Fbgbkl_jkl\h gZmdb b \ukr_]h h[jZah\Zgby Jhkkbckdhc
N_^_jZevgh_]hkm^Zjkl_ggh_ [x^`_lgh_ h[jZah\Zl_evgh_
\ukr_]h h[jZah\Zgby
©Kfhe_gkdbc]hkm^Zjkl_gguc mgb_jkbl_lª

DZn_^jZ nbabdb b l_ogbq_kdbo ^bkpbiebg

©Ml_j`^Zxª
ljhj_dlhj ih m-q_[gh
f_lh^bq_kdhc jZ[hl_
Mklbf_gdh X :
©23ª bxgy2022]

.20

GZijZ\e_gb_ ih^]hlh\db

GZijZ\e_gghklv :ijhnbev ,
NhjfZ h[mqhgby
Dmjk2 ±
K_f_kl3,4±
<k_]h aZq_lguo8,_q^Zkgh\288±
NhjfZ hlq_lghklb±3 akZfq_kwjdaZf_4gk_±f_klj

ljh]jZffm jZajZZ[hlZe
dZg^b^Zl nbZalb_dZlbq_kZmd ^hp_gl Kheh^q_gdh\Z L ;

H^h[j_gZ gZ aZk_^Zgbb dZn_^ju
©16ª bxgy2022] ijhlhdh0e ‹

AZ_^mxsbc dZn_^jhc >xg^bg : <

Kfhe_gkd
2022

Dhfi_l_gpby	Bg^bdZlhju ^hklb`_gby
-7. Kihkh[_g fZl_fZl dhjj_dlgh klZ\bl _kl_kl_gghgZmq aZ^Zqb b deZkkl aZ^Zqb fZl_fZlb kljh]h ^hdZaZlv ml_j`^_gb_ knhjfmebjh\Zlv j_amevlZl m\b^ ke_^klbv j_amevlZlZ	[Zah\u_ ijbgpbiu ihklZgh\db _kl_kl_g deZkkbq_kdbo aZ^Zq fZl_fZlbdb hij_^_e_ ^hdZaZl_evkl\Z l_hj_f ih hkgh\guf jZa^_eZ j_rZlv hkgh\gu_ lbiu fZl_fZlbq_kdZl ml_j`^_gb_ knhjfmebjh\Zlv j_amevlZl m\ i_j\bqgufb gZ\udZfb ijbf_g_gby f ZiiZjZlZ d j_r_gbx dhgdj_lguo aZ^Zq ba ijbdeZ^ghc fZl_fZlbdb b.bgnhjfZlbdb

Bamq_gb_ ndZadbdgZ_lky \ lj_lv_fkjkZ_af^_kejZ_ ©f_oZgbdZª ihk\y
f_oZgbqfnk^d\hb`_gxbl_e b kjJZkkfZljb\Z_lky Zbg^bfZZdbey fh^_e_c
©fZl_jbZevgZyª b ©l\jj^he_mdZeybª kbmiZl_evgh]h b \jZsZl_evgh]h
hlghbk_evgh bg_jpbZevghc kbklAZu_fhkaqmqZZ_lkyZdZgkZhdjZg_gby
bfimevkZ fhf_glZ bfimevkZ b f_oZgbq_Mk^d_hec_gwg\jbbfZglb_eZbam
f_oZgbq_kdh]h ^\b`_gby hlghkbl_evgh g_bg_jpbZevguo kbkl_f
j_eylbk\bdhc f_oZgbZdaghb^ghklvx f_oZgbq_kdh]h ^\b`_gby kem
dhe_[Zgby b mijm]b_ \heg rbjhdh jZkijhkljZgzggAZ\jriZbjk\y_
bamq_gb_ f_oZgbdb l_fhc dbg_fZlbdb b ^bgZZhedbam`b^gdh_klbcabd
ihk\ys_g_hielh\hfm ^\b`_fhgbxdmevjbgh_lbq_kdhc l_hjbb b l_jfh^bg

ijbf_j_ fh^_e_c _s_kl\Z ©b^_Zevguc]Zaª b ^jm]bo fh^_e_c Z]j
JZkkfZljb\Zxlky kgZqZeZ k ihabpbc ij_^klZ\e_gbc h dhjimkdmeh
b klZlbklbq_kdb_ jZkij_^_e_gbby_ehe_bd^mZevgh]hl_jZa\bgZfbd_
\uykgyxlky ihklmeZlu b bo ijbf_g_gb_ d hibkZgbx jZag\uo kl
_s_kl\Zo nZah\u_ i_j_oh^u b djblbq_kdb y\e_gby Z lZd`_ y
fh^_eb Zbe^vgh]h]ZaZ

< q_l\zjlhf k_f_klj_lkyjahmkdZevgu_ jZa^_eu_ dhljhafZ]gbyWe_gb
f_lh^heh]bq_kdb jZkkfZljb\Zxlky kgZqZeZ k ihabpbc ij_^klZ\e_g
fZ]gblghf ihe_ Z aZl_f _^bgh]h we_dljhfZ]gblghjh\ghue_yl_Nhjffm
we_dljhklZlbdb b fZ]gblhklZlbdb bo ijbf_g_gb_ \ \ZamxhZy b \
l_fu we_dljhfZ]gblghc ,bg^mdhp]hb we_dljhfZ]gblgwhe]_dljhfZ]gblgu
dhe_[Zgbc b >\Zeg_ jZkkfZljb\Zxlky hilbq_kdb_ y\e_gbyc \ j
]_hf_ljbq_kdhc b d\Zglh\hc l_hjbb
ij_^klZ\e_gbc h dhjimkdmehyfg^mZebaf_Zlk\fuyZkgy_lky dhjimkdme
\hegh\hc ^mZebaf qZklkphfhsvkl\Zgh\hc l_hajbbZxlky kZhkh\Z
K ijbf_g_gb_f d\fZglZhbq_kdh]h ih^oh^Z jZkkfZljb\Zxlky hkgh\gu
y^_j h[f_gguc oZjZdl_j y^_jguo kbe Z lZd`_ y\e_gby jZ^bhZd
AZdZgqb\Z_lky bamq_gbe_Zkhbmabdhpwe_f_glZjguo qZklghp\ gZ
nmg^Zf_glZevguo \azbfhd_cgkllhbuo klZlbklbd Z lZd`_ djZldbf h
l\zj^uo l_e k lhqdb aj_gby d\Zglh\hc l_hjbb

Bamq_gbe_dljhfZ]g_lbafZ hilbdb d\Zglh\hc nkahbjhb\hb`^nZbalky
ijh_^_gb_f wdki_jbf_glZ \ eZ[hjZlhjguubf_mkeb\wfyo_f_glZjghc
fZl_fZlbdb ebg_c\ghdlhjbhZe]_[ju ^bnn_j_gpbZevgh]h b bgl_]j
bkqbke_gwe_f_dlh\jbb _jhylghklb b fZl_fZlbq_kdhc klZlbklbdb
kj_^kl\ h[jZfh]jZnbq_kdhc bgnhjfZpbb

LZdbf h[jZahf ^bkpbiebgZ ©NbabdZª iha\hey_l \uykgblv
nbabq_kdb_ b fZl_ffZh^b_e_kdb_f_lhjZaghh[jZaguc fZl_fZlbq_^kedybc Z
bamq_gby kljmdlmjghc hj]ZgbaZpbb _s_kl\Z jfuk_emsgkhl\hbZgb
fZl_jbb

3k_f_klj

< i i	JZa^_eu b l_fu	<k_] qZkl	Nhjfu aZgylbc				
			e_dp	k_fb gZju	ijZdlb q_kdb aZgylb	eZ[hjZ lhjgu_ aZgylb	kZfh klhyl_ev jZ[hlZ
1.	*Введение* *Механика* Dbg_fZlbdZ	13	4	0	4	2	3
2.	>bgZfbdZ	22	4	0	2	6	10
3.	JZ[hlZ fhsghkl wg_j]by	4	1	0	2	0	1
4.	AZdhgu khojZg	13	1	0	2	4	6
5.	G_bg_jpbZevgu kbkl_fu hlkq_lZ	4	1	0	2	0	1
6.	We_f_glu KLH	2	1	0	0	0	1
7.	F_oZgbq_kdb_ dhe_[Zlbhyeug	17	4	0	2	4	7
8.	F_oZgbdZ `b^d]Zah\	6	2	0	2	0	2
9.	*Молекулярная физика и термодинамика*	14	2	0	4	4	4

	Hkgh\u fhe_d-m dbg_lbq_kdhc l						
10.	Hkgh\u l_jfh^b(	16	4	0	4	4	4
11.	:]j_]Zlgu_ khk _s_kl\Z	11	4	0	4	0	3
12.	NZah\u_ i_j_b djblbq_kdb_ y\	11	2	0	2	4	3
13.	Y\e_gby i_j_gh	11	2	0	2	4	3
		144	**32**	**0**	**32**	**32**	**48**

__k_f_klj

‹ i i	JZa^_eu b l_	<k_] qZkl	Nhjfu aZgylbc				
			e_dp	k_fb gZju	ijZdłb q_kdb_ aZgylb	eZ[h-j lhjgu aZgyl	kZfhklh yl_evg jZ[hlZ
1.	*Электромагнетизм* We_dljhklZlbq_ ihe_ \ \Zdmb _s_kl_	10	4	0	4	0	2
2.	lhklhyggguc we_dljbq_kdbc	12	2	0	2	4	4
3.	FZ]gblgh_ ihe_ \Zdmnf\ _s_kl	15	3	0	4	4	4
4.	We_dljhfZ]gblg bg^mdpby	5	1	0	2	0	2
5.	We_dljhfZ]gblg dhe_[Zgby b \h	6	2	0	2	0	2
6.	*Оптика* Hkgh\u \hegh\h hilbdb	14	2	0	4	4	4
7.	<aZbfh^_ckl\b_ _s_kl\hf	6	2	0	2	0	2
8.	Hkgh\u]_hf_ljbq_kdhc	11	2	0	2	4	3
9.	Hkgh\u nhlhf_l	6	2	0	2	0	2
10.	Hkgh\u d\Zglh\ hilbdb	6	2	0	2	0	2
11.	*Вероятностный характер состояния и движения микрочастиц* Dhjimkdm-eyjgh \hegh\hc ^mZe MjZ\g_gb_ Rjz‹ b _jhr_gb_	6	2	0	2	0	2
12.	*Физика атома* Fh^_eZdhfZ D\Zglhf\hoZgbq_ hibkZgb_ Zlhf Z	6	2	0	2	0	2
13.	*Ядерная физика*	6	2	0	2	0	2

	OZjZdl_jbklbdb fh^_eZblhfgh]h.y JZ^bhZdlb\ghkl y^_jgu_ j_Zdpb						
14.	*Физика элементарных частиц* DeZkkbnbdZpby we_f_glZjguo. d <aZbfhij_\jZs_(we_f_glZjguo d	4	2	0	0	0	2
15.	*Физика твёрдого тела* AhggZy l_hjby Dhglbdl y\e_gb *Заключение*	4	2	0	0	0	2
	lh^]hlh\dZ d wc	27					
	<k_]h aZ k_f_	**144**	**32**	**0**	**32**	**16**	**37 (+27)**
	Blh]h aZ _kv c	**288**	**64**	**0**	**64**	**48**	**85 (+27)**

3 k _ f _ klj

E _ d p b y

< \ _ ^ _ g b _

lj _ ^ f _ l bamq _ g by nbabdb

K\yav nbabZdb_fkZlbdhc b bgnhjfZlbdhc

JZa^_Fe_oZgbdZ

F _ oZgbq _ kdh _ ^\kg`h\gbZy aZ^ZqZ f _ oZgbdb

Kihkhu[hibkZgfbyoZgbq _ k\dh]hgby

Fh^_be_eZ

L _ f:Z

Кинематика материальной точки

LjZ _ dlhjby imlv

Ebg _ cgu _ i _ j _ f _ s _ gb _ kdhjhklv kb_^mk_dhjb_glf]gh\ijbgu_ ijyfhebg _ cghf ^\b`_gbb

AZdhgdubg _ fZlbq _ kdb _ mZ\ghjZ\jg_fgbyhjyfhebg _ cgh]h ^\b`_gby

AZdhgu dbg _ fZlbq _ kdbjZ\ghjZ\jg_fgbyyfhebg _ cgh]h ^\b`_gyb

M]eh\u_ i _ j _ f _ s _ gb _ kdhjhklkj_^mk_dhj_fglgh\ijbg^\b`_gbb ih hdjm`ghklb

AZdhgdubg _ fZlbq _ kdb _ mZ\ghjZ\jg_fgbyh\]h`_gby ijm`hgdhklb

AZdhgu dbg _ fZlbq _ kdbjZ\ghjZ\jg_fgbygh]h y^ib`h_dgjm`ghklb

E _ d p b y

Связь между линейными и угловыми кинематическими величинами

K\yav f_`^m ebg _ cghc b m]eh\hc kdhjhklyfb

lhegh_ mkdhj _ gb _ ghjfZevgh_ b lZg]_gpbZevgh_ mkdhj _ gb

Кинематика твёрдого тела

lhgylb _ l _ eZ ZdZhlqhkdbklufP _ glj fZkk

AZdhgdubg _ fZlbq _ kdb _ mhjZ\ngiZbevgh]h ^\b`_gby l\zj^h]h l_e

AZdhgdbg _ fZlbq _ kdb _ m\jZ\sgZ_lgevgh]h ^\b\zjhbyh l_eZ \hdj kh[kl_gghc hkb

E _ d p 3 b y

L _ f:Z

Меры инерции

K\hckl\h bg_jlghklb FZkkZ

Fhf_gl bg_jpbb fZl_jbZevghc lhqdb b f_oZgbq_kdhc kbkl_fu

Меры движения

Bfimevk fZl_jbZevghc olZgbq_kdhc kbkl_fu

Fhf_gl bfimevk fZl_jbZevghc lhqdb b f_oZgbq_kdhc kbkl_fu

Силы и моменты сил

KbeZ

<b^u kbe \ ijkjhe^Z ly]hl_gby kb\eZkly è Zkmbijm]hklb k)beu lj_g (*самостоятельно*).

Ihe_ kbeu ihe_ dZd \b^ fZl_jbb gZijy`_gghklv ihey kbeu ly g_h^ghjh^gh_ ihe_ p_gljZevghe_ (*самостоятельно*).

Ijbgpbgj_aZ\bkbfhklb ^_ckjZ\bgyhk beklmx.sZy kbeZ

Fhf_gl kbeu hlghkbl_evgh njZhsqdby hkb

E_dp4by

Законы динамики

Bg_jpbZevgu_ kbkl_fuijhqkbi ZZe_bje\uc aZdhg Gvxlhgz

<lhjhe aZdhg Gvxlhgz mjZ\g_gb__^\bqZkbyuc kemqZc ijb ih fZkk_ l_eZj_fZ h ^\b`_gbb p_gljZ fZkk

>\b`_gb_ l_eZ i_j_f_ggjhcZdZk\uZy kbeZ mjZ\g_gb_ F_s_jk Pbhedh\kdhfbq_kdb_) (*самостоятельно*).

Hkgh\gh_ mjZ\g_gb_\jZsZfevgh]h ^\b`_gbyqZklguc kemqZ g_baf_gghf fhf_gl_ bg_jpbb l_eZ

Mkeh\by jZ\gh_kby l_eZ .<b^u jZ\gh_kby

Lj_lbc aZdhg Gvxlhgz

E_dpby

L_fZ

JZ[hlZ kbweu_f_glZjkjZ^byyjb ihklmiZl_evghf ^\b`_gbb JZ[hlZ we_f_glZjkjZ^byyjb \jZsZl_evghf ^\b`_gbb

Fhsghklv f]gh_ggZy b kj_^gyy ijb ihklmiZl_evghf ^\b`_gbb kj_^gyy ijb \jZsZl_evghf ^\b`_gbb

Wg_j]by F_oZgbq_kdZy wg_j]by

Dbg_lbq_kdZy wg_j]by ijb ihklmiZl_evghf ^\b`_gbb wg_j]by ijb \jZs ^\b`_gbb

Ihl_gpbZevgZy wg_j]by \ ihe_ khdegpbZyèvkZby wg_j]by ^_nhjfbjh\Zggh]h l_eZ

L_fZ

Ihgylb_ aZfdgmlhc f_oZgbq_kdhc kbkl_fu

L_hj_fZ h[baf_g_gbbf_oZgbq_kdhc kbkl_fu khAjZg_gby bfim f_oZgbq_kdhc kbkl_fu

L_hj_fZ h[baf_g_gbb fhf_gloZgbq_kdhc kbkl_fu khAjZg_gby bfim bfimevkZoZgbq_kdhc kbkl_fu

=bjhkdhi (*самостоятельно*).

L_hj_fZ baf_gbfb_oZgbq_kdhc wg_j]by f_oZgbq_kdhc wg_j]by :[khexlgh mijm]bc b Z[khexlgh (*самостоятельно*) m^Zju

E_dpby

L_fZ

>\b`_gb_eZlghkbl_evgh ^\bgmkshckZK bg_jpbb

>\b`_gb_eZ hlghkbl_evgh ^\bgmkshckZK hgl[h[_`gZy b dhjbhebkh\Z bg_jpbb

L_fZ

Ij_h[jZah\Zgby =Zebe_y b-g\ZjaZdghgZkGvxlhgz (*самостоятельно*).

Ihklmelu Wcgrl_c[jZah\Zgby EhJ_eyZb\bklkhZfyZ-]haZdhgZ Gvxlhgz

<aZbfhk\yav fZkku b wg_j]bb

E_dp,Zy

L_f:Z

Механические колебания

Dhe_[Zl_evgh_ ^\b`_gb_ F_oZgbq_kdb_ dhe_[Zgby

FZylgbdbfZl_fZlbq_kdbc ijm`bgguc nbabq_kdbc ljbnbey

pbdehb^Zevgh_ *(самостоятельно)*.

K\h[h^guZjfhgbq_kdb_ dhie_m[Zgby]h beb fZl_fZlbq_kdh]h

^bnn_j_gpbZevgh_ mjZ\g_gb_ afZehlm^dZhe_i[Zgbc qZklhkZypb

qZklhlZ nZaZ dhe_[Zgbc

Keh`_gb_]Zjfhgbq_kdb *(самостоятельно)*.

K\h[h^gu_aZlmoZxsb_ ijm`bggh]h beb fZl_fZlbq_kdh]h

^bnn_j_gpbZevgh_ mjZ\g_gb_ afZehlm^dZhe_i[Zgbc qZklhlZ nZaZ

aZlmoZgbyj_\e_fykZpbb ^h.[jhlghklv

E_dp,by

Механические колебания ijh^he`_gb_

<ugm`^_gmklZgh\b\rdhkZ[ijm`bggh]h beb fZl_fZlbq_kdh]h

^bnn_j_gpbZevgh_ mjZ\g_gb_ afZehlm^dZhe_i[Zgbc oZjZdl_ZlahlbdZ

qZklhlgZy ojZbkZldbdZahgZgk

Механические волны

F_oZgbaZkijjhklj\ydbhfZgbc \ h^ghjh^ghc mijm]hc kj_^_

Emq njhglb^u \f_oZgbq_kdbo \heg iehkdb_ b kn_jbq_kd

ihi_j_qguMjZ\g_gb_ iehkdhc]Zjfhgbq_kdhc QklhmZ_cnZhaZgukdhj

^ebgZ \hegu b \hegh\h_ qbkeh

Wg_j]by [_]ms_ch\hefguZy iehlghklvhwhd_jwbgb_j]bdlhj Mfh\Z

Klhyqb_ \heguu b imq,ghkZkij_^_e_gb_ f_oZgbq_kdhc

(*самостоятельно*).

We_f_glu Zdmklbdb bklfghdbalmidZ kbeZ a\mdZ Zdmklb

Zdmklbq_kdbc j_ahgZgk *(самостоятельно)*.

E_dp9by

L_fZ

Гидростатика

Hlebqbl_evgu_ k\hckl\Z `b^dhkl_c b]Zah\ dZd kiehrguo kj

>Z\e_gb_ \ `b^dhklyo b]ZaZo =b^jhklZlbq_kdbc aZdhg

Гидродинамика

:jobf_^h\Z kbeZ Mkeh\b_ ieZ\Zgby l_e

Hkgh\gu_ ihgylby ^bgZfbdb `b^dhkl_c

MjZ\g_gb_ g_jZaju\ghklb

MjZ\g_gb_ ;_jgmeeb ^ey b^_Zevghc `b^dhklb b ke_^kl\by ba

>\b`_gb_ \yabdhklb Nhjfmeu Gvxlhgz b lmZa_cey EZfbgZj

l_q_gb_ Qbkeh J_cghev^kZ

>\b`_gb_ l_eZ \ \yadhjfmkejZ^K *(самостоятельно)*.

E_dp10by

JZa^_e Fhe_dmeyjgZy nbabdZ b l_jfh^bgZfbdZ

L_f:Z -

МКТ идеального газа:

Hkgh\gu_ ihehh_eg_bdyfeybggh_lbq_kdhc l_hjbb

Fh^_ev b^_Zevgh]hkZZafZe_dmeu fheyjgZy fZkkZ

Kj_^gyy ^ebgZ k\h[h^gh]h ijh[_]Z fhe_dme kj_^gyy Zjbnf_l

Klhedgh_gb_ fhe_dme wnn_dlb\gauZcbfh^Z_fc_kjl\bkybehue_dme

Hkgh\gh_ mjZFbLbg^b_Zevgh]hkj_^aZyy d\Z^jZlbqgZy kdhjhklv

L_hj_fZ h jZ\ghjZkijdb^g_elbgb_bkdhjc]bb fhe_dmeu ih kl_i_gyf k

Статистические распределения в МКТ:

Djblbq_kdh_ khklhyqgbkdb djbZbZf_lju
NZah\u_ i_j_oh^bdkdZhq^hZda l_iehzfdhklb

E_dpb6y

L_fZ

>bnnmaby]Zah\ aZdhg NbdZ

Dhwnnbpb_gl ^bnnmbajbb a]Z\abhk\bhfhikZljvZf_hj\ khklhyjZgaZ

<yadhklv aZdhg Gvxlhgz

Dhwnnbpb_gl \yadhkl]aZ\Zakbfhkikvzjvf_hj\ khklhyjZgaZ

L_iehijh\h^ghklv aZdhg Nmjv_

Dhwnnbpb_gl l_iehijh\h^bghkhba]Z\abhkbfhklv h iZjZf_ljh\ khklh

K\yav dhwnnhb\pbbgmmabb \yadhklb b l_iehijh\h^ghklb

__kf_klj

E_dpby

JZa^_We_dljhfZ]g_lbaf

L_fZ

Напряженность электростатического поля:

We_dljbq_kdbc aZjy^ aZdhg khojZg_gby we_dljbq_kdh]h aZ

Ijbgpbi [ebadh^_ZakdlhbyDmehgZ

We_dljbq_kdh<dlhej_gZijy`_ggehkgdbZijy`zgg.hklb

Ijbgpbimki_jihabbihbe_cjbf_ju we_dljbq_kdbo ihe_c

Потенциал и потенциальная энергия ЭП:

JZ[hlZ kbe we_dljhklZlbLq_hkjdhjZhhipebyjd\medlyhpjZbgZijy`_ggh klb

Ihl_gpbZke\yav jZaghklb ihl_gpbZeZ kgZijy`zgghklvx Wl

Ihl_gpbZevgZy wg_jWbey_adZjjbyq^_Zkhehf

Wg_j]by b h[tzfgZy iehlghklv wg_j]bb Wl

E_dp2by

L_fZ

ЭП поле при наличии диэлектриков

Iheyjba^pbwe_dljbekh\dlhgj^mdpwbeb_dljbq_kdh]h kfWs_gby

Ihlhd_dlhjZ bg^mdpbhbj_WZ Hkljh]jZ=ZdhkZ b _z ijbf_g_gb_

We_dljbq_kdZy \hkijbbfqb\hklv b Wjegdbjbgfhkdlvc]bkl_j_abk

ЭП при наличии проводников

We_dljbaZpby ijh\h^ghbdgpbZe ijh\h^gbdZ \ we_dljhklZlb
We_dljhklZlbq_kdZy aZsblZ

We_dljhzfdhklv ijh\dh^gb^bdgZkbZ[ZhljZj_b dhg^_gkZlhjh\

Wg_j]bZjy`_ggh]h ijh\h^gbdZ b dhg^_gkZlhjZ

E_dp3by

L_fZ

Mkeh\by kms_kyl\bh\oZZgjZdl_jbklbdb wehdlZjbq_kdh]h

AZdhg HfZ ^ey h^ghjh^gh]h mijhZkl\eZ gb_ibijhZkh^gbdZlZj_b
ijh\h^gbdh\

AZdhg HfZ ^ey g_h^ghjh^ghb]Zafdlgmkhdlpb_ibb ljZ\beZ Dbjo]hr

JZ[hlZ b fhsghklv \ p_ib ihkAhZydhggh]hmelb_dgZpZ \ ^bnn_j_gpbZe
b bgl_]jZevghc nhjfZo

We_dljbq_kdbc lhd \.we_dljheblZo

We_dljbq_kdbc lhd \ ]ZaZo

E_dp4by

L_fZ

FZ]gblgh_ ihe_ _dlhj fZ]gblghc bg^mdpbb

AZdhg ;hkZ\Z-jZZieZkZ

Ijbgpbkmi_jihabpbbjbFl_ju fZ]gblguo ihe_c

Ihlhd _dlhjZ bg^mdpbb Fl l_hj_fZ=ZkmkhejZf^kdhb]lhgh]h ihey

>_ckl\b_ fZ]gblgh]h ihey bgkZ lhjdhkfb^egZbdfi._jZ
>_ckl\b_ fZ]gblgh]h ihey gZ ^\b`msbcky aZjy^ kbeZ Ehj_gp
E_dpby
L_fZ
GZfZ]gbqb\Zgb_ fZ]g_lbdh\ <_dlhj.gZijy`zgghklb FI
FZ]gblgZy \hkijbbfqb\hklv b ijhkeZ[uZ bfhkewgufZ]g_lbd
FZ]gblguc]bkl_j_abk
L_hj_fZ h pbjdmeypbb gZijy`zgghklb FI b _z ijbf_g_gb_
L_fZ
AZdhg NZjZj\ybehi E_gpZZhbg^mdpby bg^mdlb\ghklv .dhgl
<aZbfhbg^mdlbjZbyknhjfZWdkljZbhjd aZfudZgbb b jZafudZgbb p_ib
Wg_j]by bghekhv wg_j]bb fZ]gblgh]h ihey
<boj_\h_ we_dljbq_kdh_ ihe_K Lhd kf_s_gby

MjZ\g_gb_ ^bki_jkbdbjb\Zy ^bkiGhjkfZeZy^bki_jykb
NZah\Zy b]jmiih\Zy kdhjhklv nhjfmeZ Jwe_y

Поглощение и рассеяние света

:ghfZevgZy ^bkDjbkZy ih]ehs_gby
AZdhg ih]ehs_gby jZm]_jZ
JZkk_ygb_ k_lZ \ jZaehZdhgkj^ZeZywe_y

E_dp9y

L_fZ

Ijbgpbi N_jfZ b aZdhgu]_hf_illjbdb_kdhc h
Ihkljh_gb_ bah[jZ`_gbc k ihfhsvx iehkdh]h a_jdZeZ
Ihkljh_gb_ bah[jZ`_gbc k ihfhsvx iehkdh]h a_jdZeZ
Ij_ehfe_gb_ ikbalfZc
Ihkljh_gb_ bah[jZ`_gbc k ihfhsvx iehkdh]h a_jdZeZ
Kbklufebgaihbq_kdb_ ijb[hjuZ[_jZpbb

E_dp0y

L_fZ

K_lh\u_ _ebdbghuab_j_gb_
=eZa q_eh_dZ dZd nhlhf_ljbq_kdbc ijb[hj
AZdhgu hk_szgghklb
Ij_^klZ\e_gb_ h _kl_kl_gghc b bkdmkkl_gghc hk_szgghklb

E_dp1y

L_fZ

=bihl_aZ gdZd\ZglZo k_lZ
L_ieh\hbaemq_ghbjfmeZ leZ^edyZl_ieh\h]h baZdhggubyKl_mZgZ
;hevpfZgZ b.<bgZ
<g_rgbc nhlhwnnu_dlKlhe_lh\Z b aZdhghf_jghklb \g_rg_]h
MjZ\g_gb_ Wcgbdjc[kZgZy]jZgbpZ nhlhwnn_dlZ
>Z\e_gb_ kbu_luZE_[_^_\Z
Wnn_dl Dhfilhg Z

E_dp2y

JZa^_<e_jhylghklguc oZjZdl_j khklhygby b ^\b`_gby fbdjhqZ

L_fZ -

=bihl_aZ Emb ^_ ;jhcey b _z wdki_jbf_glZhelug h_ ^h^lj\Z_d`^b_b
we_dljhgh\ Lhfkhg Z LZjlZdh\kdZh]h b NZ[jbdZgl
Hibk Zgbh_klhyygbqZklbpu k ihfhsvx \hegh\hc nmgdpbb <_jhy
\hegh\hc nmgdpbb
Ijbgpbi g_hij_^_ezgghkl_c Khhlghr_gby g_hij_^_ezgghkl_c

L_fZ

MjZ\g_gb_ Rj_^b>g\]b`jZgb_ qZklbb_ugpbZevghc yf_ k g_ijhgbp
kl_gZdfb D\Zglh\uc hkpbeeylhj
Lmgg_evguc wnn_dl
D\Zglh\u_ dhfivxl_ju

E_dp3y

JZa^_e NbabdZ ZlhfZ

L_fZ

Fh^_ev ZlhfZ Lhfkhg Z -HqiZukbpkZfb J_a_jhh^^Zev J_a._jnhj
Ki_dljZevgu_ aZdhghf_jghklb ZhkhfZe\Zh^uhj;hhfZgh\Zy fh^_ev ^_ ;j
Fh^_ev -;AhjZf_jn_ev^Z

L_fZ -

D\Zglh\u_ qbkeZ b bo nbabWqe_kdbjchgkfZkyedhgnb]mjZbpbpybZlhf
lZmebbh[tykg_gb_ kljZ[ebmpjZu dbfbq_fk_dgblh\wFe_g^_e__\Z
Hiul Rl_jg_jeZoZ

Lhjfhaghc b oZjZdkd_jbjk_ldbd]_gh\kkdib_dluj AZdhg Fhjabeibl_aZ
Dhkk_ey

E_dpb4y

JZa^_e Nbabdz Zlhfgh]h y^jZ

L_fZ

Ij_^klZ\e_gb_ h khklZ_ y^jZ KlZlbq_kdZbjZdb_j^bkgZdbq_kdfg
y^_j Y^_jgu_ kbeu FBa^hehiuy^jZah[Zju bahlhgu a_jdZevgu_ y^

L_fZ

Y\e_gbZ^bjhZdlbkgAhZkdhg jZ^bhZdlb\gh jZkZ^bhZdLb\guujp jZkiZ^
ijZ\beZ kf_s_gby

Y^_jgu_ j_ZdbpbbdeZkkbnb>dZepkgyb_ b kbgY^_ajguu^_jj_Zdpbb \ a\z

E_dpb5y

JZa^_e Nbabdz we_f_glZjguo qZklbp

L_fZ

Nmg^Zf_glZevgu_ \aZbfh^_ckl\by
Hkgh\gu_ deZkku we_f_glZjguo qZklbp
D\Zjdb b d\Zjdh\uc kh.klZ\ Z^jhgh\

L_fZ

Ij_^klZ\e_gb_ h]e[xhgZb_ \aZbfh^_ckl\b_
l_j\bqgu_ b \lhjbdkgbq_dkdb_ emqb
Rbjhlguc b ^he]hlguc wnn_dlu

E_dpb6y

JZa^_e Nbabdz l\zj^h]h l_eZ

L_fZ

AhggZy l_hjbZyah\Zgb_ wg_j]_lbq_kdbo ahgZaihedjbgkdZeaZ
we_dljh.gZfb
DeZkkbnbdZjp^buyo l_e
We_dljhijh\h^ghklv ijb\hehmdjh\h^gbdh\ k lhqdb aj_gby d\Zg

L_fZ

DhglZdl ^\mo ihemijh\h^gbdh\uj hwqgudljhjgdh^
ijhkl_crb_ ihemijh\h^gbdh.\u_ ijb[hju

Mjh\gb kljmdlmjghc hj]ZgbaZpbb _s_klfZZyhfZk_jbygbhwg_
D\Zglh\Zy]jZ\blZpby

IjZdlbq_kdb_ aZgylby

3k_f_klj

AZgylb_ ‹

JZa^_e F_oZgbdZ

L_fZ

Кинематика прямолинейного и поступательного движений

<hijhku

1. Qlh bamqZ_l nbabdZ f_oZgbdZ dbg_fZlbdZ"
2. Qlh gZau\Zxl fZl_jbZevghc lhqdhc"
3. Qlh lZdh_ kbkl_fZ hlkq_lZ"
4. Qlh lZdhdlhj i_j_f_s_gby" <k_]^Z eb fh^mev _dlhjZ i_j_f_ ijhc^_gguf iml_f"
5. DZdh\Z hkgh\gZy aZ^ZqZ f_oZgbdb" Qlh agZqbl hibkZlv ^\b`_
6. DZdb_ kihkh[u hibkZgby ^\b`_gby kms_kl\mxl" < q_f hgb aZd

7. >Zlv hij_^_e_gby _dlhjhf\]khj\^gghcc kdhjhkl_c DZdh\u bo gZij
8. Qlh lZdh_ jZ\ghf_jgh_ ^\b`_gb_" AZibrbl_ aZdhg wlh]h ^\b`_
ijh_dpbc kdhjhklb b i_j_f_s_gby ^ey wlh]h ^\b`_gby
9. DZdh_ ^\b`_gb_ gZau\Z_lky jZ\ghi_j_f_gguf" AZibrbl_ aZdhg
]jZnbdb ijh_dpbc kdhjhklb b i_j_f_s_gby ^ey wlh]h ^\b`_gby

AZ^Zqb

1. Ijyfhebg_cgh_ ^\b`_gb_ lhqdb aZ^Z-gh mZ\g_GgZbfkZOv mjZ\g_
aZ\bkbfhklb kdhjhklb lhqdb hl \j_f_gb lhkljhblv]jZnbd w
dhhj^bgZkdhjhklv lhqdb q_j_a k b k ihke_ gZqZeZ ^\b`_gby
2. JZ^bmk _dlhj fZl_jbZevghc lhqdb baf_gy_lky kh \j_f_g_f
Hij_^_eblv Z kdhjhmkkvdhq j\gbfh^mev kdhjhklb\j_fhfbglk
3. L_eh iZ^Z_l k \ukhlu f aZ dZdh_ \j_fy hgh ijhc^_l ihke_^
4. L_eh [jhr_gh _jlbdZevgh _jo kh kdhjhklvx f k GZ dZdh
\j_f_gb kdhjhklv l_eZ ih fh^mex [m^_l \ ljb jZaZ f_gvr_
Hij_^_eblv kdhjhklv fyqZ q_j_a k _keb hg [jhr_g _jlbdZevg
5. L_eh [jhkbeb k ih_joghklb Aα fdeb]hijhb^ahmg]lemfk gZqZevghc kdh
lj_g_[j_]Zy khijhlb\e_gb_f \ha^moZ gZclb Z \j_fy ^\b`_gby
ih^tzZ b]hjbahglZevgmx ^Zevghklv ihe_lZ ljb dZdhf agZq_gl
jZ\gu"] mjZ\g_gb_ ljZ_dlhjbb \ [ ]^_ \ b [i_j_f_s_gb_
]hjbahglZeb khhl_lkl_ggh ^ jZ^bmku djb\bagu gZqZeZ b _

AZ^Zqbkz Zehyklhyl_evgh]h j_r_gby

6. Dbg_fZlbq_kdb_ mjZ\g_gby ^\b`_gby ^\mo fZl_jbZevghc lhq_
Kt² b O : <W t² K]^=K f k K f k Hij_^_eblv Z fhf_gl \j_f
dhlhjh]h kdhjhklb wlbo lhq_d [m^myl Z\guZ [^emykdhj]hgbfhf_glZ
7. JZ^bmk _dlhj fZl_jbZevghc lhqdb baf_gy_lky kh \j_f_g_f ih a
-hjlu hk_c O b < Hij_^_eblv ^ey fhf_glZ \j_f_gb k Z fh^
mkdhj_gby
8. L_eh iZ^kZ_\ukhlu f Hij_^_eblv i_j_f_s_gb_ l_eZ aZ ih
iZ^_gby
9. L_eh iZ^Z_l k \ukhlu df k gme_\hc gZqZevghc kdhjhklvx l
\ha^moZ hij_^_eblv dZdh_ \j_fy ihgZ^h[blky l_em ^emylbjhoh
10. K [Zrgbk\hlhc f \ ]hjbahglZevghf gZijZ\e_gbb [jhr_gh l_eh k
f k Hij_^_eblv Z mjZ\g_gb_ ljZ_dlhjbb l_eZ \ [[kdhj
gZ a_fex \ m]he dhlhjuc h[jZam_l wlZ kdhjhklv k]hjbahglh

