

N\_ ^Zevgh\_ ]hkmZkl\ ggh\_ [x^]gh\_ h[ZahZl\_ evgh\_ mġ^gb\_  
\kr\_ ]hh[ZahZgby  
Kfhe\_ gkdbc]hkmZkl\ ggucmgb\ kbl\_ l<sup>a</sup>

DZn\_ Znbadbbl\_ ogbqkdboġkpbiebg

Ql\ Z<sup>a</sup>  
Ihj\_ dlhjhmġ[gh -  
f\_ lhġqkdhcZ[hl\_  
Mklbf\_ gdhX: .  
Q8<sup>a</sup> k\_ gly[jy 2020 ]

### Рабочая программа дисциплины Б1.В.06 Физика

**ġ\_ ġihġlhġb** : 44.03.05 Педагогическое образование (с двумя профилями  
подготовки)

**ġ\_ ġkġnbv** : Математика, информатика

NhfZh[ mġgby : hgZy

Dmġ± 2

K\_ f\_ klġ± 3, 4

<k\_ ]haZqlguo\_ ġgbp± 8, ġkh± 288

NhfZhqlġghklbaZql ± 3 k\_ f\_ klġ , wdaZf\_ g± 4 k\_ f\_ klġ

Ih]ZffmZaZ[hlZe Z  
dZġġZlnbadh -fZl\_ fZlbqkdbo gZmdġp\_ ġKhehġgdhZL;

Hġ[j\_ gZgZaZk\_ ZġbbdZn\_ ġ  
Ql<sup>a</sup> k\_ gly[jy 2020 ]ihġhdhe<

AZ\ ġnxsbcdZn\_ ġc

>xġġg:<

Kfhe\_ gkd  
2020

## 1. Место дисциплины в структуре ОП

>bkpbiebgZ @babdZ^hlgkblky d @kl b nhfjrn\_f hc mZklgbdZfb h[ZahZl\_evguo hlghr\_gbc ^a ; ehdZ © bkpbiebg ufhnmeb^a Zgggh]hgZiZ^e\_gbyih^hlhdbHgZbamZ\_lky \ b k\_f\_klZo .

>ey mki\_rgh]h hkh\_gby Zggghc @kpbiebgu g\_h[ohdfu gZudb klm^gh\ knhfbhZgggu\_ ip bamqgbb g\_lhevvdh rdhevguo dmj kh\nnabddb b fZl\_fZlbdb gh @kpbiebg @kghu bgnhfZlbdb b u@kebl\_evghc l\_ogbdb^a @Zl\_fZlbqkdbc ZgZeba^a , @bg\_cgZy Ze]\_lZ^a @ZeblbqkdZy ]\_hf\_lpy^a@kghu bgnhfZlbdb u@kebl\_evghc l\_ogbdb^a dhlhu\_ij^f\_kl^mlbamqgbbxnababd

Bamqgb\_ @babd b^a i@bkohdl gZy^m k bamqgb\_f @kpbiebg @e\_f\_glZgZy fZl\_fZlbdZ^a @Zl\_fZlbqkdbc ZgZeba^a @kghZgby ]\_hf\_lpb^a @\_hpy \\_hylghklb b fZl\_fZlbqkdZy klZlklbdZ^a @klZh[Z[hldb]Znbqkdhc bgnhfZpbb^a fh[\_ki\_b]l bo^aZbfhh[mkeh^e\_gghklv .

>bkpbiebgZ @babdZ^a ij^f\_klm\_l bamqgbb @kpbiebg @>bnn\_j\_gpbZevgu\_ mZg\_gby b mZg\_gby fZl\_fZlbqkdhc nabdb^a @u@kebl\_evghc wdki\_@f\_gl^a @\_hpy \\_hylghkl\_c b fZl\_fZlbqkdZy klZlklbdZ^a @ @kpbiebgZgZy ip\_dlgZy ^yl\_evghklv \ \_kl\_kl\_gghgZmg hf h[ZahZgbb^a @Zl\_fZlbqkdh\_fh^ebhZgb\_ ^a @ke\_ggu\_f\_lh^a @\_dlbhZgb\_bgnhfZpbbggh -h[ZahZl\_evghc kj\_@^a @Zldbmf ih\_j\_r\_gbx aZZgZ W<F^a ihahe yy bamZlv bo k ip e\_qgb\_f ij^f\_lghc [Zau f\_lh^ \ b ipgpbih\ nbabqkdhcgZmdb

Bamqgb\_ dmjZ hkghZgh gZ lZ@pbbgguo f\_lhZo ukr\_c rdheu aZbfhkyab k mdZaZggufb @kpbiebgZfb Z lZd\_ gZ bkihevahZgbb kh\_j\_f\_gghc mg[ghc f\_lh@qkdhc ebl\_Zlmj wdki\_@f\_glZevguo f\_lh^ \ bamqgby bgnhfZpbbgguo b h[ZahZl\_evguo l\_ogheh]bc kj @klZgpbhgghcnhfuh[mqgby .

## 2. Планируемые результаты обучения по дисциплине

ИД	В
<p>ПК-7.                      Кк [E_Hhb                      dhj dlhW                      _k k hfg_                      a@eHb                      aH_Hb                      hhhhdZ                      ml\ jh                      khfnehW                      jameWnblv                      k @ihemqgh                      jameWZ</p>	<p>Знать: Zhu ipihl@dbk k hggoa@                      deHb aZ @Hij ^e b hgggo ihglbb                      hdZ^eW hj fhhg^eZ H b                      Уметь: jrKhgg_lh E_Hhb a@dZ                      ml\ jhkhfnehWameWnblv h k @                      Владеть: i hbgdEfgb E_Hhh                      WZl jr_bdhj_lgo a@ Zeho hE^c                      i@e^cZ^E @bhj@b</p>

### 3. Содержание дисциплины

Bamqgb\_nbabdb gZhgZ\_lky \ljlv\_f k\_f\_klj k Za^eZ @oZgbdZ^ihkyszggh]h  
f\_oZgbqkdh fm b`gb x l\_e b kj^ ZkkfZljbZ\_lky dbg\_fZlbd Z b dgZfbd Z ey fh^e\_c  
Zl\_pZevgZy^b @h\_l\_eh^ \kemqyo bo ihklmiZl\_evgh]h b ZsZl\_evgh]h b`gbc  
hlghkbl\_evgh bg\_pZevghc kbbk\_fu hlkqlZ AZI\_f bamq\_lky l\_fZ h aZdhgZo khoZg\_gby  
bfimevkZ fhf\_gIZ bfimevkZ b f\_oZgbqkdhc wg\_jbb l\_eZ M^e\_gh gbfZgb\_bamqgbx  
f\_oZgbqkdh]h b`gby hlghkbl\_evgh g\_bg\_pZevguo kbbk\_f hlkqlZ Z lZd`\_we\_f\_gIZf  
jeylbbkldhc f\_oZgdbd Zaghbghklvx f\_oZgbqkdh]h b`gby kemZl f\_oZgbqkdb\_  
dhe\_[Zgby b mijm]b\_ heg rbjdh ZkijhklZgzggu\_ \ijh^ b l\_ogbd\_ AZ\_jZ\_lky  
bamqgb\_f\_oZgdbd\_l\_fhc dbg\_fZlbd b b`g gZfbd b dhkl\_cb]Zah\ >Ze\_\_ bamqgb\_nbabd b  
ihkys\_gh l\_iehlfm b`gbx fhe\_dmeygh -dbg\_lbgkdhc l\_hpb b l\_fhdgZfbd b gZ  
ipf\_j fh^e\_c \s\_klZ @Zevguc]Zabfm]bofh^e\_cZ]j]Zlguokhklhygbc \s\_klZ  
ZkkfZljbZxlky hkghgu \_ml \jgb y FDL , l\_hj f ZhZkij^e\_gbbdbg\_lbgkdhcwg\_jbb  
b klZlklbgkdb\_ Zkij^e\_gby fhe\_dme \ fh^eb b^Zevgh]h ]ZaZ < l\_fhdgZfbd\_  
\uykgyxly ihklmeZlu b bo ipf\_g\_gb\_ d hibkZgbx Zaguo khklhygbc b ihp\_kkh\ \  
\s\_klZo nZah\_i\_johu b dplbgkdb ye\_ gby Z lZd`\_ye\_gby i\_jghkZ gZ ipf\_j  
fh^ebb^Zevgh]h]ZaZ .  
<qlv]hfk\_f\_klj\_bamq\_xlky hklZevgu\_Za^eunbabdbW e\_dlfhZ]gblgu \_ye\_gb y  
f\_lhneh]bgkdb ZkkfZljbZxlky kgZZeZkihappbcij\_RlZe\_gbyh[we\_dlfhgkdhfihe\_b  
fZ]gblghfihe\_ZaZl \_f\_bgh]hwe\_dlfhZ]gblgh]hiheyNhfmeljnxlkyhkghgu\_l\_hjfu  
we\_dlfhklZlbd b fZ]gblhklZlbd bo ipf\_g\_gb\_ \Zdmmf\_b \s\_kl\ AZI\_f bamq\_x lky  
l\_f u we\_dlfhZ]gblghc bgmdpb , \_bgh]h we\_dlfhZ]gblgh]h ihey we\_dlfhZ]gblguo  
dhe\_[Zgbc b heg >Ze\_\_ ZkkfZljbZxlky hilbgkdb\_ ye\_gby \ZfdZo heghhc  
]\_hf\_lbgkdhc b dZglhhc l\_hpc dhlhj\_ \p\_ehf iph^l d uykg\_gbx khj\_f\_gguo  
ij\_RlZe\_gbc h dhjmkdmeygh -heghhf mZebaf\_k\_lZ AZI\_f uykgy\_lky dhjmkdmeygh -  
heghhcfnZebafZklbp\_s\_kl Zb kihfsvx dZglhhc\_l\_hpb bamq\_xlkyk^cklZlhfh\  
Kipf\_g\_gb\_fdZglhh -f\_oZgbqkdh]hihohZ ZkkfZljbZxlkyhkghgu\_k^cklZlhfguo  
y^h[f\_gguc oZZdl\_jy^guo kbe Z lZd`\_ye\_gby ZbhZdlbgkklb b y^gu\_jZdpbb  
AZdZghZ\_lky bamqgb\_nbabdb deZkkbnbdZpb\_c we\_f\_gIZguo Zklbp gZ hk gh\  
nmgZf\_gIZevguo aZbfh^cklb c b dZglhuo klZlklbd Z lZd`\_dZlbf h[ahhf k^ckl\  
lz^ol\_eklhqbaj\_gbydZglh^cl\_hpb  
Bamqgb\_we\_dlfhZ]g\_lfafZhilbdb dZglh^c nbabdb b nbabdb ZlhfZ kihjhZ\_lky  
ih\^gb\_f wdki\_p\_f\_gIZ \ eZ[hZlhg\_uo mkehpyo b ipf\_g\_gb\_f we\_f\_gIZghc  
fZl\_fZlbd ebg\_cgbc b \dlhg^c ) Ze]\_ju bnn\_jgpbZevgh]h b bgl\_]Zevgh]h  
bkqke\_gby we\_f\_glh\ l\_hpb \hylghklb b fZl\_fZlbgkdhc klZlklbdb hkgh\]\_hf\_lpb  
kj\_Rlh[Z[hldb]Znbqkdhc bgnhfZpbb  
LZdbf h[Zahf bkpbiebgZ @babdZ^ihahey\_l uykgblv dZd ipf\_gyxly Zagu\_  
nbabqkdb\_b fZl\_fZlbgkdb\_ fh^eb b f\_lh^ Zagh[Zaguc fZl\_fZlbgkdbc ZiiZl ey  
bamqgby kljndlmghc h]ZgbaZpbb \s\_klZ <k\_e\_gg hc b ihe\_hc nhfu kms\_klhZgby  
fZl\_pbb

#### 4. Тематический план

3 k f klj

< ii	T^eub_l_fi	kh K	NjaZb				
			e_dp	k_b - Z	iqB - qBb aZb	eZ - lhj_ aZb	h - hyl_eZ MZ
1.	<b>hZ</b>	13	4	0	4	2	3
2.	<b>hZ</b>	22	4	0	2	6	10
3.	<b>hshkv sp</b>	4	1	0	2	0	1
4.	<b>hngkoZb</b>	13	1	0	2	4	6
5.	<b>Chp_ h_fihlhlZ</b>	4	1	0	2	0	1
6.	<b>hfhK</b>	2	1	0	0	0	1
7.	<b>FoqB dhe_h b heg u</b>	17	4	0	2	4	7
8.	<b>FoqBhk cb Zh\</b>	6	2	0	2	0	2
9.	<b>hhe_dmeyh dhhcl_hb</b>	14	2	0	4	4	4
10.	<b>hul_hB</b>	16	4	0	4	4	4
11.	<b>:jB_kkhyh s_Z</b>	11	4	0	4	0	3
12.	<b>hhu_i_johu dhhbye_h</b>	11	2	0	2	4	3
13.	<b>Y_pi_jhK</b>	11	2	0	2	4	3
<b>Итого</b>		<b>144</b>	<b>32</b>	<b>0</b>	<b>32</b>	<b>32</b>	<b>48</b>

kf kj

< ii	T^eub_fi	kh K	NjaZb				
			e_dp	k_b - Z	iqB - qBb aZb	eZ - lhj_ aZb	h - yl_eZ MZ
1.	<b>hvdhh ihe_ \ hmmf s_k</b>	8,5	4	0	4	0	0,5
2.	<b>hhygc h dhhbhd</b>	10	2	0	2	4	2
3.	<b>h_ihe_ hmmf_hs_k</b>	13,5	3	0	4	4	2,5
4.	<b>hvdhh hndp</b>	3,5	1	0	2	0	0,5
5.	<b>hvdhh</b>	10	2	0	2	4	2

6.		12,5	2	0	4	4	2,5
7.		10,5	2	0	2	4	2,5
8.		10	2	0	2	4	2
9.		4,5	2	0	2	0	0,5
10.		10,5	2	0	2	4	2,5
11.		4,5	2	0	2	0	0,5
12.		10,5	2	0	2	4	2,5
13.		4,5	2	0	2	0	0,5
14.		2	2	0	0	0	0
15.		2	2	0	0	0	0
		27					
		<b>144</b>	<b>32</b>	<b>0</b>	<b>32</b>	<b>32</b>	<b>21 (+27)</b>
		<b>288</b>	<b>64</b>	<b>0</b>	<b>64</b>	<b>64</b>	<b>69 (+27)</b>

## 5. Виды образовательной деятельности

### Занятия лекционного типа

3 k f klj

3 бжды

*б бйdb*

*Ijfbamgbybabd*

Kyavnabdbk fZl\_fZlbdhcbbgnhfZlbdhc .

*z бзб б йдж*

F\_oZgbqkdh\_й`gb\_ , hkgghgZyaZZZf\_oZgdbd

Kihkh[ u hibkZgby f\_oZgbqkdh]h й`gby

Fh^e b l\_eZ

**L\_fZ: Кинематика**

LZ\_dlhpyimlv

Ebg\_cgu\_ i\_jf\_s\_gb\_ kdhjklv b mkdhj\_gb\_

kj\_йb\_ b f]gh\ggg\_

йp

iyfhebg\_cghfй`gbb

AZdhgudbg\_fZlbqkdb\_mZg\_gby Zghf\_gh]h iyfhebg\_cgh]hй`gby

AZdhgudbg\_fZlbqkdb\_mZg\_gby Zghi\_jf\_ggh]h i\_yfhebg\_cg\_h]h й`gb y.

M]ehй\_i\_jf\_s\_gb\_kdhjklvbmkdhj\_gb\_ kj\_йb\_bf]gh\ggg\_ йpй`gbbih

hdjngkklb

AZdhgudbg\_fZlbqkd b\_mZg\_gby Zghf\_gh]h й`gbyihhdjngkklb

AZdhgudbg\_fZlbqkdb\_mZg\_gby Zghi\_jf\_ggh]hй`gb y ihhdjngkklb

3 бжды .

~~*Kyfneggbmй`klj*~~

Ihegh\_mkdhj\_gb\_ ghfZevgh\_blZg]\_gpbZevgh\_mkdhj\_gby

~~*IjbleZ*~~

~~*Zbqtd h kbbkl\_f u P\_glfZkk .*~~

AZdhgudbg\_fZlbqkdb\_mZg\_gby ihklmiZl\_evgh]hй`gbylй]hl\_eZ

AZdhgu dbg\_fZlbqkdb\_mZg\_gby ZsZl\_evgh]h й`gby lй] ]h l\_eZ hdjm]

kh[kl\gghchkb

3 бжды 3

**ЛZ : Динамика**

~~*Klhgilgklbй`kZ*~~

Fhf\_glbg\_pbbfZl\_йZevghclhdqbbf\_oZgbqkdhckbbkl\_fu

~~*Bnevкй`bZvgthй*~~

~~*Zbqtd*~~

~~*kbbklfй*~~

Fhf\_glbfimevkZ fZl\_йZevghc lhqbbf\_oZgbqkdhckbbkl\_fu

~~*KeZ*~~

( <bйkbeй]й^ (kbeZly]hl\_gbykbeZly`klb \k kbeZmij]hklbkbeulj\_gby ) )

Ihe\_kbeuihe\_dZdbfZl\_йbgZiy`gghklviheykbeuly`klbhй]й]й`gh\_b g\_hй]й]й`gh\_йhe\_ p\_glZevgh\_йhe\_ )

Iйppbig\_aZйkbfhklb^cklйykbe Zgh^cklмxsZykbeZ .

Fhf\_glkbeuhlghkbl\_evghlhqbbhkb Zs\_gby .

3 бжды 4

~~*BйbZvgkbbklй`kZ*~~

~~*ijbgpiZbey*~~

~~*Iй]й`GklйZ*~~

<lйhc aZdhg GklhgZ mZg\_gb\_ й`gby

b\_]h Zklguc kemZc йp ihklhyggch

fZkk\_l\_eZ L \_hj\_fZhй`gbbp\_glZfZkk .

j\_ZdlbgZy kbeZ mZg\_gb\_F\_s\_kdh]h nhfmeZ

Pbhedhkdh]h dhkfbqkdb\_kdh]hklb ) ( ).  
 Hkghgh\_mZg\_gb\_bZfbdZ sZl\_evgh]h b`gby b ]h Zklguc kemZc ip  
 g\_baf\_gghffhf\_gl\_bg\_pbbl\_eZ .  
 MkehbyZgh\_kbyl\_eZ<bZg\_h\_kby .  
 Lj\_lbcAZdhgGklhgZ

*3 бж ды 1*

**LZ : Работа, мощность, энергия**

Z[h]Zkbeu we\_f\_glZgZyb kj\_gyy ip ihklmiZl\_evghf`gbbZ[h]Zfhf\_glZkbeu  
 we\_f\_glZgZyb kj\_gyy ipZsZl\_evghf`gbb  
 Fhsgklv f]gh\_ggZy b kj\_gyy ip ihklmiZl\_evghf`gbb Fhsgklv f]gh\_ggZy b  
 kj\_gyy ipZsZl\_evghf`gbb  
 Wg\_jbyF\_oZgbqkdZywg\_jby  
 Dbg\_lbqkdZywg\_jby ip ihklmiZl\_evghf`gbb Dbg\_lbqkdZywg\_jby ipZsZl\_evghf`gbb  
 Ihl\_gpbZevgZy wg\_jby \ ihe\_ kbeu ly`klb Ihl\_gpbZevgZy wg\_jby m]n]h  
 ^nhfb]Zggh]hl\_eZ

**L\_fZ: Законы сохранения**

Ihgylb\_aZfdgmlhcf\_oZgbqkdhc kkl\_fu  
 L\_hj\_fZ h[ baf\_g\_gbb bfimevkZ f\_oZgbqkdhc kkl\_fu A Zdhg khoZg\_gby bfimevkZ  
 f\_oZgbqkdhc kkl\_fu .  
 L\_hj\_fZ h[ baf\_g\_gbb fhf\_glZ bfimevkZ f\_oZgbqkdhc kkl\_fu A Zdhg khoZg\_gby fhf\_glZ  
 bfimevkZ f\_oZgbqkdhc kkl\_fu .  
 =bjkdhi ).  
 L\_hj\_fZ h[ baf\_g\_gbb f\_oZgbqkdhcwg\_jbb A Zdhg khoZg\_gby f\_oZgbqkdhcwg\_jbb  
 : [khexlghm]m]n]bcbZ[khexlghg\_m]m]bcmZju ( )

*3 бж ды 2*

**LZ : Неинерциальные системы отсчета**

**bb** l\_eZ hlghkbl\_evgh ihklmiZl\_evgh`ms\_cky gkhK beZbg\_jbb  
 >b`gb\_ l\_eZ hlghkbl\_evgh ZsZxs\_cky gkhP \_glh[\_gZy b dh]hebkhZkbeu  
 bg\_jbb

**L\_fZ: Элементы специальной теории относительности**

**Ih]h]Zb\_y]klv** -]haZdhgZGklhgZ ( ).  
 IhklmeZlu Wcgrl\_cgZ ij.h [ZahZgby Ehj\_gpZ . JeylbbklkdZy nhfZ -]h aZdhgZ  
 GklhgZ  
 <aZbfhkyavfZkkubwg\_jbb

*3 бж ды, 7*

**LZ : Механические колебания и волны**

**Zevgh`gb`bq]h]Zby**  
 F Zylgdbd fZl\_fZlbgkdbc i]nbgguc nbabqkdbc l]nbeyguc dhgbqkdbc  
 pbdehbZevguc ).  
 Kh[hgu\_ ] Zfhgbqkdb\_dhe\_[Zgby i]nbggh]h beb fZl\_fZlbgkdh]h fZylgbdZ  
 bnn\_j\_gpbZevgh\_mZg\_gb\_aZdhg dhe\_[Zgbc : fieblmZ i\_ph^ZklhlZ pbdebq \_kdZy  
 ZklhlZnZaZdhe\_[Zgbc  
 Keh`gb\_]Zfhgbqkdbodhe\_[Zgbc ).  
 Kh[hgu\_ aZlmoZxsb\_ i]nbggh]h beb fZl\_fZlbgkdh]h fZylgbdZ :  
 bnn\_j\_gpbZevgh\_mZg\_gb\_aZdhg dhe\_[Zgbc : fieblmZ i\_ph^ZklhlZnZaZ^dj\_f\_gl  
 aZlmoZgbyjfy j\_eZdkZpbbh]h]lghklv .

*3 бж ды, 8*

*ij`gb\_*

mklZghb\_r\_ky dhe\_[Zgby ijbogg]hbebfZl\_fZlbqkdh]hfZylgbdZ  
ðnn\_j\_gpbZevgh\_mZg\_gb\_aZdhgdhe\_[Zgbc : fieblmgh -ZklhlgZyoZZdl\_þklbdZ N Zah  
ZklhlgZy oZZdl\_þklbdZ J \_ahgZgk

~~Q~~baf ~~Z~~ijkljZgb y dhe\_[Zgbchghhghcmijn]hckj^  
Emqnhgl b \ bû f\_oZgbqkdbo heg iehkdb\_ b kn\_þqkdb\_ ihhevgu\_ b  
ihi\_j\_gu\_ MZg\_gb\_ iehkdhc ]Zfhgbqkdhc [\_]ms\_c hegu Q ZklhlZ nZaZ kdhþklv  
ðbgZhegubheghh\_þkeh  
Wg\_]by[\_]ms\_chegu h[tzfgZyiehlghklvwg\_]bbi hlhdwg\_]bb b\ \_dlhMfhZ  
Klhyþ\_ hegu , Zkij^e\_gb\_ f\_oZgbqkdhc wg\_]bb  
(  
~~þ~~g\_l~~þ~~klb~~þ~~bkl~~þ~~b~~þ~~b~~þ~~ij~~þ~~g~~þ~~b~~þ~~amZ kbeZm~~þ~~klb~~þ~~g~~þ~~gb\_  
~~þ~~klb~~þ~~g~~þ~~g~~þ~~kmevljZmd ).

