

Solution

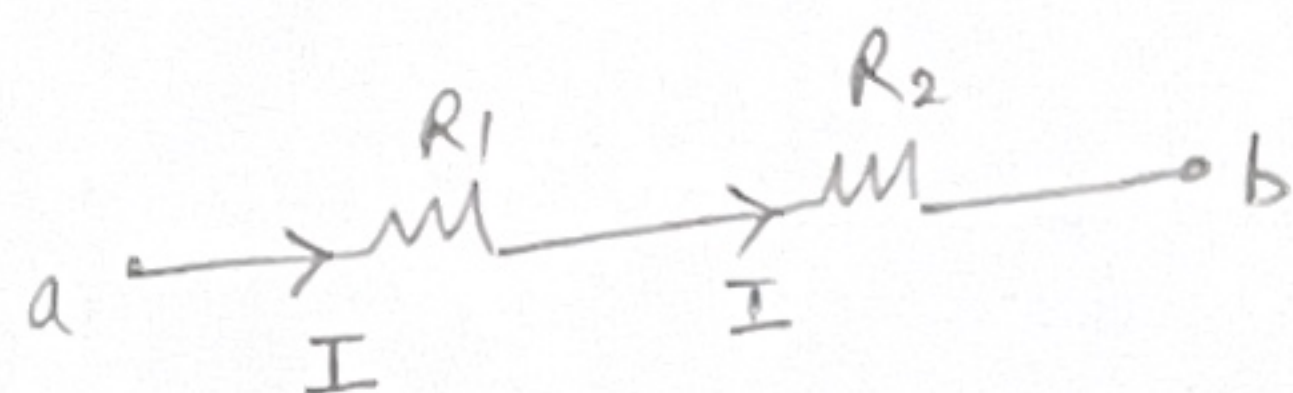
PHYS-205B

(Midterm Exam 02)

Fall 2025

①

Problem 1



$$V_a - IR_1 - IR_2 = V_b$$

$$4.5 - I(10.) - I(20.) = -1.5$$

$$6.0 = I(30.)$$

$$I = \frac{6.0}{30.} = 0.20 \text{ A}$$

Problem 2

Consider the following independent equations

$$V = \frac{Q}{4\pi\epsilon_0 R}$$

and

$$V = \frac{Q}{C}$$

R - distance.

L - Length.

Together, we have

$$[C] = [\epsilon_0][R]$$

$$\left[\frac{C}{\epsilon_0}\right] = [R] = L$$

Problem 3

at $t = RC$

$$Q = CV[1 - e^{-1}]$$
$$= 0.63 CV$$

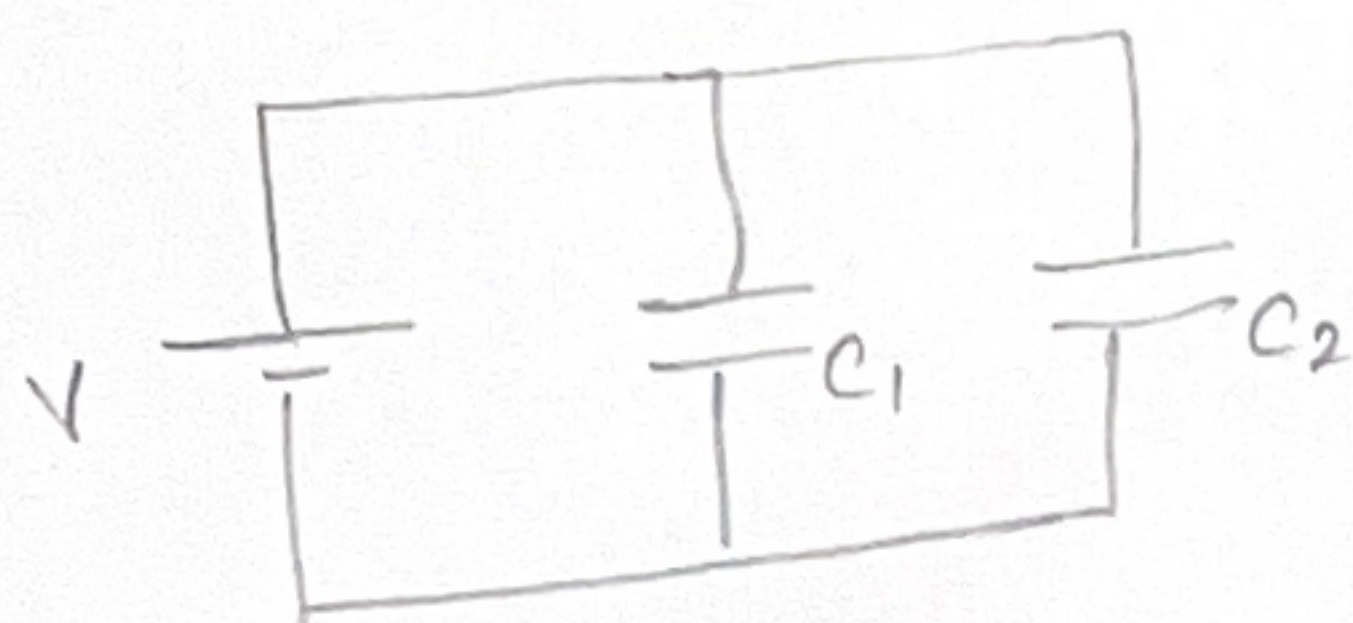
CV = maximum charge.

