877,4406971115   0,0291   0,0001

Tepelná roztažnost

$\rho = \rho_0 \cdot (1 - \beta \cdot \Delta T)$ $\beta_{benzín} = 1{,}06 \cdot 10^{-3}\ K^{-1}$

$V = V_0 \cdot (1 + \beta \cdot \Delta T)$

$l = l_0 \cdot (1 + \alpha_l \cdot \Delta T)$

Povrchové napětí

$\sigma = \frac{F}{l}$ = povrchové napětí $\sigma = \frac{h \cdot \rho \cdot g \cdot r}{2}$

l = obvod nádoby

~~H = výška výstupu = $\frac{v_0^2}{2g}$~~ $\frac{2\sigma}{\rho \cdot g \cdot r} = h$

~~0,0338069669 m~~ → 1. 0,0676139338 m

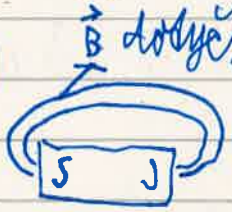
2. 0,0338069669 m

3. 0,14056836028 m

Magnetizmus

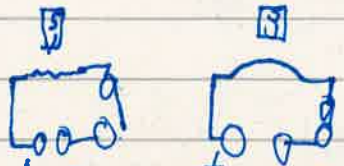
B = magnetická indukcia
charakterizuje intenzitu poľa v danom bode

[T] $\vec{B}$ dotyčnica



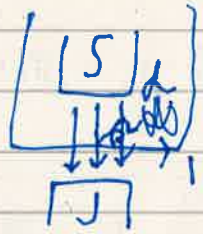
$\frac{1}{N^3}$

$\vec{F}_{mv} = \vec{B} \cdot I \cdot l \cdot \sin\alpha$



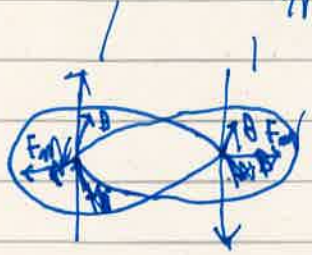
- ampérovo pravidlo pravej ruky - určuje smer indukcie
- smer palca - smer prúdu, smer prstov - smer indukcie

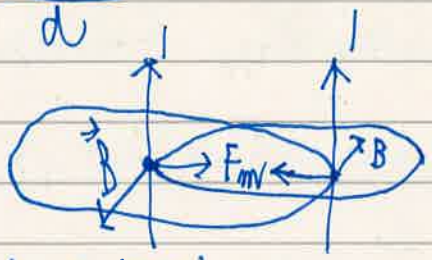
- flemingovo pravidlo ľavej ruky
- určuje smer sily, prsty ukazujú smer prúdu a indukcia vstupuje do dlane, palec ukazuje smer sily



$\vec{F}_{mv} = \vec{B} \cdot I \cdot l \cdot \sin\alpha$ l = aktívna dĺžka vodiča
α = uhol medzi indukciou a vodičom

$F_{mv} = k_v \cdot \frac{I_1 \cdot I_2}{d}$ k_v = konštanta $= \frac{\mu}{2\pi}$





$\vec{B} = \mu \cdot \frac{N \cdot I}{l}$

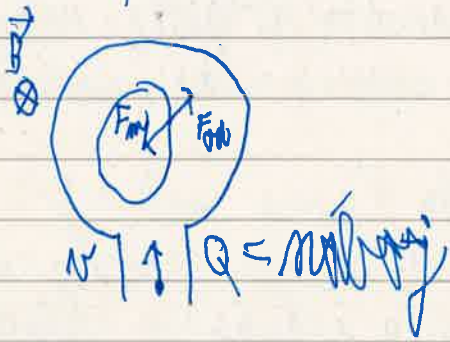
N = počet závitov
I = prúd
l = aktívna dĺžka cievky

$\mu_0 = 4\pi \cdot 10^{-7} \frac{N \cdot m}{A^2}$
permeabilita
$\mu_r = \frac{\mu}{\mu_0}$

1. $B = 2\,T$
$l = \sout{8\,cm}\ 0{,}08\,m$
$I = 6\,A$
$\alpha = 90^\circ$
$\alpha_2 = 30^\circ$

$F_m = 12 \cdot 0{,}08 = 0{,}96\,N$
$F_{m_2} = 0{,}48\,N$

2. $F_m = 0{,}2\,N$
$l = 0{,}125\,m$
$I = 4\,A$
$B = 0{,}4\,T$



$$\vec{B} \cdot I \cdot l = m \cdot \frac{v^2}{r}$$

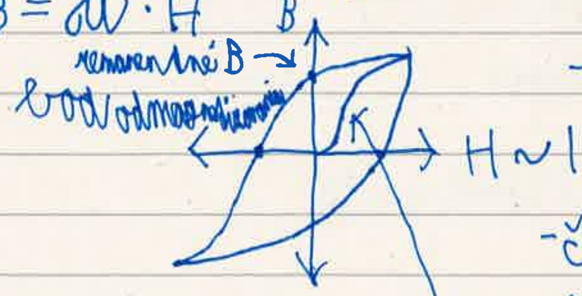
$$\vec{B} \cdot \frac{Q}{t} \cdot l = m \cdot \frac{v^2}{r} \qquad F_m = F_{od}$$

$$B\,Q = \frac{m \cdot v}{r}$$

- feromagnetické látky $\mu_r = 10^2 \dots 10^5$
- diamagnetické látky - ~~zosilňujú~~ zoslabujú $\mu_r < 1$
- paramagnetické látky - zosilňujú $\mu_r > 1$

- intenzita magnetického poľa $= H = \frac{B}{\mu}$

$B = \mu \cdot H$



- hysterézna slučka

- čím väčšie roztvorenie, tým vhodnejší na výrobu magnetov - magneticky tvrdé

krivka prvotnej magnetizácie

- Lenzov zákon: Indukovaný prúd v uzavretom obvode má taký smer, že svojím magnetickým poľom pôsobí proti zmene magnetického poľa, ktoré ho vyvoláva.

- príklad

rozpätie krídel = 40 m = l

$B = 0,4 \cdot 10^{-3}$ T

$v = 600$ km/h $= 166,\bar{6}$ m/s

$\sin\alpha = 1$ $\cos\alpha = 1$ (normála krídla)

$U_i = -\frac{\Delta fí}{\Delta t} = -\frac{B \cdot \Delta S}{\Delta t}$

$fí = B \cdot S \cdot \cos\alpha$

1. $U_i = ? = -B \cdot v \cdot l = -0,02\bar{6}$ V

2. ak sa do zmení ak zrýchli o 200 km/h za 30 s?

$U_i = -0,03\bar{5}$ V

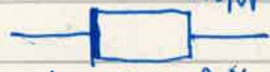
Striedavý prúd

Vzorec $U = R \cdot I \rightarrow u = X_R \cdot i$

X_R = rezistancia [Ω]

súčiastky

R = odpor



L = indukčnosť cievky

L brzdí prúd

$u = U_{max} \cdot \sin(\omega \cdot t + \varphi_u)$

ω = uhlová rýchlosť

$i = I_{max} \cdot \sin(\omega \cdot t + \varphi)$

C = kapacita $= \varepsilon \cdot \frac{S}{d}$

S = plocha platní

d = vzdialenosť platní

ε = permeabilita

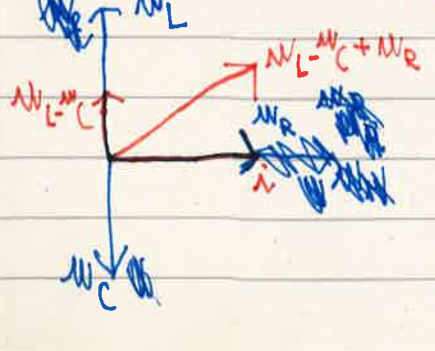
C brzdí napätie

$Q = C \cdot U$ [C] [F] [V]

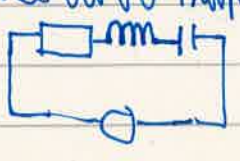
$C = \frac{Q}{U}$

$X_C = \frac{1}{\omega \cdot C}$

- fázory - ukazuje ako časovo súvisia prúd a napätie (vektory)



sériové zapojenie



$u_{výs} = \sqrt{u_R^2 + (u_L - u_C)^2}$ [Ω]

Z = impedancia = odpor v obvode s R, L, C so striedavým prúdom

$i \cdot Z = u_{výs}$ →

$Q = C \cdot U$

$i \cdot Z = \sqrt{i^2 \cdot X_R^2 + \left(i \cdot \omega L - i \frac{1}{\omega C}\right)^2}$

$Z = \sqrt{X_R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}$

$\omega = 2\pi \cdot f$
$f = 50\,Hz$

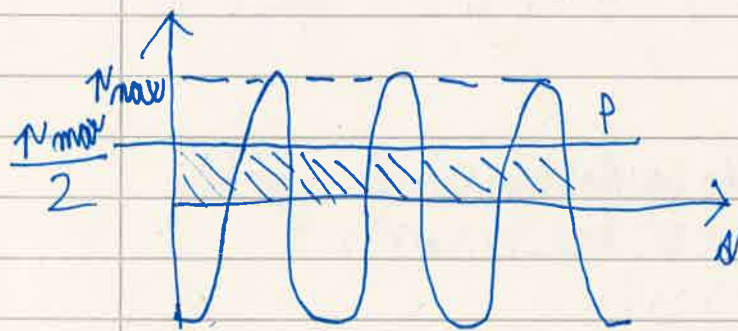
$Z = \sqrt{R^2 + (\omega L)^2}$

$u = Z \cdot i$

$[\Omega]\ X_C = \frac{1}{\omega C}$ = kapacitancia

$u = i \cdot X_C \quad u = u_{max} \cdot \sin\left(\omega \cdot t - \frac{\pi}{2}\right)$