3 бжды 9

## **IV Механика жидкостей и газов**

~~H~~b~~þ~~l~~þ~~evg~~þ~~kl~~þ~~kl~~þ~~kl~~þ~~iehg~~þ~~aj^  
>Z~~þ~~\_gb\_þ~~þ~~h~~þ~~lyob]ZaZo=þ~~þ~~klZlþqkdbcaZdhg  
:~~þ~~jb~~þ~~be~~þ~~kl~~þ~~eh~~þ~~ie~~þ~~Z~~þ~~þ~~þ~~  
Hkghgu\_ihgylbyþgZfbdbbþhkl\_c  
MZg\_gb\_g\_Zajghklb  
MZg\_gb\_;\_gmeeb~~þ~~eyb^Zevghcbþhklbþke\_þlþybag\_]h  
>þ`\_gb\_yadhcbþhklbNhfmeu~~þ~~xlhgZbImZa\_cyEZfbgZgh\_blmþme\_glgh\_  
l\_qgb\_þkeh]cghev~~þ~~Z  
>þ`\_gb\_l\_eZyadhckj^ n hfmeZklhdKZ ( ).

3 бжды 10

## 2 бж6 кбжзый ы дгдж д бм к дй дж **L\_fZ: Основы молекулярно-кинетической теории**

~~H~~þ~~þ~~ih~~þ~~þ~~þ~~f ~~h~~dejgh -dbg\_lbqkdhcl\_þþb  
Fh^evb^Zevgh]h]ZaZ FZkkZfhe\_dmeufheygZyfZkkZ  
Kj\_þyy~~þ~~ebgZkþ[hgh]hiþ[\_]Zfhe\_dmekj\_þyyZþnf\_lbqkdZykdhþklv  
Klhedgh\gb\_fhe\_dmewnn\_dlbgu~~þ~~cbZf\_lþbeu~~þ~~Zbfh^cklþyfe\_dme  
Hkghgh\_mZg\_gb\_ FDL b^Zevgh]h]ZaZ Kj\_þyydZ~~þ~~lbgZykdhþklv  
L\_hj\_fZhZghZkij^e\_gbb dbg\_lbqkdhc wg\_]bbfhe\_dmeuihkl\_i\_gyfkþ[hü

~~Z~~j~~þ~~egb~~þ~~he~~þ~~ik~~þ~~þ~~þ~~f beb dbg\_lbqkdbf wg\_]byf gZb\þylg\_crZy  
kdhþklv  
Zkij^e\_gb\_ fhe\_dmeihhl\_gpbZevgufwg\_]byf ;Zþf\_lþqkdZynhfmeZ

3 бжды 11

## **IV : Основы термодинамики**

~~H~~þ~~þ~~ih~~þ~~þ~~þ~~  
H[s\_gZ~~þ~~ehL>  
~~þ~~ie\_h\_gZ~~þ~~ehL> L\_fþqkdh\_mZg\_gb\_khklhygby b^Zevgh]h ]ZaZ mZg\_gb\_  
F\_g^e\_Z ±DeZi\_chgZ DZehþqkdh\_mZg\_gb\_khklhygbyb^Zevgh]h]ZaZ  
=Zah~~þ~~\_aZdhgudZd~~þ~~klgu\_kem~~þ~~þmZg\_gbykhklhygbyb^Zevg h]h]ZaZ :ðZ[Zlgu~~þ~~  
ihp\_kkmZg\_gb\_ImZkkhgZ  
<gmlj\_ggyywg\_]byi \_h\_gZ~~þ~~ehL> .  
Z[hZ]ZaZ D hebqklhl\_ieh lu  
Iþf\_g\_gb\_gZ~~þ~~ehZL>dbahihp\_kkZfb^Zevguo]ZaZo  
F heygZybm^evgZyl\_iehZfdhklb b^Zevgh]h]ZaZ þahihp\_kkZo .

***Wglhiby\ Ihh\_gZ***

Wglhiby\ Ihh\_gZehl\_fhbgZfbdb  
KlZl bklbqkdZylZdlhdZwglhibbmZg\_gb\_;hevpfZgZ  
Baf\_g\_gb\_wglhibbahihp\_kkZo  
Pbdebqkdb cdjm]hhc ihp\_kk Ihgylb\_hl \_iehu o b ohehbevgu o fZrbg Za.  
PbdeDZghl\_hj\_fuDZgh  
Ljlv\_gZehl\_fhbgZfbdb \_hj\_fZGklZ bk e\_klbybag\_z  
=Zgbpuihf\_gbfhklbaZdhghL.>

**И** Агрегатные состояния вещества

***L\_fjqkdh\_ mZg\_gb\_ khklhygby jZevgh]h ]ZaZ mZg\_gb\_ <Zg -^j -<ZZevkZ,***

bahl\_fu<Zg -^j -<ZZevkZbWgkZ  
Z[h]Zk beiply`gbyfhe\_dme d Zehjqkdh\_mZg\_gb\_khklhygbyjZevgh]h]ZaZ .

***Ih\jghklgh\_gZly`gb\_K\ h[hgZywg\_]byih\jghklgh]hkehyNhfmeZIEZkZ***

Ih\jghklgh\_gZly`gb\_K\ h[hgZywg\_]byih\jghklgh]hkehyNhfmeZIEZkZ  
KfZq Z\_fhklvbdhklvxih\jghkl\_cDZibeeygu\_ye\_gby  
Zklhjul\_iehlZjklhj\_gbyhkfhbqkdh\_Ze\_gb\_ .

***:gbahlhiby d]klZeeh\ .***

:gbahlhiby d]klZeeh\ .  
Lbiukya\_cZklbpd]klZeeZo  
L\_iehh\_Zkrbj\_gb\_d]klZeeh\  
DeZkkbqkdZyl\_hpyl\_iehzfdhklbd]klZeehZdhg>xehg]Zbllb  
:fhjgu \_\s\_klZ i hebf\_jbdb\_d]klZeeu ( ).

**И** Фазовые переходы и критические явления

I hgylbynZaubnZah]hi\_johZ NI .  
NIhZbkdujZym^evgZyl\_iehlZ .  
MZg\_gb\_l\_iehh]h[ZeZgkZ  
>bgZfbqkdh\_Zgh\kb\_bdhklbbiZZ <eZghklvlhdZjku .  
MZg\_gb\_DeZi\_chgZ ± DeZmabmkZbZ]ZffZkhklhygby\\_s\_klZ  
D]lbqkdh\_khklhygb\_d]lbqkdb\_iZzf\_lj  
NZahu\_i\_johjZ b @kdZhd\_iehzfdhklb .

**И** Явления переноса

>bnnmaby]ZahZdhgNbdZ  
Dhwnnbpb\_g]bnnmabb]Zah\ b\_]haZbkbfbhklv hl iZzf\_lj hkhklhygby ]ZaZ  
<yadhklvaZdhgGklhgZ  
Dhwnnbpb\_glyadhklb]Zah\ b\_]haZbkbfbhklvhl iZzf\_lj hkhklhygby ]ZaZ  
L\_iehijhghklvaZdhgNmj\_  
Dhwnnbpb\_gll\_iehijhghklb]Zah\ b\_]haZbkbfbhklvhiZzf\_ljhkhklhygby]ZaZ .  
Kyavdhwnnbpb\_gl h]bnnmabbyadhklbb l\_iehijhghklb

L\_fZ Электростатическое поле в вакууме

~~WlbaZkZgbWlbaZ~~

Ipgpbi[ebadh^cklby a ZdhgDmehgZ  
We\_dlpgkdh\_ihe\_ < \_dlhgZiy`gghklb ebgbbgZiy`gghklb  
Ipgpbik mi\_jhabpb b ihe\_c Ipf\_juwe\_dlpgkdboihe\_c

~~WbeaklZkly~~

~~Wjhepb~~

~~WZygklb~~

Ihl\_gpbZe Kyav Zaghklbihl\_gpbZeZkgZiy`gghklvxWI  
Ihl\_gpbZevgZywg\_jbyaZjZ\ we\_dlpgkdhf ihe\_  
Wg\_jbybh[tzfgZyiehlghklvvg\_jbbWI

**LZ** Электростатическое поле в веществе

IajbaZy bwe\_dlphd\ <\_dlhj bgfndpbb we\_dlpgkdh]hkf\_s\_gby WI  
I hlhd\\_dlhZbgfndpbbWI L\_hj\_fZHklh]Zkdh]h -=ZmkkZb\_zipf\_g\_gb\_  
We\_dlpgkdZyhkiipfbqklvbihgpbZ\_fhklv We\_dlpgkdbc]bkl\_jabk

~~WejbaZy ijbZ~~

~~h IpgbZ ijbZ\ wklZkfl ih\_~~

~~WklZkflZ~~

We\_dlhzfdhklvihhgbdZ dhg^gkZlhj Zb [ZIZj\_bdhg^gkZlhj\  
Wg\_jby aZj`ggh]hihgbdZbdhg^gkZlhZ

**LZ** Постоянный электрический ток

Mkehbykms\_klhZgb yboZZdl\_pklbdbwe\_dlpgkdh]h lhdZ  
AZdhg HfZ ey hghgh]h mZkldZ p\_ib Kh ihlbe\_gb\_ ihhgbd Z b [ZIZj\_b  
ihhgbdh\  
AZdhgHfZeyg\_hghgh]hmZkldZp\_ib ba Zfdgmlhcp\_ibIzbeZDbp]hnZ  
Z[hIzbfhsgklvp\_ibihklhyggh]hlhdZ AZdhg>hmeY - E\_gpZbnn\_jgpbZevghc  
bbgl\_jZevghcnhfZo  
We\_dlpgkdbclhd\we\_dlheblZo  
We\_dlpgkdbclhd\ZaZo

**LZ** Магнитное поле в вакууме

FZ]gblgh\_ihe\\_dlhfZ]gblghcbgndpbb  
AZhg;bh ± KZZZ - EZieZkZ  
Ipgpbikmi\_jhabpb bFI Ipf\_jfZ]gblguoihe\_c  
Ihlhd\\_dlhZbgfndpbbFI\_l\_hj\_fZHklh]Zkdh]h ± =ZmkkZyfZ]gblgh]hihey  
>\_cklb\_fZ]gblgh]hiheygZihhgbd b klhdhf kbeZ:fi\_Z  
>\_cklb\_fZ]gblgh]hiheygZbmsbckyaZjKbeZEhj\_gpZ

L\_fZ Магнитное поле в веществе

WfZ]gbbZgb\_fZ]g\_lbdh<\_dlhgZiy`gghklbFI  
F Z]gblgZy hkiipfbqklv b ihgpbZ\_fhklv KeZ[u\_ b k bevgu\_ fZ]g\_lbd b.  
FZ]gblguc]bkl\_jabk  
L\_hj\_fZhpjmeypbbgZiy`gghklbFIb\_zipf\_g\_gb\_

L\_fZ Электромагнитная индукция

AZdhg NZZ^y i Zbeh E\_gpZ KZfhbgfndpby bgfndlbghklv dhglmZ k lhdhf  
<aZbfhbgfndpby lZgknhfZlhj . WdklZlhd b ipaZfudZgbbbZafudZgbbp\_ib  
Wg\_jbybiehl ghklvvg\_jbbfZ]gblgh]hihey



**И** Kbkf u ebgah ilbqkdb\_ib[hj]      **n И** bboZ[\_Zpbb

3 бжды 0

**ИЭ Основы фотометрии**

**Иhу \ egb**      **bbf j b**  
=eZaqeh\\_dZdZdnhlhf\\_lpqkdbci[hj]  
AZdhguhк\\_szgghklb  
Ij KlZe\\_gb\\_h\\_kl\\_kl\\_gghcbbkdmkkl\\_gghchk\\_szgghklb

3 бжды 1

**ИЭ Основы квантовой оптики**

**ИhI\_aZ** IeZgdZ hdZglZok\\_lZ  
L\\_ieh\\_ baemqgb\\_ n hfmeZ IeZgdZ    ey l\\_ieh\\_h baemqgb    . AZdhgu Kl\\_nZgZ ±  
;he vpfZgZb<bgZ  
<g\\_rgbc nhlhwnn\\_dl    h iulu    Klhe\\_lhZ b aZdhghf\\_ghklb g\\_rg\\_h nhlhwnn\\_dlZ  
Mg\\_gb\\_Wcgrl\\_cgZ    bdZkgZy]ZgbpZnhlhwnn\\_dlZ  
>Z\\_gb\\_k\\_lZ    h iul u E\\_[\_^Z  
Wnn\\_dlDhfilhgZ

3 бжды 2

г бзб бмы йкн йча м ж бмкн кыйды д дв бйды джкн н д

**И Корпускулярно-волновой дуализм микрочастиц**

=bihl\\_aZEmb^:hceyb\\_zwdki\\_bf\\_glZevgh\\_ih\\_l]gb\_      h iulu ihbnZdpbb  
we\\_dl]ghLhfkhgZLZ]Zdhkdh]hbNZ[bdZgl      Z  
HibkZgb\\_ **состояния** Zklbpu k ihfsvx hēghc nmgdpbb <\_hylghklguc kfuke  
hēghc nmgdpbb  
I]gpbig\\_hij^ezgghkl\\_cKhhlghr\\_gbyg\\_hij^ezgghkl\\_c  
L\\_fZ **Уравнение Шрёдингера и его решение**  
Mg\\_gb\\_Rj]bg]Z      >b\\_gb\\_Zklbpu      ihl\\_gpbZevghc yf\\_k g\\_ihgbpZ\\_fufb  
kl\\_gdZfbDZglhuchkpbeylhj  
Lmgg\\_evgucwnn\\_dl  
DZglh\\_dhfivxl\\_j      u

3 бжды 13

г бзб дгдж к

**И Модели атома**

Fh^ev ZlhfZ LhfkhgZ Hiulu k      C-ZklbpZfb Ia\\_jhZ      fh^ev Ia\\_jhZ  
Ki\\_dlZevgu\\_aZdhghf\\_ghklbZlhfZhhZ IhklmeZlu ;hZ      <hēghZy fh^ev^:hcey  
Fh^ev ;hZ -Ahff\\_j\\_evZ

L\_fZ **Квантово-механическое описание атома**

DZglh\\_bkeZ b bo nbabqkdbc kfuke      We\\_dl]ggZy dhgnb]mZpby ZlhfZ    **И**  
**Иeb** bh[tykg\\_gb\\_kljndlmjl      Z[ebpZobfbqkdbowe\\_f\\_glhF\\_g^e\\_Z  
HiulRl\\_gZ    ± =\\_pZoZ.  
Lhfhaghc b    oZZdl\\_pklbq    kdbc j\\_gl]\_ghkdb    \_ ki\\_dlj u AZdhg Fhaeb ]bihl\\_aZ  
Dhkk\\_ey

3 бжды 14

г бзб дгдж к йк км

**И Характеристики и модели атомного ядра**

**ИZ h h kZy]Zhb Иhb**      **оZ ИZgo**  
y^**Иg kuh^ebZ**      **Bahlhiubh]bhlhga j]Zy yZ**  
L\_fZ **Радиоактивность и ядерные реакции**  
Ygbj    **ИZgkl**      b. AZdhgZbhZdlbghZkiZZLbiuZbhZdlbguoZkiZ\]  
ijZbeZkf\\_s\\_gby  
Y^gu\\_jZdpbb    , bodeZkkbnbdZpby>\_e\\_gb\\_bkggl\\_ay^j      Y^gu\\_jZdpbbazazo

г бзб дгдж зб бй мйч и н д

**Классификация элементарных частиц**

**Нгггг аВ^сб**

Hkghgu\_deZkkuwe\_f\_glZguoZklbp

DZjbbdZjh\uckhklZ\ Zjgh\ .

**Взаимопревращение элементарных частиц**

**Иг бнбг**

H[f\_ggh\_aZbfh^cklp\_

I\_bgu\_blhpgu\_d hkfbgkdb\_embq

Rbjlgucbhe]hlgucwnn\_dlu

г бзб дгдж м к к бз

**Зонная теория**

**Нг l\_hj**

h jhg gjlhb ahg\ djZz

a jnegb ahg

**в\_dljg**

DeZkknbdZpbyl\ zjol\_e .

We\_dljihghkklvihghbdh\ bihemihghbdhklhdhaj\_gbydZglhcnbabdb

**Контактные явления**

DhglZdl\moihemihghbdhwe\_dljggh -ghgu ci\_joh^

Ihkl\_crb\_ihemihghbdh\\_ip[hj

**Заключение**

**Мгndlmhc hjs\_kk ke\_gc**

**Игггг бб**

**гггг**

Занятия семинарского типа  
Лм ж дибнюб г йы ды

3 k f klj

йы дб

г бзб б йдж  
L\_fZ: Кинематика

klj

1. [blurred]
2. [blurred]
3. [blurred]
4. [blurred]
5. [blurred]
6. [blurred]
7. [blurred]
8. [blurred]
9. [blurred]

к

AZZq

1. [blurred]  $-2 + 3t - 0,5t^2$  [blurred]  $ZibkZlvmZg\_gb\_$   
aZbkbfbhklb kdhjklb lhqb hl jf\_gb Ihkljblv jZnbd wlhc aZbkbfbhklb gZclb  
dhfhgZlmbkdjhjklvlhqbqj akbkihke\_gZZeZb\\_gby
2. [blurred]  $\vec{r} = 4t^2\vec{i} + 3t\vec{j} + 2\vec{k}$ ,  
Hij^eblvZkdhjklv  $\vec{v} [mkdhj\_gb\_ \vec{a} fhfnevkdjhjklb\ fh\_glj\_f\_gbk$
3. [blurred]
4. [blurred]
5. [blurred] Dd ]h]bahglm k gZZevghc kdhjklvx Xh  
lj\_g\\_ [j\_]Zy khijh\ b\\_e\\_gb\\_f \ ha^moZ gZclb Z \ j\\_fy ^\ b\\_gby  
ih^tzfZ b ]hjbahglZevgm x ^Zevghklv gZ q\\_bz b l j b] eZ d ]hf kZ gby h  
jZ\ gu" ] mjZ\ g\\_gb\\_ ljZ\\_dlhjbb \ [ ]^\\_ \ b [ i\\_j\\_f\\_s\\_gb\\_  
]hjbahglZeb khhl\\_lkl\\_ggh ^ jZ^bmkudjb\bagu gZqZeZ b \\_  
AZZqeykZfhklhyl\_evgh]hjr\_gby
6. [blurred]  $\vec{r} = t^3\vec{i} + 3t^2\vec{j} + t\vec{k}$   
Kit^2 bO\_2 : 2 < ^2WK 2t^2] ^K 1 = -fkK 2 fkHij^eblvZfhf\\_glj\\_f\\_gbey  
dhlh]hkdjhjklbwlbolhqd[mfmlZgu[mkdhj\_gbyZbZeywlh]hf\\_glZ
7. [blurred] lhqbbaf\_gy\_lkykhj\_f\_g\_fihaZdhgm  $\vec{r} = t^3\vec{i} + 3t^2\vec{j} + t\vec{k}$   
- hjuhk\_cOb < Hij^eblv\_e\_yfhf\\_glZj\_f\_gb kZ fhfnev kdjhjklb [ fhfnev  
mkdhj\_gby
8. [blurred] xh
9. [blurred]
10. [blurred] imlb

Кинематика

hiku

- 1. 
- 2. 
- 3. 
- 4. 
- 5. 
- 6. 
- 7. 

h

AZb

- 1.  
- 2.  

$M 3 t t^2 t^3$

- 3.  
- 4.  

$v 0,3t 0,1t^2$

h.

tu

- 4.  

Hij^eblvZfhf\_glj\_f\_gbipdhlhjf\_dlhj  
mkdhj\_gbyh[Zam\_ik\_dlhkdjhklbm]heh[imlvihc^gguc\_l\_ehfaZwlhj\_fy

h

- 5.  
- 6.  
- 7. 

$M 0,5t^2$

AZbEykhklhyl evghlhr gby

- 6.  
- 7. 

<sup>-2</sup> Q a k ihke\_gZqez

<sup>2</sup> QmZ\gZbmkdhe\_kZ"

ZsZ\_lky lZd h aZbkbfhklv mjeZ ihhjlZ ZbmkZ bkdZ hl

if\_gb aZZ\_lky mZg\_gb\_f  $M 2 4t^3$  Hij^eblv Ey lhqd gZ h[h^ dhe\_kZ bkdZ  
ghfZevgh\_bIZg]\_gpbZevgh\_mkdhj\_gbyfhf\_glj\_f\_gb\_k\_dmg0hlgZqezb`gby  
ZIZd\_m]he ihhjlZ ipdhlhjf ihegh\_mkdhj\_gb\_khklZey\_lkZbmkhf bkdZ m]he  
45<sup>h</sup>.

- 8.  
- 9.  

$M 0,5t^2$

- 9.  
- 10. 

Hij^eblvgfhfZevgh\_mkdhj\_gb\_lhqbaj\_ak\_dmgfhke\_gZqezb`gby

h

kfk

h

Д Динамика

1. к \_\_\_\_\_

- 2. 
- 3. 
- 4. 
- 5.  
- 6. 
- 7. 

8.  khklhblihgpbig\_aZbkbfhklb^cklbykbe"

9.   
10. 

11.   
  


AZZb

1.  e\_blgZ]hphaglZevghc ih\oghklb Dhwnnbpb\_gllj\_gby   
l\_eh^cklm\_l]hphaglZevgZy kbeZ) Hij^eblv kbemlj\_gby ey (no kemZ\_V)  
(G) Bah[Zablv ]Znbqkdb dZdbaf\_gy\_lky kbeZlj\_gby ip baf\_g\_gbb  
kbeu)

2.  

3.   
 [jmkdZP d]dhwnnbpb\_gllj\_gby[jmkdh\  
hklheHij^ebl\_mkdhj\_gb\_kdhlhjf\milkyl\_eZZIZd`kbemgZly`gbygblb

4.   
  


AZZbeykZfhklhyl evghlhj\_r\_gby \_\_\_\_\_

5.   
 <sup>H</sup> d]hphaglmhl\_eh\lkyZghf\_ghKd Zdbfmkdhj\_gb\_f  
[m^l\]Zlvkyl\_eh\_keblm`kbemipehblvihm]ehf <sup>H</sup> d]hphaglm"

6.  1 d]bP 2 d]e\_Zl gZ Z[khexlgh ]eZdhf klhe\_L\_eZ kyaZgu  
g\\_khfufrgmjhf dhlhjc ZajuZ\_lky\_kebdl\_emkf\_gvr\_c fZkkhc ip ehblv kbem  
OZdmx fgbfZevgmxbemgZhip ehblvd\_l\_em[hevr\_cfZkkuh[uZahZlv  
rgmj"

7.   


8.    
\_\_ebgZ O dhwnnbpb\_gllj\_gby P  ZevgZy kdhjklv l\_eZ ZgZ gmex  clb\_lfy  
kimkdZl\_eZkgZdehgghciehkdhklb

D

Д Работа, мощность, механическая энергия

киhk \_\_\_\_\_

- 1. 
- 2. 
- 3. 
- 4. 
- 5. 
- 6.  
- 7. 
- 8. 

1. [redacted] [redacted]  
2. [redacted] Xh ihiZ^Z\_l \ gb`gbc d  
kl\_j`gy aZdj\_ie\_ggahhglgZevghc hkb ijhoh^ys\_c q\_j\_a \\_jogb  
b aZklj\_\Z\_l \ g\_f FZkkZ kl\_j`gy P ^ebgZ O Hij\_^\_eblv e  
dhgpZ kl\_j`gy kjZam ihke\_ ihiZ^Zgby imeb

AZZqeykZfhklhyl evghljr gby

5. Z [redacted] x 10 2t t^2 [redacted]  
[redacted]  
6. [redacted] [redacted]  
7. [redacted] [redacted]  
8. [redacted] ] bñ kZhgk

йы об 1

### Z Законы сохранения

1. [redacted]  
2. [redacted]  
3. [redacted]  
4. [redacted] p\_glfZkkkkl\_fufZl\_bZevguolhqdDZd\_]hfhghhij^eblv"  
5. [redacted]  
6. [redacted]  
7. [redacted] [redacted]  
8. [redacted] < [redacted]  
9. [redacted] [redacted]

AZZq

1. [redacted]  
2. [redacted]  
3. [redacted] 1 d] b P 2 d] ðmlky ihklmiZl\_evgh ñev ]hñahglZevghc  
ijfhc \hghf gZiZe\_gbb Kdhjklb rZj\ñ mZZ Y 1 fk b Y 2 fk  
Hij^eblvkdhhjklbrZj\ ihke\_Z[khexlghmij]h]hmZZ  
4. [redacted] [redacted] n Za[hevr\_fZkku gZe\_lZxs\_]h  
kñgbbkikhkZkZñ rZYMZkqlZlvp\_glZevgufbZ[khexlghmij]bf

- 5.
- 6.
- 7.
- 8.
- 9.

