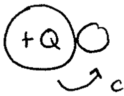
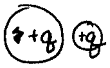
Practice Exam 1

①

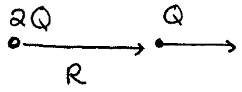


charge transfers!

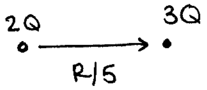
Ⓓ 

where $q < Q$

②



$F \propto \frac{(2Q)Q}{R^2} = \frac{2Q^2}{R^2}$



$$F' \propto \frac{(2Q)(3Q)}{(R/5)^2}$$

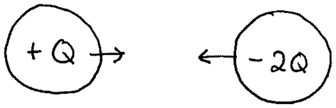
$$= \frac{6Q^2 \cdot 25}{R}$$

$$= 150\,\frac{Q^2}{R^2}$$

$$= 75F$$

Ⓓ

③



$-\Delta U = \Delta K$

↳ same force, same distance (same mass)

must have same ΔU & ΔK, so same v! Ⓑ

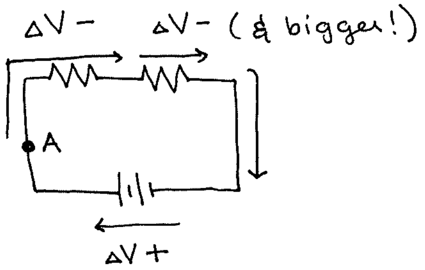
④ should be equally distributed, & $\vec{E}$ points from pos. to neg.

Ⓐ

⑤ To verify we need to show $I_{batt} = I_1 + I_2$

we can use voltmeters over R to calc I_1 & I_2, but not over the battery so A & B don't work. C has no measure of I_{batt}, but Ⓓ does.

⑥



I loose potential across the resistors, more between B & C since it has a higher resistance, and I need to get back where I started. Ⓓ

⑦ Going from $i \to f$ has the same ΔE_{th}

i-c-f: $W + Q = \Delta E_{th}$

$-30J + 95J = \Delta E_{th}$

sys does work

$65J = \Delta E_{th}$

i-d-f: $W + Q = \Delta E_{th}$

$-10J + Q = 65J$

$Q = 75J$ Ⓔ

⑧ ΔQ has to be the same:

Q lost by water = Q gained by block

$$(mc\Delta T)_{water} = \left(\frac{1500J}{5°C}\right)\Delta T$$

$$(0.5\,kg)\left(4.186\,\frac{kJ}{kg°C}\right)(100°C - T_f) = \left(\frac{300J}{°C}\right)(T-2$$

same final temp

☆ I know we forgot to give you this in the problem; it will be given in the exam when you need it!

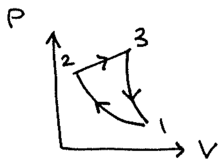
$$2093kJ - \left(2.09\,\frac{kJ}{°C}\right)T_f = \frac{300J}{°C}T_f - 600J$$

$$208.7kJ = \left(2.39\,\frac{kJ}{°C}\right)T_f$$

$$T_f = 87°C$$

Ⓔ

⑨.



	W	Q	ΔE
1→2	+		
2→3	— (& bigger)		
3→1	— (& bigger)		
+			
	−	+	0

neg W legs are bigger b/c pressure higher the whole time

has to be true if W is − & ΔE is 0.

comes back to same spot

Ⓔ

⑩. Work is negative (expands)

ΔE is less negative

⇒ Q must be positive (heated)

Ⓑ

⑪. 1 ~~a~~. isothermal: no ΔT, no ΔE_{th}

2 ~~b~~. adiabatic: $Q = 0$, $W = \Delta E_{th}$

3 ~~c~~. iso vol.: $W = 0$, $Q = \Delta E_{th}$

4 ~~d~~. isobar: $W = -$, $Q > \Delta E_{th}$

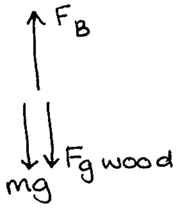
$4 > 2 = 3 > 1$ Ⓓ

⑫. isothermal → $\Delta E = 0$

$$\frac{W + Q = \Delta E}{+328\text{J} \quad \boxed{-328} = 0}$$

Ⓑ

⑬.