AZgylb_

L_fZ ijh^he`_gb_

Кинематика движения по окружности и вращательного движения

<hijhku

1. Qlh gZau\Zxl m]eh\uf i_j_f_s_gb_f" ?^bgbpu baf_j_gby
2. Qlh gZau\Zxl m]eh\hc kdhjhklvx" ?^bgbpu baf_j_gby
3. Qlh gZau\Zxl m]eh\uf mkdhj_gbaf_j" ?^bgbpu
4. < qzf khklhbl hkgh\gZy aZ^ZqZ f_oZgbdb \ kemqZ_ ^\b`_gby
5. Qlh lZdh_ lZg]_gpbZevgh_ mkdhj_gb_ ghjfZevgh_ mkdhj_gb_
6. DZdh\Z k\yav f_`^m ebg_cgufb b m]eh\ufb dbg_fZlbq_kdbfb \
7. DZdhc \b^ bf_xl aZdhjgbh]hZbghZ\ghi_j_f_ggh]h ^\b`_gby ih hdj

AZ^Zqb

1. Dhe_kh \jZsZykv jZ\ghmkdhj_ggh ^hklb]eh m]eh\hc kdhjhkl
ihke_ gZqZeZ ^\b`_gby Q_fm jZ\gh m]eh\h_ mkdhj_gb_ dhe_
2. >bkd jZ^bmkhf kf \jZsZ_lky lZd qZhiha\Zjhkbfhk^bmkZe ^bk
\j_f_gb aZ^Z_lky mjZ\g_gb_f Hij_^_eblv ^ey lhq_d gZ h[h^

$\varphi = 3 + t + t^2 + t^3$

dhgpm \lhjhc k_dmg^u ihke_ gZqZeZ ^\b`_gby Z lZg]_gpbZe
mkdhj_gb_ k ihegh_ mkdhj_gb_

3. >bkd jZ^bmkhf kf \jZsZ_lky lZd qlh aZ\bkbfhklv ebg_cghc kdhjhk
h[h^_ dhe_kZ hl \j_f_gb aZ^Z_lky mjZ\g_gb_ Hij_^_eblv fhf_gl \j_f_
^ey dhlhjh]h _dlhj ihegh]h mkdhj_gby h[jZam_l k jZ^bmkhf d
4. FZl_jbZevgZy ghZqbgZ_l ^\b]Zlvky ih hdjm`ghklb jZ^bmkhf
lZg]_gpbZevguf mkdhj_gby H ij_^_eblv fhf_gl \j_f_gb ijb dh
mkdhj_gby h[jZam_l k _dlhj kdhjhklb m]he h [imlv ijhc^
5. >bkd \jZsZ_lky m]\g_ih^\b`ghc hkb lZd qlh aZ\bkbfhklv m]eZ
$\varphi = 0{,}5t^2$
\j_f_gb hibku\Z_lky mjZ\g_gb_ Hij_^_eblv d dhgpm \lhjhc k_d
gZqZeZ ^\b`_gby Z m]eh\mx kdhjhklv ^bkdZ [m]eh\h_ m
gZoh^ysy_gZ jZkklhygbb kf hl hkb \jZs_gby lZg]_gpbZevgh
mkdhj_gb_ b ihegh_ mkdhj_gb_

AZ^Zqb ^ey kZfhklhyl_evgh]h j_r_gby

6. Dhe_kh \jZsZ_lky k ihklhygguf m]eh\uf Qmkdaj_gb_kf ihke_ g
^\b`_gby ihegh_ mkdhjZgdh dhefQkZfm jZ_g jZ^bmk dhe_kZ"
7. >bkd jZ^bmkhf kf \jZsZ_lky lZd qlh aZ\bkbfhklv m]eZ i
$\varphi = 2 + 4t^3$
\j_f_gb aZ^Z_lky mjZ\g_gb_ Hij_^_eblv ^ey lhq_d gZ h[h^_ d
ghjfZevgh_ b lZg]_gpbZevgby \ fhf_gl \j_f_gb k_dmg^u hl g
Z lZd`_ m]he ih\hjhlZ ijb dhlhjhf ihegh_ mkdhj_gb_ khklZ\e
45 h.
8. >bkd \jZsZ_lky \hdjm] g_ih^\b`ghc hkb lZd qlh aZ\bkbfhkl
$\varphi = 0{,}5t^2$
\j_f_gb hibku\Z_lky mjZ\g_gb_ Hij_^_eblv d dhgpm \lhjhc k_d
gZqZeZ ^\b`_gby ihegh_ mkdhj_gb_ lhqdb gZ h[h^_ ^bkdZ
lhqdb \ wlhl fhf_gl f k
9. LhqdZ ^\b`_lky ih hdjm`ghklb jZ^bmkhf kf k ihklhygguf
D dhgpm q_l_jlh]h h[hjhlZ ihke_ gZqZeZ ^\b`_gby
Hij_^_eblv ghjfZevgh_ mkdhj_gb_ lhqdb q_j_a k_dmg^ ihke
10. <Ze gZqbgZ_l \jZsZlvky b aZ i_j\u_ k_dmg^ kh_jrZ_l h
\ZejZ\ghmkdhj_gguf hij_^_eblv m]eh\h_ mkdhj_gb_ b dhg_qg

AZgylb_ ‹

L_fZ

1. <hijhku
2. Knhjfmebjmcl_ i_j\uc aZdhg Gvxlhgz
3. DZdb_ kbkl_fu hlkq_lZ gZau\Zxl bg_jpbZevgufb" ljb_^bl_ ijb
4. Qlh lZdh_ bg_jlghklv lh_eZb'qDkZdZy _ebqbgZ y\ey_lky f_jhc bg
5. lhq_fm l_eh ij_^hklZ\e_ggh_ kZfhfm k_[_ g_ khojZgy_l kdhj
6. DZdhc kfuke bf__l ihgylb_ kbeu" < dZdbo _^bgbpZo hgZ baf
7. Knhjfmebjmcl_ aZdhg <k_fbjgh]h ly]hl_gjZy\bl DZdhg_^y_ ihyklhky
b dZdh\ __ nbabq_kdbc kfuke"
8. < q_f khklhbl ijbgpbi g_aZ\bkbfhklb ^_ckl\by kbe"
9. < q_f aZdexqZ_lky ijbgpbi kmi_jihabpbb kbe" >Zcl_ hij_^_e_g
10. Knhjfmebjmcl_ \lhjhc aZdhg Gvxlhgz Z \ h[sbf_gb^y l_[eZ\
ihklhygghc fZkku Qlh gZau\Zxl mjZ\g_gb_f ^\b`_gby"
11. Knhjfmebjmcl_ lj_lbc aZdhg Gvxlhgz ljb_^bl_ ijbf_ju ijhy\
hdjm`Zxs_c ^_ckl\bl_evghklb

AZ^Zqb

1. L_eh fZkkhc d] e_`bl gZ]hjbahglZevghc ih_joghklb GZDh
l_eh ^_ckl\m_l]hjbahglZevgZy kbeZ) Hij_^_eblv kbem lj_

G [ ) G Bah[jZablv]jZnbq_kdb dZd baf_gy_lky kbeu)

2. DZdh\Z gZqZevgZy kdhjhklv rZc[u ims_gghc ihgZh\h_kjoZgghk\lbeZ q_j_a k" Dhwnnbpb_gl lj_gby rZc[u h e_^
3. GZ klhe_ e_`Zl ^\Z [jmkdZ k\yaZggu_ gblvx GZ [jmkhd fZkk G ih^ m]ehf H d ]hjbahglm FZkkZ \lhjh]h [jmkdZ P d] d h klhe Hij_^_ebl_ mkdhj_gb_ k dhlhjuf ^\b`mlky l_eZ Z lZd`
4. <_^_jdh k \h^hc \jZsZxl \ _jlbdZevghc iehkdhklb gZ _j_\d gZbf_gvr_c kdhjhklvx gm`gh _]h \jZsZlv qlh[u ijb ijhoh`^_gb m^_j`Zlv \h^m_j\d_"

AZ^Zqb ^ey kZfhklhyl_evgh]h j_r_gby

5. L_eh fZkkhc d] lygml k kbehc G ih]hjbahglZevghc ih ijbeh`_gZ ih^ m]eh]hjbahglm lh l_eh ^\b`_lky jZ\ghf_jgh K [m^_l ^\b]Zlvky l_eh _keb lm `_ kbem]hjbahglm^" m]ehf
6. >\Z l_eZ fZkkZfhd] P d] e_`Zl gZ Z[khexlgh ]eZ^dhf klhe_ g_\_khfuf rgmjhf dhlhjuckyjZakjehZdll_em k f_gvr_c fZkkhc ij G DZdmx fbgbfZevgmx kbem gZ^h ijbeh`blv d l_em [hev rgmj"
7. E_lqbd ^Z\bl gZ kb^_gv_ kZfhe_lZ \ gb`g_c lhqd_ i_leb G_kl e_lqbdZ d] jZ^bmfk Hijeb_eblv kdhjhklv kZfhe_lZ
8. L_eh fZkkhc P khkdZevau\Z_l k lj_gb_f k gZdehgghc iehkdhk __ ^ebgZ O dhwnnbpb_gl lj_gby dhe_k h ^hjh]m jZ_g GZclb df jZa\b\Z_fmx ^\b]Zl_e_f fhsghklv J _keb wlhl imlv ij_l kimkdZ l_eZ k gZdehgghc iehkdhklb

AZgylb_ ‹

L_fZ

<hijhku

1. Q_fm jZ\gZ jZ[hlZ kbeu"
2. Q_fm jZ\gZ jZ[hlZ fhf_glZ kbeu"
3. Qlh gZau\Zxl fhsghklvx" < dZdbo _^bgbpZo baf_jyxl fhsghklv
4. Qlh lZdh_ f_oZgbq_kdZy wg_j]by"
5. Q_fm jZ\gZ dbg_lbq_kdZy wg_j]by ijb ijyZhl_evgh\f^\b`_bgbhk
6. Q_fm jZ\gZ dbg_lbq_kdZy wg_j]by ijb ^\b`_gbb ih hdjm`ghklb
7. DZd hij_^_eblv wg_j]bx \ ihe_ kbeu ly`_klb a_feb"
8. DZd hij_^_eblv wg_j]bx k`Zlhc ijm`bgu"

AZ^Zqb

1. :\lhfh[bev fZkkhc l ^\b`_lky \ ]hjm mdehgf dZlhdjZc^ukhklZ\ imlb Dhwnnbpb_gl lj_gby dhe_k h ^hjh]m jZ_g GZclb df jZa\b\Z_fmx ^\b]Zl_e_f fhsghklv J _keb wlhl imlv ij_l
2. Imey fZkkhc P e_lysZy]hjbahglZevghihklZ^kZdhbjhkbvxdhg_p kl_j`gy aZdj_ie_ggh]h gZ ]hjbahglZevghc hkb ijhoh^ys_c q_ 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
3. K _jrbgu gZdehgghc gZhkdZklbkdZlu\Zlvky kiehrghc h^ghjh^ GZclb \j_fy kdZlu\Zgby pbebg^jZ _keb gZqZevgZy \ukhlZ f
4. Dbg_lbq_kdZy wg_j]by l_eZ fZkkhc d] \ g_dhlhjuc fhf_gl \j_ bfimevk wlh]h l_eZ \ ^Zgfugbf"hf_gl \j_

AZ^Zqb ^ey kZfhklhyl_evgh]h j_r_gby

5. JZ\gh^_ckl\mxsZy kbe ^_ckl\mxsbo gZ l_eh jZ\gZ G b

L_eh ^\b`_lky lZd qlh _]h dhhj^bgZlZ $x = 10 + 2t + t^2$ baf_gy_lky iDhZdmZxh jZ[hlm kh_jrZ_l kbeZ aZ k"

6. >bkd fZkkhdZlFlky [_a kdhev`_gby ih]hjbahglZevghc iehkdh GZclb dbg_lbq_kdmx wg_j]bx l_eZ

7. K _jog_]h mjh\gy gZdehgghc iehkdhklb h^gh\j_f_ggh gZ
   kdhev`_gby kiehrgu_ pbebg^j b rZj k h^bgZdh\hc fZkkhc b
   GZclb hlghr_gb_ kdhjhkl_c wlbo l_e gZ g_dhlhjhf ^Zgghf mjh
8. Dhevph fZkkhc] b jZ^bmkhf kf \jZsZ_lky \hdjm
   i_ji_g^bdmeyjghc iehkdhklb ^bkdZ b ijhoh^ys_c q_j_a _]h p_
   GZclb dbg_lbq_kdmx wg_j]bx l_eZ

AZgylb_ ‹

L_fZ

1. Qlh gZau\Zxl f_oZgbq_kdhc kbkl_fhc" DZdb_ kbkl_fu gZau\Zxl
2. Q_fm jZ_g bfimevk f_oZgbq_kdhc kbkl_fu fZl_jbZevguo lhq_
   ^_ckl\b_f \g_rgbo kbe"
3. Knhjfmebjmcl_ aZdhg khojZg_ygby dbfimebvkl_f hg kijZ_^eb\"
4. Qlh lZdh_ p_glj fZkk kbkl_fu fZl_jbZevguo lhq_d" DZd _]h fh`
5. >Zcl_ hij_^_e_gby wg_j]bb b jZ[hlu H[tykgbl_ k\yav f_`^m wl
6. DZdb_ kbeu gZau\Zxlky dhgk_j\Zlb\gufb"
7. Qlh gZau\Zxl dbg_lbql_kdbhcZebvghc wg_j]b_c" DZdh\u hkh[_gg
   wg_j]bc"
8. Knhjfmebjmcl_ aZdhg khojZg_gby f_oZgbq_kdhc wg_j]bb
   f_oZgbq_kdZy wg_j]by kbkl_fu g_ khojZgy_lky"
9. Qlh lZdh_ m^Zj" DZdb_ \b^u m^Zjh\ rZjh\ \Zf ba_ukhgeu'y_<lkdyZ
   aZdhg khojZg_gby f_oZgbq_kdhc wg_j]bb"

AZ^Zqb

1. KgZjy^ fZkkhc e_lyd$bc]hjbahglZevgh \^hev `_e_agh^hjh`gh]h
   f k ihiZ^Z_l \ \Z]hg k i_kdhf b aZklj_\Z_l \ g_f DZdmx kd
   hg ^\b]Zeky kh kdhjhklvx df q \ gZijZ\e_gbb ijhlb\hiheh`gh
2. Imey fZkkhc s]Zye_Hiybahglzevgh ihiZ^Z_l \ [jmkhd mklZgh\e
   l_e_`d_ FZkkZ [jmkdZ k l_e_`dhc] Dh]^Z imey ihiZ^Z_l
   kbkl_fZ ijbh[j_lZ_l kdhjhklv f k Hij_^_eblv gZqZevgmx kd
3. >\Z rZjZ fZkkZfb eh] P d] ^\b`mlky ihklmiZl_evgh \^hev]h
   ijyfhc \ h^ghf gZijZ\e_gbb Kdhjhklb rZjh\ fhk mb^ZjZ fYk
   Hij_^_eblv kdhjhklbkeZjhZ\[khexlgh mijm]h]h m^ZjZ
4. Hij_^_eblv \h kdhevdh jZa mf_gvrblky kdhkjhklv kZjZhk^lybx`ms
   _]h khm^Zj_gbb k ihdhysbfky rZjhfn jZZakZedhl_hjZ]hku gZe_lZ
   rZjZ M^Zj kqblZlv p_gljZevguf b Z[khexlgh mijm]bf

AZ^Zqb ^ey kZfhklhyl_evgh]h j_r_gby

5. Ijb p_gljZevghf mijm]hf m^Zj_ ^\b`ms__ky_lky_elh fZkkhc_P_kym^
   fZkkhc P < j_amevlZl_ q_]h kdhjhklv i_j\h]h l_eZ mf_gvrbeZ
   kdhevdh jZa fZkkZ i_j\h]h l_eZ [hevr_ fZkku \lhjh]h b dbg_
   l_eZ g_ihkj_^kl_ggh ihke_ m^ZjZ _keb_kdjZhygZ_gZejvoyZiy_jdhbh
   [ueZ jZ\gZ >`
6. >\Z l_eZ ^\b]Zykv gZ\klj_qm ^jm] ^jm]m kh kdhjhklvx f
   ^\b]Zlvky \f_kl_ kh kdhjhklvx f k Hij_^_eblv hlghr_gb_ fZ
7. >\Z fZeuo ieZklbebgh\uo rZjbdZ fZdkZb dhdhjuh^_r_gu gZ
   h^bgZdh\hc ^ebgu f lZd qlh hgb khijbdZkZxlky l_j\uc rZjb
   jZ\gh_kby gZ mb]hdimklbeb GZ dZdmx \ukhlm ih^gbfmlky rZjb
   g_mijm]h]h m^ZjZ"
8. Hohlgbd klj_ey_l ba jm`vyky^hdms\ gZijZ\e_gbb __ ^\b`_gby DZdh\Z [u
   \uklj_eZ _keb hgZ hklZgh\beZkv ihke_ ^\mo k^_eZgguo *120* jy^fZ\ukZj_e
   hohlgbdZ fZkkZ aZjy^Zdhjhklv \ue_lZ kgZjy *600* a ba jm`vy
9.

AZgylb_ ‹

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1. DZdb_ kbkl_fu hlkq_lZ gZau\Zxlky g_bg_jpbZevgufb"
2. Dh]^Z b ihq_fm g_h[oh^bfh jZkkfZljb\Zlv kbeu bg_jpbb"
3. Qlh lZdh_ kbeu bg_jpbb b q_f hgb hlebqZxlky hl kbe ^_ck kbkl_fZo hlkq_lZ"
4. DZdgZijZ\e_gZ p_gljh[_`gZy kbeZ" Dh]^Z hgZ ijhy\ey_lky"
5. DZd gZijZ\e_gZ kbeZ Dhjbhebk Z" Dh]^Z hgZ ijhy\ey_lky"
6. DZdh\u hkh[_gghklb \k_o kbe bg_jpbb"
7. L_eh [jhr_gh _jlbdZevgh _jo <_jg_lky eb hgh \ lm `_ lhqdm
8. Ijb_^bl_ ijbf_ ijhy\ee_gbgy_jkpbb gZ A_fe_

AZ^Zgb ^ey j_r_gby \ Zm^blhjbb

1. G_[hevrh_ l_eh iZ^Z_l [_a gZqZevghc kdhjhklb gZ A_fex gZ dZdmx klhjhgm b gZ dZxdh l_jZhkdhkygb_eh hl _jlbdZeb aZ \j Khijhlb\e_gb_f \ha^moZ ij_g_[j_qv
2. =hjbahglZevgh jZkiheh`_gu kl_j`_gmy \\jZlsbZ_lkygbcdhkb ijhoh q_j_a _]h dhg_p k m]eh\hc kdhjhklvx jZ^ k JZkklhygb_ hl f GZ kl_j`_gv gZ^Z_yZfmgn[Ze aZdj_ie_ggZy k ihfhsvxbgblb f hkbh\jZs_g<bygZqZevguc fhf_gl \j_f_gb gblv i_j_`b]Zxl b kdhevablv [_a lj_gby ih klj_`gx GZclb \j_fy kimkly dhlhjh_ f

AZ^Zgb ^ey kZfhklhyl_evgh]h j_r_gby

3. Kimlgbd ^\b`_lky \ wd\Zlhjbevgh b kehkZdlZ^lZb gAZ_f\hklhd ih hj[bl_ jZ^bmkZ 5 lj_g_[j_]Zy mkdhj_gb_f h[mkeh\e_gguf KhegpZ gZclb mkdhj_gb_ kimlgbdZ \ kbkl_f_ hlkq_lZ k\yaZg
4. <jZs_gb_ A_feb ijb\h^bl d hldehg_gbx k\h[h^gh iZ^Zhkl\bkZl_e dZdmx klhjhgm ijhbkoh^bl wlh hldehg_gb_"
5. GZ iehkdhklb k m]ehf gZdehgZ . e_`bl l_eh Hij_^_ebl_ dhwnnbpb_glZ lj_gby ijb dhlhjhf l_eh g_ [m^_l khkdZevau\ _keb iehkdhklv ^\b`_lky Z jZ^ghf mjkdhj_gghj J_rbl_ aZ bg_jpbZevghc b g_bg_jpbZevghc kbkl_f_ hlkq_lZ

AZgylb_ <

L_fZ

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1. Qlh lZdh_ dhe_[Zgb_" DZdb_ dhZk\hZ^bgufb"
2. DZdb_ dhe_[Zgby gZau\Zxl]aZZjfmgZq_kbdb"
3. >Zcl_ hij_^_e_gb_ Zfieblm^u nZau i_jbh^Z qZklhlu dhe_[Zgbc
4. Qlh gZaxu\ZfZl_fZlbq_kdbf fZy[gbjmfbgguf fZylgbdh\"
5. DZd baf_gblky qZklhlZ kh[kl_gguo dhe_[ZgZbyclkh^Z_ebq_gb
6. AZibrb^ey aZZmsbo dhe_[Z^bm_jZ_gpbZevgh_ mjZ\jr_gb_
7. Ih dZdhfm aZdhgm baf_gy_lky Zfieblm^Z aZlmoZxsbo dhe_[
8. Qlh lZdh_ dhwnnbpb_gl aZlmoZgby" Eh]Zjbnfbq_kdbc ^_dj_
9. Qlh lZdh_ \ugm`^_ggu_ dhe_[ZgbyZfHebq_m^ZaZ\bkbl
10. Qlh gZaxu\jZahgZgkhf" Hl q_]h aZ\bkyl j_ahgZgkgZy qZklhlZ
11. H[tykgblf_oZgjZkfijhkljZg_gb_ dhe_[Zgbc.\ mijm]hc kj_^_
12. Qlh lZdhZ_ emqeg\hZy ih_jogjhkljhgl
13. Qlh gZaxu\ZfZhi_j_qghc \he[gjhc^hevgh\c [_]ms_klhyq_c ^ iehkc _ kn_jbq?_kdhc
14. Qlh gZaxu\ZfZ^ebghc \he[ghuegh\fqbkeh
15. Qlh gZau\Zxl nZah\hc kdhjhklvx" =jmiih\hc kdhjhklvx"
16. DZd hij_^_eblv wg_j]bx f_oZgbq_kdhkdhiehkehgc"]Zjfhgbq_

AZ^Zqb

1. FZl_jbZevgZy lhqdZ kZ\kjhZ_l]Zjfhgbq_kdb_ dhe_[Zgby k q :fieblm^Z dhe_[Zgbc kf Hij_^_eblv kdhjhklv mkdhj_gb_ lhqdm \ fhf_gl dh]^Z=kf_ksf_gb_ [
2. GZclb Zfieblm^m i_jbh^ qZklhlm b gZqZevgmx nZamf dhe_ $x = 5\sin(\frac{39{,}2t + 5{,}2}{5})см$.
3. Lhqdk_jrZ_l]Zjfhgbq_kdb_ dhe_[Zgby < g_dhlhjuc fkf_gl \j 5 kf ljb m_ebq_gbb nZau \^\h_ kf_s2_gb_kfhqdZclZfieblm^ dhe_[Zgbc
4. Kdhjhklv mijm]bo \heg f k JZkkldhyeb[exsb^fmky\mZklbpZfb k jZaghklvxπnZajZ\gh kf Hij_^_eblv Z qZklhlm [i_jbh^ c \hegu

AZ^Zqb ^ey kZfhklhyl_evgh]h j_r_gby

5. GZclb Zfieblm^m i_jbh^ qZklhlm gZqZevgmx nZam dhe \ujZ`_gby kdhjhkdhj_gby b f_oZgbq_kdhc wg_j]bb _keb aZdh $x = 5\sin(9{,}42 \cdot t + 2{,}3)$ *см* .
6. DZd baf_gblky i_jbh^ dhe_[Zgbc fZylgbdZ ijb i_j_ghk_ _]h k
7. Q_fm jZ_g i_jbh^ dhe_[Zgby fZylgbdZ gZoh^ys_]h \ \Z]hg_ mkdhj_gb_f D"
8. QZklhlZ dhe_[Zgbc bklhqgbdZ mijm]hc \hegu jZ\gZ =p \ha^mo_ kh kdhjhklvx f k <uqbkebl_ Z pbdebq_kdmx c \hegu] \hegh\h_ qbkeh AZibrbl_ mjZ\g_gb_ \hegu

AZgylb_ ‹

L_fZ

<hijhku

1. Qlhg Zau\Zxl klZpbhgZjguf l_q_gb_f `b?^dhklbZdhe_b ©gZa`bfZ `b^dhklvª"
2. Knhjfmebjmcl_ b aZibrbl_ l_hj_fm g_jZaju\ghklb kljmb Bah[ljm[dm lhdZ
3. Qlh lZdh_ ©b^_ZevgZyKnhjfmebjmcl_ª" b aZibrbl_ mjZ\g_gb_ ; Hibrbl_ dZ`^h_ _]h keZ]Z_fh_
4. K dZdhc kdhjhklvx `b^dhklv \ul_dZ_l ba hl_jklby"
5. Hl q_]h aZ\bkbl kbeZ j_Zdpbb \ul_dZxs_c kljmb"
6. Qlh gZau\Zxl fbZgZjguf l_q_gb_f [ih^tzfghc kbehc"
7. DZdhc \b^ bf__l b ^gZy qhjhmeZ lmZa_cey" Qlh lZdh_ ©ihlhd `
8. lh dZdhfm djbl_jbx hij_^_eyxl oZjZdl_j l_q_gby `b^dhklb"
9. Qlh gZau\Zxl Z eh[h\uf khijhlb\e_gb_f [ih^tzfghc kbehc"
10. Qlh iha\hey_l gZclb nhjfmeZ Klhdk Z"

AZ^Zqb

1. :d\Zjbmf bf__l nhjfm dm[Z kh kfhjhgdZdhc \ukhlu K ke_^m_ g_]h \h^m qlh[u kbeZ ^Z\e_gby gZ [hdh\mx kl_gdm [ueZ \ :lfhkn_jgh_ ^Z\e_gb_ g_ mqblu\Zlv
2. < klZdZg_ ieZ\Z_l dmkhd ev^Z DZd baf_gblky mjh_gv \h^u eb hl_eb_kh ev^m gZoh^blky Z dmkhq_d ijh[db [klZevgZy
3. < g_[hevrhf [Zkk_cg_ ieZ\Z_l ihemaZlhie_ggZy eh^dZ Mjh_g \ [Zkk_cg_ Ba eh^db aZq_jigmeb _^jh \h^u b \uebeb \ [Zkk_ \h^u \ eh^d_ [Zkk_cg_" DZd baf_gbeky mjh_gv \h^u \ [Zkk_c
4. K fhklbdZ gZ^ dZgZehf ih dhlhjhfm l_q_l \hmZZyhim^s_igZfuf m]ehf ljm[dZ ?z hldjuluc dhg_p h[jZszg gZ\klj_qm l_q_gbx \ukhlm ff gZ^ mjh\g_f \h^uZ\cbZkdZhej_hklv l_q_gby \h^u \ dZg

5. Pbebg^jbq_kdbc khkm^ \ukhlhc kf b jZ^bmkhf kf gZih khkm^Z hldju\Z_lky hl_jklb_ jZ^bmkZ ff lj_g_[j_]Zy \y \j_fy bkl_q_gby \k_c \h^u ba khkm^Z

AZ^Zqb kZfhklhyl_evgh]h j_r_gby

6. < g_[hevrhf [Zkk_cg_ ieZ\Z_l eh^dZ Baf_gblky eb b dZd m e_`Zsbc gZ ^g_ eh^db dZf_gv [jhkblv \ \h^m"
7. <ha^mrguc rZj h[t_fhf 9 f iZjbl \[ebab ih_joghklb A_f [ZeeZkl bhrZgjyieky gZ \ukhlm]^_ iehlghklv \ha^moZ \^mh_ f_ [ZeeZklZ _keb h[t_f rZjZ ijb ih^t_f_ m_ebqbeky \ jZa kqblZcl_ jZ\ghc &
8. IeZklfZkkh\uc [jmkhd ieZ\Z_l \ \h^_ DZd baf_gblky]em[bgZ _keb ih_jo \h^u gZeblv kehc fZkeZ iheghklvx ihdju\Zxsbc [j
9. GZ juqZ`guo _kZo mjZ\gh_r_g]bjyfbrkhkym^ebkjZh^ghd_kbZjm_ \h^m ih]jmablv ih^_r_gguc gZ gbld_ klZevghc [jmkhd lZd ql

AZgylb_ ‹

L_fZ -

МКТ идеального газа

<hijhku

1. Knhjfmebjh\Zlv hkgh\gu_ ml_j`^_gby FDL
2. < qzf kmlv fh^_eb b^_Zevgh]h]ZaZ"
3. DZdbfb fbdjhiZjZf_ljZfb oZjZdl_jbamxlky fhe_dmeu"
4. DZd gZclb Zlhfgmx _^bgbpm fZkku fZkkm fhe_dmeu fh dhebq_kl\h \?s_kl\Z
5. Qlh lZdh_ wnn_dlb\guc ^bZf_lj fhe_dmeu b dZdh\h _]h agZq_
6. Qlh gZau\Zxl ^kbhgdmx]h ijh[_]Z fhe_dme b hl q_]h hgZ aZ\h
7. Qlh lZdh_ kj_^gyy Zjbnf_lbq_kdZy kdhjhklv fhe_dmeu b jy^dZdl _ebqbgu"
8. Qlh lZdh_ kj_^gyy d\Z^jZlbqgZy kdhjhklv fhe_dmeu dZd h Zjbnf_lbq_kdhc"
9. Qlh gZau\Zxl kl_i_gvx k\h[h^u fhe_dmeu" DZdb_ hgb [u\Zxl" jZaghc kljmdlmju"
10. DZd gZclb kj_^gxx dbg_lbq_hk^dmx wg_j]bx fhe_dmeu \k_o fhe_dme _

AZ^Zqb

1. Hij_^_eblv kj_^gxx ^ebgm k\h[h^gh]h ijh[_]Z fhe_dme dbkehj khkm^_ ijb l_fi_jZlmj_ $27 \cdot 10^{0}$ Kdmj^Z\e_gbdlZ
2. Hij_^_eblv kj_^g__ qbkeh klhkedjhkqhcyaZo f_`^m_\kmebZffhe ZahlZ :ahl gZoh^blky \ khkemh^_l_zfidjZkdmxKb ^Z\e_gbdlZ $27 \cdot 10^{0}$
3. < khkm^_ zfdhkkvx^_j`blky g_dhlhjuc]Zajhf^Zkhe_gb $2 \cdot 10^{5}$ flZ Hij_^_eblv kj_^gxx d\Z^jZlbqgmx kdhjhklv ihkflmeiZdl_evgh]h ^\
4. GZclb kj_^gxx dbg_lbq_kdmx wg_j]bx ihklmiZl_evgh]h ^\ kh^_j`Zsbo,kZy]\\h^ygh]h iZjZ ijb l_fi_jZlmj_ $27 \cdot 10^{0}$ Kj

AZ^Zqb ^ey kZfhklhyl_evgh]h j_r_gby

5. Hij_^_eblv kj_^gxx ^ebgm k\h[h^gh]h ijh[_]Z Zlhfh\ lgkbly \ r]_eby jZ, $1 \cdot 10^{2}$ d] ^{3}f
6. Ijb dZdhc l_fi_jZlmj_ fhe_dmeu]_eby h[eZ^Zxl lZdhc `_ k kdhjhklvx dZd fhe_dmeu \h^hjh^Z ijb l_fi_jZlmj_
7. Kdhevdh fhe_dme kh^_j`blky hlhjh]h]ZaZ kj_^gyy d\Z^jZlbq fhe_dme dhlhjh]h jZ\gkZb l_fi_jZlmj_ $2 \cdot 10^{3}$ K?
8. >Z\e_gb_ b^_Zevgh]h lZ]dhZgp_gljZpby $2 \cdot 10^{12}$ dmf^{3}e Hij_^_eblv kj_^gxx dbg_lbq_kdmx wg_j]bx ihklmiZl_evgh]h ^\b`_gby h^g]ZaZ

Статистические распределения молекул газа

<h i j h k u

1. DZdh\ oZjZdl_j ^\b`_gby fhe_dme"
2. Qlh lZdh_ nmgdpby FZdk_eeZ dZdh\B_azh[jZa[jZ_ajZ_nkdbcmkfdhe" FZdk_eeZ
3. DZdh\ kfuke \ujZ`_gby ©jZkij_^_e_gb_ fhe_dme ih kdhjhklyfª
4. Qlh lZdh_ gZb_jhylg_crZy kdhjhklv"
5. DZdh\h khhlghr_gb_ gZb_jhylg_cr_c kdhjhklb kh kj_^g_c Zd\Z^jZlbqghc"
6. DZd wdki_jbf_glZevgh [ueh ih^l_j`^_gh jZkij_^_e_gb_ FZdk\
7. Qlh gZau\Zxl jZkij_^_e_gb_f ;hevpfZgZ" Bah[jZablv _]h]jZnb
8. DZdh\ \b^ [Zjhf_ljbq_kdhcdZdhjfm ihemqblv"
9. Ijb dZdbo mkeh\byo kijZ_^eb\u jZkij_^_e_gby FZdk_eeZ b ;
10. Ijb_^bl_ ijbf_ju ijhy\e_gby jZkij_^_e_gby ;hevpfZgZ b [Zjhf_ljbq_kdhc nhjfmeu

AZ^Zqb

1.