\_\_\_\_\_

S b hlimklbeb GZ dZdmx \ukhlm ih^gbfmlky rZj  
g\_mijm]h]h m^ZjZ"

Hohlgbdklj\_ey\_lbjmnyk\ims\_ckyehdbgZiZe\_gbb\_\`gbyDZdhZ[ueZkdhklvehdbh  
\uklj\_eZ\_keb hgZ hklZghbeZkv inke\_ \no k^eZgguo ihj^\uklj\_eh\FZkkZ ehdb  
bajmny

**Z Неинерциальные системы отсчета**  
kihk

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

\_\_\_\_\_

AZZqeyi\_r\_gbyZmblhpb

x hldehgbky l\_ehl\jbdZeb aZj\_fy iZ^gby"

Khijhbe\_gb\_fhafoZij\_g\_ljq

m

v

h k <gZqevgucfhf\_glj\_f\_gbgblvi\_j\_b]ZxlbfnmlZgZhgZ\_l  
kdhevablv[\_alj\_gbyihklj\_gxZclbj\_fykimklydhlhj\_fmnlZke\_lblkhkl\_jy  
AZZqeykZfhklhyl evghlhj\_r\_gby

\_\_\_\_\_

kh[hghiZZxsbol\_ehlgZiZe\_gbyhl\kZ<  
dZdmxklhjgmijhbkohblwlhhldehg\_gb\_"

Zk h. b b b b

Z [ b b

**Z Механические колебания и волны**  
kihk

- 1.

\_\_\_\_\_

Z kh[hgufb [ \ugm^ggufb"

2.  $dhe_{[ZgbygZauZxl]}ZfhgbqkdbfbaZlmoZxsbf"$
3.  $x | Z fZl_fZlbgkdbffZylgbdhf [ijbagguffZylgbdh"$
4.  $x | Z fZl_fZlbgkdbffZylgbdhf [ijbagguffZylgbdh"$
5.  $x | Z fZl_fZlbgkdbffZylgbdhf [ijbagguffZylgbdh"$
6.  $x | Z fZl_fZlbgkdbffZylgbdhf [ijbagguffZylgbdh"$
7.  $x | Z fZl_fZlbgkdbffZylgbdhf [ijbagguffZylgbdh"$
8.  $x | Z fZl_fZlbgkdbffZylgbdhf [ijbagguffZylgbdh"$
9.  $x | Z fZl_fZlbgkdbffZylgbdhf [ijbagguffZylgbdh"$
10.  $x | Z fZl_fZlbgkdbffZylgbdhf [ijbagguffZylgbdh"$
11.  $x | Z fZl_fZlbgkdbffZylgbdhf [ijbagguffZylgbdh"$
12.  $x | Z fZl_fZlbgkdbffZylgbdhf [ijbagguffZylgbdh"$
13.  $x | Z fZl_fZlbgkdbffZylgbdhf [ijbagguffZylgbdh"$
14.  $x | Z fZl_fZlbgkdbffZylgbdhf [ijbagguffZylgbdh"$
15.  $x | Z fZl_fZlbgkdbffZylgbdhf [ijbagguffZylgbdh"$
16.  $x | Z fZl_fZlbgkdbffZylgbdhf [ijbagguffZylgbdh"$

1.  $x | Z fZl_fZlbgkdbffZylgbdhf [ijbagguffZylgbdh"$
2.  $x | Z fZl_fZlbgkdbffZylgbdhf [ijbagguffZylgbdh"$
3.  $x | Z fZl_fZlbgkdbffZylgbdhf [ijbagguffZylgbdh"$
4.  $x | Z fZl_fZlbgkdbffZylgbdhf [ijbagguffZylgbdh"$
5.  $x | Z fZl_fZlbgkdbffZylgbdhf [ijbagguffZylgbdh"$
6.  $x | Z fZl_fZlbgkdbffZylgbdhf [ijbagguffZylgbdh"$
7.  $x | Z fZl_fZlbgkdbffZylgbdhf [ijbagguffZylgbdh"$
8.  $x | Z fZl_fZlbgkdbffZylgbdhf [ijbagguffZylgbdh"$

иы об 4

### Механика жидкостей и газов

кижк

1.  $x | Z fZl_fZlbgkdbffZylgbdhf [ijbagguffZylgbdh"$
2.  $x | Z fZl_fZlbgkdbffZylgbdhf [ijbagguffZylgbdh"$
3.  $x | Z fZl_fZlbgkdbffZylgbdhf [ijbagguffZylgbdh"$
4.  $x | Z fZl_fZlbgkdbffZylgbdhf [ijbagguffZylgbdh"$
5.  $x | Z fZl_fZlbgkdbffZylgbdhf [ijbagguffZylgbdh"$

- 6. eZfbgZpuf\_l\_qgb\_f[ lm]m e\_glguf\_l\_qgb\_f"
- 7.
- 8.
- 9.
- 10.

AZZqb

- 1. ~~██████████~~  
~~██████████~~  
██
- 2. ████ ██████████
- 3. ████ =^l\_i\_j\ur\_mh\gv
- 4. h0<sup>2</sup> ehđ\_beb[Zkk\_cg\_DZdbaf\_gbekymh\gvh0[Zkk\_cg\_"

- 4. ~~██████████~~ 9███ █
- 5. ~~██████████~~  
██

AZZbëykZfhklhyl\_evgh|hjr\_gby

- 6. ████
- 7. ████ ██████████ 'm
- 8. [ZeeZklZ\_keb h[t\_f rZZ ip ih^f\_m\ebëky \ ZaZ"L\_fi\_Zlmjn hafnoZ khlZcl\_Zghc&
- 9. ████ ██████████

Z : Основы молекулярно-кинетической теории

йы 0б 5

hku

- 1. ████
- 2. ████
- 3. ████
- 4. ~~██████████~~ ~~██████████~~ ,  
dhebqklh\s\_klZ ?
- 5. ████
- 6. k[hgh]hih[\_]Zfhe\_dmebhlg]hhgZaZbkl"
- 7. ~~██████████~~  
██
- 8. ~~██████████~~  
██
- 9. ~~██████████~~ ж
- 10. ████

AZZb

- 1. ████  
██ 27<sup>0</sup>K bZe\_gbb dIZ .

2. k
3. e ipl\_fi\_Zlmj 27<sup>0</sup>K bZe\_gbb dIZ .
3. e kh^plkyg\_dhlhuc]ZafZkkhc ] ihZe\_gb\_f 2,0·10<sup>5</sup> IZ .  
Hij^eblvkj\_gxxdZylbgmxkdhjklvihklmiZl\_evgh]h`gbyfhe\_dme
4. 0,20 ]h^gh]hiZipl\_fi\_Zlmj 27<sup>0</sup>K.  
hyl ehjr
5. 2,1·10<sup>-2</sup> djf<sup>3</sup>.
6. D
7. ] g\_dhlh]h ]ZaZ kj\_gyy dZylbgZy kdhjklv  
fhe\_dmedhlh]hZgZ fk ipl\_fi\_Zlmj 23<sup>0</sup>K ?
8. Z 2,0·10<sup>12</sup> kf<sup>-3</sup> Hij^eblv  
kj\_gxxdbg\_lbqkdmxwg\_jbxihklmiZl\_ evgh]h`gbyhghcfe\_dmeul\_fi\_Zlmjn  
]ZaZ

*ÿ ð*

ku

- 1.
2. Bah[Zabl \_ ]Znbdnmgdpbb  
FZdk\eeZ
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.

8.  $\frac{dZ}{dt} = \frac{dZ}{dZ} \frac{dZ}{dt}$
9.  $\frac{dZ}{dt} = \frac{dZ}{dZ} \frac{dZ}{dt}$

ий об

L : Основы термодинамики

hku

1.  $\frac{dZ}{dt} = \frac{dZ}{dZ} \frac{dZ}{dt}$
2.  $\frac{dZ}{dt} = \frac{dZ}{dZ} \frac{dZ}{dt}$
3.  $\frac{dZ}{dt} = \frac{dZ}{dZ} \frac{dZ}{dt}$
4.  $\frac{dZ}{dt} = \frac{dZ}{dZ} \frac{dZ}{dt}$
5.  $\frac{dZ}{dt} = \frac{dZ}{dZ} \frac{dZ}{dt}$
6.  $\frac{dZ}{dt} = \frac{dZ}{dZ} \frac{dZ}{dt}$
7.  $\frac{dZ}{dt} = \frac{dZ}{dZ} \frac{dZ}{dt}$
8.  $\frac{dZ}{dt} = \frac{dZ}{dZ} \frac{dZ}{dt}$

AZZb

1.  $\frac{dZ}{dt} = \frac{dZ}{dZ} \frac{dZ}{dt}$
2.  $\frac{dZ}{dt} = \frac{dZ}{dZ} \frac{dZ}{dt}$
3.  $\frac{dZ}{dt} = \frac{dZ}{dZ} \frac{dZ}{dt}$
4.  $\frac{dZ}{dt} = \frac{dZ}{dZ} \frac{dZ}{dt}$
5.  $\frac{dZ}{dt} = \frac{dZ}{dZ} \frac{dZ}{dt}$
6.  $\frac{dZ}{dt} = \frac{dZ}{dZ} \frac{dZ}{dt}$
7.  $\frac{dZ}{dt} = \frac{dZ}{dZ} \frac{dZ}{dt}$
8.  $\frac{dZ}{dt} = \frac{dZ}{dZ} \frac{dZ}{dt}$
9.  $\frac{dZ}{dt} = \frac{dZ}{dZ} \frac{dZ}{dt}$

ий об

hku

1.  $\frac{dZ}{dt} = \frac{dZ}{dZ} \frac{dZ}{dt}$
2.  $\frac{dZ}{dt} = \frac{dZ}{dZ} \frac{dZ}{dt}$

3. ~~██████████~~
4. ~~██~~ h██
5. ~~██~~ █ bh ij^eblvZ[hlm dhebqklh l\_iehlu  
bfheygmxl\_ieh\_fdhklv .
6. ~~████~~ b h ij^eblv Z[hlm dhebqklh  
l\_iehlubfheygmxl\_ieh\_fdhklvÿybahl\_fbqkdh]hihp\_kkZ
7. ~~████~~ b h ij^eblv Z[hlm dhebqklh  
l\_iehlubfheygmxl\_ieh\_fdhklvÿyZbZ[Zlbqkdh]hihp\_kkZ
8. ~~██~~ █ )?
9. ~~██~~
10. ~~██~~

AZZq

1. ~~██~~ <sup>3</sup> ipZë\_gbb FIZ?]hgZ]j\_ebipihklhyggfh[t\_f\_  
hZë\_gbyFIZHij^eblvbaf\_g\_gb\_g mlj gg\_cwg\_jbb]ZaZ[hlmkh\j\_ggmX  
]Zahfbl\_iehlmkhh[s\_ggmX]Zam
2. ~~████~~ <sup>5</sup> IZ h <sup>5</sup> IZ b\_keb \gZze\_Zkrbj\_gby ]Za  
aZgbfZeh[tzf f <sup>3</sup> 0.
3. ~~██~~ ] gZ]j\_Zxl ipihklhyggfhZë\_gbbhl 320 h D hij^eblv  
dhebqklh l\_iehlu ih]ehs\_ggh\_ ]Zahf baf\_g\_gb\_gmlj gg\_c wg\_jbb Z[hlm  
Zkrbj\_gby]ZaZ
4. ~~██~~ █
5. ~~██~~ ██  
~~██████~~ ██  
p,Vb S,THij^eblvbaf\_g\_gb\_wglhibbhhZf\_ñgZzevgufb ██  
dhg\_gufkhhklhygbyfb
6. ~~████~~ D █ D .  
Hij^eblv DI> l\_iehlc fZrbgu Z[hZxs\_c ih pbdem DZgh ihegmx fhsghklv  
fZrbgu\_kebgZ]j\_Zl\_ev\_k\_dmgghi\_j\_Z\_l\_c > l\_iehlu  
AZZqÿykZfhklhyl\_evghlj\_r\_gby
7. ~~██~~ ] bah[Zgh gZ]j\_lhl D h D Hij^eblv dh ebqklh  
l\_iehlukhh[s\_ggh\_]ZamZ[hlm]ZaZbaf\_g\_gb\_gmlj gg\_cwg\_jbb
8. ~~██████~~ ]██  
~~██~~ <sup>0</sup>C\_kebipbahl\_fbqkdhfZkrbj\_gbbwlhl]Zakh\jbeZ[hlm>"
9. ~~██~~ ██ █ ██ l h e Zkdhev dh  
baf\_gblky \gmlj\_ggyy wg\_jby ]ZaZ \_keb\_Zkrbj\_gb\_ ihbahbehkv Z bah[Zgh [  
ZbZ[Zlgh"
10. ~~████~~ <sup>3</sup> ip ñdzlghf bahl\_fbqkdhf  
m\ebqgbbh[ t\_fZ>hZkrbj\_gbyhamogZohbekyihZë\_gb\_fZlfb\_l\_fi\_Zlmj  
D .
11. ~~██~~  
~~██████~~  
h b
12. B^ZevgZy l\_iehZy fZrbgZ Z[hZxsZy ih pbdem DZgh kh\jZ\_l\_Z[hlm aZ pbde  
d>L\_fi\_ZlmZ\_gZ]j\_Zl\_ey D Z ohehðevgbdZ ± D Hij^eblv dhebqklh  
l\_iehluihemqggh\_Z[hbf\s\_klhfhlgZ]j\_Zl\_eydhebqklh\_l\_i ehlui\_j\_Zggh\_  
ohehðevgbdmdiðbdeZ

**Агрегатные состояния вещества**

кжу

1. [blurred]
2. [blurred] -Δj -<ZZevkZ"DZdh\nbabqkdbc kfuke ihizhd  
©ab© bhijgbbg -Δj -<ZZevkZ"
3. [blurred] -Δj -<ZZevkZWgkKZ" DZdhcmzklhd bahl\_fu<Zg -Δj -  
<ZZevkZnbabqkdbg\_hafh`gbihqfm"
4. [blurred] bahl\_fjZevgh]h ]ZaZ ihemqgguo ip Zaguo \_]h l\_fi\_ylmZo b  
ihqfm"
5. [blurred]

AZZb

1. [blurred]
2. [blurred]
3. [blurred] Δj -<ZZevkZ© bZgukhhl\lkl\gghG f<sup>4</sup>fhev<sup>2</sup> b ·10<sup>-5</sup> f<sup>3</sup>fhev  
[blurred] -Δj -<ZZevkZ © b © b<sup>a</sup>Zgu kh hl\lkl\ggh  
G·f<sup>4</sup>fhev<sup>2</sup> b ·10<sup>-5</sup> f<sup>3</sup>fhev
4. [blurred] -Δj -<ZZevkZ© bZgu  
khh\lkl\gghG f<sup>4</sup>fhev<sup>2</sup> b ·10<sup>-5</sup> f<sup>3</sup>fhev  
AZZbeykZfhklhyl evgh]jr\_gby
5. [blurred] <sup>0</sup>KZē\_gb\_]ZaZ  
ZghZlfZib <sup>0</sup>KZē\_gb\_m\ebqehkvhlZl<uqkebl\_ihklhyggu\_<Zg -Δj -  
<ZZevkZeywlh]h]ZaZ
6. [blurred] ff<sup>3</sup> gZohbky fhev hhhZ ip ghfZevghfZē\_gbbKqlZy  
]ZajZevgufhij^eblvhkdhev dhZagZhm\ebqlv\_]hl\_fi\_ylmjnt[uZē\_gb\_  
m\ebqehkv]h\_"
7. [blurred] <sup>0</sup>KKZgbl\_jamevlZlkqlZy]Zab^Zevguf **б**
8. [blurred]
9. [blurred] <sup>3</sup>h  
f<sup>3</sup>KqlZy\_]h Zg -Δj -ZZevkhuf<sup>a</sup>hij^eblv kh\j\_ggmX Z[hlm baf\_g\_gb\_  
gmlj\_gg\_cwg\_jbbkhh[s\_ggh\_dhebqklhl\_iehlu

кжу

1. [blurred] b dhkl\_c"
2. [blurred]
3. [blurred] Z m^evghckh[hghcwg\_jb\_cih\oghklbbdhklb [ dhwnnbpb\_gl hf  
ih\oghklgh]hgZly`gby"

4. [blurred]
5. [blurred] Hlq]h aZpkbl ukhlZ ihtzfZ beb himkdZgby  
bdhklbihdZibeeyjn"
6. [blurred]
7. [blurred] H[tykgbl \_ f\_oZgbaf  
l\_ieh]h]Zkrbj\_gbyl\j\ol\_e
8. [blurred]
9. [blurred]

AZZb

1. [blurred] -3 f 3  
dZZy"Te]ghklv m^evgZy l\_ieh]fdhklv b dhwnnbpb\_gl ih\jghklgh]h gZly`gby  
jmlbZgukhhl\\_lkl\\_gghd]f <sup>3>d]</sup> DbG
2. [blurred]
3. [blurred] <sup>3</sup>eyd\_hkbgZfGd]f <sup>3.</sup>  
87 <sup>0</sup>K fZkkhc d] hlZ\_l\_ieh]moehghe h^lZdhe`\_`  
fZkkul\_fi\_ZlmZdhlhjc 17 <sup>0</sup>KBol\_fi\_ZlmjklZghylkyhbgZdh\fb]hdZaZlvth  
wgl]hiby]pwlhfm\\_ebqZ\_lky
4. [blurred]
5. [blurred]  $\cdot 10^{-6} D^{-1}$ .
6. [blurred] AZZbe ykZfhklhyl evgh]hj\_r\_gby
7. [blurred]
8. [blurred]  $\pm fZkehZ\_gfGehlghklvfZkeZ$   $\pm d]f$  <sup>3.</sup>
9. [blurred]  $29 \cdot 10^{-6} D^{-1} f_b$   $\pm 17 \cdot 10^{-6} D^{-1}$ .
10. [blurred]

йы об 1

Z Фазовые переходы  
kihk

1. [blurred]
2. [blurred] Zahbl\_nZah\i\_j\_ohu  
 $\pm l\_h\_l\_eh^a$
3. [blurred]
4. [blurred]
5. [blurred]
6. [blurred]
7. [blurred]

8. [REDACTED] ± DeZmabmkZ"
9. [REDACTED] [REDACTED] ? Q
10. [REDACTED] AZZb
1. [REDACTED] -^\_j -ZZevkhZ  
ihklhyggZy©beyg\_lhZgZ ·10<sup>-5</sup> f<sup>3</sup>fhev
2. [REDACTED]
3. [REDACTED] D Z Z
4. [REDACTED]
5. [REDACTED] baf\_g\_gb\_wglhibb Zgh  
d>DiehlghklvñubevZZgukhhl\_lkl\_gghd]f 3 bd]f 3.  
evZ ip ij\_Zs\_gbb \_]h \hŷghc iZjip  
l\_fi\_Zlmj\_DL\_iehzfdhklv evZ kq]Zlv g\_aZbkys\_c hl\_l\_fi\_Zlmj ZzevgZy  
l\_fi\_ZlmZevZZgZDL\_fi\_ZlmjnieZe\_gbyeVziPgylvZghcD  
AZZbeykZfhkhlvl evghljr\_gby
6. [REDACTED] 3 th[u ip gZ]j\_Vgbb  
gZ[exZlv d]lbqkdh\_khklhygb\_"D]lbqkdh\_Ze\_gb\_Zgh Zlf d]lbqkdZy  
l\_fi\_ZlmZ ± DfhaygZyfZkkZ ± 74·10<sup>-3</sup> d]fhev
7. [REDACTED] 0 Khl ghkbl\_evgZyeZghklv haſmoZZgZ  
Hij^eb]vfZkkmhŷguoiZh\dhfgZl\_Ieh]ghklvgZkus\_ggh]hŷgh]hiZZ  
ipwlhel\_fi\_Zlmj\_ZgZ]f 3.
8. [REDACTED]
9. [REDACTED]
10. [REDACTED] 0C\_z  
m^evgZy l\_iehzfdhklv >d] ·D m^evgZy l\_iehlZ ieZe\_gby ·10<sup>5</sup> >d]  
l\_fi\_ZlmZieZe\_gby 0Cm^evgZyl\_iehlZk]hZgby]ZaZ ·10<sup>7</sup> >d]

**Z : Явления переноса**  
kijk

1. [REDACTED]
2. [REDACTED]
3. [REDACTED]
4. [REDACTED] h
5. [REDACTED]
6. [REDACTED] K
1. [REDACTED] AZZb  
10<sup>-2</sup> f<sup>2</sup> aZ k\_dmg^\_keb\_gZiZe\_gbb i\_j\_gbdmeyghf wlhc ih\\_pghklb ]Zb\_gl  
iehlghklbZ\_g d]f 4L\_fi\_ZlmZ\_ZahlZ D Kj\_gyy ebgZ kh[hgh]h ih[\_]Z  
fhe\_dmeZahlZZgZ -7 fZwnn\_d]bgucbZ f\_lj 3,1·10<sup>-10</sup>f
2. [REDACTED]

3. ~~\_\_\_\_\_~~  
 $\epsilon_0$  b kh^Zs\_jh  $\cdot 10^{22}$  fhe\_dme\_eb dhwnnbpb\_gl bnnmabb wlh]h ]ZaZ\_Z\g  
 $2 \cdot 10^{-5} f^2 k''$

AZZb\_eykZfhklhyl\_evgh]hj\_r\_gby

4. ~~\_\_\_\_\_~~  
ghfZevguo mkehbyo hg\_Z\g  $\cdot 10^{-6}$  f^2k KblZlv th  $^0C\_keb$  ip  
g\_baf\_gghfh[tzf\_khkmZkdbkeh]hf gZlj\_Zgb\_ ijbahreh ip

5. ~~\_\_\_\_\_~~  
~~\_\_\_\_\_~~  
~~\_\_\_\_\_~~ gmlj\_gg\_jh lj\_gby dhwnnbpb\_gl\  
l\_iehijhghklb

6. ~~\_\_\_\_\_~~  
~~\_\_\_\_\_~~ f  $^2$  Zkklygb\_f\_m ZfZfb kf"  
L\_fi\_ZlmZihf\_s\_gbb  $^0CZkgZjmb$   $-10^0C > Z_e\_gb\_ghfZevgh\_$

k f klj

*ийи об*

**Z : Электростатическое поле в вакууме и в веществе**

kjku

1. ~~\_\_\_\_\_~~  
2. ~~\_\_\_\_\_~~  
3. ~~\_\_\_\_\_~~ g ~~\_\_\_\_\_~~ b we\_dl]hklZlbqkdh]hihey WI ?bgbpubaf\_j\_gbygZijzggghklb

4. ~~\_\_\_\_\_~~  
5. ~~\_\_\_\_\_~~ we\_dl]bqkdh\_kf\_s\_gb\_ WI ?bgbpubaf\_j\_gbybgfndpbb

6. ~~\_\_\_\_\_~~ Hklh]Zkdh]h  $\pm = ZmkkZ_eybgfndpbb$  WI

7. ~~\_\_\_\_\_~~ ~~\_\_\_\_\_~~  $\pm = khaZgggh]h$  Z  
lhqgufaZyhf[aZy`gghc gblvx`aZy`ggufpbebgf]aZy`gghc kn\_jc^  
aZy`gghciehkdhklvx

8. ~~\_\_\_\_\_~~ ~~\_\_\_\_\_~~ ~~\_\_\_\_\_~~  
i\_j\_bke\_gguf bur\_aZy`ggufbl\_eZfb

9. ~~\_\_\_\_\_~~  
10. ~~\_\_\_\_\_~~ ~~\_\_\_\_\_~~

11. ~~\_\_\_\_\_~~  
~~\_\_\_\_\_~~

12. ~~\_\_\_\_\_~~ WI.

