IV/2

$m = 1500\,kg$

$\Delta t = 3.1\,s$

$v = 100\,km/h = 27.8\,m/s \qquad \frac{1000}{60 \cdot 60} = \frac{1}{3.6}$

---

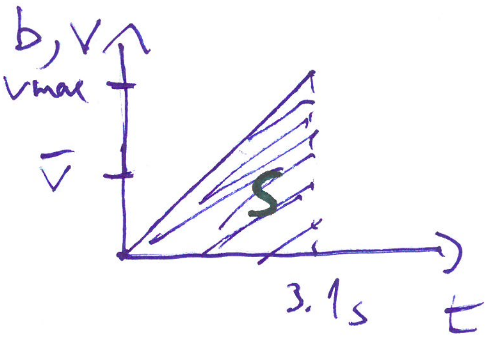
a) $F = m \cdot a$

$a = ?$

$$a = \frac{\Delta v}{\Delta t} = \frac{27.8\,m/s}{3.1\,s} = 8.97\,m/s^2$$

$$F = 1500\,kg \cdot 8.97\,m/s^2 = 13452\,N \approx \underline{\underline{13.45\,kN}}$$

b)



$$s = \frac{v_{max}}{2} \cdot \Delta t = \bar{v} \cdot \Delta t =$$

$$= \frac{27.8\,m/s}{2} \cdot 3.1\,s = \underline{\underline{43.1\,m}}$$

(IV/5.)

$F_{pull} = 103\,N$

$F_{frict} = 15\,N$

$m = 25\,kg$

$\Delta t = 5\,s$

---

a)

$$\sum F_{res} = F_{pull} - F_{frict} = 103\,N - 15\,N = 90\,N$$

$$\sum F_{res} = m \cdot a$$

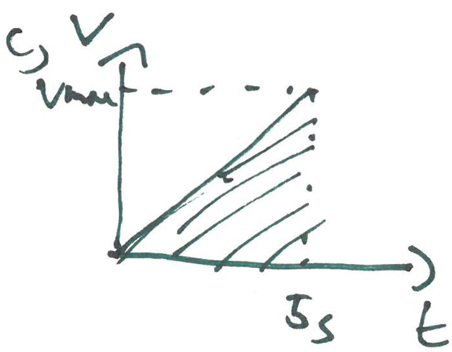
$$a = \frac{\sum F_{res}}{m} = \frac{90\,N}{25\,kg} = \underline{\underline{3.6\ m/s^2}}$$

b)

$$a = \frac{\Delta v}{\Delta t} = \frac{v_{max}}{\Delta t}$$

$$v_{max} = a \cdot \Delta t = 3.6\ m/s^2 \cdot 5\,s = \underline{\underline{18\ m/s}}$$

c)

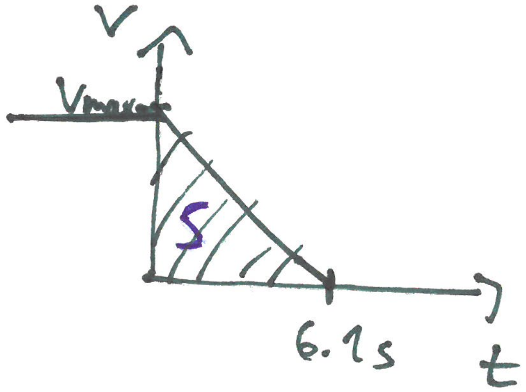


$$s = \bar{v} \cdot \Delta t = \frac{v_{max}}{2} \cdot \Delta t = \frac{18\ m/s}{2} \cdot 5\,s = \underline{\underline{45\,m}}$$

IV/6. $m = 20\,kg$

$\Delta t = 6.1\,s$

$s = 9.2\,m$



a) $s = \frac{v_{max}}{2} \cdot \Delta t$

$2s = v_{max} \cdot \Delta t$

$v_{max} = \frac{2s}{\Delta t} = \frac{2 \cdot 9.2\,m}{6.1\,s} = \underline{\underline{3.02\,m/s}}$

b) $a = \frac{\Delta v}{\Delta t} = \frac{-3.02\,m/s}{6.1\,s} = \underline{\underline{-0.495\,m/s^2}}$

c) $F_{friction} = m \cdot a = 20\,kg \cdot (-0.495\,m/s^2) = \underline{\underline{-9.9\,N}}$

$\frac{kg \cdot m}{s^2} = N$

IV/8.