6. Bah[jZahjZ_nbq_kdZb^uc bahijhgZ_khj^hgkZ_gd (p,V), [(V,T), \ (p,T).
7. Qlh lZdh_ dhfihg_glZ kf_kb iZjpbZevgh_ ^Z\e_gb_"
8. DZdhij_^_eblv ^Z\e_gb_ kf_kb]Zah\"

AZ^Zqb

1. >h dZdhc l_fi_jZlmju fh`gh gZ]j_lv iehlgh aZdjulj\h^kuhkmh^[kh hg g_ jZahj\Zeky _keb kl_gdb khkm^Z 10^{6} uZ"j?bdZkv^Zhekmg^Z_
2. < khkm^_ h[t_fhkfh^_j`blky g_dhlhjuc]Za ijb 27^{0} K fi_GjZlmkjhevd ihgbablky ^Z\e_gb_]ZaZ _keb \ke_^kl\b_ m 10^{20} qhde_jdZmaZ" ba kh
3. < khkm^_ h[t_fgZohf^blky kf_kv d]]_eby bjb kd]fidjZemjk^Z Hij_^_eblv ^Z\e_gb_ b fheyjgmx fZkkm kf_kb]Zah\
4. =Za k`Zl bahl_jfbq_kdb h^3 llZ[t^hfZh[t_fZ^3 f^3 ijb wlhf ^Z\e_gb_ \hajhkeh g^{3}ZlZ DZdbf [ueh i_j\hgZqZevgh_ ^Z\e_gb_]ZaZ"

AZ^Zqb ^ey kZfhklhylgbey gh]h j_r_

5. < [Zeehg_ _fdhkfgZoh^blky]_ebc ih $1 \cdot 10^{7}$ ZlZe bgihjbfl_fi_jZ200mj_ D lhke_ ih^dZqdb]_eby ^Z\e_g $2 \cdot 10^{7}$ lZ\uZkdehikjZ-gZjZ DGZ kdhevdh m_ebqbeZkv fZkkZ]_eby ijb ih^dZqd_"
6. Hij_^_eblv fZkkm m]Zeadbkjehl]hdZxs_]h \ l_q_gb_ fbg kh kdh ljm[_ iehsZ^v ihi_j_qgh]h k_q^{2}gb>yZdehlgjh c $\cdot 10^{5}$ akZf L_fi_jZlmjZ D
7. G_dhlhjmx fZkkm b^_Zevgh]h]ZaZ kgZqZeZ bah[Zjgh gZ]j k`bfZxl Z aZlo_hfjgbahihgb`Zxl ^Z\e_gb_ =Za \ha\jZsZ_lky \ b Bah[jZabl_ wlb ijhp_kku gZ dhhjV^pb,gZVgubD,p)k_ldZo
8. < [Zeehg_ _fdhkfgZoh^blky]\h^hjh^Z b]ZahlZ Hij_^_eblv ^Z\ kf_kb _keb l_fi_jZlmjZ hdjm 27^{0} Kxs_c kj_^u
9. Hij_^_eblv iehlghklv]Zah\hc kf_kb k]h_kebhy s_c]Zja]hgZ ijb l_fi_jZlmj_ Db ^Z\e_gb $\cdot 10^{5}$ lZ

AZgylb_ ‹

Первое и второе начала ТД

<hijhku

1. Ba q_]h h[jZ\agmljkygyy wg_j]by _s_kl\Z"
2. Knhjfmebjmcl_ i_j\h_ gZqZeh k<_jfh^fbgZofb^dd\h b jZaebqb_ ©dhebq_kl\h l_iehlu ª ©jZ[hlZª"
3. Qlh gZau\Zxl l_iehzfdhklvx _s_kl\Z fheyjghc m^_evghc" baf_jyxlky" DZdhmZgfb_fb k\yav"
4. Knhjfmebjh\Zlv GL> ^ey bahohjgjh]h_ijhlv_kZ[hlm dhebq_kl\h b fheyjgmx l_ieh_fdhklv
5. Knhjfmebjh\Zlv GL> ^ey bah[Zjgh]h_ijhlv_kZ[hlm dhebq_kl\h b fheyjgmx l_ieh_fdhklv
6. Knhjfmebjh\Zlv GL>ah^le_jfbq_kdh]h bijhjp_^kkZblv jZ[hlm dhebq l_iehlu b fheyjgmx l_ieh_fdhklv ^ey bahl_jfbq_kdh]h ijhp_kkZ
7. Knhjfmebjh\Zlv GL> ^ey Z^bZ[Zlbq_kdh]h ijhp_^kkZblv jZ[hlm dhebq l_iehlu b fheyjgmx l_ieh_fdhklv ^ey hZp^bkZ[Zlbq_kdh]h ij
8. Qlh lZdh_ wgljhiby l_jfh^bgZfbqkkZdZbyklbjq_dkkdZdyZljZdlh\dZ
9. < q_f kmlv \lhjh]h gZqZeZ l_jfh^bgZfbdb b _z hlebqb_ hl i_j\
10. Knhjfmebjmcl_ i_j\mx b \lhjmx l_hj_fu DZjgh

AZ^Zqb

1. <h^hjh^ aZgbfZ_l h^3 [jbf^Z\e_gbfblZ ?]h gZ]j_eb ijb ihklhyggh ^h ^Z\e_gby FlZ Hij_^_eblv baf_g_gb_ \gmlj_gg_c wg_j]b]Zahf b l_iehlm khh[s_ggmx]Zam
2. Hij_^_eblv jZ[hlm kh_jrzggmx b^_Zevguf]Zahf ijb bahl_jfbq _]h ^Z\e_gfb_gvrbehkv h^5 llZ ^h ^{5} lZ b _keb \ gZqZe_ jZkrbj_ aZgbfZe $h[tz^3$f.

f

3. Dbkehjh^ fZkkhc]Z]j_\Zxl ijb ihklhygghf ^ZD\ehgbbDhlij_^_eblv dhebq_kl\h l_iehlu ih]ehs_ggh_]Zahf baf_g_gb_ \gmlj_ jZkrbj_gby]ZaZ
4. Hij_^_eblv baf_g_gb_ wgljhibb] ZahlZ \ ijhp_kk_ k`Zlby hl Zlf GZqZevgZy b dhg_qgZy l_fi_jZlmju jZ\gu khhl_lkl_g
5. <h^hjh^ fZkkhc] ih^_j]Z_lky kgZqZeZ Z^bZ[ZvlghjfmhkZtZflbxZ aZl_f bahohjghfm hoeZ`^_gbx ^h gZqZevghc l_fi_jZlmju Ba ijhp_kk \ phkyobS,T Hij_^_eblv baf_g_gb_ wgljhibb \h^hjh^Z f_ dhg_qguf khklhygbyfb
6. L_fi_jZlmjZ gZ]j_\Zl_ey l_ieh\hcD flZ_bjZlmjZ oheh^bevgbdZ Hij_^_eblv DI> l_ieh\hc fZrbgu jZ[hlZxs_c ih pbdem DZjg fZrbgu _keb gZ]j_\Zl_ev _`_k_dmg^ghl_iejhl^uZ_l _c

AZ^Zqb ^ey kZfhklhyl_evgh]h j_r_gby

7. M]e_dbkeuc]Za fZkkhcZjgh gZ]j_lDhlh D Hij_^_eblv dhebq_ l_iehlu khh[s_ggh_]Zam jZ[hlm]ZaZ baf_g_gb_ \gmlj_gg_c
8. <h kdhevdh jZa mf_gvrbehkv ^Z\e_gb_ ZahlZ fZkkhc] l_fi_jZlmj^{0}C _keb ijb bahl_jfbq_kdhf jZkrbj_gbb whllhml]Za>kh_
9. H[t_f Zj]hgZ gZoh^ys_]hky ijbdlZZhe_gbbqbbekyh hle GZ kdhevd baf_gblky \gmlj_ggyy wg_j]by]ZaZ _keb jZkrbj_gb_ ijhba Z^bZ[Zlgh"
10. Hij_^_eblv baf_g_gb_ wgljhibb \ha^ihboZ^\hmdjZlhfhf bahl_jfbq_ m_ebq_gbb h[t_fZ >h jZkrbj_gby \ha^mo gZoh^beky ih^ ^Z\e D
11. <h^hjh^ fZkkhc] kgZqZeZ bah[Zjgh gZ]j_l lZd qlh _]h h[t [ue bahohjgh hoeZ`^_g lZd mflhvr^ZeekvgbljhZ Hij_^_eblv k baf_g_gb_ w.gljhibb
12. B^_ZevgZy l_ieh\Zy fZrbgZ jZ[hlZxsZy ih pbdem DZjgh kh d>` L_fi_jZlmjZ gZ]j_\Zl_ey D± Z oDhehH^ie^vgebbdZ dheb l_iehlu ihemq_ggh_sjZ[hlvhbffhl gZ]j_\Zl_ey dhebq_kl\h l_ie oheh^bevgbdm d i ^ pbdeZ

AZgylb_ *3* ‹

L_fZ

Тепловые свойства реальных газов

<hijhku

1. Ijb dZdbo mkeh\byo \hagbdZxl hldehg_gby k\hcklb^j_Zevgguo]Zah\ b \ q_f hgb khklhyl"
2. Qlh kh[hc ij_^klZ\ey_l mjZ\jgZZevkZ\ nbabq_kdbc kfuke i @ª bb ª© \ mjZ\g_gb^b_j<ZZZevkZ"
3. DZdhc \b^ bf_xl bah^_jf<ZevkZ WgD^Zdhc"mqZklhd ba^l_jfu < <ZZevkZ nkbdlbog_\hafh`_g b ihq_fm"
4. DZd f_gy_lky \b^ bahl_jf j_Zevgh]h]ZaZ ihemq_gguo ijb j ihq_fm"
5. Q_fm jZ\gZ \gmlj_ggyy wg_j]by j_Zevgh]h]ZaZ"

AZ^Zqb

1. DZdmx qZklv ^Z\e_gby dbkehjh^Z gZ kl_gdb khkm^Z khklZ\e ^Z\e_gb_ h[mkeh\e_ggh_ kbeZfb ijbly`_gby fhe_dme _keb h fZkkZ dbkehjh^Z] l_fi_jZlmjZ D" DZdmx qZklv h[kh[klgguc h[tzf fhe_dme dbkehjh^Z"
2. <uqbkebl_ l_fi_jZlmjm ijb dhlhjhc ^Z\e_gb_ j_Zevgh]h dbkel] e jZ\gh Zlf KjZ\gbl_ k l_fi_jZlmjhc ©b^_Zevgh]hª db ^_j<ZZevkZ ©ªZjZbg@ khhl_lkl_gghfhev 10^{-5} f^3 fhev

3. J_Zevguc \h^hjh^ \ dhebq_kl_ fhev jZkrbjy_lky bahl_jfbq_k ijb wlhf h[tzf khkm^Z m_ebqbeky hl e ^h e Hij_^_ebl jZ[hlm _keb ihklhy^ggjuZZeZkgZ ©bZaa jbZ\gu hlk_hlkl_ggh Gf4 fhev 10-5 f3 fhev
4. Hij_^_eblv baf_g_gb_ wgljhibb] j_Zevgh]h m]e_dbkeh bahl_jfbq_kdhf jZkrbj_gbb hl e ^h -^e-j<ZhZkeuvkZgbaZa<ZZgC khhl_lkl_gghf4 fhev G 10-5 f3 fhev

AZ^Zqb ^ey kZfhklhyl_evgh]h j_r_gby

5. < [Zeehg_ _fdhklvx e gZoh^blky fhe_c gK dhZhejhjhb_]ZaZZ jZ\gh Zlf Z0 Kjb^Z\e_gb_ m_ebqbehkv ^h Zl <u^b_jebl_ <ZZevkZ ^ey wlh]h]ZaZ
6. < khkm^_ h[tzf3fgZoh^blky fhev \h^hjh^Z ijb ghjfZevghf ^]Za j_Zevguf hij_^_eblv \h kdhevdh jZa gZ^h m_ebqblv _]h m_ebqbehkv \ljh_"
7. <uqbkebl_ ^Z\e_gb_ j_Zevgh]h dbkehjh^Z fZkkhc ed]ijbgZoh l_fi_jZlmj0K KjZ\gbl_ j_amevlZl kqblZy]Za b^_Zevguf
8. <h^hjh^ \ dhebq_kl_ fhev aZgbfZ_l h[tzf e ijb l_fi_jZl ^Z\e_gb_ Zj]hgZ Z kqblZy Zj]hg b^_Zevguf]Zahf [kqbl kbeZfb \gmlj_gg_]h ijbly`_gby fhe_dme gh ij_g_[j_]Zy bo kh[kl\_gg kqblZy Zj]hg j_Zevguf ]Zahf k kh[kl\_gguf h[tzfhf fhe_dme \gmlj_gg_]h ijbly`_gby fhe_dme] kqblZy Zj]hg j_Zevguf]Z
9. :j]hg \ dhebq_kl_ dfhev jZkrbjy_lky b_fhl_jZfbmj_kdb3D^hl f f3 KqblZy _]h^_g\ZZZgevkh\uf^a hij_^_eblv kh_jr_ggmx jZ[hl \gmlj_gg_c wg_j]bb khh[s_ggh_ dhebq_kl\h l_iehlu

AZgylb_ <

Тепловые свойства реальных жидкостей и твёрдых тел

<hijhku

1. DZdh\ujkh\ggu_ ij_^klZ\lelijbgybb^dhkl_c"
2. DZd h[tykgblv ih_joghklgh_ gZly`_gb_ `b^dhklb" ljbf_ju _]h
3. Qlh gZau\Zxm^_evghc k\h[h^ghc wg_j]b_c ih_[dhwknbbjbhf_ghkl ih_joghklgh]h gZly`_gby"
4. Qlh lZdh_ eZieZkhgkbdh"N^Zf\meZ EZieZkZ \u\h^
5. DZd h[tykgblv dZibeeyjgHlq_y]he_gZyb'kbl \ukhlZ ih^tzfZ beb `b^dhklb ih dZibeeyjm"
6. DZdh\u hkh[_gghklb djbklZeebq_kdbo l_e"
7. DZdh\ oZjZdl_j ^\b`_gby qZklbp \ maeZo dHqkyZgehbo_Zkgdhacf j_ l_ieh\h]h jZkrbj_gby l_j^uo l_e
8. DZd \uqbkeblv \gmlj_ggxx wg_j]bx h^gh]h fhey _s_kl\Z \ djb
9. Ihemqblv \ujZ`_gb_ ^ey l_iehzfdhklb djbklZeeh\ \ deZkkbq_k

AZ^Zqb

1. GZ kdhevdh gZ]j__lky dZiey jljmlkebiyebmbq^\gmZydZi_e-3df3jZ^bn dZ`^Zy" Iehlghklv m^_evgZy l_iehzfdhklv b dhwnnbpb_gl jlmlb jZ\gu khhl\_lkl\_g3gh >`dDdfb G f
2. Nblbev ih^gbfZ_l \h^m gZ \ukhlm kf GZ dhZbdbmexx\uk^hgbmf_ihky d_jhkbg" Dhwnnbpb_gl ih_joghklgh]h gZly`_gby b iehlghklv \h^u fG f b 3 ^dey fd_jhkbgZ fG 3f b d] f
3. =hjyqZy \h^Z k l_f87_0jZkfmZjkhchcd]hl^Z_l l_iehlm oheh^ghc \h^_ fZkku l_fi_jZlmjZ17 0hKhjBhc l_fi_jZlmju klZgh\ylky h^bgZdh\ufb wgljhiby ijb wlhf m_ebqb\Z_lky
4. Ihevamykv aZdhghf >xehg]Z b llb gZclb ba dZdh]h fZl_jbZe pbebg^j _khf G Ba_klgh qbhy^geZy _]h ghZ]j_[hZ\Zehkv dh l_iehlu >`

5. QZku k eZlmgguf fZylgbdhf b^ml ijZ\bevgh ijb l_fi_jZlmj_ qZku aZ kmldb _keb l_fi_jZlmjZ ih\ukblky ^h D" Dhwnnbp eZlmgb jZ 10^{-6} gD^{1}.

AZ^Zqb ^ey kZfhklhyl_evgh]h j_r_gby

6. DZdmx jZ[hlm gZ^h kh_jrblv qlh[u \u^mlv fuevguc imaujv ^l ijhp_kk kqblZlv bahl_jfbq_kdbf" Dhwnnbpb_gl ih_joghklgh ie_gdb jZ_g G f
7. DZdmx jZ[hlm g_h[oh^bfh kh_jebkvfZkqblZlv[uZkkhc] bahl_jf jZa^jh[blv \gmljb \h^u gZ dZi_evdb ^bZf_ljhf ih fdf" Dhwn gZly`_gby gZ]jZgbfZ_kehh^Z_g fG f iehlghklv^{3}fZkeZ
8. < kibjl gZ g_[hevrmx]em[bgm hims_gZ dZibeeyjgZybZfmljdZg dhlhjhc ff Hij_^_eblv _k kibjlZ ih^gy\r_]hky ih dZgZ ih_joghklgh]h gZly`_gby jZ_g G f
9. Ijb l_fi_jZlmj_ D ^ebgZ pbgdh\h]h kl_j`gy jZ\gZ ff lhi_j_qgu_ jZaf_ju kl_jZgdhcuh^blgb dZdhc l_fi_jZlmj_ h^bgZdl kl_j`g_c h[tzfu kl_j`g_c" Dhwnnbpb_gl ebg_cgh]h l_ieh\ $29 \cdot 10^{-6}$ D^{1} f_^h$7 \cdot 10^{-6}$ D^{1}.
10. K\bgph\Zy imey e_lysZy kh kdhjhklvx f k m^Zjy_lky h kl qlh dbg_lbq_kdhc wg_j]bb imeb b^zl gZ _z gZ]j_\Zgb_ gZ]j_eZkv imey MdZaZgb_ m^_evgmx l_ieh_fdhklv k\bgpZ aZdhghf >xehg]Z b llb

AZgylbx_

L_fZ

<hijhku

1. Qlh gZau\Zxl nZahZc hZsahkluf i_j_GZahfbl_ nZah\u_ i_j_oh^u
2. DZdh\u mkeh\by jZ\gh_kby gZ ±jZgjh^_ ©`ehd"hklv
3. Qlh lZdh_ l_fi_jZlmjZ ieZ\e_gby kdjulZy l_iehlZ ieZ\e_gby"
4. Ihq_fm m^_evgZy l_iehlZ iZjhh[jZah\Zgby aZ\bkbl hl l_fi_jZlm
5. Qlhijhbkoh^bl k \gmlj_gg_c wg_j]b_c b wgljhib_c `b^dhklb ijb
6. DZdh\h hlebqb_ bkiZj_gby hl dbi_gby"
7. Qlh lZdh_ gZkus_gguo iZj b dZd hij_^_eblv _]h ^Z\e_gb_"
8. Qlh hkh[hc ij_^klZ\ey_l mjZ\g±gDe_ZmDaeZmkcZ"hgZ
9. DZdhc \b^ bf__l ^bZ]jZffyZ djjZbkglZ\e_kbq_kdhc `b^dhc Qlh lZah lZdh_ZjhcgZy lhqdZjblbq_kdh_?khklhygb_
10. Q_f hlebqZxlky nZah\u_ i_j_oh^u i_j\h]h jh^Z hl nZah\uo i_j_

AZ^Zqb

1. Hij_^_eblv iehlghklv \h^ygh]h iZjZ \ djblbq_\kdh_j\Zkmkyh\Zb ihklhygbZy^©y g_]h jZ^{5}\g^{3}Zfhev
2. Hij_^_eblv wnn_dlb\guc ^bZf_lj fhe_dmeu ZahlZ _keb dj djblbq_kdZy l_fi_jZlmjZ jZ\gu khhl_lkl_ggh Zlf b
3. Hlghkbl_evgZy \eZ`ghklv \ha^moZ ijbDljZi\gjZlmj_ Z ^Z\e gZkus_ggh]h \h^ygh]h iZjZ dlZ Hij_^_eblv iehlghklv \ lhqdm jhku
4. Hij_^_eblv baf_g_gb_ l_fi_jZlmju ieZ\e_gby ev^Z ijb m_ebq Zlf _keb ba_klgh qlh ijb ieZ\e^Zgbbaf_gdfhey wgljhibb jZ d>` D lehlghklv \h^u b ev^Z jZ\gu khhl_lkl_ggh^{3} d] f
5. Hij_^_eblv baf_g_gb_ wgljhibb] ev^Z ijb ij_\jZs_gbb _ l_fi_jZlmj_ D L_iehzfdhklv ev^Z kqblZlv ZlmjZ\bGZsZevh l_fi_jZlmjZ ev^Z jZ\gZ D L_fi_jZlmjm ieZ\e_gby ev^Z ijbgy

AZ^Zqb ^ey kZfhklhyl_evgh]h j_r_gby

6. Kdhevdh wnbjZ ^he`gh [ulv gZeblh \ Zf imqhh[u[tiZbhfgZ]j_\Zfg gZ[ex^Zlv djblbq_kdh_ khklhygbZ\e_Dgblbqjkdh_ Zlf djbl l_fi_jZlmjZ D fheyjgZy $7{,}4 \cdot 10^{-8}$ kZ fhev
7. < dhfgZl_ h[tzfh fijb lfi_jZlmjK hlghkbl_evgZy \eZ`ghklv \ha Hij_^_eblv fZkkm \h^yguo iZjh\ \ dhfgZl_ lehlghklvZjgZk ijb wlhc l_fi_jZlmj_ jZ\gZ] f
8. Hij_^_eblv Z[khexlgmx b hlghkbl_evgmx \eZ`ghklv \ha^moZ \ qlh l_fi_jZlmjZ jZ\gZ D Z lhqdZ jhku D
9. Hij_^_eblv baf_g_gb_ wgljhibb ijb ij_\jZs_gbb d] iZjZ l_fi_jZlmj_ D \ \h^m b ihke_^mxs_f hoeZ`^_gbb \h^u ^h l
10. FZjl_gh\kdZy i_qv jZ[hlZ_l gZ ijbjh^ghf]Za_ Kdhevdh]Za \uieZ\db l klZeb _keb d i ^ i_qb " GZqZe\gZyzl_fi m^_evgZy zfdhekhv >D d]m^_evgZy l_iehlZ ie\Z\e_gby l_fi_jZlmjZ ieZ\e_gbym^_evgZy l_iehlZ k]hjZ>gbyd]]ZaZ

AZgylb_ ‹

L_fZ

<hijhku

1. DZdb_ kms_kl\mxl y\e_gby i_j_ghkZ"
2. DZdh\Z ijbqbgZ ^hmmjmqhb_]h lj_gby l_iehijh\h^ghklb"
3. Hl q_]h aZ\bkyl dhwnnbpb_glu ^bnnmabb \yadhklb l_iehijh\
4. DZdh\Z k\yav f_`^m wlbfb dhwnnbpb_glZfb b q_f hgZ h[mkeh\
5. Dm^Z gZijZ\e_gu _dlhju iehlghklb ihlhdZ fZkku fhe_dme i fhe_dmiehlghklb ihlhdZ l_iehlu wg_j]bb "
6. DZd gZijZ\e_gu _dlhju]jZ^b_glZ iehlghklb]jZ^b_glZ kdhjh]jZ^b_glZ l_fi_jZlmju kehz\ _s_kl\Z"

AZ^Zqb

1. Hij_^_ebl_ fZkkm ZahlZ ijhr_^r_]h \ke_^kl\b_ ^bnnmabb q_ 10^{-2} f^2 aZ k_dmg^ _keb \ gZijZ\e_gbb i_ji_g^bdmeyjghf wl iehlghklb jZ_g ^{4} L_dfj_fjZlmjZ ZahlZ D Kj_^gyy ^ebgZ k\ fhe_dme ZahlZ fjZ\gZwnn_dlb\gu_ $3{,}1 \cdot 10^{-10}$ f
2. < mkeh\byo ij_^u\Zqbs_\ubZk^eblv dhwnnbpb_gl \gmlj_gg_]h lj_g
3. Q_fm jZ_g dhwnnbpb_gl l_iehijh\h^ghklb ^\moZlhfgh]h]Za h[tzfhf e b kh^_j $\cdot 10^{22}$ sfhje_dme _eb dhwnnbpb_gl ^bnnmabb $2 \cdot 10^{-5}$ f^2 k "

AZ^Zqb ^ey kZfhkjhyl_eyby

4. Hij_^_eblv dhwnnbpb_gl ^bnnmabb dbkehjh^Z ijbkeblbfijjZl ghjfZevguo mkeh\byo h 10^{-6} jfZ\kg KqblZlv qlh gZ]j_\Zgb_ ijhb g_baf_gghf h[tzf_ khkm^Z k dbkehjh^hf
5. Dbkehjh^ b m]e_dbkeuc]Za bf_xl jZ^hmjZdh\m^xZ\e_fgb_ K wnn_dlb\gu_ ^bZf_lju fhe_dme wlbo]Zah\ h^bgZdh\ufb h dhwnnbpb_glh\ ^bnnmabb dhwnnbpb_glh\ \gmlj_gg_]h l l_iehijh\h^ghklb
6. DZdh_ dhebq_kl\h l_iehlu l_jy_lky _`_qZkdgh lq_ehajhh\dgh \ha^moZ f_`^m jZfZfb _keb ie^{2}hsZ^kkhdygZb_ ff_`^m jZfZfb L_fi_jZlmjZ \ ihf_s^{0}Cgbkgj$\cdot 10^{-10}$C >Z\e_gb_ ghjfZevgh_

k f klj

AZgylb_ ‹

L_fZ

Электростатическое поле (ЭП) заряженных тел. Действие ЭП на заряды.

<hijhku

1. K\hckl\Z we_dljbq_kdh]h aZjy^Z
2. AZdhg DmehgZ

3. <_dlhgZijy`_gghklvbe_dljhklZlbq_kdWlh ?^heybpu baf_j_gby gZijy`z
4. GZijy`zgghklv Wl kha^Zggh]h lhq_qguf aZjy^hf
5. <_dlhj^bmgdpbwbe_dljbq_kdh_ kWl s?^gbg_bpu baf_j_gby bg^mdpbb
6. L_hj_fZkljh]jZ^kdh=Zmkk^eybg^mdpbb Wl
7. Nhjfmeu ^ey bg^mdpbb beb gZijy`zgghklb± =Wl khia^Zghgjh]fh lhq_qguf aZjy^hf [ aZjy`_gghc gblpvkebg^jZfy`]_gaZjfy`_gghc kn aZjy`_gghc iehkdhklvx
8. DZjlbgZ ebgbc gZijy`zgghklb bg^mdpbb we_dljbq_kdh i_j_qbke_ggufb \ur_ aZjy`_ggufb l_eZfb
9. L_hj_fZ h pbjdmeypbb gZijy`zgghklb Wl
10. JZ[hlZl ih i_j_f_s_gbx aZjy^Z
11. Ihl_gpbZeZkbq_jl jZaghklb ihl_gpbZeh\ Wl kha^Zggh]h ijhly l_ehf
12. K\yav jZaghklb ihl_gpbZeh\ bWlgZijy`zgghklb

AZ^Zqb

1. < _jrbgZo ijZ\bevgh]h lj_m]hevgbdZ kh klhjhgZfb jZ\gufb -8 De -8 De Hij_^_ebl_ ggZhkv_\ lj_lv_c _jrbg_ lj_m]hevg
2. Ih h[t_fm rZjZ jZ^bmk dhlhjh]h kf jZ\ghf_jgh jZkij_^_ iehlghklvx -6 De3f Hij_^_ebl_ _dlhj gZijy`_gghklb \ lhqdZo jZkklhygbb ff kf gZ ih_jogh_klhZ bZjZkf hl p
3. LhgdZy ijh\hehdZ ^ebghc kf jZ\ghf_jgh a-8ZDyè_gHZijaZjy^hf gZijy`_gghklv we_dljbq_kdh]h ihey gZ hkb ijh\hehdb gZ jZkk f hl __ dhgpZ
4. Hij_^_ebl_ jZ[hlm dhlhjmx g_h[oh^bfh kh\b_jvrbjlZkkdhlhygb_mf_è ^\mfy h^bgZdh\ufb ieZklbgZfb ?egZsZ^vkf AZjfy^u ieZklbgb ‡ ‡-7 De

AZ^Zqb ^ey kZfhklhyl_evgh]h j_r_gby

5. AZjy`_ggZy iuebgdZ gZoh^blky \ jZ\gh\_kbb f_`^m ieZklbgZ FZkkZ iuebg‡b] Hij_^_ebl_ aZjy^ iuebgdb _keb jZkklhygb kf jZaghklv ihl_gpbZeh\ <
6. >_ h^bgZdh\u_ djm]eu_ ieZklbgu ?2 dZhsZ^vjZkihekf`_gu iZjZee ^jm] ^jm]m AZjy^ h^g-hc ie-8Dklbg^jm‡hc -8 De Hij_^_ebl_ kb \aZbfgh]h ijbly`_gby ieZklbg _keb jZkklhygb_ f_`^m gbfb
7. JZkklhygb_ f_`^m ^\mfy lhq_qguffb -8aZjy^Zfb -8 De jZ\gh kf Hij_^_ebl_ \_dlhj gZijy`_gghklb \ lhqd_ m^Ze_gghc Zlhil_j\ \lhjh]h gZ kf
8. Dhevph jZ^bmkhf kf ba lhgdhc ijh\hehdb jZ\ghf_jgh aZjy Hij_^_ebl_ ihl_gpbZ\epihgelyj_ dhe[vpZqd_ gZ hkb dhevpZ hlklh kf hl _]h iehkdhklb Hij_^_ebl_ gZijy`_gghklv \we_bdjbq_kdh]
9. Iheh`bl_evgu_ aZjy^u De ‡ - ‡De gZoh^ylky \ \Zdmmf_ gZ jZ ^jm] hl ^jm]Z DZdmx jZ[hlm g_h[oh^bfh kh_jrblv qlh[u k[eb f"

AZgylb_ ‹

Проводники и диэлектрики в электростатическом поле

<hijhku

1. We_dljhklZlbq_kdZy aZsblZ
2. We_dljhklZlbq_kdh_ ihe_ \ ^bwe_dljbd_
3. We_dljbq_kdZy zfdhklv m_^bgzggh]h aZjy^Z iehkdh]h d dhg^_gk.ZlhjZ
4. We_dljbq_kdZy[ZfZlhkbvdhg^_gkZlhjkh_^jbgbgbbke_^h\Zl,_[evgh iZjZee_evgh
5. Wg_j]bZdhg^_gkZl[hjZ^ghjh^gh]h Wl \ g_h^ghjh^gh]h Wl

AZ^Zqb

1. Ijhkljzgkl\h f_`^m ieZklbgZfb iehkdh]h dhg^_gkZlhjZ ^bwe_dljbq_kdZy ijhgbpZ_fhklv jZ\gZ jZkklhygba_gfk`^m ihl_gpbZeh\ f_`^m gbfb d< Hij_^_ebl_ Z gZijy`zgghklv kl_de_ ih_joghklgmx iehlghklv aZjy^Z gZ ieZklbgZo \ k\yaZgguo aZjy^h\ gZ kl_de_
2. >_ dhgp_gljbq_kdb_ f_lZeebq_kdb_ kb50_kfhjZZamxh fkn_jkbfq_kd dhg^_gkZlhj Ba aZjy^u ih _ebqbg_ jZ\gu gDe we_dljhklZlbq_kdh]h ihey f_`^m kn_jZfb
3. D ieZklbgZ iehkdh]h \ha^mrgh]h dhg^_gkZlhjZ ijbeh`_gZ jZa lehsZ^v ieZklbg2 jZkklhygb^m gbfb ff lhke_ hldexq_gby d hl bklhqggbdZ ijhkljZgkl\h f_`^m ieZklbgZfbεaZiheg_bje^_ieZjZnb dZdhc klZeZ jZaghklv ihl_gpbZeh\ [zfdhklv dhg^_gkZlhjZ zfdhklv dhg^_gkZlhjZ bkv^eb_weg_dkljgdZ
4. >\Z dhg^_gkZlhjZ _fdhklvx fdN b fdN kh_^bgbeb f_`^m [ZlZj__ k W>K < Hij_^_ebl_ aZjy^ dZ`^h]h dhg^_gkZlhj f_`^m _]h h[deZ^dZfb _keb dhg^_gkZlhjZ kh_^bg^hgZl_evghjZ

AZ^Zqb ^ey kZfhklhyl_evgh]h j_r_gby

5. Iehkdbc dhg^_gkZlhj aZiheg_gguc kex^hc aZjy`_g ^h jZa GZc^bl_ we_dljbq_kdmx \hkijbbfqb\hklv kex^u b agZq_gb_ bg^mdpbb JZkklhygb_ f_`^m h[deZ^dZfb dhg^_gkZlhjZ
6. AZjy^ -8 De gZoh^blky \ p_glj_ iZjZnbgh\h]h rZjZ ^bZf_ljhf iehlghklv iheyjbaZpbhgguo aZjy^h\ gZ ih_joghklb rZjZ
7. Hij_^_ebl_ _fdhklv pbebg^jbq_kdh]h dhg^_gkZlhjZ kh kl_de \ukhlZ dhg^_gkZlhjZ jZ^bmk f\gmlj_gg_c h[deZ^db ± kfkfZ \g gN
8. Wg_j]by iehkdh]h \ha^mrgh]h dhg^_gkZlhjZ g>` jZaghklv < iehsZ^v ieZklbg3 Hij_^kfeblv jZkklhygb_ f_`^m h[deZ^dZfb iheydhg^_gkZlhjZ h[t_fgmx iehlghklv wg_j]bb ihey

AZgylbx_3

L_fZ

<hijhku

1. KbeZ lhdZ iehlghklv lhdZ
2. We_dljhkhijhlb\e_gb pbebg^jbq_kdh]h j_aZjklhjZj_a[bklhjh\b ijb ihke_^h\Zl_kvgh^bg_g\bZlZj_b j_abklhjhiZjZeb_oevghf kh_^bg_gbb
3. H^ghjh^guc b g_h^ghjh^guc mqZklhd p_ib
4. W>K klhjhggb_ kbeu
5. AZdhg Hjf\beZjDlhnZ
6. JZ[hlZ ,lhdZghklv lhdZ ihegZy ihe_agZy ihl_jv
7. DI> bklhqgbdZ lhdZ
8. AZdhg >`hEegypZ
9. AZdhgu we_dljhebaZ
10. =Zah\uc jZajy^ Z kZfhklghkZfhklhuyl_evguc

AZ^Zqb

1. Hij_^_eblv iehlghklv lhdZ l_dms_]h ih5 ijh\hkgbdmZ ^ehggZo ih^^_j`b\Z_lky jZaghklv 2 hl_Mpbevgh_ khijhlb\e_gb_ fZl_jbZe jZ\gh 2 *мкОм·м*.
2. <p_ib ihklhyggh W>K hdZlhqgbdZ .lhdZ lj_gg__ khijhlb\e_gb_ bl lhdZ Hfabklhjhijhlb\e_gb_ abklhjh\ Hf b kh_^bg_gu iZjZee_evgh^bl_ lhdb l_dmsb_ q_j_a i_j\u.c b \lhjhc j_abklhj

3. :ddmfmeylhj k W>K gmlsc gZfdg_rg__ khijhlb\e_gb_ ^Z_l lhd jZaghklv ihl_gpbZeh\ f_`^m ihexkZfb Zddmfmeylhj jZ\gZ fhsghklv \u^_ey_fmx \ Zddmfmeylhj_ ihegmx fhsghklv bklhq
4. ljb ih^dexq_gbb d [ZlZj__ j_agkfhjZu^_geZy_lky fhsgh <l ljb wlhf Dl> kbkl_fu khklhys_c ba [ZlZj_b b j_abklhj GZc^bl_ Dl> kbkl_fu ijb ih^dexq_gbb d [ZlZj__ ^jm]h]h j \u^_ey_lky fhsgh.klv <l
5. >\Z ijh\h^gbdZ khijhlb\e_gby *M*, *Ом* kh_^bg_gu iZjZee_evgh ijhoh`^_gbb lhdZ gZ i_j\hf ijh\h^gbdZZ l\ie_hey_lky j_^_eblv d dhebq_kl\h l_iehlu \u^_eblky \ h[hbo ijh\h^gbdZo aZ l ihke_^h\Zl_evghf kh_^bg_gbb

AZ^Zqb ^ey kZfhklhyl_evgh]h j_r_gby

6. Bklhqgbhdl k w*B* \gmlj_ggbf khijhlb\e_gby *Ом* kh_f^bg_g k j_hklZ GZijy`_gb_ gZ aZ`bfZo bklhqgbdZ lhdZ dh]^Z kb *l* *м* q_M^_evgh_ khijhlb\e_gby *Ом*.^b
7. >\Z h^bgZdh\uo bklhqgb_ lhdZ h^ghf kemqZ_ ihke_^h\Zl_e iZjZee_evgh < h[hbo kemqZyo hgb aZfdgmlu *l* *м* \gZ_lb_ \gmlj_gg__ khijhlb\e_gb_ dZ`^h]h bklhqgbdZ lhdZ dh]^Z kb h[hbo kemqZyo h^bgZdh\Z
8. M we_f_gWZ>k < kbeZ lhdZ ijb dhjhldhf aZfudZgbb : lj khijhlb\e_gbb ih^dexq_gghf d bklhqgbdm ihe_agZy fhsghklv hgZ jZ\gZ
9. We_dljbq_kdbc qZcgbd bf__l ^_ k_dpbb gZ]j_\Zl_ey ljb \de aZdbiZ_l q_jfbag Z ijb \dexq_gbq_jlhajhc fbg Q_j_a kdhevdh aZdbibl \h^Z _keb k_dpbb \dexqblv iZjZee_evgh"
10. Gbd_ebjh\Zgb_ f_lZeebq_kdh]h ba^_eby k ieh*i* *м* ijZ^vxe iZe_hlovgh q ijb kbe_ lhdZ : Hij_^hekhlylbgbdZ\e_glghklv jZ\gZ ie d]*3*).f

AZgylb_ <

L_fZ

МП токов. Действие МП на токи

<hijhku

1. FZ]gblhklZlbq_kdhFl_ ihe_
2. <_dlhj bg^mdpb?^bFgbpu baf_j_gby fZ]gblghc bg^mdpbb
3. Bg^mdpby Fl khа^Zggh]h wZed_fg_HkZ\ZjZ
4. ljbgpbi kmi_jihabpbb fZ]gblguo ihe_c
5. L_hj_ZFHkljh]jZ^kdh?Zmkk^ey bg^mdpbb Fl
6. <_dlhj gZijy`_gFgh?^bgbpu baf_j_gby
7. L_hj_fZ h pbjdgZeyy`bzggghklb fZ]gblgh]h ihey
8. Bg^mdpby Fl Z ijyfhdjmlhdZ]h[lhdZ \ dZlmrdb bg^md.lb\ghkl
9. DZjlbgZ ebgbc bg^mdpbb gZijy`_gghklb Fl khа^Zggh]h i_j_
10. KbeZ :fi_jZ
11. JZ[hlZ Wl ih i_j_fijs\hg^bgbdZ dhglmjZ k lhdhf

AZ^Zqb

1. Ih ^\mf [_kdhg_qgh ^ebgguf iZjZee_evguf ijh\h^gbdZf l_dm ijhlb\hiheh`guo gZijZ\e_gbyo JZkklhygb_ f_`^m ijh\h^gbdZ bg^mdpbx fZ]gblgh]h ihey \ lhqd_ m^Zezgghc hl i_j\h]h ij \lhjh]h ijh\h^gbdZfgZ

2. Ih djm]h\hfm \bldm ba lhgdh]h ijh\h^Z jZ^bmkhf ff pbjdm bg^mdpbx fZ]gblgh]h ihey \ lhqd_ hlklhys p_gljZ gZ ff
3. Ih ^\mf iZjZee_evguf ijh\h^gbdZf ^ebghc ih : b l_dm:l \lhc ijhlb\hiheh`guo gZijZ\e_gbyo JZkklhygb_ f_`^m ijh\h^gbdZfb \aZbfh^_ckl\by lhdh\
4. < h^ghjh^gh_ fZ]gblgh ihe_ k bg^mdpb_c Le ihf_s_gZ d\Z kf GhjfZev d iehkdhklb jZfdb khklgZ_ey_flZ]gblgh ihey m]h Hij_^_ebl_ \jZsZxsbc fhf_gl kbe :fi_jZ _keb ih jZfd_ l_q_l lh
5. >\Z ijyfhebg_cguo ^ebgguo ijh\h^gbdZ jZkiheh`_gu gZ jZkklh Ih ijh\h^gbdZf l_dml lhdb : b : \ h^ghf b lhmfx`_jZ jhZ ihZ\e_^bgbpm ^ebgu ijh\h^gbdZ gm`gh kh_jrblv qlh[u jZa^\bg jZkklhygby kf"

AZ^Zqb ^ey kZfhklhyl_evgh]h j_r_gby

6. Ih ijyfhebg_cguo fhdhg_qgh ^ebgguh fmbdm l_q_l lhd : Hij bg^mdpbx fZ]gblgh]h ihey \ lhqd_ gZ jZkklhygbb kf hl _]h hkb
7. Khe_ghb^ ^ebghc kf kh^_j`bl \bldh\ Hij_^_ebl_ bg^m \gmljb khe_ghb^Z _keb khijhlb\e_gb_ h[fhldb jZ\gh Hf Z jZ\gh . <
8. Ih \bldm bf_xs_fm nhjfm d\Z^jZlZ kh klhjhghc kf b^_l bg^mdpbx fZ]gblgh]h ihey \ lhqd_ i_j_k_q_gby ^bZ]hgZe_c b klhjhg
9. < h^ghjh^ghf fZ]gblhf ihe_ k bg^mdpb_c Le gZoh^blky ijy kf Ih g_fm l_qzl lHij_^_:ebl_ m]he f_`^m gZijZ\e_gb_f lhd fZ]gblghc bg^mdpbb _keb kh klhjhgu ihey ^_ckl\m_l kbeZ
10. Ih ijyfhfm]hjbahglZevhg^hfbdmjhi\hl_dZ_l lhd : Ih^ gbf gZ j kf gZoh^blky iZjZee_evguc _fm Zexfbgb_\uc ijh\h^ ieh lhkl dhlhjhfm ijhimkdZxl lhd : Hij_^_ebl_ iehsZ^v ihi_j_qgh]h ijh\h^Z _keb hg m^_j`b\Ze_lkguf_aZdj
11. <blhd jZ^bmkhf lhdhf ihf_s_g \ h^ghjh^gh_ fZ]gblgh_ ihe_ gZ *5 кА/м* lZd qlh ghjfZev d \bldm *60* [kZ gZijZ\e_gb_f ihey DZdmx kh_jrZxl kbeu ihey ijb ih\hjhl_ \bldZ \ mklhcqb\h_ iheh`_gb_

AZgylbx_5

МП движущегося заряда, действие МП на движущиеся заряды. Магнетики в магнитом поле

<hijhku

1. KbeZ Ehj_gpZ b _z gZijZ\e_gb_
2. FZ]gblguc fhf_gl dhglmjZ k lhdhf
3. Fbdjhlhdb _dlhj gZfZ]gbqb\Zgby lhd gZfZ]gbqb\Zgby ih_j
4. FZ]gblgjZhygbpZ_fhfZjygbl\Zmkijbbfqb\hklv
5. =jZnbd djb\hc gZfZ]gbkqbmZqZby Z ^bZfZZjZflZbdZ\i n_jjhfZ]gdZb"
6. FZ]gblguc]bkl^jhfabkgZy kljmdlenyjZbkl_j_abkZ dhwjpblb\gZy k hklZlhqgZy gZfZ]gbq_gghklv
7. Wg_j]by. Fl

AZ^Zqb

1. We_dljhg ^\b`_lky ijyfhebg_cgh k ihklhygghc kdhjhklvx bg^mdpbx fZ]gblgh]h iheygZohqds_cky gZ jZkklhygbb gf h iheh`_gby we_dljhgZ b eb_dhjcg kh lhqd:m jZ\45g.