AZZb

1. ~~\_\_\_\_\_~~  $^{-8} De$  -  $^{-8} De$  Hij^ebl\_gZij`gghklv]i\_lv\_c\jbg\_lj\_m]hevghdZ

2. ~~\_\_\_\_\_~~ ~~\_\_\_\_\_~~  
~~\_\_\_\_\_~~  $^{-6} Def$   $^3$  Hij^ebl\_\dlhgZij`gghklb ]hdZo gZohysboky gZ  
ZkklygbbffkfgZih\jghklbbkfhlp\_g]ZrZZ

3. ~~\_\_\_\_\_~~  $^{-8} De$  Hij^ebl\_  
gZij`gghklv we\_dl]bqkdh]hihey gZhkbij]hehd bgZZkklygbbkfh]\_\_dhgpZ  
fhl\_dhgpZ

4. ~~\_\_\_\_\_~~  
~~\_\_\_\_\_~~  $^2$  gZkfAZjtieZklbg†  $^{-7} Deb$  -  
†  $^{-7} De$

AZZb\_eykZfhklhyl\_evgh]hj\_r\_gby

5. ~~\_\_\_\_\_~~  
~~\_\_\_\_\_~~ -]Hij^ebl\_aZy`uebgdb\_kebZkklygb\_f`mieZklbgZfb  
kf bZaghklvihl\_gpbZeh<

6. ~~██████████~~ ~~██████████~~ <sup>2</sup> dZZy Zkiheh`gu iZZee\_evgh  
 fn] fn]m AZj`hghe ieZklbgu - <sup>-8</sup> De fn]hc ± <sup>-8</sup> De Hij^ebl\_kbem  
 aZbfg[h]hiþly`gbyieZklbg\_kebZkklygb\_f`mgbfb Z kf [ f
7. ~~██████████~~ <sup>-8</sup> De b - <sup>-8</sup> De Zgh kf  
 Hij^ebl\_`dlhjgZij`gghklb \hd\_ mZe\_gghe hl i\_h]h aZjZ gZ kf Z hl  
 \hj]hgZkf
8. ~~██████████~~ -De  
 Hij^ebl\_ihl\_gpbZeihey Z `p\_glj`dh evpZ[ \hd\_gZhkbdhevZhlklhys\_cgZ  
 kfh]\_]hiehdhklbHij^ebl\_gZij`gghklvwe\_dlþqkdh]hiheyw\bolhdZo
9. ~~██████████~~ -De b ‡ -De gZohþlky Vdmmf\_gZZkklygbb f  
 fn]hlfn]ZDZdmxZ[hlmg\_h[ohþfhkh\ \_jblvþ[uk[ebablvaZj`hZkklygby  
 f"

ÿü öó .

kiku

1. ~~██████████~~  
 2. ~~██████████~~  
 3. ~~██████████~~ ~~██████████~~  
 4. ~~██████████~~ [ZIZj\_b dhg^gkZlh]þ bo kh\_þg\_gbbZ ihke\_hZl\_evgh , [  
 iZZee\_evgh  
 5. ~~██████████~~ Z dhg^gkZlhZ [hghhgh]hWIg\_hghhgh]hWI  
AZZb

1. ~~██████████~~ ~~██████████~~ ~~██████████~~  
~~██████████~~  
~~██████████~~ ~~██████████~~  
~~██████████~~ ~~██████████~~  
~~██████████~~
2. ~~██████████~~ 50 kf h[Zamxlkn\_þqkd bc  
 dhg^gkZlhj Ba aZj` ih `ebhg\_ Zgu gDe Hij^eblv wg\_jbx  
 we\_dlþklZ lbqkdh]hiheyf`mkn\_Zfb
3. ~~██████████~~  
~~██████████~~ <sup>2</sup>Zkklygb\_f`mgbfbffihke\_hldexqgbydhg^gkZlhZ  
 hlbklhgbdZihklZgklhf`mieZklbgZfbaZihegebebiZZnb ghf HHij^eblvZ  
 dZdhe klZeZ Zaghklv ihl\_gpbZeh[ zfdhklv dhg^gkZlhZ`h\_g\_k\_gby þwe\_dlþdZ\  
 zfdhklvdhg^gkZlhZihke\_g\_k\_gbyþwe\_dlþdZ
4. ~~██████████~~ ~~██████████~~  
~~██████████~~  
~~██████████~~  
AZZþeykZfhklhyl\_evgh]hj\_r\_gby
5. ~~██████████~~ ~~██████████~~ ~~██████████~~  
~~██████████~~ ~~██████████~~  
~~██████████~~ ~~██████████~~
6. ~~██████████~~ <sup>-8</sup> De gZohþlky `p\_glj\_iZZnbg[h]h rZZ þZf\_lhf kf Hij^ebl\_  
 iehlgklyiheyþ aZpbhgguoaZj`hgZih`þghklbrZZ
7. ~~██████████~~ ~~██████████~~ ± kf  
~~██████████~~  
 gN
8. ~~██████████~~ ~~██████████~~  
~~██████████~~ <sup>2</sup>Hij^eblvZkklygb\_f`mh[deZdZfbgZij`gghklv  
 ihydhg^gkZlhZ[h[t\_fgmxiehlgklywg\_jbbihey

Z : Постоянный электрический ток  
kihk

1. ~~...~~
  2. ~~...~~  $kh\_dg\_gbb \setminus [ZIZj\_bj\_abklhj]pbo$  ~~...~~  $izZee\_evghfk\_dg\_gbb$  b
  3. ~~...~~
  4. ~~...~~
  5. ~~...~~  $\pm E\_gpZ$
  6. ~~...~~  $, f\ hsg hklv\ lhdZi\ hegZyi\ he\_agZyi\ hl\_j$
  7. ~~...~~
  8. ~~...~~
  9. ~~...~~
  10. ~~...~~  $g$  AZZb
- 
1. ~~...~~ b
  2. ~~...~~  $\langle gmlj\_gg\_khihlbe\_gb\_bklhgbdZ$   
 $lhdZ\ Hf\ j\_abklhj\ khihlbe\_gby\ fb\ j\_abklhj \setminus Hf\ b\ Hf\ kh\_dg\_gu$   
 $izZee\_evgh\ G\ Zcbl\_lhdbl\_dmsb\_qj\_ai\_jcbllhjcj\_abklhj$
  3. ~~...~~  $\langle b \rangle$
  4. ~~...~~  $\langle l\ i\ p\ w\ lhf\ DI \rangle\ k\ b\ k\ l\_f\ u\ k\ h\ k\ l\ h\ y\ s\_c\ b\ a\ [ZIZj\_b\ b\ j\_abklhj\ Z\ h\ d\ Z\ a\ Z\ e\ k\ y\ Z\ g\ u\ f$   
 $Zcbl\_DI \rangle\ k\ b\ k\ l\_f\ i\ p\ i\ h\ d\ e\ x\ g\ b\ b\ d\ [ZIZj\_m]h \setminus h\ j\_abklhj\ Z\ g\ Z\ d\ h\ l\ h\ j\ f$   
 $u^{\wedge}ey\_lky\ f\ h\ s\ g\ h\ k\ l\ v \langle l$
  5. ~~...~~  $b\ kh\_dg\_gu\ izZee\_evgh\ i\ p$   
 $i\ p\ h\ o\ h\ g\ b\ b\ l\ h\ d\ Z\ g\ Z\ i\ h\ f\ i\ p\ h\ g\ b\ d\ u^{\wedge}ey\_lky\ l\_iehlu\ Hij^{\wedge}eblv\ d\ Z\ d\ h$   
 $d\ h\ e\ b\ q\ k\ l\ h\ l\_iehlu\ u^{\wedge}eblky \setminus h [h\ b\ o\ i\ p\ h\ g\ b\ d\ Z\ o\ a\ Z\ l\ h\ \_j\ f\ y\ i\ p\ b\ o$   
 $i\ h\ k\ e\ h\ Z\ l\_ev\ g\ h\ f\ k\ h\ dg\_gbb$   
AZZb<sup>e</sup>ykZfhklhyl evghljr gby
  6. ~~...~~  $b\ gmlj\_ggbf\ khihlbe\_gb\_f\ kh\_dg\_g\ k\ j\ h\ k\ l\ Z\ l\ h\ f$   
 $Zij\_gb\_g\ Z\ a\ Z\ b\ f\ Z\ o\ b\ k\ l\ h\ g\ b\ d\ Z\ Z\ g\ h$   
 $^2\ M\ e\ v\ g\ k\ l\ j\ b\ e\ g\ b\ f\ 1,68 \cdot 10^{-8}$
  7. ~~...~~  $izZee\_evgh \langle h [h\ b\ o\ k\ e\ m\ Z\ y\ o\ h\ g\ b\ a\ Z\ f\ d\ g\ m\ l\ u\ g\ Z\ g\_rg\_ khihlbe\_gb\_$  l  $\pm$
  8. ~~...~~
  9. ~~...~~  $\pm\ qj\_a\ f\ b\ g\ Q\ a\ k\ d\ h\ e\ v\ d\ h\ j\_f\_gb$   
 $a\ Z\ d\ b\ i\ b\ l\ h\ Z\_k\ e\ b\ k\ d\ p\ b\ b\ d\ e\ x\ h\ l\ v\ i\ Z\ Z\ e\ e\_evgh"$
  10. ~~...~~  $^2\ i\ p\ h\ e\ Z\ e\ h\ k\ v$   
 $i\ p\ k\ b\ e\_l\ h\ d\ Z: Hij^{\wedge}ebl\_l\ h\ e\ s\ b\ g\ m\ h\ k\ e\ y\ g\ b\ d\ e\ y\ Z\ e\_g\ l\ g\ h\ k\ l\ v\ Z\ g\ Z\ i\ e\ h\ l\ g\ h\ k\ l\ v$   
 $d\ j\ f\ ^3).$

Л Магнитное поле в вакууме и в веществе

кжу

- 1. FI
- 2. <
- 3. ± KZZZ
- 4.
- 5. ZHk]h]Zkdh]h ± =ZmkkZÿbgfndpbbFI
- 6. F . ?bgbpubaf\_jgby
- 7. gZiy`gghklbfZ]gblgh]hihey
- 8.
- 9.
- 10. K
- 11. ihh`gbdZdhglmZklhdhf

AZZq

- 1. :b:\  
   
   
 kf
- 2.   
 Z p\_glj\_bldZ [ gZhkb\_bldZ\hd\_hklhys\_chl\_h  
p\_glZgZff
- 3. f :b:\
- 4.   
k<sup>2</sup> Zev d iehkdhklb Zfdb khklZey\_l k gZiZe\_ gb\_f fZ]gblgh]h ihey m]he<sup>0</sup>  
Hij^ebl\_ZsZxsbcfhf\_glkbe:fi\_Z\_kebihZfd\_l\_qllhd:

AZZqÿykZfhklhyl evgh]hj.r\_gby

- 6. :
- 7.
- 8. :
- 9.   
k :
- 10.
- 11. dhlh]fmijimkdZxlhd:Hij^ebl\_iehsZ`ihi\_jgh]hk\_qgbyZexfbg\_b]h  
ihhZ\_kebhgm^bZ\_lkyg\_aZdj \_iezgguf .  
klhdhf ihf\_s\_g`ghh`gh\_fZ]gblgh\_ihe\_gZiy`gghklvx  
lZd ih ghfZev d bldmh[Zam\_l m]he 60<sup>0</sup> kgZZgbf]h`x]n  
k]rZlkbeih]ijbi]h]b]Zklh]h]b]"

<sup>3</sup>ih



e\_Zs\_ c'ehkdhklbldZ

- 4. [redacted]
- 5. [redacted] Bgndlbghklvk he\_ghb^Z
- 6. [redacted] khe\_ghb\ ip bo kh\_bg\_gbb Z ihke\_hZl\_evgh [ iZzee\_evgh
- 7. [redacted]
- 8. [redacted]

AZZb

- 1. h [redacted]
- 2. [redacted] bgndpb\_c Le I\_j\_gbdmeyjd iehkdhklb Zfdb khklZey\_l k gZiZe\_gb\_f fZ]gblgh]hihey]heHij^ebl\_klhjgmZfdb\_kebba\klghhjkj\_g\_agZqgb\_W>KbgndpbhagbdZxs\_cZfd\_ipdexqgbbiheyazkZghf<
- 3. [redacted] j [redacted]
- 4. [redacted] 0 h aZ . Ipwlhfkhe\_ghb^ gZdZiebZ\_lwg\_jbx
- 5. [redacted] Hfbk he\_ghbkhijlb\_e\_gb\_fHf bbgndlbghklvx =g kh\_bg\_gu iZzee\_evgh b ihkh\_bg\_gu qj a dexqd bklhgbdm k W>K < Hij^eblvgZij`gb\_gZdhgpZokhe\_ghbZqj akbkihke\_ZafudZgbyp\_ib AZZb^ykZfhklhyl\_evgh]hjr\_gby
- 6. [redacted] <sup>2</sup> k^eZg ba ihhehdb khijlb\_e\_gb\_f Hf Kbeh\ ebgbbhghgh]hfZ]gblgh]hiheykgndpb\_cLei\_j\_gbdmeyjueiekdhklbldZ D bldm ipkh\_bg\_g ]ZevZghf\_ljZcbl\_we\_dlpqkdbc aZj^ijr\_fbc qj a ]ZevZghf\_ljpbihhl\_bldZgZm]hef
- 7. [redacted] fihf\_s\_gh\ fZ]gblgh\_ ihe\_i\_j\_gbdmeygh ebgyf fZ]gblghc bgndpbb >bZf\_ljdhevp\_ kf bZf\_lf\_gh]hijhZ ffZcblkdhklvbaf\_g\_gbyfZ]gblgh]hihey\hlhf\_gl dh]ZkbeZ lhdZdhevp\_klZg\_lZghc:
- 8. [redacted] <sup>-2</sup> f^2 Zkiheh`g i\_j\_gbdmeygh ebgyf fZ]gblghc bgndpbb FZ]gblgZybgndpbyf\_gy\_lkyihaZdhgm B(t) = 5.sin(4,7.t) LeHij^ebl\_ Z aZpkbfhklv fZ]gblgh]h ihldZ hl\_jf\_gb [ f]gh\ggh\_agZqgb\_fZ ]gblgh]h ihldZ qj a k\ aZpkbfhklv W >K bgndpbb hl\_jf\_gb ]fZdkbfZevgh\_agZqgb\_W>K bgndpbb ^ f]gh\ggh\_agZqgb\_W>Kbgndpbb qj ak .
- 9. [redacted]
- 10. [redacted] <sup>2</sup> <l\_qgb\_kipgZij`gbb< gZdhgpZokhe\_ghbZh[fhld\_u^ey\_lkydhebqklhl\_iehluZgh\_wg\_jbbfZ]gblgh]h iheygmlpkhe\_ghbZKqlZyihe\_hghjgufgZcblkbemlhdZh[fhld\_

Z Электромагнитные колебания и волны

kku

- 1. [redacted] [redacted] [redacted]

2. [redacted] Z [redacted] [redacted]
3. [redacted] Z \ b^Zevghf dhglmj [ \j\_Zevghf dhglmj \ip  
 ugm^gguodhe\_[Zgbyo\dhglmj .
4. [redacted]
5. [redacted]
6. [redacted]
7. [redacted] b^Zevgh]h dhe\_[Zl\_evgh]hdhglmZ .
8. [redacted]
9. [redacted]
10. [redacted]
11. [redacted]
12. [redacted]
13. [redacted]
14. [redacted] (\Zdmmf\_ \ \s\_kl\ [ n ZaZ  
 ZklhlZ ] i\_bh^ ^ heghh\_bkeh \_^ ebgZ hegu .
15. [redacted] [redacted] \ ihlhd  
 wg\_jbb jiehlgkklvihlhdZwg\_jbb \dlhMfhZ -Ihcglb]Z ^ bgl\_gkbghklv .  
AZZb
1. [redacted] x
2. [redacted] f N  
 [redacted] 25 f=g b jabklhZ khihlbe\_gb\_f 1 Hf FZdkbfZevguc aZy^  
 dhg^gkZl hZ Z\g fDe Hij^eblv Z i\_bh^we\_dlhfZ]gblguo dhe\_[Zgbc [  
 eh]Zpnbqkdbc ^dj\_f\_gl aZlmoZgby we\_dlhfZ]gblguo dhe\_[Zgbc \  
 )mZg\_gb\_aZpkbfhklbgZiy`gbygZieZklbgZodhg^gkZlhZhlj\_f\_gb
3. [redacted]  
 [redacted]  
 [redacted] [redacted]  
 [redacted] [redacted]
4. [redacted]  
 [redacted] =p Zeh]Zpnbqkdbc^dj\_f\_glaZlmoZgbydhe\_[ZgbcZ\g 0,2.
5. [redacted] H=2 b P=1 ZkijklZgy\_lky iehkdZy we\_dlhfZ]gblgZy hegZ :fieblmZ  
 gZiy`gghklb we\_dlqkdh]h ihey hegu <f Zclb Z Zfieblmfm gZiy`gghklb  
 fZ]gblgh]hihey [ nZahmxkdhjklv hegu ;\ bgl\_gkbghklv hegu  
AZZbeykZfhklhyl evgh]hjr\_gby
6. [redacted] [redacted] k ihke\_gZqeZ  
 we\_dlhfZ]gblguodhe\_[Zgbcb^Zevghfdhglmj\_kebdhg^gkZlhpf\_1\_fdhklv fN b  
 [ueaZy`gh De ZbgfndlbghklvdZlmrdbZgZ f=g .
7. [redacted] [redacted] 3 ZaZaZ 1 fk .  
 Hij^eblv khihlbe\_gb\_dhglmZ\_keb\_fdhklv dhg^gkZlhZ fdN bbgfndlbghklv  
 dZlmrdb f=g .
8. [redacted] [redacted]  
 [redacted] b\_jabklh]khihlbe\_gb\_f Hf Hij^ebl\_eykemZyfZdkbfmfZlhdZdZdhk  
 hlghr\_gb\_wg\_jbbfZ]gblgh]hiheydZlmrdbdwg\_jbbwe\_dlqkdh]hiheydhg^gkZlhZ
9. [redacted]  
 [redacted] [redacted] 8 ZaZ 5 iheguodhe\_[Zgbc
10. [redacted] H [redacted] [redacted]  
 dhg^gkZlhj\_fdhklvx fdN Hij^eblv qj\_a kdhevdiheguo dhe\_[Zgbc ZfieblmZ  
 lhdZ\dhglmj\_mf\_gvrblky\ e jZ

11.  $\vec{E} = E_0 \cos(kx - \omega t)$

$\vec{B} = B_0 \cos(kx - \omega t)$

12.  $(P=1) \vec{E}(x,t) = 2 \cdot 10^{-2} \sin(2\pi \cdot 10^6 t \pm 8,97 \cdot x)$   $\vec{H} = H_0 \cos(kx - \omega t)$   
 $n = \frac{c}{v} = \frac{3 \cdot 10^8}{v}$   $\vec{E} = E_0 \cos(kx - \omega t)$   $\vec{B} = B_0 \cos(kx - \omega t)$

13.  $\vec{E} = E_0 \cos(kx - \omega t)$   $\vec{B} = B_0 \cos(kx - \omega t)$   
 $\vec{E} = E_0 \cos(kx - \omega t)$   $\vec{B} = B_0 \cos(kx - \omega t)$

ОСНОВЫ ВОЛНОВОЙ ОПТИКИ

1.  $\vec{E} = E_0 \cos(kx - \omega t)$

2.  $\vec{B} = B_0 \cos(kx - \omega t)$

3.  $\vec{E} = E_0 \cos(kx - \omega t)$   $\vec{B} = B_0 \cos(kx - \omega t)$

4.  $\vec{E} = E_0 \cos(kx - \omega t)$   $\vec{B} = B_0 \cos(kx - \omega t)$

5.  $\vec{E} = E_0 \cos(kx - \omega t)$   $\vec{B} = B_0 \cos(kx - \omega t)$

6.  $\vec{E} = E_0 \cos(kx - \omega t)$   $\vec{B} = B_0 \cos(kx - \omega t)$

7.  $\vec{E} = E_0 \cos(kx - \omega t)$   $\vec{B} = B_0 \cos(kx - \omega t)$

8.  $\vec{E} = E_0 \cos(kx - \omega t)$   $\vec{B} = B_0 \cos(kx - \omega t)$

9.  $\vec{E} = E_0 \cos(kx - \omega t)$   $\vec{B} = B_0 \cos(kx - \omega t)$

AZZb

1.  $\vec{E} = E_0 \cos(kx - \omega t)$   $\vec{B} = B_0 \cos(kx - \omega t)$

2.  $\vec{E} = E_0 \cos(kx - \omega t)$   $\vec{B} = B_0 \cos(kx - \omega t)$

3.  $\vec{E} = E_0 \cos(kx - \omega t)$   $\vec{B} = B_0 \cos(kx - \omega t)$

4.  $\vec{E} = E_0 \cos(kx - \omega t)$   $\vec{B} = B_0 \cos(kx - \omega t)$

5.  $\vec{E} = E_0 \cos(kx - \omega t)$   $\vec{B} = B_0 \cos(kx - \omega t)$

6.  $\vec{E} = E_0 \cos(kx - \omega t)$   $\vec{B} = B_0 \cos(kx - \omega t)$

7.  $\vec{E} = E_0 \cos(kx - \omega t)$   $\vec{B} = B_0 \cos(kx - \omega t)$

AZZb

5.  $\vec{E} = E_0 \cos(kx - \omega t)$   $\vec{B} = B_0 \cos(kx - \omega t)$

6.  $\vec{E} = E_0 \cos(kx - \omega t)$   $\vec{B} = B_0 \cos(kx - \omega t)$

7.  $\vec{E} = E_0 \cos(kx - \omega t)$   $\vec{B} = B_0 \cos(kx - \omega t)$



9. [REDACTED]

5-]hfZdkbfmfZ 30<sup>0</sup> ZgbZvgZgklvèbgjZjrZld  
Hij^eblvihklhyggmxjr\_ldbèbgmj\_r\_ldb

O

' O

10. [REDACTED]

ki\_dlj i\_h]hihj dZgZ[exZ\_lkyihm]ehff

11. [REDACTED]

60<sup>0</sup> gZ[exZ\_lkybnZdpbhggucfZd kbfmf 2-]hihj dZ

12. [REDACTED]

60<sup>0</sup> gZ]Zgv fhghd]klZeeZ NaCl fheygZy fZkkZ ·10<sup>-3</sup> d]fhev iehlghklv dhlh]h  
]kf <sup>3</sup> Hij^eblv m]he èbgm hegu baemqgby\_ keb ip hlZ\_gbb hl wlhc ]Zgb  
gZ[exZ\_lkyfZdkbfmf]j lv\_]hihj dZ

йы дб 10

### Z Взаимодействие света с веществом kijk

- 1. [REDACTED]
- 2. [REDACTED]
- 3. [REDACTED]
- 4. [REDACTED]
- 5. [REDACTED]
- 6. [REDACTED]
- 7. [REDACTED]
- 8. [REDACTED]
- 9. [REDACTED]
- 10. [REDACTED]
- 11. [REDACTED]
- 12. [REDACTED]

[fZ]gblgufihe\_f

-Ehj\_gpZ

± Q\_gdhZ

AZZb

1. [REDACTED]

<sup>0</sup> Hij^ebl\_m]he :jkl\_Z ip iZ^gbb k\IZ ba  
harmoZgZih\\_pghklvwlh]hd]klZeeZ

2. [REDACTED]

ihy]paZlhjb ZgZebaZlhj\_ keb m]he f\_ m bo ]eZgufb iekdhklyfb  
dZ hfgbdhe\_l\_j\_lkybgl\_gkbghklbiZZxs\_]hk\IZ

<sup>0</sup> b\

3. [REDACTED]

<sup>0</sup>. Hij^ebl\_lhesbgm lZ dhc dZp\_ hc ieZklbgdb dhlhZy ip ihf\_s\_gbb  
f\_miZZee\_evgu fbgbdheyfbiheghklvx]Zkblwlhkl\_l

4. [REDACTED]

5. [REDACTED]

<sup>-1</sup> DZdZyheywg\_jbb]hklb]Z\_lZkl\_gbc"

6. < [REDACTED]

± dZaZfb

gZ[exZ\_lky dZkgh\_ kf\_s\_gb\_dhlh\_hl\\_lklm\_l]zodZlghfm mf\_gvr\_gbx dklhlu  
baemqgby Hij^ebl\_kdZdhckdh]klvxmZey\_lkydZaZj  
AZZbèykZfhklhyl\_evgh]hj\_r\_gby

7. [REDACTED]

8. [REDACTED]

30<sup>0</sup> fèblv

labgmfm]Zlbgdgh]hg]gklZ

9.  $\frac{1}{n} \frac{dn}{dz} = -\frac{1}{R} \frac{dR}{dz}$   $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$
10.  $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$
11.  $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$   $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$   $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$
12.  $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$   $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$

## Основы геометрической оптики

иы об

### Классическая

1.  $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$
2.  $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$
3.  $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$
4.  $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$
5.  $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$   $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$
6.  $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$   $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$
7.  $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$   $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$   $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$
8.  $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$   $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$
9.  $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$
- Аналитическая
1.  $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$   $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$
2.  $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$   $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$   $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$
3.  $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$   $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$   $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$
4.  $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$   $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$
5.  $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$   $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$
6.  $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$   $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$   $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$
7.  $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$   $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$   $\frac{1}{R} \frac{dR}{dz} = -\frac{1}{R} \frac{dR}{dz}$