$m_1 = 200\,000 \text{ tons} = 200\,000\,000 \text{ kg} = 2 \cdot 10^8 \text{ kg}$

$1 \text{ ton} = 1000 \text{ kg}$

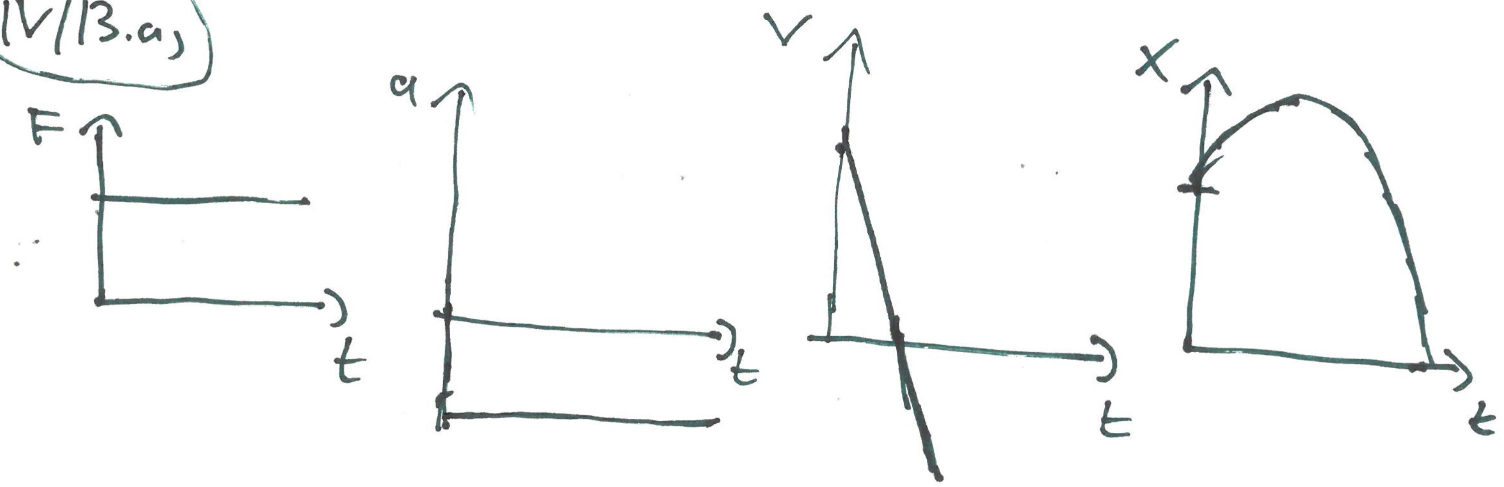
$m_2 = 300\,000 \text{ tons} = 3 \cdot 10^8 \text{ kg}$

$r = 2 \text{ km} = 2000 \text{ m}$

$$F = G\frac{m_1 m_2}{r^2} = 6.67 \cdot 10^{-11} \frac{m^3}{kg \cdot s^2} \cdot \frac{2 \cdot 10^8 kg \cdot 3 \cdot 10^8 kg}{(2000\, m)^2} \approx \underline{\underline{1\,N}}$$

$$\frac{m \cdot kg}{s^2} = N$$

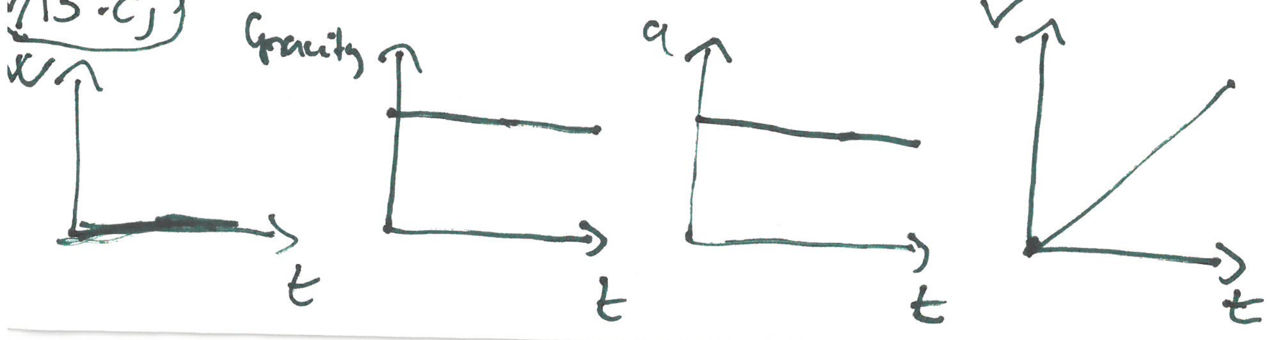
IV/13.a)



[redacted] $m \cdot g + m \cdot a$

$mg - m \cdot a$

/13.c)



IV/11.

$m = 2kg$

$x = 25\ cm = 0.25\ m$

equilibrium: $\sum F_{res} = \emptyset$

$$\emptyset = F_{spring} - m \cdot g$$

$$F_{spring} = mg = 2kg \cdot 9.81\ m/s^2 = \underline{\underline{19.62\ N}}$$

spring constant: $k = \frac{\Delta F_{ext}}{\Delta X} = \frac{F}{X} = \frac{19.62N}{0.25m} = \underline{\underline{78.5\ N/m}}$

↳ always positive

IV/12.

higher spring constant → smaller extension

10% is the smallest if the original length was the smallest