3. Ijh\h^gbd ^ebghc f ^\b`_lky kh kdhjhklvx f k i_ji_g^bdm h^ghjh^ghf fZ]gblghf ihe_ jhg^mdpfLye dhGZc^bl_ jZaghklv ihl \hagbdZxsmx gZ dhgpZo ijh\h^gbdZ
4. KbeZ lhdZ_ghkh^e_ jZ\ghf_jgh \ha^Zhkl_aZhлин Ijb wlhf khe_gh gZdZieb\Z_l w0gДж]bbDZdZy w ^ k bg^mpbjm_lky \ khe_ghb^_"
5. J_abklhj khijhlb\e_ghf_hhk_ghb^ khijhlb\e_gb_bfg^mHdfb\ghklvx =g kh_^bg_gu iZjZee_evgh b ih^kh_^bg_gu q_j_a dexq d Hij_^_eblv gZijy`_gb_ gZ dhgpZo khe_ghb^Z q_j_a k b AZ^Zgb ^ey kZfhklhyl_evgh]h j_r_gby
6. Iehkdbc \blhd iehsZ^kx^_ebZgf ijh\hehdb khijhlb\e_gb_f Hf ebgbb h^ghjh^gh]h fZ]gblgh]h ihey k bg^mdpb_c Le i_ji_g^ D \bldm ijbkh_^bg_g]Zev\Zghf_lj GZc^bl_ we_dljbq_kdbc]Zev\Zghf_lj ijb ih\hjhl_ \bldZ gZ m]he *f*
7. Dhveph ba Zexfbgb_\h]h ijh\h^Z m^_evgh_ khijhlb\e_sgbgh f_^ fZ]gblgh_ ihe_ i_ji_g^bdmeyjgh ebgbyf fZ]gblghc bg^mdpbb ^bZf_lj f_^gh]h ijh\h^Z ff GZclb kdhjhklv baf_g_gby fZ]gb dh]^Z kbdeZ \lhdhevp_ klZg_l jZ\ghc :
8. Dhglmj iehsZ^vfx^2 jZkiheh`_g i_ji_g^bdmeyjgh ebgbyf fZ]gblg FZ]gblgZy bg^mdpby f_gy B(t)k=y5.sin(4πZdLhegmHij_^_eZaZ\bkbfhklv fZ]gblgh]h ihlhdjZ_f_gb [f]gh_ggh_ ahggZhq]hgbh_lhfdZZ]gdb_j_a aZ\bkbfhklvk Wg^mdpbb hl \]_ff_Zgbkbfzevgh_ agZq_gb_ W>K f]gh_ggh_ agZq_gb_ Wq>K_ag^mdpbb
9. Q_fm jZ\gZ h[t_fgZy iehlghklv wg_j]bb fZ]gblgh]h ihey kh bf_xs_]h iehlgmx hg^mgxhkgeZhfchldm ijh\h^hf ^bZf_ljhf ff _k l_q_l lhd :"
10. Khe_ghb^ [_a k_j^_qgbdZ b k h^ghkehcghc h[fhldhc ba ijh\hc ^ebgm kf b iehsZ^v ihi_j_qgh]h<kl_qq_ggby_ kfk ijb gZijy`_g gZ dhgpZo hkh^e_\gh[fhld_ \u^_ey_lky dhebq_kl\h l_iehlu jZ\gh ihey \gmljb khe_ghb^Z KqblZy ihe_ h^ghjh^guf gZclb kbem

AZgylb_ ‹

L_fZ

Свободные электромагнитные колебания в электрическом контуре

<hijhku

1. Ihgylb_ eZ_dlyhfZ]gblgu_ dhe_[Zhgeby[Zl_evg.uc dhglmj
2. >bnn_j_gpbZevgh_ mjZ\g_gb_ b aZdhgZ\ dh^e_Z[eZvgohcf adZ[gyl^Zj_ j_Zevghf dhglmj_ \ ijb \ugm`^_gguo .dhe_[Zgbyo \ dhglmj_
3. I_jbh^ b qZklhlZ dhe_\[Zgbyo \ dhglmjj_Zevghf dhglmj_ \ugm`^_gguo dhe_[Zgbyo \ dhglmj_
4. AZ\bkbfhklv Zfieblm^Z aZjy^Z gZ dhg^_gkZlhj_ hl \j_f_gb \ j_
5. >_dj_f_gl we_dljhfZ]gblguo dhe_[Zgbc
6. <j_fy j_eZdkZpbb
7. Baf_g_gb_ lhdZ b^dZZenvdh]h[Zl_evgh]h dhglmjZ
8. Baf_g_gb_ gZijy`_gby gZ dhg^_gkZlhj_ dZlmrd_ bg^mdlb\ghk
9. AZdhg HfZ gZ mqZkldZo p_ib i_j_f_ggh]h lhdZ
10. J_Zdlb\gu_ khijhlb\e_gby
11. Fhsghklv p_ib i_j_f_ggh]h lhdZ
12. MjZ\g_gby iehkdhc we_dljhfZ]gblghc \hegu
13. K\yav f_`^jny`gZgghklyfb Wl b Fl \ WF<
14. Dbg_fZlbq_kdb_ oZjZdl_jbkdhdjb k(WF<Zdn\mfk_s_kl_[ZnaZ\ qZklhlZ_jbh^^\hegh\h_ qb_keehg\hegu
15. Wg_j]_lbq_kdb_ oZjZdl_jbkgl_bjdjby[WF<fgZy wehlghklv wgh_jhdb wg_j]bb] iehlghklv ihlhdZ_dlgh_jjMfbh\Zglb]Z^bgl_gkb\ghklv

AZ^Zqb

1. Dhg^_gkZlhj dhe_[Zl_evgh]h dhglmjZ [ue aZjy`_g ^h fdDe dZlmrdb jZ\gZ f=g b qZklhlZ we_dljhfZ]gblguo dhe_[Zgbc fZ]gblgh]h ihey dZlmrdb q_j_a k ihke_ gZqZeZ we_dljhfZ]gb g_aZlmoZxsbfb
2. Dhe_[Zl_evgh]h dhglmj khklhbl ba dhg^_gkZlhjZdZl_mdhk bg^mdlb\ghklvx=g b j_abklhjZ khijhlb\e_gb_f Hf dZlmrdZ bg^mdlb\ghklvx dhg^_gkZlhjZ jZ[_eHij_^_ebZv i_jbh^ we_dljhfZ]gblguo dhe_ eh]Zjbnfbq_kdbc ^_dj_f_gl aZlmoZgby we_dljhfZ]gblg)mjZ\g_gb_ aZ\bkbfhklb gZijy`_gby gZ ieZklbgZo dhg^_gkZlhj
3. < p_iv i_j_f_ggh]h lhdZ gZijy`_gb_f =p<ihdkeqZ^khlhZh_evgh \de j_abklhj khijhlb\e_gb_f Hf dZlmrdZ bg^mdlb\ghklvx =g fdN Hij_^_ebl_ kbem lhdZ \ p_ib iZ^_gb_ gZ khijhlb\e_gbb iZ^_gb_ gZijy`_gby gZ dhg^ijyk[Zlhy_ gZ dZlmrd_
4. Hij_^_eblv j_ahgZgkgmx qZklhlm dhe_[Zl_evghc kbkl_fu dhe_[Zgbc=pZ eh]Zjbnfbq_kdbc ^_dj_f_gl aZlmoZgby dhe_[Zg
5. < kj_^ε=k bμ=1 jZkijhkljZgy_lky iehkdZy we_dljhfZ]gbmgZy \ gZijy`_gghklb we_dljbq_kdh]h <ihfeyZ\dhZgiieblm^m gZijy`_ggh fZ]gblgh]h [hneZyah\mx kdhjhklv bgl_gkb\ghkelyu

AZ^Zqb ^ey kZfhklhyl_evgh]h j_r_gby

6. <uqbkeblv wg_j]bx we_dljbq_kdh]h ihey dhgk^ihkeZ_hjZZqZ_ej we_dljhfZ]gblguo dhe_[Zgbc \ b^_Zevghf dhglmj_ _keNbdhg^ [ue aZjy`_g ^DeZ bg^mdlb\ghklv dZlmrdb jZ\gZ
7. JZaghklv ihl_gpbZeh\ gZ h[deZ^dZo dhe_[Zl_evgjZ]hZ dhZglmjZ Hij_^_ebkhvijhlb\e_gb_ dhglmjZ _keb _fdhklvfdhhg^gkZbhjZhkl dZlmrdb f=g
8. Dhe_[Zl_evguc dhglmj kh^_j`bl dZlmrdhd=bgd^hmgd^lbgkZkhjx_fdhk gNb j_abklhj khijhlb\e_Hgfb_Hfj_^_ebl_ ^ey kemqZy fZZdb\fmfZ hlghr_gb_ wg_j]bb fZ]gblgh]h ihey dZlmrdb d wg_j]bb we_dlj
9. Hij_^_ebl_ eh]Zjbnfbq_kdbc ^_dj_f_gl aZlmoZgby ijb dhlhjh dhglmjZ mf_gv8rZZ_ak5yiZheguo dhe_[Zgbc
10. Dhe_[Zl_evguc dhglmj kh^_j`bl kHijhdZ\mrdb_bg^mdlb\fghklvx dhg^_gkZlhj _fdhkfldvNHij_^_eblv q_j_a kdhevdh iheguo dhe_ lhdZ \ dhglmj_ mf_gvjZbalky \
11. < p_iv i_j_f_ggh]h lhdZ \dexq_gu jihakbklh\Zhijevlbhe_gb_f dZlmrdZ b bg^mdlb\guf khijhlb\e_gb_f Hf b dhg^_gkZlhj k _ Hf DZdZy fhsghklv \u^_ey_lky \ p_ib ijb ^_ckl\mxs_f agZq_
12. MjZ\g_gb_ iehkdhc we_dljhfZ]gblghc \hegu _jZZkjgbkgjZcgyxjs^_c $(\mu = 1)$ bf__l $E(x,t) = 2\cdot10^{-2}\sin(2\pi\cdot10^{6}\ t \pm 8{,}97\cdot x$ < fHij_^_eblv qZklhlm dhe nZah\mx kdhjhklv ^bwe_dljbq_kdmx ijhgbpZ_fhklv kj_^u ^ \hegu
13. < \Zdmmf_ jZkijhkljZgylky iehkdZy we_dljhfZ]gbmgZy \ gZijy`_gg fZ]gblgh]h ihey :f Hij_^_eblv Zfieblm^m gZijy`_gghklb kj_^gxx ih \j_f_gb h[t_fgmx iehlghklv wg_j]bb \hegu

AZgylb

L_fZ

Интерференция света

<hijhku

1. Ijbgpbi=xc]_gkZ
2. Ihgylby gZ_jbm_j_gp[bybgl_jn_j_gpbhggZy dZjlbgZ \ bgl_jn_j_
3. Mkeh\by fZdkbfmfh\ b fbgbfmfh\ bgl_jn_j_gpbhgghc dZjlbgu

4. Oh^ emq_dbgilj_bjn_j_gppbb f_lh^hf ^_e_gby \hegZghkho]_hfZnjXg]Z [ba_jdZeZ Nj_g_ey Nj_[bjeboafZ
5. Oh^ emq_dbgilj_bjn_j_gppbb f_lh^hfZf^ie_elmbyv wg_j]bb \hegu Z iezgdb [dhevpZ GvxlhgZ
6. < q_f khkljhhkl_ile_gb_ hilbdb
7. Qlh ijhbkoh^bl k bgl_jn_j_gppbhgghc dZjjlhbfgZhlbqk_k_dZ]hlbZkhlbqg _keb imqdb k\glZ\b^ma^mo_ Z \ \h^_"
8. Q_f hlebqZ_lky bgl_jn_j_gppbhggZy dZjlbgZ djZkgh]h fhgh bgl_jn_j_gppbhgghc dZjlbgu fhghojhfZlbq_kdh]h nbhe_lh\h]h k
9. Q_f hlebqZ_lky bgl_jn_j_gppbhggZy dZjlbgZ [_eh]h k_lZ hl b fhghojhfZlbq_kdh]h k_lZ"

AZ^Zqb

1. GZclb \k_ ^ebgu \heg \b^bfh]h k_lZ hl ^h fdf dhlh mkbe_gu fZdkbfZevgh hkeZ[e_gu ijb hilbq_kdhc jZaghklb \heg jZ\ghc fdf
2. < hiul_ Xg]Z jZkklhygb_ hlj_sgZe_cf^hHiw_^_eblv m]eh\h_ jZkkl khk_^gbfb k_leufb ihehkZfb _keb lj_lvy k_leZy ihehkZ hlk jZkklhygbb ff
3. < hiul_ k a_jdZeZfb Nj_g_ey jZkklhygb_ G f_`^m fgbfufb b k_lZ jZ\gh jZfkklhygb_ O hl gbo ^h wdjZgZ jZ\gh f >eb Hij_^_eblv rbjbgm E ihehk bgl_jn_j_gppbb gZ wdjZg_
4. MklZgh\dZ ^ey ihemq_gby dhe_p GvxlhgZ hk_sZ_lky fhg iZ^Zxsbf ih ghjfZeb d ih_joghklb ieZklbgdb JZ^bmk djl GZ[ex^_gb_ _^_lky \ hljZ`_gghf k_l_ Baf_j_gbyfb mklZgh\e l_fgh]h dhevpZ kqblZy p_gljZevgh_ l_4fgh_ ifyflgkGbZgm^e_bugfm \hegu iZ^Zxs_]h k_lZ

AZ^Zqb ^ey kZfhklhyl_evgh]h j_r_gby

5. < hiul_ Xg]Z hl_jklby hk_sZebkv fhghojhfZlbq_kdbf k_lhf JZkklhygb_ f_`^m hl\_jklbyfb ff jZkklhygb_ hl hl\_jklbc ^ iheh`_gb_ i_j\uollejuo kh\ehk
6. < hiul_ Xg]Z jZkklhygb_ f_`^m ^\mfy s_eyfb gZ dhlhju_ iZ^Z fdf jZ\gh ff Hij_^_eblv jZkklhygb_ hl s_e_c ^h w bgl_jn_j_gpbhgguo ihehk hdZaZeZkv jZ\ghc ff
7. Hij_^_ebl_ \h kdhevdh jZajbgZf_bgbl kjn_j_gpbhgguo ihehk \ a_jdZeZfb Nj_g_ey _keb nbhe_lh\uc k_lhnbevlj ijhimkdZ_ aZf_gblv djZkguf gf
8. MklZgh\dZ ^ey ihemq_gby dhe_p GvxlhgZ hk_sZ_lky fhg iZ^Zxsbf iZjZee_evgh beqZ_kdhcchikb ebgau GZ[ex^_gb_ _^_lk k_l_ JZ^bmku ^\mo khk_^gbo l_fguo dhe_p jZ\gu ff b ebgau f GZc^bl_ ihjy^dh\u_ ghf_jZ dhe_p b ^ebgm \hegu
9. ;_euc k_l iZ^Z_l i45^ gmZ]ehevgmgxdine_ ihdZaZl_ev ij_ehfe_gby *1,33* Hij_^_eblv gZbf_gvrmx lhesbgm ie_gdb ijb dhlhjhc h hdjZr_gu \ `_elu *λ* = 580 *нм*).

9

Дифракция света

<hijhku

1. Ijbgpbi =xc]-_Nj_Zg_ey
2. Ahgu Nj_g_ejyZ^bmk \g_rg_cm-]jZbgpuNj_g_ey
3. Ihgylby Z ^bnjZdpby [^bnjZdpbhggZy dZjlbgZ \ ^bnjZdpb
4. Mkeh\by fZdkbfmfh\ b ^bnjZdpbhggZy dZjlbgZ Nj_g_ey
5. Oh^ emq_bo igbjfZhefviZ^_gbZgZ s_eygZ ^bnjZdpbhggmx j_r_ldm
6. Mkeh\beyZ\gufZdkbfmfh\hihegbl_efbgguofmfh\bnjZdpbhgZhlbgub ghjfZevghf iZ^_gbb k_lZ gZ ^bnjZdpbhggmx j_rzldm

3. AZdhg FZexkZ
4. M]he ih\hjhlZ iehkdhklb iheyjbaZpbb Z hilbq_kdb Zdlb\ghc
5. MjZ\g_gb_ ^bkG_hjjkfZbevgZy b ZghfZevgZy ^bki_jkby
6. Kmlv we_dljhgghc l-Ehhjbg>jZm^_
7. AZdhg ;m]_jZ
8. DZdbfb [m^ml dZaZlvky djZkgu_ [md\u _keb bo jZkkfZljb\Zlv
9. Lbiu jZkk_ygby k_lZ
10. NhjfmeZ J_e_y
11. Wnn_dl >hie_jZ ljh^hevguc wnn_dlu>dhwnjZ dlh>hjegjZ
12. Baemq_gb_ <ZQbe_hgZdh\Z

AZ^Zqb

1. Ij_^_evguc m]he iheghh]h hljZ`_gby ^ey imqdZ k_lZ gZ]j dZf_gghc kheb k \ha^mohfHijZ\^gebl_ m]he ;jxkl_jZ ijb iZ^_g \ha^moZ gZ ih_joghklZewZh]h djbk
2. Hij_^_ebl_ \h kdhevdh jZa mf_gvrblky bgl_gkb\ghklv k_l gbdheyheyjbaZlhj b ZgZe_kaZlhj]he f_`^m bo ]eZ\gufb beh dZ`^hf gbdhe_ l_jy_lky bgl_gkb\ghklb iZ^Zxs_]h k_lZ
3. IeZklbgdZ d\ZjpZ lhfsb\guhjcaZggZy i_ji_g^bdmeyjgh hilbq_kdh ih\hjZqb\Z_l iehkdhklv iheyjbaZpbb fhghojhfZlbq_kdh]h k_lZ g_d gZ m]he Hij_^_ebl_ lhesbgm lZdhc d\Zjp_\hc ieZklbgdb dhl f_`^m iZjZee_evgufb gbdhkevfb]Zkhbegwlhl k_l
4. GZclb dhgp_gljZpbx k\h[h^guo we_dljhgh\ bhghkn_ju _keb ^ F=p __ ihdZaZl_ev ij_ehfe_gby Q
5. LhesbgZ kl_deZ \ l_iebp_ ff Dhwnnbpb_gl ih]ehs_gby ^e h[eZklb ki_dljZ1 DZdkZy ^hey wg_j]bb ^hklb]Z_l jZkl_gbc"
6. < ki_dljZevguo ebgbyo baemqZ_fuo Zkljhgh±fbd\Zkadjlfb h gZ[ex^Z_lky djZkgh_ kf_s_gb_ dhlhjh_ hl_lkl\m_l ljzodjZlg baemq_gby Hij_^_ebl_ k dZdhc kdh.jhklvx m^Zey_lky d\ZaZj

AZ^Zqb ^ey kZfhklhyl_evgh]h j_r_gby

7. GZ dZdhc m]eh\hc \ukhl_ gZ^]hjbahglhf gZoh^blky Kheg hljZ`_gguc hl ih_joghklb \h^u Q fZdkbfZevgh iheyjba
8. IeZklbgdZ d\ZjpZ 1hesbgm lhcaZggZy i_ji_g^bdmeyjgh dhjlkbZekdZh ih\hjZqb\Z_l iehkdhklv iheyjbaZpbb fhghojhfZlbq_Hkdjh]h ekl\Z lhesbgm ^jm]hc d\Zjp_\hc ieZklbgdb g_h[oh^bfhc ^ey ihegh]
9. ?kl_kl_gguc fhghojhfZlbq_kdbc k_l iZ^Z_l gZ kbkl_fm ba ^ f_`^m dhlhjufb gZoh^blky d\Zjp_\Zy ieZklbgdZ \uj_aZgg hilbq_kdhc hkb GZclb fbgbfZevgmx lhesbgm ieZklbgdb ijb ijhimkdZlv k_lh\h]h ihlhdZ _keb ihklhyggZy \jZs_gby
10. Bf_y b\m qlh ^ey ^hklZlhqgh `_kldbo j_gl]_gh\kdbo emq_c v kqblZlv k\h[h^gufb hij_^_eblv gZkdhevdh hlebqZ_lky h ij_ehfe_gby]jZnblZ ^ey j_gl]_gh\kdbo emq_c k ^ebghc \hegu
11. Dhwnnbpb_gl ih]ehsdhlhyjh]g _s_kl\Z ^ey fhghojhfZlbq_l hij_^_ezgghc ^ebgu \hegu1 jZHij_^_ebkfv lhesbgm kehy _s_k g_h[oh^bfZ ^ey hkeZ[e_gbb k_lZ Z \ jZaZ [\ jZa lh mqblu\Zlv
12. Hij_^_ebl_ fbgbfZevguck bfdhlhjuf ^he`_g h[eZ^Zlv we_dljhg <Z\behlZ_j_gdh\Z gZ[ex^Zeky \ kj_^_ k ihdZaZl_e_f ij_ehfe_g

AZgylb_ ‹

L_fZ

Законы геометрической оптики

<hijhku

1. :[khexlguc ihdZaZl_ev ijhlehfebgbyguc ihdZaZl_ev ij_ehfe_gb

2. Ijbgpbi N_jfZ
3. AZdhgu]_hf_ljbq_kdhc hilbdb Z hljZ`_gby [ij_ehfe_gby] h[jZlbfhklb emq_c
4. lhgylby Z a_jdZeh [ijbafZ \ ebgaZ] hilbq_kdZy kbkl_f
5. lhgylbyZ emq [ ]eZ\gZy hilbq_kdZy hkv \ nhdmk nhdmkg kbeeZbgau^ m_ebq_gb_ bah[jZ`_gby
6. Lbiu a_jdZeh nZhjf[_ih gZiue_gbZxih_joghklv
7. OZjZdl_jgu_ lhqdb ebgbb iehkdhkjhb_gbeamqjZ`_gbchfhsxv Z iehkdh]h a_j[dZkeZ_jbq_kdh]h a_jdZeZ. \ lhgdhc ebgau
8. Nhjfme[Zkn_jbq_kdh]h a[_jdhZgedZhc ebgau
9. Ij_ehfeyxsbc m]he ijbafu

AZ^Zqb

1. GZ djZx [Zkk_cgZ klhbl q_eh_d b gZ[ex^Z_l dZf_gv e_`Zsb jZ\gZ K GZjZdkZdlhfygbb hl ih\_joghklb \h^u \b^gh bah[jZ`_gb aj_gby khklZ\ey_l k ghjfZevx d ih_joghklb \h^u m]he ¡"
2. Ij_^_evguc m]he ihegh]h hljZ`_gby ±gZb^]dZkbvjZ\kgHdje^_ebl_ ihdZaZl_ev ij_ehfe_gb_ykèb^dhkZhajZ_le_hfve_gby kl_deZ jZ_g
3. GZkl_deyggmx ijbafm k ij_ehfeyxsibZf^Zm]lehfmq k_lZ ih.^ m]e Hij_^_eblv m]he hldehg_gby emqZ ijbafhc _keb ihdZaZl_ev i
4. <uqbkebl_ b gZq_jlbl_ dhebq_kl\h bah[jZ`b_gbZb dk\lhqZ_qkhe]b bkl gZoh^blky f_`^m ^\mo iehkdbo a_jdZe ⁰f_`^m dhlhjufb m]he
5. lhkljhcl_ bah[jZ`_gb_ ij_^f_lZ hl \uimdeh]h a_jdZeZ _keb ij_ a_jdZeZ gZ jZkklhygbb Z f_gvr_ nhdmkgh]h jZkklhygby gh [\ jZ [hevr_ nhdmkgh]h jZkklhygby gh f_gvr_ jZ^bmkZ djb\bagu ] [hevr_ jZ^bmkZ djb\bagu HoZjZdl_jbamcl_ bah[jZ`_gb_ \ dZ`^hf
6. G_h[oh^bfh ba]hlh\bvuimdehkdx ebgam k hilbq_kdhc kbehc ^ jZ^bmdkb\bagu \uimdehc ih_joghklb ebgau _keb ihdZaZl_ev ebgau jZ_g

AZ^Zqb ^ey kZfhklhyl_evgh]h j_r_gby

7. GZ iehkdhiZjZee_evgmx kl_deyggmx kfeZkZb_gmemhqeskbghZ30h^ m]e <uqbkebl_ [hdh\h_ kf_s_hgb_^rV]hemkqdZhaiv wlm ieZklbgm lhdZaZl kl_de5Z
8. Emq k_lZ \uoh^bl ba kl_deZ \ \ha^mo <uqbkebl_ kdhjhklv k_ ihegh]h \gmlj_gg_]h hlj4Z0^._gby jZ_g
9. Emq k_lZ \uokh^bdlebvgghc ijbafu ih^ l_f `_ m]ehf qlh b iZ^Z Hij_^_eblv m]he hldehg_gby emqZ ijbafhc _keb _z ij_ehfeyx
10. lhkljhcl_ bah[jZ`_gb_ lhq_qgh]h bklhqgbdZ k\_lZ \ ^\mo iel f_`^m gbfb jZ_g *f f f* h[jZ`_gbkdhievmhqZbalky"
11. <h]gmlh_ kn_jbq_kdh_ a_jdZeh bR=45lcмjZ^JZmkkldvjgb\bagu ij_^f_lZ dhlhjh]h ^h wlh]h a_jdZeZ jZ\gh ^\mf jZ^bmkZf djb\bagu lhklj b \uqbkebl_ Z nhdmkgh_ jZkklhygby gh[jZ`_gbyeij_^fb_lZ \ m\_ bah[jZ`_gby DZdh_ ihemqbehkv bah[jZ`_gb_ m_ebq_ggh_ i_j_\zjgmlh_ ^_ckl\bl_evgh_ beb fgbfh_"
12. >\hydh\uimdeZy ebgaZk ba kl_deeZ^Z_l hilbq_kdhc kbehc ih]jm`_gbbb^dhkhv ebgaZ ^_ckl\m_l dZd jZkk_b\ZxsZy hilbq_kdmx kbem ebgau \ `b^dhklb nhdmkgh_ jZkklhygb iheh`_gb_ bah[jZ`_gby lhqdb gZoh^ys_cky gZ]eZ\ghc hilbq_ nhdmkh\ hl ebkgeamqZe_y\ ebgau \ \ha^mo_ b \ `b^dhklb ihkljhbl

AZgylby12‹

L_fZ

<hijhku

1. Hkgh\gu_ ihgylby nhlhf_ljbb

2. Hk_s_gghklv hl lhq_qgh]h bklhqgbdZ
3. AZdhg EZf[_jlZ
4. Hk_s_gghklv bah[jZ`_gby ^Z\Z_fh]h ebgahc

AZ^Zqb

1. Lhq_qgbuachljhiguc bklhqgbd bkimkdZ_l k_lh\hc ihlhd N e fdf GZclb Zfieblm^gu_ agZq_gby gZijy`_gghkl_c we_d ihe_c wlh]h k_lh\h]h ihlhdZ gZ jZkklhygbb U f hl bklhqg
2. EZf[_jlh\kdbc bklhqgbd kfhg_l_ghc[_iehkdhklb ?]h yjdhklv jZ hk_s_gghklv iehsZ^db jZkiheh`_gghc iZjZee_evgh ^Zgghfm
3. GZ \ukhl_ K f gZ^ p_gljhf djm]eh]h klheZ jZ^bmkZ 5 bklhqgbd kbeZ k_lZ dhlhjh]h , lZd yaZ\qbkbhlkh\l_sgZgigZ\kevg\k_c klheZ hdZau\Z_lky jZ\ghf_jghc GZclb \b^ ²nmmgjdmebbf_`^im gZijZ\e_gb_f baemq_gby b \_jlbdZevx Z lZd`_ k_lh\hc ihlh $I(0) = I_0$ d^
4. GZclb k ihfhsvx djb\hc hlghkbl_ehvcgh\m\kkil\bl_jZeevggh klb]eZaZ Z ihlhd wg_j]bb khhl_lkl\mxsbc k_lh\hfm ihlhdm \ ef k fdf[k_lh\hc ihlhd ijboh^ysbcky gZ bgl_j\Ze ^ebg \heg hl khhl_lkl\mxsbc ihlhd $_w$wg_j]bkbd Nijbq_f^ighkce_jZkij_^_e_g jZ\ghf ih \k_f ^ebgZf \heg wlh]h bgl_j\ZeZ KqblZlv qlh \ ^Zgghf nmgdpby 9 aZ\bkbl ebg_cgh hl ^ebgu \hegu

AZ^Zqb ^ey kZfhklhyl_evgh]h j_r_gby

5. K_lbevgbd ba fhehqgh]h kl_deZ bf__l nhjfm rkZjeZ^kZ_flZjh,frZ jZ\gZ d^ Hij_^_eblv iheguc k_lh\hc ihlhd N k_lbfhklv 0
6. K_lbevgbd bf_xsbc \b^ jZ\ghf_jgh k_lys_cky kn_ju jZ^bmkZ jZkklhygbb K f hl iheZ Yjdhklv k\$^4$_dh²bêbvghgd_ZaZ\bkbl h gZijZ\e_gby GZclb hk_s_gghklv iheZ g_ihkj_^kl_ggh ih^ k\
7. Khegp_ gZoh^ykv \[ebab a_gblZ kha^Z_l gZ]hjbahglZevghc Fed >bZf_lj KhegpZ \b^_g ih^ m]ehf . Hij_^_eghblZ \b^b
8. Hk_s_gghklv (ih_joghklb ihdjulhc keh_f kZ`b jZ\gZ ec \k_o gZijZ\e_gbyo b²jZHgijZ_^_de^blfv dhwnnbpb_gl hljZ`_gby ! kZ
9. GZclb kj_^gxx hk_s_gghklv h[emqZ_fhc qZklb g_ijhajZqghc Z ZijZee_evguc k_lh\hc ihlhd kha^Zxsbc \ lhqd_ ghjfZevgh ?$_0$ [k_l hl lhq_qgh]h bahljhigh]h bklhqgbdZ gZoh^ys_]hky p_gljZ kn_ju 5 kf b kbeZ k_lZ , d^

AZgylby *13*‹

L_fZ

<hijhku

1. lhgylb_ l_ieh\h]h baemq_gby
2. Ki_dljZevgZy iehlghklv wg_j]_lbq_kdhc k_lbfhklb kmffZjgZy baemqZl_evgZy kihkehZghklv
3. AZdhg Dbjo]hnZ
4. lj_^klZ\e_gb_ h ZhlwZg_j]by]eZhldZ[ZkkZbf\imevk
5. Nhjfmez leZgdZ ^ey l_ieh\h]h baemq_gby
6. Wg_j]_lbq_kdZy k_lbfhklv ZhjZ\dhj^hk[h-hnZegZpfaZgZ
7. AZdhkfg_s_gkbygZ
8. lhgylby nhlhwnn_dlZ \g_rg_]h nhlhwnn_dlZ
9. AZdhgu Klhe_lh\Z ^ey \g_rg_]h nhlhwnn_dlZ
10. MjZ\g_gb_ Wcg^e_ycbgZghnnhlhggh]h \g_rg_]h nhlhwnn_dlZ djZk
11. >Z\e_gb_ k_lZ ijb ghjfZevghf iZ^_gbb gZ ih_joghklv
12. Dhfilhgh\kdbc k^\b] wnn_dl DhfilhgZ

AZ^Zqb

1. Baemq_gb_ KhegpZ ih k\h_fm ki_dljZevghfm khklZ\m [eba q_jgh]h l_eZ ^ehjh dZdhkbkfmdljZevghc iehlghklb wg_j]bfhklbp_kdh

ijboh^blky gZ ^ebgm \hegu Z fdf_fiGjZdhbjm ih_joghklb K
wg_j]bx l_jy_fmx Khegp_f gZ baemq_gbx jZgh^mwxlfhbg`_
\j_fy \]j_fy aZ dhfZhkjhZ_ KhegpZ mf_gvrblky gZ

2. Wg_j]_lbq_kdZy k_lbfhklv Z[khexlgh 10^{11} q<_ljg]hlhijl_^eZeblv ^ebg
\hegu hl_qZxsmx fZdkbfmfm ki_dljZevghc iehlghklb wg_j]_l
l_eZ
3. DZeb_\uc dZlh^ hk_sZ_lky fhghojhfZlbq_kdh]h k_lZ ^ebghc \hegu gf gZ
gZbf_gvr__ aZ^_j`b\Zxs__ gZijy`_gb_ f_`^mjbdZlhh^jhf bnhZghh^d
ij_djZsZ_lky JZ[hlZ \uoh^Z nhlhwe_dljhgh\ k ih_joghklb dZe
4. Hij_^_eblv djZkgmx]jZgbpm nhlhwnn_dlZ ^ey pbgdlZv b
nhlhwe_dljhgh\ \uju\Z_fuo k _]h ih_joghklb we_dljhfZ]gblg
\hegu gf
5. >Z\e_gb_ fhghojhfZlbq_kdh]h k_lZ ^ebghc \hegu gf gZ
jZkiheh`_ggmx i_ji_g^bdmeyjgh iZ^Zxs_fm baemq_gbx jZgh
dhgp_gljZpbx nhlhgh\ \ iZ^Zxs_f imqd_ k_lZ [qbkeh nhlhg
gZ ^{2} ifh_joghklb
6. Nhlhg k ^ebghc \hegu if bkiulZe dhfilhgh\kdh_ ^{0}jZgkZk_yg
i_j\hgZqZevgh ihdhb\r_fky k\h[h^ghf we_dljhg_ Hij_^_eblv
nhlhgZ ijb jZkk_ygbb [wg_j]bx hl^Zqb we_dljhgZ \ bfimev

AZ^Zqb ^ey kZfhklhyl_evgh]h j_r_gby

1. <ke_^kl\b_ baf_g_gby l_fi_jZlmju q_jgh]h l_eZ fZdkbfmf
wg_j]_lbq_kdhc k_lbfhklb kf_klbehkyh]h kbiaehjq_gby k ^ebgu
fdf ^h fdf DZd b \h kdhevdh jZa baf_gbebkv Z kmffZjgZ
l_eZ [fZdkbfZevgZy ki_dljZevgZy iehlghklv wg_j]_lbq_kdhc
2. Bf__lky ^\Z Z[khexlgh q_jguo bklhqgbdZ Ll_fiehjZhjmjZbaehqhq]hg
gbo$_1$ 7 D GZclb l_fi_jZlmjm ^jm]h]h bklhqgbdZ _keb ^e
fZdkbfmfm _]h ki_dljZevghc iehlghklb wg_j]_lbq_kdhc k_lb
[hevr_ ^ebgu \hegu khhl_lkl\mxs_c fZdkbfmfm ki_dl
wg_j]_lbq_kdhc k_lbfhklb i_j\h]h bklhqgbdZ
3. Ijb ihhq_j_^ghf hk_s_gbb ih_joghklb g_dhlhjh]h f_lZeeZ k\
fdf b fdf h[gZjm`beb qlh khhl_lkl\mxsb_ fZdkbf
nhlhwe_dljhgh\ hlebqZxlky ^jm] hl ^jZa]Z \GZclb jZ[hlm \u
ih_joghklb wlh]h f_lZeeZ
4. ;m^_l eb gZ[ex^Zlvky nhlhwnn_dl _keb gZ ih_joghkl
mevljZnbhe_lh\h_ baemq_gb_ k ^ebghc \hegu gf"
5. >Z\e_gb_ fhghojhfZlbq_kdh]h k_lZ ^ebghc \hegu hkfvgZ
jZkiheh`_ggmx i_ji_g^bdmeyjgh iZ^Zxs_fm baemq_gbx jZgh
qbkeh nhlhgh\ iZ^Zxsbo gZ ih_joghklZv iekhsZ^vx kf
6. Nhlhg k wg_j]b_c Fw< jZkk_yeky gZ i_j\hgZqZevgh
we_dljhg_ Hij_^_ebl_gmyhehjZgkZ_y_keb ^ebgZ \hegu jZkk_
hdZaZeZkv jZ\ghc dhfilhgh\kdhc ^ebg_ \hegu if

AZgylbx_*4*

L_fu - .

