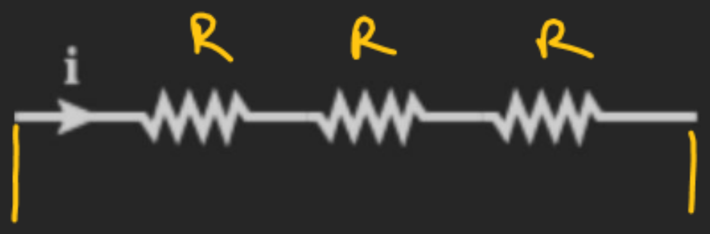
Nishant Jindal

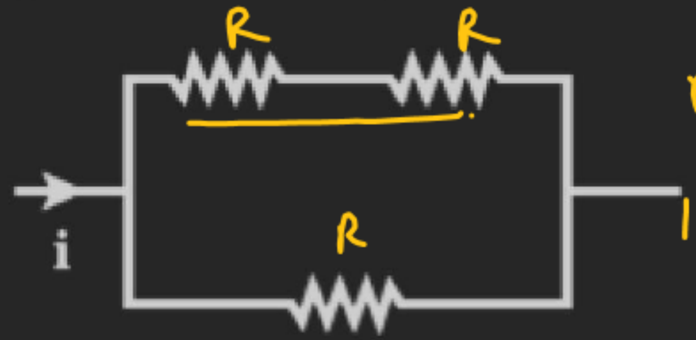
Q.2 Three resistance of equal value are arranged in the different combinations as shown below. Arrange them in increasing order of power dissipation.



(I)

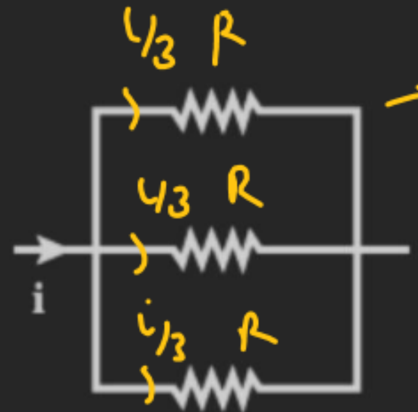
$R_{eq} = 3R$

$\boxed{P = i^2 R_{eq}}$



(II)

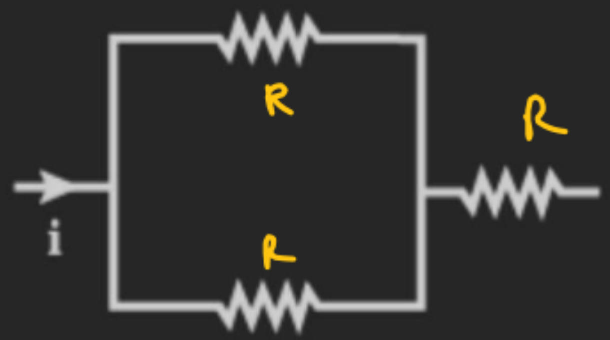
$R_{eq} = \frac{2R \cdot R}{2R+R} = \frac{2R}{3}$



(III)