Problem 4

$$\vec{F} = q \vec{v} \times \vec{B}$$

$$|\vec{F}| = qvB \sin\theta = 0 \quad (\text{because } \theta = 0)$$

Problem 5



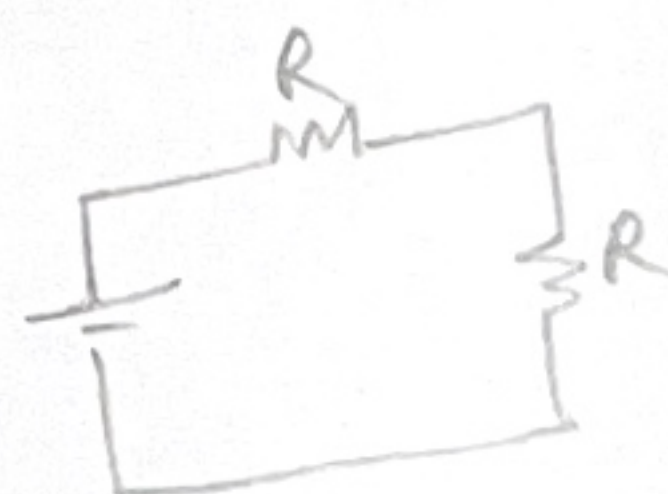
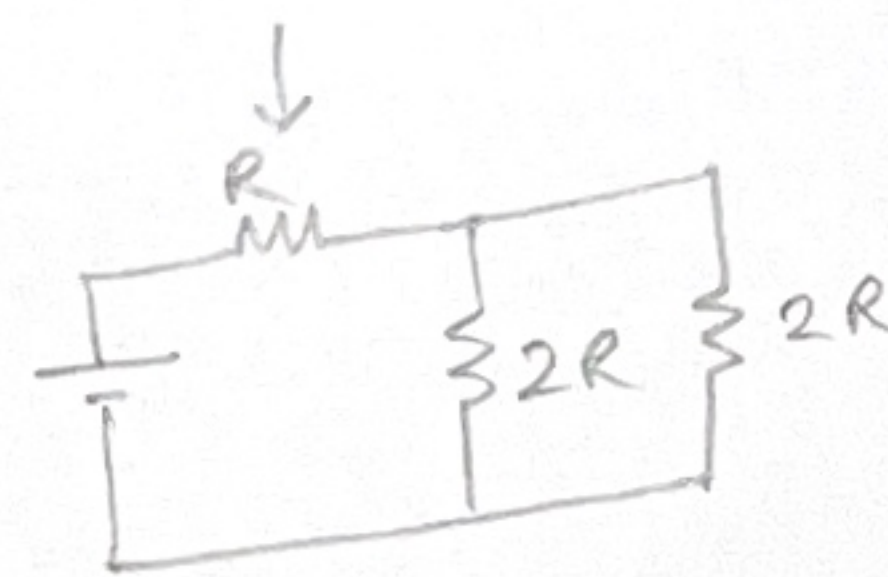