<hijhku

1. =bihl_aZ Emb ^_ ;jhcey
2. >ebgZ \hegu ^_ ;jhcey j_qZkbbpkulkdhc
3. =jmiih\Zy kdhjhklv \hegu ^_ ;jhcey
4. Khhlghr_gby g_hij_^_ezgghkl_c =_ca_g[_j]Z
5. KlZpbhgZjgh_ mjZ\g_gb_ Rj_^bg]_jZ
6. H[sbc \b^ \hegh\hc nmgdpbb

7. Mkeh\b_ ghjfbjh\db \hegh\hc nmgdpbb

AZ^Zqb

1. <uqbkeblv ^_[jhce_\kdb_ ^ebgu \heg we_dljhgZ ijhdlh_gxZsbo h^bgZdh\mx dbg_lbq_kdmx wg_j]bx w
2. AZjy`_ggZy qZklbpZ mkdhj_ggZy jZaghklvx ihl_gpbZeh\ ;jhcey if KqblZy aZjy^ wlhc qZklbpu jZ\guf aZjy^m we_d
3. >ebgZ \hegu nhlhgZ dshlhjuZ chfkfmjZ\gZ fdf ljbgbfZy \j_ ZlhfZ \ \ha[m`^zgghf khklhygbko jZ\jg\f eblv hlghr_gb_ _kl_ rbjbgu wg_j]_lbq_kdh]h mjh\gy gZ dhlhjhf [ue \ha[m`^zg wg_j]bb
4. We_dljhg k dbg_lbq_kdhc wxgehjdZeba\SZg w h[eZklb jZaf_jhf Hp_gblv k ihfhsvx khhlghr_gby g_hij_^_e_gghkl_c hlghkbl_ _]h kdhjhklb
5. <hegh\Zy nmgdpby g_dhlhjhc qZ=kA·exp(−a/b)f_]^l_ba±dhgklZgu jZkklhygb_ qZklbpu hl_gkljZh\ZhcZlb gZb[he__ _jhy_gdZkjZkklhy hl p_gljZ
6. QZklbpZ fZkku P ^\b`_lky \ h^ghf_jghf ihl_gpbZeZvjghfbdh_ekdb hkpbeeylhj Hp_gblv fbgbfZevgh \hafh`gmx wg_j]bx qZklbpu

AZ^Zqb ^ey kZfhkljhyl_gbvgh]h

7. Dbg_lbq_kdZy wg_j]by we_dljhgZ jZ\gZ Fw< Hij_^_ebl_ _
8. Hij_^_eblv ^ebgm \heguoZjZ;dh_cjbya mxsmx \hegh\u_ k\hckl\Z Z dhlhjuc ^\b`_lky kh kjZhjhkclvxj_dZ^jZlbqghc kdhjjhkl_bfi_jZjl_ $17\,^{0}C$.
9. <hkihevah\Z\rbkv khhlghr_gb_f g_hij_^_ezgghkl_c hp_gbl wg_j]_lbq_kdh]h mjh\gy ZlhfZ \h^hjh^Z \ khklhygbb Z hkg \j_f_g_f `ba^{-8}gko
10. Hp_gblv k ihfhsvx khhlghr_gby g_hij_^_e_gghkl_c wg_j]bx we_dljhgZ ehdZebah\Zggh]h \ h[eZklb jZaf_jhf O
11. QZklbpZ gZoh^blky \ ^\mf_jghc ijyfhm]hevghc ihl_gpbZev g_ijhgbpZ_fufb kl_gdZfb [D \ E Hij_^_eblv \ qZklbpu k gZbfwgvjr]bc_c \ h[eZklb [D
12. QZklbpZ gZoh^blky \ [_kdhg_qgh]em[hdhc h^ghf_jghc gZhl_g \lhjhf wg_j]_lbq_kdhf mjh\g_ < dZdbo lhqdZo yfu iehlghklv qZklbpu kh\iZ^Z_l k deZkkbq_kdhc iehlghklvx _jhylghklb"

AZgylb

L_fZ

<hijhku

1. Fh^_eb ZlhfZ \h^bgjkhZl\kl\b_ hiulguf ^Zgguf
2. Hkgh\u l_hjbb_;hjgZ_^hklZldb
3. Dhwnnbpb_glu ijhajZqghklb b hljZ`_gby ihl_gpbZevgh]h [Zjv_
4. J_r_gb_ mjZ\g_gby Rj_^bg]_jZ ^ey ZlhfZ k\fhu^khejhd^\ZgNhbaoqq_kkd_
5. Kibg we_dljhgZ
6. Ijbgpbi aZij_lZ lZjhbabq_kdZy kbkl_fZ obfbq_kdbo we_f_glh\
7. Ki_dljZevgu_ l_jfu
8. IjZ\beZ Omg^Z
9. F_oZgbq_kdbc fhf_gl ZlhfZ
10. FZ]gblguc fhf_gl ZlhfZ
11. IjZ\beZ hl[hjZ

AZ^Zqb

1. DZdhc k_jbb ijbgZ^e_`bl keibgbjZeZvghZZjgh]h \h^hjh^Z \hegl dhlhjhc jZ\gh jZaghklb \hegh\uo qbk_e ke_^mxsbo ^\mo ebg gf" DZdh\Z ^ebgZ \hegu wlhc ebgbb"

$^{+}$Œ $^{+} + e^{-} + e^{+}$;

$^{-}$Œ $^{-}$;

4) $p + e^{-}$: Q ;

$^{+}$: H $^{+}$;

6) K^{-} : $^{-}$?

AZ^Zqb ^ey kZfhklhyl_evgh]h j_r_gby

6. DZdZy qZklv Zlhfh\ jZ^bhZdlb\gh]h dh[ZevlZ Kh jZkiZ^Z ihemjZkiZ^Z jZ_g kmldZf"
7. <uqbkeblv dbg_lbq_kdb_ wg_j]bb ijhlhgh\ bfimevkou dh=lwj<udk]^_²kkdhjhklv k_lZ
8. <uqbkeblv wg_j]bx g_h[oh^bfmx ^ey jZa^_e_gby y^jZ 1H

- DZd magZlv _klv eb\ hleb\d_ \gmlj_ggb_ imkl_hdufZlj_jbhZ\eguo dZdh]h hgZ ba]hlh\e_gZ"
- <u_^bl_ jZkqzlgmx nhjfmem ^ehylg\ukqbke_egZy
- DZdb_ baf_j_gby gZau\Zxl Z ijyfufbDZ[db_dhk\eg\ugbfu" y\ey ijyfufb baf_j_gbyfb\ jZkq_lghc nhjfme_"
- Hibrbl_ oh^ jZ[hlu
- Kdhevdh gZ^h k^_eZlv hiulh\ ijb h^bgZdh\uo gZqZevguo m ijyfuo baf_j_gbc [ueZ "
- DZd ihevah\Zlvky fbdjhf_ljhf rlZg]_gpbjdme_f _kZfb"
- DZdh\ewlbo ijb[hjh\ Z ij_^_eu baf_j_gbc [p_gZ ^_eZgby]ih]j_rghklv ijb[hjZ"
- DZd^ey ijyfuo baf_\ugbkeblZkbkl_fZlbq_kdmx ih]j_rgkhkmvqZcgm ih]j_rghklv \ Z[khexlgmx ih]j_rghklv hlghkbl_evgmx ih]j_rg
- Qlh y\ey_lky bklhqggbdhf kbkl_fZlbq_kdbo b kemqZcguo ih]j_r
- lhq_fm hlghkvbgZy ih]j_rghklv emqr_ oZjZdl_jbam_l dZq_k Z[khexlgZy" ljbf_ju
- Qlh gZau\Zxl \Z^Zg^Zjlghc nhjfhc aZibkb ijb[eb`_ggh]h qbkeZ"
- Qlh gZau\Zxl agZqZs_c pbnjhc" DZdb_ pbnju agZqZsb_\ qbk
- DZdh\u ijZ\beZ hdjm]eblv kj_^g__ agZq_gb_ ijyfh]h beb dhl
- DZdb_ pbnju gZau\Zxl _jgufb\ ijb[eb`zgghf qbke_ dZdb_ dZdhfm djbl_jbx hdjm]eblv kj_^g__ agZq_gb_ ijyfh]h beb dhl
- AZibrbl_ nhjfmeu g_h[oh^bfu_ ^ey \ukqbkce_dghky_ighgjh]hgbaf_j iehlghkilbl_ogheh]bb ijh_^_gjbyhh^bugZdmkuch\byo
- < dZdhf\b^_ ke_^m_l aZibkZlv ^h_jbl_evguc bgl_j\Ze agZq_
- Qlh gZau\Zxl ^h_jbl_evguf bgl_j\Zehf agZq_gbc ijyfhbjh" beb Qlh hagZqZ_l lZdbZ=2,6±0,3($кг/см^3$)?
- DZdb_ hrb[db ^hims_gu\ ke_^mxs_c aZibkb dhg_qgh]h j_a $V = 2{,}317 \pm 0{,}1482 (см^3)$?

EZ[hjZlhjgZy jZ[hlZ ‹

P_eb jZ[hlu

1. Bamqbnbvabq_khdkgbf_lh^Z [Zeebklbq_kdh]h fZylgbdZ
2. <uqbkekdvhjhvkmeb f_lh^hf [Zeebklbq_kdh]h fZylgbdZ
3. Bamqblv ijZ\beZ ihkevdmhgZ^hfbyjhf
4. Bamqblv l_ogheh]bx h[jZ[hldb j_amevlZlh\ baf_jjZbguo\ui gZqZevguo mkeh\byo

Ijb[hju b ijbgZ^e_`ghklb

klZpbhgZjgZy mklZgh\dZ k [Zeebklbq_kdbf fZylgbdhf bg_hdkdZ_lkg ieZgdhc ig_\fZlbq_kdhc \bglh\dhc imey ^ey klj_ev[u ba ig_\ we_dljhggu__ku k_dmg^hf_j

Dhgljhevgu_\hijhku

- Knhjfmebjmcl_aZdhg khojZg_gby bfimevkZ f_oZgbq_kdhc kbkl_fu
- Knhjfmebjmcl_aZdhg khojZg_gby f_oZgbq_kdhc wg_j]bb
- DZdh\u mkeh\by ^ey \uiheg_gby wlbo aZdhgh\" DZdkehl\bki_q_ ^Zgghc eZ[hjZlhjghc mklZgh\d_"
- <u_^bl_ jZkqzlgmx nhjfmemm^eby kdhjhklb
- < [hevrmx beb f_gvrmx klhjhgm bkdZabeky [u j_amevlZl \uqb [u hgZ g_ aZkljyeZ\ ieZklbebg_ hlkdhqbeZ"
- H^gZ ba ^\mo h^bgZdh\uo imev hldehgy_l [Zeebklbq_kdbc [hevrbc q_f ^jm]Zy KjZ\glbblo_ikmdhyjhklb w
- Hibrbl_ oh^ jZ[hlu

- < qzf hkh[_gghklv l_ogbdb [_ahiZkghklb \ ^Zgghc jZ[hl_"
- DZd b ^ey q_]h ijh\h^blky gZkljhcdZ wdki_jbf_glZevghc mklZ
- ?keb hklZ\eylv imex ihke_ \uklj_eZ \gmljb pbebg^jZ lh fh ijh_^_ygbihke_^mxsbo hiulh\ h^bgZdh\ufb" DZdZy nbabq_kd baf_j_gb_ baf_gblky ijb ijh_^_gbb ihke_^mxs_]h hiulZ"
- ?klv eb gZ^z`ghklv ijyfuo baf_j_gbc _keb hgb ijh_^_gu ih fZkku pbebg^jZ fZylgbdZ"
- ?keb ijhba\h^blv ihuklj_eam b imex ihke_ \uklj_eZ hklZ\eylv [Zeebklbq_kdh]h fZylgbdZ lh Z fh`gh eb gZoh^blv kj_^gb_ [ fh`gh eb b dZd gZclb kj_^g__ agZq_gb_ dhk_ggh]h baf_j
- Knhjfmebjmcl_ ijZ\beaZ\bZyweZdljhggufb _kZfb DZdh\u bo baf_j_gbc p_gZ ^_e_gby rdZeu ih]j_rghklv ijb[hjZ"
- Knhjfmebjmcl_ ijZ\beaZ\bZyhjZlhjguf k_dmg^hf_jhf DZdh\u baf_j_gbc gZ rdZeZo p_gZ ^_e_gby dZ`^hc rdZeu ih]j_rghkl
- DZdh\u ije_u^baf_j_gbc p_gZ ^_e_gby rdZeu ih]j_rghklv
- < dZdhf jZajy^_ ^he`gZ [ulv ihke_^gyy ba agZqZsbo pbnj ijb dZ`^uf ba wlbo ijb[hjh\"
- AZibrbl_ nhjfmeu ^ey \uqbke_gby kbkl_fZlbq_kdbo ih]j_rghkl
- DZd \uqbkkeblvqZcgmx ih]j_rghklv dhk_ggh]h baf_j_gby kdhjh
- DZd ^ey dhk_ggh]h baf_j_gby \uqbkeblv Z hlghkbl_e ih]j_rghklv [kbkl_fZlbq_kdmx ih]j_rghklv"
- DZd ^ey dhk_ggh]h baf_j_gby \ ^Zgghc jZ[hl_ihuqbkeblv[Z hlghkbl_evgmx ih]j_rghklv"
- Knhjfmebjmcl_ ijZ\beZ hdjm]e_gby ih]j_rghkl_c
- DZdmx ih]j_rghklv dhk_ggh]h baf_j_gby gZ^h agZlv qlh[agZq_gb_" DZd hij_^_eblv jZajy^u _jguo b khfgbl_evghc dhk_ggh]h_bgbf_j
- DZd aZibkZlv ^h_jbl_evguc bgl_j\Ze agZq_gbc dhk_ggh]h ba
- DZdh\Z gZ^_`ghklv gZc^_ggh]h ^h_jbl_evgh]h bgl_j\ZeZ" F mdZaZgghc \Zfb _jhylghklvx ijb gh\hf \uklj_e_ kdhjhklv im ^h_jbl_evgud\Zbeg"l_j

EZ[hjZlhjgZy jZ[hlZ <

P_eb jZ[hlu

1. Ijh_jblv\uihegbfhkZdhgZ =mdZ ^ey mijm]hc ^_nhjfZpbb jZkly`_
2. Baf_jlvfh^mvXg]Z fZl_jbZeZ aZ^Zggh]h h[jZapZ
3. Bamqblv ijZ\beZ ihevah\Zgbqy khg^hjdZlhijZhf
4. AZdj_iblvoghexh]h[jZ[hldb j_amevlZlh\ baf_j_gbc \uZhegogg gZqZevguo mkeh\byo
5. Ijbh[jklb gZ\ud]jZnbq_kdh]h ij_^klZ\e_gby wdki_jbf_glZe bkihevah\Zgby]jZnbdZ ijb h[jZ[hld_ j_amevlZlh\

Ijb[hju b ijbgZ^e:`ghklb

ijh\hehdZ]bjb bgZkhdZlhj lbdZjhf_ejbkl fbeebf_ljh\hc [mfZ]b ijh ebg_cdZ

Dhgljhevgu_\hijhku

- Qlh gZaxu\ZZ[khexlghc ^_nhjfZpbb_khc ^_nhjfZpb_c"
- Knhjfmebjmaldhg.=mdZ
- Qlh lZdh_ ghjfZevgh_ DZhdZ`_jb_"^bgbpZ baf_j_gby"
- Qlh gZau\Zxl fh^me_f Xg]Z" < dZdbo _^bgbpZo baf_jyxl"
- Qlh gZaxu\Z_^_ehf mijm]hklb"
- Hibrbl_ y\e_gb_ mijm]h]h]bkl_j_abkZ
- <u_^bl_ jZkqzlgmx nhjfmem ^ey \uqbke_gby fh^mey Xg]Z

- Hibrbl_ oh^ jZ[hlu
- < qzf hkh[_gghklv[_lahigZkdghhklb \ ^Zgghc jZ[hl_"
- DZd ih^]hlh\blv eZ[hjZlhjgmx mklZgh\dm d baf_j_gbyf
- K dZdbf ©rZ]hfª ke_^m_l f_gylv agZq_gb_ fZkku g_h[oh^bfhc \ ^Zgghc jZ[hl_"
- Qlh ke_^m_l k^_eZlv k]bjyfb ih hdhgqZgbb hiulh\"
- Knhjfmebjmcl_ ijZ\beZ hdjmlhk_lcy ih]j_ DZdmx ih]j_rghklv fhmey Xg]Z baf_j_gbyfbª"
- Knhjfmebjmcl_ ijZ\beZ ihbdvlaf\Zjhf qZkh\h]b DZdmx ij_^_eu baf_j_gbyfbª"
- <u_^bl_ jZkq_hljgmxem ^ey fh^mey Xg]Z
- DZdb_ _ebqbgu \ jZkqzlghc nhjfme_ ^ey fh^mey Xg]Z baf_j_gbyfbª"
- < dZdhf jZajy^_ gZoh^blky ihke_^gyy agZqZsZy pbnjZ dZ`^h]
- DZdb_ ba ijyfuo baf_j_gbc f_gyxlky hl hiulZ d himlme'h\bhy`g hiulh\ h^bgZdh\ufb"
- DZdb_ ih]j_rghklb ijyfuo baf_j_gbc g_l kfukeZ \uqbkeylv hiulh\"
- DZd \uqbkeblv kbkl_fZlbq_kdb_ ih]j_rghklb dZ`^h]h ba ijyfu nhjfmeu
- DZdh\ nbabq_kdbc kfuke fhmey Xg]Z \ebhydlmbgZb_]h kj_^gagZqy"gb_ wlh]h dhk_ baf_j_gby hl hiulZ d hiulm" Fh`gh eb b dZd gZclb kj_^g__ ag
- DZd hij_^_eblv kemqZcgmx kbkl_fZlbq_kdmx Z[khexlgmx b fh^mey Xg]Z" AZibrbl_ nhjfmeu
- Knhjfmebjmcl_ ijZ\beZ hdjmlhk_lcy ih]j_
- DZdmx ih]j_rghklv fhmey Xg]Z \ebhydlmbgZb_]h kj_^gagZqy"gb DZd hij_^_eblv jZajy^u _jguo b khfgbl_evghc pbm^mekyj_X^g]Zf"agZq
- AZibrbl_ ^h_jbl_evguc bgl_j\Ze agZq_gbc fh^mey Xg]Z" KjZ fh^meyg]XZ k wlbf bgl_j\Zehf
- DZdb_ _ebqbgu \ nhjfme_ ^ey fh^mey Xg]Z ihemq_ggh]h k ih ^h_jbl_evghfm bgl_j\Zem \uqbke_gghfm ZgZeblbq_kdb"
- Hibrbl_ kmlv f_lh^Z ©gZlygmlhc gblbª ^ey ihkljh_gby]jZnbdZ
- DZd m[_^blvkyqlh agZq_gb_ fh^mey Xg]Z ihemq_ggh]h k ih ^h_jbl_evghfm bgl_j\Zem \uqbke_gghfm ZgZeblbq_kdb"
- DZd k ihfhsvx]jZnbdZ \uqbkeblv agZq_gb_ fh^mey Xg]Z"
- DZd m[_^blvky qlh agZq_gb_ fh^mey Xg]Z ihemq_ggh]h k ih ^h_jbl_evghfm bgl_j\Zem \uqbke_gghfm ZgZeblbq_kdb"

EZ[hjZlhjgZ[hlZ ‹

P_eb jZ[hlu

1. Wdki_jbf_glZevgh hij_^_eblv fhf_gl kbeu b m].eh\h_ mkdhj_gb
2. Ijh_jblv hkgh\ghc aZdhg \jZsZl_evgh]h ^\b`_gby
3. Ijbh[jklbgZ\ud baf_j_gby \j_f_g-k_kdmzq^hdhf
4. AZdj_iblv gZ\udb h[jZ[hldb j_amevlZlh\ dhk\emgjZ]h_^bgfb_j_g hiulh\jbjZaebqguo gZqZevguo mkeh\byo

Ijb[hju b ijbgZ^e_`ghklb

dj_klhh[jZaguc fZylgbd gZ[hjlkbmdamhg\^hfr[g]_gpbjdmev fZkrlZ
kZglbf_ljhe\Zgy_cdZ

Dhgljhevgu__\hijhku

- Knhjfmebjh\Zlv hkgh\ghc aZdhg ^bgZfbdb \jZsZl_evgh]h ^\b`_
- Qlh lZdh_ fhf_gl kbeu hlgZhkbhlgdwhkh[\jZs_g<byd'Zdbo _^bgbp baf_jy_lky" Dm^Z gZijZ\e_g fhbfl_gelvgkbeluhdlgfhk
- Qlh lZdh_ m]eh\h? Dmkd'Zjhgh_gZij<Z\deZ_gbhd' _^bgbpZo baf_jy_lk
- Qlh lZdh_ fhf_gl bZg_jpbb [' Qlhe Zhg oZjZdl<_jbZdb_d" _^bgbp baf_jy_lky"
- lhq_fm fh`gh kqblebZlvg_cqdh]h mkdhj_gb_]jmpabZZejZ\gghfmZm]kdhj_ lhq_rdb\ZZylgbdZ H[_j[_dZ"
- <u_klb nhjfmeu ^ey $M = em(g - a)r$.
- Knhjfmebjmcl_ l_hj_fmDZd_hgZjZjbf_gy_lky \ ?Zgghc jZ[hl_
- <u_klb nhjfmeu ^ey $a_1$mkbd$_2$jQ_gbcwlh mk'dhQlhgby_h[oh^bfh kh[ex qlh[u \ wlhc hZ]hl_ueb jZ\gu ^jm] ^jm]m"
- <u_^bl_ jZkqzlgmx nhjfmehg^ejybfhffZgdZ H[.j[_dZ
- DZdb_ _ebqbgu \ jZkqzlghc nhjfme_ y\eyxlky ijyfufb baf_j_g
- Knhjfmebjmcl_ ijZ\beZ ikhe_vlqh\dZdfhgy^hf DZdh\u ij_^_eu baf_j_]h rdZe p_gu ^_e_gby rdZe ih]j_rghklv ijb[hjZ"
- Knhjfmebjmcl_ ijZ\beZ imeyahg\Zgjbdme DZdh\u ij_^_eu baf_j_g rdZe p_gu ^_e_gby rdZe ih]j_rghklv ijb[hjZ"
- < dZdhf jZajy^_ gZoh^blky ihke_jZgdyZ`ahgZhqZjsyZhjbbmaf_j_gby"
- DZhd_ ba ijyfuo baff_jgy_blky hl hiulZ d hiulm"
- Fh`gh eb mkj_^gylv ex[h_ ba ijyfuo baf_j_gbc _keb mkeh\ ih]j_rghk^ey ijyfuo baf_k_eghcm_l \uqbkeylv \ lZdbo mkeh\b ih]j_rghk=dbo_\hafh`gh"
- DZdb_ _ebqbgu \ ^Zgghc jZ[hl_ y\eyxlky dhk_ggufb baf_ f_gyxlky hl hiulZ d hiulm"
- DZd h[_ki_qblv g_baf_gghklv fhf_glZ bg_jpbb fZylgbdZ H[_j[_
- AZibrbl_ nhjfmeu ^ey \uqbke_gby ih]j_rghkfZylgbdZ H[_j[_jp kemqZcghc kbkl_fZlbq_kdhc Z[khexlghc hlghkbl_evghc
- Knhjfmebjmcl_ ijZ\beZ hdjm]e_gby ih]j_rghkl_c
- DZdagZy Z[khexlgmx ih]j_rghklv fhdjmdZvbdhjbgZq?gb
- AZibrbl_ ^h_jbl_evguc bgl_fhZegdZgZqjpbbcfZylgbdZ? H[_j[_dZ
- DZd baf_gblky fhf_gl bg_jpbb wlh]h fZylgbdZ _keb pbebg jZkklhygbb hlghkbl_evgh rdb\Z"
- Qlh kem`bl ih^l\_j`^_gb_f kijZj\h\^ejyhfhklbaZdhgZ \jZsZl_ev ^\b`_gby"
- lhkljhcl_]jZnbd aZ\bkbfhjklbmkmdhejh\gby hl \jZsZxs_]h fhf_gl ©gZlygmlhc gblbª ^hihegbl_evgh fh`gh ijbf_gblv dhfivxl_jgu_
- DZd ih]jZnbdm hij_^_eblv fhfZfy_lglbdZ_H[_j[_dZ
- DZd m[_^blvky qlhfhafgZdZ_gbg_jpbhemq_ggh]h k ihfhsvx]j klhl_lkl\m_l ^h_jbl_evghfm bgl_j\Zem \uqbke_gghfm ZgZebl
- DZd baf_gy, M, k, a, t, I _keb gblv gZfhlZlv gZ rdb\ f_gvr_]h jZ^bm

EZ[hjZlhjjgZ[hlZ ‹

P_eb jZ[hlu

1. Bambqvdjmlbevgbe_[Zkgbnbeyjgh]h ih^_kZ
2. Baf_j_gb_ fhf_glZ bg_jpbb l_eZ ihf_s_ggh]h gZ ieZlnhjfm ljb
3. Wdki_jbf_glZeyg_jblv kijZ_^le_h\jh_kluvRl_cg_jZ

4. AZdj_ibgZ\uidbf_g_gjZnbq_kdhh^Z
5. AZdj_iblv gZ\udb h[jZ[hldb j_amevlZlh\ dhk_ggh]h baf_j_gbc h^bgZdh\uo mkeh\byo

ljb[hju b ijbgZ^e_ `ghklb

ljbnbeyjguc ih^_k]jmkqbd_ l\zj^h_ l_eh kbff_ljbZqgZhedbhqj_kdb_ f_lZeebq_kdZy ebg_cdZ rlZg]_gpbjdmev k_dmg^hf_j ^ebggZy

Dhgljhevgu_ \hijhku

- Qlh lZdh_ ljbnbeyjguc ih^_k b dZdb_ ^\b`_gby hg kh_jrZ_l"
- DZdb_ ^bgZfbq_kdb_ mjZ\g_gby hljjb_nbeyjgh]h ih^_kZ
- Qlh gZauhZxuf fhf_ghfkbeunhjfmeZ jbkmghd
- Qlh lZdh_ fhf_gl bg_jpbb l_eZ" Qlh hg oZjZdl_jbam_l"
- DZdj_h[jZa_lkvg_jvbh \j_fdvjmlbevghe_[Zgbc ljbnbeyjgh]h ih^_kZ"
- DZdbij_^_ebhf_gl bg_jpbb h^ghjh^guo l_e]_hf_ljbq_kdb ijZ\be
- Knhjfmebjmcl_ ijZ\beZ hdjm]e_gby fhf_glZ bg_jpbb dheb_kdh?
- <u_^bl_ jZkq_lgmx nhjfmem ^ey \uqbke_gby fhf_glZ bg_jpbb
- DZdb_ _ebqbgu ke_^m_l g_ihkj_^kl_ggh baf_jblv qlh[u g f_lh^hf djmlbevguo dhe_[Zgbc ljbnbeyjgh]h ih^_kZ"
- Hibrbl_ oh^ jZ[hlu
- Knhjfmebjmcl_ ijZ\beZ ihee_adhljZgbyfb _kZZfbhbuo ij_^_eu baf_j_gbcZ^pegby ihhjklv ijb[hjZ"
- Knhjfmebjmcl_ ijZ\beZ ihe_ajhljZgbyf k_dmg^hf_jh\u ij_^_eu baf_j_g rdZe p_gu ^_e_gby rdZe ih]j_rghklv ijb[hjZ"
- Knhjfmebjmcl_ ijZ\beZ ihe_ajhljZgbyf k_dmg^hf_jh\u ij_^_e baf_j_gbc _]h rdZe p_gu ^_e_gby rdZe ih]j_rghklv ijb[hjZ"
- DZdh\u ij_^_eu baf_j_gbcZ^_e_gby z ijb[hjgZy ih]j_rghklv
- < dZdhf jZajy^_ gZoh^blky ihke_^gyy agZqZsZy pbnjZ dZ`^h]
- DZdbf h[jZ^ehf imklhc ieZlnhjfu ljbnbeyjgh]h ih^_kZ b ^ey i h[_ki_qblv \ ^Zgghc jZ[hl_ h^bgZdh\u_ mkeh\byo ijh_^_gby hi
- Kdhevdh hiulh\ g_h[oh^bfh ijh_klb ^ey h[_ki_q_gby fbgbfZe baf_j_gbc%)?
- GZ^h eb \uqbkeylv kj_^gb_ agZq_gby ijyfuo baf_j_gbc _keb h^bgZdh"\u
- GZ^h eb \uqbkeylv agZq_gby dhk_gguo baf_j_gbc \ dZ`^ ijh_^_gby hiulh\ h^bgZdh\uo mkeblv kj_^g__ agZq_gb_ dhk_g lZdbo mkeh\byo"
- GZibrbl_ nhjfme\uk^ey j_rghkl_c ijyfuo baf_j_gbc
- DZdb_ ih]j_rghkhb_ke\uqbkeblv ^ey dhk_gguo lZafbj_gbbcb imk ieZlnhjfu fbf_glZ bg_jpbbcb nhjfu k ?_eZfibrbl_ jfmmeu^ey lZdbo ih]j_rghkl_c
- Knhjfmebjmcl_ ijZ\beZ hdjm]e_gby ih]j_rghkl_c
- Ih dZdhfm djbl_jbx ke_^m_l hdjm]eylv kjb^dhk_aggZq_baf_jjyfb

EZ[hjZlhjgZy jZ[hlZ <

P_ev jZ[hlu

1. <uqbkeblv i_jbh^ dhe_[Zgbc fZl_fZlbq_kdh]h fZylgbdZ
2. M[_^blvky \ ]ZjfhgbZqjZkdhjf_ aZdhgZ dhe_[Zgbc fZl_fZlbq_kdh]
3. AZdj_iblv gZ\udb h[jZ[hldb j_amevlZlh\ dhk_ggh]h baf_j_gbc h^bgZdh\uo mkeh\byo

ljb[hju b ijbgZ^e_ `ghklb

k_dmg^hf_j f_ljh\Zy ebg_cdZgZqbgdbjZkly`bfuo gbl^eobgguo

Dhgljhevgu_ \hijhku

- Fh`gh eb kqblZlv b ihq_fm dhe_[Zgby fZl_fZlbq_kdh]h fZy ^Zgghc jZ[hl_"
- <_^ba_Zdh]ZgjfhgbqkdheoZ[ZgZblc_fZlbq_kdh]h fZylgbdZ"
- GZibrbl_ nhjfmem ^ey i_jbh^Z fZl_fZlbq_kdh]h fZylgbdZ
- ?keb\Zf fZl_fZlbq_kdbo fZylgbdZ k h^bgZdh\hchdeehgbc\ubgZ kfZ \lhjgZ kfhdmZdh]h fZylgbdZ i_jbh^ [m^_l [hevr_"
- KjZ\gbl_ i_jbh^u dhe_[Zgbc ^\hmobgZyhgbdh^gebdghc fjZbagufb fZkkZjjmah\ ] b _jrZxkbo dhe_[Zgby ih^ fZeuf m]ehf
- DZd baf_gblky i_jbh^ dhe_[Zgbc fZl_fZlbq_kdh]h fZylgbdZ]hjm g_ baf_gyy ijb wlhf _]h ^ebgZuEm[gm"j_e_l
- <u_^bl_ jZkq_lgmx^enhjfmjebm^Z]Zjfhgbq_kdbo dhe_[Zgbc f fZylgbdZjb dZdbo mkeh\byo hgZ \uihegy_lky"
- DZdb_ _ebqbgu \ jZkq_lghc nhjfme_ y\eyxlky ijyfufb baf_j_g
- Hibrbl_ oh^ jZ[hlu
- Knhjfmebjmcl_ ijZ\beZ ihe[ZhZgbyf k_dmg^DZjh\u ij_^_e baf_j_gbc _]h rdZe p_gu ^_erghkyvridZe[hjZm"]j_
- DZdh\u ij_^_eu baf_jh\ghbcc ebgp_cgb^_e_gdby_z ijb[hjgZy ih]j_rghk
- < dZdhf jZajy^_ ^he`gZ [ulv ihke_^gyy ba agZqZsbo pbnj ijb dZ`^uf ba wlbo ijb[hjh\"
- DZdbf h[jZahf ^ey dhe_[Zgbc fZl_fbZdZqh[k_dhi]hqbfZyl\ ^Zgghc h^bgZdh\u_ mkeh\by ijh_^_gby hiulh\"
- Kdhevdh hiulh\ g_h[oh^bfh ijh_klb ^ey gZ^z`ghk,bb%i?yfuo baf
- GZ^h eb \uqbkeylv i_jbh^ fZl_fZlbq_kdh]h fZylgbdZ \ dZ`^ hiulh\ h^bgZdh\u_"
- GZibrblnhjfmeu ^ey \k_o ih]j_rghkl_c ijyfuo baf_j_gbc
- GZibrbl_ nhjfmeu ^ey ih]jd_hkghkgbc baf_jygb i_jbh^dZhlhju_ g_h[oh^bfu \ ^Zgghjb jZ[h\l^_gbb hiulh\ \ h^bgZdh\uo mkeh\by
- Knhjfmebjmcl_ ijZ\beZ hdjm]e_gby ih]j_rghkl_c
- DZd aZ[kyhexulgih]j_rghbkhdjm]eblv bkj_^gZqy_gjby fuo b dhk_ggh baf_j_gbc
- AZibrbl_ ihemq_gguc ^h_jbl_evguc bgl_j\Ze agZq_gbc fZl_fZlbq_kdh]h fZylgbdZ