$P_3 = (i/3)^2 \times R \times 3 = \frac{i^2 R}{3}$

$R_{eq} = \frac{R}{3}$

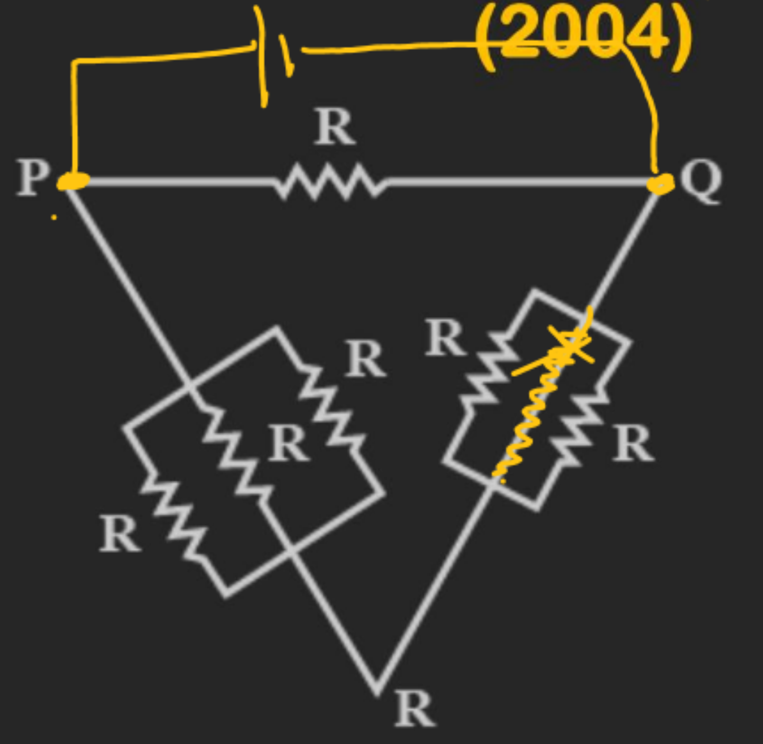


(IV)

$R_{eq} = \frac{R}{2} + R = \frac{3R}{2}$

III < II < IV < I

Q.3 Six identical resistors are connected as shown in the figure. The equivalent resistance will be (2004)



(A) maximum between P and R

(B) maximum between Q and R

(C) maximum between P and Q

(D) all are equal.

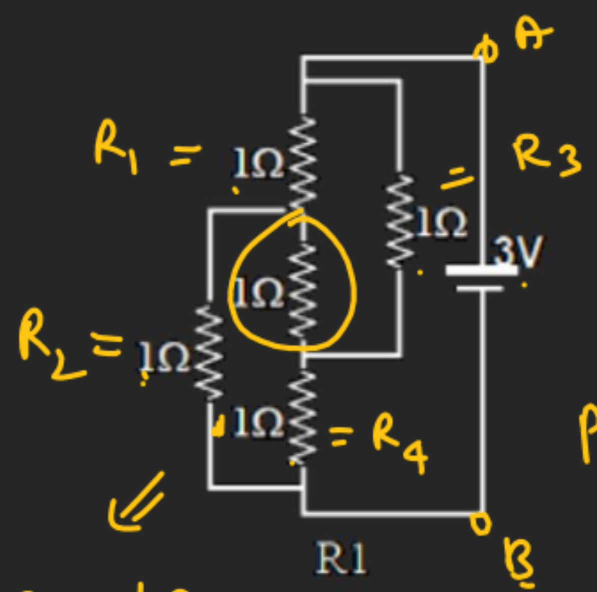
Q.4 Figure shows three resistor configurations R_1 and R_2 and R_3 connected to 3 V battery. If the power dissipated by the configuration R_1, R_2 and R_3 is P_1, P_2 and P_3 respectively, then **(2008)**

(A) $P_1 > P_2 > P_3$

(B) $P_1 > P_3 > P_2$

(C) $P_2 > P_1 > P_3$

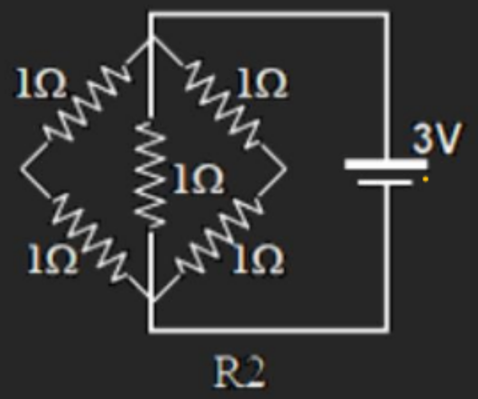
(D) $P_3 > P_2 > P_1$

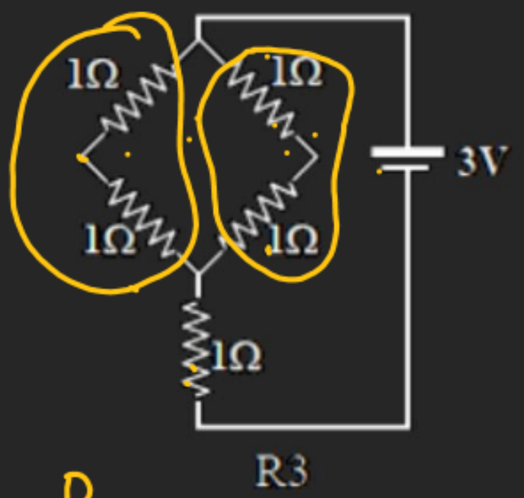


$R_{eq} = 1\,\Omega$.

$P = \underline{9\text{ watt}}$

$P = \dfrac{V^2}{R_{eq}}$





$R_{eq} = 2\,\Omega$.

