PHYS 2311 Ch. 7 HW

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MisConcQ 1.

1. d
3. e
5. d
7. c
9. b
11. b
13. d

Problem 1.

$$W = \vec{F_g} \cdot \Delta\vec{x}$$

$$F_g = mg$$

$$W = mg\Delta x = (280)(9.8)(3.80) = \boxed{10\,400\,\text{J}}$$

Problem 2.

$$W = \vec{F} \cdot \Delta\vec{x}$$

$$\Delta x = \frac{W}{F_g} = \frac{W}{mg} = \frac{70.0}{(1.85)(9.8)} = \boxed{3.86\,\text{m}}$$

Problem 5.

$$m = 46.0\,\text{kg}, \quad \Delta x = 10.3\,\text{m}, \quad \mu_k = 0.40$$

$$W = \vec{F} \cdot \Delta\vec{x}$$

$$\vec{F} = F_{app} - f_k = 0$$

$$f_k = F_N\mu_k = mg\mu_k = (46.0)(9.8)(0.40) = 180.32\,\text{N}$$

$$\implies F_{app} = 180.32\,\text{N}$$

$$W = (180.32)(10.3) = \boxed{1860\,\text{J}}$$

Problem 8.

$$m = 950\,\text{kg}, \quad \Delta x = 510\,\text{m}, \quad \theta = 9.0^\circ$$

$$F_g = mg\sin\theta$$

$$W = mg\sin\theta\Delta x$$

$$W = (950)(9.8)\sin(9.0)(510) = \boxed{7.4 \times 10^5\,\text{J}}$$

Problem 12.

$$\vec{x}(t) = \vec{x}_0 + \vec{v}_0 t + \frac{1}{2}\vec{a}t^2$$

$$\Delta x = \frac{1}{2}at^2$$

$$F = ma$$

$$W = F\Delta x = \frac{1}{2}a^2t^2m = \frac{1}{2}(2.0)^2(8.0)^2(4.0) = \boxed{512\,\text{J}}$$

Problem 18.

$$\vec{A}\cdot\vec{B} = (2.0x^2)(11.0) + (-4.0x)(2.5x) + (5.0)(0)$$

$$= 22x^2 - 10x^2 = \boxed{12x^2\ \text{units}}$$

Problem 20.

$$\vec{A}\cdot\vec{B} = (5.8)(8.2) + (-3.4)(4.3) + (-6.2)(-7.0) = 76.34$$

$$|\vec{A}| = \sqrt{(5.8)^2 + (-3.4)^2 + (-6.2)^2} = 9.15$$

$$|\vec{B}| = \sqrt{(8.2)^2 + (4.3)^2 + (-7.0)^2} = 11.61$$

$$\theta = \arccos\left(\frac{A\cdot B}{|A||B|}\right)$$

$$\theta = \arccos\left(\frac{76.34}{9.15\cdot 11.61}\right) = \boxed{44.2^\circ}$$

Problem 22.

$$\vec{V_1} = 0\hat{i} + 75\hat{k}$$

$$\vec{V_2} = 48\cos(-48)\hat{i} + 48\sin(-48)\hat{k} = 32.11\hat{i} - 35.67\hat{k}$$
$$\vec{V_1} \cdot \vec{V_2} = (0)(32.11) + (75)(-35.67) = \boxed{-2675\,\text{units}}$$

Problem 25.

(a)

$$\vec{B} + \vec{C} = (-8.0 + 5.8)\hat{i} + (6.1 - 9.2)\hat{j} + 4.2\hat{k} = -2.2\hat{i} - 3.1\hat{j} + 4.2\hat{k}$$
$$\vec{A} \cdot (\vec{B} + \vec{C}) = (9.0)(-2.2) + (-8.5)(-3.1) + (0)(4.2) = \boxed{6.55}$$

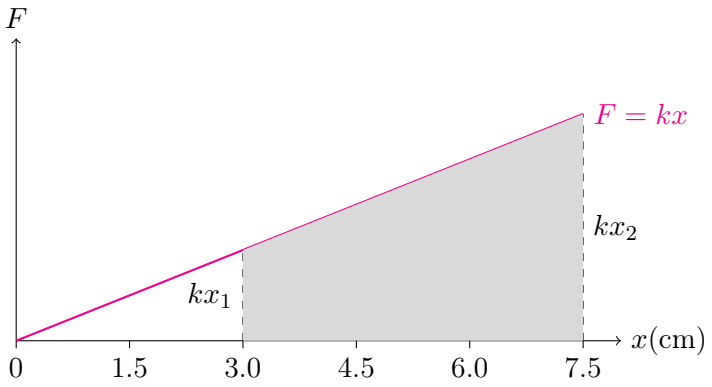
(b)

$$\vec{A} + \vec{C} = (9.0 + 5.8)\hat{i} + (-8.5 - 9.2)\hat{j} = 14.8\hat{i} - 17.7\hat{j}$$
$$\vec{B} \cdot (\vec{A} + \vec{C}) = (-8.0)(14.8) + (6.1)(-17.7) + (4.2)(0) = \boxed{-226}$$

(c)

