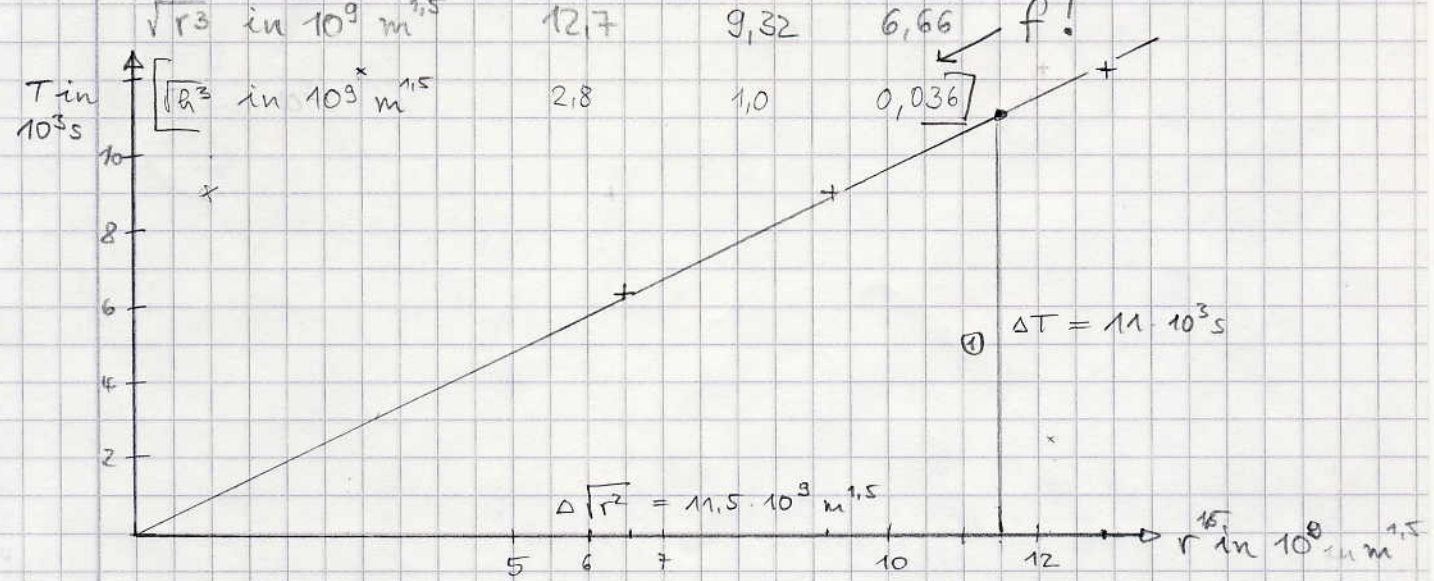
1.1 (6 BE)

Messung Nr	1	2	3
r in 10^6 m	5,43	4,43	3,54
$\sqrt{r^3}$ in 10^9 $m^{1,5}$	12,7	9,32	6,66
$\sqrt{r^3}$ in 10^9 $m^{1,5}$	2,8	1,0	0,036



(3) 1.2 $k = \frac{\Delta T}{\Delta\sqrt{r^3}} = \frac{11 \cdot 10^3\,s}{11{,}5 \cdot 10^9\,m^{1,5}} = 9{,}56 \cdot 10^{-7}\,\frac{s}{\sqrt{m^3}}$

$= 9{,}6 \cdot 10^{-7}\,\frac{s}{\sqrt{m^3}}$

(6) 1.3 $F_z = F_G \iff \frac{mv^2}{r} = G\frac{Mm}{r^2} \iff \frac{m\,4\pi^2 r^2}{r\,T^2} = G\frac{Mm}{r^2}$

$\iff T \overset{①}{=} \sqrt{\frac{4\pi^2 r^3}{GM}} \overset{①}{=} \underbrace{\sqrt{\frac{4\pi^2}{GM}}}_{k}\sqrt{r^3}$

$k = \sqrt{\frac{4\pi^2}{GM}} \overset{①}{\iff} 4\pi^2 = k^2 GM \iff M \overset{①}{=} \frac{4\pi^2}{G k^2}$

$M = \frac{4\pi^2}{6{,}672 \cdot 10^{-11}\,\frac{m^3}{kg\,s^2} \cdot (9{,}56 \cdot 10^{-7})^2\,\frac{s^2}{m^3}} = 6{,}4(11) \cdot 10^{23}\,kg$ ①

(3) 1.4.1
- Umlaufdauer Satelit = Rotationsdauer Planet
- Bahnebene Satelit in Äquatorebene d. Planeten
- Gleicher Umlaufsinn Planet u. Satelit

1.4.2 $T = k \cdot \sqrt{r^3} \iff r^3 \overset{①}{=} \frac{T^2}{k^2} \iff r = \sqrt[3]{\frac{T^2}{k^2}}$

$r_S = \sqrt[3]{\left(\frac{24{,}7 \cdot \ldots \cdot 3600\,s}{9{,}56 \cdot 10^{-7}\,\frac{s}{\sqrt{m^3}}}\right)^2}$ ① $= 2{,}05 \cdot 10^7\,m$ ①

$h \overset{①}{=} r_S - r_M = 2{,}05 \cdot 10^7\,m - 3{,}43 \cdot 10^6\,m = 20{,}47 \cdot 10^6\,m - 3{,}43 \cdot 10^6\,m = 17{,}04 \cdot 10^6\,m$

