第七章：功与能（2003年 - 2017年）

① $W = \frac{1}{2}m(2v)^2 - \frac{1}{2}mv^2$

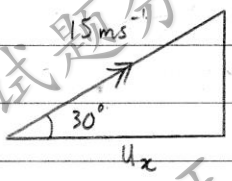
$= 2mv^2 - \frac{1}{2}mv^2$

$= \frac{3}{2}mv^2$

$= 3\left(\frac{1}{2}mv^2\right)$

$= 3E_k$ #

B

② 

$u_y = 15\sin 30$

$= 7.5\,ms^{-1}$

竖直方向

$u = 7.5\,ms^{-1}$ $\quad v^2 = u^2 + 2as$

$s = ?$ $\quad 0^2 = 7.5^2 + 2\times -9.8\,s$

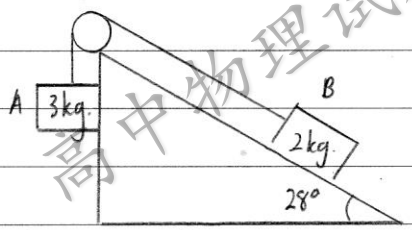
$v = 0$ $\quad s = 2.87m$

$a = -9.8$

∴ 离水面的最大高度 $= 2.87m + 1.5m$

$= 4.37m$

B

③ 

$m_A g h_1 = m_B g h_2 + \frac{1}{2}(m_A + m_B)v^2$

$\frac{1}{2}(m_A + m_B)v^2 = m_A g h_1 - m_B g h_2$

$= 3\times 9.8\times 0.35 - 2\times 9.8(0.35\sin 28)$

$= 7.07\,J$ #

A

④ $m_2 gh = m_1 g\left(\frac{h}{2}\right) + \frac{1}{2}m_1\left(\frac{v}{2}\right)^2 + \frac{1}{2}m_2 v^2$

$m_2 gh = \frac{1}{2}m_1 gh + \frac{1}{8}m_1 v^2 + \frac{1}{2}m_2 v^2$

$8m_2 gh = 4m_1 gh + m_1 v^2 + 4m_2 v^2$

$8m_2 gh - 4m_1 gh = v^2(m_1 + 4m_2)$

$4gh(2m_2 - m_1) = v^2(m_1 + 4m_2)$

$v = \sqrt{\frac{4gh(2m_2 - m_1)}{m_1 + 4m_2}}$ #

D

⑤ $mgh + \frac{1}{2}mu^2 = \frac{1}{2}mv^2$

$gh + \frac{1}{2}(\sqrt{gr})^2 = \frac{1}{2}v^2$

$gh + \frac{1}{2}gr = \frac{1}{2}v^2$

$16\times 9.8 + \frac{1}{2}\times 9.8\times 8 = \frac{1}{2}v^2$

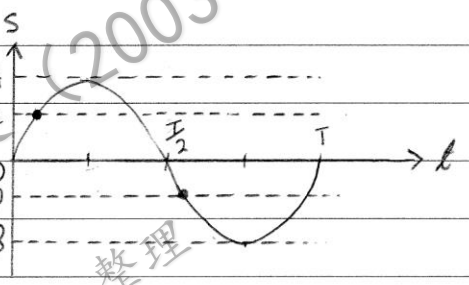
$v = 19.8\,ms^{-1}$

$R = \frac{mv^2}{r} + mg\cos\theta$; $\theta = 0$

$= \frac{220\times 19.8^2}{8} + 220\times 9.8\cos 0$

$= 12937N$ #

B

⑥ 

质量 m 从 C 点到 D 点的距离为 2h.

$W = Fs$

$= mg(2h)$

$= 2mgh$

B

⑦ $E_{gp} = mgh$

$= mgL$

$= g\int_0^{\frac{L}{4}} mL\,dL$

$= g\left[\frac{mL^2}{2}\right]_0^{\frac{L}{4}}$

$= g\left[\frac{mL}{32} - 0\right]$

⑧ $E = W$

$E = Fs$.

$480 = F(0.15)$

$F = 3200N$ #

C

⑨ $P = \frac{W}{t}$

$= \frac{mgh}{t}$

$= \frac{25 \times 10}{5}$

$= 50W$

D

⑩ $E_k = \frac{1}{2}mv^2$

$E_k = \frac{1}{2}m(u^2 + 2ah)$.

$E_k = \frac{1}{2}mu^2 + mah$.

$E_k = mah + E_{ko}$ #

$Y = mX + C$

A.

⑪ $E_k = \frac{1}{2}mv^2$

$= \frac{1}{2}m(u+at)^2$

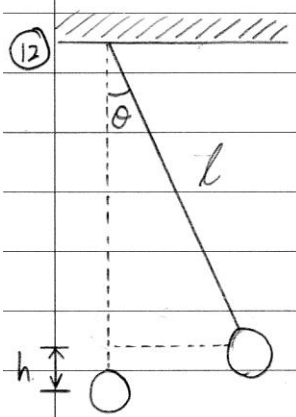
$= \frac{1}{2}m(u^2 + 2uat + a^2t^2)$

$= \frac{1}{2}mu^2 + muat + \frac{1}{2}ma^2t^2$; $u = 0$

$= \frac{1}{2}ma^2t^2$ #

B

⑫



水平力做的功最后将转换成小球的重力势能.

