Practice Exam v2

(1.)

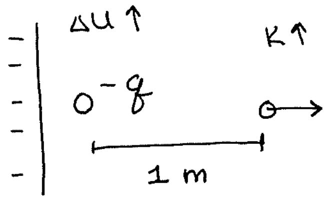
$-Q$ ○ charge transfers

$(-q)$ ○ $-q$

where $q < Q$

(D)

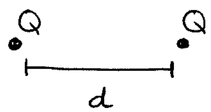
(2.)



- ΔU = 0 at infinity
- the plate is in the system so no work is done.

I only. (A)

(3.)



$F \propto \frac{Q^2}{d^2}$

$\frac{1}{(d/4)^2} \rightarrow \frac{16}{d^2}$

$\frac{1}{(d/2)^2} \rightarrow \frac{4}{d^2}$ (B)

$\frac{(2Q)(2Q)}{(d/2)^2} \rightarrow \frac{16Q^2}{d^2}$

$\frac{(2Q)(Q)}{(d/4)^2} \rightarrow \frac{32Q^2}{d^2}$

Let me try again...

	W	Q	ΔE
I	+ ↑ bigger	— ↑ bigger	— ↑ same
II	+	—	— ↓

gas is compressed

must be neg to to compensate.

$P_xV_x = 10$

$P_yV_y = 4$

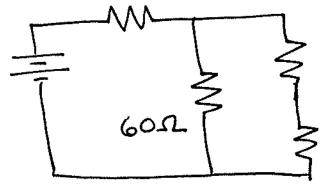
ΔE is neg.

I & V

(D)

(4.)

all the current goes thru this guy.



$\frac{1}{2} R_2$.

↳ these two are in series so $I_3 = I_4$

twice the resistance of the other leg, so half the current

$I_1 > I_3 = I_4 > I_2$

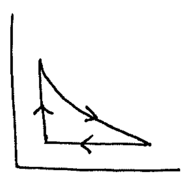
(B)

(5.) We need measurements across each leg, & thru the main circuit.

To get that, both switches need to be closed.

(E)

(6.)



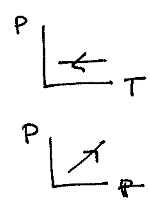
1–2: V dec, T dec, P const.

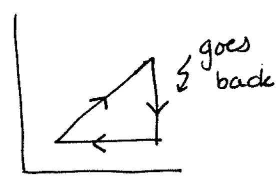
2–3: P inc, T inc

3–1: P dec, T ?

T dec, P const

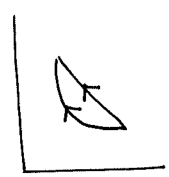
P inc, T inc





(A)

(7.)



ΔE same (same start & end)

W greater for Process I (higher pressure the whole time)

	W	Q	ΔE
I	+ (bigger)	~~+~~ — oops!	— same
II	+	~~+~~ — (bigger)	—

gas is compressed

↳ to compensate.

look @ pnts to find sign.

PV

$(P_x, V_x) \rightarrow (2,5) = 10$

$(P_y, V_y) \rightarrow (4,1) = 4$

ΔE decreases

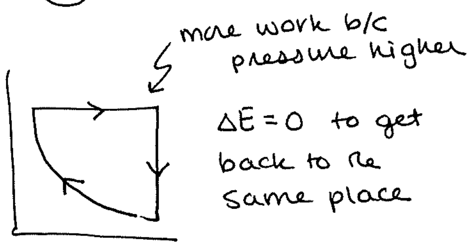
(8.) isothermal: $\Delta E = 0$

compressed: $W = +$

W	Q	ΔE
+ NJ	− NJ	0

(B)

(9.)



$\Delta E = 0$ to get back to the same place

W	Q	ΔE
—	+	0

expands at higher P then it is compressed at.

has to balance.

(D)

(10.) changed direction:

- flipped sign of charge

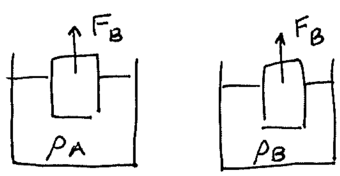
OR

- flipped field

(F needs to flip, $F = qv \times B$)

(B)

(11.)



Same $V_{sub} \rightarrow F_B$ same?