$P = \dfrac{V^2}{2} = \dfrac{9}{2}$.

$\dfrac{1}{R_{eq}} = \dfrac{1}{2} + 1 + \dfrac{1}{2} = 1 + 1 = 2$

$\left(R_{eq} = \dfrac{1}{2}\right)$

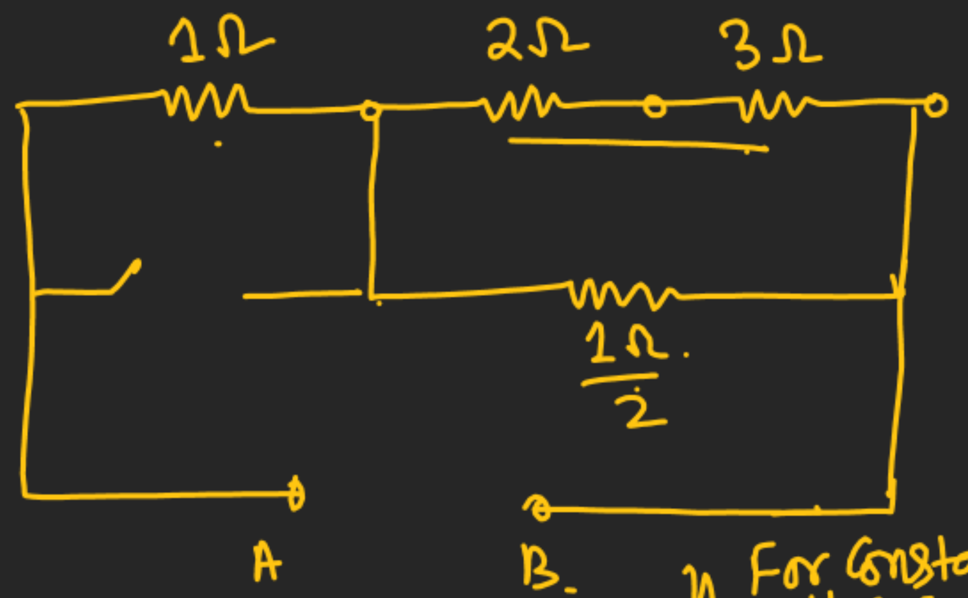
$P_2 = \dfrac{9}{1/2} \Leftarrow$

$= \underline{18\text{ watt}}$

Nishant Jindal

CURRENT ELECTRICITY

Q-5: - S_1 open



S

$$(R_{eq})_1 = 1 + \left(\frac{5 \times 1/2}{5 + 1/2}\right)$$

$$= 1 + \frac{5/2}{11/2}$$

$$= \left(\frac{16}{11}\right)\Omega$$

For constant voltage source

$$\frac{1}{(R_{eq})_2} = \frac{1}{1} + \frac{1}{2} + \frac{1}{3}$$

$$= \frac{6+3+2}{6}$$

$$\frac{1}{(R_{eq})_2} = 11/6$$

$$(R_{eq})_2 = \left(6/11\right)$$

$$\frac{P_1}{P_2} = \frac{(R_{eq})_2}{(R_{eq})_1}$$

$$\frac{P_1}{P_2} = \frac{6}{11} \times \frac{11}{16}$$

$$P_1 < P_2$$

When Constant Current Source Connected

$$P = i^2 R$$

$$\frac{P_1}{P_2} = \frac{(R_{eq})_1}{(R_{eq})_2}$$

$$\frac{P_1}{P_2} = \frac{16}{11} \times \frac{11}{6}$$

$$\boxed{P_1 > P_2}$$

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Q.5 In circuit-1 and circuit-2 shown in the figures, $R_1 = 1\Omega, R_2 = 2\Omega$ and $R_3 = 3\Omega$. P_1 and P_2 are the power dissipations in circuit-1 and circuit-2 when the switches S_1 and S_2 are in open conditions, respectively. Q_1 and Q_2 are the power dissipations in circuit-1 and circuit-2 when the switches S_1 and S_2 are in closed conditions, respectively. Which of the following statement(s) is(are) correct?