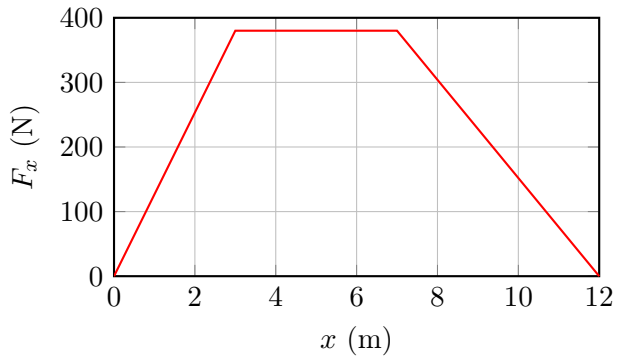
$$\vec{B} + \vec{A} = (-8.0 + 9.0)\hat{i} + (6.1 - 8.5)\hat{j} + (4.2 + 0)\hat{k} = 1\hat{i} - 2.4\hat{j} + 0\hat{k}$$
$$(\vec{B} + \vec{A}) \cdot \vec{C} = (1)(5.8) + (-2.4)(-9.2) + (0)(0) = \boxed{27.9}$$

Problem 37.



$$W = \int_{0.03}^{0.075} 65x = \frac{1}{2}65x^2\Big|_{0.03}^{0.075} = \frac{1}{2}(65)(0.075)^2 - \frac{1}{2}(65)(0.03)^2 = \boxed{0.15\,\text{J}}$$

Problem 39.



$$W = \frac{1}{2}(380)(3) + (380)(4) + \frac{1}{2}(380)(5) = \boxed{3040\,\text{J}}$$

Problem 41.

(a)

$$W = \frac{1}{2}(400)(3) + (400)(4) + \frac{1}{2}(400)(3) = \boxed{2800\,\text{J}}$$

(b)

$$W = \frac{1}{2}(-200)(1.5) + (-200)(2) + \frac{1}{2}(-200)(1.5) = -700\,\text{J}$$

$$2800\,\text{J} - 700\,\text{J} = \boxed{2100\,\text{J}}$$

Problem 45.

$$W = \int_{0.0}^{1.0} \frac{3.0}{\sqrt{x}} = 3.0 \int_{0.0}^{1.0} x^{-\frac{1}{2}} = 3.0 \cdot 2x^{\frac{1}{2}}\Big|_{0.0}^{1.0} = 3.0 \cdot (2(1)^{\frac{1}{2}}) = 3.0 \cdot 2 = \boxed{6.0\,\text{J}}$$

Problem 55.

(a)

$$3K_i = K_f$$

$$3(\frac{1}{2}mv_i^2) = \frac{1}{2}mv_f^2$$

$$3v_i^2 = v_f^2$$

$$\sqrt{3}v_i = v_f$$

$$\implies \boxed{\sqrt{3}}$$

(b)

$$K = \frac{1}{2}m\left(\frac{v}{2}\right)^2 = \frac{1}{8}mv^2 = \frac{1}{4}\left(\frac{1}{2}mv^2\right) = \frac{K}{4}$$

$$\implies \boxed{\frac{1}{4}}$$

Problem 56.

$$W_{\text{net}} = W_{\text{stop}} - W_{\text{moving}} = 0$$

$$W_{\text{stop}} = W_{\text{moving}}$$

$$W_{\text{net}} = \Delta K$$

$$K_{\text{stop}} = W_{\text{stop}}$$

$$K_{\text{stop}} = \frac{1}{2}mv^2 = \frac{1}{2}(9.11 \times 10^{-31})(1.10 \times 10^{6})^2 = \boxed{5.51 \times 10^{-19}\,\text{J}}$$

Problem 59.

$$W = F\Delta x$$

$$F = \frac{W}{\Delta x}$$

$$W = K = \frac{1}{2}mv^2$$

$$F = \frac{\frac{1}{2}mv^2}{\Delta x} = \frac{\frac{1}{2}(0.145)(32)^2}{0.22} = \boxed{337.5\,\text{N}}$$

Problem 60.

$$m = 0.085\,\text{kg}, \quad F = 105\,\text{N}, \quad \Delta x = 0.75\,\text{m}$$

$$W = F\Delta x = K = \frac{1}{2}mv^2$$

$$F\Delta x = \frac{1}{2}mv^2$$

$$\sqrt{\frac{2F\Delta x}{m}} = v$$

$$v = \sqrt{\frac{2(105)(0.75)}{0.085}} = \boxed{43.0\,\text{m/s}}$$

Problem 65.

$$\Delta x = 8.0\,\text{m}, \quad v_i = 5.0\,\text{m/s}, \quad v_f = 0\,\text{m/s}$$

$$f_k = F_N \mu_k$$

$$W = f_k \Delta x$$

$$W = \Delta K = \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2 = \frac{1}{2} m (v_f^2 - v_i^2)$$

$$\frac{1}{2} m (v_f^2 - v_i^2) = F_N \mu_k \Delta x$$

$$F_N = mg$$

$$\frac{\frac{1}{2} m (v_f^2 - v_i^2)}{mg\Delta x} = \mu_k$$

$$\mu_k = \frac{v_f^2 - v_i^2}{2g\Delta x} = \frac{0 + 25.0}{2(9.8)(8.0)} = \boxed{0.16}$$