

a) $a = \frac{F}{m} = \frac{9}{3} = 3$ 4

$v = v_0 + at = 2 + 3t$ 4

$x = x_0 + v_0 t + \frac{at^2}{2} = 1 + 2t + \frac{3t^2}{2}$ 4

b) $a = \frac{F}{m} = \frac{9t}{3} = 3t$ 4

$v = \int a dt = \int 3t dt = 3 \frac{t^2}{2} + v_0$ 4

$v = 2 + \frac{3t^2}{2}$

$x = \int v dt = 2t + \frac{3}{2} \frac{t^3}{3} + x_0 = 1 + \frac{t^3}{2} + 2t$ 5

Problem 2, test 1, Phys 1121

Mark

$$m = 0.01 \text{ kg}, \quad m + M = 0.1 \text{ kg}$$

$$v = 1000 \frac{\text{m}}{\text{s}}$$

a) Kinetic energy of the bullet

$$E_{\text{bul}} = \frac{mv^2}{2} = 0.01 \cdot \frac{(1000)^2}{2} = 0.5 \cdot 10^4 \text{ J}$$

5

b) Speed of the block

$$mv = (M+m)V$$

$$V = \frac{m}{M+m} v = \frac{1}{10} \cdot 1000 = 100 \frac{\text{m}}{\text{s}}$$

5

c) Kinetic energy of the block

$$E_{\text{bl}} = (M+m) \frac{V^2}{2} = 0.1 \cdot \frac{(100)^2}{2} = 0.5 \cdot 10^3 \text{ J}$$

5

d) height

$$(M+m)gh = E_{\text{bl}}$$

$$h = \frac{E_{\text{bl}}}{g(M+m)} = \frac{0.5 \cdot 10^3}{9.8 \cdot 0.1} = 0.51 \cdot 10^3 \text{ m}$$

5

e) distance

$$F_{\text{fr}} \cdot x = \mu_k (M+m) g x = E_{\text{bl}}$$

$$x = \frac{E_{\text{bl}}}{\mu_k (M+m) g} = \frac{0.5 \cdot 10^3}{0.1 \cdot 0.1 \cdot 9.8} = 0.51 \cdot 10^4 \text{ m}$$

5

$$a) \quad I = \int_0^L x^2 dx \cdot \frac{M}{L} = \frac{L^3}{3} \frac{M}{L} = \frac{ML^2}{3}$$

15

$$b) \quad T = 2\pi \sqrt{\frac{ML^2}{3MgL}} = 2\pi \sqrt{\frac{L}{3g}}$$

10

Problem 4, test 1, Phys 1121

Mark

a)
$$\frac{m v^2}{r} = \frac{G M_r m}{r^2}$$

15

b)
$$M_r = \frac{v^2 r}{G}$$

10

~~c)
$$M_R = \frac{v^2 R}{G}$$~~

~~$$M_R - M_r = \frac{v^2 R}{G} - \frac{v^2 r}{G}$$~~