$P = \frac{P_{max}}{2}$



$U \cdot \frac{U}{R} = \frac{u_{max} \cdot \frac{u_{max}}{R}}{2}$

$U_{ef}^2 = \frac{u_{max}^2}{2}$

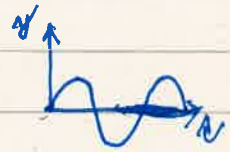
$U_{ef} = \frac{u_{max}}{\sqrt{2}}$

$[\Omega]\ X_L$ = induktancia (odpor vo vnútri cievky) $= \omega \cdot L$

$u = i \cdot X_L$ cievka posúva napätie o $\frac{\pi}{2}$ $u = u_{max} \cdot \sin\left(\omega \cdot t + \frac{\pi}{2}\right)$

Kmitanie

- periodický dej – pravidelne opakujúci sa dej
- frekvencia – počet opakovaní za sekundu – f [Hz]
- netlmené kmitanie / kmity – nestrácajú energiu
- tlmené kmity – amplitúda klesá
- amplitúda – maximálna výchylka
- kmit = opakovanie
- perióda – ~~dokola~~ trvanie / čas jedného kmitu
- kyv = polovica kmitu



$y(t) = \sin(\omega \cdot t + \varphi) \cdot y_{max}$

$v = \frac{\Delta s}{\Delta t} = \frac{\Delta y}{\Delta t}$

$v_{max} = \omega \cdot y_{max}$

$v(t) = v_{max} \cdot \cos(\omega \cdot t + \varphi)$

$a(t) = \frac{\Delta v}{\Delta t}$

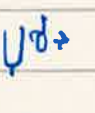
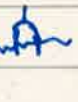
$a(t) = a_{max} \cdot \sin(\omega \cdot t + \varphi)$

- budeme skúmať pohyb 2 kyvadiel, zistiť od čoho závisí perióda

10:30 Laboratórna skúška

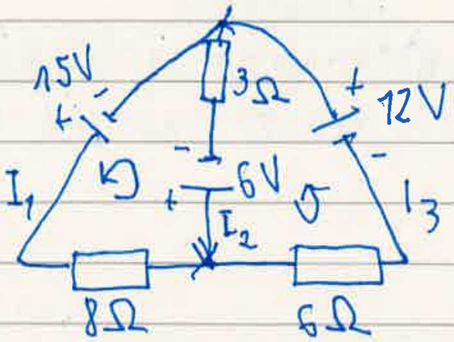
Akustika

- časť fyziky zaoberajúca sa šírením zvuku
- zvuk - pravidelné vnemie - zmena tlaku

- pokus 1 
- pokus 2 
- pokus 3 
- pokus 4 
- pokus 5 
- pokus 6 

3.

6. mám



$I_1 + I_2 = I_3$

$15V - 6V = 8I_1 - 3I_2$ (9V)

$6 + 12 = 3I_2 + 6I_3$

$27 = 8I_1 + 6I_3$

$27 = 8I_1 + 6I_1 + 6I_2$

$45 = 8I_1 + 6I_1 + 16I_1$

$45 = 30I_1$

$15 = 10I_1$

$I_1 = 1{,}5 = \frac{3}{2}$

$I_2 = 1$

$I_3 = 2{,}5$

$9 = 8 \cdot \frac{3}{2} - 3I_2 \quad / + 3I_2 - 9$

$3I_2 = \frac{24}{2} - 9 \quad / 3$

$I_2 = 4 - 3$

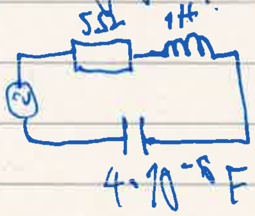
$I_2 = 1$

30. $T = 2\pi\sqrt{\frac{l}{g}}$ $\quad l = \frac{3}{4} l_0 \quad \sqrt{\frac{3}{4}} \doteq 0{,}86602540 3$

$F_g = K \cdot \frac{m_1 \cdot m}{r^2} \quad \frac{\frac{1}{81} m_Z}{(3{,}7)^2} \quad \left(\frac{1}{3{,}7}\right)^2 m_N^2 \quad \frac{(3{,}7)^2}{81} \doteq 0{,}169$

2. $U_{ef} = 5\,V \quad R = 5 \quad L = 1\,H \quad C = 4 \cdot 10^{-6}\,F$

ω, I



$\omega L - \frac{1}{\omega C} = 0 \quad \omega - \frac{1}{\omega 4 \cdot 10^{-6}} =$

$\omega - \frac{10^6}{4\omega} \quad / \cdot \omega + \frac{10^6}{4}$

$\omega^2 = \frac{10^6}{4}$

$\omega = 500 \quad \varphi \doteq 79{,}577$

c) ~~7,071~~ 10,

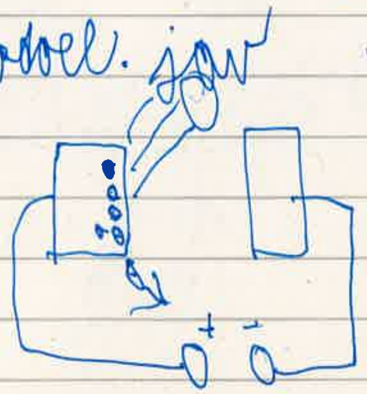
C daná s porozumením!!!

Einsteinova $h \cdot f = W_v + \frac{1}{2} m v^2$ $E = h f$

fotón - svetelné kvantum, častica $v = c$

~~$\lambda = \dots$~~ Comptonov jav 

- fotoel. jav $\lambda = \frac{c}{f} = cT$ $f = \frac{c}{\lambda}$ $h \frac{c}{\lambda} = W_v + \frac{1}{2} m v^2$



príklad

$\lambda = 360 \cdot 10^{-9}$ m

$v = 30000$ m/s

g $F = m \cdot g$ $p = \frac{F}{S}$

1) a) 50 kg/m² b) 55 kg/m² $\rho = 1{,}2759$ kg/m³

$p + \frac{1}{2} \rho v^2 = p + 50 \cdot g$ ~~kg/m²~~

$\frac{1}{2} \rho \cdot v^2 = 50 \cdot g$ a) ~~8,853 m/s~~ 27,728 b) ~~9,285~~ 29,081

$v^2 = \frac{2 \cdot 50 g}{\rho}$ ~~$v = 8{,}853$ m/s~~

4) $F_m = B \cdot I \cdot l \cdot \sin \alpha$ $l = 5 \cdot 10^{-2}$ m $m = 5 \cdot 10^{-2}$ kg

$I = 10$ A $\beta = 1°$ $g = 10$ $\alpha = 90°$

$F_m = F_g \cdot \sin$ ~~...~~ ~~$5 \cdot 10^{-1} = B \cdot 10 \cdot 5 \cdot 10^{-2} \cdot \sin \alpha$~~

~~1. 4,134 T~~ ~~$1 = B \sin \alpha$~~

~~$B = \frac{F_m}{I \cdot l \cdot \sin \alpha} = 4{,}43356494$ T~~ $\frac{1}{\cos \beta} \cdot F_g$

0,5 T

$B = 0{,}249328002$ T ✓ 2. $\Delta F =$ ~~0,058716791 N~~

3. 44,92289121° ✓

4 anyhow

7. $y_m = 10^{-1}$ m $T = 2$ s $t = 0{,}2$ s
$\omega = \pi$

$y = 0{,}0587$
$v = 0{,}254$
$a = -0{,}579$

| 6. $f = 10$ kHz
$C = \varepsilon \frac{S}{d}$ C 4x

$\omega = \frac{1}{\sqrt{LC}}$

$\omega = \sqrt{\frac{L}{C}}$

$s = 4\pi r^2$
volný: $s = \frac{1}{2} g t^2$
$v = \sqrt{2gh}$

hore:
$h = v_0 t - \frac{1}{2} g t^2$ $T = \frac{v_0}{g}$
$v = v_0 - g \cdot t$
$H = \frac{v_0^2}{2g}$

5. $v = \frac{1}{10} c = \frac{1}{10} 3 \cdot 10^8$ m/s $= 3 \cdot 10^7$ $B = 0{,}5$ T $Q = 1{,}6 \cdot 10^{-19}$ C $m = 9{,}1 \cdot 10^{-31}$ kg

$F_m = Q v B \sin\alpha$ $F_d = \frac{m v^2}{r}$

$F_m = F_d$
$Q v B = \frac{m v^2}{r}$ /: $v B Q \cdot r$
$r = \frac{m v}{B Q}$ ~~$= 3{,}4125 \cdot 10^{-8}$ m~~ ~~$E = 4{,}095 \cdot 10^{-24}$ J~~ $E = 4{,}095 \cdot 10^{-16}$ J

$r = 3{,}4125 \cdot 10^{-4}$ m

8. $\max = 10^{-9}$

$2 \cdot 10^{-9}$ $3 \cdot 10^{-9}$ $6 \cdot 10^{-9}$ (+ −) 300 V

$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$

$U \cdot C = Q$ $Q = 300$ nC

$\frac{1}{2} + \frac{1}{3} + \frac{1}{6}$

1. $C_s = 10^{-9}$ F $= 1$ nF

$\left(\frac{3}{6} + \frac{2}{6} + \frac{1}{6}\right) \cdot \frac{1}{10^{-9}}$

$W = \frac{1}{2} C U^2$
2 nF 150^2

2. 50 V

$\frac{1}{10^{-9}}$

4. 22500 nJ

$F_{h} = -k y$ $f = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$ $y = y_m \sin \omega t$

$k = ? \; ~~m/s~~ \; kg/s^2$

$g = 10 \; m \cdot s^{-2}$ $l = 4 \cdot 10^{-2} \; m$

$\frac{m \cdot g}{k} = l$ $m^{?}/s^2$

př. $k = 250$ 4·10

$\frac{l}{g} = \frac{m}{k}$ $m = \frac{l}{g} \cdot k$

$f = 2{,}5164$

2. $\frac{U_2}{U_1} = \frac{N_2}{N_1}$ $\frac{U_1}{U_2} = \frac{I_2}{I_1} = \frac{N_1}{N_2}$