S_1 & S_2 closed then Q_1 & Q_2

S_1 & S_2 open P_1 & P_2

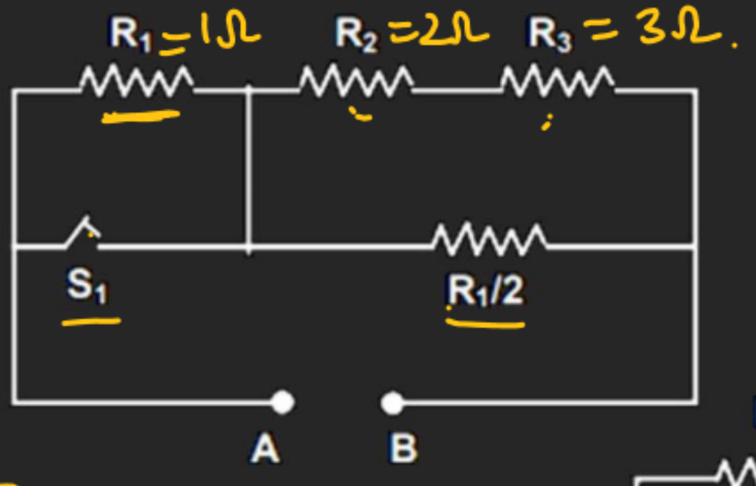
(A) When a voltage source of 6 V is connected across A and B in both circuits, $P_1 < P_2$.

(B) When a constant current source of 2amp is connected across A and B in both circuits, $P_1 > P_2$

(C) When a voltage source of 6 V is connected across A and B in Circuit-1, $Q_1 > P_1$.

(D) When a constant current source of 2 amp is connected across A and B in both circuits, $Q_2 < Q_1$.

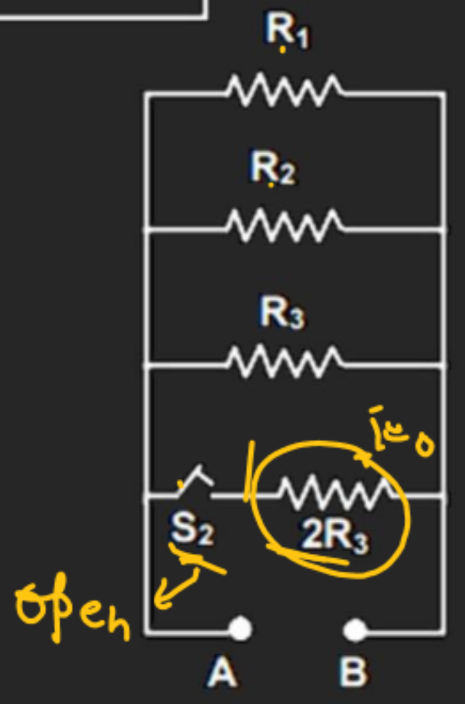
(2022)



Circuit-1

S_1 & S_2 open,

$(R_{eq})_1 =$



Circuit-2

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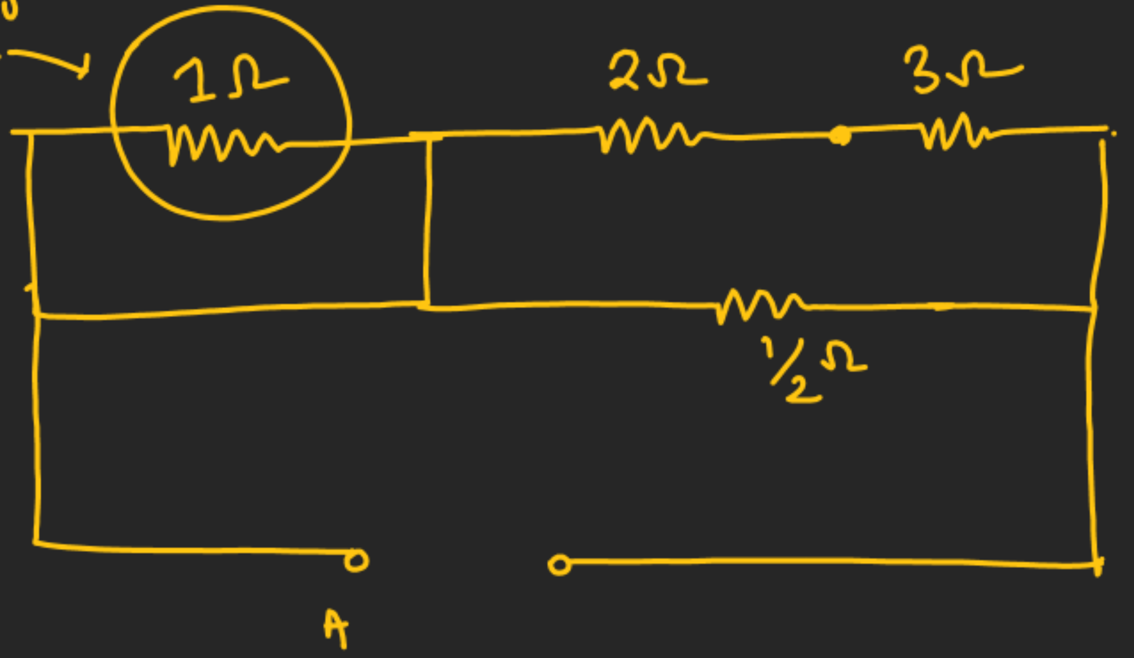
Maximum Power transfer theorem