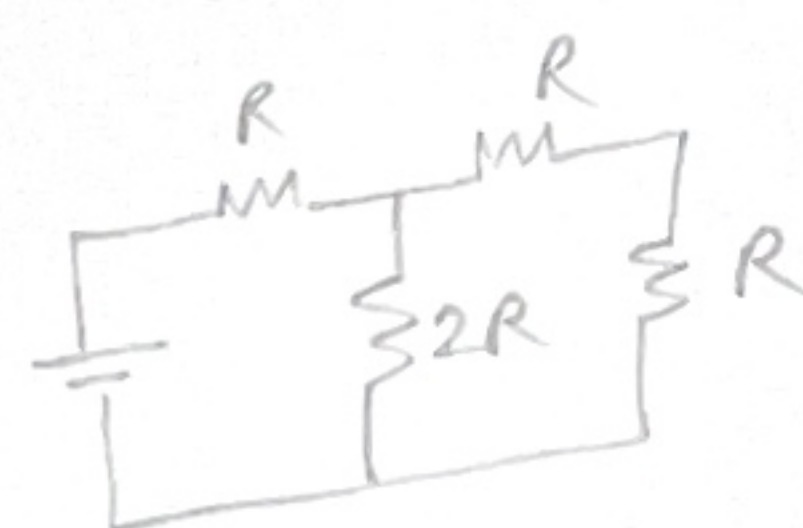
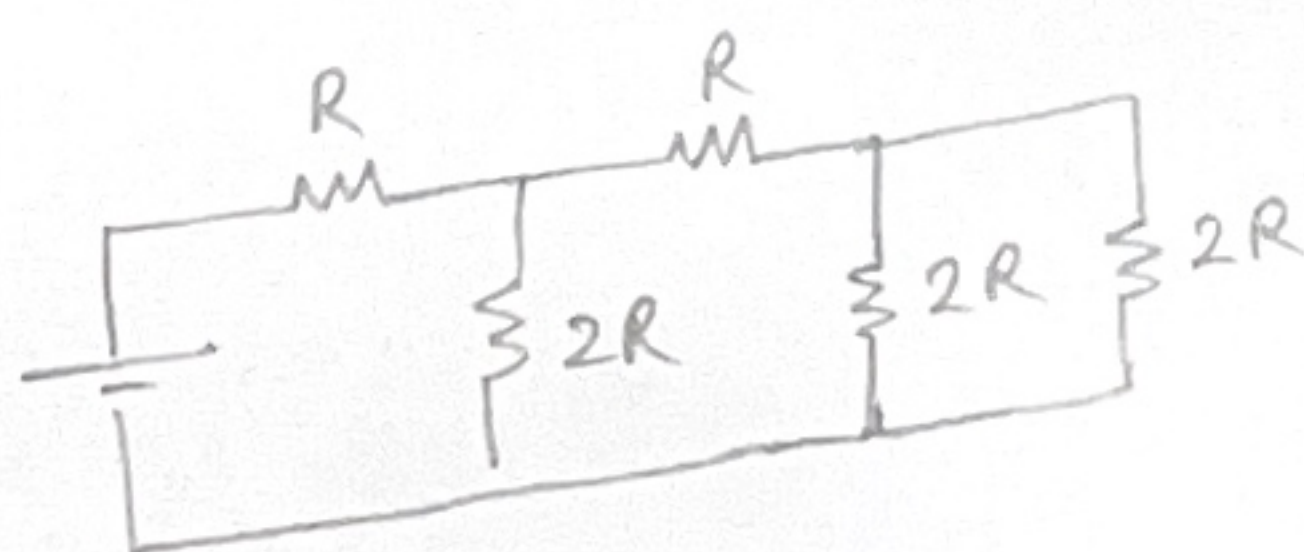
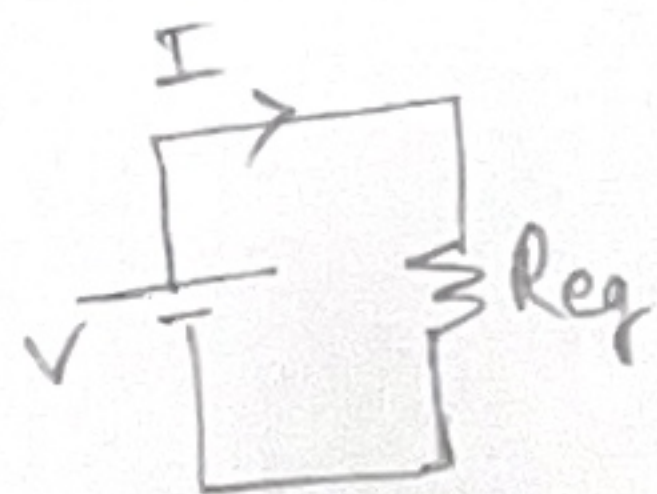
$$\frac{U_1}{U_2} = \frac{\frac{1}{2} C_1 V_1^2}{\frac{1}{2} C_2 V_2^2}$$