$\frac{g}{l}$ $d = k^{-1} \frac{x}{y}$

$U_1 \cdot N_2 = U_2 \cdot N_1$

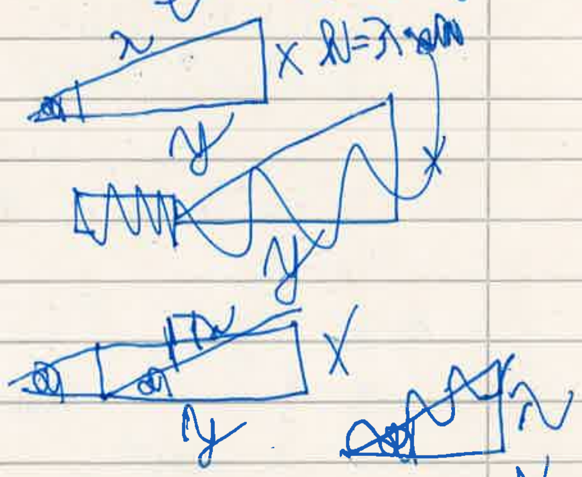
$U_2 = 110$ 1x800

$I_2 = 16{,}36$

$N_2 = 0{,}81$ ~~$N_1 = 2200$~~

$N_1 = 109{,}09$

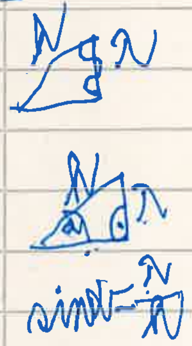
109,9



4. interferenční $2nd + \frac{\lambda}{2} = k\lambda$ $c = 3 \cdot 10^8 \; m/s$

$2nd + \frac{\lambda}{2} = (2k+1)\frac{\lambda}{2}$ $c_{olej} = 2 \cdot 10^8 \; m/s$

$n_{olej} = \frac{3}{2}$



$2nd = k\lambda - \frac{\lambda}{2}$ $2nd = k\lambda - \frac{\lambda}{2}$

$d = 0{,}2 \; \mu m = 2 \cdot 10^{-7} \; m$

$\frac{2nd}{k} = \frac{\lambda}{2}$ $2nd = (k - \frac{1}{2})\lambda$

~~optické ... 3 · 10^{-4} m = 10^{-8}~~

$\frac{2nd}{k - \frac{1}{2}} = \lambda$

viditelné $790 \cdot 10^{-9} - 390 \cdot 10^{-9}$ m $\frac{4nd}{k} = \lambda$

$3 \cdot 2 \cdot 10^{-7} = 6 \cdot 10^{-7}$

max $1{,}2 \cdot 10^{-6}$ m $2nd = (2k+1)\frac{\lambda}{2} - \frac{\lambda}{2}$

min $6 \cdot 10^{-7}$ m $2nd = (2k+1-1)\frac{\lambda}{2} = (2k)\frac{\lambda}{2} \; / : 2k \cdot 2$

vle

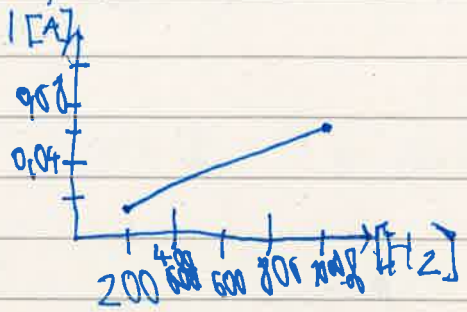
max $4 \cdot 10^{-7}$ m $\frac{2nd}{k} = \lambda$

min $6 \cdot 10^{-7}$ m

10. $X_C = 500\ \Omega$ $f = 200\ Hz$ $C = 1{,}5915 \cdot 10^{-6}\ F$

$X_C = \frac{1}{\omega C}$ $C = \frac{1}{X_C \omega}$

$\frac{6}{\frac{1}{X_C \omega}} = 6 C \omega = 6 (2\pi f$



11. $C = 16 \cdot 10^{-6}\ F$ $R = 200\ \Omega$ $U = 220\ V$ $f = 50\ Hz$

$\omega = 2\pi 50$

$X_C = \frac{1}{\omega C} = 19{,}89436789$

$Z = 282{,}0967695\ \Omega$ $I = 0{,}7798\ 74226\ A$

$U_R = 155{,}9748954$

$U_C = 155{,}9510476$

$\frac{\pi}{2}$

12. $V = 5 \cdot 10^{-2}\ m^3$ $m = 0{,}5\ kg$ $V = \frac{4}{3}\pi r^3$

$F_g = F_{V2}$

$m \cdot g = V \cdot \rho \cdot g$ $1 \cdot \rho = 954{,}9296586\ \frac{kg}{m^3}$

$m = V \cdot \rho$ $2 \cdot m_{Vd} = 0{,}02359875$

$\frac{m}{V} = \rho$

13. l_0 $\sigma_N = \varepsilon \cdot E$ $E = 70$ Pa $\alpha = 2{,}9 \cdot 10^{-5} K^{-1}$

$\sigma_N = 0{,}029319$

$\sigma_N = 0{,}29319\ P_a$

$\sigma_N = 29\ MP_a$

$\Delta l = 10^{-3}\ m$

$\frac{\Delta l}{l_1} = \frac{1}{E} \cdot \frac{F}{S}$ $S = r^2 \cdot \pi$

$ES \frac{\Delta l}{l_1} = F$

$F = 78539{,}81638\ N$

$W = 7{,}85398\ 1634\ J$

0) $F = 2277{,}654674\ N$

15. $10^{-9} \cdot 12 \cdot 10^{-2} \cdot 12 \cdot 10^{-2}$ do ~~kwadratu~~ $4 \cdot 10^{-13}$

$S_{drewna} = 900 \cdot kg \cdot m^{-3}$ $S_{H_2O} = 1000$ $g = 9{,}81$

$F_{Vz} = V \cdot S \cdot g = 56{,}5056\,N$ ~~$m = 144 \cdot 10^{-3}\,kg$~~

~~$k = 141{,}264$~~ $m = 1{,}296\,kg$

$F = 0{,}565056$ $f = 49{,}84879165\,Hz$

$k = 141{,}264$ ~~$T = 0{,}$~~

$T = 2\pi\sqrt{\frac{m}{k}}$ $T = 0{,}601820004\,s$

16. $I_1 = 1\,A$ $R = 20\,\Omega$ $L = 2\,H$ $f = 50\,Hz$ $U = 20\,V$

$Z = \sqrt{20^2 + (100\pi \cdot 2)^2} = 628{,}63676\,\Omega$

$I_2 = 0{,}031814875\,A$

17. $m = 30\,kg$ $\alpha = 4°$ $F_g = m \cdot g$

$F_W = \sin\alpha \cdot F_g$

1. $F_p = 0{,}68431007\,N$ ~~$54{,}7448\,N$~~

2. $a = 0{,}38431007\,m/s^2$

$F = m \cdot a$ 3. $t = 36{,}06978\,s$

$a = \frac{F}{m}$ ~~4.~~ $v = 13{,}862016577\,m/s$

$s = \frac{1}{2} a t^2$

$t^2 = \frac{2s}{a}$

$t = \sqrt{\frac{2s}{a}}$

19. $\frac{1}{f} = \left(\frac{n_2}{n_1} - 1\right)\left(\frac{1}{R_1} + \frac{1}{R_2}\right)$ $n_1 = n_{wa} = 1$ $n_2 = 1{,}5$ $n_1 = 1{,}63$ $R = 0{,}5\,m$

$\phi = 2$ $f = \frac{1}{2}$ ~~wypukłe~~

$\phi = -0{,}31901$ $f = -3{,}134615385$ ~~rozpraszające~~

17. $T = 1\,s$ $g = 9{,}81\,m/s^2$ $g_M = 1{,}625\,m/s^2$

$T = 2\pi\sqrt{\frac{l}{g}} = 2\pi\frac{\sqrt{l}}{\sqrt{g}}$ $/\cdot\sqrt{g} : 2\pi$

$\frac{T\sqrt{g}}{2\pi} = \sqrt{l}$ a) $l = 0{,}248490202\,m$

b) $T = 2{,}457015075\,s$

$T = \pi\sqrt{\frac{l}{g}} + \pi\sqrt{\frac{l}{2g}} = T = \pi\left(\sqrt{\frac{1}{g}} + \sqrt{\frac{1}{2g}}\right) = 1{,}712285017\,s$

21. $W_v = 8{,}50\cdot10^{-19}\,J$ $h = 6{,}625\cdot10^{-34}\,Js$

$f = \frac{W_v}{h} = 1{,}28301\cdot10^{15}$

a) $\lambda = 2{,}339823529 4\cdot10^{-7}\,m$ c) Elektróny by mohli uvoľnené a mohol by nastať vonkajší fotoel. jav.

b) nenastal by fotoel. jav.

22. $d = 2\cdot10^{-4}\,m$ $\sigma = \frac{F}{l}$ $28°C \rightarrow 20°C$ $\rho_0 = 870\,kg\cdot m^{-3}$

$\sigma = 29{,}1\cdot10^{-3}\,N m^{-1}$ $F = \rho\cdot g\cdot h\cdot S$ $\beta = 1{,}06\cdot10^{-3}\,K^{-1}$

$\rho = 862{,}684436$

$\rho g h S = \sigma l$ $/ : \rho g S$

$h = \frac{\sigma l}{\rho g S} = 0{,}034385236\,m$ a) $\cdot 2$

b) $0{,}01719261 \cdot 2$

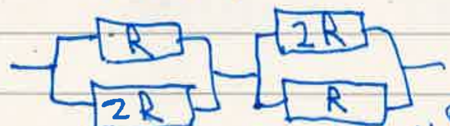
c) $0{,}206311416 \cdot 2$

d) ~~0,206311~~

23.