$= 1{,}7 \cdot 10^7\,m$

$(T = 88920\,s)$

φ = 5,0															
1	...	9,5	2	...	13	3	...	16,5	4	...	19,5	5	...	22	
6	...	24,5	7	...	27	8	...	29,5	9	...	31,5	10	...	34	
11	...	36,5	12	...	39	13	...	41,5	14	...	43,5	15	42 ...	46	

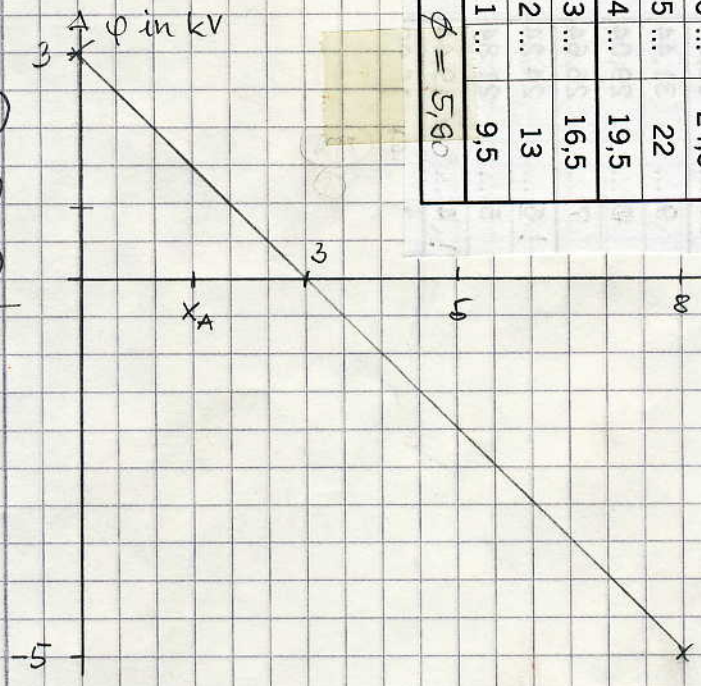
2.1

Dia (3)

E (2)

$\varphi(3cm)=0$ (1)

6



$\varphi(3{,}0\,cm) = 0$ ①

$E = \frac{U}{d} = \frac{16 \cdot 10^2 V}{0{,}080\,m}$ ① $= 200\,\frac{kV}{m}$

$= \underline{2{,}0 \cdot 10^5\,\frac{V}{m}}$ ①

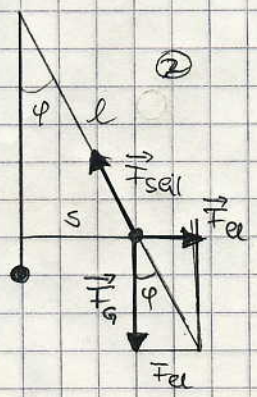
(3) 2.2 $E = \frac{U_{12}}{s_{12}} \Leftrightarrow U_{12} = E \cdot s_{12}$ ④ $= 2{,}0 \cdot 10^5\,\frac{V}{m}$ ① $(0{,}065\,m) = \underline{+13\,kV}$ ①

alt: $U_{12} = \varphi_1 - \varphi_2$ ① $= 3kV - (-10kV) = 13\,kV$ ①

(3) 2.3 $W_{12} = q \cdot E\,(r_1 - r_2)$ ④ $= 6{,}6 \cdot 10^{-9}\,C \cdot 2{,}0 \cdot 10^5\,V/m\,(0{,}075 - 0{,}005)\,m$ ①

$W_{12} = \underline{9{,}24 \cdot 10^{-5}\,J}$ ① $= 0{,}092\,mJ$

(7) 3.1



②

$\sin\varphi = \frac{s}{\ell} \Leftrightarrow \varphi = \sin^{-1}\left(\frac{2}{50}\right) = 2{,}29°$ ②

$\tan\varphi = \frac{F_{el}}{F_g}$ ① $\Leftrightarrow F_G = mg$ ① $= \frac{qE}{\tan\varphi}$

$m = \frac{6{,}6 \cdot 10^{-9}\,C \cdot 2{,}0 \cdot 10^5\,\frac{N}{C}}{9{,}81\,\frac{N}{kg} \cdot \tan(2{,}29°)}$ ① $= 3{,}34 \cdot 10^{-3}\,kg = \underline{3{,}4\,g}$

(2) 3.2 Auslenkung ändert sich nicht, da Feld homogen

(5) 3.3 $\varphi = \frac{1}{4\pi\varepsilon_0} \cdot \frac{Q}{r}$ ① ; $E_{pot} = q\varphi$

$\Rightarrow E_{pot}(r) = \frac{1}{4\pi\varepsilon_0} \cdot \frac{e^- \cdot Q}{r}$ ①

$E_{pot}(r = 0{,}05m) = \frac{1}{4\pi \cdot 8{,}854 \cdot 10^{-12}\,\frac{F}{m}} \cdot \frac{-1{,}6 \cdot 10^{-19}\,C \cdot 6{,}6 \cdot 10^{-9}\,C}{0{,}050m}$ ④

$= -1{,}892 \cdot 10^{-16}\,J = \underline{-1{,}9 \cdot 10^{-16}\,J}$ ④

① Man muß $1{,}9 \cdot 10^{-16}\,J$ aufwenden zum "ionisieren" ①