9.  $n \uparrow f_m]ehf \uparrow b i Z Z_1 g Z g_z$   
Hij^eblvm]hehldehg\_gbyem^i^pafhc\_keb\_zij\_ehfeyxsbcm]he

10.  $R$

11.  $R$

$R$

bah[Z\_gby ijf\_IZ \m\ebqgb\_  
bah[Z\_gby DZdh\_ ihemqehkv bah[Z\_gb\_ m\ebqggh\_ beb mf\_gvr\_ggh\_ ijfh\_ beb  
i\_j^gmlh ^ckl^l\_evgh\_bebfgbfh\_"

12.  $n_k \ h[eZZ_1 \ hilbqkdhc \ kbehc \ \uparrow j \uparrow p_z$   
ih]jn\_gbb \ b^dhklv \ n\_ ebgaz ^cklm\_l dZd Zkk\_bZxsZy Hij^eblv  
hilbqkdmx kbem ebgau \ b^dhklb \ nhdmkgh\_ Zkklygb\_ ebgau \ b^dhklb  
ih eh\_gb\_bah[Z\_gbylhqbgZoh^s\_ ckygZ]eZghchilbqkdhchkbZgZkklygbblyo  
nhdmkh^lebgau^y \ kemZ\_ ebgau^afmo\_b^dhklbihkl^hblvwlbbah[Z\_gby

йбл 0бл 12

### Z Основы фотометрии

#### kihk

1.  $R$
2.  $R$
3.  $R$
4.  $R$

#### AZZq

1.  $R$

2.  $R$

3.  $R$

4.  $R$

$I(0) = I_0 d^2$  m]he f\_m  
gZiZe\_gb\_f baemqgby b \ JbdZevx ZIZd^k \ lh^c ihld iZZxsbC gZ klhe\_keb

4.  $R$

Zihld wg\_ jbbkhl \ lklmxsbck \ lh^fm ihldm^efk^ebgch^egu b  
fdf [k \ lh^c ihld i^poh^sbcky gZ bgl\_ Ze^ebg heg hl h fdf\_keb  
khl \ lklmxsbcihld wg\_ jbbN \ w f<lip \ qfihke\_gbcZkij^e\_gZghf\_gh  
ih k\_f ebgZf heg wl]h bgl\_ ZeZ KqlZlv \ Vgghf ki\_dl^veghf bgl\_ Ze\_  
nmgdpy9aZ^kblebg\_cg^hl^ebgu^egu

#### AZZq^ykZf^hklhyl evgh]hj\_r\_gby

5.  $R$

6.  $R$

hl iheZ Yj^hklv k \ lbevgbdZ /  $4 df^2 b_g_aZ^kbl \ hl$   
gZiZe\_gb^yZclbhk \ s\_gghklviheZg\_ ihkj\_Rl \ gghih^l \ lbevgbdhf

7.  $R$

8.  $R$

$^2$ Hij^eblvdhwnnbpb\_g^hl^Z\_gbykZb

9.  $R$

?\_0[k \ lhlhggh]hbahl^igh]hbklhgbdZgZoh^s\_ ]hkygZ^kklhygbbO kfhl  
p\_gl^Zkn\_ju \ J \ Z^mkkn\_ju5 kf \ bkbeZk \ lZ, d^



4. ~~mb~~ ~~u~~ ~~b~~ ~~q~~ ~~b~~ ~~k~~ ~~z~~

~~h~~

~~h~~

5. ~~mb~~ ~~u~~ ~~b~~ ~~q~~ ~~b~~ ~~k~~ ~~z~~

~~h~~ ~~h~~ ~~h~~ ~~h~~

~~h~~

<sup>2</sup> aZk

6. ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~

~~b~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~

~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~

~~h~~

ий об 4

***L* u : Корпускулярно-волновой дуализм.  
Уравнение Шрёдингера и его решение**

h<sub>h</sub>h<sub>h</sub>

1. ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~

2. ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~

3. ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~

4. ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~

5. ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~

6. ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~

7. ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~

~~h~~

AZZh

1. ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~

~~h~~

<.

2. ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~

~~h~~

~~h~~

3. ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~

~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~

<sup>-8</sup> k hij^eblv hlghr\_gb\_ \_kl\_kl\gghc

rbjgu wg\_j\_lbqkdh]h m]gy

gZ dhlh]f [ue ha[mzg we\_dl]g d baemf\_fhc

wg\_j]bb

4. ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~

~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~

~~h~~

5. ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~

~~h~~

\ = A exp(-r/a)]^

A b a ± dhgklZglu r ±

zkklygb\_zklbpuhlkbh]hp\_glZc]bgZb[he\_\\_h]ylgh\_zkklygb\_

r\_j zklbpu

hlp\_glZ

6. ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~

~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~

<sup>2</sup>]Zfhgbqkdbc

hkpbeylh]Hp\_gblvfbgbfZevghhafhgm]wg\_j]bxzklbpulZdhfihe\_

AZZh<sub>h</sub>eykZfhklhyl\_evgh]h]r\_gby

7. ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~

8. ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~

~~h~~

~~h~~

d\Z

~~h~~

ip]\_fi\_Z]mj

17 °C.

9. ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~

~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~

~~h~~

<sup>-8</sup> k

~~h~~

10. ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~

~~h~~

11. ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~

~~h~~ [D ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~

~~h~~

12. ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~ ~~h~~

h]hf wg\_j\_lbqkdhf m]hg\_ < dZdbo

lh]Zo yfu ieh]ghklv\_\\_h]ylghklb h[gZjn`gby

zklbpukh\ZZ\_]lkdeZkkbqkdhcieh]ghklv\_\\_h]ylghklb"

l gZ

Физика атома

1.  $\psi = b e^{-gk r}$
- 2.
- 3.
- 4.
- 5.
6.  $I_{phbqkdZykbkl\_fZobfbqkdbowe\_f\_glh}$
- 7.
- 8.
- 9.
- 10.
- 11.

AZZb

1.  $\psi = A e^{-br} \cos(kr - \omega t + \phi)$   
- bJ -
2.  $l_{fhZgu} = -b \cdot -0,04$
3.  $\psi = A e^{-br} \cos(kr - \omega t + \phi)$
4.  $\psi = A e^{-br} \cos(kr - \omega t + \phi)$   
n = 4;
5.  $\psi = A e^{-br} \cos(kr - \omega t + \phi)$   
K-, L- b M-h[hehdq b s-ihh[hehdqZbgZihehbogm p-

AZZb eykZfhklhyl evghlj r gby

6.  $\psi = A e^{-br} \cos(kr - \omega t + \phi)$   
ZlhfZgh]h h h Z b ZiZahg\_ebgheghl
7.  $\psi = A e^{-br} \cos(kr - \omega t + \phi)$   
+ \_kebip
8.  $\psi = A e^{-br} \cos(kr - \omega t + \phi)$   
h[hehdZ"
9.  $\psi = A e^{-br} \cos(kr - \omega t + \phi)$   
-U] ^ Db.  $^2 g\_dhlhu\_ihklhyggu\_$
10.  $\psi = A e^{-br} \cos(kr - \omega t + \phi)$   
- b3 -l\_fhwlh]h
11.  $^2D_{3/2} : ^2P_{1/2}, ^3P_1 : ^2S_{1/2}, ^3F_3 : ^3P_2, ^4F_{7/2} : ^4D_{5/2}$

— DZdh\u agZq\_gby \_]h hj[bIZevgh]h d\Zglh\h]h qbkeZ

Ядерная физика

1.  $\psi = A e^{-k r} \sin(k r)$
- 2.
- 3.

4.    
 5.    
 6.    $\pm$  ZevnZ~~4~~klbp beb g\_clhgh\  $\pm$  y^gu\_jZdpbb [he\_\_  
 wnn\_dlb~~g~~ubihqfm"

7.     
 8.   $k > 1[ \quad k = 1 \backslash \quad k < 1\emptyset$

AZZq  
 1.   bahlhi dZevpby <sup>45</sup><sub>20</sub>~~D~~ bf\_\_l i\_ph^  
 ihem~~Z~~kiZZZguckmldZfZclbZdlbgkklvfd]wlh]hij\_iZIZ

2.  (Z\_f )ZZlhZ/L -wg\_jbykyabyZdhlh]hFw<[yZK -  
 mdhlh]hwg\_jbykyabgZh~~g~~gmdehgZgZ Fw<

3.   $^{12}_6\text{C}$   
 hb~~g~~Zdh~~u~~o ~~4~~klbpu FZkkZ yZ m]e\_hZ P  $c = 11,9967 \cdot Z_f fZkkZ yZ ]_e$ by P <sup>He</sup> =  
 4,0015 · Z\_f Z\_f  $10^{\pm 27}$  d], kdh~~h~~klv k\IZk = 3  $10^8$  fk , Fw< = 1,6  $10^{\pm 13}$  >` ).  
 HI\lij\_klZvl\_f\_]Zwe\_dlhghevI Zobhdjn]ebl\_h^kyluo

4.   $^3_7\text{Li} + ^1_1\text{H} \rightarrow ^2_4\text{He} + ^2_4\text{He}$  .

5.    
 1)  $\text{CH}^-$  ;  
 2)  $\text{C}^+ : \text{H}^+ + e^- + e^+$  ;  
 3)  $\text{C}^- : \text{H}^-$  ;  
 4)  $p + e^- : \text{Q}^-$  ;  
 5)  $\text{H}^+ : \text{H}^+$  ;  
 6)  $\text{K}^- : \text{H}^-$  ?

AZZq~~e~~ykZfhklhyl evgh]hjr\_gby

6.   

Лабораторные занятия

3 k f klj

*б йдж*

< Измерение плотности твёрдого тела  
P ebZ[hlu

1. ~~\_\_\_\_\_~~

h

2. ~~\_\_\_\_\_~~

h

3. ~~\_\_\_\_\_~~

h

4. ~~\_\_\_\_\_~~

5. ~~\_\_\_\_\_~~

h

~~\_\_\_\_\_~~ ~~\_\_\_\_\_~~

~~\_\_\_\_\_~~

b

~~\_\_\_\_\_~~

~~\_\_\_\_\_~~

Ib[hjubipgZê ghklb

we\_dlhggu\_ \ kurlZg]\_gpbjmevfbdhf\_lhgghgh\_lxh\_l\_eh

Dhglhevgu hijku

x ~~\_\_\_\_\_~~

x ~~\_\_\_\_\_~~

: khcklhl\_eZbebhcklZ\s\_klZ"

x ~~\_\_\_\_\_~~

x ~~\_\_\_\_\_~~

h

x ~~\_\_\_\_\_~~

~~\_\_\_\_\_~~

x ~~\_\_\_\_\_~~

DZdb\_ \ebhgu yeyxlky

iyfufbbaf\_j\_gbyfbZkqlghcnhfme\_"

x ~~\_\_\_\_\_~~

x ~~\_\_\_\_\_~~

h

x ~~\_\_\_\_\_~~

x ~~\_\_\_\_\_~~ u éy wlboip[hjZij^eubaf\_j\_gbc[p\_gZ^e\_gbyih]j\_rghklvhlkqZ

] ihlj\_rghklvip[hZ"

x ~~\_\_\_\_\_~~

ihlj\_rghklvZ[khexlgmxi]j\_rghklvhlghkbl\_evgmxi]j\_rg hklv"

[ kemZcgmx

x ~~\_\_\_\_\_~~

x ~~\_\_\_\_\_~~

h

x ~~\_\_\_\_\_~~

x ~~\_\_\_\_\_~~

x ~~\_\_\_\_\_~~

~~\_\_\_\_\_~~

x ~~\_\_\_\_\_~~

~~\_\_\_\_\_~~

Ib\klbipf\_j

x ~~\_\_\_\_\_~~

h

~~\_\_\_\_\_~~

x ~~\_\_\_\_\_~~

h

~~\_\_\_\_\_~~

h

x ~~\_\_\_\_\_~~

~~\_\_\_\_\_~~

x ~~\_\_\_\_\_~~

h

U 2,6 r0,3 ( / <sup>3</sup> ) ?

x ~~\_\_\_\_\_~~

V 2,317 r0,1482 <sup>3</sup> ?

Измерение скорости пули методом баллистического маятника

Р е з у л т а т ы

1. nbabqkdb \_hkgh\ u f\_lhZ[Zeebklbqkdh]hfZylgbdZ
2. kdhjkl v imebf\_lhfh[Zeebklbqkdh]hfZylgbdZ
- 3.
- 4.

Ib[hjubi]gZ^ ghklb

klZpbhgZgZy mklZghdZ k [Zeebklbqkdbf fZylgbdhf hlkqlguf mkljcklhf ebg\_cdZ k  
 ieZgdhc b ig\_fZlbqkdhc bglhdhc imey ey kljev[u ba ig\_fZlbqkdhc bglhdhc  
 we\_dlhgggu \ kuk\_dmgfhf\_j

Dhglhevgu hijku

- X
- X
- X kb c \
- X ZgghceZ[hZlhghcmklZghd\_ "
- X
- X
- X
- X
- X
- X hiulZ"
- X
- X agZqgbyijfuobaf\_jgbc  
 [fhghebbdZdgZclbkj\_g\_agZqgb\_dhk\ggh]hbaf\_jgbykdhjhklbimeb"
- X Knhfmebjncl\_ iZbeZ ihevahZgby we\_dlhggufb \kZfb DZdhü bo ij^eu  
 baf\_jgbcg\_Z^e\_gbyrdZeuih]j\_rghklvip[hZ"
- X ihevahZgby eZ[hZlhguf k\_dmgfhf\_hf DZdhü \_]h ij^eu  
 baf\_jgbcg\_ZrdZeZop\_gZ^e\_gbyrdZncrdZeuih]j\_rghklvip[hZ"
- X ?
- X
- X
- X
- X kbkl\_fZlbqkdmx
- X ih]j\_rghklv[kbkl\_fZlbqkdmxih]j\_rghklv"
- X
- X
- X
- X

x [REDACTED]  
[REDACTED]  
[REDACTED]

[REDACTED]

EZ[hZlhgZyZ[hZ<

### Проверка закона Гука и измерение модуля Юнга P e M u

1. h b \ihegbfhkl v aZdhgZ=mdZëymij]hc^nhfZpbbyZkly`\_gby
2. B b fhme v Xg]ZfZl\_bZeZaZZggh]hh[ZapZ
3. [REDACTED]
4. [REDACTED] l\_ogheh]b x h[Z[hldb j\_amev]Zlh\baf\_j\_gbc \iheg\_gguo ip Zaguo  
gZZevguomkehbyo
5. b b gZud ]Znbqkdh]h ij\_kZe\_gby wdki\_bf\_g]Zevguo Zgguo b  
bkihevahZgby]ZnbdZi]h[Z[hld\_j\_amev]Zlh\  
Ib[h]ubi]gZe\_gkklb

ihhehdZ]b]b]g]bdZlhj Zkhh]hlbiZ fbdhf\_lj ebklfbefb\_l]hc[mfZ]bi]haZgZy  
ebg\_cdZ.

### Dhg]hevgu\_hij\_hku

- x [REDACTED] Z[khexlg]hc^nhfZpb\_c [ hlghkbl\_evghc^nhfZpb\_c"
- x [REDACTED]
- x [REDACTED] DZdhZ\_]h\_b]gbpZbaf\_j\_gby"
- x [REDACTED]
- x [REDACTED] x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED] \_]hrdZe p\_g u^e\_gbyrdZe ih]j\_rghklvi]hZ"
- x K [REDACTED] \_]hrdZe ,  
p\_gu^e\_gbyrdZe ih]j\_rghklvi]hZ"
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED] Fh\_l eb\_f\_gylvky agZqgb\_wlh]h dhk\\_ggh]h  
baf\_j\_gbyh]hiulmFh]ghebbdZdgZclbkj\_ë\_agZqgb\_fh]meyXg]Z"
- x [REDACTED] fh]meyXg]ZAZibrbl\_nhfmeu
- x [REDACTED]
- x [REDACTED] [REDACTED] [REDACTED] \_]h kj\_ë\_ ]h agZqgb y"DZd  
hij^eblvZaj]u\_guobkh fgb]\_evghcpbnkj\_ë\_fagZqgbb fh]meyXg]Z"

X [REDACTED]  
 X [REDACTED] u ke\_m\_l ihfbkZlvZghkbZ[kpbkbbh]gZI"  
 X [REDACTED]  
 X [REDACTED]  
 X [REDACTED]  
 X [REDACTED]  
 X [REDACTED]  
 X [REDACTED]  
 X [REDACTED] fhagZqgb\_fhneyXg]Zihemqgggh]hkihfhsvx]ZnbdZkhhl\_lklm\_l  
 h\bl\_evghfmbgl\_Zem\ubke\_gghfmZgZeb1bqkdb"

**Проверка основного закона вращательного движения (на маятнике Обербека)**  
P e

1. [REDACTED]
2. [REDACTED]
3. [REDACTED] b gZ\udbaf\_j\_gby]f\_gbkqlhdhf -k\_dmghf\_hf
4. [REDACTED] hiulh\ ip Zae bguogZ\evguomkehbyo

Ib[h]ubipgZ\ ghklb  
 dj\_klhh[Zaguc fZylgbd gZ[hj]mah\ kqlhd -k\_dmghf\_j rlZg]\_gpbj1mev fZkrlZ[gZy  
 kZglbf\_lhZy ebg\_cdZ

Dhglhevgu\_hihku

X [REDACTED]  
 X [REDACTED] hkb Zs\_gby" < dZdbo\_0gbpZo  
 baf\_j\_lkyDmZgZiZe\_gfhf\_glkbeuhlgkbl\_evghlhqb"  
 X [REDACTED] ? DmZhgghgZiZe\_gh" <dZdbo\_0gbpZobaf\_j\_lky"  
 X [REDACTED] < dZdbo\_0gbpZo  
 baf\_j\_lky"  
 X [REDACTED] ebg\_cg]hmkdhj\_gb\_]maZZghlZg]\_gpbZevghfmmkdhj\_gbx  
 lhqd rdbZ fZylgbdZH[\_]\_dZ"  
 X [REDACTED] M m(g a)r.  
 X [REDACTED] ZgghcZ[hl\_ ?  
 X [REDACTED] a\_1 b a\_2 . Qwlhmkdhj\_gby Qg\_h[ohbfhkh[exZlv  
 fh[uwlhcZ[hl\_ hgb[uebZgu]m]m"  
 X [REDACTED]  
 X [REDACTED]  
 X [REDACTED] -\_dmghf\_hf DZdh\ij^eubaf\_j\_gbc  
 \_]hrdZep\_gu^e\_gbyrdZeih]j\_rghklvip[hZ"  
 X [REDACTED]  
 X [REDACTED]  
 X [REDACTED] f\_gy\_lkyhlhiulZdhiulm"  
 X [REDACTED]  
 X [REDACTED] ± g\_hafhgh"

x f\_gyxlkylhliulZdhiulm"

x

x

x

x

x

x \_agZqgb \_?

x

x

x

x

x

x

x

x

x

x

M , r , a , t , l \_kegbvlgZfhlZlvGZrdbf\_gvr\_]hZbmkZ"

EZ[hZlhgZyZ[hIZ<

**Измерение моментов инерции твердых тел и помощью трифилярного подвеса и проверка теоремы Штейнера**

P ebZ[hlu

1. d jnlbevgu \_ dhe\_[Zgby lpbneygh]hih^kZ

2.

3. l\_hj\_fuRl\_cg\_Z

4. gZud ipf\_g\_gby ]Znbqkdh]h f\_lhZ

5.

Ib[hjbiPgZE\_gkklb

lpnbeygucih^kkl[hj ]jnabdlZh\_l\_ehkbff\_lpgchnhfu ; ZgZebIbqkdb\_ \ku ,

f\_lZeebqkZyebg\_cdZrIzG]\_gpbdmevk\_dmghf\_pbggZyebg\_cdZbebjne\_lDZ

DhgIhevgu hijku

x

x

x k fu fhf\_ gl hf kbeu nhfmeZpkmghd . ?

x

x d jnlbevgu o dhe\_[Zgbc lpbneygh]hih^kZ"

x

x l\_hj\_fm RI\_cg\_Z DZd ih\plv l\_hj\_fm RI\_cg\_Z (dZqkl\_ggh b

dhebqkl \\_ggh)?

x

x

x dhe\_[Zgbc lpbneygh]hih^kZ"

x

x

x Z^e\_gbyih]j\_rghklvip[hZ" b

x

x

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x

x

x p\_gZ^e\_gby b\_zip[hgZyih]j\_rghklv ?

x d  
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ih]j\_rghkl\_c  
x  
x b dhk\\_gguobaf\_j\_gbc"

EZ[hZlhgZyZ[hZ<

Изучение законов колебаний математического маятника  
P e lu

- 1.
- 2.
- 3.

l]h]ubipgZè ghklb  
ébgguog\_Zklybfuobébgguo gblyo  
Dhglhevgu hijku

k\_dmghf\_f\_lhZyebg\_cdZrZpdbgZ

x  
x aZdhg]Zfhgbqkdbo dhe\_[Zgbc fZl\_fZlbqkdh]hfZylgbdZ"  
x  
x gblbfhldehgbeb - i\_üc gZ5  
kf Zlhjc gZkf lhm dZdh]hfZylgbdZi\_ph{m^l[hevr\_"  
x fZkkZfb ]mah]b]kh\jZxsbodhe\_[ZgbyihfZeufm]ehf gblb fb Zagufb  
x fZl\_fZlbqkdh]hfZylgbdZ\_kebZihgylvky\ukhdh\  
]hjng\_baf\_gyyi]pwlhf\_]hébgui\_j\_e\_l \_lv gZEmgm"  
x éy i\_phZ ]Zfhgbqkdbo dhe\_[Zgbc fZl\_fZlbqkdh]h  
fZylgbdZ ]pdZdbomkehbyohgZuihegy\_lky"  
x  
x  
x p\_gZ^ e\_gby b\_zip[hgZyih]j\_rghklv ?  
x  
x h  
x , 90 % ?  
x  
x

x       baf\_jgb y i\_phZ , dhlhj\_  
g\_h[ohbfuZgghcZ[hl\_ ipih\^gbbhiulhhbgZdh\omkehbyo .

x

x  u ihlj\_rghkl b hdjm]eblv kj\_ b\_agZqgb y ij yfuo b dhk\\_ggh]h  
baf\_jgbc ?

x

EZ[hZlhgZyZ[hlZ<

### Определение коэффициента упругости пружины P\_e

1.   dhwnnbpb\_glmijn]hklbijmbguklZlbg kdbff\_lhhf
2.   dhwnnbpb\_glmijn]hklbijmbguBgZfbqkdbff\_lhhf
3.

Ip[hjubiBgZe\_gkklb  
gZ[hjnahk\_dmgHf\_jbg\_cdZ  
Dhglhevgu\_hihku

klZevgZyijmbgZgZdhgrl\_cg\_

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x

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< dZdbo

\_bgbpZohgbaf\_j\_lky"

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x

x   v kj\_ agZqgb\_dhwnnbpb\_glmijn]hklbb\_]hij]\_rghklb \_kebiulu  
ihh\ykyipZa guogZvevguomkehbyo"

x

x       qfn

x

x

x

x

x

x

x   dhe\_[Zgbc" <dZdbo\_bgbpZobaf\_jxlk\_wlb\\_ebhgu" ^ i\_phhf

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x  qfn

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X [REDACTED]  
X [REDACTED]  
X [REDACTED]  
X [REDACTED]

8gZfbqkdhff\_lh^ ?

EZ[hzlhgZyZ[hLZ<

### Изучение свободных колебаний пружинного маятника

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1. [REDACTED]
2. [REDACTED]
3. [REDACTED]

gZud b ubke\_gbyih]j\_rghkl\_cijfuobdhk\ gguobaf\_j\_gbc

Ib[hjubi]gZE ghklb  
mkljckllheb\_g\_cdZkhkmRhhck\_dmghf\_j  
Dhglhevgu hijku

ijnbgguacfZylgbdhllkqlgh\_

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X [REDACTED]  
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X [REDACTED]  
X [REDACTED]

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X [REDACTED]  
X [REDACTED]

cos<sup>2</sup>dZdhf© sin<sup>a</sup>

X [REDACTED]  
X [REDACTED]  
X [REDACTED]

\_bgbpZohgbaf\_j y\_lky"

X [REDACTED]  
X [REDACTED]  
X [REDACTED]

Z dhwnnbpb\_glhf aZlmoZgby [ ^dj\_f\_glhf aZlmoZgby \  
eh]Zpnfbqkdbf \_dj\_f\_glhf aZlmoZgby] jf\_g\_f jeZdkZpbb ^h]hlghklvx  
dhe\_[Zgbc ?

