



ASTANA PHYSICS BATTLES

ЗАДАЧИ АСТАНИНСКИХ ФИЗИЧЕСКИХ БОЕВ

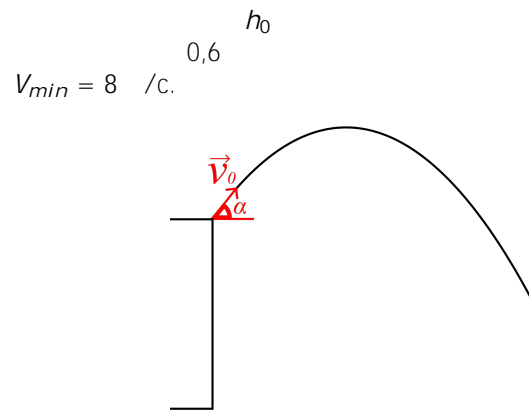
ОТБОРОЧНЫЙ ЭТАП

АВТОР ЗАДАЧ: БИСИМБИ Д.
ИЛЛЮСТРАЦИИ: НЕТАЛИЕВА Д.
ВЕРСТКА: ХАСЕНОВ Н.

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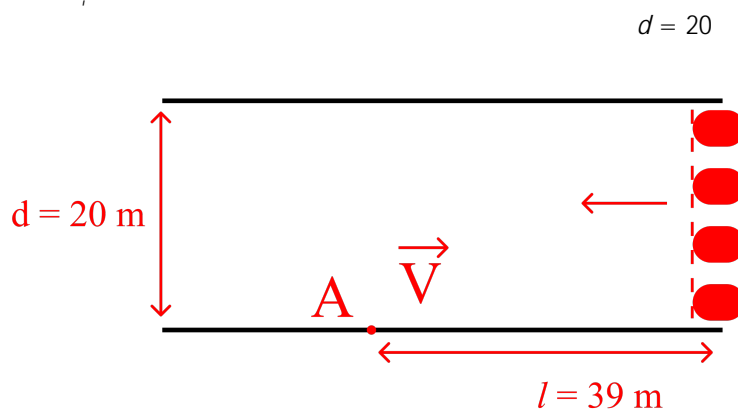
1.1



a)

b) tg

1.2 Crossy Road



$V = 4 \text{ / .}$

$I = 39$

$U = 8$ /c.

a)

?

b)

?

)

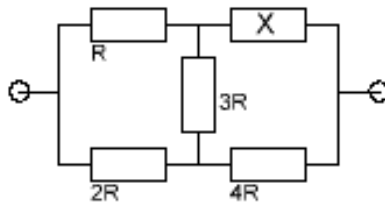
c)

?

d)

?

1.3



U

R

$I = U R^n +$

$n 2 Z; 2 R; 2 R:$

a-c

$R_x = 3R.$

a)

$n.$

b)

c)

d)

$R = 2$

R_x

$2R 4R$

?

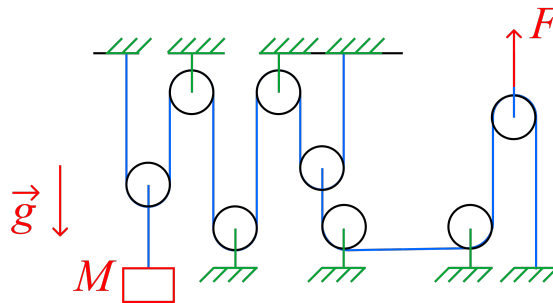
1.4

$V = 0.5$, $t = 20$ C.
 $t^0 = 42$ C. , $t_a = 40$ C.
 $V = 1$, $Q =$
 $t_0 = 38$ C. , $t_1 =$
 850
 40 C.
 a) c
 b) ?
) ?

1.5

?
 10%
 $q = 1$
 70

1.6



a)

$F = 100$

b) , ? 1 ,

c) ? ()

1.7

$$r = 5 \text{ .}$$

$$r = 20 \text{ .}$$

1.8

...

$$q = 10 \\ d = 0.1 \text{ .}$$

$$U = 100 \text{ ,}$$

a)

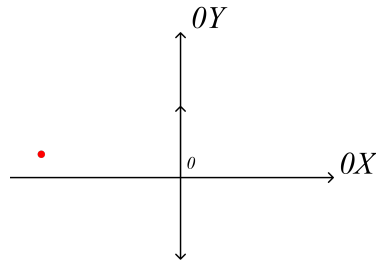
?

b)

$$q^0 = 100 \\ ?$$

1.9

() $F = 20$
: $y_0 = 10$; $x_0 = 30$



a) x_0 ?

b) y_0 ?

$V = 2$ / .

c)

$V = 2$ / .

d)

$V = 2$ / .

e)

1.10

e-g
'-';

" / " ; '+'
'0'.

a-d,

$$hK_i = nhU_i$$

K

U

a)

n.

b)

c)

d) \forall ,

$$\frac{mV^2}{2} = jUj.$$

e)

U?

f)

?

g)

?