24. 95% účinnosť $V = 1{,}5\cdot10^{-4}\,m^3$ $\Delta T = 85°C$ $P_v = 500\,W$

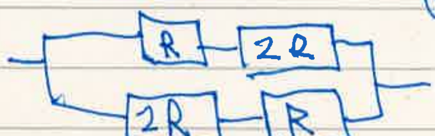
$c = 4200\,J\cdot kg^{-1}\cdot K^{-1}$ $t = 112{,}7368421\,s$ $P = 475\,W$

26. 

$R_v = 80\,\Omega = 4 : 2 \cdot R_v = \frac{4}{3}R$ $\frac{1}{R} + \frac{1}{2R} = \frac{3}{2R} = \frac{1}{R_v}$

$R_v = \frac{2}{3}R$

a) $R = 60\,\Omega$



b) $90\,\Omega$

$\Delta U = W' + Q$

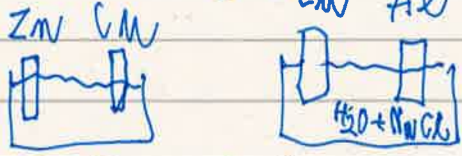
25. $m = 0{,}1\ kg$ 1-2-3-4-1   a, izochorický, izotermický, ..., izotermický

$M = 2 \cdot 10^{-3}\ kg \cdot mol^{-1}$ b, při 1 a 2

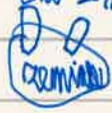
$R_m = 8{,}31\ J \cdot K^{-1} \cdot mol^{-1}$ $n = 50\ mol$ d, ~~249,3 J~~ 83,100 kJ

$V = 0{,}103{,}875$

$pV = NkT = n R_m T$ $V = \frac{n R_m T}{p}$



$R = \frac{\rho \cdot l}{S}$ $I = \frac{U}{R} = \frac{U_e}{R_i + R}$ $G = \frac{1}{R}$



$U = 1{,}6\ V$

$I = 0{,}8\ A$

2. $h = 0{,}015$ $a = 0{,}04$ $f = 0{,}015$

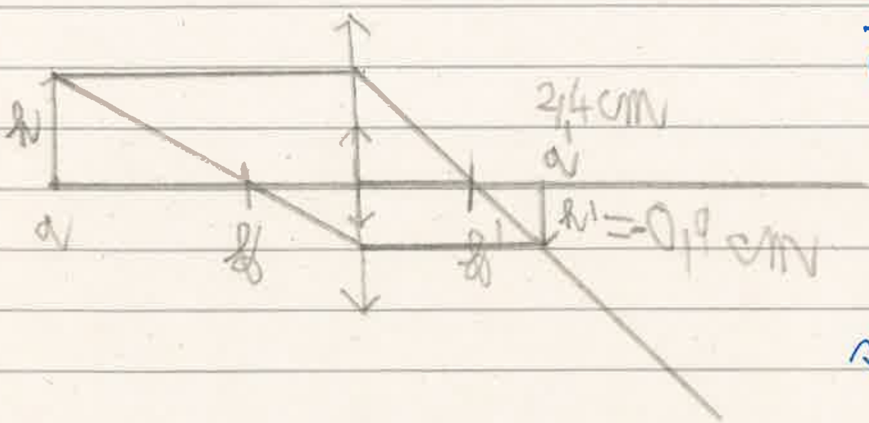
$h' = 9 \cdot 10^{-3}$ $a' = 0{,}024$

$Z = -\frac{a'}{a}$

$Z = 0{,}6$

$\frac{1}{a} + \frac{1}{a'} = \frac{1}{f}$

$\frac{1}{a'} = \frac{1}{f} - \frac{1}{a}$



$s = v_0 t - \frac{1}{2} a t^2$

28. $m = 1{,}5 \cdot 10^{-3}\ kg$ $h = 5\ m$ $h_v = 1{,}5\ m$ $g = 9{,}81\ m/s^2$

$v_{dv} =$ ~~8,136717523 m/s~~ 9,904544412 m/s $t_{dv} = 1{,}009637555\ s$

$\frac{10}{9{,}81}$

Seminár

- príklad č. 4
- vodič $l = 0{,}05\,m$ a $m = 0{,}05\,kg$
  $I = 10\,A$ $\alpha = 14^\circ$ $g = 10\,m \cdot s^{-2}$

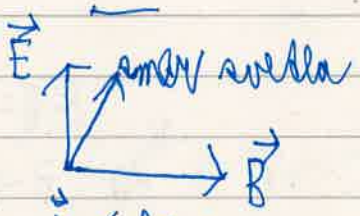
$\vec{F}_m = \vec{B} \cdot I \cdot l \cdot \sin\alpha$ $\vec{F}_g = m \cdot g = 0{,}5\,N$

$F_g \cdot \sin\alpha \cdot \tan\alpha = F_g \cdot \tan\alpha = F_m$ $\frac{F_g}{\cos\alpha} = F_m$

$B = 0{,}124932802\,T$ $F_{výsledná} = F_g + F_m$

Svetlo

- elektromagnetické vlnenie
- priečne vlnenie
- nepolarizované má $\vec{E}$ a $\vec{B}$ kolmé - stále sa vždy kolmé
- polarizované má $\vec{E}$ a $\vec{B}$ v určitom smere



$\vec{E}$ a $\vec{B}$ sú kolmé

- index lomu = $n = \frac{c}{v_{v\ prostredí}}$
- frekvencia a farba sa nemení

- príklad č. 5 ~~náboj Q = 1 e~~ $U = 1000\,V$

$v_1 = 0{,}146\,m$ $\quad v_2 = 0{,}153\,m$

$B = 0{,}14\,T$ $\quad$ ~~$Q = 1{,}6 \cdot 10^{-19}\,C$~~

elementárny elektrický náboj $1{,}6 \cdot 10^{-19}\,C = Q$

atómová hmotnostná konštanta $1{,}66 \cdot 10^{-27}\,kg$

$U \cdot Q =$ elektrické pole

$E_k = \frac{1}{2} m \cdot v^2$

$U \cdot Q = E_k$

$B \cdot Q = m \cdot \frac{v}{r}$

~~$E_k = 1000\,J$~~

~~$2000 = m \cdot v^2$~~

~~$m = \frac{2000}{v^2}$~~

$\frac{2UQ}{v^2} = m$

$A_r = \frac{m}{m_A}$

$B \cdot Q = \frac{2UQ}{v^2} \cdot \frac{v}{r} \quad / : Q$

$B = \frac{2U}{v^2} \cdot \frac{v}{r}$

$B = \frac{2U}{v \cdot r} \quad / \cdot v : B$

$v = \frac{2U}{B \cdot r}$

$m = \frac{2UQ}{\left(\frac{2U}{B \cdot r}\right)^2} = \frac{2UQ}{\left(\frac{4U^2}{B^2 \cdot r^2}\right)}$

$m = \frac{Q}{\left(\frac{2U}{B^2 \cdot r^2}\right)} = \boxed{\frac{Q \cdot B^2 \cdot r^2}{2U} = m}$

$m_1 = 3{,}3423488 \cdot 10^{-26}\,kg$

$A_1 = 20{,}13463133$

$m_2 = 3{,}6705312 \cdot 10^{-26}\,kg$

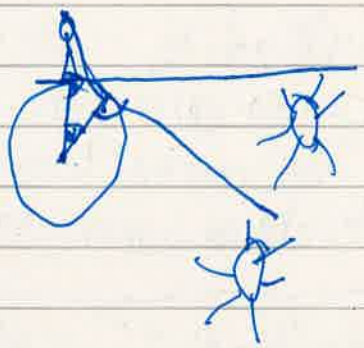
$A_2 = 22{,}11163373$

$F_m = B \cdot Q = 2{,}24 \cdot 10^{-20}$

24 h 86400 s
11,1 s

$\alpha = 0{,}04625°$

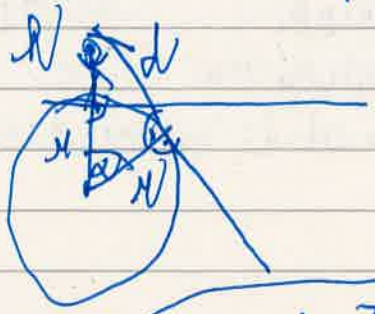
$N = 1{,}7\,m$



$\alpha = ?$

$N = \frac{2R}{\alpha^2}$

$N = 5217957{,}279\,m$



príklad - v kalorimetri je olej

$C_{kalorimetra} = 63 \frac{J}{°C}$

$u_{výs} = i \cdot Z$

$Z = \sqrt{X_R^2 + (\omega L - \frac{1}{\omega C})^2}$

- príklad 2. obvod: zdroj 50 V do série rezistor 5 Ω, cievka 1 H, kondenzátor 4 μF

a) nakreslí obvod

b) pri akej frekvencii bude najvyšší prúd?

79,57747155 Hz

c) Aký je jeho efektívna hodnota? 10 A

$u_{výs} = 50\,V = i \cdot Z$

$Z = \sqrt{X_R^2 + (\omega L - \frac{1}{\omega \cdot 10^{-6}})^2} = \sqrt{25 + (\omega - \frac{1}{\omega \cdot 10^{-6}})^2} = \sqrt{25 + \omega^2 - \frac{2}{10^{-6}} + \frac{1}{\omega^2 \cdot 10^{-12}}}$

najvyšší prúd je ak $(\omega L - \frac{1}{\omega C})^2 = 0$ $0 = (\omega - \frac{1}{\omega \cdot 4 \cdot 10^{-6}})^2$ ⇒ rezonancia

$0 = \omega - \frac{1}{\omega \cdot 4 \cdot 10^{-6}} \;/ \cdot \omega + \frac{1}{4 \cdot \pi^{-6}}$

$\frac{1}{4 \cdot 10^{-6}} = \omega^2$

$f = 2\pi \cdot \omega$

rezonančná frekvencia

$f = \frac{1}{\sqrt{L \cdot C}} \cdot \frac{1}{2\pi}$

$\omega = \frac{1}{\sqrt{L \cdot C}}$

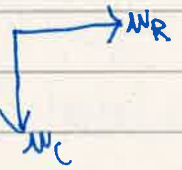
odstredivá sila = $m \cdot \frac{v^2}{r}$

- príklad 8. - obvod so 16 kHz, cievkou a kondenzátorom
  a) ako sa zmení frekvencia ak vzdialenosť platní kondenzátora sa zmenší na štvrtinu? zníži sa dvojnásobne
  b) ako sa zmení kapacita kondenzátora? zoštvornásobí sa.