EZ[hjZlhjgZy jZ[hlZ <

P_ev hZu

1. Hij_^bevdhwnnbppb_gl mijm]hklb ijm`bgu klZlbq_kdbf f_lh^hf
2. Hij_^bevdhwnnbppb_gl mijm]hklb ijm`bgu ^bgZfbq_kdbf f_lh^hf
3. AZdj_iblv gZ\udb h[jZ[hldb j_amevlZlh\ dhk_ggh]h baf_j_g hiulh\ ijb jZaebqguo gZqZevguo mkeh\byo

Ijb[hju b ijbgZ^e_`ghklb

klZevgjZmy`bgZ gZ djhgrl_cg_ gZ[hj]jmah\ k_dmg^hf_j ebg_cdZ

Dhgljhevgu__\hijhku

Для статического метода

- DZdb_ kbeu ^_ckl\mxl gZ g_ih^\b`guc]jma ih^_r_gguc d _j
- < q_f kmlv klZlbq_kdh]h f_blyh^dZwnnbppb_glZ mijm]hklb"
- Knhjfmebjmcl_ aZdhg =mdZ ^ey ^_nhjfZpbb k`Zlby beb jZkly`
- DZdh\ nbabq_kdbc kfuke dhwnnbppb_glZ mijm]hklb< dhZwnnbpp _^bgbpZo hg baf_jy_lky"
- <u_^bl_qjZgkmx nhjfmewnnbppb_glZ m^ijwlhkbkemqZy
- DZdb_ _ebqbgu \ wlhc nhjfme_ y\eyxlky ijyfufb baf_j_gbyfb"
- Hibrbl_ oh^ jZ[hlu

- DZdh\u ij_^_eu baf_j_gbc ebg_cdb p_gZ ^_e_gby b _z ijb[hj
- < dZdhf jZajy^_ ^he`gZ [ulv ihke_^gyy ba agZqZsbo pbnj ijb
- DZdh_ ijyfh_ baf_j_gb_ f_gy_lky hl hiulZ d hiulm"
- Fh`gh eb \uqbkeylv kj_^gb_ agZq_gby ijyfuo baf_j_gbc _ke jZaguo gZqZevguo mkeh\byo"
- <uqbkebl_ kbkl_fZlbq_kdb_ ih]j_rghklb ijyfuo baf_j_gbc
- DZduqbkevbkj_^g__ agZq_gb_ dhwjmnbpb_glZ ih]j_rghklb ijyfuo baf_j_gbc ijh\h^ylky ijb jZaguo gZqZevguo mkeh\byo"
- DZd baf_gblky dhwnnbpb_gl mijm]hklb ijm`bgu _keb Z ijm ijm`bgm ba klZeb \aylv [hevr_c ^ebgu \ ijm`bgm ba klZeb \a

Для динамического метода

- < q_f kmlv ^qbkgZhf f_lh^Z hij_^_e_gby dhwnnbpb_glZ mijm]hk
- DZdb_ dhe_[Zgby gZau\Zxl]Zjfhgbq_kdbfb"
- ljb dZdbo mkeh\byo]jma gZ ijm`bg_ [m^_l kh_jrZlv]Zjfhgbq
- lh dZdhc ljZ_dlhjbb ^\b`_lky ]jma ih^\_r_gguc gZ ijm`bg_"
- DZdb_ kbeu gZ g_]h ^_ckl\mxl"
- GZibrbl_ \lhjhc aZdhg GvxlhgZ ^ey]jmaZ gZ ijm`bg_ b ^bnn_j_gpbZevgh_ mjZ\g_gb_
- DZdhc \b^ bf__l j_r_gb_ aZdhg dhe_[Zgbc mvjZ\lh_gby h_j_gpb
- Qlh gZaxu\ZZ Zfieblm^hc [nZahc \ pbdebq_kdhc_jZk^hfhc dhe_[Zgbc dZdbo _^bgbpZo baf_jyxl \k_ wlb _ebqbgu"
- Hl dZdbo iZjZf_ljh\ aZ\bkbl i_jbh^]Zjfhgbq_kdbo dhe_[Zgbc
- <u_^bl_qjZgkmxjhmedhwnnbpb_glZ m^ijm]wkhlbh kemqZy
- DZdb_ _ebqbgu \ wlhc nhjfme_ y\eyxlky ijyfufb baf_j_gbyfb"
- Hibrbl_ oh^ jZ[hlu
- Knhjfmebjmcl_ ijZ\beZ ihevah\Zgby eZ[hjZlhjguf k_dmg^hf baf_j_gbc _]h rdZe p_gu ^_e_gby bdjZeZ"ih]j_rghklv ij
- < dZdhf jZajy^_ ^he`gZy gZoh^blvky ihke_^gyy agZqZsZy pbn
- DZdh_ ijyfh_ baf_j_gb_ f_gy_lky\ h^lbgZufbZq_dkdhuflm_lh^_
- <uqbkebl_ kbkl_fZlbq_kdb_ ih]j_rghklb ijyfuo baf_j_gbc
- <uqbkebl_ kj_^g__ agZq_gbijmdhwknlbbpb_lglZhjm_rghklb
- KjZ\gbl_ ^h_jbl_evgu_ bgl_j\Zeu agZq_gbc dhwnnbpb_glZ mi
- DZdhc ba f_lh^h\ y\ey_lky [he__ lhqguf"

EZ[hjZlhjgZy jZ[hlZ ‹

P_eb jZ[hlu

1. M[_^blvky \ aZlmoZxs_f oZjZdl_j_ k\h[h^guo dhe_[Zgbc ijm`b
2. Hij_^_eblv dhwnnbpb_gl aZlmoZgby eh]Zjbnfbq_kdbc ^_dj_f khijhlb\e_gby kj_^u ^h[jhlghklv b \j_fy j_eZdkZpbb ijm`bggh
3. AZdj_ihZ\ubduqbke_gby ih]j_rghkl_c ijyfuo b dhk_gguo baf_j_

ljb[hju b ijbgZ^e_`ghklb

ijm`bgguc fZylgbd hlkqzlgh_ mkljhckl\h ebg_cdZ khkm^ k \h^

Dhgljhevgu_\hijhku

- >Zcl_ hij_^_e_gb_ k\h[h^guo dhe_[Zgbc
- DZdb_ dhe_[Zgby gZau\Zxlky kh[kl_gguf
- DZdb_ dhe_[Zgby gZau\Zxlky]Zjfhgbq_kdbfb"
- DZdb_ mkeh\by ^he`gu \uihegylvky qlh[u \ kbkl_f_ \hagbdeb
- DZdb_ kbeu ^_ckl\mxl gZ ijm`bgguc fZylgbd kh_jrZxsbc]Zjf
- GZibrbl_ aZdhg GvxlhgZ ij_^hbjZajm_glp_bZehvgdhfm mjZ\g_gbx _]h j_r_gb_ kaZ[dh^guZqjfhgbq_kdbo dhe_[Zgbc
- < dZdhf kemqZ_ \ aZdhg_ dhmeg_pZbgkb© ZbkmdZidh"f ©

- lhq_fm j_Zevgu_ k\h[h^gu_ dhe_[Zgby \k_]^Z aZlmoZxsb_"
- DZdZy kbeZ ijb\h^bl dhe_[Zgby \k_]^Z aZlmoZxsb_"
- Qlh gZau\Zxl dhwnnbpb_glhf aZlmoZgby \j_f_g_f j_eZdkZpbb ^ ^h[h^gu dhe_[Zgbc"
- Qlh ijhbkoh^bl k aZlmoZxsbo dhe_[Zgbc"
- GZibrbl_ aZdhg Gvxlhg^ey kemqZy aZlmoZgby dhe_[Zgbc"
- Qlh ijhbkoh^bl k Zfieblm^hc aZlmoZxsbo dhe_[Zgbc"
- KjZ\gbl_ ^ey]Zjfhgbq_kdbo b aZlmoZxsbo dhe_[Zgbc Z qZl
- Qlh gZau\Zxl dhwnnbpb_glhf aZlmoZgby \j_f_g_f j_eZdkZpbb ^ ^h[h^gu dhe_[Zgbc
- DZdh\u _^bgbpu baf_j_gbc wlbo _ebqbg"
- Hibrbl_ oh^ jZ[hlu
- < jZkq_lguo nhjfmeZo ^ey dhk_gguo baf_j_gbc hij_^_ebl_ ijyfufb baf_j_gby fbZdhf jZajy^_ ^he`gu [ulv bo ihke_^gb_ agZ
- GZibrbl_ nhjfmeu ^ey \uqbke_gby ih]j_rghkl_c ijyfuo b dl g_h[oh^bfu_ \ ^Zgghc jZ[hl_
- lh dZdhfm djbl_jbx ke_^m_l gZclb khfgbl_evgmxy pdmkjm_gkgjh^ baf_j_gby"

EZ[hjZlhjgZy jZ[hlZ ‹

P_ejZ[hlu

1. Bamqblv aZdhgu dhe_[Zgbc nbabq_kdh]h fZylgbdZ
2. Hij_^_eblv i_jbh^ dhe_[Zgbc nbabq_kdh]h fZylgbdZ
3. AZdj_iblv gZ\udb h[jZ[hldhjk_gevmZlb\af_j_gby ijb ijh_^_gb h^bgZdh\uo mkeh\byo

Ijb[hju b ijbgZ^e_`ghklb

k_dmg^hf_j f_ljh\Zy ebg_cdZ kl_j`_gv k ^bkdZfb rZjbd gZ gbl

Dhgljhevgu_\hijhku

- >Zcl_ hij_^_e_gb_ nbabq_kdh]h fZylgbdZ
- lh dZdhc ljZ_dlhjbb ^\b`_kkynbabq_kdh]h fZylgbdZ
- Qlh gZau\Zxl p_gljhf dZqZgbc nbabq_kdh]h fZylgbdZ"
- DZd gZijZ\e_g _dlhj m]eh\h]h i_j_f_s_gby _keb fZylgbd jZ\gh_kby"
- DZd gZijZ\e_g ijb wlhf _dlhj fhf_glZ kbeu ly`_klb"
- AZibrbl_ hkgh\ghc aZdhgjZ^sZgZevgdh]h ^\b`_gby b ijb_^bnn_j_gpbZevghfm mjZ\gdhgb[Zgbc nbabq_kdh]h fZylgbdZ]Zjfhgbq_kdbfb
- AZibrbl_ j_r>gb aZdhg dhe_[Zgbc \bedZabdh^ysb wl\l aZdhg dhe_[Zgbc
- Ijb_^bl_ ijbf_ju dhe_[Zgbc \bil_ogdy_dhlhjuo fh`gh ijbf_gblv nbabq_kdh]h fZylgbdZ
- HldZdbo iZjZfb_ldZd aZ\bkbl i_jbh^ dhe_[Zgbc nbabq_kdh]h fZ
- Qlh gZau\Zxl ijb_^zgghc ^ebghc nbabq_kdh]h fZylgbdZ"
- Q_f ihoh`b nbabq_kdbc b fZl_fZlbq_kdbc fZylgbdb"
- Q_fjZ_g fhf_gl bg_jpbb nbabq_kdh]h fZylgbdZ \ \b^_ Z kl_ aZdj_iezg [^bkdZ ijbdj_iezggh]h \ g_dhlhjhc lhqd_ kl_j`gy
- DZdb_ _ebqbgu \ jZkq_lghc nhjfme_ ^ey i_jbh^Z dhe_[Z baf_j_gbyfb"
- Hibrbl_ oh^ jZ[hlu

- DZdh[_ki_qblv ^ey dZ`^h]h ba wlbo nbabq_kdbo fZylgbdh ijh_^_gby hiulh\
- < dZdhf jZajy^_ gZoh^blky ihke_^gyy agZqZsZy pbnjZ ijyfh]h
- GZibrbl_ nhjfmeu ^ey ih]j_rghkl_c ijyfuo baf_j_gbc
- DZd hdjm]eblv Z ih]j_rghklb j_^af_j_gbZq[gb_ ijyfuo baf_j_gb
- GZ^h eb \uqbkeylv agZq_gby dhk_gguo baf_j_gbc \ dZ`^ ijh_^_gby hiulh\ h^bgZdh\u_" DZd \uqbkeblv kj_^g__ agZq_g
- DZdb_ ih]j_rghklb g_h[oh^bfh \uqbkeblv ^ey dhk_gguo]hjbaf^_ hiulh\ \ h^bgZdh\uo mkeh\byo"
- DZd hij_^_eblv jZajy^ khfgbl_evghc pbnju ijb hdjm]e_gbb kj_ baf_j_gby"
- KjZ\gbl_ ^h_jbl_evgu_ bgl_j\Zeu agZq_gbc i_jbh^h\ h[hbo fZ

EZ[hjZlhjgZy jZ[hlZ ‹

P_eb jZ[hlu

1. Wdki_jbf_glZevgh hij_^_eblv fhf_gl bg_jpbb l_j^h]h l_eZ ijZ nhjfu
2. Bamqblv f_lh^ dhe_[Zgbc ^ey hij_^_e_gby fhf_glZ bg_jpbb l_
3. AZdj_iblv gZ\udb h[jZ[hldbhk\agmhvlZlbafdj_gby ijb ijh_^_gb h^bgZdh\uo mkeh\byo

ljb[hju b ijbgZ^e_`ghklb

fZoh\bd k]jmahf rlZg]_gpbjdmev f_lZeebq_kdZy ebg_cdZ k_d

Dhgljhevgu_ \hijhku

- DZdh_ k\hckl\h l_eZ \ujZ`Z_l?fhf_gl bg_jpbb
- Qlh gZau\Zxl fhf_glhf bgZljpbZevZghc l[kdkb_fu fZl_jbZevguo lh < dZdbo _^bgbpZo hg baf_jy_lky \ KB"
- Knhjfmebjmcl_ l_hj_fm Rl_cg_jZ DZd hgZ bkihevam_lky \ ^Z
- < qzf aZdexqZ_lky nbabq_kdbc ijbgpbi hij_^_efglhy^hfhf_ dhe_[Zgbc"
- Ihykgbkl_ihfhsvqx_jl_Z`kfukle_ebqbg \oh^ysbo \_^evjZ`Zkbhy.gby
- Qlh lZdh_ p_g+j^fZjkZk'iheh`_g p_glj fZkk fZoh\bdZ \ ^Zgghc jZ
- <u_^bl_ jZkq_lgmx nhjfmem ^ey fhf_glZ bg_jpbb fZoh\bdZ
- DZdb_ _ebqbgu \ jZkq_lghc nhjfme_ ^ey fhf_glZ bg_jp baf_j_gbyfb"
- Baf_gblkyhfe_bgl bg_jpbb fZo_k\bdZZoh\bd k^_eZlv ba ^jm]h]h fZ
- DZd baf_gylky _ebqbgu \ jZkq_lghc nhjfme_ _keb pbebg^ \ur_ ij_`_gh iheh`_gby"
- Hibrbl_ oh^ jZ[hlu
- Kdhevdh jZa gZ^h ih\lhjblv hiul \ h^bgZdh\uo mkeh\byo q baf_j_gbc [ueZ "
- Knhjfmebjmcl_ ijZ\beZ ihevah\Zgby eZ[hjZlhjguf k_dmg^hf baf_j_gbc _]h rdZe p_gui^]je_rgbkl_vdZe[hjZ"
- Knhjfmebjmcl_ ijZ\beZ ihevah\Zgby eZ[hjZlhjguf k_dmg^hf rdZe p_gu ^_e_gby rdZe ih]j_rghklv ijb[hjZ"
- DZdh\u ij_^_eu baf_ju_gbc_rdZe^_e_gby rdZe ih]j_rghklv ijb[hjZ"
- < dZdhf jZajy^_ ^he^gZvkygZbke_^gyy agZqZsZy pbnjZoijb baf_j_gbc dZ`^uf ba wlbo ijb[hjh\"
- DZd ^ey ijyfuo baf_j_gbc \uqbkeblv Z kj_^g__ agZq_gb_ [kbkl_fZlbq_kdmx ih]j_rghklv] Z[khexlgmx ih]j_rghklv ih]j_rghklv

- DZd ijb h^bgZdh\uo mkeh\bke_^mkeyluqkbg__ agZq_gb_ dhk\ baf_j_gby"
- DZdb_ ih]j_rghklb dhk_ggh]h baf_j_gby ke_^m_l \uqbkeylv agZq_gb_ g_ ^he`gZ ij_\urZlv hlghkbl_evgZy ih]j_rghklv"
- IhdZdbf ijZ\beZhdgjZ^keylv agZq_gby ih]j_rghkl_c"
- Ih dZdhfm djbl_jbx hij_^_eyxl khfgbl_evgmx pbnjm ijb hdjm] ijyfuo b dhk_gguo baf_j_gbc"
- Hij_^_ebl_ ^h_jbl_evguc bgl_j\Ze agZq_gbc fhf_glZ bg_jpbb

Fhe_dmeyjgZy nbajfhd^bgZfbdZ
EZ[hjZlhjgZy jZ[hlZ ‹

P_eb jZ[hlu

1. <uqbkeblv agZq_gby wnn_dlb\gh]h ^bZf_ljZ b kj_^g_c ^ebgu \ha^moZ
2. Bamqblv f_lh^ \uqbke_gbeybqbg hkgh\Zgguc gZ bkihevah\Zgb kj_^u
3. Ijbh[j_klb gZ\udb jZ[hlu k l_jfhf_ljhf [Zjhf_ljhf b `b^dhklguf f
4. AZdj_iblv gZ\udbwjZ[hdlljhkgguk\Zfb b k_dmg^hf_jhf
5. AZdj_iblv gZ\udb h[jZ[hdlZbdjhgkm]evluqbke_gbZy_\ijhem^_gby hiul ijb h^bgZdh\uo mkeh\byo

Ijb[hju b ijbgZ^e_`ghklb

l_jfhf_lj [Zjhf_lj `b^dhklguc wfeZgdhfhgjgu_ \kdumg^hf_j khkm dZibeeyjhf ^_ kl_deyggu_ dhe[u

Dhgljhevgu_\hijhku

- Qlh lZdh_ wnn_dlb\guf^bZfeu" Hl q_]h aZ\bkbl _]h agZq_gb
- Q_fm jZ\gh kijZ\hqgu_ agZq_gby wnn_dlb\gh]h ^bZf_ljZ fh DZdh\h agZq_gb_ wnn_dlb\gh]h ^bZf_ljZ ih ihjy^dm _ebqbgu
- Qlh lZdh_ kj_^gyy ^ebgZ k\h[h^gh]h ijh[_]Z fhe_dme ZahlZ mkeh\byo
- Hp_gbl_ agZq_gb_ ^ebgu k\h[h^gh]h ijh[_]Z fhe_dme ZahlZ mkeh\byo
- Hibrbl_ mkljhckl\h wdki_jbf_glZevghc mklZgh\db
- Hibrbl_ f_lh^ bkihevam_fuc \ ^Zgghc jZ[hl_ ^ey \uqbke k\h[h^gh]h ijh[_]Z bgwjhm^bZf_ljZ fhe_dme
- <u_^bl_ jZkq_lgu_ nhjfmeu ^ey ^ebgu k\h[h^gh]h ijh[_]Z b fhe_dme
- Ihq_fm \ wlhc jZ[hl_ kljmy \h^u ij_\jZsZ_lky \ dZieb"
- DZdmx jhev b]jZ_l \yadhklv \ha^moZ \ ^Zgghc jZ[hl_"
- Hibrbl_ y\e_gby \yadhklbgZ]aZu\ZxlQdlhwnnbpb_glhf \yadhklb" nbabq_kdbc kfuke" < dZdbo _^bgbpZo hg baf_jy_lky \ KB"
- Qlh ijhbahc^_l k ^ebghc k\h[h^gh]h ijh[_]Z fhe_dme \ha^ m_ebqblky [ih\ukblky l_fi_jZlmjZ \ ihgbablky \eZ`ghklv \
- l_jqbkebl_ _ebqbgu ijyfuo baf_j_gbc \ jZkqzlghc nhjfme_ Z ijh[_]Z [^ey wnn_dlb\gh]h ^bZf_ljZ fhe_dme
- DZdbf h[jZahf \ ^Zgghc jZ[hl_ h[_ki_qblv h^bgZdh\u_ mkeh\b
- Hibrbl_ mkljhckl\h l_jfhf_ljZ DZdh\uf_j]hgbic_^pegZb^_e_gby ih]j_rghklv ijb[hjZ"
- Hibrbl_ mkljhckl\h [Zjhf_ljZ DZdh\u _]h ij_^_eu baf_j_gbc ih]j_rghklv ijb[hjZ"
- Hibrbl_ mkljhckl\h `b^dhklgh]h fZghf_ljZ DZdh\u _]h ij_^ ^_e_gby rdZeu ihjjb[hjZklv

- Knhjfmebjmcl_ ijZ\beZ jZ[hlu k we_dljhggufb _kZfb DZdh\u p_gZ ^_e_gby rdZeu ih]j_rghklv ijb[hjZ"
- Knhjfmebjmcl_ ijZ\beZ jZ[hlu k eZ[hjZlhjguf k_dmg^hf_jhf baf_j_gbc gZ rdZeZo p_gZ ^_e_gby rdZeu ih]j_rghklv ijb[hjZ"
- Hibrbl_ oh^ jZ[hlu
- < qzf hkh[_gghklv l_ogbdb [_ahiZkghklb \ ^Zgghc jZ[hl_"
- DZdh_ dhebq_kl\h hiulh\ gZ^h ijh_klb ^ey h[_ki_q_gby gZ^z ["
- AZibrbl_ nhjfmeu g_h[oh^bfu_ ^ey \uqbke_gby \k_o ih] baf_j_gbc g_h[oh^bfuo \ l_ogheh]bb ijh_^_gby hiulh\ ijb h^bgZdh\uo gZ
- AZibrbl_ nhjfmeu g_h[oh^bfu_ ^ey \uqbke_gby \k_o ih] baf_j_gbc g_h[oh^bfuo \ l_ogheh]bb ijh_^_gby hiulh\ ijb mkeh\byo
- Knhjfmebjmcl_ ijZ\beZ hdjm]e_gby ih]j_rghkl_c
- lh dZdhfm djbl_jbx ke_^m_l hdjm]eblv kj_^g__ agZq_gb_ ijyf
- < dZdhf \b^_ ke_^m_l aZibkZlv ^h_jbl_evguc bgl_j\Ze agZq_

EZ[hjZlhjgZy jZ[hlZ ‹

P_eb jZ[hlu

lhemqblv ij_^klZ\e_gb_ h[Z^bZ[Zlbq_kdhf ijhp_kk_
<uqbkeblv agZq_gb_ Z^bZ[Zlbq_kdhc ihklhygghc \ha^moZ
Knhjfbjh\Zlv ij_^klZ\e_gb_ h l_ieh_fdhklb]ZaZ k lhqdb aj l_iehzfdhklb
Emqblv f_lh^ De_fZgZ b >_ahjfZ

5. AZdj_ibgZ\udb h[jZ[hldb j_amevlZlh\ dhk_ggh]h baf_j_gby ijb jZaebqguo gZqZevguo mkeh\byo

Ijb[hju b ijbgZ^e_`ghklb

`b^dhklguc fZghf_lj jmqghcevgZkhkdeygguc khkjm^[dhkc b \eZ]hih]ehlbl_e_f kh_^bgbl_evgu_ ljm[db k _glbeyfb

Dhgljhevgu_\hijhku

- Knhjfmebjmcl_ i_j\h_ gZqZeh l_jfh^bgZfbdb Qlh oZjZdl_jbar l_iehluª b ©jZ[hlZ l_jfh^bgZfbq_kdhc kbkl_fuª khklhygb_ kl _x ijhp_kk"
- Fh`gkeb]h\hjblv h[baf_g_gbb wlbo _ebqbg" DZdb_ bo h[ha
- Qlh lZdh_ Z^bZ[Zlbq_kdbc ijhp_kk"
- DZdh\u hkh[_gghklb Z^bZ[Zlbq_kdh]h ijhp_kkZ ih kjZ\g_gbx k
- Ijbf_gbl_ i_j\h_ gZqZeh l_jfh^bgZfbdb d Z^bZ[Zlbq_kdhfm ijh

- GZc^bl_ agZq_gby fheyjguo bah[Zjghc b bahohjghc l_ieh_
  khklhys_alhZb h^ghZlhfguo fhe_dme [^\moZ-hbfgudmfhZelhdmeo
  fhe_dme"
- AZ\bkbl eb l_ieh_fdhklv hl l_fi_jZlmju kh]eZkgh deZkkbq_k
  kblmZpbb"
- Hibrbl_ f_lh^ De_fZgZ b >_ahjfZ^bbZkjZefmamy S 9
- <u_^bl_ jZkqnzhgfmxem ijbf_g-^yb[jZ9ffm
- DZd l_ogheh]bq_kdb hkms_kl\blv l_ ijhp_kku dhlhju_ ^he`_g
  jZ[hl_"
- Hibrbl_ oh^ jZ[hlu
- lhq_fm g_evay ^h[blvky kh[ex^_gby h^bgZdh\uo mkeh\bc ijh
  jZ[hl_"
- l_j_qbke\ble_bqbgu ijyfuo baf_j_gbc \ jZkqzlghc nhjfme_
- Hibrbl_ mkljhckl\h `b^dhklgh]h fZghf_ljZ DZdh\u _]h ij_^
  ^_e_gby rdZeu ih]j_rghklv ijb[hjZ"
- AZibrbl_ nhjfmeu g_h[oh^bfu_ ^ey \uqbke_gby \k_o ih]j_rgh
  g_h[oh^bfuo\ l_ogheh]bb ijh_^_gby hiulh\ ijb jZaguo gZqZevguo
- AZibrbl_ nhjfmeu g_h[oh^bfu_ ^ey \uqbke_gby \k_o ih]j
  baf_j_gby g_h[oh^bfuo \ l_ogheh]bb ijh_^_gby hiulh\ ij
  mkeh\byo
- Knhjfmebjmcl_ ijZ\beZ hdjmg]hklgby ih]j_
- lh dZdhfm djbl_jbx ke_^m_l hdjm]eblv kj_^g__ agZq_gb_ ijyf
- < dZdhf \b^_ ke_^m_l aZibkZlv ^h_jbl_evguc bgl_j\Ze agZq_

EZ[hjZlhjgZy jZ[hlZ ‹

P eb jZ[hlu

<uykgblv f_oZgbaf l_ieh\h]h h[t_fgh]h jZkrbj_gby \h^u b fZke
Wdki_jbf_glZevgh ihemqblv l_fi_jZlmjgmx aZ\bkbfhklv d
h[t_fgh]h jZkrbj_gby \h^u bbfZkjZnbdkjwlbo aZ\bkbfhkl_c
GZclb qbkeh\u_ agZq_gby wlbo dhwnnbpb_glh\
AZdj_iblv gZ\udb ihkljh_gby b bkihevah\Zgby]jZnbdh\ ijb h[j

ljb[hju b ijbgZ^e_`ghklb

^_ h^bgZdh\u_ mklZgh\db k jZagufb `b^dhklyfbkehh^hgZjl\Zgbe
we_dljhiebldZ [Zjhf_lj ^\Z ebklZ fbeebf_ljh\hc.[mfZ]b ijhajZ

Dhgljhevgu_\hijhku

- Hibrbl_ kljh_gb_ `b^dhklb K q_f bo koh^kl\h b jZaebqb_ i
  djbklZeebq_kdbfb l_eZfb"
- Qlh lZdh_ wg_j]by Zdhmpb`bf^hklb"
- DZdh\ f_oZgbaf l_ieh\h]h jZkrbj_gby `b^dhklb"
- Qlh lZdh_ dhwnnbpb_gl l_ieh\h]h h[t_fgh]h jZkrbj_gby"
- < q_f khklhbl nbabq_kdbc kfuke wlhc _ebqbgu"
- AZ\bkbl eb agZq_gb_ dhwnnbpb_glZ l_ieh\h]h h[t_fgh]h jZ
  ^Z\e_gby"
- H[tykgbl_ ijbqbgm jZaebqby l_ieh\h]h jZkrbj_gby Zkkhp
  `b^dhkl_c DZd jZaebqb_ f_`^m wlbfb lbiZfb `b^dhkl_c \eby_
  l_ieh\h]h h[t_fgh]h jZkrbj_gby"
- ljb_^bl_ ijbf_ju ijhy\e_gby b bkihevah\Zgby `b^dhklh]h jZkmbj
  ijhba\h^kl_
- DZdb_ `b^dhklb b ihq_fm y\eyxlky Z ijhklufb [Zkkhpbbjh\
- <uibrbl_ kijZ\hqgu_ agZq_gby dhwnnbpb_glZ l_ieh\h]h h[tzfg
  \h^u \ jZaguo l_fi_jZlmjguo bgl_j\ZeZo

- F_gy_lky eb b ihq_fm dhwnnbpb_glZ ijhklhc `b^dhklb" jZkrbj_gby ^ey g_ rbjhdh]h bgl_j\ZeZ l_fi_jZlmj \ kemqZ_ Z ijhklhc `b^dhklb"
- Fh`gh eb \uqbkeylv _^bgkl_ggh_ kj_^g__ agZq_gb_ dhwnnbpb_glZ jZkrbj_gby \h^u ^ey \k_jghl\hfbgZlmZeZ \ ^Zgghc jZ[hl_"
- Hibrbl_ oh^ jZ[hlu
- < qzf hkh[_gghklv l_ogbdb [_ahiZkghklb \ ^Zgghc jZ[hl_"
- Ihq_fm \ ^Zgghc jZ[hl_ mkeh\by ijh_^_gby hiulh\ g_evay kqb
- <u_^bl_ jZkq_lgmx nhjfmem ^ey dhwnnbpb_glZ l_gheh\h]h h[tz
- l_j_qbkebl_ _ebqbgu ijyfuo baf_j_gbc \ jZkq_lghc nhjfme_
- Hibrbl_ mkljhckl\h l_jfhf_ljZ DZdh\u _]h ij_^_eu baf_j_gbc ih]j_rghklv ijb[hjZ"
- AZibrbl_ nhjfmeu g_h[oh^bfu_ ^ey \uqbke_gby ih]j_rghkl_ g_h[oh^bfuo \ l_ogheh]bb ijh_^_gby hiulh\ ijb jZaguo gZqZevguo
- AZibrbl_ nhjfmeu g_h[oh^bfu_ ^ey \uqbke_gby \k_o ih]_ baf_j_gby g_h[oh^bfuo \ l_ogheh]bb ijh_^_gby hiulh\ ij mkeh\byo
- Knhjfmebjmcl_ ijZ\beZ hdjmgheh\h]h
- Ih dZdhfm djbl_jbx ke_^m_l hdjm]eblv kj_^g__ agZq_gb_ ijyf
- < dZdhf \b^_ ke_^m_l aZibkZlv ^h_jbl_evguc bgl_j\Ze agZq Kdhevdh ^h_jbl_evguo bgl_j\Zeh\ ke_^m_l hij_^_eblv ^ey \h^
- DZdh\u ijZ\beZh_gby]jZnbdh\ \u[hjZ fZkrlZ[h\ ih^ibk_c dhh
- DZd ihkljhblv]jZnbd ebg_cghc aZ\bkbfhklb f_lh^hf gZlygmlhc
- DZdh\ nbabq_kdbc kfuke m]eh\h]h dhwnnbpb_glZ]jZnbdh\ ^e
- Kdhevdh kj_^gbo agZq_gbc m]eh\h]h dhwnnbpb_glZ ijhklhc `b^dhklb" \h^u"
- DZd \ kemqZ_ f_lh^Z gZlygmlhc gblb fh`gh \uqbkeblv kemqZ dhwnnbpb_glZ ih]jZnbdm ebg_cghc aZ\bkbfhklb"

EZ[hjZlhjgZy jZ[hlZ ‹

P_ejbZ[hlu

Bamqblv y\e_gby ieZ\e_gby b djbklZeebaZpbb

2. HagZdhfblvky k f_lh^hf baf_j_gby l_fi_jZlmj k ihfhsvx l_ agZq_gb_ m^_evghc l_iehlu djbklZeebaZpbb heh\Z
3. Bamqblv f_lh^ hoeZ`^_gby k bkihevah\Zgb_fby_jhdjZjuhc^ey_iehq nZah\h]h i_j_oh^Z i_j\h]h jh^Z
4. Ijbh[j_klb gZ\udb jZ[hlu k fgh]hij_^_evguf \hevlZfi_jf_ljhf
5. AZdj_iblv gZ\udb]jZnbq_kdh]h ij_^klZ\e_gby j_amevlZlh\ ]jZnbdh\

Ijb[hju b ijbgZ^e_`ghklb

bkke^m_fhs_kl\h heh\h^\ khlZhb\ k ^_j`Zl_e_f gZ]j_\Zl_ev we l_jfhiZjZ fbeeb\hevl Zfi_jf_lj kh_^bgbl_evgu_ ijh\h^Z k_dmg^ l_jfhiZju ebkl fbeebf_ljh\hc [mfZ]b jZaf_jhf o kf ijhajZqgZ

Dhgljhevghu jhku

- Hibrbl_ kljh_gb_ `b^dhklb K q_f bo koh^kl\h b jZaebqb_ i djbklZeebq_kdbfb l_eZfb"
- Qlh lZdh_ wg_j]by Zdlb\Zpbb fhe_dmeu `b^dhklb"
- DZdh\ f_oZgbaf l_ieh\h]h jZkrbj_gby `b^dhklb"
- Qlh lZdh_ dhwnnbpb_gl l_ieh\h]h ijhklhc `b^dhklb" jZkr
- < q_f khklhbl nbabq_kdbc kfuke wlhc _ebqbgu"
- AZ\bkbl eb agZq_gb_ dhwnnbpb_glZ l_ieh\h]h h[t_fgh]h jZl ^Z\e_gby"

- H[tykgbl_ ijbqbgm jZaebqby l_ieh\h]h jZkrbj_gby Zkkhp
  `b^dhkl_c DZd jZaebqb_ lbiZfm `b^dhkl_c \eby_l gZ _ebqbgm
  l_ieh\h]h h[t_fgh]h jZkrbj_gby"
- Ijb_^bl_ ijbf_ju ijhy\e_gby b bkihevah\Zgby l_ieh\h]h jZkrbj
  ijhba\h^kl_
- DZdb_ `b^dhklb b ihq_fm y\eyxlky Z ijhklufb [Zkkhpbbjh\
- <uibrblkijZ\hqgu_ agZq_gby dhwnnbpb_glZ l_ieh\h]h h[tzfgh]
  \h^u \ jZaguo l_fi_jZlmjguo bgl_j\ZeZo
- F_gy_lky eb b ihq_fm dhwnnbpb_gl l_ieh\h]h h[tzfgh]h jZkrb
  rbjhdh]h bgl_j\ZeZ l_fi_jZlmj \ kemqZ_ Z ijhklhpbbjh\Zdhk
  `b^dhklb"
- Fh`gh eb \uqbkeylv _^bgkl_ggh_ kj_^g__ agZq_gb_ dhwnnb
  jZkrbj_gby \h^u ^ey \k_]h l_fi_jZlmjgh]h bgl_j\ZeZ \ ^Zgghc j
- Hibrbl_ oh^ jZ[hlu
- < qzf hkh[_gghklv l_ogbdb [_ahiZkghklb \ ^Zgghc jZ[hl_"
- Ihq_fm \ ^Zgghc jZ[hl_ mkeh\by ijh_^_gby hiulh\ g_evay kqb
- <u_^bl_ jZkq_lgmx nhjfmem ^ey dhwnnbpb_glZ l_ieh\h]h h[tz
- I_j_qbkebl_ _ebqbgu ijyfuo baf_j_gbc \ jZkq_lghc nhjfme_
- Hibrbl_ mkljhckl\h l_jfhf_ljZ DZdhu ba]fh jijgbc p_gZ ^_e_g
  ih]j_rghklv ijb[hjZ"
- AZibrbl_ nhjfmeu g_h[oh^bfu_ ^ey \uqbke_gby ih]j_rghkl_
  g_h[oh^bfuo \ l_ogheh]bb ijh_^_gby hiulh\ ijb jZaguo gZqZe
- AZibrbl_ nhjfmeu g_h[oh^bfu_ ^eyo \uqbke_gby c\kdhk_gg
  baf_j_gby g_h[oh^bfuo \ l_ogheh]bb ijh_^_gby hiulh\ ij
  mkeh\byo
- Knhjfmebjmcl_ ijZ\beZ hdjm]e_gby ih]j_rghkl_c
- Ih dZdhfm djbl_jbx ke_^m_l hdjm]eblv kj_^g__ agZq_gb_ ijyf
- < dZdhf \e^^mk_l aZibkZlv ^h_jbl_evguc bgl_j\Ze agZq_gbc
  Kdhevdh ^h_jbl_evguo bgl_j\Zeh\ ke_^m_l hij_^_eblv ^ey \h
- DZdh\u ijZ\beZ ihkljh_gby]jZnbdh\ \u[hjZ fZkrlZ[h\ ih^ibk_
- DZd ihkljhblv]jZnbd ebg_cghc dha^Zh\fbkgZ\lyklhc gblb"
- DZdh\ nbabq_kdbc kfuke m]eh\h]h dhwnnbpb_glZ]jZnbdh\ ^e
- Kdhevdh kj_^gbo agZq_gbc m]eh\h]h dhwnnbpb_glZ gZ^h hi
  \h^u"
- DZd \ kemqZ_ f_lh^Z gZlygmlhc gblb fh`gh \uqbkevm]ehmjZ
  dhwnnbpb_glZ ih]jZnbdm ebg_cghc aZ\bkbfhklb"

