

Chapter

Final Exam - 02/1 (Q17 → Q30)

solutions

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Q17

(ch1)

M = ρV from ρ = M/V

ρ = 1.25 × 10⁻³ g/cm³

V = 5 × 8 × 3 = 120 m³

Convert ρ into kg/m³

ρ = 1.25 × 10⁻³ g/cm³ × (1 kg / 10³ g) × (1 cm³ / (10⁻² m)³)

ρ = (1.25 × 10⁻³ / 10³) × (1 / 10⁻⁶) kg/m³

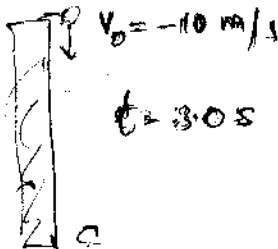
ρ = 1.25 kg/m³

⇒ M = 1.25 × (120) m³

M = 150 kg

Q18

(ch2)



v_0 = -10 m/s

t = 3.0 s

a = -9.8 m/s²

y - y_0 = v_0 t + 1/2 a t²

y = -10(3) + 1/2 (-9.8)(3)²

y = -74.1 m

h = 74 m

Q19
(ch3)

$A = \langle -10, 10 \rangle$ $B = \langle -10, -10 \rangle$

$\vec{A} + \vec{B} = \langle -20, 0 \rangle = -20 \hat{i}$
 $\vec{A} - \vec{B} = \langle 0, 20 \rangle = +20 \hat{j}$

$\vec{A} + \vec{B} \perp \vec{A} - \vec{B}$

Q20
(ch4)

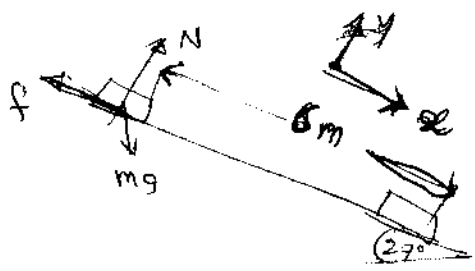
x	y
$v_{x0} = 20 \text{ m/s}$	$v_{y0} = 98 \text{ m/s}$
$x - x_0 = 400 \text{ m}$	$y - y_0 = ?$
$a_x = 0$	$a_y = -9.8 \text{ m/s}^2$

$x - x_0 = v_{x0}t + \frac{1}{2}a_x t^2$

$t = \frac{x - x_0}{v_{x0}} = \frac{400}{20} = 20$

$t = 20 \text{ (s)}$

Q21
(ch5)

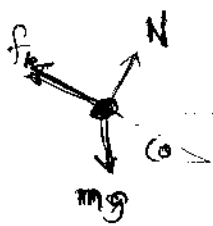


$v_0 = 0$
 $x - x_0 = 6 \text{ m}$
 $t = 2$
 $a = ?$

$x - x_0 = v_0 t + \frac{1}{2} a t^2$

$a = \frac{2\Delta x}{t^2} = \frac{2(6)}{4} = 3.0 \text{ m/s}^2$

HBD



$$\sum F_x = ma_x$$

$$mg \sin \theta - f = ma$$

$$mg \sin \theta - \mu N = ma$$

$$\sum F_y = ma_y$$

$$N - mg \cos \theta = 0$$

$$\sum F_y = ma_y$$

$$N - mg \cos \theta = 0$$

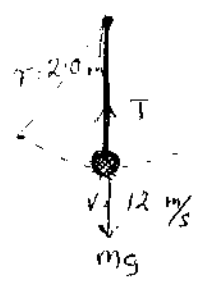
$$mg \sin \theta - \mu (mg \cos \theta) = ma$$

$$\mu = \frac{g \sin \theta - a}{g \cos \theta}$$

$$\mu = \frac{(9.8) \sin 27 - 3}{(9.8) \cos 27}$$

$$\mu = 0.17$$

Q22
(ch 6)



$$\sum F_r = ma_r$$

$$T - mg = m \frac{v^2}{r}$$

$$T = mg + m \frac{v^2}{r}$$

$$= 0.5(9.8) + \frac{(0.5)(12)^2}{2}$$

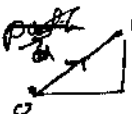
$$T = 41 \text{ N}$$

Q23
(ch 7)

