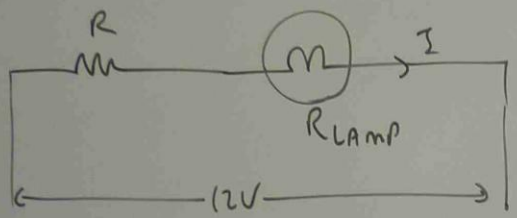
LAMPS AND RESISTOR CIRCUITS

(1) AN INDICATOR LAMP RATED AT 6V, 0.6 W IS REQUIRED TO SHOW WHEN A 12V SUPPLY IS SWITCHED ON. CALCULATE THE RESISTANCE AND POWER RATING OF A SUITABLE DROPPER RESISTOR.

LAMP 6V, 0.6W



$R = R_T - R_{LAMP}$

$= 120 - 60$

$= 60\Omega$

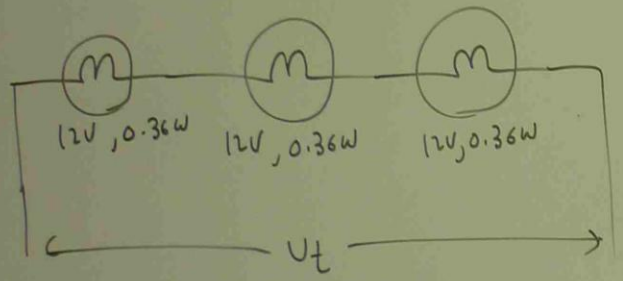
$$I \text{ (PASSING THROUGH LAMP)} = \frac{P}{V} = \frac{0.6\,W}{6V} = 0.1\,Amp$$

$$R_T = \frac{Vt}{I_t} = \frac{12}{0.1} = 120\,\Omega$$

$$P = \frac{V^2}{R_{LAMP}} \longrightarrow R_{LAMP} = \frac{V^2}{P} = \frac{6^2}{0.6} = \frac{36}{0.6} = 60\Omega$$

LAMPS IN SERIES AND PARALLEL

(2) THREE FILAMENT LAMP INDICATORS ARE EACH RATED AT 12V, 0.36W. IF THEY ARE CONNECTED IN SERIES, WHAT SUPPLY VOLTAGE SHOULD BE USED? WHAT CIRCUIT CURRENT WILL FLOW AND WHAT TOTAL POWER WILL THE CIRCUIT DISSIPATE?

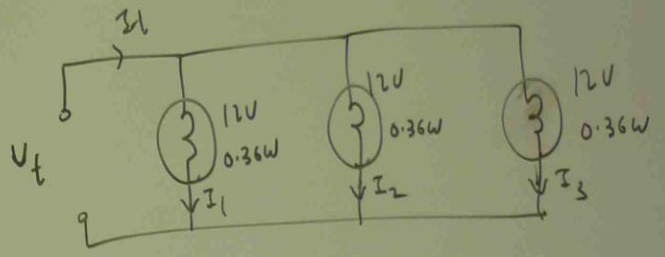


$$P_T = 0.36 + 0.36 + 0.36 = 1.08\ W$$

$$V_t = 12 + 12 + 12 = 36\ V$$

$$I_t = \frac{P_T}{V_T} = \frac{1.08}{36} = 0.03\ A\ (OR)\ 30mA$$

(3) THE SAME THREE 12V, 0.36W LAMPS ARE CONNECTED IN PARALLEL. AGAIN FIND THE SUPPLY VOLTAGE TO BE USED. THE CIRCUIT CURRENT AND TOTAL POWER DISSIPATED.



$$V_t = 12\ V$$

$$I_1 = I_2 = I_3 = \frac{P}{V} = \frac{0.36}{12} = 0.03\ A$$

$$I_t = I_1 + I_2 + I_3 = 0.03 + 0.03 + 0.03 = 0.09\ A$$

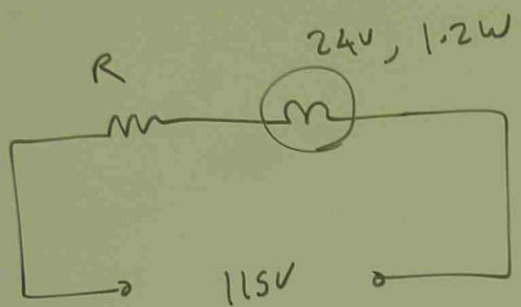
$$P_t = V_t \times I_t = 12 \times 0.09 = 1.08\ W$$

EXERCISE

(1) A 24 V, 1.2W INDICATOR LAMP IS TO BE USED FROM A 115 V SUPPLY AS SHOWN IN FIGURE.