CURRENT ELECTRICITY

Q-5

when S_1 and S_2 closed.

Shorted



$$(R_{eq})_1 = \frac{5 \times 1/2}{5 + 1/2} = \frac{5/2}{11/2}$$

$$= \frac{5}{11}$$

$$\frac{1}{(R_{eq})_2} = \frac{1}{2} + 1 + \frac{1}{3} + \frac{1}{6}$$

$$= \frac{3}{2} + \frac{3}{6}$$

$$\frac{1}{(R_{eq})_2} = \frac{3}{2} + \frac{1}{2} = 2$$

$$(R_{eq})_2 = \frac{1}{2}$$

When Voltage Source

$$\frac{Q_1}{Q_2} = \frac{(R_{eq})_2}{(R_{eq})_1} = \frac{1}{2} \times \frac{11}{5} = \frac{11}{10}$$

$Q_1 > Q_2$

when Constant current apply

$$\frac{Q_1}{Q_2} = \frac{(R_{eq})_1}{(R_{eq})_2} = \frac{5 \times 2}{11} = \frac{10}{11}$$

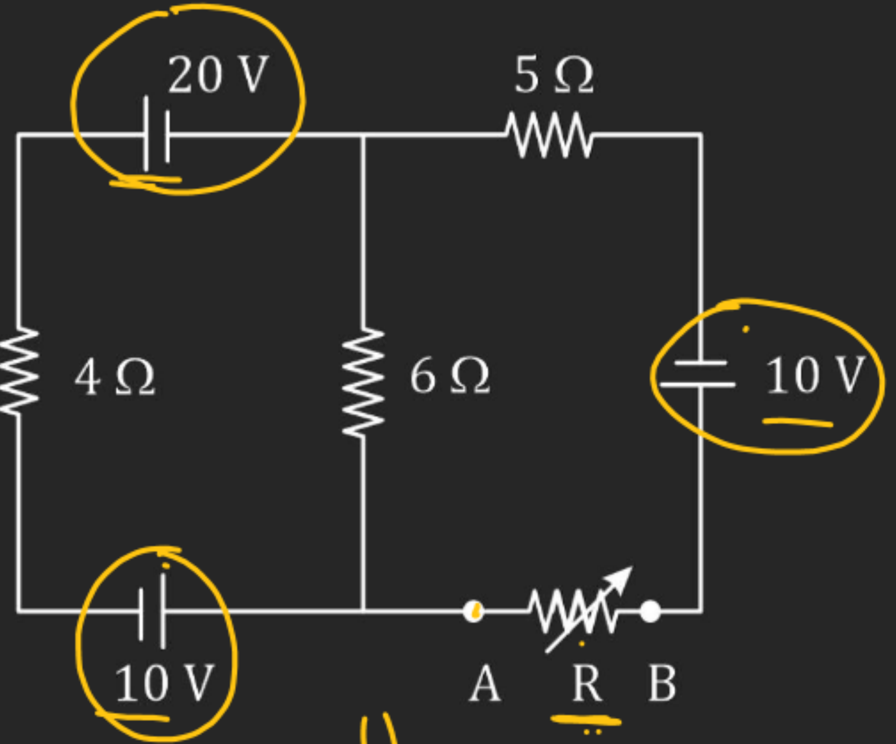
$Q_1 < Q_2$

$P = i^2 R \Rightarrow P \propto R \; (i = c)$

$P = \frac{V^2}{R}$

$P \propto \frac{1}{R} \Rightarrow V = C.$

Q.7 In the circuit shown in figure, find the value of resistance R at which the power transferred to this resistance will be maximum.