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X [REDACTED]  
X [REDACTED]  
X [REDACTED]  
X [REDACTED]

[REDACTED]

EZ[hzlhgZyZ[hLZ<

### Исследование законов колебаний физического маятника

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1. [REDACTED]
2. [REDACTED]

3.   


Испытание

k\_dmghf\_f\_lhZy

ebg\_cdZkl\_jgvkdkdZfbrZpdgZgblb  
Dhglhevgu\_hihku

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>M dhe\_[Zgbc nbabqkdh]h fZylgbdZ khZy bo

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X dhe\_[Zgbc

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X 

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X 

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X 

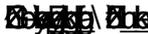
X 

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EZ[hZlhgZyZ[hIZ<

**Определение моментов инерции твердых тел методом колебаний**

Результаты

1. 



2. 

3. 



Испытание

fZohbd k]nahfrlZg]\_gpblmevf\_lZeebqkdZyebg\_cdZk\_dmghf\_j

Dhglhevgu\_hihku

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x [ kbkl\_fufZl\_pZevguohlqd"  
 <dZdbo\_0gpbZohgbaf\_y\_lkyKB"  
 x  
 x <hkhbbbh  
 x Zkfuke \ebhgghysbouZ\_gb \_éyZkklhygby a.  
 x =^Zkiheh\_gp\_glfZkkfZohbdZggghcZ[h\_l"  
 x  
 x \n  
 x g\ gheghg  
 x ,\_kebfZohbdk^eZlvbfm]h]hfZl\_pZeZ"  
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 x Z^e\_gbyrdZe u,ih]j\_rghklv[hZ"  
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 x Zkj\_g\_agZqgb\_[kemZcgmxih]j\_rghklv\  
 kbkl\_fZlbqkdmx ih]j\_rghklv ] Z[khexlmgmx ih]j\_rghklv ^ hlgkbl\_evngx  
 ih]j\_rghklv"  
 x ydn bjk  
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 x h  
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*кз бжзыйы ы дгдж д бм к дй дж*

**Измерение эффективного диаметра и средней длины свободного пробега молекул газа**

Р е з ю л т ы

1. <uqkeblvagZqgbywnn\_dlbgh]h0Zf\_lZbkj\_g\_cébgukh[hgh]h]h[\_]Zfhe\_dme  
hafoZ
2. Bamqlvf\_lh\qke\_gbywlbo\\_ebhg hkgghZgguc gZ bkihevahZgbb yé\_gby yadhklb  
kj\_0
3. I]h]j\_klbgZudbZ[hlukl\_fhf\_lhf[Zhf\_l jfbbdhklguffZghf\_lhf
4. AZdj\_iblvgZudbZ[hluk we\_dlhggufb \kZfbbk\_dmgf\_jhf
5. AZdj\_iblvgZudbh[Z[hldb]amevl ZIZdhk\ggh]h\qke\_gbykem 4\_ih^gbyhiulh\  
iph0gZdhuomkehbyo

I]h]j\_bibgZé\_gkklb

l\_fhf\_lj [Zhf\_lj bdhklguc fZghf\_lj we\_dlhgg\_u\_\ku k\_dmgf\_j khkm^k  
dZibeeyh\_f^kl\_deygu\_dhe[u

Dhglhevgu\_h]jku

x

X ~~XXXXXXXX~~

X ~~XXXX~~

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ih[\_]Zfhe\_dmeZahlZbdbkehjZipghfZevguo

mkehbyo

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Измерение адиабатической постоянной газа

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1. Ihembqlvij\_klZe\_gb\_h[ZbZ[ZlBqkdhfihp\_kk\_

<ubkeblvagZqgb\_ZbZ[ZlBqkdhcihklhygghc^afnoZ

KnfhbjZlv\_ij\_klZe\_gb\_h\_l\_ieh\_fdhklb ]ZaZ k lhqb aj\_gby deZkkbqkdhc l\_hpb

l\_iehZfdhklb

Bamqlvf\_lhDe\_fZgZb>\_ahfZ

5. AZdjiblv\_gZudbh[Z[hldb\_jamevZlh\dhk\ggh]h baf\_j\_gby ip ih\^gbb hiulh\

ZaebguogZevguomkehbyo

Ip[h]ubipgZe\_g^hklb

Dhglhevgu hijku

Wdki\_bf\_glZevgh ihemqlv l\_fi\_Zlmgmx aZbkbfhklv dhwnnbpb\_glZ l\_ieh]h  
h[t\_fgh]hZkrbj\_gbyh0bfZkeZihklh blv]ZnbdbwlboaZbkbfhkl\_c

Cclbqkehü\_agZqgbywlbodhwnnbpb\_glh\  
AZdj\_ibilvgZüdbihklh\_gbybbkihevahZgby]Znbdh]h[Z[hld\_j\_amevlZlh\  
Ib[h]ub]p]gZÉ ghklb

^h0gZdhü\_mklZgh]b kZagufbbdhklyfbhfcbl\_ogbqkdbf  
we\_dl]hiebldZ[Zhf\_l]ZebklZfbeebl\_h]hc[mfZ]bijaZgZyebg\_cdZ  
Dhgl]hevgu\_hihku

fZkehfgZ]j\_Zl\_ev

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[REDACTED]

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**Определение удельной теплоты кристаллизации металла**  
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Bamqlvyē\_gbyieZē\_gbybdpklZeebaZpbb

2. HagZdhfblvky k f\_lhñf baf\_j\_gby l\_fi\_Zlmjk ihfsvx l\_fhiZju <uqkeblv  
agZqgb\_m^evghcl\_iehluδpklZeebaZpbbhehZ

3. Bamqlvf\_lhñoeZ^gbyk bkihevahZgb\_fl\_fhiZjuēyūq bke\_gby kdjilhc\_l\_iehlu  
nZahh\hi\_j\_ohZi\_h]hjZ

4. Iph[j\_klbgZudbZ[hlukfgh]hij^evgufhevIZfi\_f\_lhf

5. AZdj\_iblv\_gZudb\_ljZnbqkdh]h\_ij\_klZē\_gby\_j\_amevlZlh\baf\_j\_gbc b bkihevahZgby  
ljZnbdh\

Ib[hjbiqgZē\_g\_hk\_l\_b

bkke\_ñ\_f\_h\_\s\_klhhehkhkkm ^rlZl\_bk^Zl\_e\_fgZ]j\_Zl\_evwe\_dl\_hiebl\_dZ

l\_fhiZjZfbbebhevIZfi\_f\_lkh\_δgbl\_evgu\_ihhZk\_dmghf\_ljZnbdl\_Zñbhqdb

l\_fhiZjebklfbef\_ljh\_c[mfZ]bZaf\_hfokfihaZgZyebg\_cdZ

Dhglhevgu\_hjhku

x [REDACTED]  
[REDACTED]

x [REDACTED]

x [REDACTED]

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x [REDACTED]

x [REDACTED]  
[REDACTED]

x [REDACTED] [REDACTED] [REDACTED]

[REDACTED] f\_ñwlbfb\_lbiZfbdhkl\_cēby\_lgZ\ebhgmdhwñbpb\_gl  
l\_ieh\_h]hh[t\_fgh]hZkrbj\_gby"

x [REDACTED]

x [REDACTED]

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[REDACTED]

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### Измерение скорости испарения жидкости и изменения её энтропии при этом процессе

P\_eZlu

1. [redacted] hû
2. [redacted] ipi\_joh^\_iZj
3. [redacted]  
[redacted]

Ib[hjubiPgZê ghklb

we\_dlhggu\_ \ku wlbehuc kibj ðk lbeebhZggZy hZ g\_ukhdbc pbebgðqkdbc  
khkmf\_jhf\_ljZg]\_gpbjmevk\_dmgñf\_j

Dhglhevgu hijku

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-dbg\_lbqkdhcl\_hpb"  
[redacted]

x [redacted]  
baf\_jgbcgZrdZeZop\_gZ^e\_gbydZhcrdZeuih]jrgkvlip[hZ"

x [redacted]  
x [redacted]  
x [redacted]

x [redacted] Z[hZ\_gZhevgu\_ mkehby ih\^gby hiulh\ fhgh kqZlv  
hðgZdhùfb"

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úçhkbð

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- x [redacted]
- x [redacted]

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EZ[hZlhgZyZ[hIZ<

**Изучение явления теплового расширения твёрдых тел**  
P elu

1. [redacted]
2. [redacted]
3. [redacted]
4. [redacted]
5. [redacted]

ip

gZljZgbbhl\_zi\_hgZqevghcEbgU

Ib[hjubiPgZE ghklb

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f\_lZeebqkdb\_ljn[dbj\_abghU\_reZg]bihklZdZkhrdZehcdx\_l

Zdhe[Zwe\_dlhieblDZ

bgbdZ lhj qkhk)h lbiZ

[Zhf\_ljl\_fhf\_ljebkl fbeebf\_ljhC [mfZ]b ihaZgZy

ebg\_cdZ

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- x [redacted]
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- [redacted]
- [redacted]

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- x [redacted]
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- x [redacted]
- [redacted]

dhwnnbpb\_glZebg\_cgh]hZkrbj\_gbyEyklZebb

eZlmgB"

- x [redacted]
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- x [redacted]
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- x [redacted]
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[redacted]

- x [redacted]
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- x [redacted]
- [redacted]

[redacted]

- x [redacted]
- [redacted]

+ hbgZdhUo bebZaguo?kebZaguo lhdZdh\_ba  
 ijfuobaf\_j\_gbcEghf\_gylvkhbagZqgby"

- x [redacted]
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- x [redacted]
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[redacted]

- [redacted]
- [redacted]



dhe[Z k dbiylbevcbd hf dZehpf\_lj g\_[hevrhc khkmf\_fhf\_lj[Zhf\_lj  
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Измерение коэффициента вязкости жидкости

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rZpdbfbdfhf\_lk\_dmghf\_jlZg]\_gpbjimevfbefb\_lhZyebg\_cdZ

klZevgu\_



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 X  - f\_lhKlhdKZ beb f\_lh@Zibeeygh]h bkdhabf\_lZ - Zkl f\_gvrnx  
 hrb[dm\ubke\_gbydhwnbpb\_glZyadhklb]hp\_glghfuZ\_gbb"  
 X    


EZ[hZlhgZyZ[hZ<

**Исследование температурной зависимости коэффициента  
 вязкости жидкости**  
Р е з у

1.      
2. 
3. 

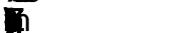
l\_fi\_Zlmj

Yaguomkehoyo .

Ib[hjubiPgZ@\_ghklb

bkdhabf\_ljk ]ebp\_bghf\\_f\_hklZl\_gZ]j\_Zl\_ev k\_dmgfh\_j\ebklZ fbefbf\_ljhç  
 [mfZ]bihaZgZyebg\_cdZ

Dhglhevgu hijku

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Изучение явления теплопроводности твёрдых тел

Р е з ю л ю

KnfhbjZlvij KlZę\_gb\_hl\_iehijhghklb

KnfhbjZlvij KlZę\_gb\_hl\_fi\_Zlmghfihe\_

BamqlvaZdhgNmj\_

BamqlvdZehpf\_lpqkdbcf\_lhñij^e\_gbydhwnnbpb\_glZl\_iehijhghklb\s\_klZ

<ubkeblvdhwnnbpb\_gll\_iehijhghklbkieZZeZlmgb

6. AZdj\_iblv gZudbihevahZgby[Zhf\_lhf\_lfhf\_dmghf\_jf

AZdj\_iblv gZudbh[Z[hldb\_j\_amevlZlh\paf\_j\_gbc ip ih\^gbb hiulh\hgbo bl\_o

\_mkehbyo

Ib[hjubięZę` ghklb

dZehpf\_lpqkdbcklZdZg kh kieZhfklZdZgtdb kh evñf miehlgbl\_ev\_ey evZrlZlb\

we\_dlhieblZ dhe[Z k ljm[dhc rbjdbk khkm^ey lZehc hù [Zhf\_lj1\_fhf\_lj

k\_dmghf\_j we\_dlhggu\_ \kuklZdZgtd .

Dhglhevgu\_hijku

x [redacted]

x [redacted] <

dZdbo\_ęgbpZobaf\_j\_lky]Zb\_gl l\_fi\_ZlmjKB"

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x [redacted]

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-lZdbg\_evaykqlZlvhđgZdhufb"

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b

**Экспериментальное изучение обобщенного закона Ома**  
P\_e

1. B e b     v f \_m l h d h f b Z a g h k l v x i h l \_g p b Z e h g Z m Z k l     d \_p \_i b
2. H e     w e \_d l j h i m s \_c k b e u b k l h g b d Z l h d Z b k h i j l b e \_g b y m Z k l d Z p \_i b
- 3.
- 4.

I p [ h j b i p g Z e \_ g h k l b

Z d d m f m e y l h j h e     v l f \_l j f b e e b Z f i \_f \_l j j \_a b k l h j u d e x q \_j d e x Z l \_e v \_j ] m e b j m \_f u c  
b k l h g b d l h d Z k h \_ g b l \_e v g u \_i j h Z

D h g l h e v g u \_ h i j k u

- x
- x
- x
- x < b e b     b k b
- x
- x b e b g z h e     g Z b f \_g v r b o d Z Z l h \ e y i j \     ^ \_g b y g Z b e m q \_c i j f h c i h
- x < b h     w d k i \_p f \_g l Z e v g u f l h q Z f

E Z [ h Z l h g Z y Z [ h l Z <

**Исследование зависимости полной мощности, полезной мощности и к.п.д. источника от нагрузки**  
P\_e

1. B
2. H
3.     b
4.     b

I p [ h j b i p g Z e \_ g h k l b

b k k e \_m \_f u c b k l h g b d h e v l f \_l j Z f i \_f \_l j Z ] Z a b g k h i j l b e \_g b c d e x q h \_g b l \_e v g u \_  
i j h Z

D h g l h e v g u \_ h i j k u

- x
- x
- x
- x b e b     b e b
- x D e     e     m     b e b
- x     b     x     b     g Z b [ h e v r b f
- x = /     h a f h g u f D I > "
- x



- x [redacted]
- x [redacted]
- x [redacted]
- x [redacted]

[redacted]

- x [redacted]
- [redacted]
- x [redacted]
- [redacted]

[redacted]

EZ[hZlhgZyZ[hIZ<

**Определение горизонтальной составляющей магнитного поля  
Земли  
Р еџу**

1. [redacted] hij^eblv ]hphagI Zevgm xkklZeyxsmx bgfndpbb fZ]gblgh]hihey  
A\_feb
2. [redacted] -]ZevZghf\_lZ
3. [redacted] -]ZevZghf\_lhf
4. [redacted] [redacted]

Ib[hjubiPgZê ghklb

Izg]\_gk-]ZevZghf\_lZfi\_f\_lj hklZlhcg hci\_j dexZl\_evkh\_đgbl\_evgu\_iphZ  
Dhglhevgu hijku

- x [redacted] h[gZjmblv"
- x [redacted]
- x [redacted]
- x [redacted]
- x [redacted]
- x [redacted]
- x [redacted]

fhgh

EZ[hZlhgZyZ[hIZ<

**Определение кривой намагничивания железа по методу  
Столетова  
Р еb Z[hlu**

1. [redacted]
2. | [redacted]
3. [redacted] [redacted]
4. [redacted]
5. [redacted] b ZaguomkehbyohiulZ

Ib[hjubiPgZê ghklb

[Zeebklbqkdbc ]ZevZghf\_ljZfi\_f \_lj \_e\_aguc lhpb^k nfy h[fhldZfb bklhgbd  
lhdZfZ]Zabgkhihlbê\_gbckh\_đgbl\_evgu\_iphZ

Dhglhevgu hijku

- x MdZbl\_nbabqkdbckfuke\_dlhphbgfndpbbbgZij`gghklbfZ]gblgh]hihey
- x [redacted]
- x [redacted]
- x [redacted]
- x [redacted]
- x [redacted]

EZ[hZlhgZyZ[hZ<

## Изучение последовательной цепи переменного тока

Р\_е\_ш\_е\_н\_и\_е

1. Введение

- x ~~1/~~
- x ~~2/2~~
- x ~~3/~~

~~у~~

*Кл дж*  
**Определение радиуса кривизны линзы с помощью колец Ньютона**  
P eb Z[hlu

1. G
2. H
3. I
4. J

~~fbdhkdhi bklhgbd k\IZ k\lhnbevlj~~ Ib[hjubiPgZé ghklb : ~~iehkdh\imdeZy ebgaZ b~~  
~~iehkdhIZZee\_evgZyieZklbgdZ~~ ~~h[t\_dlb\guc fbdhf\_lj~~

Dhglhevgu hijku

- x ~~1/~~
- x ~~2/~~
- x ~~3/~~
- x ~~4/4~~
- x ~~5/~~
- x ~~6/~~
- x ~~7/7~~
- x ~~8/~~
- x ~~9/~~
- x ~~10/~~

~~1/2~~

~~-\imdeZyebgaZk[hevrbfZbmkhfdjpbagu"~~

~~1/2~~

~~dhevpZfbGklhgZ\_kebf\_mieZklbgdhcbebgahcgZeblvhfm"~~

~~EZ[hZlhgZyZ[hIZ<~~

**Определение длины световой волны с помощью бипризмы Френеля**  
P eb Z[hlu

1. G
2. H
3. I
4. J

~~ébguk\lhçhegu~~

~~1/2~~

~~bklhgbd k\IZ k\lhnbevlj s\_ev hilbqkdZy kdZfvy [bi\pafZ kh[bZxsZy ebgaZ~~  
~~hdmeygucfbdhf\_ljebg\_cdZ~~

Dhglhevgu hijku

- x ~~1/~~
- x ~~2/~~
- x ~~3/~~
- x ~~4/~~
- x ~~5/~~
- x ~~6/~~
- x ~~7/~~

~~éywlhcko\_fu~~

~~hiul\_"~~

**Определение показателя преломления стеклянной пластинки при помощи микроскопа**

Р е ш е н и е

- 1.
- 2.
- 3.
- 4.

И б р а н и е

fbdhkdhigZ[hjeZklbgfbdhf\_lj

Dhglhevgu\_hihku

- x
- x
- x
- x
- x
- x
- x

EZ[hZlhgZyZ[hIZ<

**Определение длины световой волны при помощи дифракционной решетки**

Р е ш е н и е

- 1.
- 2.
- 3.
- 4.

k\IZ gZ i\_phdqkdhc      kljndlmj\_bnzdpbhgghc

bakhklZeyxs\_c[\_eh]h      k\IZ .

И б р а н и е :

hilbqkdZy kdZfvy bklhgbd k\IZ wdZg kh rdZehc b s\_evx\_bnzdpbhgggu\_jr      zldb ,  
ebg\_cdZ

- x
- x
- x
- x
- x
- x
- x
- x
- x
- x
- x

lbi\_bnzdpb\_b\_gZ[exZ\_lky \ Zgghc\_Z[hI\_"

      u?

bf\_xsboky\_bnzdpbhgggu      jr\_zlhd

EZ[hZlhgZyZ[hIZ<

**Дифракция лазерного излучения**

Р е ш е н и е

- 1.
- 2.
- 3.

И б р а н и е

\_ebc-g\_hghuceZa\_hilbqkdZykdZfvyebgaZgZ[hh[t\_dlhe\_y\_bnzdpbbwdZg

Dhglhevgu\_hihku

- x
- x

- x
- x
- x
- x

y

EZ[hZlhgZyZ[hLZ<

**Экспериментальная проверка закона Малюса**  
P\_eb\_Z[hlu

1. |
- 2.
3. |
- 4.
- 5.

Ib[hjubiPgZê ghklb :

ihcyhbûhk\l\_lbl\_ev]ZevZghf\_ljrlZlb\jhZ ebklfbcebf\_ljhç[mfZ]bebg\_cdZ  
dZevdmeylhj.

Dhglhevgu\_hjku

- x
- x
- x
- x
- x
- x
- x
- x

EZ[hZlhgZyZ[hLZ<

**Определение фокусных расстояний тонких линз**  
P\_eZlu

- 1.
- 2.
- 3.

Ib[hjubiPgZê ghklb :

hilbqkdZykDZfvyhk\l\_lbl\_evij\_f\_lgZ[hçbga  
wdZgebg\_cdZ

Dhglhevgu\_hjku

- x
- x
- x
- x
- x
- x
- x

x [kdhg\_ghklbd kh[bZxs\_cebga\_ ? ]h ba  
x Qkmlvf\_lh\hçke\_gbynhdmkguoZkklhygbcebgaZgghcZ[hL\_"

EZ[hZlhgZyZ[hLZ<

**10: Изучение оптических приборов**  
P\_eb\_Z[hlu

- 1.
2. H

b aPl\_evghclj[m[uD\_ie\_Z .

Ib[hjubiPgZê ghklb :

fbdhf\_ljbfZhilbqkdZy -apl\_evgyZy ljm[Z gZ[hjebga gZ[hj h[t\_dlbh'hdmejh[h[t\_dlbgu

kdZfvyebg\_cdZ  
Dhglhevgu\_hjhku  
Hibrbl\_mkljcklhfbdhkdhiZ

- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

L ljm[ul\_e\_kdhiZ )?

apl\_evghc ljm[u

agZy nhdmkgu\_zkklhygby

h[t\_dlb'hdme yZ"

EZ[hZlhgZyZ[hIZ

Основы фотометрии

P\_eZlu

- 1. B [REDACTED]
- 2. B [REDACTED]
- 3. B [REDACTED]
- 4. [REDACTED]
- 5. [REDACTED]
- 6. [REDACTED]

[REDACTED]

[REDACTED]

lhqgufbklhgbdhfk\IZ

Ib[hjubi'gZ'e ghklb :

nhlhf\_ljkeeb exdkf\_ljhilbqkdZy kdZfvy gZ[hj  
k\lh]hihey

eZfi mklZghdZ ey bkke\_nZgby

Dhglhevgu\_hjhku

- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]
- x [REDACTED]

[REDACTED]

[REDACTED]

dZdbo\_8gbpZohgbbaf\_j \_lky"

HldZdbo\\_ebhgbdZdaZ'kblhk\\_szgghklv"

[REDACTED]

EZ[hZlhgZyZ[hIZ

Измерение температуры тела неконтактным методом

P\_ebZ[hlu

- 1. [REDACTED]
- 2. [REDACTED]

[REDACTED]

3. 

Ib[hjubi]gZè ghklb \_\_\_\_\_ :  
gbojhfhZy ihhehdZ j\_lmeylhj gZij`gby \uijfb\_l\_ev Zfi\_f\_lj hevlf\_lj  
hilbqkdbcibhf\_ljlexq\_fhf\_ljbdhf\_lj  
Dhglhevgu hijku \_\_\_\_\_

x 

x 

x 

x  K

Kl\_nZgZ ± ;hevpfZgZ

x 

± ;hevpfZgZgZhkgh\ ipf\_g\_gbynhfmeuIeZgdZHldZdbo

nba\ebhgaZpkblihklhyggZyKl\_nZgZ ± ;hevpfZgZ"

x 

x 



x 

x 

x 

x 

x 

x 







EZ[hZlhgZyZ[hIZ < : Изучение основных законов внешнего фотоэффекта

P eb Z[hlu \_\_\_\_\_

1. B

-Zfi\_ghcoZZdl\_bklbdbZdmmfgh]h

nhlhwe\_f\_gIZ

2.  

3. 

4. 

Ib[hjubi]gZè ghklb \_\_\_\_\_ :

kmjfygh -p\_ab\_ùc Zdmmfguc nhlhwe\_f\_gl hevlf\_lj fbdhZfi\_f\_lj \uijfb\_l\_ev  
ihl\_gpb hf\_ljk\lbi\_evhilbqkdZy kdZfvyebg\_cdZ

Dhglhevgu hijku \_\_\_\_\_

x 

x 

x 

x 



x 

-Zfi\_gZyoZZdl\_bklbdZg\_rg\_]hnhlhwnn\_dIZ"

x 

x 

x 

x 

x 





x 

EZ[hZlhgZyZ[hIZ

Экспериментальная проверка уравнения Эйнштейна

P eb Z[hlu \_\_\_\_\_

1.   

2.  

y Wcgrl\_cgZ èyg\_rg\_]hnhlhwnn\_dIZ

3. H 

4.   

è bkihevam\_fh]hnhlhwe\_f\_gIZ .