A SUITABLE BALLAST RESISTOR VALUE IS

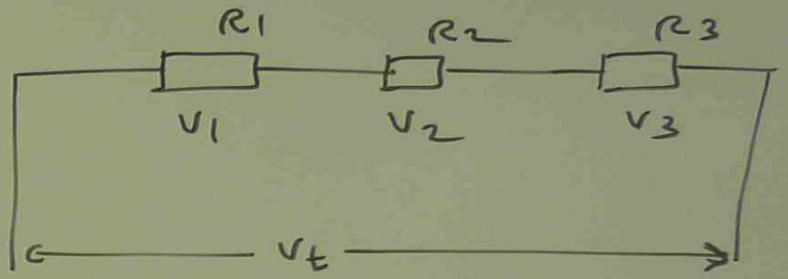
(a) 2300 Ω (b) 480 Ω (c) 91 Ω (d) 1820 Ω



(2) A SUITABLE POWER RATING FOR THE ABOVE PROBLEM IS

(a) 5W (b) 10W (c) 2W (d) 7.27W

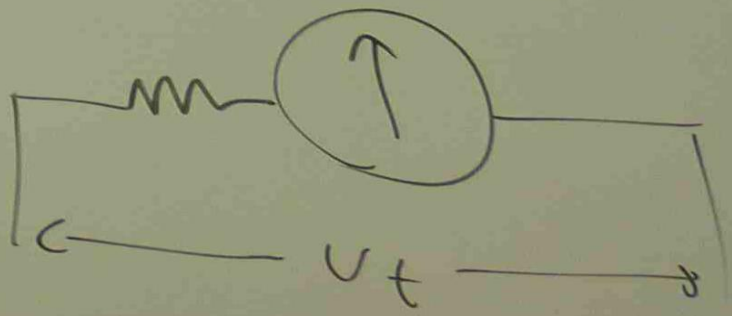
THE POTENTIAL DIVIDER



$$V_1 = V_t \times \frac{R_1}{R_1 + R_2 + R_3}$$

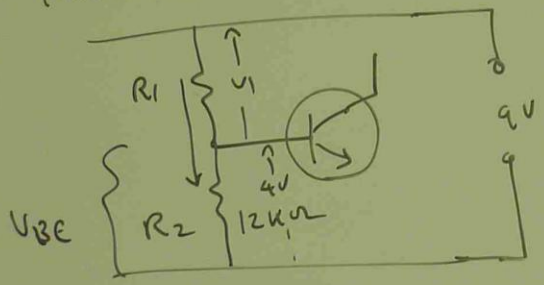
$$V_2 = V_t \times \frac{R_2}{R_1 + R_2 + R_3}$$

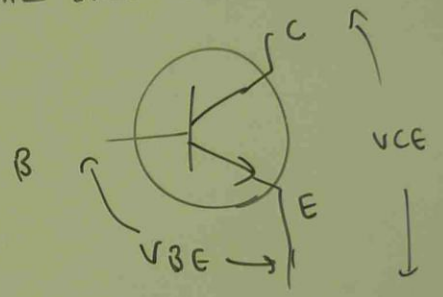
$$V_3 = V_t \times \frac{R_3}{R_1 + R_2 + R_3}$$

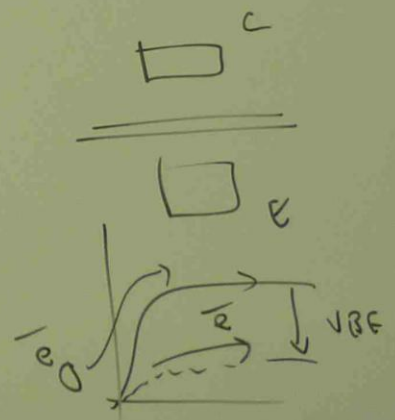


pb (1)

A CIRCUIT IS FED WITH A 9V SUPPLY. BUT A 4V POTENTIAL TO GROUND IS REQUIRED AT THE BASE OF A PARTICULAR TRANSISTOR. IF THIS VOLTAGE IS TO BE DERIVED FROM THE SUPPLY WITH A 12 KΩ RESISTOR CONNECTED TO GROUND, CALCULATE THE VALUE OF THE SECOND RESISTOR FORMING THE NECESSARY POTENTIAL DIVIDER







