

Test 2 solutions 2A

1. (a)

$$220^2 + v_{WE}^2 = 280^2$$

$$v_{WE} = 173.21 \frac{\text{km}}{\text{h}}$$

$$(b) \tan \theta = \frac{173.21}{220}$$

$$\theta = 38.21^\circ$$

$$(c) t = \frac{1000 \text{ km}}{220 \frac{\text{km}}{\text{h}}}$$

$$t = 4.4 \text{ h}$$

(d)

$$D = (173.21 \frac{\text{km}}{\text{h}}) \cdot (4.4 \text{ h})$$

$$= 787 \text{ km}$$

(2.) $\downarrow y(\text{pos})$ DOWN is positive y.

$$(a) D = 6.0 = 7 \cos 30^\circ \cdot t$$

$$t = 0.9897 \text{ (s)}$$

$$(b) h = v_{0y} \cdot t + \frac{1}{2} g t^2$$

$$h = (7) \cdot \sin 30^\circ \cdot t + \frac{1}{2} g t^2$$

where $t = 0.9897 \text{ (s)}$
from (a).

$$h = 8.26 \text{ (m)}$$

$$(c) v_x = 7 \cos 30^\circ = v_{0x}$$

$$v_x = 6.06 \frac{\text{m}}{\text{s}}$$

(d.)

$$v_y = 7 \sin 30^\circ + (9.8) t$$

$$v_y = v_{0y} + g t$$

$$t = 0.9897 \text{ (s)}$$

$$\Rightarrow v_y = 13.2 \frac{\text{m}}{\text{s}}$$

test 2

(2.)

(c)

$$v = \sqrt{6.06^2 + 13.2^2} \left(\frac{m}{s} \right)$$

$$v = 14.5 \frac{m}{s}$$

(3.) (a)

$$\sum F_y = 0 = N + F \sin 30 - mg$$

$$N = mg - F \sin 30$$

$$N = 73 \text{ (N)},$$

given $F = 50 \text{ (N)}$.

(b) $ma_x = F \cos 30 - f_k$

$$f_k = \mu_k \cdot N, \mu_k = 0.1$$

$$N = 73 \text{ (N)}$$

$$a_x = 3.63 \frac{m}{s^2}$$

(4.)

$$M = 50 \text{ kg}$$

(a) $N = Mg \cos \theta$

$$N = 424 \text{ (N)}$$

(b) UP

(c) M goes DOWN incline:

$$Ma = Mg \sin \theta - f_k - T$$

$$ma = T - mg$$

$$M = 50 \text{ kg}; m = 5 \text{ kg}$$

$$\theta = 30.$$

ADD TO ELIMINATE T:

NOTE: $f_k = \mu_k Mg \cos \theta$

$$a = \frac{Mg \sin \theta - \mu_k Mg \cos \theta - mg}{(M+m)}$$

$$a = 2.79 \frac{m}{s^2}$$

Test 2

(4.)

$$(d) \quad ma = T - mg$$

$$\Rightarrow T = m(a + g)$$

$$T = (5)(2.79 + 9.8)$$

$$T = 62.9 \text{ (N)}$$

$$(e) \quad v^2 = 2ah$$

$$v = \sqrt{(2)(2.79)(1.5)} = 2.89 \frac{\text{m}}{\text{s}}$$

(5.) (a) \uparrow

$$(b) \quad \frac{v^2}{R} = \frac{10^2}{1} = 100 \frac{\text{m}}{\text{s}^2}$$

$$(c) \quad \frac{Mv^2}{R} = N - Mg$$

$$N = M\left(\frac{v^2}{R} + g\right)$$

(5.)

$$(c) \quad N = 7 \cdot \left(\frac{10^2}{1} + 9.8\right)$$

$$N = 768.6 \text{ (N)}$$

(d.) \downarrow

$$\frac{v^2}{R} = \frac{10^2}{1} = 100 \frac{\text{m}}{\text{s}^2}$$

$$\frac{Mv^2}{R} = N + Mg$$

$$\rightarrow N = \frac{Mv^2}{R} - Mg$$

$$N = (7) \frac{10^2}{1} - (7)(9.8)$$

$$N = 631.4 \text{ (N)}$$

$$(6.) \quad KE_1 + U_1 = KE_2 + U_2$$

$$0 + MgR = \frac{1}{2} Mv^2 + 0$$

$$v = \sqrt{2gR} = 4.4 \frac{\text{m}}{\text{s}}$$

Test 2

solutions

$$\frac{mv^3}{R} = N - Mg$$

$$N = M \left(\frac{v^3}{R} + g \right)$$

$$N = 7(19.6 + 9.8)$$

$$N = 205.8 \text{ (N)}$$

$$(b) KE_1 + U_1 = KE_3 + U_3$$

$$0 + MgR = \frac{1}{2}mv_3^2 + mgR'$$

$$R' = 0.700 \text{ (m)}$$

$$\text{and } R = 1.0 \text{ (m)}$$

$$\Rightarrow v_3 = 2.42 \left(\frac{\text{m}}{\text{s}} \right)$$