$W = mgh$

$= mg(l - l\cos\theta)$

$= mgl(1 - \cos\theta)$ #

A.

⑬

⑭ B

⑮ $\frac{1}{2}mu^2 + mgh_1 = \frac{1}{2}mv^2 + mgh_2$

$\frac{1}{2} \times 2^2 + 10 \times 5 = \frac{1}{2}v^2 + 10 \times 2$

$v = 8 ms^{-1}$

C.

⑯ $mgh = \frac{1}{2}mv^2 + E_{内}$

$mgh = \frac{1}{2}m(u^2 + 2as) + E_{内}$.

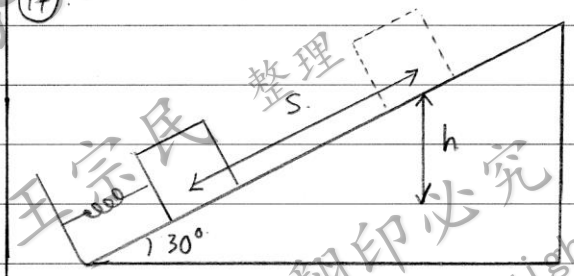
$mgh = \frac{1}{2}mu^2 + mas + E_{内}$; $u = 0$, $s =$

$mgh = mah + E_{内}$

动能

A

⑰



$\frac{1}{2}kx^2 = mgh$

$\frac{1}{2}kx^2 = mgL\sin\theta$

$\frac{1}{2} \times 2500 \times 0.2^2 = 2 \times 9.8 \times L \sin 30$

$L = 5.1m$ #.

D.

⑱ $mgh = Fs$

$0.5 \times 10 \times (12 + 0.2) = F \times 0.2$

$F = 305N$ #

B

NO.: Date:

作答题

① (i) 使小球作水平匀速圆周运动的向心力不做功，位能及动能勻保持不变，故小球在水平匀速圆周运动中机械能守恒。

(ii) 木块在下滑过程中作匀速运动，是因木块克服阻力做功，消耗了机械能，故机械能不守恒。

② (i) $P = FV$

$P = F_{阻} V$

$F_{阻} = \frac{P}{V}$

$= \frac{60000}{12}$

$= 5000N$ #

(ii) $P = FV$

$60000 = F \times 10$

$F = 6000N$

$F_{合} = ma$

$F - F_{阻} = ma$

$6000 - 5000 = 5000a$

$a = 0.2 ms^{-2}$ #

(iii) $F_{合} = ma$

$F - F_{阻} = ma$

$F - 5000 = 5000(1)$

$F = 10000N$

$P = FV$

$60000 = 10000V$

$V = 6 ms^{-1}$

$u = 0$ $v = u + at$

$a = 1$ $6 = 0 + t$

$v = 6$ $t = 6s$ #

$t = ?$

③ (a) (i) $2N$ #

(ii) $5N$ #

(iii) $F_{合} = ma$

$F - F_{阻} = ma$

$10 - 5 = 2a$

$a = 2.5 ms^{-2}$ #

(iv) $Ft = mv - mu$; $u = 0$

$Ft = mv$

$\frac{1}{2} \times 5 \times 5 = 2V$

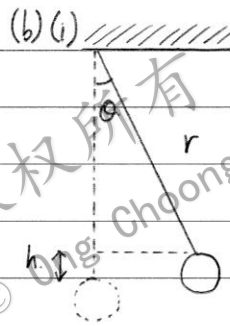
$V = 6.25 ms^{-1}$ #

(v) $\frac{1}{2}mv^2 = Fs$

$\frac{1}{2} \times 2 \times 6.25^2 = 5s$

$S = 7.81m$ #

(b) (i)



$E = mgh$

$= mg(r - r\cos\theta)$

$= mgr(1 - \cos\theta)$ #

(ii) 势能, $E_{gp} = mgr(1 - \cos\phi)$ #

$E_{total} = E_{gp} + E_k$

$mgr(1 - \cos\theta) = mgr(1 - \cos\phi) + E_k$

$E_k = mgr(1-\cos\theta) - mgr(1-\cos\phi)$

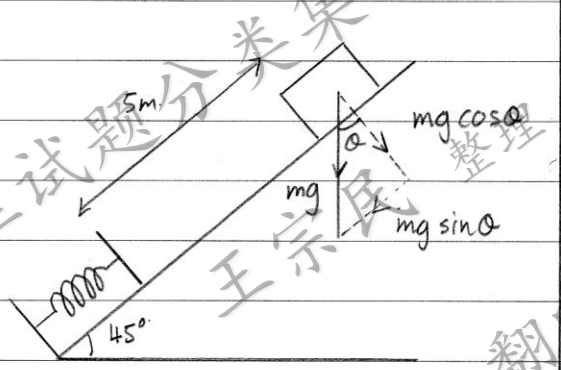
$= mgr(1-\cos\theta - 1 + \cos\phi)$

$= mgr(\cos\phi - \cos\theta)$ #

$\frac{1}{2}mv^2 = mgr(\cos\phi - \cos\theta)$

$v = \pm\sqrt{2gr(\cos\phi - \cos\theta)}$ #

④



(i) $mgh = \frac{1}{2}mv^2 + F_s$

$mgL\sin\theta = \frac{1}{2}mv^2 + mg\cos\theta(\mu s)$

$10\times9.8\times5\sin45 = \frac{1}{2}\times10v^2 + 10\times9.8\cos45\times0.5\times5$