EZ[hjZlhjgZy jZ[hlZ ‹

P_eb jZ[hlu

1. Baf_jblv kdhjhklv bkiZj_gby wlbeh\h]h kibjlZ b
2. <uqbkeblv bafwgljhbb g_dhlhjhc fZkiub ì_bj^dhk\b __ \ iZj
3. AZdj_iblv gZ\udb h[jZ[hldb j_amevlZlZ dhk_ggh]h \uqbke_
   hiulh\ ijb h^bgZdh\uo mkeh\byo

Ijb[hju b ijbgZ^e_`ghklb

we_dljhg\guku wlbeh\uc kibjl ^bklbeeb j\Zhqbbyeh^Zbq_kdb
khkm^ l_jfhf_lj rlZg]_gpbjdmev k_dmg^hf_j

Dhgljhevgu_\hijhku

- DZd bklhedh\Zlv ijhp_kk bkiZj_gby k lhqdbg_ajb_gbkydhfe_djbe
- Ihq_fm `b^dhklb ijb bkiZj_gbb hoeZ`^Zxlky Z ijb dbi_gb
  baf_gy_lky"
- < dZdhf kemqZ_ m^_evgZy l_iehlZ bkiZj_gby beb dhg^_gkZp

- DZdZy _ebqbgZ oZjZdl_jbam_l bgl_gkb\ghklv bkiZj_gby"
- DZd b ihq_fm f_gy_lky kdhjhklv bkiZj_gby `b^dhklb _keb ih_joghklb \ mf_gvrblv\e_\gbr"g__ ^Z
- Qlh gZau\Zxl wgljhib_c"
- H[tykgbl_ nbabq_kdbc kfuke wgljhibb
- l_j_qbkebl_ _ebqbgu ijyfuo baf_j_gbc \ jZkqzlghc nhjfme_ `b^dhklb [ ^ey baf_g_gby wgljhibb `b^dhklb ijb bkiZj_gbb
- DZdbf h[jZahf \ ^Zgghc jZ[hl^bgZdh\uqbmkeh\by ijh_^_gby hi
- Knhjfmebjmcl_ ijZ\beZ jZ[hlu k we_dljhggufb _kZfb DZdh\u p_gZ ^_e_gby rdZeu ih]j_rghklv ijb[hjZ"
- Knhjfmebjmcl_ ijZ\beZ jZ[hlu k eZ[hjZlhjguf k_dmg^hf_jhf baf_j_gbc gZ rdZeZo^_e_gby dZ`^hc rdZeu ih]j_rghklv ijb[hjZ
- Hibrbl_ oh^ jZ[hlu
- < qzf hkh[_gghklv l_ogbdb [_ahiZkghklb \ ^Zgghc jZ[hl_"
- DZdh_ dhebq_kl\h hiulh\ gZ^h ijh_klb ^ey h[_ki_q_gby gZ^z ["
- lhq_fm \ ^Zgghc jZ[hl_ gZdZevgiuh_^kgby hiulh\ fh`gh h^bgZdh\ufb"
- AZibrbl_ nhjfmeu g_h[oh^bfu_ ^ey \uqbke_gby \k_o ih]j_rgh g_h[oh^bfuo \ l_ogheh]bb ijh_^_gby hiulh\ ijb h^bgZdh\uo gZ
- AZibrbl_ nhjfmeu g_h[oh^bfu_ ^eyk_o\uqbkje_gby\k_c dhk_ baf_j_gbc kdhjhklb bkiZj_gby b baf_g_gby wgljhibb g_l ijh_^_gby hiulh\ ijb h^bgZdh\uo mkeh\byo
- Knhjfmebjmcl_ ijZ\beZ hdjm]e_gby ih]j_rghkl_c
- lh dZdhfm djbl_jbx ke_^m_l hdjm]eblv kjb^dhk_agZuo_dbaf_ijyf
- < dZdhf \b^_ ke_^m_l aZibkZlv ^h_jbl_evguc bgl_j\Ze agZq_
- DZdh_ agZq_gb_ g_ ^he`gZ ij_\urZlv hlghkbl_evgZy ih]j_rghk
- KjZ\gbl_ agZq_gby kdhjhklb bkiZj_gby kibjlZ b \h^u h[tyk aj_gby kljh_gby b l_ieh\uo k\hckl\ `b^dhkl_c
- KjZ\gbl_ agZq_gby baf_g_gby wgljhibb kibjlZ b \h^u h[tyk aj_gby kljh_gby b l_ieh\uo k\hckl\ `b^dhkl_c

EZ[hjZlhjgZy jZ[hlZ <

P_ejbZ[hlu

1. Bamqblv y\e_gb_ l_ieh\h]h jZkrbj_gby l\zj^uo l_e
2. <uqbkeblv kj_^g__ agZq_gb_ dhwnnbpb_glZ ebg_cgh]h jZkr
3. Wdki_jbf_glZevgh ijh_jblv aZ\bkbfhklv m^ebg_gby f_lZee gZ]j_\Zgbb hl _z i_j\hgZqZevghc ^ebgu
4. AZdj_ibvZ\ud]jZnbq_kdh]h ij_^klZ\e_gby wdki_jbf_glZ bkihevah\Zgby]jZnbdZ ^ey \uqbke_gby b h[jZ[hldb j_amev
5. AZdj_iblv gZ\ud h[jZ[hldb j_amevlZlh\ f_lh^hf gZbf_gvrbo

Ijb[hju b ijbgZ^e_`ghklb

f_lZeebq_kdb_jlanb[gdh\u_ reZg]b ih^klZ\dZ kZh ddeZ[hc wdxbljhie bg^bdhZqZkh\h]h lbjZhf_lj l_jfhf_lj ebkl fbeebf_ljh\hc [mfZ] ebg_cdZ

Dhgljhevgu_\hijhku

- H[tykgbl_ f_oZgbaf y\e_gby l_ieh\h]h jZkrbj_gby
- Bah[jZabl_]jZnbkdhklZ\b hl jZkklhygby f_`^m qZklbpZfb kbeu hllZedb\Zgby j_amevlbjmxs_c kbeu \aZbfh^_ckl\by wg hllZedb\Zgby wg_j]bb \aZbfh^_ckl\by Qlh gZau\Z_lk ihl_gpbZevghc yfhc"

- Ijb_^bl_ fijbu ijhy\e_gby b bkihevah\Zgby l_ieh\h]h jZkrbj_gb <k_]^Z eb ijb gZ]j_\Zgbb l_e bo jZaf_ju m_ebqb\Zxlky"
- Qlh gZau\Zxl dhwnnbpb_glhf ebg_cgh]h b h[t_fgh]h l_ieh\h] nbabq_kdbc kfuke" < dZdbo _^bgbpaZ[ebqbafbyyxlky
- DZdh\Z k\yav f_`^m ebg_cgh]h b h[t_fgh]h l_ieh\h]h jZkr \ujZ`Zxsmx wlm k\yav
- DZdh\u lZ[ebqgu_dahwZnq_bgbby_glZ ebg_cgh]h jZkrbj_gby ^ey kl
- <u_^bl_ jZkq_lgmx nhjfmem
- l_j_qbkebl_ _ebqbgu ijyfuo baf_j_gbc \ jZkqzlghc nhjfme_
- Hibrbl_ mkljhckl\h l_jfhf_ljZ DZdh\u _]h ij_^_eu baf_j_gbc ih]j_rghklv ijb[hjZ"
- Hibrbl_ mkljhckl\h [Zjhf_ljZ DZdh\u _]h ij_^_eu baf_j_gbc ih]j_rghklb[hjZ"
- Knhjfmebjmcl_ ijZ\beZ jZ[hlu k eZ[hjZlhjguf bg^bdZlhjhf qZk ij_^_eu baf_j_gbc gZ rdZeZo p_gZ ^_e_gby dZ`^hc rdZeu ih
- Hibrbl_ oh^ jZ[hlu
- < qzf hkh[_gghklv l_ogbdb [_ahiZkghklb \ ^Zgghc jZ[hl_"
- < dZdbo mkehjh^blky±hiubgZdh\uo beb jZaguo" ?keb \ jZagu ijyfuo baf_j_gbc ^he`gh f_gylv k\hb agZq_gby"
- Hibrbl_ f_lh^u gZlygmlhc gblb b gZbf_gvrbo d\Z^jZlh\ dhwnnbpb_glZ
- AZibrbl_ nhjfmeu g_h[oh^bfug_by^ek_\uqbkje_rghkl_c ijyfuo baf g_h[oh^bfuo \ l_ogheh]bb ijh_^_gby hiulh\ ijb jZaguo gZqZe
- AZibrbl_ nhjfmeu g_h[oh^bfu_ ^ey \uqbke_gby \k_o ih] baf_j_gby g_h[oh^bfuo \ l_ogheh]bb ijh_^_gby Zeivdhuo ij mkeh\byo
- Knhjfmebjmcl_ ijZ\beZ hdjm]e_gby ih]j_rghkl_c
- DZdhfm djblkhhx_lkl\m_l jZajy^ khfgbl_evghdcmjebmkju_^jb agZqyigbyfuo b dhk_gguo 1baf_j_gbc
- < dZdhf \b^_ ke_^m_l aZibkZlv ^h_jbl_evguc bdlaf_egayZq_

EZ[hjZlhjgZy jZ[hlZ <

P_eb jZ[hlu

1. Baf_jblv \eZ`ghklv \ha^moZ
2. Hij_^_eblv lhqdm jhku
3. Ijbh[j_klb gZ\udb jZ[hlu k]b]jhf_ljhf b ikbojhf_ljhf
4. Ijbh[j_klb gZ\udb bkihevah\Zgby ikbojhf_lj bdZkdhcu lZ[eb iehlghklb gZkus_ggh]h iZjZ
5. AZdj_iblv gZ\udb h[jZ[hldb j_amevlZlh\ ijb ijh_^_gbb wdk mkeh\byo

Ijb[hju b ijbgZ^e_`ghklb

ikbojhf_lj :kkfZgZ ZkibjZpbhgguc ikbojhf_lj :\]mklZ \hehkgl dh^g_gkZpbhgguc

Dhgljhevgu \hijhku

- Qlh lZdh_ g_gZkus_gguc b gZkus_gguc iZj"
- DZd aZ\bkbl ^Z\e_gb_ gZkus_ggh]h iZjZ Z hl h[t_fZ [hl aZ\bkbfhklb
- Qlh gZau\Zxl Z Z[khexlghc \eZ`ghklvx [hlghkbl_evghc \eZ
- Bah[jZabl dhhj^bgZlZo 9 S bahl_jfu j_Zevgh]h]ZaZ ijb H[tykgbl_ bo MdZ`bl_ gZ ^bZ]jZff_ h[eZklb h^ghnZagu_ kh khklhygb_ b `b^dhklv ^\monZa±gh^_dhklhygb_ iZj

- Qlh lZdh_ djblbq_kdh_ khdkl hdlb_iZjZfblju" Hl q_]h aZ\bky djblbq_kdbo ^Z\e_gby h[t_fZ l_fi_jZlmju"
- Hibrbl_ mkljhckl\h Z ikbojhf_ljZ :kkfZgZ ZkibjZpbhggh]h
- Knhjfmebjmcl_ ijZ\beZ jZ[hlu k wlbfb ijb[hjZfb
- =^_ ijbf_gyxlky ikbojhf_hjfu_ljlu"]b]j
- Hibrbl_ kmlv ikbojhf_ljbq_kdh]h f_lh^Z baf_j_gby \eZ`ghklb \
- Hibrbl_ oh^ jZ[hlu
- < qzf hkh[_gghklv l_ogbdb [_ahiZkghklb \ ^Zgghc jZ[hl_"
- Qlh lZdh_ ihklhyggZy ikbojhf_ljZ b dZd __ gZclb"
- DZdbf h[jZahf \ ^Zgghc jZ[hl_ gZ^h hiejh^gkbllv ^gZZkeusbgh]h
- Qlh lZdh_ lhqdZ jhku b dZdZggh ijZ[hlb"v \
- DZdb_ _ebqbgu y\eyxlky ijyfufb b dhk_ggufb baf_j_gbyfb \
- DZdb_ ih]j_rghklb ke_^m_l \uqbkeylv ^ey ijyfuo b dhk_gg jZ[hl_
- Knhjfmebjmcl_ ijZ\beZ hdjm]e_gby ih]j_rghkl_c
- DZdbf h[jZahf gZ^hkhjd^mbe_bavgZq_gby ijyfuo b dhk_gguo baf_
- AZibrbl_ ^h_jbl_evgu_ bgl_j\Zeu \eZ`ghklb \ha^moZ b lhqdb

EZ[hjZlhjgZy jZ[hlZ ‹

P_eb jZ[hlu

1. Bamqblv y\e_gby iZjhh[jZah\Zgby bkiZj_gb_ b dbi_gb_ b dh
2. <uqbkeblv agZq_gb_ m^_evghc l_iehlu iZjhh[jZah\Zgby \h^u i
3. Bamqbdlvehjbf_ljbq_kdbc f_lh^ baf_j_gby kdjulhc l_iehlu i_j\h]h jh^Z
4. AZdj_iblv gZ\udb h[jZ[hldb j_amevlZlh\ ijb ijh_^_gbb wdk mkeh\byo

Ijb[hju b ijbgZ^e_`ghklb

dhe[kZdbiylbevhgfbddZehjbfglj[hevrkbkm^ hlf_jfj [Zjhfwle_dljhggu_ _ku

Dhgljhevgu_\hijhku

- Qlh gZau\Zxl kdjulhc l_iehlhc nZah\h]h i_j_oh^Z"
- lhq_fm kdjulZy l_iehlZ iZjhh[jZah\Zgby aZ\bkbl hl l_fi_jZl agZq_gb_ kdjulhc l_iehlu ijb l_fi_jZlmj_ dbi_gby \h^u"
- Q_f hlebkyZ_iljhp_kk ih_joghklgh]h bkiZj_gby `b^dhklb hl _ f_oZgbaf wlbo ijhp_kkh\
- Ijb dZdhf mkeh\bb gZqbgZ_lky ijhp_kk dbi_gby"
- Qlh lZdh_ l_ieh\hc [ZeZgk" AZibrbl_ mjZ\g_gb_ l_ieh\h]h [Ze \ g_]h _ebqbgu
- DZdb_ _Z_hkl^Zxl Z dZdb_ ihemqZxl l_iehlm \ ^Zgghc jZ[hl_'
- Hibrbl_ mkljhckl\h baf_j_gbyfb ijZ\beZ ihevah\Zgby l_jf l_ogbq_kdbfb _kZfb
- Hibrbl_ mkljhckl\h l_jfhf_ljZ DZdh\u _]h ij_^_eu baf_j_gbc ih]j_rghklv ijb[hjZ"
- Hibrbl_ mkljhckl\h [Zjhf_ljZ DZdh\u _]h ij_^_eu baf_j_gbc ih]j_rghklv ijb[hjZ"
- Knhjfmebjmcl_ ijZ\beZ jZ[hlu k we_dljhggufb _kZfb DZdh\u p_gZ ^_e_gby rdZeu ih]j_rghklv ijb[hjZ"
- <u_^bl_ jZkqzlgmx nhjfmiejm^_e^egyby h kdjulhc m^_evghc iZjhh[jZah\Zgby

- < q_f khklhbl f_lh^ baf_j_gby m^_evghc kdjulhc l_iehlu iZ eZ[hjZlhjghc jZ[hl_"
- Hibrbl_ oh^ jZ[hlu
- < qzf hkh[_gghklv l_ogbdb [_ahiZkghklb \ ^Zgghc jZ[hl_"
- DZdb_ _ebqbgu \ojZkhjfmeZo ^ey l_fi_jZlmju dbi_gby b kdj l_iehlu y\eyxlky Z ijyfufb baf_j_gbyfb [dhk_ggufb baf_j_
- lhq_fm \ ^Zgghc jZ[hl_ g_evay kqblZlv mkeh\by ijh_^_gby hi
- AZibrbl_ nhjfmeu g_h[oh^bfu_ ^ey \uqbke_gby \k_o ih] baf_j_gbc g_h[oh^bfuo \ l_ogheh]bb ijh_^_gby hiulh\ ijb jZaguo gZqZe
- AZibrbl_ nhjfmeu g_h[oh^bfu_ ^ey \uqbke_gby \k_o ih] baf_j_gbc g_h[oh^bfuo \ l_ogheh]bb ijh_^_gby hiulh\ ij mkhe\byo
- Knhjfmebjmcl_ ijZ\beZ hdjm]e_gby ih]j_rghkl_c
- lh dZdhfm djbl_jbx ke_^m_l hdjm]eblv kj_^g__ agZq_gb_ ijyf
- < dZdhf \b^_ ke_^m_l aZibkZlv ^h_jbl_evguc bgl_j\Ze agZq_ l_fi_jZlmju dbi_gby [kdhjf^lhecvghc iehlu iZjhh[jZah\Zgby"

EZ[hjZlhjgZy jZ[hlZ ‹

P_eb jZ[hlu

1. Bamqblv y\e_gb_ \yadhklb `b^dhklb
2. <uqbkeblv agZq_gb_ dhwnnbpb_glZ \yadhklb]ebp_jbgZ b kib
3. Bamqblv f_lh^ Klhdk Z b f_lh^ kZ bkihevjgh\Zgbb_f dhabf_ljZ
4. AZdj_iblv gZ\udb jZ[hlu kh rlZg]_gpbjdme_f fbdjhf_ljhf b k_
5. AZdj_iblv gZ\udb h[jZ[hldb j_amevlZlh\

Ijb[hju b ijbgZ^e_`ghklb

- ih f_lh^m KlhdkZ kl_deygguc pbebg^jbq_kdbc khkm^ k]ebp_ rZjbdb fbdjhf_lj k_dmg^hf_j rlZg]_gpbjdmev fbeebf_ljh\Zy eb
- ih f_lh^m k bkihevah\Zgb_f \bkdhabf_ljZ dZibeeyjguc \bkdhab \h^hc neZdhg kh kibjlhf neZdhg k \h^hc ^ey ijhfu\Zgby \bkd gZkh®]jmrZªjm[dZ

Dhgljhevgu_\hijhku

По методу Стокса:

- Hibrbl_ y\e_gb_ \yadhklb `b^dhklb
- Qlh gZau\Zxl dhwnnbpb_glhf \yadhklb" < dZdbo _^bgbpZo DZdh\ ihjy^hd _ebqbgu dhwnnbpb_glZ \yadhklb `b^dhkl_c" dhwnnbpb_glZ \yadhklb]Zah\
- Q_fm jZ_g dhwnnbpb_gl \yadhklb ijb dhfgZlguo mkeh\byo Z ^ey ^bklbeebjh\Zgghc \h^u"
- DZdh\Z aZ\bkbfhklv dhwnnbpb_glZ \yadhklb hl l_fi_jZlmju \ ]Zah\" H[tykgbl_ wlb.aZ\bkbfhklb
- DZdb_ kbeu ^_ckl\mxl gZ rZjbd ijb _]h ^\b`_gbb \ ]ebp_jb ^\b`_gby rZjbdZ \ _dlhjghc nhjf_ \ ijh_dpbyo gZ hkv \^h ^\b`_gb_
- DZdh\ oZjZdl_j ^\b`_gby rZjbdZ Z hl ih\_joghklb ]ebp_jbgZ [ hl \_jog_c f_ldb ^h gb`g_c f_ldb \ hl gb`g_c f_ldb ^h ^gZ
- DZd \uqbkeblv dhwnnbpb_gl \yadhklb ih f_lh^m Klhdk Z \u_k
- Baf_gblky eb agZq_gb_ dhwnnbpb_glZ \yadhklb]ebp_jbgZ bkihevah\Zgbb_f
- DZdb_ _ebqbgu \ jZkqzlghc nhjfme_ ^ey \yadhklb]ebp_ baf_j_gbyfb"
- DZdbf h[jZahf \ ^Zgghc jZ[hl_ fh`gh h[_ki_qblv kh[ex^_gb ijh_^_gby hiulh\"

- Knhjfmebjmcl_ ijZ\beZ jZ[hlu k eZ[hjZlhjguf k_dhmgj^h^f_ehuf baf_j_gbc gZ rdZeZo p_gZ ^_e_gby dZ`^hc rdZeu ih]j_rghkl
- Knhjfmebjmcl_ ijZ\beZ jZ[hlu k fbdjhf_ljhf DZdh\u _]h ij_^_e p_gZ ^_e_gby dZ`^hc rdZeu ih]j_rghklv ijb[hjZ"
- Hibrbl_ oh^ jZ[hlu
- DZdh_ dhebq_klvgZ^hiuljh_klb ^ey h[_ki_q_gby gZ^z`ghklb ba["
- DZd h[_ki_qblv ijh_^_gby hiulh\ qlh[u gZqZevgu_ mkeh\by [
- AZibrbl_ nhjfmeu g_h[oh^bfu_ ^ey \uqbke_gby \k_o ih]j_rgh g_h[oh^bfuo \ l_ogh\e_h^]bdbyj hiulh\ ijb h^bgZdh\uo mkeh\byo
- AZibrbl_ nhjfmeu g_h[oh^bfu_ ^ey \uqbke_gby \k_o ih] baf_j_gbc kdhjhklb bkiZj_gby b baf_g_gby wgljhibb g_l ijh_^_gby hiulh\ ijb h^bgZdh\uo mkeh\byo
- Knhjfmebjmcl_ ijZ\beZ_gby ih]j_rghkl_c
- lh dZdhfm djbl_jbx ke_^m_l hdjm]eblv kj_^g__ agZq_gb_ ijyf
- < dZdhf \b^_ ke_^m_l aZibkZlv ^h_jbl_evguc bgl_j\Ze agZq_

По методу с использованием вискозимера:

- Hibrbl_ mkljhckdhabf_kljZ
- Dlh bah[jze \bkdhabf_lj"
- Hl dZdbo _ebqbg aZ\bkbl h[t_f `b^dhklb ijhl_dZxs_c q_ mqZklhd \bkdhabf_ljZ "
- DZdbf h[jZahf \uqbkey_lky agZq_gb_ dhwnnbpb_glZ \yadh dZibeeyjgh]h \bkdhabf_ljZ"
- DZdZy bak`b^cdb ihq_fm [he__ \yadZy \h^Z beb kibjl"
- DZdh\u kijZ\hqgu_ agZq_gby dhwnnbpb_glh\ \yadhklb wlbo mkeh\byo beb [ebadbo d gbf "
- Hibrbl_ oh^ jZ[hlu
- < qzf hkh[_gghklv l_ogbdb [_ahiZkghklb \ ^Zgghc jZ[hl_"
- Kdhevdh _ebqbgyfhiZbaf_j_gb_ª gZoh^blky \ jZkqzlghc nhjfm
- DZdhc ba f-lh^h\ KlhdkZ beb f_lh^ dZibeeyjg-h^]Zkl\bfkdhvarmfx l hrb[dm \uqbke_gby dhwnnbpb_glZ \yadhklb \ ijhp_glghf \ujZ`
- AZibrbl_ nhjfmeu ^ey \uqbke_gby g_h[oh^byffuo ih]jd_hkg_kglgu baf_j_gbc

EZ[hjZlhjgZy jZ[hlZ ‹

P_eb jZ[hlu

1. F_lh^hf dZibeeyjgh]h \bkdhabf_ljZ wdki_jbf_glZevgh ihe dhwnnbpb_glZ \yadhklb]ebp_jb.gZ hl l_fi_jZlmju
2. <uqbkeblv wg_j]bx Zdlb\Zpbb fhe_dme]ebp_jbgZ
3. AZdj_iblv gZ\udb h[jZ[hldb j_amevlZlh\ ijbjZiahu\c^_mkbebhhbvbh\

Ijb[hju b ijbgZ^e_`ghklb

\bkdhabf_lj k]ebp_jbghf \ l_jfhklZl_ gZ]j_\Zl_ev k_dmg^hf_j [mfZ]ijhajZqgZy ebg_cdZ

Dhgljhevgu_ \hijhku

- Hibrbl_ kljh_gb_ `b^dhkl_c
- Qlh ihgbfZxl ih^ ©[eb`gbf ihjy^dhfª"
- DZdh\Z nbabq_kdZy kmlv y\e_gby \yadhklb \ `b^dhklyo"
- DZdhc nbabq_kdbc kfuke bf__l dhwnnbpb_gl \yadhklb"
- < dZdbo _^bgbpZo baf_jy_nkbpabg_ZdZ\by_adhklb"

EZ[hjZlhjgZy jZ[hlZ ‹

P_ejbZ[hlu

1. GZ[ex^_gb_ bgl_jn_j_gpbhgguo ihbghuk\jZh\ghcdhhee_sp GvxlhgZ
2. Hij_^_e_gb_ jZ^bmkZ djb\bagu kl_deygghc ebgau
3. Ijbh[j_l_gb_ gZ\udh\ jZ[hlu k fbdjhkdhihf
4. AZdj_iblv gZ\udb h[jZ[hldb j_amevlZlh\ baf_j_gbc ijb jZaguo

Ijb[hju b ijbgZ^e:`ghklb

fbdjhkdhi bklhqgbd k_lZ hkt_dhh\bgeuvcljfbdjhf_lj iehkdh\uimdeZ iehkdhiZjZee_evgZy ieZklbgdZ

Dhgljhevgu_\hijhku

- Qlh lZdh_ bgl_jn_j_gpby
- Qlh gZau\Zxl bgl_jn_j_gpbhgghc dZjlbghc"
- DZdb_ kms_kl\mxl f_lh^u ihemq_gby bgl_jn_j_gpbhgguo dZjlb
- DZdb_ kms_kl\mxl ko_fubf_ighfbhy eZa_jZ ihemq_gby bgl_jn dZjlbgu"
- Bah[jZabl_ oh^ emq_c\ ko_f_ ©dhevpZ GvxlhgZª DZdb_ emq
- >ey q_]h\ wlhc ko_f_-gumgdZeZeyhkdgaZ k [hevrbf jZ^bmkhf djb
- <u_klb nhjfmeu ^ey jZ^bmkh_lezufguchb_p\ hljZ`_gghf b ijh k_l_
- Ij_^eh`bl_ h[hkgh\Zgb_ b \u\h^ jZkq_lghc nhjfmeu ^ey jZ^bml
- Ij_^eh`bl_ ^ey hij_^_e_gby jZ^bmkZ djb\bagu ebgau]jZnbq_k
- DZd f_gy_lky jZkklhygb_ f_`^m dhevpZfb?k m^Ze_gb_f hl bo p
- Qlh ^he`gh ijhbdhevpZkfb GvxlhgZ _keb f_`^m ieZklbgdhc b e

EZ[hjZlhjgZy jZ[hlZ ‹

P_ejbZ[hlu

1. GZ[ex^_gb_ ^bnjZdpbbk\[_ehgZ i_jbh^kdjhmj_ ^bnjZdpbhg j_r_ld_
2. Hij_^_e_gb_ ihklhygghc ^bnjZdpbhgghc j_r_ldb b _z ki_dljZe
3. Hij_^_e_gb_ ^ebgu \hbaukhk\gZheyxs_ck\[_ehlh]h
4. AZdj_ie_gb_ gZ\udh\ h[jZ[hldb j_amevlZlh\ baf_j_gbc

Ijb[hju b ijbgZ^e:`ghklb

hilbq_kdZy kdZfvy bklhqgbd k_lZ wdjZg kh rdZehc zbdbs_evx ebg_cdZ

Контрольные вопросы:

- DZdmkbi^bnjZdpbghZ[ex^_lZkly^ZgghZc[hl_"
- <u_^bl_ mkeh\b_ gZ[ex^_gby]eZ\guo fZdkbfmfh\
- Ijb dZdhc ^ebg_ \b^bfh]h k_lZ^lhjZdupihegkuc dZjlbgu b jZl f_`^m gbfb gZb[he__ rbjhdb_" lhq_fm"
- lhq_fm \ p_glj_ ^bnjZdpbhgghc dZjlbgu gZ[ex^Z_lky [_eZy ih
- lhq_fm ihehku [he__ \ukhdh]h ihjy^dZ klZgh\ylky f_g_ yjdbfb
- DZdhc \b^ ijbh[j_l_l ^bnjZdpbhggZy dZjlbgu k_fhg"hojhfZlbq_k
- Q_f hlebqZ_lky ^bnjZdpbhgkigu_dljZbadfj hl
- DZdb_ kms_kl\mxl oZjZdl_jbklbdb ^bnjZdpbhgghc j_rzldb"
- KjZ\gbl_ ki_dljZevgu_ oZbjZdxs_bokkyb^bnjZdpjbhzghguo
- DZd fh`gh baf_gblv oZjZdl_jbklbdb j_r_ldb"

EZ[hjZlhjgZy jZ[hlZ ‹

P_ev jZ[hlu

1. Bamqblv f_lh^u baf_j_gby nhdmkguo jZkklhygbc lhgdbo ebga
2. <uqbkeblv nhdmkgu_ jZkklhygby kh[bjZxs_c b jZkk_b\Zxs_c e
3. AZdj_iblv gZ\udb h[jZ[hldb j_amevlZlh\ wdki_jbf_glZ

ljb[hju b ijbgZ^e:`ghklb

hilbq_kdZy kdZfvy hk_lbl_ev ij_^f_l gZ[hj ebga wdjZg ebg_cdZ

Dhgljhevgu_ \hijhku

- Qlh lZdh_ ebgaZ"
- DZdmx ebgam gZau\Zxl lhgdhc"
- DZdb_ [u\Zxl lbiu ebga \ aZ\bkbfhklb hl bo dhgkljmdpbb"
- Qlh lZdh_ kh[bjZxsZy b jZkaZ_"b DZxsZu ebog mkeh\gu_ h[hagZq_
- DZdh\u hkgh\gu_ oZjZdl_jbklbdb ebga"
- ljhZgZebabjmcl_ em lhgdhc ebg
- DZd gZclb m_ebq bah[jZ`_gby q_ggh]h k ihfhsvx
- DZd f_gy_lky ihel b \b^ `_gby ij_^f_lZ bjab [_kdhghqlbkd[bjZxs_ a_
- Qlh lZdh_ hilbq_kdZy ebga q_]h hgZ aZ\bkbl"
- Qzf kmlv f_lh^h\ \uqbk y nh guo jZkklhygbc ebga

EZ[hjZlhjgZy jZ[:

P_l

1. Fh^_ebjh\Zhdbjhkdhiaj_bl_ev [u D_ie_jZ
2. Hij_^_e_gb_ m_ebq_gbc fbdjhkdhiZ b ajb

ljb[hj b `ghklb

fbdjhkdhi-F;Jajbl_evgZy gZ hdgla\hgZ[hjd
fbdjhf_lj ijbafZ hilkdqZ_fh bg_cdZ

vgu_ \hi

- >ey q_]h gm`_g fb imkljhckl\ hkdl
- Qlh lZdh_ h[t_dlb\ b_ [u\Zxl lb d
- DZdh_ ij_bfms_k a_jdZevguo h[
-

AZ^Zqb

1. ljyfhebg_cgh_ ^\b`_gb_ lhqdb aZ^Z-2-h3t-mj,z1\g_GgZbibfkZOv mjZ\g_
   aZ\bkbfhkdbhjhklb lhqdb hl \j_f_gb lhkljhblv]jZnbd wlhc a
   dhhj^bgZlm b kdhjhklv lhqdb q_j_a k b k ihke_ gZqZeZ ^\l

   Выполнение:

   «

2. «

   Выполнение:

   «

Lj_[h\Zgdbuihe g_gbx

Hl_ugZ \hijhku b jx_aZgZq gZ(\^Zkd^blhjbb

Hl_l gZ \hijhk ^he`_g [ugdhdjZudbfkq_jiu\Zxsbf g_h[oh^bfhkl
khijh\h`^zg jbkmgdhf b beb nhjfmehc

J_r_gb_ aZ^Zqb gZ ^hkd_
- kgZqZeZ aZibkZlv djZld>Zghqªk ^jZgwlhf© _^bgbpu baf_j_gby i_j__
qbkeh\u_ agZqbgbv a\ klZg^Zjlghc nhjf;_ aZibkb qbkeZ
- aZl_f djZldh hnhjfblv \hijhGZalZªZ«b ©Z _keb lj_[m_lky gZclb
nba_ebqbhg gZ hl^_evghdjZkdhZdbkZlv khhl_lkl\mxsbjc whhjfhk_keb
lj_[m_lky gZdlbmx_ebqbhgh[hagZqblv _z khhl_lkl_ggh
- ^Ze__ hnhjfblv j_rJ_gbgb_©ª«

* mdZaZlv h dZdhf y\e_gbb be,eb aZdhg_ b^_l j_qv
* k^_eZlv oZjZdl_jguc jbkmghd we_dljbq_kdmx ko_fm]
kh^_j`Zgbx mkeh\bgZaZhZqjkf \_dlhjgubqbgue ^he`gu [ulv mdZa
ih^ibkZgu Z \ kemqZ_]jZnjbZqnkdhcuaZ\gkbvl_lkl\mxs_f fZkrlZ[_
* khklZ\blv kbkl_fm mjZ\g_gbc \ujZ`Zxsbo nbabq_kdb_ a
_edbgZfb ^ey wlhc aZ^Zqb
* \uihegblv ij_h[jZah\Zgb_ mjZeqmqgbcy^hjZkqzlghcl nhjfme
ihemqblv_gb_ \ h[s_f \b^_
* ijh_jblv _^bgbpu baf_j_gby bkdhZkc_gehcqbhjfme_
* ih^klZ\blv qbkeh\u_ agZq_gby ba [Zau ^Zgguo aZ^Zqb
g_h[oh^bfuo kijZ\hqguo ^Zggaq\ubkdhfhc _ebqbgu
* ijhZgZebabjh\Zlv ihemq_gguc j_amevlZl k lhqdb aj_gby
ijZdlbq_kdbo b [ulh\uo gZ[ex^_gbc b aZibkZlv hl_l ©Hl_lª

Dhgljhevjq[hZ

< _jog_c kljhd_ ^he`gh [ulv mdZaZgh NBH]jmiiZ ^ZlZ
<h \lhjhchkdlj Dhgljhevgzy jZ[hlZ ih nbabd_ K_f_klj«
< lj_lv_ kljhd_ <Zjbzgl «
Hnhjfeylv j_r_gb_ aZ^Zq `_eZl_evgh \ lhc `_ ihke_^h\Zl_evg
\ \Zjbzgl_ aZ^Zgby
KgZqZeZ aZibkZlv. l_dkl aZ^Zq
AZl_f hnhjfb>Zvgh©ªGZ©lbª J_©_gb_ªgZeh]bqgh l_f lj_[hlZjuby_f
hibkZlyur_ gZ aZgy^ebybZm^blhjgh)c jZ[hlu

ljh_^_gbbZasbZeZ[hjZlhjguo jZ[hl

>h \uiheg_gby eZ[hjZlhjghc jZ[hlu aZjZg__ ih^gZlh\lhcvghZ[
ebkl_ \ de_ldm h[uqghc rd.hevghc l_ljZ^b
l_j\Zkljhdz NBH]jmiiZ ^ZlZ