- príklad 11. - obvod so sériovým zapojením C = 16 μF a R = 200 zapojený na 50 Hz
  a) zistite impedanciu $Z = \sqrt{40000 + \left(\frac{1}{100\pi \cdot 16 \cdot 10^{-6}}\right)^2} = \sqrt{40000 + \left(\frac{1}{1600\pi \cdot 10^{-6}}\right)^2}$

  b) zistite prúd pretekajúci obvodom ak U = 220 V? $I = \frac{220}{Z}$
  c) zistite napätie na rezistore a kondenzátore.
  $u_R = \frac{220}{Z} \cdot 200$
  $u_C = \frac{220}{Z} \cdot \frac{1}{\omega \cdot C}$

  d)



- príklad 16. - obvod s cievkou (L = 2H a R = 20 Ω)
  U = 20 V f = 50 Hz

a) zistite prúd pri jednosmernom a striedavom prúde I = 1 A $i = \frac{20}{628{,}63676}$
b) zistite impedanciu $Z = \sqrt{400 + 200^2\pi^2} = 628{,}63676\ \Omega$

- príklad 23. - primárna cievka transformátora má 2400 závitov a 120 Ω, sekundárna cievka má 120 závitov a odpor $5 \cdot 10^{-2}$ Ω, účinnosť 90%, napätie na primárnej cievke je 2200 V, príkon 2 kW
  a) $U_2 = 110$ V $I_2 = 16{,}\overline{36}$ A $= 2000\,W \cdot 0{,}9 \cdot \frac{1}{U_2}$ $I_1 = 0{,}\overline{90}$ A
  → zistite U a I na sekundárnej cievke
  - b) aké straty energie pripadajú na vinutie cievok? $I_1^2 \cdot R_1 + I_2^2 \cdot R = 99{,}17355372$ W

10 d = 1,8 cm

$9 \cdot 0{,}144$

$$\begin{array}{r} 0{,}144 \\ \cdot\, 9 \\ \hline 1{,}296 \end{array}$$

$1{,}296$

příklad iný $f = ?$ $\frac{1}{3}f = \frac{10^3}{7{,}5}$ Hz $= \frac{1000}{7{,}5}$ Hz $f = \frac{3000}{7{,}5} = 400$ Hz

$3T = 7{,}5\ ms = 7{,}5 \cdot 10^{-3}\ s$

příklad iný $y = y_m \cdot \sin\left(2\pi \cdot t + \frac{\pi}{4}\right)$ $y_m = 2\ cm$

$t = 0$

$y = 2\ cm \cdot \sin\left(\frac{\pi}{4}\right) = 2\ cm \cdot \frac{\sqrt{2}}{2} = \sqrt{2}\ cm$

příklad iný

$y = \sin\left(2\pi \cdot t + \frac{\pi}{4}\right) = 1$

$\frac{\pi}{2} = 2\pi \cdot t + \frac{\pi}{4} = \frac{2\pi}{4}$ $\frac{3\pi}{4} = 2\pi \cdot t \ /:\pi:2$ $\frac{3}{8}\ s = t$

$\frac{2\pi \cdot 3}{8} - \frac{\pi}{4} = \frac{3\pi}{4} - \frac{\pi}{4} = \frac{2\pi}{4} = \frac{\pi}{2}$ $t = 0{,}375\ s$

$0 = \sin\left(2\pi \cdot t - \frac{\pi}{4}\right)$ $0 = 2\pi \cdot t - \frac{\pi}{4}$ $\frac{\pi}{4} = 2\pi \cdot t$

$\frac{1}{8}\ s$ = max rýchlosť v

---

příklad 1. $S = 30\ m^2$ $m = 1500\ kg$ $p_{atmosferický} = 100000\ Pa$

$g = 9{,}81\ N/kg$ $50\ kg/m^2$ $\rho_{vzduchu} = 1{,}27\ \frac{kg}{m^3}$ $v = 27\ \frac{m}{s}$

$\sqrt{\frac{2 \cdot 9{,}81 \cdot 50}{1{,}27}} = v$

$g \cdot 50\ kg/m^2 + 100000 = 100000 + 0{,}5 \cdot 1{,}27 \cdot v^2$

---

příklad 15. 10 cm, 12 cm, 12 cm — plávu na hladine, zatlačíme o 0,4 cm do vody

$g = 9{,}81\ m/s^2$ $\rho_{dubového\ dreva} = 900\ kg/m^3$ $\rho_{vody} = 1000\ kg/m^3$ $h_1 = 9\ cm$ $h_2 = 9{,}4\ cm$

$V_{hranolu} = 1440\ cm^3 = 1{,}44\ dm^3 = 0{,}00144\ m^3$ $m_{hranolu} = 1{,}296\ kg \doteq 1{,}3\ kg$

$F_{vz} = F_g$

$S \cdot h \cdot \rho_{vody} = S \cdot h \cdot \rho_{dreva}$

$h_1 = h_2 \cdot 0{,}9$

$h_1 = 9\ cm$

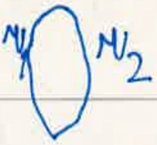
určte silu spôsobenú ponorením F_{vz} pre $0{,}4\ cm$ $= 0{,}4\ cm \cdot 12\ cm \cdot 12\ cm \cdot 9{,}81 \cdot 1000 = 0{,}565\ N = \Delta F$

určte periódu $T = ?\ s$

$T = 2\pi \cdot \sqrt{\frac{m}{k}} = 2\pi \cdot \sqrt{\frac{l}{g}}$

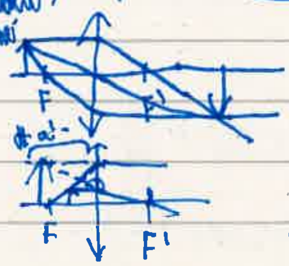
pružina kyvadlo

$F = k \cdot y = 0{,}565\ N = k \cdot 0{,}4\ cm$



Optika - šošovka

- spojka ↕
- ~~rozptylka~~



tenká šošovka $\frac{1}{f} = \left(\frac{n_2}{n_1} - 1\right)\cdot\left(\frac{1}{r_1} + \frac{1}{r_2}\right)$

geometricky $\frac{1}{f} = \frac{1}{a} + \frac{1}{a'} = \varphi$ optická mohutnosť

$Z = \frac{y'}{y} = -\frac{a'}{a}$

- oko - akomodácia φ (zaostrenie)
- najbližší bod - 5 cm
- najvzdialenejší - ∞
- konvenčná zraková vzdialenosť - 25 cm
- chyby/vady
  - krátkozrakosť

krátko

ďaleko

$0,05 \cdot 0,05 = 0,0025$

$0,0025 \cdot 0,05 = 0,000125$

430^2 420^2 $500^2 = 250000$ $400^2 = 160000$

- úloha: ~~padajúci kamienok padá 10 s koľko metrov padá?~~ zvuk za 10 s do studne

343 m/s

t_N - t_{10} - t_{zvuk} $t_N = 8,874$ s

$g = 9,81$ $s = \frac{1}{2} g t^2$

$t_{zvuk} = \frac{s}{343 m/s}$ $s = 386,218$ m

$t_N = 10 - \frac{\frac{1}{2} g t_N^2}{343 m/s}$

$343 t_N = 3430 - \frac{1}{2} g t_N^2 \quad / -3430 + \frac{1}{2} g t_N^2$

$\frac{1}{2}\cdot 9,81 \cdot t_N^2 + 343 t_N - 3430 = 0$

$t_N = \frac{-343 \pm \sqrt{343^2 - 4\cdot 4,905\cdot(-3430)}}{9,81}$

$4\cdot 4,905 \cdot 3430$ $19,62$

$t_1 = \frac{-343 \pm 430,05}{9,81}$

$430,05 - 343 = 87,05$

$343 \cdot 343$: $1029 + 13720 + 102900 = 117649$

$117649 + 67296,6 = 184945,6$

$\sqrt{\ } = 430$

32
21

3430	430	430,5	430,445	125
· 19,62	· 430	· 430,5	· 430,445	· 4,19
1168,60	0	2152,5	430,05	1125
20580	12900	0	· 430,05	1250
30870	172000	12915	21,5025	90000
34300	184900	17220	0	
67296,6		184115	0	92375

12901,5
172020
184949 11,5025

$87,05 : 9,81 = 8,08$
8,52

78,48

$8705 : 981 = 8,8$
8520

-78,48

$870500 : 981 = 8,874$

8570
7320
4530
606

8570	981	7320
− 7848	· 7	− 6867
732	6867	453

981	4530	10,000
· 4	− 3924	− 8,874
3924	606	1,126

4,19 · 12,5 = 22,95 ; 83,80 ; 419,00 ; 60375

343 · 1,126 = 12,058 ; 6,86 ; 343 ; 343 ; 386,218

S = 112 m
m = 5 kg
obdĺžnik 35 · 20 cm na konci?