$v = 5.88\ ms^{-1}$ #

(ii) $\frac{1}{2}mv^2 + mgh = \frac{1}{2}kx^2 + Fs$

$\frac{1}{2}mv^2 + mgx\sin\theta = \frac{1}{2}kx^2 + mg\cos\theta(\mu x)$

$\frac{1}{2}\times10\times5.88^2 + 10\times9.8\times0.2\sin45° = \frac{1}{2}k(0.2)^2 + 10\times9.8\cos45\times0.5\times0.2$

$k = 8990\ Nm^{-1}$ #

(iii) $\frac{1}{2}kx^2 = mgh + Fs$

$\frac{1}{2}kx^2 = mgL\sin\theta + mg\cos\theta(\mu L)$

$\frac{1}{2}\times8990\times0.2^2 = 10\times9.8\times L\sin45 + 10\times9.8\times\cos45\times0.5L$

$L = 1.73\ m$

∴ 木块被弹簧推上斜面的距离

$= 1.73m - 0.2m$

$= 1.53\ m$ #

⑤ (i) $E = mgh$

$= (250+75)\times9.8\times20$

$= 63.7\ kJ$ #

(ii) $E = \frac{1}{2}mv^2$

$63700 = \frac{1}{2}(250+75)v^2$

$v = 19.8\ ms^{-1}$ #

(iii) 过山车及乘客在A, B及C三个点的总机械能是相同的。

⑥ (a) $f_k = \mu F_N$

$= \mu mg$

$= 0.1\times4\times10^3\times10$

$= 4\times10^3\ N$

(b) (i) $P = \frac{W}{t}$

$W = Pt$

$= 50000\times1$

$= 50\ kJ$

(ii) $F = ma$

$F_{牵} - F_{阻} = ma$

$F_{牵} - 4000 = 4000\times1.5$

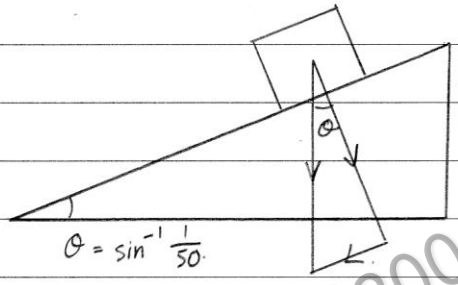
$F_{牵} = 10000\ N$

$P = Fv$

$50000 = 10000v$

$v = 5\ ms^{-1}$ #

(c).



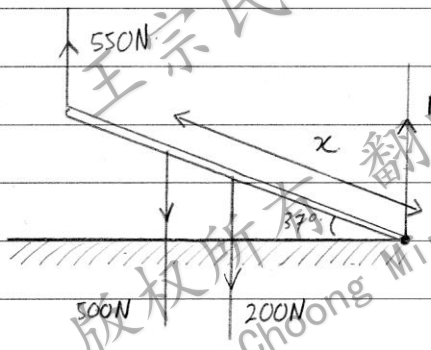
$P = Fv$

$P = (mg\sin\theta + mg\mu\cos\theta)v$

$50000 = [4\times10^4\times\frac{1}{50} + 4\times10^4\times0.1\times\cos(\sin^{-1}\frac{1}{50})]\,V$

$V = 10.42\ ms^{-1}$

(7) (a)(i)



$\Sigma M = 0$.

$-550\times4\times\sin127 + 500x\sin53 + 200\times2\times\sin53 = 0$

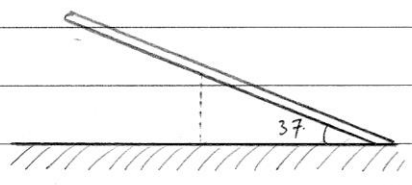
$x = 3.6\,m$ #

(ii). $\Sigma F_y = 0$

$550 + R - 500 - 200 = 0$

$R = 150\,N$ #

(b)(i)



木板的质心的高度改变

$= (1m + 2m) - (2\sin37)$

$= 1.8m$ #

物体C的高度改变

$= (4+1) - (4\sin37)$

$= 2.6\,m$ #

(ii) $m_c g h_c = m_{AB} g h_{AB} + \frac{1}{2}(m_c + m_{AB})v^2$

$550\times2.6 = 200\times1.8 + \frac{1}{2}(55+20)v^2$

$V = 5.34\ ms^{-1}$ #