$$\rho_{water} V \cancel{g} = m\cancel{g} + \rho_{wood} V \cancel{g}$$

$$m = (\rho_{water} - \rho_{wood}) V$$

$$m = \left(1000 - 390 \ \frac{kg}{m^3}\right)(0.21 \cdot 0.16 \cdot 0.059 \ m^3)$$

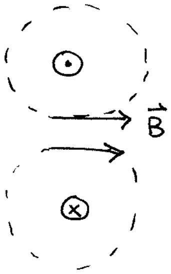
$$m = 1.2 \ kg$$

Ⓓ

⑭. $r = \dfrac{mv}{qB}$ $\quad r' = \dfrac{1}{2} r$

Ⓑ

⑮.



$\vec{B}$ in the same direction as $\vec{v}$,

$F = 0$! Ⓔ

⑯. $R = \dfrac{\rho L}{A}$

a. $\dfrac{\rho L}{2A}$

b. $\dfrac{\rho L}{4A}$ $\quad D > A = C > B$ Ⓐ

c. $\dfrac{\rho L}{2A}$

d. $\dfrac{2\rho L}{A}$

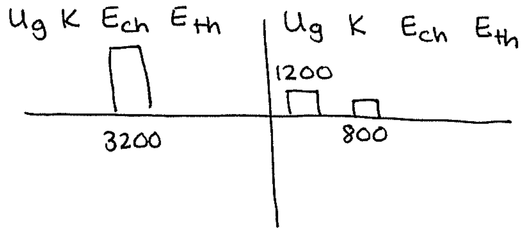
⑰. τ got larger, took longer.

$\tau = RC$.

a increases R, increases τ

Ⓐ

18.



$$3200 = 1200 + 800 + \Delta E_{th}$$

$$1200 = \Delta E_{th}$$ Ⓑ

19. density is all that matters!

Ⓓ

20. $PV = nRT$

$\uparrow \downarrow$ — —

must inc. "sealed"

<u>BUT</u> $v_{avg} \propto KE \propto T$

if T is the same, v_{avg} <u>must</u> be the same.

Ⓓ

21. $y_1 = y_2$

$d_1 =$ $d_2 =$

$v_1 = 1.0\,m/s$ $v_2 = 5.0\,m/s$

$P_1 = 10^5$ Pa $P_2 = ??$

(same)

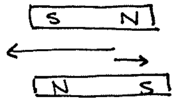
$$P_1 + \frac{1}{2}\rho v_1^2 + \cancel{\rho g y_1} = P_2 + \frac{1}{2}\rho v_2^2 + \cancel{\rho g y_2}$$

$$P_2 = P_1 + \frac{1}{2}\rho\left(v_1^2 - v_2^2\right)$$

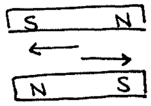
$P_2 = 8.8 \times 10^4$ Pa Ⓔ

22. Need: $\longrightarrow \vec{B}$ total

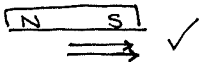
a.



b.



Ⓒ



23. $e_{real} = \frac{W}{Q_H} = \frac{Q_H - Q_C}{Q_H}$

$= \frac{300J}{1000J}$

$= 0.3$ Ⓐ

24. K const. $v_1^2 = v_2^2$

↳ by continuity, $A_1 = A_2$

U_g dec. $y_2 < y_1$ Ⓔ

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

$Q = 80\,cm^3/s$

$R = 4 \times 10^{-4}\,cm$

$L = 0.1\,cm$

$\eta = 4 \times 10^{-3}\,Ns/m^2$

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

$\Delta p = 3.18 \times 10^{12}$ Ⓔ