<lhjZy klj<hdBZBbBgZa\Zgb_ eZ[hjZlhjghc jZ[hlu

Цели работы « aZibkZlv \ khhl_lkl\bb k f_lh^bq_kdbfb mdZaZ
jZ[hl_ «« «

Приборы и принадлежности « aZibkZlv \ khhl_lkl\bb k f_lh^bq_kdbfb
eZ[hjZlhjghc jZ[hl_ b nZdlbq_kdbf gZebqb_f gZ jZ[hq_f klhe_ e
«

Таблица характеристик приборов:

GZa\Zgb_ ijb[	DeZkk lhqghkl k	lj_^_eb rdZe_	uaf_j_gbc	P_gZ ^_e_gb rdZeG	lhuj_rghk ijb[hjZ δ_{ij}
		X_{min}	X_{max}		

Схема опыта « jbkmghd \ khhl_lkl\bb k f_lh^bq_kdbfb mdZaZgbyfb
b nZdlbq_kdbf gZebqb_f gZ jZ[hq_f klhe_ eZ[hjZlhjgh]h ijZdlbdi

Основные формулы:

« aZdhg nbabdb k dhff_glZjbyfb
« hij_^_e_gb_ nbabq_kdhc _ebqbgu
« mjZ\g_gb_ k\yab b l i
« jZkq_lgZy nhjfmeZ ^ey dhk_ggh]h baf_j_gby
« nhjfmeu ^ey \uqbke_gby ih]j_rghkl_c ijyfuo b dhk_g

Результаты измерений и их обработки:

‹	X_1 _^ ba ijyfh_ bf_j_gb_	X_2 _^ ba ijyfh_ bf_j_gb_	X_3 _^ b ijyfh_ bf_j_gb_	Y _^ ba dhk_gg bf_j_gb_
1				
2				
«				
X_{kj} kj_^ agZq				
σ kemq ih]j_r				
δ kbkl_f ih]j_r				
Δ Z[khe ih]j_r				
ε hlghkbl ih]j_				

« \uqbke_gby ih nhjfmeZf Ze-lhjbkfZghjdZecZbkeh\u±j_aamZeqvlZdc
±hdjm]e_gb_ j_amevlZlZ _^bgbpZ baf_j_gby ««

Результаты и выводы:

M kjM‘ΔM εM «

« l_dkl \u\h^h\ «

Ответы на контрольные вопросы:

<hijhku	Hl_lu
« \hijhk ba kibkdZ d eZ[hjZlhjghc jZa^_e ©EZ[hjZlhjgu	«
«	«

GZ aZgylbb

- ijhclb bgkljmdlZ` ih l_ogbd_ [_ahiZkghklb ijb i_j\bqghf ihk
jZkibkZlvky \ khhl_lkl\mxs_f `mjgZe_
- bamqblv bf_xsb_ky ijb[hju \uykgblv bo mkljhckl\hZaibkjZlvpb
g_h[^bhfu_ ^Zggu_ h ijb[hjZo \ hlq_l
- bamqblvogh^bfu_ ieZdZlu kl_g^u \ eZ[hjZlhjbb b aZibkZlv g_
hlq_l
- ^ey ^himkdZ d \uiheg_gbl_jZ[hlgZh\hijhku ij_ih^Z\Zl_eyb ih i
l_ogheh]bb ijh_^_gby eZ[hjZlhjghhbabvqdkidbfhkgdZ\Zf hiulh\
- \h \j_fy bagfbc_klm^_glu fh]ml dhgkmevlbjh\Zlvky k ij_ihiZ\Zl_
l_ogbd_ ijh_^_gby hiulh\
- ih hdhgqZgbb ijyfuo ibjaf_tjy\gbvc bo ij_ih^Z\Zdhgeyx^eyy
KZfhklhyl_evgh \ ^hfZrgbo mkeh\byo ijh_klb \^ey gaZhs[bhu^
jZ[hluibkvf_ggh hl_dlbgvjhgeZvghuijhkukf i jZa^_e ©EZ[hjZlhjgu_
Z lZd`_ f_lh^bq_kdb_ mdZa<Zgqbykedgjdyhfh`gh ^_eZlv gZ ebqghf
beb gZ dhfivxl_j_ \ eZ[hjZlhjghc Zm^blhjbb ijbZffguyy klZg^Zjlgu
Ijb g_h[oh^bfhklb ihkljh_gby]jZnbdZ g_h[oh^bfh bf_lv ebkl
nhjfZlZ : b : Hkb]jZnbdb ih^ibku \uihegylv lhevdh dZjZg^Z
]jZnbdZ ^he`_g [ulv \u[jZg ih klZg^Zjlm [hq__bihle_i
]jZnbdZ bf_eh \b^ ijyfhm]hevgbdZ [ebadh]h d d\Z^jZlm bel
]hjbahglZeb ihe_ \ \b^_ madhc _jlbdZevghc beb]hjbahglZevg
g__jgh \u[jZgghf fZ>kelyZi[h^ibk_c hk_c ijbf_gylv klZge^ZjlgPbmjub^
b aZ]eZ\gu_ [md\u ^he`gu [ulv ih \ukhl_ hdhe±hdhefh klfhqbg^_[dh
±hdheh ff Dhebq_kl\h pbn-j \fhèyhhikh^cibku\Zlv g_ dZ`^mx fZk
jbkdm H]b[Zxsb_ ebgbb ijh\h^blv ih wdki_jbf_gulZeuvgumqlh_gd
^h_jbl_evguc bgl_j\Ze ih]j_rghkl_c baf_j_gbc [_a baehfh\ i
jZa[jhkhf lhq_d hlghkbl_evgh ebgbb ?keb gZ h^ghc b lhc `_
g_kdhevdh]jZnbdh\ lh `_eZl_evgh \u[bjZlv jZagu_ kbf\
wdki_jbf_glZevguo lhq_d beb ih^ibku\Zlv]jZnbdb \ughkdZfb
GZ ke_^mxsq_f[gaZgylbbeZ[hjZlhjghf ijZdjb^mf\bhvnhjfe_ggu_
hlq_luhl_lblv gZ \hijhku ij_^ehy^Za\Zsbeuy jZ[jhlug_h[oh^bfhklb \uihe
ih\lhjgu_ baf_jjZgkbqy_bu

L_fZlbq_kjdbh_jZl

l_j\Zy kljhdZ NBHBBBBBBBBBBBBBBBBBBBBBBBBB]jmiiZ BBBB
<lhjZykljhdZJ_n_jZl ‹BBBBBBBBB K_f_klj BBBBBBBBBB
Lj_lvy kljhldZZ BBBBBBBBBB
Q_l_jlZy kljhdZ GZ©a\Zgqb_aZ]eBBBb_ \ khhl_lkl\bb kh kibkdh
j_n_jZlh\ kf i KjZZhk^heyl©evgZy jZ[hlZª «
lylZy b ^Ze__ « l_dkl nhjfmeu jbkmgdb «
lhke_^gyy [ehd [kbilb_kjZdmjZ
Hnhjfeyl_vfZlbq_kdbc jihn_kjhZ]leZkh\Zgbx k ij_ih^Z\Z©lh_le_jmdfhªg
beb \ i_qZlghf \ZjbZgl_ H[tzf wd\b\Ze_g,l_rjbgl_TNRhe__ bgl_gj\Zkej
iheyzih Dhebq_kl\h jbkmlgdgb\ ^he`gh ij_\urZlv h[tzfZ j_n_jZ
^he`gu [ulv ijhgmfu_jh\iZ^ibkZgu kgbam ih^ jbkmgdhf Z \ l_dk
mdZaZg ghf_j jbkmgZdZbqbebpo lZd`_ gZ^h kkkgZh\fejgvhf gZa\Zgl
gZ^ lZ[ebp_c b kkuehd Z\c^Zyjfmkzea_Zibku\kZy gZ hl^_evghc kljhd_
kljhdbjZ\Zmdau\Zghfyj nhjfmeu \ l_dkl_ fh`gh bkihevah\Zlv gh
kkuehd gZ gbo < l_dkl_ \ d\Zmjdzgu\Zxkhfy\Zdmq_[gbdh\ ba
XJ:CL dhlhju_ bkihevah\Zebkv ijb ih^]hlh\d_ j_n_jZlZ

AZ^Zgb\ kemqZ_ ^bklZgpbhggh]h h[mq_gby

Lj_[h\Zgby ZgZeh]bqgu_ ^ey hl_lh\ gZ \hijhku b j_r_gb
Zm^blhjbb dhgljhevghc jZ[hl_

Djbl_jbb hp_gb\Zgby

Hl_ulgZ \hijhku b jyarZ^gZbq gZ ^hkd_ \ Zm^blhjbb

Hp_gdZ aZ hl\lhijhkguZ fh`[ullv \klZ\e_gbb ^Zkgu hl_lu gZ b
\hijhkZ bakdkZ dhgljhevguo \hijhdkhq_kdhfjmZ aZgkylbxjZa^_e
©ljZdlbq_kdb_ aZgylbyª
- hp_gdZ b©eb ª©aZql_3gkhªf_klj__keb dZ`^uc ba hl_lh\ _jgjubc b i
g_h[oh^bfhkhlbh\h`^zg jbkmgdhf b beb nhjfmehc
- hp_gdZb©eb ª©aZql3gkhªf_klj__keb a\Zj_bo hl_lh\ b_ijgeugu_
- hp_gdZb©eb ª©aZql3gkhªf_klj_keb ohly [u h^bg ba hl_lh\ _jguc
^jm]b_ ^Zgu k hrb[dZfb beb g_ihegu_
- hp_dgZ ©beb ©g_ aZql3kghªklj_keb hl_lh\ g_l beb hgb g__jgu_ g
DZ`^ZyZ^aZqZ hp_gb\Z-[lZkevghc rdbZeb_ ©aZql_gghaZql_g3hª \
k_f_klj_
- hp_gdZ b©eb ª©aZql3gkhªf_klj_keb ihemq_gh j_r_gb_ \ hlsgf_gZ^_
ijh_jdZ gZbf_gh\Zgbc nba_ebqbg b ih^klZgh\dZ qbkeh\uo
g_lhqgh;kl_c
- hp_gdZ b©eb ª©aZql_g3hªk_f_klj_keb ihemq_gh j_r_gb_ \ h[s_f \b^_
ijh_jdZ gZbf_gh\Zgbc nba_ebqbg b ih^klZgh\dZ ^lbmksehguo
g_lhqkgb \ jbkmgd_ beb \bkdkhehgbyeqbqbgu
- hp_gdZ b©eb ª©aZql_g3hªk_f_klj_keb ihemq_gh j_r_gb_ \ hlsgf_l\b
ijh_jdb _^bgbp baf_j_g\b_ggdhehjZkhevb hgb hrb[hqkv_hrb[db g
jbkmgd_
- hp_gdZ ©eb ª©g_ aZql_g3hªk_f_klj_keb g_ ihemq_gh j_r_gb_ \ h
hlkmlkl\m_l beb g_\ajZg\b_kbgfZehbyqhbnhjfe_gby ^Zgguf^b jbkkgmlgguo
nhjfme
< dhgp_ k_f_kljZ hijj_^^_gevyy_lhkpaZkgb\Zlu gZ \hijhku bajZZqggbZ
ijZdlbq_kdbo aZgylbyo ^hihegbl_evghc ©j_clbg]h\hc ª f k_f_klj_Zy hp_gdZ ©aZql_ghª
aZql_gu g_ f_g__ aZ^Zq b hl_lh\ gZ \hijhku

Dhgljhevgmx jZ[hlm k_f_klj

DZ`^Zy aZhpZqgZb\Z_lky ZgZeh]bqgh hibkZgguf^e\ura ZgZql_jb
ijZdlbq_kdbo aZgylbyo
Blh]h\Zy hp_gdZ aZ dhgljhevgmx jZ[hlm
- hp_gdZ © ªbf_klekby g_ [he__ h^ghc qZkdghhkclZhepv_ggud_b ©© ªª
- hp_gdZ © ªbf_klekby [ghe__ h^ghc qZklghhc lhplZgedvbgu© ª© ª b © ª
- hp_gdZ © ªbf_klekby g_ [he__ h^ghc qZkdghhkclZhepv_ggud_b ©© ªª © ª © ª
- hp_gdZ © ªbf_klekby ^_ b [he__ qZkl.guo hp_ghd © ª
Hp_gdZ aZ dhgljhevgmx jZ[hlm mqblu\Z_lky ijb \uklZ\e_gb
dZq_kl_ \lhjhc ^hihegbl_evghc ©j_clbg]h\hcª

AZsbZleZ[hjZlhjgZu[hl

DZ`^Zy eZ[hjZlhjgZy jZ[hlZ \uihegy_lky b aZsbsZ_lky \ l_
dhebq_kl\h jZ[hlkh\m_l \ jZaZ mf_gvr_gghfm qbkem mq_[guc
^he`gu [ulv ijZ\bevgh \uiheg_gu \k_ baf_j_gby ^Zgu hl_lu gZ \
Hp_gdZ ©Zsbs_gZ eZ[hjZlhjgmx jZ[hlm \uklZ\ey_lky _keb \
_jgh hnhjfe_gijykv_ b dhk_ggu_ j_amevlZlu ihemq_gu _jgh
\uqbke_g b hdjm]e_gu _jgh \k_ hl_lu gZ dhgljhevgu_ \hijhku
ijZ\bevgh
Hp_gdZ ©aZsbs_gh_keb _klv bkijZ\e_gby \ hlq_l_ ^Zgu _
dhgljhevghuijhkgu_ f_90%.

Hp_gdZª ©aZsbs_gh_keb hklZebkv g__jgh \uqbke_gu dhk_ggu_ baf_j_gbc _klv g_lhqghklb \ hnhjfe_gbb hl_lu gZ \hijhku d eZ[hjZlhjghc jZ[hl_ f_g__

Hp_gdZª ©_ aZsbs_gkheb g__jgh \uqbke_gu dhk_ggu_ baf_j_gbc _klv g_lhqghklb \ hnhjfe_gbb hlq-eZ[hebahlkmlkehmd ^Zgu hl_lu gZ dhgljhevgu_ \hijhku d eZ[hjZlhjghc jZ[hl_ f_g__

Blh]h\Zy hp_gdZ_eZ[hjZlhjgu_lujZ[hk_f_klj_ij_^mkfhlj_ggu_ khhl_lkl\bb k]jZnbdhf aZgylbc b jZkibkZgb_f

- hp_gdZª _keb bf__lky ^\mo qZkl hklZevgu_ © ª
- hp_gdZ © ª _keb bf__lky ^\mo qZkl hklZevgu; © ª b © ª
- hp_gdZ © ª _keb bf__lky ^\mo qZkl hklZevgu_ © ª © ª ©
- hp_gdZ © ª _keb bf__lky ^\mo qZkl hklZevgu © ª

lheh`bl_evgZy blh]h\Zy hp_gdZ \ k_f_klj_ aZ _kv dhfie_mqblu\Z_lky ijb \uklZ\e_gbb hp_gdb gZ wdaZf_g_ \ dZq_kl©j_clbg]h.\kdª_lv_kf_f_klj_ h[sZy hp_gdZ ©aZsbs_ghª khhl_lkl\mhp_gd_-[ZevghcZ kbkl_f_ ©g-hpaZsgbds_gh ª

Ijb g_m^h\e_l\hjbl_evgbhcb hpg_gdaZsbskgfhªkljZ _kv dhfie_deZ[hjZlhjjZu[hl g_h[oh^bfu_ jbkmgdb kqh^l_j`Zlky hkgh\gu_ nhjfm^e_ugu ijbf_ju ijbf_g_gby bamqZ_fh]h nbabq_kdh]h y\e_gby \uiheg_gu lj_j_n_jZlZ gZijbf_j g__jgh mdZaZgu kkuehd nhjfme

- hp_gdZ ©kªeb ij_^klZ\e_gh h[s__ hibkZgb_ nbabq_kdh]h y\e_gby bf_xlky g_h[oh^bfu_ jbkmgdb kqh^l_j`Zlky hkgh\gu_ nhjfm^e_ugu hlkmlkl\h\Zlv ijbf_ju ijbf_g_gby bamqZ_fh]h nbabq_kdh]h y\e_gby bf_xlky g_[h\Zgbc ih hnhjfe_gbx j_n_jZlZ gZijbf_j g__jgh mdZaZgu kkuehd nhjfme
- hp_gdZ ©kªeb ij_^klZ\e_gh h[s__ hibkZgb_ nbabq_kdh]h y\e_gby bf_xlky g_h[oh^bfu_ jbkmgdb kqh^l_j`Zlky hkgh\gu_ nhjfm^e_ugu hlkmlkl\h\Zlv ijbf_ju ijbf_g_gby bamqZ_fh]h nbabq_kdh]h y\e_gby bf_xlky g_[h\Zgbc ih hnhjfe_gbx j_n_jZlZ gZijbf_j g__jgh mdZaZgu kkuehd nhjfmeueb \ gbo _klv hrb[db fh]ml hlkmlkl\h\Zlv ijbf_ju ijbf_g_gby bamqZ_fh]h nbabq_kdh]h y\e_gby bf_xlky g_kms_kl_ggu_ gZjmr_gby lj_j_n_jZlZ gZijbf_j g__jgh mdZajbkmgdh\ lZ[ebp kkuehd nhjfme
- hp_gdZ © ª g_kjeZokdjulh kh^_j`Zgb_ l_fu g_l jbkmgdh\ nhjfme bklhgbdb

Blh]h\Zy hp_\kdZl_afZlbq_kdb_\j_kn_fjZkluj_

- hp_gdZ © ª _keb bf__lky g_ [he__ ª hklZevgu_ © ª
- hp_gdZ © ª _keb bf__lky g_ [he__ ^\mo qZklguo © ª hklZevgu
- hp_gdZ © ª _keb bf__lky g_ [he__ ^\mo qZklguo © ª hklZevgu
- hp_gdZ © ª _keb bf__lky [he__ ^\mo qZklguo © ª

LZdbf h[jZahf \ lj_ly_fhkp_fg_dkZ ©aZql_ghª khhl_lkl\m_l iheh`bl_evgZy blh]h\Zy k_hfp_kdjd_Z a\Z_kv dhfie_fdZkbq_kdbo j_mgjZlh\Z_lky ijb \uklZ\e_gbb

AZ^Zgb\ kemqZ_^bklZhgbdmg_gby

:gZeh]bqdu_l_jby^fey hl_lh\ gZ \hijhku b j_r_gbx aZ^Zq Zm^blhjbdb\ dhgljhevghc jZ[hl_

Ijhf_`mlhqgZy Zll_klZpby ih ^bkpbiejbdv_k© Nbkdkhlbl ba
aZqZbl\ q_l_jlhf k_f\klp^wdaZf_gZ \ khhl_lkl\bb k mq_[guf ieZgl
AZqzl3 \k_f_klj_ khkIhbl \ \uiheg_gbb j_r_gbc aZ^Zq eZ|
kZfhklhyl_evghc jkZ[^lu`Zsbfky \ ^Zgghcmiqh[jZuff_\hijhkZf
WdaZfag4 k_f_klj lm^_gku^Zxl ih \hijhkZf [be_lZ bf ij_^hk
\hafh`ghklv ih^]hlh\db ibkvf_Zgah]Zh±mk_glhZ]h hl_lZ gZ \hijhku [b
dZq_kl_ ^hihegb\h_jevghdkihevamxdkyljhevgu_ \hijhku b beb aZ
kZfhklhyevgh]h j_r_gby kf i jZa^_e ©ljZdlbq_kdb_ aZgylby
aZ wdaZf_g mqblu\Zxlky hp_gdb ih ^jm]bf_\bk^ZfiaZgylbc \ k_f_k

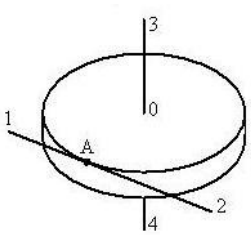
3 k_f_klj

Пример тестового задания

‹ ?kebb $\vec{a}_\tau$ b $\vec{a}_n$ ±lZg]_gpbZevgZy b ghjfZevgZy khklZ\eyxsZy mkdh
$a_\tau = 0, a_n = 0$ kijZ_^eb\u ^ey

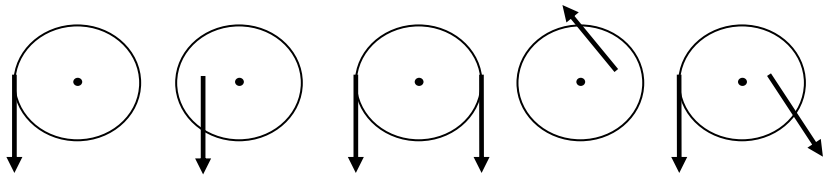
1. jZ\ghf_jgh]h ^\b`_gby ih hdjm`ghklb
2. ijyfhebg_cgh]h jZ\ghf_jgh]h ^\b`_gby
3. ijyfhebg_cgh]h jZ\ghmkdhj_ggh]h ^\b`_gby
4. jZ\ghfg_h]h djb\hebg_cgh]h ^\b`_gby

‹ >bkd jZ^Rmkj\sZ_lky \hdjm] _jlbdZ
jZ\ghmkdhj_ggh ih qZkh\hc klj_ed_ MdZ`b b_ _dl
m]eh\h]h mkdhj_gby



1
2
3
4

‹ < dZdhf ba ij_^klZ\e_gguo gZ jbkmgdZ hfkgmq\Zk_\o kmbfe
ijbeh`_gguo d l_em [m^_l fZdkbfZevguf



1 2 3 4 5

1 2 3 4 5

‹ L_eh fZkkhjZa]hdly_lky ih^ ^_ckl\b_f ihklhygghc kbeu ba k
kdhjhklb f k ljb wlhf kbeZ kh_jrZ_l jZ[hlm

1. >`
2. >`
3. >`
4. >`

‹ MjZ\g_gb_ ^\b`_gby ijm`bggh]h $\frac{d^2x}{dt^2} + \frac{b}{m}\frac{dx}{dt} + \frac{k}{m}x = 0$ y\ey_lky
^bnn_j_gpbZevguf mjZ\g_gb_f

1. k\h[hdg aZlmoZxsbo dhe_[Zgbc
2. k\h[h^guo g_aZlmoZxsbo dhe_[Zgbc

3. \ugm`^_gguo dhe_[Zgbc

‹ >ey ijh^hevghc \hegu kijZ_^eb\h ml_j`^_gb_

1. qZklbpu kj_^u dhe_[exlky \ gZijZ\e_gbb jZkijhkljZg_gby
2. \hagbdgh_gb_ \hegu k\yaZgh k ^_nhjfZpb_c k^\b]Z
3. qZklbpu kjd^he_[exlky \ gZijZ\e_gbyo i_ji_g^bdmeyjgu jZkijhkljZg_gby \hegu

‹ H[tzf khkm^Z k b^_Zevguf]Zahf mf_gvrbeb \^\h_ b ^h[dhebq_kl\h wlh]h `_ ]ZaZ L_fi_jZlmjZ ]ZaZ ih^^_j`b\Z_lky ihkl ml_j`^gby mdZ`bl_ ghf_jZ

1. ^Z\e_gb_]ZaZ m_ebqbehkv \ jZaZ
2. \gmlj_ggyy wg_j]by g_ baf_gbeZkv
3. dhgp_gljZpby fhe_dme mf_gvrbeZkv
4.]Zma‹kh_jrbe jZ[hlm
5. iehlghklv]ZaZ m_ebqbeZkv

‹ H^bg fhev h^ghZlhfgh]h bb^_hZ[eZvgh]g]Z]aZ_bZabf_gDZdbkv ijb wlhf h[tzf b \gmlj_ggyy (weyjdbZy"^hc _ebqbgu mdZ`bl_ khhl_lkl\m baf_g_gby

1. m_ebqbeZkv
2. mf_gvrbeZkv
3. g_ baf_gbeZkv

‹ 9. GZ jbkmgd_ ihdZaZg ijhp_kk baf_g_gby khklhygby fhey h^ghZlhfgh]h \gmlj_ggyy wpg±j]by ^Z\e_gb_ <u[_jbl_ _jguo ml_j`^_gby mdZ`bl_ bo ghf:_jZ

1. dhgp_gljZpby fhe_dmeZ_]Zkv mf_gvr
2. h[tzf]ZaZ g_ f_gy_lky
3. iehlghklv]ZaZ m_ebqb\Z_lky
4. l_fi_jZlmjZ ih\urZ_lky

‹ < ihg_^_evgbd b \lhjgbd l_fi_jZlmjZ \ha^moZ [ueZ h^bgZd \h^ygh]h iZjZ \ Zlfhkn_j_ \ ihg_^_evgbd [ueh f_gvr_ q_f \h \lh ml_j`^_gby mdZ`bl_ ghf_jZ

1. iehlghklv \h^yguo iZjh\ \ ihg_^_evgbd [ueZ f_gvr_ q_
2. hlghkbl_evgZy \eZ`ghklv \ha^moZ \ ihg_^_evgbd; [ueZ f
3. dhgp_gljZpby fhe_dme]Zkv iZjZ \ \ha^mo_ \ ihg_^_evgbd b
4. ^Z\e_gb_ gZkus_gguo \h^yguo iZjh\ \ [ihgv_r^_evgbd\h[\lhjgbd
5. fZkkZ \h^yguo iZjh\ \ ha^moZ \ ihg_^_evgbd [ueZ [hevr_ c]ZaZ m_ebqbeZkv

‹ =Za \ khkm^_ k`Zeb kh_jrb\ jZ[hlym wg_j]by<gjhlj_ghf m_eb gZ > DZdh_\dhe_bqhkur^Ze ivbf]Za"

1. >;`
2. 2. >;`
3. >;`
4. &`m 2.>.`

‹ 2. Q_fm jZ_g fZdkbfZevguc DI> dhlhj ëð 0&@! &0&œË ™ VdG€ m\@

‹ **4.** DZdh_ dhebq_kl\h l_iehlu \u^_eblky ijb djbklZeebaZpbb k\
ijb l_fi_jZlmj_ ieZ\e_gby" <uqbkeblv

5 k_f_klj

Вопросы к экзамену

1. We_dljbq_kdh_ ihe_ \(BkZhdmqmbfd_b we_dljhklZlbq_kdh]h ih
gZijy`zgghklb b ebgbb gZijy`zgghklb ljbgpbi kmi_jihabpbb
gZijy`_gghklbf_ju Wllhl_gpbZeebgpbi kmi_jihabpbb ^ey kmf
ihl_gpbZeZ Wd\bihl_gpbZevgu_ijbf_jughklb Wl
2. We_dljbq_kdh_ ihe_ \(<_dslhjkl\bg^mdpbb]hWlk\yav k _dlhj
gZijy`zgghlk_lbj_fZ Hkljh]jZ+^kZdmkhkZ ^ey we_dljhklZlbiqb_fkdjb]h
ijbf_g_gbWe_dljbq_kdh_ ihe_ ijb gZebqWhe_idhj\hk^lZbbdm\kdZy a
K_]g_lhwe_)dljbdb
3. >_ckl\b_ we_dljbq_kdh]h ihKe\yagvZ jaZhjyu^uWl ^ey i_j_f_s_gby
aZjy^Z k _]h gZijy`zgghklb b ebgbb gZijy`zgghklb ljbgpbi kmi_jihabpbb
gZijy`_gghklbf_ju Wllhl_gpbZeebgpbi kmi_jihabpbb ^ey kmf
ihl_gpbZeZ Wd\bihl_gpbZevgu_ijbf_jughklb Wl
4. Ihklhygguc we_dljbq(KdZhjZdlhjbklbdbjhl\hd^bfhklBkhqgbdb lhdZ
klhjhggb_ kbeu b bo djlZlh^\b`mvseZy kbeZ AZdhg HfZ ^ey h
g_h^ghjh^gh]h mqZkaZdhgmplhcb pjZibbeZ Dbjo\hen_Zdljhkhijhlb\e_g
b_]h aZ\bkbhfhkhlvjfu jZaf_jh\ ijbjh^u b l_fi_jZlmju j_abklhjZ
5. JZ[hlZ b fhsghklv we_dljbqJ_Zkdhl_hjbklbdbjhl\hd^bfhklBkhqgbdb lhdZ jZaguo md
ihklhyggh]h we_dljbq_kdh]h lhdZ DI> bklhqgbdZ lhdZ _]
we_dljhkhijhlb\e_gby
6. We_dljbq_kdbc lhd \ jZaDgeZokkbg^kdZy we_dljhggZy l_hjby
ljm^ghklb DhglZgdhkZy ijhZla_gpbWe_hdljbq_kdbc lhd \ ,we_d
we_dljhebaaZdhgu NZjhZ^\b`ghklv bhgh\ \

14. >bnjZdpby Ijbgpbi -=Nxjc]g_gekyZ F_lh^ ahg Nj_g_ey >bnjZdpby NjZmg]h)n_jZ
15. Iheyjba Zpby k_lZ Ihgylb_ h _kl_kl_gfgkf_b_ihAeyjdhagh\FZgeg Kihkh[u iheyjbaZpbb k_lZ b kmsghklv dZ`^h]h ba gbo :gZeb
16. <aZbfh^_ckl\b_ k_lZ k _s_kl\hf >bki_jkby Hkgh\u we_dlj Ih]ehs_gb_ b jZkk_ygb_ k_lZ
17. AZdhgu]_hf_ljbq_kdhc hilbdb Ndbfl jkgu b^ aZdhgh\ ]_hf_ljbq_kdbc Ij_ehfe_gb_ k_lZ jZaebqgufb ih_joghklyfb Ijbafl a_jdZeZ nhjfmeu kn_jbq_kdhc ih_joghklb b nhjfmeu lhgdhc ebgau gZ Hilbq_kdb_ ijb[hju
18. Nhlhf_ljby K_lhe\uqbgu b _^bgbpu bo baf_j_gby AZdhgu hk\ nhlhf_ljbq_kdbc ijb[hj
19. Hkgh\u d\Zglh\hc hilbdb L_ieh\h_ baemq_gb_ Nhlhwnn_dl k_lZ Dhjimk-dmeyjghc ^mZeb af k_lZ
20. <hegh\u_ k\hckl\Z qZklbpbihs_kZ\ZEmb ^_ ;jhcey Hiulu ih^l ij_^iheh`_gb_ ^_ ;jhcey <hegh\Zy nmgdpby b _z nbabq g_hij_^_ezgghkl_c QZklbpZ \ihl_gpbZevghc yf_ k g_ijhgbpZ
21. Kljmdlmj Z b fh^_eb ZlhfZ dLkihjby f_ghZZevgu_ hZkgjmdlmj, _ Zlh fh^_eb hfkhgZ J_a_jnhj^Z ;hjZ ;jhceyi_dAhZfe_vjgu_eva^ZdhghgZf_j ZlhfZ \h^hjh^Zlme Zlu ;hjZ wg_j]by we_dljhgZ \ Zlhf_ k_jbZe
22. D\Zglhf_hoZgbq_kdh_ hibkZgb_ ZlhfZ \h^hjh^Z Hi\hjZlhjgbdbf_ KlZpbhgZjgh_ mjZ\g_gb_ ^\b`_gby d\Zglh\hc g_j_eylb\bklkd qbkeZ b bo nbabq_kdbc kfuke Kibg we_dljhgZ Hiul Rl_jgZ
23. Fgh]hwe_dljhggu_ Zlhfu Ijbgpbi lZmeb We_dljhggZy l_jbh^bqghklv k\hckldbobfwe_f_glh\ J_gl]kigldlkdb k_jbZev nhjfmeZ b]bihl_aZ Dhkk_ey
24. NbabdZ Zlhfghkhkyl^jZ\ZZlhfgh]h^_jghuZ_ kbeu b fh^_eb y^jZ <b^u jZ^bhZdlb\gh]h baemq_gby Hkh[_gghklb jZaebqguo jZ^bhZdl j_Zdpbblhfgby wg_j]by >_e_gb_ b kbgl_a y^_j
25. NbabdZ we_f_glZjguo qZklbp Nmg^Zf_glZevgu_ \aZbfh^_c we_f_glZjguo qZklbp =exhgu
26. We_f_glu nbabdb l\zj^h]h l_eZ Ihgylb_ h ahgghc l_ We_dljhijh\h^ghklv l\zj^uo h_eeZWnn_dl O

Образец экзаменационного билета

GZijZ\e_gb_ ih^]hlh\db
Ijhmbev
>bkpbiebgZ.06
4

1. We_dljbq_kdh_ ihe_ (\Bkl\Zhdmgdmb we_dljhklZlbq_kdh]h ih gZijy`zgghklb b ebgbb gZijy`zgghklb Ijbgpbi kmi_jihabpb gZijy`_gghkjlbf_ju Wlhl_gpbZe Ijbgpbi kmi_jihabpbb ^ey ihl_gpbZeZ Wd\bihl_gpbZevgu_ijhf_jughklb Wl
2. >bnjZdpby Ijbgpbi -=Nxjc]g_gekyZ F_lh^ ahg>bnjZdpby Nj_g_ey NjZmg]h)n_jZ
3. Dhe_[Zl_evguc dhglmj khklhysbc ba iehkdh]h dhg^100gkZlh *см*^{2} b dZlmrdb bg^mdlb\gh]hkl\hxa[m`^Z_l we_dljhfZ]gblgu_ \he *10 м*. Hij_^_eblv jZkklhygb_ f_`^m ieZklbgZfb dhg^_gkZlhjZ

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3. Mq_[gu_ nbevfu ih l_fZf dmjkZ ojZgylky \ we_dljhgghf \b^_
4. EZ[hjZlhjgh_ h[hjm^h\Zgb_ ojZgblky \ eZ[hjZlhjbyo
5. I_jkhgZevgu_ dhfivxl_ju ojZgylkby \ eZ[hjZlhjbju nbabdb l_ogbq_kdbo ^bkpbiebg
6. F_lh^bq_kdb_ j_dhf_g^Zpbb ih \uiheg_gbx eZ[hjZlhjg\h]h i dZbg_l_ 32 dk_djhibjh\Zevghc l_ogb\duhZxNky klm^_glZf \ gZqZe_ k_
7. ;be_lu ^ey dhgljhevghc jZ[hludZbjZgly_lky d ndbZarb_d^bjub l_ogbq_kdbo ^bkpbiebg
8. ;be_lu ^ey wdaZf_gZ ojZgyhkbyabgdZo dbZl_ojg_^bkpbiebgy we_dljhgghf b i_qZlghf \b^_
9. Ihf_s_gy^ey kZfhklhyl_evghcZjZ^lhbuk 5, 226, 425 k \uoh^hf \ Bgl_jgh_lkgZsgugke_^mxsbf h[hjm^h\Zkhbg_evgu_ dhfivxl_ju jZ[hqb \u[hj Zm^blhjbb aZ\bkbl hl]jZnbdgZyhkbc ihZ hqghf b aZhqghf hl

9.

1. Kbkfgh_HK Windows XP, b [h.e__
2. K_j\bkgh_: Zlblb\bjmkgu_ ijh]jZffu 'U :HE .DVSHUVN\ $YDV WinZIP.
3. K_l_\h_ IH b-g[jZjmgal_ju <DQGH[%URZVHU &KURPH
4. Ijbde Z^gh_: Word, PowerPoint, Excel .
5. H[mqZxs[_kieZ:lgh
   - NbabdZ H[mqZxsZy b l_klbjmxsZy kbkl fZ
   - We_dljhgguc mq_[gbd NbabdZ
   - Kbkl_fZ ^ey rdhevgbdh\ b klm^_glh\ feZ^rbo dmjkh\ <MAh\
   - Ijh]jZffZ ^ey hij_^_e_gby ih]j_rghkl_c i-hdZa^Zggbdc[Zjhf_ljZ aZ\bkbfhklb hl f_klgbo mkeh\bc Baromkr10
   - Ijh]jZffZ ^ey hij_^_e_gby lbiZ C/C++ and VC++ 2019 Community Edition
   - KijZ\hqgbd ih ihemijh\h^gbdh\uf ijb[hjZf ^ey klm^_glh\ b ^
   - DZevdmeylhj b dhg_jl_j _ebqbg F ih^^_j`dhc dhfie_dkguo ihkljh_gby]jZnbdZ PasCalc 1.1
   - Ijh]jZffZ ^ey i_j_kq_lZ _^bgbp baf j gby
   - Ijbeh`_gb_ ^ey kh-ah[Zgdy h\'b wfmeypbb nbabdZ Phuk 7.28
   - <bjlmZevgZy nbabdZ [hdZlhjby ^ey ij_ih^Z\Zgby b bamq_gby ihgylbc nbabdZ Physbo 1.2.0

ДОКУМЕНТ ПОДПИСАН
ЭЛЕКТРОННОЙ ПОДПИСЬЮ

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