5. =

Ib[hjubi]gZè ghklb \_\_\_\_\_ :

fhghojfZlhjhlhwe\_f\_glfbdhZfi\_f\_ljhevlf\_lj bklhgdbk\lZuijfb\_l\_ev

Dhglhevgu hijku \_\_\_\_\_

x =

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

-Zfi\_ghc oZydl\_pklbdb g\_rg\_]h nhlhwnn

\_dlZ b hibrbl\_

И

Изучение спектра атома водорода и определение постоянных Ридберга и Планка

1. G

2. W

3. M

b b\_jZ

g

Ib[hjubiPgZe ghklb

fghghfZlhj ljm[dZ k iblZgby

ZlhfZguf hhhhf dZlmdZ mfdhjZ uijfbl\_ev [ehd

Dhglhevgu hijku

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

EZ[hZlhgZyZ[hLZ<

Изучение закона радиоактивного распада

1. W

2. M

h h b aZdhgZbh Zdlbgh]h ZkiZZ

Ib[hjubiPgZe ghklb

kqlbdbhgbbjnxsbobaemqgbckqlbdwe\_dlpqkdbo

bfimevkhue\_khkknbevlfhf

Dhglhevgu hijku

x

x

x

x

x

x

x

x

x

x

x

x

x

x

x

DZkiZZIzbehkf\_s\_gbyipf\_uZkiZZ

-ZklbpZ"

E- b E- ZkiZH\ IZbeZkf\_s\_gbyipf\_uZkiZH\

Z

M

x   
x D   
x 

# Самостоятельная работа

3 k f klj

KZfhklhyl\_evgyZ[hZkhklhblba  
ih7hlhd\_b ibkvf\_gguo hl\lh\ j\_n\_Zlu gZ g\_dhlhju\_ l\_hj\_lhqkdb\_ hihku ih  
e\_dpbggufaZgylbyf k\_f\_klj ,  
ih7hlhd\_hl\lhgZdhgljevgu\_hihkubjr\_gbxaZZaykZfhklhyl\_evghcZ[hud  
izdlbqkdbfaZgylbyf  
ih7hlhd\_d \uiheg\_gbxbasbl\_eZ[hZlhguoZ[hI ipwlhf\ Z[hIZokihklh\_gb\_f  
]Znbdh\ himkdZ\_lky hihegbl\_evgh d f\_lhm @Zlygmhc gblb^ ipf\_gylv f\_lh^  
gZbf\_gvrbodZLhèyubke\_gbcm]ehùodhwnnbpb\_glhbdhfivxl\_gu\_ih]Zffu ).

1. [redacted] kbeZmijn]hklbkbeulj\_gby ).
2. [redacted]
3. [redacted]
4. [redacted]
5. [redacted]
6. [redacted] 1 q
7. [redacted] -]haZdhgZGxlgZq
8. [redacted]
9. [redacted]
10. [redacted]
11. [redacted]
12. [redacted]

## 6. Критерии оценивания результатов освоения дисциплины (модуля)

### 6.1. Оценочные средства и критерии оценивания для текущей аттестации

*ibZklZjyhlkxjf*

:

- 1) ~~ib~~
- 2) ~~ib~~ ~~ib~~ -ZpZglZ \ dZhfZpZgl\_ih  
aZZb gZ Zagu\_1\_fu bamZ\_fh]h Za^eZ nbabdb \Zgghf k\_f\_klj ih u[hjn  
ij\_ihZZl\_eyfh`lihhblvkiyibkvf\_gghZmbllhghbebibkvf\_gghaZhgh ;
- 3) ~~ib~~ ip wlhf \kemZ\_ bklZgpbhggh]h jbfZ h[mqgby ±  
uiheg\_gbyeZ[hZlhghcZ[hlugZh[hjnhZgbbg\_lj[m\_lky
- 4) ~~ib~~ ~~ib~~ k lj);
- 5) \ kemZ\_jbfZbklZgpbhggh]hh[mqgby ± uiheg\_gbyaZZgbcij\_ihZZl\_eyihl\_fzf  
e\_dpbhgguo b iZdlbqkdbo aZgylbc aZZgby b hl\_lu Zaf\_sZxlky gZ ieZlnhf\_  
MOODL).

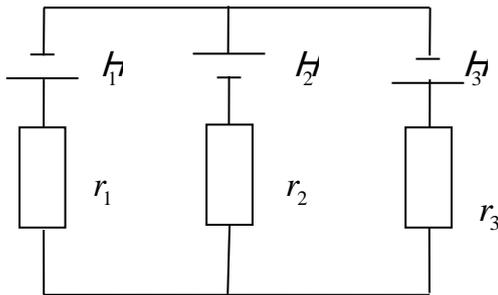
*Лмд бмч*

$$I_j k l Z e_{-} g u i Z a^{e} Z d l b q k d b_{-} a Z g \frac{< h i j k \ u \ b a Z Z q \ b \ g Z i Z d l b q k d h f a Z g y l b b}{y l b y^a}$$

~~Dh~~ ~~Z~~

<sup>4</sup>  
~~Zgl~~

1. ~~ib~~ ± ~~ib~~  
~~ib~~ \ ~~ib~~ ~~ib~~  
~~ib~~ ~~ib~~  
lhd\_
2. ~~ib~~ lhdZ H 2,0 , H H 1,0 kh\_bg\_gu dZd ihdZaZgh gZ jkmgd\_  
<gmlj.ggb\_khihlbe\_gby bklhgbdh\ r<sub>1</sub> r<sub>2</sub> r<sub>3</sub> 0,40 Hij^ebl\_lhdb \llyo  
p\_ib



3. ~~ib~~ b  
khihlbe\_gb\_fHfZkiheh`ggZyi\_j\_gbdmeyghebgbyfbgndpbbfZ]gblgh]h  
ihyDZdhcaZyihl\_dZ\_lqj\_aihl\_j\_gh\_k\_qgb\_Zfdbipihhl\_gZf
4. ~~ib~~  
~~ib~~
5. ~~ib~~ m ipohbkyfZdkbfmfki\_dlZevghciehlgkklbwg\_j\_lbqkdhc  
k\_lbfhklb0 7 )max qg h]hl\_eZipl\_fi\_Zlmj\_W K
6. ~~ib~~ -ZklbpbkimkdZ\_ll\_qgb\_hgh]hZkZfd]bahlhiZ1D <sup>24</sup>i\_ph^  
ihemZkiZZdhlh]hZ\_lgq

Ib\^guur\_izA^e©Z[hZlhgu\_Z[hlu^ \_\_\_\_\_ Z[h]

Ib\^guur\_ izA^e© \_\_\_\_\_ L fZlbqkdb o j n Zl h\  
KZfhklhyl\_evgyZ[hIZ^a )

\_\_\_\_\_ AZZgb c kemZ bklZgpb hggh]hh[mqgby \_\_\_\_\_  
;<NbabdZ  
IH F B

**Задание 1**  
**к^а^а**

\_\_\_\_\_ : \_\_\_\_\_

[1] :ca\_gphg : ? NbabdZ mq[gbd b izdlbdfm f\_y mah\ : ? :ca\_gphg ^2 FhkdZ :  
BaZl\_evklhXZcl 2020. <https://urait.ru/bcode/450504>

«

kijk	Hlu	kedZ
«	«	«

**АZZq**

1. **а** -2 +3t - 0,5t^2 ZibkZlv mZg\_gb\_  
aZbkbfhklb kdhjklb lhqb hl jf\_gb Ihkljblv jZnbd wlhc aZbkbfhklb gZclb  
dhhjgZlmbkdhhjklvlhqbqj\_akbkikhe\_gZzeZb`gby

«

2. «

«

**мбж йды ж ч лкз йбид**

\_\_\_\_\_ Hl\_l u gZhhkubj\_r\_gb \_\_\_\_\_ x aZZgZhk\_d\_ (Zmb]hpb  
Hl\_lgZhhkhe`g[ulvdZl dbf gh lhgu f bbkjuZxsbf i]g\_h[ohb]fhklb  
khijhZg]pkmgdhfbbebnhfmehc  
J\_r\_gb\_aZZbgZhk\_d\_  
- kgZzeZ aZibkZlv dZldh hZgh© >Zgh^ i jwlhf\_bgbpubaf\_jgbyi\_j\klbKB  
bkehj\_agZqgbyaZibkZlvklZgZ]ghcnhf\_aZibkbqkeZ ;  
- aZl\_f dZldh hnhfblv hijk aZZq © GZclb^Z\_keb lj[m\_lky gZclb g\_kdhevdh  
nba\ebbg lhgzhl^evghc klhd\_ dZldh aZibkZlv khhl\lklmxsbc hijk i jwlhf\_keb  
lj[m\_lkygZclb \dlhg mx \ebbg m lh h[hagZqlv\_zkhh\lkl\ggh  
- Z\_e\_hnhfblvj\_r\_gb\_© J\_r\_gb\_^  
\* mdZaZlvhdZdhfy`gbbbebaZdhg\_b^lj\_q ,  
\* k^eZlv oZZdl\_guc jkmghd we \_dl]qkdmx ko\_fm jZnbd khhl\lklmxsbc  
kh^Zgbx mkehpy aZZq gZ dhlhjf k\_\dlhg\_u\_\ebbg\_u hegu [ulv mdZaZgu b  
ih]bkZguZkemZ\_jZnbqkdhcaZZq jZnbd uihgblv khhl\lklmxs\_ffZkrIZ[\_  
\* khklZblv kkl\_fm mZg\_gbc uZZxsbo nbabqkdb\_ aZdhgu b kyab f\_fm  
\_eb q gZfbeywlhcaZZq

\* \uihegblv ijh[ZahZgb\_ mZg\_gbc h ihemqgby Zkq\ghc nhfmeu  
 ihemqblv jr\_gb\_h[s\_fb^  
 \* ih\blv\_bgbpubaf\_j\_gbybkdhfhc\ebqgu \ Zkq\ghcnhfme\_  
 \* ihklZblv bkeh\ agZqgby ba [Zau Zgguo aZZq Z IZd\_k bkihevahZgb\_f  
 g\_h[ohbfuokiZhguoZgguo\ubkeblvagZqgb\_bkdhfhc\ebqgu  
 \* ihZgZebabhZlv ihemqgguc jamevlZl k lhqb aj\_gby \_]h hklh\ghklb ba  
 iZ dlbqkdbob[ulh\ogZ[ex^gbcbaZibkZlvhl\l \l^a

DH Z[hl Z

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 ZpZgl\_aZZgby  
 KgZZeZaZibkZlv\_l\_dklaZZq .  
 AZl\_f hnhfblv © >Zgh^© GZclb^© J\_r\_gb\_`aZgZeh]bgh l\_f lj[hZgbyf d hlhj\_  
 hibkZgu ur\_ gZaZgylbb éyZmðlhghcZ[hlu ).

Ih^gb \_ba Zsbl ZeZ[hZlhguoZ[hl  
 >h\uiheg\_gbyeZ[hZlhghcZ[hlu aZZg\_\_ih\hblvrZ[ehg hlqIZ gZhcghf  
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: 1 aZibkZlv \khh\lklb k f\_lhðqkdbfb mdZaZgbyfb d eZ[hZlhghc  
 Z[hl\_< <

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ZgbiZ	EKk lqklb k	Ijèhafgbih rã_		EZ ègby rãu C	Ih ujrklv ijbZ G
		X <sub>min</sub>	X <sub>max</sub>		

:  
 aZdhgnbabdbkdhff\_glZpyfb  
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 mZg\_gb\_kyabbli  
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 a hfmeuéy\ubke\_gbyihlj\_rghkl\_cijfuobdhk\gguobaf\_j\_gbc<<

<	X <sub>1</sub> _ðaf ijfh_ bf_j_gb_	X <sub>2</sub> _ðaf ijfh_ bf_j_gb_	X <sub>3</sub> _ðaf ijfh_ bf_j_gb_	Y_ðaf dhk\ggh_ bf_j_gb_
1				
2				

X				
V				
G				
'				
H				

- ihklZghdZqkeh\oagZqgbc ± jamevlZl

± hdjn]e\_gb\_jamevlZlZ\_ogbpZ baf\_jgby«

:

M M kj “ ' M H M «

k\_dkl\h\h«

:

<hihku	HI\lu
kihkbakibkdZd eZ[hZlhghcZ [hl_kfi Za^e@Z[hZlhgu_Z[hlu^a	«
«	«

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hlql

- ey himkdZ d uiehg\_gbx Z[hlu h h l\lblev gZ hihku ij ihZlZl\_ey ih ip[hZf b  
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- \h\fy baf\_jgbc klm^glu fh]ml dhgkmevlbZlvky k ij ihZlZl\_e\_f b eZ[hZglhf ih  
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- i hhdhgZgbbijfuobaf\_jgbc ij.tyblvboij ihZlZl\_exey dhglhey .  
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Ip g\_h[ohbfhklb ihklh\_gby ]ZnbdZ g\_h[ohbfh bf\_lv ebkl fbebf\_lhlc [mfZ]b  
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g\_kdhev dh ]Znbdh\ lh `eZl\_evgh u[bZlv Zagu\_ kbfeu ey h[hagZggy  
wd

L\_fZlbqkdb\_jn\_Zl\_u

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 jn\_ZlhkfiZa^e© KZfhklhyl\_ evgZyZ[hIZ\*

lylZybZe\_k\_dklnhfmeuþkmgdb«

Ihke\_gyy[ehdEbl\_ZlmZ (kibkhd)

Hnhfeylv\_l\_fZlbqkdbcjn\_Zl i hkh]eZkhZgbx kij ihZVl\_e\_ffhgh @jndb^

beb\ZlghfZþZgl\_H[tzfwdbZe\_gl\_gg\_[he\_\_i\_klj ., rþnl TNR bgl\_Ze

ihey ± ih Dhebqklþkmgdh\ b nhlhg\_ heghij\urZlvh[tzfZjn\_ZlZþkmgdb

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*mð ómðð κ öýð ÿðy*

Hl\_l\_u\_gZhiþkubjr\_gb\_y\_aZZqZñkd\_Zmðlhþb

Hp\_gdZ aZ hl\_l\_gZ hijku fh\_l [ulv\_klZe\_gZ\_k eb\_Zgu hl\_lu\_gZ b [he\_\_  
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QZdlbqkdb\_aZgylyb^a

- hp\_gdZ © beb @Zt gh^ 3 k\_f\_klj ,\_keb dZùc ba hl\_lh\guc b iheguc ip

g\_h[ohðfhklbkhiþhþgþkmgdhfbbnbnhfmech

- hp\_gdZ © beb @Zt gh^ 3 k\_f\_klj \_kebZb alj\_ohl\lh\gu\_ bihegu\_

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þ]b\_Zgukhrb[dZfbbeg\_ihegu\_

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k\_f\_klj :

- hp\_gdZ © beb @Zt gh^ 3 k\_f\_klj \_kebihemqghjr\_gb\_\h[s\_fb^uiheg\_gZ

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g\_lhghkl\_c ;

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- hp\_gdZ © beb @Zt gh^ 3 k\_f\_klj \_kebihemqghjr\_gb\_\h[s\_fb^ gh\_g\_l

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þkmgd\_

- hp\_gdZ © beb @ aZt gh^ 3 k\_f\_klj \_kebihemqghjr\_gb\_\h[s\_fb^

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nhfme .

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. <h lhjf k\_f\_klj - h[sZy hp\_gdZ @Z gh^a\_keb [ueb  
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iZhevgh

Hp\_gdZ @^a aZsbs\_gh \_keb\_klv bkiZe\_gby \hlql\_Zgu \gu\_hl\_lu gZ  
dhglhevq\_hihku g\_f\_g\_ 90%.

Hp\_gdZ @^a aZsbs\_gh \_keb hklZebkv g\_\gh uhke\_ggufb b eb g\_\gh  
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hl\_lugZhihkudeZ[h]ZlhghcZ[h]l\_g\_f\_g\_ 80 %.

Hp\_gdZ @^a g\_ aZsbs\_gh \_kebg\_\ghuhke\_gudhk\ggg\_u\_baf\_j\_gbyih]j\_rghklb  
baf\_j\_gbc\_klv g\_lhghklb \hnhfe\_gbb hlqlZ\_beb hikmlklm\_l dZdnc -eb[h ba\_]h [ehdh\  
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Blh]hZy hp\_gdZ aZ k\_ eZ[h]Zlh gu\_ Z[h]lu \ k\_f\_klj ij\_mkfhlj\_ggu\_ \  
khhl\lklbkb]ZnbdhfaZgylbcbZkibkZgb\_f :

- hp\_gdZ@kebbf\_lky g\_[he\_hnoZkl guo@klZevgu\_© ;
- hp\_gdZ@kebbf\_lky g\_[he\_hnoZkl guo@klZevgu\_© ;
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- hp\_gdZ<sup>©</sup> \_kebij\_klZē\_ gh[s\_\_hibkZgb\_nbabqkdh]hyē\_gby g\_lbebfZeh ꞑkmgd h\, nhfmeu beb \gbo\_klv hrb[db fh]ml hlkmlklhZlv ipf\_ū ipf\_g\_gby bamZ\_fh]h nbabqkdh]h yē\_gby bf\_xlky g\_kms\_kl\ggu\_gZjmr\_gby lj[hZgbc ih hnhfe\_gbx j\_n\_ZlZgZiꞑf\_g \ghmdZaZgughf\_Zꞑkmgdh]Z[ebꞑkuehdnhfme  
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Blh]hZyhp\_gdZaZ k\_l\_fZlꞑkdb\_j\_n\_Zlu \ 3 k\_f\_klj :  
 - hp\_gdZ<sup>©</sup>kebbf\_lkyg\_[he\_ꞑoZklguo]klZevgu\_<sup>©</sup>  
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LZdbfh[Zahf\lv\_fk\_f\_klj hp\_gdZ<sup>©</sup>Zh\_gh^khh\lklm\_liehb]evghchp\_gd\_ih  
 5-[Zevghckbkl\_f\_©\_aZq\_gh^a - hp\_gd\_© Ihehb]evgZyblh]hZyhp\_gdZ\ 3 k\_f\_klj aZ  
 \kvdhfe\_dk l\_fZlꞑkdboj\_n\_Zlh\ mꞑluZ\_lkyipꞑklZē\_gbb aZq]Z .

AZZgb y kemZ\_ ꞑklZgꞑbhggh]hh[mqgby  
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 Zmꞑhꞑb bꞑhglꞑevghcZ[hl\_

## 6.2. Оценочные средства и критерии оценивания для промежуточной аттестации

Ihf\_mlhgZy Zll\_klZpby ih ꞑꞑꞑbiebg\_ ꞑbabdZ^a ljl\_v\_f k\_f\_klj khklhbl ba  
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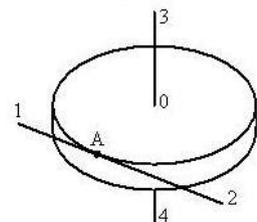
3 k f klj

$\forall \vec{a}_i, b, \vec{a}_n \in \text{Lg}]_{\text{gpbZevgZybgghfZevgZykhklZeyxsZy mkdhj\_gbylhkhlg hr\_gby}}$   
 $a_w \neq 0, a_n \neq 0$  kiZ\ēbūēy

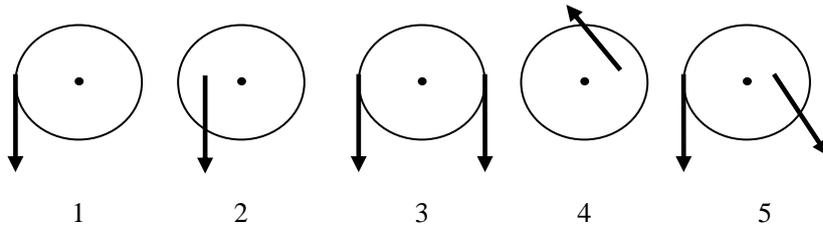
1.
2.
3.
4.

•  $\text{днж м д н R } \forall sZ\_lky \text{ h}djm] \setminus jbdZevghc \text{ hkb}$   
 $\forall ghmkdhj\_ggh \text{ ih } \forall khhc \text{ klj\_ed\_MdZbl\_gZiZē\_gb\_} \setminus dlhZ$   
 $m]ehh]hmkdhj\_gby$

- 1
- 2
- 3
- 4



жжж дг лмб н збййч й мдн йж нв и б н мйча к бй нб ндз  
 лмдз кв бййч жс бз Э б жвд з йч б



1 2 3 4 5

0 бзк ника ж  $\frac{d^2x}{dt^2} = \frac{b}{m} \frac{dx}{dt} - \frac{k}{m}x = 0$  уёу\_lky  
 kdhjklbfljwlfhkbeZkh\jZ\_lZ[hlm

- 1.
- 2.
- 3.
- 4.

1 Пм йбйбб дв бйды лм в дййк к ы йдже  $\frac{d^2x}{dt^2} = \frac{b}{m} \frac{dx}{dt} - \frac{k}{m}x = 0$  уёу\_lky

0nn\_jgpbZevgufmZg\_gb\_f

- 1.
- 2.
- 3.

2 зы лмк кз йка кзйч нлм б з д к бмв бйббб

- 1.
- 2.
- 3.

< H[tzf khkmZ k b^Zevguf jZahf mf\_gvrbeb h\_b h[Zpbeb \khkm^YZdh\_`  
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- 1.
- 2.
- 3.
- 4.
- 5.

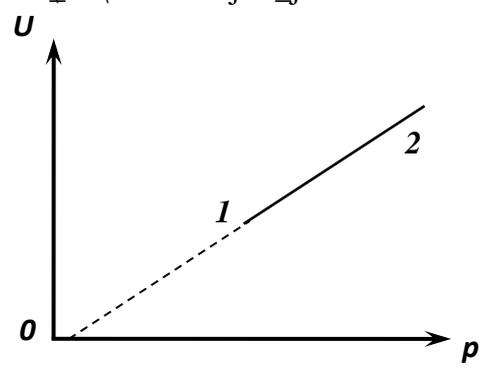
4 К дй кз к йк к йк к д б з йк к дгкЭ мйк й мбз д жбaf\_gbebkviwlfh\_]h  
 h[tzf b gmlj\_ggyy wg\_]by" (ёу dZhc \ebqgu mdZbl\_khhl\_lklmxsbc oZZdl\_j  
 baf\_g\_gby)

- 1.  ;
- 2.  ;
- 3.

9. Zpkmgd\_ihdZaZgihp\_kkbaf\_g\_gbykhklhygby  
 fheyghZlhfg[h]ZaZ (U ± gmlj\_ggyywg\_]by p ±  
 Zё\_gb\_<u[\_pl\_ \guo ml\j`gby mdZbl\_  
 boghf\_Z :

- 1.
- 2.
- 3.
- 4.

Zk



лкйб бз йджд кмйдж б лбм м кз Эз к дй ж ка Л м д з йкб з бйбб  
к ыйк к л м кн бмб лкйб бз йджд Эз к бй ф б и б к кмйдж ч Эмд б бмйч  
бмв бйды жв д бйк бм

1. ~~██~~ hafo\_ihg^evgbd[ueZf\_gvr\_qfhlhgbd

2. ~~██~~

3. ~~██~~

4. ~~██████~~

б

5. ~~██~~

<sup>3</sup> hafoZihg^evgbd[ueZ[hevr\_qfhlhgbd

]ZaZm\ebqZkv

=Za khkm^kZebkh\jbZ[hlm >> gmljgg

yywg\_]byipwlhf m\ebqZkv

gZ>DZdh\_dhebqkl \hl\_iehlu hlZeip wlf]Za"

1. > ;

2. > ;

3. > ;

4. > .

2. QmZ\gfZdkbfZevgucDI>dhlhjc fh`lbf\_lvl\_iehcb]Zl\_evkl\_fi\_Zlmjc

gZ]j\_Zl\_ey <sup>0</sup>Kbl\_fi\_ZlmjcohehdevgbdZ <sup>0</sup>K

1. 90 %;

2. 3 %;

3. 70 %;

4. 30 %.