1000000
V = 603,75 cm³

5000 g

Príklad č. 12 guľa 5 cm hmotnosť 5 kg $V = \frac{4}{3} \pi r^3$ $r^3 = 125 cm^3$

$r = 0,05 m$ $r^3 = 0,000125 m$ ~~V = 0,0002375 m³~~ $\frac{4}{3}\pi = 4,19$

1. Akú hustotu má kvapalina v ktorej sa vznáša? 954 kg/m³ $\rho = 954 \frac{kg}{m^3}$
2. Aká je hmotnosť telesa, ktoré vložené do gule plnej sa vznášalo vo vode? 0,0236

- príklad č. 22 - Kapilára má priemer 0,2 mm (0,0002 m) a, ako vysoko v nej vystúpi benzén, ak je pri teplote 28°C jeho hustota 870 $kg \cdot m^{-3}$ a povrchové napätie 29,1 $mN \cdot m^{-1}$ pri 20°C? β pre benzén = $1{,}06 \cdot 10^{-3}\ K^{-1}$

- príklad č. 5

$v = \frac{6}{10} = 6 \cdot 10^{-1}$ $B = 5 \cdot 10^{-1}\ T$ $m = 9{,}1 \cdot 10^{-31}\ kg$

$Q = 1{,}6 \cdot 10^{-19}\ C$ $c = 3 \cdot 10^{8}\ m/s$

$m \cdot \frac{v^2}{r} = B \cdot Q$

$r = \frac{m \cdot v}{B \cdot Q} = \frac{9{,}1 \cdot 10^{-31} \cdot 6 \cdot 10^{-1}}{5 \cdot 10^{-1} \cdot 1{,}6 \cdot 10^{-19}} = \frac{9{,}1 \cdot 6 \cdot 10^{-12}}{5 \cdot 1{,}6} = \frac{9{,}1 \cdot 3 \cdot 10^{7} \cdot 10^{-12}}{8} = \frac{27{,}3 \cdot 10^{-5}}{8}$

$r = 3{,}412 \cdot 10^{-5}\ m$

$27{,}3 : 8 = 3{,}412$
33
10
20

$E_k = \frac{1}{2} 9{,}1 \cdot 10^{-31} \cdot 9 \cdot 10^{16} = \frac{1}{2} 81{,}9 \cdot 10^{-15}\ J$

$E_k = \frac{1}{2} m v^2$ $= 40{,}95 \cdot 10^{-17}\ J$

864 · 9,3 = 2592 + 7776 = 8035,2

$\sqrt{2 \cdot 354{,}1929} = 189{,}$
153 = 28·5
2854 = 309 · 9
7319 = 318 ...

18 · 8 = 144; 309 · 9 = 2781

2854 − 2781 = 0073

159 · 2 = 318

6100 − 4770 = 1330

$220 : 1590 = 0{,}13$
2200
6100
1330

1590 · 3 = 4770

1. $p + \frac{1}{2}\rho v^2 = p + 50 \cdot 9{,}81 \cdot 30 : 30 = p + 50 \cdot 9{,}81$

$\frac{1}{2}\rho v^2 = 50 \cdot 9{,}81$ $\qquad \rho = 1{,}2759 \frac{kg}{m^3}$

$v^2 = \frac{2 \check{h} g}{\rho}$

$v = \sqrt{\frac{2 \check{h} g}{\rho}}$ $\qquad v = \sqrt{\check{h}}\ \sqrt{2g}$ $\qquad \sqrt{24{,}92}$ $\qquad v_1 = \sqrt{50}\ \sqrt{24{,}92}$

24,12 · 50 = 0 $\qquad$ 1,2759 · 2 = 2,5548 · 9,81 = 24,92

124600 $\qquad \sqrt{1246} = 35{,}28$

346 = 65 · 5
2100 = 752 · 2
59600 = 7048 · 8

$v = \sqrt{\check{h}} \cdot \sqrt{\frac{2g}{\rho}}$ $\qquad$ 9,81 · 2 = 19,62

128 · 5 = 640 $\qquad$ 19,62 : 1,2759

19,62 : 1,28 = 15,32

$\frac{2g}{\rho} = 15{,}33$

15,33 · 50 = 0

$v = \sqrt{766{,}5}$

$\sqrt{766{,}50} = 87{,}5$
1265 = 167 · 7
9600 = 174 5 · 5
87500

$\sqrt{766{,}50} = 27{,}6$
366 = 47 · 7
3750 = 546 · 6

167 · 7 = 1169 $\qquad$ 1265 − 1169 = 96 $\qquad$ 87 · 2 = 174 $\qquad$ 87 · 87 = 609 + 6960 = 7569

1745 · 5 = 8725 $\qquad$ 1744 · 4 = 6976 $\qquad$ 9600 − 6976 = 2624 $\qquad$ 9600 − 8725 = 875

48 · 8 = 384 $\qquad$ 6976 + 1745 = 8721 $\qquad$ 47 · 7 = 329 $\qquad$ 366 − 329 = 37 $\qquad$ 546 · 6 = 3276

$s = 1000\,m$ $g = 9{,}81$ $r = 3\,mm = 3\cdot10^{-3}\,m$

$V = \frac{4}{3}\pi\cdot r^3$

~~$1000 = \frac{1}{2}g\cdot t^2$~~

$v = \sqrt{2gh} = \sqrt{2g\cdot10^3} = 140{,}071\,m/s$

$9{,}81$ $v = \sqrt{19620} = 140{,}071$

$\cdot 2$ $96 = 2\cdot4\cdot4$

$19{,}62$ $20\,28\,0\cdot0$

5 $2000 = 280\cdot0$

28000 $20000 = 2800\cdot7$

$\cdot\ 7$ $40000 = 28014\ldots$

196000

30. a) $T = 2\pi\sqrt{\frac{l}{g}} = 2\pi\frac{\sqrt{l}}{\sqrt{g}}$ T_2 bude $\sqrt{\frac{3}{4}}$ $\cdot T_1$ ✓

b) $g_{mesiac} = 1{,}625\,m\cdot s^{-2}$ ~~T_2 bude $\sqrt{\frac{1{,}625}{9{,}81}}\cdot T_1$~~ 1305

$g_{zeme} = 9{,}81\,m\cdot s^{-2}$ $-\ 950$

T_2 bude $\sqrt{\frac{9{,}81}{1{,}625}}\cdot T_1$ 355

25. $c = 4{,}2\,kJ\cdot kg^{-1}$ $m = 0{,}15\,kg$ $\Delta t = 85\,°C$ 475

$Q = m\cdot c\cdot\Delta t = 4{,}2\cdot0{,}15\cdot85$ $4{,}2$ $\cdot\ 7$

475 42 85 $\cdot\ 0{,}15$ 3325

$Q = 53{,}55\,J$ 95 $0{,}210$ 475

$\cdot\ 2$ $\cdot\ 5$ $0{,}420$ $\cdot\ 4$

950 475 85 $0{,}630$ 1900

~~$53{,}555$~~ $\cdot\ 0{,}63$

$53{,}555 : 475 = 0{,}112747$ 255

605 $t = 112{,}75\,s$ 5100

1305 $53{,}55$

3550

2250

3500

Mechanika, tekutiny — Príklady

1. Strecha domu má tvar ihlana, jedna stena má plochu 30 m^2. Strieška má plošnú hustotu 50 kg/m^2, atmosferický tlak 10000 Pa.

a) Pri akej rýchlosti sa strecha nadvihne? $\rho_{vzduchu} = 1{,}275\ kg/m^3$

$p_{\#} + 0{,}5\rho v^2 = p_{okolia}$. $p_{vnut} = p_{okolia} - 0{,}5\rho v^2 + 50\ kg/m^3 \cdot 9{,}81$ $50\ kg/m^3 \cdot 9{,}81 = 0{,}5\rho v^2$

$v = 27{,}\#72848776\ m/s$

b) Ako sa zmení výsledok, ak povrchu strieška dažďom 55 kg/m^2?

$v = 29{,}08188331\ m/s$ $\Delta v = 1{,}353395552\ m/s$

2. Striedavý prúd - Zdroj striedavého napätia s efektívnou hodnotou 50 V je zapojený do série s rezistorom s 5 Ω, cievka s 1 H a kondenzátor s $4\ \mu F = 4 \cdot 10^{-6}\ F$.

a) Nakreslite el. obvod.

b) Pri akej frekvencii bude obvodom prechádzať najväčší prúd?

$Z = R + X$ $\sqrt{R^2 + X^2}$ $X = \omega L - \frac{1}{\omega C}$ $\omega L = \frac{1}{\omega C}$ $\omega = \sqrt{\frac{1}{LC}}$ $f = 79{,}57747155\ Hz$

$\omega^2 = \frac{1}{LC}$ $\omega = 500$

c) Aký bude jeho efektívna hodnota? $I = 10\ A$

8. 2 mF | 3 mF | 6 mF

$C = \frac{1}{\frac{1}{2}+\frac{1}{3}+\frac{1}{6}} = \frac{1}{\frac{3}{6}+\frac{2}{6}+\frac{1}{6}} = \frac{1}{\frac{5}{6}} = 1$

2mF 3mF 6mF

$U_{maks} = 50\,V$

$C = 1\,mF \quad U = 300\,V \quad Q = CU \quad Q = 300\,mC$

$U_{maks} = \frac{Q}{C} = \frac{300\,mC}{6 \cdot 10^{-6}\,F}$ [illegible]

$Q_1 = Q_2 = Q_3 = 300\,mC$

$100 : 6 = 16{,}6$

$U_{maks} = \frac{300\,mC}{2\,mF} = 150\,V$

$W = \frac{1}{2} 2\,mF \cdot (150\,V)^2 = 22500\,mJ$

150
·150
0
7500
15000
22500

6. $C = \varepsilon C_0 \quad C = \frac{\varepsilon S}{d} \quad d = \frac{1}{4} d_0$ Thomsonov obrazec $\omega_0 = \frac{1}{\sqrt{LC}}$

a) [illegible]

b) [illegible]

11. $\Phi = \frac{1}{f} = \left(\frac{n_2}{n_1} - 1\right)\left(\frac{1}{N_1} + \frac{1}{N_2}\right)$

$N = 0{,}5\,m$

$\Phi = 2$

$f = \frac{1}{2}\,m$

a) [illegible]

b) $\Phi = \frac{1}{f} = \left(\frac{1{,}5}{1{,}63} - 1\right) \cdot 4 = \frac{0{,}5}{1{,}63} \cdot 4 = \frac{2}{1{,}63} \quad \Phi = \frac{2}{1{,}63}$

$\Phi = \frac{1}{f} = \left(\frac{1{,}5}{1{,}63} - 1\right) \cdot 4 = \left(\frac{1{,}5 - 1{,}63}{1{,}63}\right) \cdot 4 = -\frac{0{,}13}{1{,}63} \cdot 4 = -\frac{0{,}52}{1{,}63}$