⇒ Trick Find (R_{eq}) across AB of the ckt.

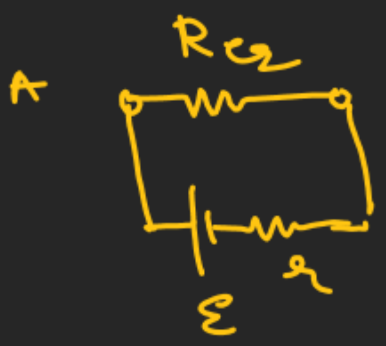
[for this Short the battery i.e replaced the battery by zero resistance wire ⇐

$$(R_{eq})_{AB} = \left[\frac{(4\times6)}{4+6}\right] + 5$$

$$= \frac{24}{10} + 5$$

$$= \frac{12}{5} + 5 = \frac{12+25}{5} = \frac{37}{5}\,\Omega$$

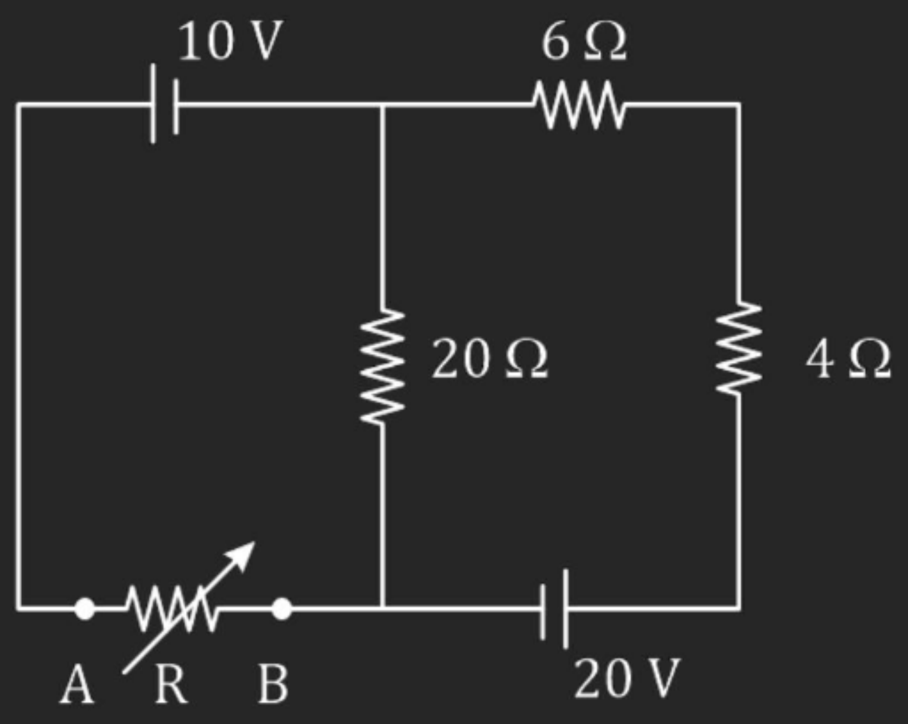
$(R_{eq})_{A-B} = ??$



→ For maximum $R = r$.

Q.8 In the circuit shown in figure, for what value of R will the power consumed by this resistance will be maximum.

H.W



Q.9 12 cells each having the same EMF are connected in series and are kept in a closed box. Some of the cells are wrongly connected. This battery is connected in series with an ammeter and two cells identical with the others. The current is $3\ \mathrm{A}$ when the cells and battery aid each other and is $2\ \mathrm{A}$ when the cells and battery oppose each other. How many cells in the battery are wrongly connected?

H.W

Q.10 In order to heat a liquid an electric heating coil is connected is to a cell of emf

H.W

$E = 12\ V$ and internal resistance $r = 1\Omega$. There are three options for selecting the resistance (R) of the heating coil. R can be chosen as $1\Omega, 2\Omega$ or $4\ \Omega$. The cell has a rating of $2000 mAh$ (milli Ampere hour) and it is to be used to heat the liquid till it expires. [The cell maintains constant emf till it lasts]

(a) Which value of R will you chose so that maximum heat (H_0) is transferred to the liquid before the cell expires? Calculate H_0.

(b) Which value of R will chose so that heat is transferred to the liquid at fastest possible rate? What percentage of H_0 (as obtained in (a)) is transferred to the liquid in this case by the time the cell expires?