$$(V_1 = V_2)$$

$$= \frac{C_1}{C_2} = 0.50$$

Problem 6

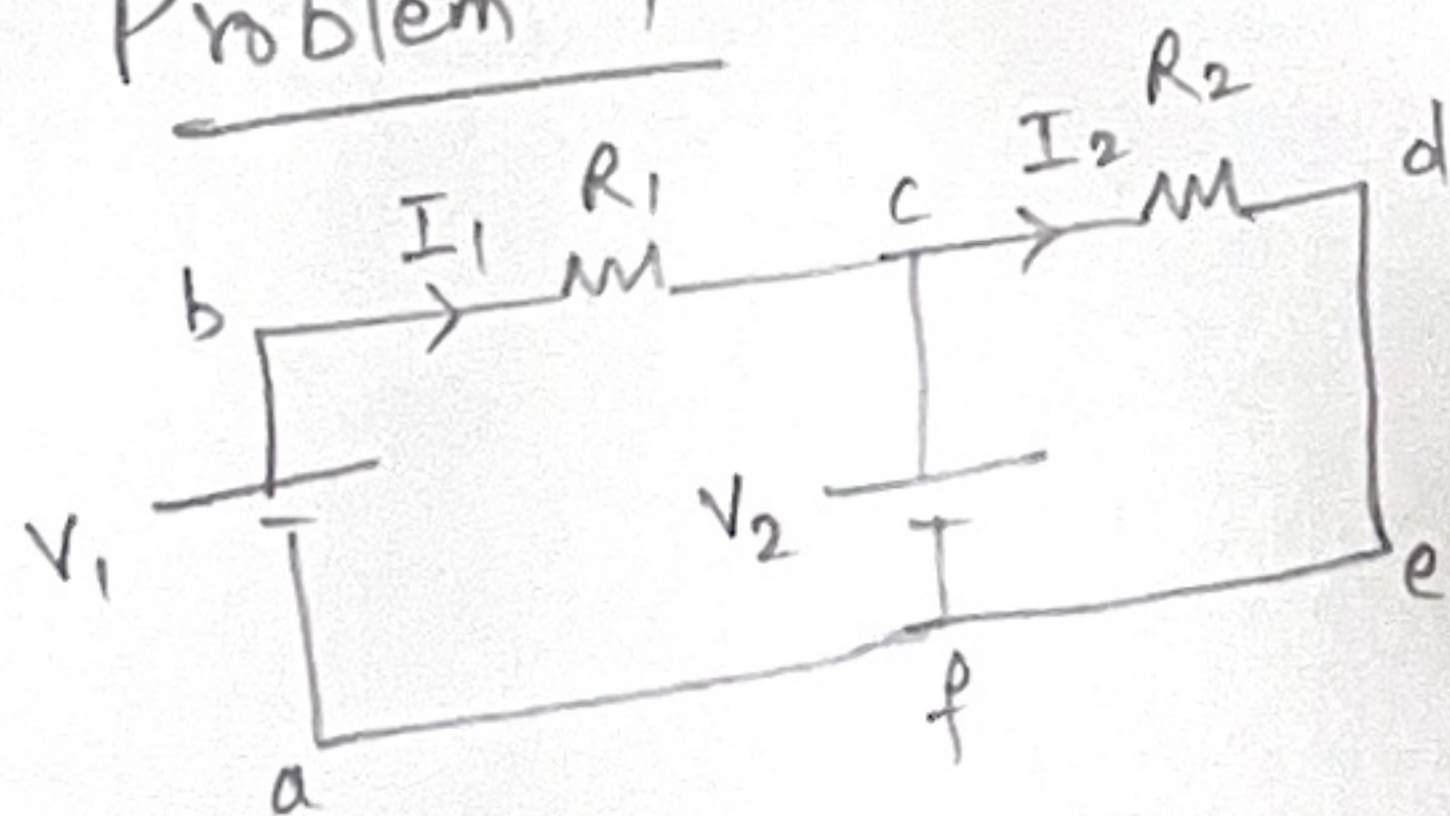
Current in R_1 will be same as the current through an equivalent resistance of the whole set.



Thus, $R_{eq} = 2R$

$$I = \frac{V}{R_{eq}} = \frac{V}{2R} = \frac{5.0}{2(5.0)} = 0.50 \text{ A}$$

Problem 7



Loop abcfa: $+V_1 - I_1 R_1 - V_2 = 0$
 $+10. - I_1(10.) - 20. = 0$

$$I_1 = -1.0 \text{ A}$$

direction of I_1 is c to b.

Loop cdef: $+V_2 - I_2 R_2 = 0$
 $+20. - I_2(20.) = 0$

$$I_2 = +1.0 \text{ A}$$