No! different ρ of liquid

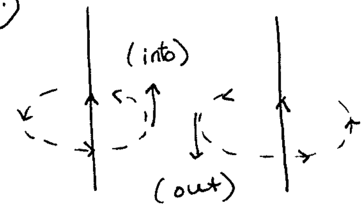
$m_1 g = \rho_A (0.6V) g$

$m_2 g = \rho_B (0.6V) g$

$$\frac{m_1 \cancel{g}}{\rho_A} = \frac{m_2}{\rho_B}$$

$\rho_A = \frac{m_1}{m_2} \rho_B$ (A)

(12.)



$\vec{B}$ cancel, so $\vec{B} = 0$! (E)

(13.) $C = \frac{k\varepsilon_0 A}{d}$

a. $\frac{k}{2d}$

b. $\frac{k}{4d}$

c. $\frac{k}{2d}$

d. $\frac{2k}{d}$

D > A = C > B

(C)

(14.) τ got smaller, went faster

$\tau = RC$

$R = \frac{\rho L}{A} \rightarrow \frac{2\rho L}{A}$ ×

$C = \frac{k\varepsilon_0 A}{d} \rightarrow \frac{k\varepsilon_0 A}{2d}$ ✓ (B)

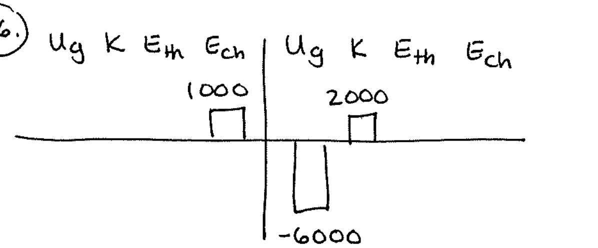
(15.) no ΔT, no ΔE

W	Q	ΔE
—	+	0

expands

(B)

(16.)



$1000 = -6000 + 2000 + \Delta E_{th}$

$5000 = E_{th}$ (C)

(17.) density is all that matters!

(E)

(18.) thermally isolated: $Q = 0$

W	Q	ΔE	ΔT	ΔP
—	0	—	—	—

expands

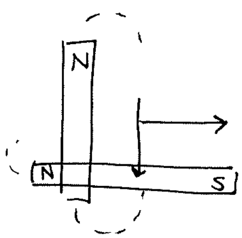
which means

which means

$PV = nRT$

$\ominus + \quad -$

(E)

(19.) 

(C)

(20.) $\Delta S_{tot} = \Delta S_H + \Delta S_C$

$= \frac{-400J}{900k} + \frac{200J}{300k}$

$= \frac{-4}{9} J/k + \frac{6}{9} J/k$

$= \frac{2}{9} J/k$ (C)

(21) $d_1 =$ $\qquad d_2 =$

$v_1 = \frac{v_2}{4}$ $\qquad v_2 =$

$v_1 d_1^2 = v_2 d_2^2$

$\frac{\cancel{v_2}}{4} d_1^2 = \cancel{v_2} d_2^2$

$d_1^2 = 4 d_2^2$

$d_1 = 2 d_2$

(C)

(22.) $Q = \frac{\pi R^4 \Delta p}{8 \eta L}$

$r_{new} = 0.6\, r_{old}$

$Q_{new} \propto (0.6\, r_{old})^4$

$= 0.13\, r_{old}^4$

$= 0.13\, Q_{old}$ (B)

(23) K increased $\quad v_2 > v_1$

$\hookrightarrow v_1 A_1 = v_2 A_2$

$\uparrow \quad \downarrow$

$A_2 < A_1$

U_g no change $\quad y_1 = y_2$ (E)

(24.) $e_{max} = 1 - \frac{T_c}{T_H}$ make T_c bigger & subtract a larger #

(B)

(25.) $\Delta S_{tot} = \Delta S_H + \Delta S_C$

$= \frac{-Q_H}{T_H} + \frac{+Q_c}{T_c}$

adding the same amount to T_c & T_H affects T_c more.

ex, if we add 300 K:

$\Delta S_H = \frac{-2000}{727} = -2.75 \Rightarrow \frac{-2000}{1027} = -1.94$

$\Delta S_c = \frac{800}{127} = 6.3 \qquad \frac{800}{427} = 1.87$

if ΔS_c gets smaller faster, ΔS_{tot} gets smaller overall. (B)