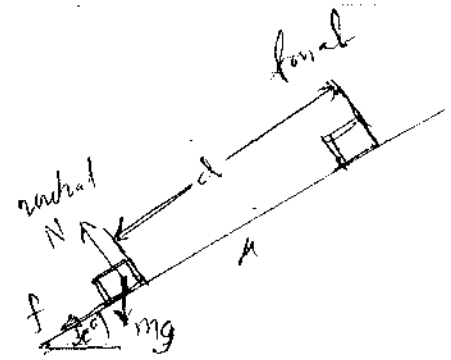
$$W = \vec{F} \cdot \vec{d}$$

$$= -15\hat{j} \cdot (3\hat{i} + 3\hat{j})$$

$$W = -45 \text{ J}$$

As \vec{F} is conservative we can choose the ~~path~~ straight line path 

Q24
(ch 8)



$m = 4.0 \text{ kg}$
 $\theta = 30^\circ$
 $K_i = 300 \text{ J}$
 $\mu = 0.3$

$$\Delta E_{\text{mech}} + \Delta E_{\text{th}} = W_{\text{ext}}$$

$$\frac{\Delta K + \Delta U}{K_f - K_i} + f d = 0$$

$$-300 + mgd \sin 30 + \mu(mg \cos 30)d = 0$$

system = block + incline + earth

$$300 = d (mg \sin 30 + \mu mg \cos 30)$$

$$d = \frac{300}{\{4(9.8) \sin 30 + (0.3)(4)(9.8) \cos 30\}}$$

$$d = 10 \text{ m}$$

925
(ch 8)



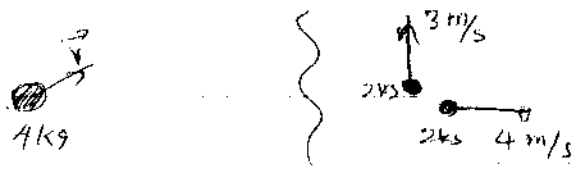
$$P = \vec{F} \cdot \vec{v} = (mg)(v) \cos(90 + 30)$$

$$= mg v \sin 30$$

$$= (20)(9.80)(4.0) \sin 30$$

$$P = 39 \text{ W}$$

926
(ch 9)



$$4\vec{v} = (2)(3\hat{j}) + (2)(4\hat{i})$$

$$\vec{v} = 2\hat{i} + 1.5\hat{j}$$

$$|\vec{v}| = \sqrt{2^2 + 1.5^2} = 2.5 \text{ m/s}$$

927
(ch 10)

$$v_{1f} = \frac{m_1 - m_2}{m_1 + m_2} v_{1i} + \frac{2m_2}{m_1 + m_2} v_{2i}$$

$$v_{2f} = \frac{2m_1}{m_1 + m_2} v_{1i} + \frac{m_2 - m_1}{m_1 + m_2} v_{2i}$$

Q28
(ch 11)

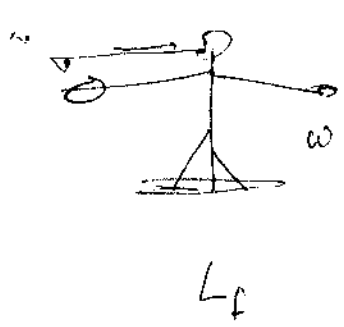
$\omega_0 = 0$
 $\Delta\theta = 2.4 \text{ rev} = (2.4)(2\pi) \text{ rad}$
 $t = 2.0 \text{ s}$
 $\omega = ?$
 α - missing

\Rightarrow use: $\Delta\theta = \frac{1}{2}(\omega + \omega_0)t$

$\omega = \frac{2\Delta\theta}{t} = \frac{2(2.4)(2\pi)}{2}$

$\omega = 15 \text{ rad/s}$

Q29
(ch 12)



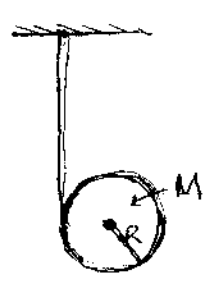
I_f - big
 ω_f - small



I_i small
 ω_i big

=

Q30
(ch 12)



$a = \frac{g \sin \theta}{1 + \frac{I}{MR^2}}$ with $\theta = 90^\circ$
 $\frac{I}{MR^2} = \frac{1}{2}$ for cylinder

$a = \frac{g}{1 + \frac{1}{2}} = \frac{2}{3}g$

$a = \frac{2}{3}g$