Tsokos p. 113 15-18, 20, 22, 23 (SL1 HW #13)

(15) 25 kg block raised up (slowly) 10.0 m by motor in 8.2 s

$$P = \frac{\Delta E}{\text{Time}} = \frac{mgh}{t} = \frac{(25)(10)(10)}{8.2} = \boxed{305\ W}$$

(16) Car engine $P = 90.0\ kW$ for car moving horizontally w/ $v = 100.\ \frac{km}{hr}$ What is $F_f = ?$

$$P = Fv \qquad F = \frac{P}{v} = \frac{90\,000}{100\ \frac{km}{hr} \times \frac{1000\ m}{1\ km} \times \frac{1\ hr}{3600\ s}} = \boxed{-3200\ N}$$

-3240

(17) Elevator motor $P = 2500\ W$

(a) What speed v can raise 1200 kg?

$$v = \frac{P}{F} = \frac{2500\ W}{12000\ N} = \boxed{0.21\ m/s}$$

(b) Load lifted more slowly due to friction

(18) 50.0 kg load raised 15 m in 125 s by a motor.

(a) $P = \frac{W}{t}$ or $\frac{\Delta PE}{t} = \frac{(50)(10)(15)}{125} = \boxed{60\ W}$

(b) Actual $P = 80\ W$ so $\frac{P_{out}}{P_{in}} \times 100 = \frac{60}{80} \times 100 = \boxed{75\%}$

(c) Same motor lifts 100.0 kg. How long would it take

$$t = \frac{\Delta PE}{P} = \frac{(100)(10)(15)}{60} = \boxed{250\ s}$$

(20) Top speed of car w/ 250 kW Power is $v = 240 \frac{km}{h} \times \frac{1000 m}{1 km} \times \frac{1 hr}{3600 s}$

What is F_f (resistance force)?

$P = Fv \qquad F = \frac{P}{v} = \frac{250000 W}{66.67 m/s} = \boxed{3750 N}$

(22) Elevator goes from ground floor to 10th floor. By 1st floor it has a constant speed. at floor 1, decelerates to a stop between floors 9 & 10.

Electrical Energy → gain in grav. PE

(23) Car mass 1200 kg goes from rest to $4.0 \frac{m}{s}$ in 2.0 s and then moves at a constant speed for 10 s more. Then brakes are applied for 4.0 s to stop car.

Resistance force = 500 N for entire time.

(a) $F = ma = (1200 kg)(2 m/s^2) = 2400 N$ in 1st 2.0 s. $+500 N = \boxed{2900 N}$

(b) Avg. P in 1st 2.0 s $\qquad P = \frac{W}{t} = F \cdot \bar{v}_{ms} = 2900 N \times 2 m/s = \boxed{5800 W}$

(c) F pushing car in next 10 s = $\boxed{500 N}$ (const. v)

(d) Power in 10 s = $500 N \times 4 m/s = \boxed{2000 W}$

(e) Braking force in last 4.0

$F = ma = (1200 kg)(-1 m/s^2) = -1200 N + 500 N = \boxed{-700 N}$

(f) Energy transformations

Chem PE → ↑ KE + heat → all heat to stop.