3. Q[u gZ]j\_lvdmkhd fheb[^gZfZkkhc ]gZ ]Zfk\_fm gZhi\_j\_Zlv dhebqkl  
l\_iehlu>` QmZgZm^evgZyl\_iehZfdhklvwlh]h\s\_klZ"uqkeblv \ h

4. DZdh\_dhebqklhl\_iehlu^eblky ipd]klZeebaZpbbkbgpZfZkkhc ]aylh]h  
ipl \_fi\_ZlmjieZq\_gby<uqkeblv

5 k \_\_\_\_\_

1. ~~██~~ \ ~~██~~ (Bklhgdbd we\_dl]klZlbgkdh]h ihey <\_dlhj  
gZiy^ggghklb b ebgb gZiy^ggghklb Ipgpbi kmi\_jhabpbb ey jamevlbjmxc\_c  
gZiy^ggghklb Ipf\_j WI Ihl\_gpbZe Ipgpbi kmi\_jhabpbb ey kmffZgh]h  
ihl\_gpbZeZWd]ihl\_gpbZevgu\_ih\pghklbWI ipf\_j )

2. ~~██~~ \ ~~██~~ (<\_dlhj bgmdpbb WI , \_]h kyav k \dlhj  
gZiy^ggghklb L\_hj\_fZHklh]Zkdh]h ± =ZmkkZeywe\_dl]klZlbgkdh]hihey ipf\_j  
ipf\_g\_gby . We\_dl]qkdh\_ ihe\_ip gZebqb ihhgbdh\ We\_dl]klZlbgkdZy aZsblZ  
K\_g\_lhwe\_dl]db )

3. ~~██~~ ~~██~~ k ~~██~~ | ~~██~~ ~~██~~  
~~██~~ pbjlmeypbb Kyav Z[hlu WI k wg\_]b\_c `Zbfh^cklby aZyh\ . Wg\_]by b  
h[tzfgZyiehlghklvlgw\_]bbwe\_dl]qkdh]hi hey).

4. ~~██~~ (OZZdl\_]klbdb lhdZ ihhbfhklb Bk lhgd b lhdZ  
klhggb\_ kbeu b bo Z[h]Z we\_ dl]h]msZy kbeZ AZdhg HfZ ey hghhgh]h b  
g\_hghhgh]hmZkldh\_p\_ib a Zfdgmlhcp\_ib . IZbeZDb]hnZ We\_dl]khi]lbq\_gb\_  
b\_]haZ]kbfhklv hlnhfuzaf\_h]h]h]bl\_fi\_Zlmj]abklhZ

5. ~~██~~ Z[h]Z b fhsgklv lhdZ ZaguomZkldh\_p\_ib  
ihklhygg]h we\_dl]qkdh]h lhdZ DI> bklhgbdZ lhdZ \_]h aZ]kbfhklv hl lhdZ b  
we\_dl]khi]lbq\_gby

6. ~~██~~ ~~██~~ ~~██~~ We\_dl]qkdbc lhd \we\_dl]heblZo ,  
we\_dl]heba aZdhgu NZZ^y i h]ghklv bhgh\\we\_dl]heblZo We\_dl]qkdbc lhd \  
]ZaZobhgbaZpbyj\_dhf[bgZpby=ZahucZaj^ b\_]hlbiu

7. ~~████~~ (FZ]gblgh\_ ihe\_ b \_]h bklhgdbd AZdhg ;bh ± KZZZ ±  
 EZieZkZ\dlhfZ]gblghcbgmdpbbbebgbbfZ]gblghcbgmdpbb < boj\_hcoZZdl\_FI  
 Ipgpbikmi\_jhabpbbeyj\_amevbjnxs\_cbgmdpbbFI . FIijfh]hlhdZbdjm]hh]h  
 lhdZ L\_hj.fZHklh]Zkdh]h ± =ZmkkZFIDms\_]hkyaZjyZ ).
8. ~~██ \ █~~ (GfZ]gbbqZgb\_ fZ]g\_lbdh\ fbd]hlhd <\_dlhj  
 gZijzggghklb FI l\_hj.fZ h pbjmeypbb gZijzggghklb FI b \_z i]f\_g\_gb\_  
 FZ]gblgZy]kijbfb]hklvbijhgbpZ\_fhklvIhgylb\_hkeZ[uofZ]g\_lbdZoßZ - biZ -  
 fZ]g\_lbdZo Kbevgu\_ fZ]g\_l bdb n\_hfZ]g\_lbdb Zglbn\_jfZ]g\_lbdb n\_jlu  
 FZ]gblguc]bkl\_jabk )
9. ~~████~~ > ~~████~~  
~~██~~ <aZbfh^ckl]\_iZZee\_evguolhdh\ . FZ]gblgucihlhdZ]hlZFI  
 F Z]gblgucfhf\_gl dhglmZklhdhfb ^ckl]\_gZg\_]hFI . >\_ckl]\_FIgZDmsbcky  
 aZj]kbeZEhj\_gpZ
10. ~~██~~ bwe\_dlhfZ]gblgh\_ ihe\_ . (We\_dlhfZ]gblgZybgmdpbyaZdhg  
 NZZ^y iZ]beh E\_gpZ =\_g\_b]hZgb\_ i\_jf\_ggh]h lhdZ KZfhhbgmdpby qZbfgZy  
 bgmd pby <boj\_h\_ we\_dl]qkdh\_ ihe\_ lhd kf\_s\_gby MZg\_gby FZdk\eeZ b  
 f Zl\_jZevgu\_mZg\_gby )
11. ~~██~~ (Dhe\_[Zl\_ evguc dhglmj K h[hgu\_ we\_dlhfZ]gblgu\_  
 ]Zfhgbqkdb\_ dhe\_[Zgby a ZlmoZxs\_b\_dhe\_[Zgby b bo oZZdl\_]klbdb I jh[ZahZgb\_  
 we\_dl]qkdhcwg\_jbb[Z]gblgmx
12. ~~██~~ <heghhc i]p\_kk <heghu\_ mZg\_gby b mZg\_gby iehkdhc  
 we\_dlhfZ]gblghc hegu Ihi\_jghklv WF< Dbg\_fZl]bqkdb\_ b wg\_]lbqkdb\_  
 oZZdl\_]klbdbWF< RdZeZ WF<)
13. ~~██~~ ~~██~~ ).
14. ~~██~~ -Nj\_g\_ey F\_lh^ahg Nj\_g\_ey >bnZdpby Nj\_g\_ey b  
 N]mg]hn\_Z ).
15. ~~████~~ f██
16. ~~████~~
17. ~~██~~ N\_fZ <uh^AZdhgh\]\_hf\_]bqkdhc hilbdb  
 Ij\_ehfe\_gb\_k\IZZaebgufb ih\]oghklyfb I]pafZ a\_j]ZeZ b lhgd\_b\_ebgau <uh^  
 nhfmeu kn\_bqkdhc ih\]oghklb b nhfmeu lhgdhc ebgau gZ hkgh\ i]pgbiZ\_N\_fZ  
 Hilbqkdb\_]p[hj
18. ~~██~~ ~~██~~
19. ~~██~~ -heghhc]mZebafk\IZ .
20. ~~██~~ ~~██~~  
 g^p]g]bz]q]b
21. ~~██~~ ~~██~~ ~~██~~ ,  
 f h^eb LhfkhgZJa\_jhZ;hZ;jcey Ahff\_j\_evZk i\_dlZevgu\_aZdhghf\_ghklb  
 ZlhZ]h]hZ ihklmeZlu;hZwg\_jbywe\_dl]hgZ]lhf\_k\_pZevgZynhfmeZ )
22. ~~██~~ -f\_oZgbqkdh\_hibkZgb\_ZlhZ]h]hZ Hi\_Zlhgucf\_lh]Zglh hc nabdb  
 KlZpbhgZgh\_mZg\_gb\_ D\_gby dZglh]hc g\_jeyl]b]k]k]dhc qklbpu DZglh]u\_  
 qkeZbbonbabqkdbckfukeKibgwe\_dl]hgZHiulRl\_gZ -=\_pZoZ
23. ~~██~~ ~~██~~ ~~██~~ ~~██~~  
~~██~~ ~~██~~ ~~██~~ )

24. ZlhfgZywg\_jby>\_e\_gb\_bkbg\_l\_ay^j

25.

26.

Федеральное государственное образовательное учреждение высшего образования  
Смоленский государственный университет  
Кафедра физики и технических дисциплин  
44.03.05 Педагогическое образование

Математика, информатика)  
Б1.В.06 Физика

4 семестр

Экзаменационный билет № 1

1. (Bklhgdbd we\_dlhklZlbqkdh]h ihey <\_dlhj  
gZiy>gghklbbebgbbgZiy>gghklbIpgpbi kmi\_jhabpbb\_eyj\_amevlbjnxs\_c  
gZiy`gghklb Ipf\_ji WI Ihl\_gpbZe Ipgpbi kmi\_jhabpbb\_ey kmffZgh]h  
ihl\_gpbZeZWdihl\_gpbZevgu\_ih\pghklbWI ipf\_ji
2. -Nj\_g\_eyF\_lh^hg Nj\_g\_ey >b nZdpbyNj\_g\_eyb  
Nzmg]hn\_Z )

100

3. <sup>2</sup>b Znrh bgfmlbgklvx  
. Hij^eblvZkklhygb\_f\_nieZklbgZfbdhg^gkZlhZ

- 4.
- 5.

AZdZn\_жс :<>xgбg  
мд бмдд к бид йдыг иб д ж бй

3 k f klj

@ZqlkklZey\_lky\_keb hghj\_f\_gghbf\_xlky  
- kj\_gyyblh]hZyhp\_gdZ@Zl\_ghfhhl\lZfgZhihkubj\_r\_gbxaZZgZiZdlbqkdhf  
aZgylbb (k\_f\_klj\_bebihaZZgbyfkemZ\_δklZgpbhggh]hh[mqgby  
- hp\_gdZ@Zl\_ghfhhdhglhevghcZ[hl\_  
- blh]hZyhp\_gdZ@sbs\_ghfhk\_fmdhfie\_dkmeZ[hj Zlhguoz[hl  
- blh]hZyhp\_gdZ@Zl\_ghfhk\_fmdhfie\_dkml\_fZlbqkdbojn\_Zlh\  
© aZl\_gh^a\_klZey\_lky\_keb\_klvohly[uhgZhp\_gdZ@aZl\_ghba  
i\_j\_bke\_gguoür\_imgdlh\

4 k f klj

Hl\_lgZhihk wdaZf\_gZpbhggh]h[be\_lZ hp\_gbZ\_lkyih 5-[ZevghcrdZe\_ :  
- hp\_gdZ © , \_keb ij\_RlZ\_gh ihagh\_hibkZgb\_nbabqkdh]h ye\_gby kh^Zlky  
g\_h[ohbfu\_пкмгdbqj\_b ko\_fu]Znbdb ), [\_ahrh[hdaZibkZgu hkghgu\_nhfmeu b  
\iiegh\_guij\_h[ZahZgbyuZ`gbc\_eyihemqgbyhdZaZl\_evklZml\jg byip^agu  
ipf\_jipf\_g\_gbybamZ\_fh]hnbabqkdh]hye\_gby  
- hp\_gdZ © \_keb ij\_RlZ\_gh \p\_ehf ihagh\_hibkZgb\_nbabqkdh]h ye\_gby kh^Zlky  
g\_h[ohbfu\_пкмгdbqj\_b ko\_fu]Znbdb ), [\_ahrh[hdaZibkZgu hkghgu\_nhfmeu , gh

- hp\_gdZ© \_kebij\_klZē\_gh dZldh\_ hibkZgb\_nbabqkdh]hyē\_gby g\_lbebfZeh\_ pkmgd h\, [a hrb[hd aZibkZgu hkghgu\_ nhfmeu\_ gh g\_l ij\_h[ZahZgbc \iZ\_gbc fh]ml hlkmklhZlvjpf\_jjpf\_g\_gbybamZ\_fh]hnbabqkdh]hyē\_gby ;

- hp\_gdZ©\_keb g\_Zkdjllkh^Zgb\_ hijkZ\_ g\_lpkmgdhnhfme\_ hims\_gu]jn[u\_ hrb[db \nhfmeb]dZo a Zdhgh\g\_ qldh]h hij^e\_gby nbabqkdbo \ebqg b bo Zaf\_ghkl\_c

DZZya ZZZ wdaZf\_gZpbhggh]h[be\_lZ hp\_gbZ\_lkyih -[ZevghcrdZe\_ :

- hp\_gdZ © , \_keb ihemqgh jr\_gb\_ \h[s\_f b^ \uiheg\_gZ ih\jZ gZbf\_ghZgbc nba\ebqgbihklZghdZbkehūo agZqgbc[\_ahrb[hdbg\_lhgghkl\_c ;

- hp\_gdZ © \_keb ihemqgh jr\_gb\_ \h[s\_f b^ \uiheg\_gZ ih\jZ gZbf\_ghZgbc nba\ebqg b ihklZghdZ bkehūo agZqgbc gh hims\_gu g\_lhgh klb \pkmgd\_ beb \bqke\_gbyobkdhfhc\ebqgu

- hp\_gdZ © \_keb ihemqgh jr\_gb\_ \h[s\_f b^ gh g\_l ih\jZ b\_ bgbp baf\_j\_gbc dhebqkl\ggh]h\_amevlZIZbebhgbhrb[hgu\_\_klvhrb[dbgZpkmgd\_ g\_aZbkbfbh

- hp\_gdZ©\_kebg\_ihemqghjr\_gb\_h[s\_fb^hlkmklm\_lbebg\_\gh\_ hl gZebq y hnhfe\_gbyZgguo]pkmg dZbhkghguonhfme . g\_aZbkbfbh

Blh]hZyhp\_gdZaZhl\lih wdaZf\_gZpbhgghfm[be\_lm

- hp\_gdZ©\_kebh^akebbf\_lkyg\_[he\_\_ hghcZklghchp\_gdb© bhklZevgu\_©

- hp\_gdZ©\_ohjrh ^akeb bf\_lkyg\_[he\_\_hghcZklghchp\_gdb© bhklZevgu\_©

- hp\_gdZ©\_mhe\_lhpl\_evgh ^akeb bf\_lkyg\_[he\_\_hghcZklghchp\_gdb© bhklZevgu\_©

- hp\_gdZ©\_mhe\_lhpl\_evgh ^akeb bf\_lky^b[he\_\_Zklguohp\_ghd©

HgZdh blh]hZy hp\_gdZ aZ wdaZf\_g mbluZ\_l g\_lhevvdh hl\l ih [be\_l mgh b\_lj ^hihegbl\_evgu\_@lbg]hū\_hp\_gdbaZ[Z[hlmk\_f\_klj :

- aZhl\lugZhihkubjr\_gb\_aZZgZhkhd\_Zmb]h]bbbeb\uiheg\_gb\_aZZgbc\ kemZ\_bklZgpbhggh]hh[mqgby

- aZdhglhevngxZ[hlm

- aZaZsbl meZ[hZlhguoZ[h

Zohblkykj\_ē\_\_ agZqgb\_bawlboljo@lbg]hūohp\_ghd?kebhghhdZauZ\_lkyur\_ hp\_gdbih[be\_lmlhblh]hZyhp\_gdZaZwdaZf\_gihurZ\_lky\_kebgb\_ ± lhihgbZ\_lky

## 7. Перечень основной и дополнительной учебной литературы

### 7.1. Основная литература

#### 3 семестр

1. **g b** ? NbabdZ mq[gb d b iZldbdmf ēy \mah\ : ? :ca\_gphg 2 FhkdZ : BaZl\_evklh\_XZcl 2 335 k 2 <ukr\_\_h[ZahZgb\_ 2 ISBN 978-5-534-00487-8. 2 L\_dklwe\_dlhggucW;KXZcl>kZcl@ 2 URL: <https://urait.ru/bcode/450504>
2. **h** < Dmk h[s\_c nbabdb\dg Dgb]Z f\_oZgbdZ mq[gb d ēy [ZdZeZ]h\ / ; < ;hgZj\G I DZeZrgbdh= = Kibpg 2 FhkdZ BaZl\_evklh\_XZcl 2 353 k 2 ;ZdZeZj :dZ^fbqkdbc dmj 2 ISBN 978-5-9916-1753-6. 2 L\_dkl we\_dlhggucW;KXZcl>kZcl@ 2 URL: <https://urait.ru/bcode/425487>
3. **h** < Dmkh[s\_cnbabdb\dgDgb]Zl\_fhbZfbdZklZlklbqkdZynba bdZ klh\_gb\_ \s\_klZ mq[gb d ēy [ZdZeZ]h\ ; < ;hgZj\ G I DZeZrgbdh\ = = Kibpg 2 2-\_ba^ 2 FhkdZ BaZl\_evklh\_XZcl 2 369 k 2 ;ZdZeZj :dZ^fbqkdbc dmj 2 ISBN 978-5-9916-1755-0. 2 L\_dkl we\_dlhgguc W;K XZcl >kZcl@ URL: <https://urait.ru/bcode/425491>
4. **h=** : H[sZy nbabdZ \ l Lhf mq[gh\_ ihkh[b\_ ēy \mah\ / = : ;h]kdbc W < ;mkbZg 2 2-\_ba^kijpni 2 FhkdZ BaZl\_evklh\_Xj Zcl 2020. 2 242 k 2 <ukr\_\_ h[ZahZgb\_ 2 ISBN 978-5-534-05451-4. 2 L\_dkl we\_dlhggucW;KXZcl>kZcl@ 2 URL: <https://urait.ru/bcode/454254>



6. **БК** B NbadZ hilbdZ We\_f\_glu Zlhfgbc b y^ghc nbadb We\_f\_glZgu\_ qkibpu mq[gh\_ikhk[b\_ey\mah\ K B Dmag\_ph\ ^2 F hkdZ BaZl\_evklh XZcl 2020. ^2 301 k ^2 <ukr\_\_ h[ZahZgb\_ ^2 ISBN 978-5-534-01420-4. ^2 L\_dkl we\_dlhgucW;KXZcl>kZcl@ ^2 URL: <https://urait.ru/bcode/451430>
7. **Б** : NbadZ: mq[gbdbiZdlbdfey\mah\ < : bd\_jh\ ^2 FhkdZ : BaZl\_evklhXZcl ^2 415 k ^2 <ukr\_\_h[ZahZgb\_ ^2 ISBN 978-5-9916-4820-2. ^2 L\_dklwe\_dlhgucW;KXZcl>kZcl@ ^2 URL: <https://urait.ru/bcode/450293>
8. **ББ** B Hkghu hilbdb L\_hpy bah[Z\_gby mq[gh\_ikhk[b\_ey\mah\ / B B KmoZgh\ ^2 2- ba^ bkij b hi ^2 FhkdZ BaZl\_evklh XZcl 2020. <https://urait.ru/bcode/453260>
9. **Б** B jndhhklhdj\_r\_gbxaZZihnbabd\_ mq[gh\_ikhk[b\_ey\mah\ / L B LjnbfhZ ^2 3- ba^bkijbhi ^2 FhkdZ BaZl\_evklhXZcl ^2 265 k ^2 <ukr\_\_h[ZahZgb\_ ^2 ISBN 978-5-9916-3429-8. ^2 L\_dklwe\_dlhgucW;K XZcl>kZcl@ ^2 URL: <https://urait.ru/bcode/449610>
10. **Б** mq[gbdb iZdlbdfey\mah\ < : Bevbg? X ;ZolbgZ G ; <bg[h]ZHZ I B KZfhce\_gdh ih^ jZdpb\_c< : BevbgZ ^2 FhkdZ BaZl\_evklhXZcl ^2 399 k ^2 <ukr\_\_h[ZahZgb\_ ^2 ISBN 978-5-9916-6343-4. ^2 L\_dkl we\_dlhguc W;K XZcl>kZcl@ ^2 URL: <https://urait.ru/bcode/450506>

## 1.2. Дополнительная литература

3 k f klj

1. **Б** ; NbadZL\_iehü\_ihp\_kku mq[gh\_ikhk[b\_ey\mah\ K ; ;h[hrbgZ = G BafZceh\ ^2 2- ba^bkijbhi ^2 FhkdZ BaZl\_evklhXZcl ^2 118 k ^2 <ukr\_\_h[ZahZgb\_ ^2 ISBN 978-5-534-08814-4. ^2 L\_dkl we\_dlhguc W;KXZcl >kZcl@ URL: <https://urait.ru/bcode/454059>
2. **Б=** : Nbabqkdb\_ hkghu\_kl\_klhagZgby mq[gh\_ikhk[b\_ey\mah\ / = : ;hf\ kdbc ^2 3- ba^bkijb hi ^2 FhkdZ BaZl\_evklh XZcl ^2 226 k ^2 <ukr\_\_h[ZahZgb\_ ^2 ISBN 978-5-534-05209-1. ^2 L\_dkl we\_dlhguc W;K XZcl>kZcl@ ^2 URL: <https://urait.ru/bcode/454253>
3. **Б=** : Nbabqkdb\_ hkghu\_fZl\_fZlbqkdh]h fh^ebhZgby mq[gbdb iZdlbdfey\mah\ = : ;hf\kdbc: K Dhgzlv\_\ Qm^b ^2 2- ba^bkijb hi ^2 FhkdZ BaZl\_evklh XZcl ^2 319 k ^2 <ukr\_\_ h[ZahZgb\_ ^2 ISBN 978-5-534-05365-4. ^2 L\_dkl we\_dlhguc W;K XZcl >kZcl@ ^2 URL: <https://urait.ru/bcode/452264>
4. **Б** ? Nbabqkdb\_ hkghu ihemqgby bgnhfZpbb mq[gbdb ey\mah\ / : ? =hevfl\_ cg ^2 FhkdZ BaZl\_evklh XZcl ^2 291 k ^2 <ukr\_\_ h[ZahZgb\_ ^2 ISBN 978-5-9916-6529-2. ^2 L\_dkl we\_dlhguc W;KXZcl>kZcl@ ^2 URL: <https://urait.ru/bcode/451328>
5. **Б** < NbadZ f\_oZgbdZ We\_dlhgklh b fZ]g\_lbaf EZ[hZlhguc iZdlbdfmq[gh\_ikhk[b\_ey\mah\ < < =hZq ^2 2- ba^i\_jZ[ b hi ^2 FhkdZ : BaZl\_evklhXZcl ^2 171 k ^2 <ukr\_\_h[ZahZgb\_ ^2 ISBN 978-5-534-07606-6. ^2 L\_dklwe\_dlhguc W;KXZcl>kZcl@ ^2 URL: <https://urait.ru/bcode/455479>
6. **Б** < NbadZ AZZh\_l\_klu F\_lhü\_j\_r\_gby mq[gh\_ikhk[b\_ey kj\_gh]h ijn\_kkbhgZevgh]h h[ZahZgby < < =hZq ^2 FhkdZ : BaZl\_evklh XZcl ^2 301 k ^2 Ijn\_kkbhgZevgh\_ h[ZahZgb\_ ^2 ISBN 978-5-534-08112-1. ^2 L\_dkl we\_dlhgucW;KXZcl>kZcl@ ^2 URL: <https://urait.ru/bcode/449119>
7. **Б** < NbadZ KZfhklhyl\_ evgZy Z[hIZ klm^glZ mq[gh\_ikhk[b\_ey\mah\ / < < =hZqG : BZgh\F < IeZklbgbgZ ^2 2- ba^bkij b hi ^2 FhkdZ : BaZl\_evklhXZcl ^2 168 k ^2 <ukr\_\_h[ZahZgb\_ ^2 ISBN 978-5-9916-9816-0. ^2 L\_dklwe\_dlhgucW ;KXZcl>kZcl@ ^2 URL: <https://urait.ru/bcode/452048>
8. **ББ** I NbadZ =Znbqkdb\_f\_lhü\_j\_r\_gby aZZq mq[gh\_ikhk[b\_ey kj\_gh]h ijn\_kkbhgZevgh]h h[ZahZgby G I DZeZrgbdh\< B Dhrdbg ^2 2- ba^ bkij b hi ^2 FhkdZ BaZl\_evklh XZcl ^2 250 k ^2 Ijn\_kkbhgZevgh\_

URL: <https://urait.ru/bcode/452419>

- 9. ~~IG~~ I NbadZ \ qQklv mq[gbd b iZdlbdf ey kj\_gh  
ih\_n\_kkbhgZevgh]h h[ZahZgby G I DZeZrgbdh\K ? FmZv\_\ 2 2-\_ba^bkijb  
hi 2 FhkdZ BaZl\_evklh XZcl 2 254 k 2 Ihn\_kkbhgZevgh\_  
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- 11. ~~D~~ < NbadZki ehrguokj^ mq[gh\_ikh[b\_ey mah\ D < Ehlh\ 2 2-\_ba^  
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- 12. ~~g~~ G NbadZ mq[gh\_ikh[b\_ey mah\ < G hdbgh\ 2 2-\_ba^bkijb  
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- 3. ~~g~~ ? Nbadqkdb\_hkghu ihemqgby bgnhfZpbb mq[gbd ey mah\ /  
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- 4. ~~K~~ < NbadZ AZZh l\_klu F\_lhu jr\_gby mq[gh\_ikh[b\_ey kj\_gh]  
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