2

2.1

$$\frac{mv_0^2}{2} + mgh_0 = \frac{mV_{min}^2}{2} + mgh_{max} \quad (1)$$

h_{max} :

$$h_{max} = h_0 + v_{0y}t + \frac{gt^2}{2} \quad (2)$$

$$\frac{v_{oy}^2 + v_{min}^2}{2} = \frac{v_{min}^2}{2} + gt v_{oy} \quad \frac{(gt)^2}{2} \quad (3)$$

v_{oy} :

$$v_{oy} = \frac{b}{2a} = gt = 8 \text{ /c} \quad (4)$$

$$v_0 = \sqrt{x_{0y}^2 + y_{0x}^2} = 10 \text{ /c} \quad (5)$$

b)

$$\text{tg} = \frac{v_y}{v_x} = 1.33 \quad (6)$$

2.2 Crossy Road

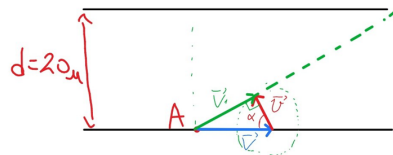
a)

$$t_1 = \frac{l}{U} = 4.875 \quad (7)$$

$$s = V t_1 = 19.5 \quad (8)$$

$$d = 0.5 \quad (9)$$

b)



v.

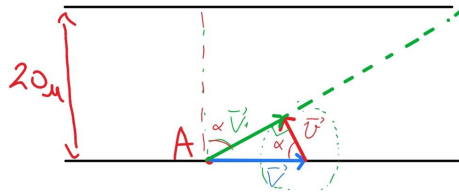
$$\sin \alpha = \frac{\rho \sqrt{V^2 - v^2}}{V} = \frac{\rho \sqrt{3}}{2} \quad (10)$$

$d = 20$;

d

$$S = \frac{d}{\sin \alpha} = 23.09 \quad (11)$$

c)



$$s_1 = d \operatorname{tg} \alpha = 34.64 \quad (12)$$

2.3

a)

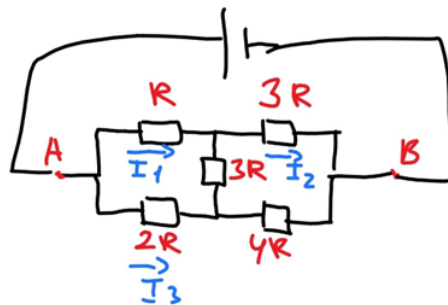
[/]

[],
 $n = 1$.

b) $U = 0$

$= 0$.

c)



$$U = R I_1 + 3R I_2 \quad (13)$$

$$U = 2R I_3 + 4R (I_3 + I_1 - I_2) \quad (14)$$

$$0 = R I_1 - 3R (I_1 - I_2) + 2R I_3 \quad (15)$$

$$I_1 = \frac{16U}{61R}; I_2 = \frac{15U}{61R}; I_3 = \frac{19U}{122R} \quad (16)$$

$$I = I_1 + I_2 = \frac{51U}{122R} \\ = \frac{51}{122} = 0.418.$$

d)

$$\frac{2R}{R} = \frac{4R}{R_x} \quad (18)$$

$$R_x = 4$$

2.4

a)

$$Q = c m(t - t_0) + c^d (t - t_0) \quad (19)$$

$$c^d = 0.5.$$

b)

$$Q = mc (t_2 + c^d t^d) = 4211 \quad (20)$$

c)

2.5

?

$$N = \frac{mN_a}{4} \quad (21)$$

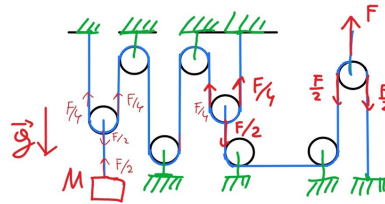
10%

$$Q = Ne \quad (22)$$

$$F = k \frac{Q}{4R^2} = 2057 \quad (23)$$

2.6

a)



$$F = 50 \text{ H.}$$

$$m = 5$$

b)

$$d = 0.5$$

c)

((.

2.7

$$PV = const \quad (24)$$

$$P = P_a + gh.$$

$$3V_1 = V_2 \quad (25)$$

$$r_2 = 3^{\frac{1}{3}} r_1 = 7:21 \quad (26)$$

2.8

a)

$$A_1 = U_{21} = \frac{qU}{2} = 0.5 \quad (27)$$

b)

$$A_2 = \frac{Eqd}{2} = \frac{qU}{2} = 5 \quad (28)$$

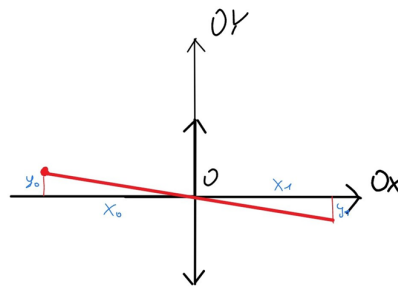
2.9

a)

$$\frac{1}{f} + \frac{1}{d} = \frac{1}{F} \quad (29)$$

$$f = 60, \quad x_1 = 60.$$

b)



y

x

$y = 20$

c) , y

d) $v_1 =$
 $2 / c,$: $v_2 = 4 /$.
 $v = 6 /$.

e) , $v_3 = 10 /$

2.10

a) $R,$ -
 :

$$U = G \frac{Mm}{R} \quad (30)$$

|| R 2|| (31)

$$\frac{mv^2}{R} = G \frac{Mm}{R^2} ||$$

$$\frac{mv^2}{2} = \frac{1}{2} G \frac{mM}{R}$$

$n = \frac{1}{2} ds.$

b) , -

c) , -

d) , -

e) ,
 :

$$w = K + U = U(1 + n) = U(1 + \frac{1}{2}) \quad (32)$$

f) -

