is balanced by friction.

N = T and μmg downward.

MULTI CORRECT

9. **Sol. (BCD)**

(B) T = mg

N = T + 4mg = 5mg

(C) Constraint

(D) Block A obtains accleration a rightwards

N (on B by A) = ma

10. **Sol. (ABCD)**

$\vec{v}_A = 4\hat{i} + 4\hat{k}$ $\qquad \vec{a}_A = -g\hat{k}$

$\vec{v}_B = 3\hat{j} + 4\hat{k}$ $\qquad \vec{a}_B = -g\hat{k}$

$\vec{v}_A - \vec{v}_B = 4\hat{i} - 3\hat{j}$ $\qquad \vec{a}_{AB} = 0$

$|\vec{v}_{AB}| = 5\,m/s$

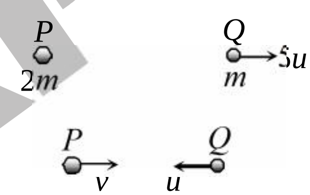
Time of flight $t_A = \frac{2\times 4}{g} = \frac{8}{g},\ t_B = \frac{2\times 4}{g} = \frac{8}{g}$

Separation when they hit the ground $= 5\times\frac{8}{g} = 4m$

11. **Sol. (BD)**

5mu = 2mv – mu

v = 3u



$\frac{1}{2}m(5u)^2 + W = \frac{1}{2}mu^2 + \frac{1}{2}\times 2m(3u)^2$

W = – 3mu^2

12. **Sol. (AD)**

Initial speed of COM = $\frac{m_1v_1 + m_2v_2}{m_1 + m_2} = \frac{v_0}{2}$

Acceleration of COM = $\frac{\text{Net force}}{\text{Total mass}} = 9\downarrow$

In COM frame, psudo force on both particles = mg$\uparrow$
psudo cancels gravity force.

Constant velocity of both particles in COM force = $\frac{v_0}{2}$(up & down)

KE when COM stops or at highest point = $2\left(\frac{1}{2}\frac{mv_0^2}{4}\right)$

Integer Type

13. Sol. (0004)

$m_0 \downarrow v_0$ $\qquad\qquad$ $m_0 \downarrow v_0$

$3m_0 \downarrow v_0$ $\qquad\qquad$ $3m_0 \uparrow v_0$

Velocity of $3m_0$ is inverted to $3v_0$ upwards after it hits the ground. Now find the velocity of m.

$$v_1 = \left(\frac{m_1 - m_2}{m_1 + m_2}\right)u_1 + \left(\frac{2m_2}{m_1 + m_2}\right)u_2 = \left(\frac{-2m_0}{4m_0}\right)(-v_0) + \left(\frac{6m_0}{4m_0}\right)v_0 = \frac{v_0}{2} + \frac{3}{2}v_0 = 2v_0$$

$h' = 4h$

14. Sol. (0007)

15. Sol.(0004)

Spring force in spring 2 before cutting = 2 mg

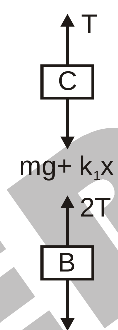
Spring froce in spring 1 before cutting = mg

just after cutting the string spring forces do not change.

For A : $k_2x - 2mg = 2ma_A \Rightarrow a_A = 0$

For B : $k_2x + 2mg = 4mg = 2ma_B \Rightarrow a_B = 2g$

For C : $k_1x + mg = 2mg = ma_C \Rightarrow a_C = 2g$

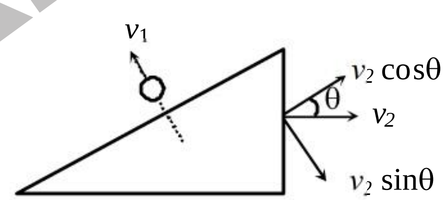


16. Sol. (0003)

$\theta = \sin\theta = \tan\theta = \dfrac{1}{200}$

Power P = (mg sin θ + Total track resistance) v

17. Sol. (0002) Equation of Newtons collision law



After collision

$$\frac{v_1 + v_2\sin\theta}{v_0}, \qquad e = \frac{v_1 + \frac{v_2}{2}}{v_0}$$

$2v_1 + v_2 = 7$ … (i)

From momentum conservation (in horizontal direction)

$mv \sin 30 = -mv_1 \sin 30 + mv_2$

$5 = \dfrac{v_1}{2} + 2v_2$ … (ii)

Solving $v_1 = 2$ m/s

18. Sol. (0005)

Normal reaction between wedge and block = $\dfrac{mg}{\sqrt{2}}$,

Normal reaction between wedge and ground $= \left(\dfrac{mg}{\sqrt{2}}\right)\dfrac{1}{\sqrt{2}} + 2mg = \dfrac{5mg}{2}$; $\qquad \mu\left(\dfrac{5mg}{2}\right) = \left(\dfrac{mg}{\sqrt{2}}\right)\dfrac{1}{\sqrt{2}}$