$f = -\frac{1{,}63}{0{,}52}$

Zelenic $N = 0{,}015\,m = 1{,}5\,cm \quad f = 0{,}015\,m = 1{,}5\,cm$

$a = 0{,}04\,m = 4\,cm$

$\frac{1}{0{,}04\,m} + \frac{1}{a'} = \frac{1}{0{,}015\,m} \quad / - \frac{1}{0{,}04\,m}$

$\frac{1}{a'} = \frac{1}{0{,}015} - \frac{1}{0{,}04} = \frac{40 - 15}{0{,}60} = \frac{25}{0{,}60} \quad a' = \frac{0{,}60}{25} = 0{,}024$

$z = -\frac{1{,}5}{4 - 1{,}5} = -\frac{1{,}5}{2{,}5} = -\frac{3}{5}$

$a' = 24\,cm \quad N' = -\frac{a}{10\,cm} = -0{,}4\,cm$

1. $L = 1\,H$ $U_m = 50\,V$ $R = 5\,\Omega$ $C = 4\,\mu F$

$\omega_0 = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{4 \cdot 10^{-6}}}$ $Z = 5\,\Omega$ $I_m = 10\,A$

$Z = 5\,\Omega + \sqrt{\frac{1}{\sqrt{4 \cdot 10^{-6}}} - \frac{\sqrt{4 \cdot 10^{-6}}}{4 \cdot 10^{-6}}} = 5 + 0\,\Omega$

$I = \frac{10\,A}{\sqrt{2}}$ $f = \frac{1}{2\pi} \cdot \frac{1}{\sqrt{4 \cdot 10^{-6}}}\,Hz$ ~~$f = 2\pi \frac{1}{\sqrt{4 \cdot 10^{-6}}}$~~

$Z = 5\,\Omega$

$I = 10\,A$

11. $C = 16\,\mu F$ $R = 200\,\Omega$ $U = 220\,V$ $f = 50\,Hz$

$\omega = 100\pi\,rad/s$

$Z = 200 + \sqrt{\left(-\frac{1}{16 \cdot 10^{-6} \cdot 10^2 \pi}\right)^2} = 200 + \frac{1}{16 \cdot 10^{-4} \cdot \pi} = 200 + \frac{10^4}{16\pi}$

$I = \frac{220\,V}{200 + \frac{10^4}{16\pi}}$

$\frac{34}{19}$

$\frac{34}{15}$

$c = 3 \cdot 10^8$ $\lambda = \frac{c}{\frac{W_v}{h}} = \frac{3 \cdot 10^8}{\frac{2,9}{6,625} \cdot 10^{15}}$

Príklad 21: Elektrón platinovej elektródy $8,50 \cdot 10^{-19}\,J$
a) $h = 6,625 \cdot 10^{-34}\,J \cdot s$ λ na fotoelektrický jav? $2,34 \cdot 10^{-7}\,m$
b) čo ak väčšia? Vtedy fotoelektrický jav nenastane
c) čo ak menšia? Vtedy sa nastane aj vonkajší fotoelektrický jav

1700
850
· 3
2550

19,875 : 8,50 = 2,33
2875
3250
7000

1 1 1
6,625
· 3
19,875

$\frac{3 \cdot 10^{-7}}{\frac{8,50}{6,625}}$

- fotoelektrický jav
  - Einstein
  - dopadajúce fotóny vyrážajú elektróny z platne, ak majú veľa energie, vyrazia ich úplne von (vonkajší fotoelektrický jav)
  - inak sa len uvoľnia elektróny a je prúd (vnútorný fotoelektrický jav)

$E = h \cdot f$ $\quad h \cdot f = W_V + \frac{1}{2} m_e \cdot v^2$ $\quad h$ = Planckova konštanta $= 6{,}63 \cdot 10^{-34}\ J \cdot s$

$\lambda = 300\ nm = 300 \cdot 10^{-9}$ $\quad E = 6{,}63 \cdot 10^{-34} \cdot 10^{15} = 6{,}63 \cdot 10^{-19}$

$f = ?$

$\lambda \cdot f = v \quad c = 3 \cdot 10^8$ $\quad 1\,eV = 1{,}602 \cdot 10^{-19}\ J$

$v = c$

$\frac{v}{\lambda} = f \quad \frac{3 \cdot 10^8}{300 \cdot 10^{-9}} = \frac{3 \cdot 10^6}{3 \cdot 10^{-7}} = 10^{15}\ Hz$

$1{,}602 \cdot 2{,}1 = 3{,}3642$

- čím vyššia frekvencia, tým nižšia vlnová dĺžka
- hraničná frekvencia $W_V = h \cdot f$

Au a Pb

1153 THz $\quad$ 973 THz

$\frac{4{,}76}{6{,}63} \cdot 10^{34}$

$6{,}63 \cdot 3 = 19{,}89$

$\lambda = 360\ nm$

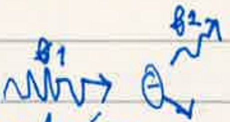
$W_V = 2{,}1\ eV = 3{,}3642 \cdot 10^{-19}\ J$

$6{,}63 \cdot 10^{-34} \cdot \frac{3 \cdot 10^8}{360 \cdot 10^{-9}} = 6{,}63 \cdot \frac{3}{360} \cdot 10^{-17} =$

$= \frac{19{,}89}{360} \cdot 10^{-17} = \frac{1989}{360} \cdot 10^{-19}$ $\quad$ bude prebiehať fotoelektrický jav

$4{,}76 : 6{,}63 = 0{,}$

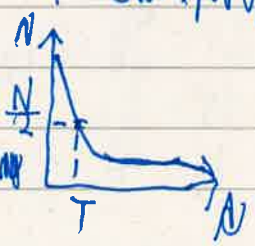
$1989 - 3{,}3642 = 1985{,}6358 \cdot 10^{-19}$ neplatí

- Comptonov jav  $f_1 > f_2$
- nukleóny - protóny, neutróny $\lambda_1 < \lambda_2$
- chemický prvok - atómy s rovnakým počtom protónov
- nuklid - atómy s rovnakým protónovým a nukleónovým číslom
- izotop
- hmotnosť jadra je menšia o hmotnostný úbytok (väzbová energia)
- väzbová energia $= E = m \cdot c^2$ a rádiu a bizmutu
- všetko vedie k železu a olovu (stabilnému)
- $^{235}_{92}U \rightarrow Kr + Ba + 2$ neutróny
- rozpadávajúce sa jadrá sú rádioaktívne
- alfa žiarenie - rozpad rádia - pohlcované hocičím (alobalom, papierom...)
- beta žiarenie - tok elektrónov pri rozpade jadra (rozptýlené)
- gamma žiarenie - prenikavé - 2 m bez vody
- aktivita = počet rozpadov za sekundu - jednotka 1 Bq - bekerel

$A(t) = \lambda \cdot N(t)$ N = počet ~~rozpadnutých~~ jadier

$\lambda = \frac{\ln 2}{T}$ = rozpadová konštanta T = čas polpremeny

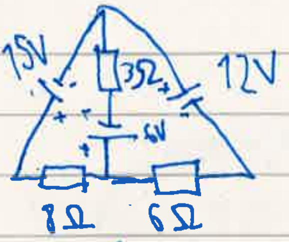
$N(t) = N(0) \cdot e^{-\lambda t}$



drevo 72% pôvodnej hodnoty 5570 čas polpremeny
28%

vzorák 4hodinovka na fyzike

3.

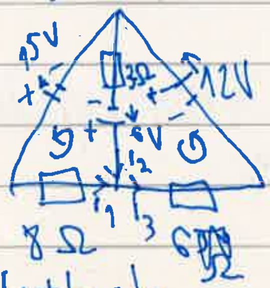


1. Kirchhoffov zákon - súčet prúdov v uzle je 0

$\sum_{n=1}^{1,2,3} I_n = 0$

2. K. z. - súčet U na zdrojoch = súčtu R·I na spotrebičoch

$\sum U_i = \sum R I$



$I_1 + I_2 = I_3$

$U_1 - U_2 = R_1 \cdot I_1 - R_2 I_2$

$U_2 + U_3 = R_2 \cdot I_2 + R_3 I_3$

$15V - 6V = 8\Omega \cdot I_1 - 3\Omega I_2$

$6V + 12V = 3\Omega I_2 + 6\Omega I_3$

$15V + 12V = 8\Omega I_1 + 6\Omega I_3$

$27V = 8\Omega I_1 + 6\Omega I_3$

$27V = 8 I_1 + 6 I_2 + 6 I_3 \;|-9 = 8 I_1 - 3 I_2 \;|-(6+12) = 3 I_2 + 6 I_3$

$0 = 6 I_2$

$27 = 8 I_1 + 6 I_3$

$27 = 8 I_1 + 6 I_1 + 6 I_2$

$45 = 8 I_1 + 6 I_1 + 16 I_1$

$45 = 30 I_1$

$I_1 = \frac{3}{2}$

$I_2 = 1$

$I_3 = \frac{5}{2}$

$27 = 12 + 6 I_3 \;|-12$

$15 = 6 I_3$

$I_3 = \frac{15}{6} = \frac{5}{2}$

5. elektrón - $v = \frac{1}{10} c$ $m = 9{,}1 \cdot 10^{-31}\,kg$ $q = 1{,}6 \cdot 10^{-19}\,C$

$B = 0{,}5\,T$

$r = \frac{m v}{B q} = \frac{9{,}1 \cdot 10^{-31} \cdot \frac{1}{10} c}{0{,}5 \cdot 1{,}6 \cdot 10^{-19}} = \frac{9{,}1}{0{,}8} \cdot 10^{-13} \cdot c = \frac{3 \cdot 9{,}1}{0{,}8} \cdot 10^{-5}\,m$

$E_k = \frac{1}{2} m c^2 \cdot 10^{-2}$ $c = 2{,}99 \approx 3 \cdot 10^8\,m \cdot s^{-1}$

