

Homework Thermal E. #1

①

$$\textcircled{1} \quad \alpha_{\text{con.}} = 18 \times 10^{-6} / \text{C} \quad \alpha_{\text{steel}} = 12 \times 10^{-6} / \text{C}$$

$$\Delta T = 40 - 10 \text{C} = 30 \text{C} \quad L_{\text{old}} = 16 \text{m}$$

$$\text{concrete} \quad \Delta L = L_{\text{old}} \alpha_{\text{con}} \Delta T = 16 \text{m} (18 \times 10^{-6} / \text{C}) (30 \text{C})$$

$$\Delta L_{\text{con.}} = 0.0097 \text{m} \approx \boxed{1 \text{cm}}$$

$$\text{steel} \quad \Delta L = L_{\text{old}} \alpha_{\text{st}} \Delta T = 16 \text{m} (12 \times 10^{-6} / \text{C}) (30 \text{C})$$

$$\Delta L_{\text{steel}} = 0.0058 \text{m} \approx \boxed{0.6 \text{cm}}$$

∴ Concrete expands & contracts more than steel

$$\textcircled{2} \quad \alpha(\text{Al}) = 24 \times 10^{-6} / \text{C} \quad L_{\text{old}} = 30 \text{m}$$

$$\Delta T = 45 \text{C}$$

$$\Delta L = L_{\text{old}} \alpha \Delta T = 30 \text{m} (24 \times 10^{-6}) (45 \text{C})$$

$$\Delta L = 0.032 \text{m} \approx \boxed{3 \text{cm}}$$

$$\textcircled{3} \quad m = 2 \text{kg} \quad \Delta T = 3 \text{C} \quad c = 0.35 \text{ kJ/kgC}$$

$$W = Q = mc \Delta T = 2 \text{kg} (0.35 \frac{\text{kJ}}{\text{kgC}}) (3 \text{C})$$

$$\boxed{Q = 2.1 \text{ kJ}}$$

HW. Ther. E. #1

Phy 101

(2)

④ $T = 30 \text{ min}$ $m = 30 \text{ kg}$
Rep. Rate 0.5 m/min m_{bar}

$m_{\text{body}} = 75 \text{ kg}$ $c(\text{body}) = 0.85 \text{ kJ/kgC}$ $\Delta T = ?$

Part 1 Picking up weight

$$W = \Delta PE = mgh (\# \text{ times lifted})$$

$$= (30 \text{ kg})(9.8 \text{ m/s}^2)(0.5 \text{ m})(30)$$

$$W = 4410 \text{ J}$$

Part 2 Body temp. change

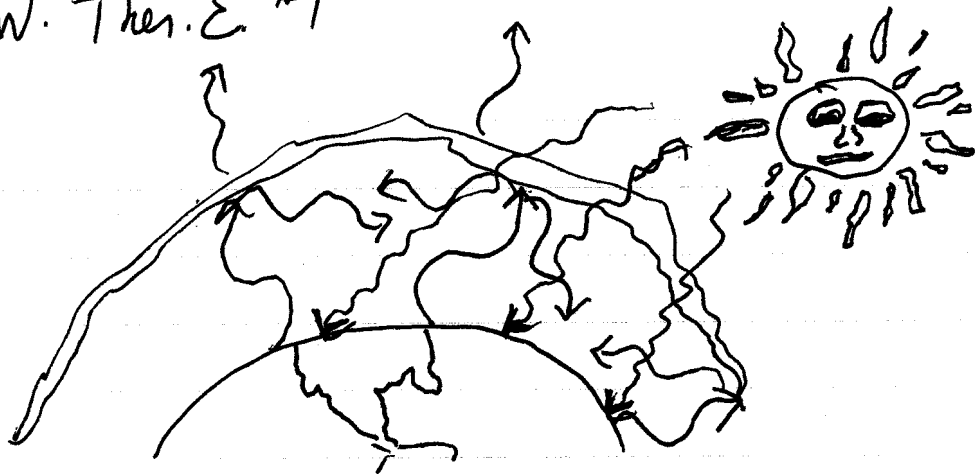
$$W = Q = mc\Delta T$$

$$W = Q = 4410 \text{ J} = mc\Delta T$$

$$\Delta T = \frac{4410 \text{ J}}{mc} = \frac{4410 \text{ J}}{(75 \text{ kg})(0.85 \text{ kJ/kgC})}$$

$$\Delta T = \frac{4.41 \text{ kJ}}{63.75 \frac{\text{kJ}}{\text{C}}} = \boxed{0.069 \text{ C} = \Delta T}$$

(5)



- (A) Sun sends short λ light into earth thru atmosphere.
- (B) Earth absorbs energy.
- (C) Earth re-emits energy in long λ 's (infrared)
- (D) Atmosphere reflects much of light back toward earth (some is emitted back to space).

(6)

- (1) CO_2 - burning fossil fuels
 - volcanic emission
 - deforestation
- CH_4 - Cow flatulation
 - Rice paddies
- NO -
- Ozone - cars, CFCs