$E_k = \frac{1}{2} 9{,}1 \cdot 10^{16} \cdot 10^{-31} \cdot 9\,J$

odraz/prekážka

$d \sin \alpha = k\lambda$ max

$d \sin \alpha = (2k+1)\frac{\lambda}{2}$ min

9. $0{,}2\ \mu m = d$ $\quad v_{sklo} = 2\cdot 10^8\ m\cdot s^{-1}$ $\quad v_{vzduch} = 2{,}2\cdot 10^8\ m\cdot s^{-1}$

$n_{sklo} = \frac{c}{v} = \frac{3}{2}$

ve viditelném spektru

interferenční maxima $2nd + \frac{\lambda}{2} = k\lambda$

minima $2nd + \frac{\lambda}{2} = (2k+1)\frac{\lambda}{2}$

$3\cdot 0{,}2\cdot 10^{-6}\ m + \frac{\lambda}{2} = k\lambda$

$\frac{3}{5}\cdot 10^{-6}\ m = \lambda\left(k - \frac{1}{2}\right)$

týden 190

10. $X_C = \frac{1}{\omega C}$ $\quad f = 200$ $\quad \omega = 400\pi$

$500\,\Omega = \frac{1}{400\pi C}$

$C = \frac{1}{500\cdot 400\pi}\ F = \frac{1}{200000\pi} = \frac{10}{2\pi}\cdot 10^{-6}\ F = \frac{10}{2\pi}\ \mu F$

$U = X_C \cdot I$

$I = \frac{U}{X_C} = U\cdot 2\pi\cdot C\cdot f$

15. $12\cdot 12\cdot 10\ cm$ $\quad \rho = 900\ kg\cdot m^{-3}$ $\quad \rho_{vody} = 1000\ kg\cdot m^{-3}$

$m = 1{,}296\ kg$ $\quad g = 9{,}81\ m\cdot s^{-2}$

$m\cdot g = \rho\cdot g\cdot V$ $\quad S = 12\cdot 12\ cm$

$m = \rho V$

$V = \frac{m}{\rho_{vody}}$

$\frac{900\cdot 12\cdot 5\cdot 10\ cm}{1000} = V$

$15 = V$

$h = 4\ cm$

$0{,}4\cdot 10^{-2}\ m\cdot 1000\cdot S =$

$0{,}4\cdot 10^{-2}\ m\cdot S\cdot 1000 = 12^2\cdot 10^{-4}\cdot 0{,}4\cdot 10^{-2}\cdot 10^3 =$

$= 12^2\cdot 0{,}4\cdot 10^{-3} = 12^2\cdot\frac{2}{5}\cdot 10^{-3}$

$F = \frac{2\cdot 12^2}{5}\cdot 10^{-3}\ N = 0{,}0576\ N\cdot g$

$0{,}555\ N$

13. ε = relativní prodloužení $\quad \alpha = 2{,}9\cdot 10^{-5}\ K^{-1}$

$E = 10^{11}\ Pa$ $\quad \sigma_n$ = normálové napětí $= E\varepsilon\ [Pa]$

$l = l_0(1 + \alpha\cdot\Delta T)$ $\quad \sigma_n = 2{,}9\cdot 10^{-4}\cdot 10^{11} = 2{,}9\cdot 10^7\ Pa$

$\varepsilon = \frac{\Delta l}{l_0} = \alpha\cdot\Delta T = 2{,}9\cdot 10^{-4}$ $\quad F = \sigma_n\cdot S = \frac{2{,}9\cdot 10^7\cdot 10^{-4}}{4}\pi = \frac{2{,}9}{4}\cdot 10^3\pi$

$S = \left(\frac{10^{-2}}{2}\right)^2\pi = \frac{10^{-4}}{4}\pi$

$10^{-3}\cdot 10^{11}\cdot 10^{-4}\cdot\frac{\pi}{4}\cdot 10^{-3} = 10\frac{\pi}{4}\ N$

$\frac{\pi}{4} = 7{,}85$

$dV \quad \left(\left(\frac{dV}{2}+\frac{dV}{2}\right)^2-\left(\frac{dV}{2}\mp\frac{dV}{2}\right)^2\right)\pi$

16. $L=2\,H \quad R=20\,\Omega \quad U=20\,V \quad f=50\,Hz \quad W=100\pi$

a) $I_1=1A \quad I_2=0{,}03A$

b) $X_L=100\pi\cdot 2=200\pi \quad Z=\sqrt{20^2+(200\pi)^2}=\sqrt{1200+200^2\pi^2}$

$Z=\sqrt{20^2+4\cdot\pi^2\cdot 2500\cdot 4}=\sqrt{20^2+40000\pi^2}$

$Z=628{,}637\,\Omega$

$20:628=0{,}03$

2000

116

23. $N_1=2400 \quad R=125\,\Omega \quad U=2200$

$N_2=120 \quad R=5\cdot 10^{-2}\,\Omega \quad P_V=2000\,W$

$\frac{U_2}{U_1}=\frac{N_2}{N_1}=\frac{U_2}{2200}=\frac{120}{2400}$

$U_2=2200\cdot\frac{120}{2400}=2200\cdot\frac{1}{20}=110$

$U_2=110V \quad I_2=16{,}363\,A$

$1\times 00:110=16{,}363$

700

400

700

40

$P_{R2}=16{,}363\cdot 25\cdot 10^{-4}=16{,}363\cdot 25\cdot 10^{-4}$

$16{,}363$

25

815

24. $P_N=500\,W \quad P=475\,W \quad C=42\,kJ=4200\,J$

$m=0{,}15\,kg \quad 35K$

$112{,}2$

$\frac{1}{80}=\frac{1}{3R}+\frac{1}{3R}=\frac{2}{3R}$

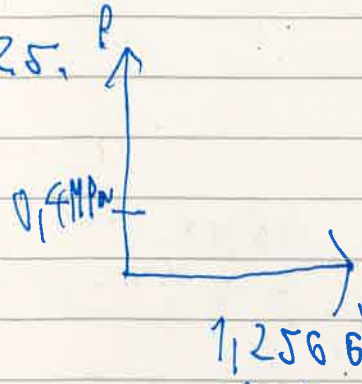
26. 

$80\,\Omega$

$\left[2R-R\right]$

$R \quad 2R$

$\left[\frac{R}{2R}\right]-R-\left[\frac{1}{R}+\frac{1}{2R}=\frac{1}{80}\cdot\frac{2+1}{2R}\right]$

25. 

$m_v = 0{,}1\ g$ $M_{mv} = 2 \cdot 10^{-3}\ kg \cdot mol^{-1}$ $R_m = 8{,}31\ J \cdot K^{-1} \cdot mol^{-1}$

$pV = \frac{m}{M_m} R_m T$ $T = 100\ K$

$V_1 =$

$1{,}256\ l$ $1{,}257 \cdot 10^{-3}$ mol. $0{,}1$ mol $0{,}001$ $2 \cdot 10^{-3}$

$0{,}002\ m$

27. Kovadobežník s indukčním průměrem $0{,}2\ m$ průměr drátu $2\ mm$ měrný el. odpor $1{,}7 \cdot 10^{-8}\ \Omega m$,

$d = 0{,}2\ \pi\ m$ $S = (\pi \cdot 10^{-3})^2 \pi = \pi \cdot 10^{-6}\ \pi\ m^2$

28. $R = 1{,}7 \cdot 10^{-8}\ \pi\ \Omega \cdot \frac{2 \cdot 10^{-1}\ \pi\ m}{10^{-6}\ \pi\ m^2} = 1{,}7 \cdot 2 \cdot 10^{-3}\ \Omega = 3{,}4 \cdot 10^{-3}\ \Omega$

a) $R = 3{,}4 \cdot 10^{-3}\ \Omega$

29. b) $U = 10\ A \cdot R = 3{,}4 \cdot 10^{-3}\ \Omega \cdot 10\ A = 3{,}4 \cdot 10^{-2}\ V = 3{,}4 \cdot 10^{-2}\ \frac{T}{\rho}$

c) m_v. c) $-1{,}08 \ldots$ $S \frac{AB}{AV}$

28. $m = 1{,}5 \cdot 10^{-3}\ kg$ $v = 5\ m$ do vody $= 1{,}5\ m$ $g = 9{,}81\ \frac{m}{s^2}$

$d_{do\ vody} = \sqrt{2gh} = 9{,}0\ldots 904\ m$

$v_0 = d_{do\ vody} \cdot g$

$1{,}5\ m = v_0 \cdot t - \frac{1}{2} a t^2 = (v_0 - \frac{1}{2} a t)\, t$

$v_0 = a \cdot t_{na\ vodu}$

$\frac{v_0}{t} = a$ $\frac{1{,}5\ m}{\frac{1}{2} v_0} = d_{na\ vodu} = \frac{3\ m}{v_0}$

$t_{na\ vodu} = 0{,}30281\ s$

$\frac{a \sqrt{v_0}}{3m} = \frac{v_0^2}{3} = a = \frac{10}{3} g^3$

v_0

$v_0 = \sqrt{10}\, g \cdot g$ $v_0^2 = 10 g \cdot g^2$

$10\ g^3$

$$1000 = 20 \cdot A - \frac{1}{2} \frac{20}{A} \cdot A^2 = 20 \cdot A - \frac{1}{2} \cdot 20 \cdot A$$

$$0{,}1 \simeq 800 \cdot A - \frac{1}{2} \frac{800}{A} \cdot A_1^2 = 800\,A - 400\,A$$

29. $l = 10^{-1}\,m$ $B = 0{,}5\,T = 5 \cdot 10^{-1}\,T$

$v = 2 \cdot 10^{-1}\,m/s$

$R = 0{,}2\,\Omega = 2 \cdot 10^{-1}\,\Omega$

$\alpha = 90^\circ$

$$V_m = \frac{V}{n} = \frac{RT}{P}$$

$\blacksquare = mol^{-1} \cdot 6{,}022 \cdot 10^{23}$ [illegible] $F_{mv} = B \cdot I \cdot l \cdot \sin\alpha$