$$V_{R_1} + V_{R_2} = V_T = 9V$$

$$V_{R_1} = V_T - V_{R_2}$$

$$= 9 - 4 = 5V$$

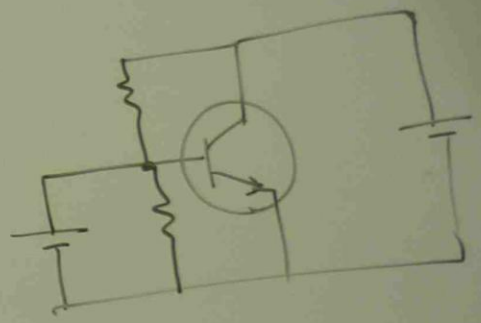
$$R_1 = \frac{V_{R1}}{I_{R_1}}$$

$$I_{R_2} = \frac{V_2}{R_2}$$

$$= \frac{4}{12\,k\Omega}$$

$$= 0.333\ mA$$

$$I_{R_2} = I_{R_1} = 0.333\ mA$$



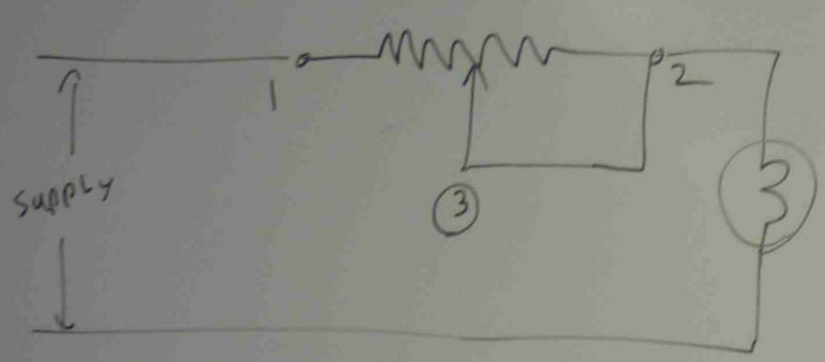
$$R_1 = \frac{V_{R_1}}{I_{R_1}}$$

$$= \frac{5}{0.333 \times 10^{-3}}$$

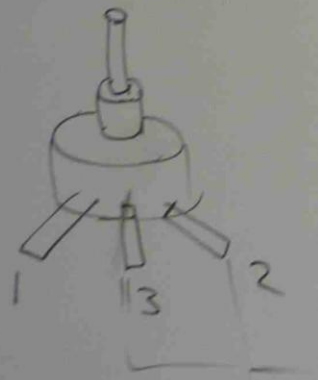
$$= 15 \times 10^3\ \Omega$$

$$= 15\ k\Omega$$

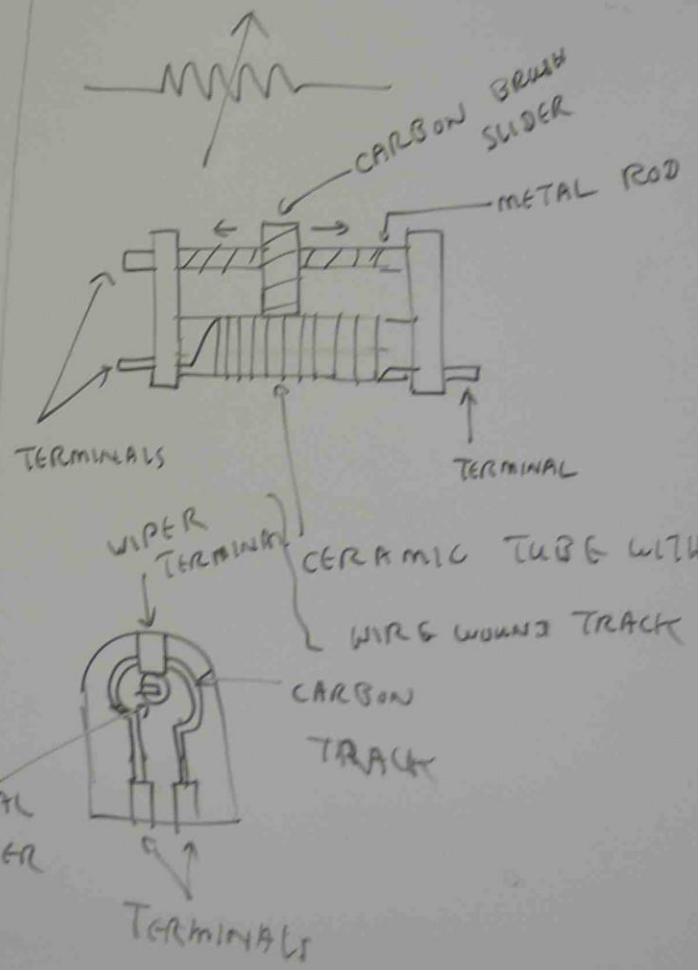
VARIABLE RESISTORS



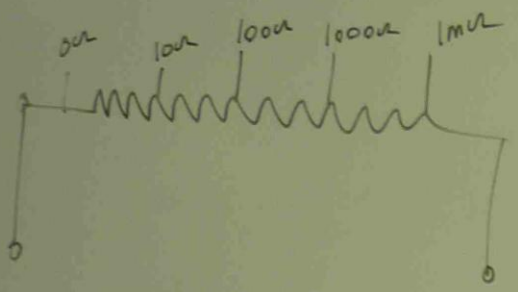
ELECTRONIC POTENTIO METER



RHEOSTAT

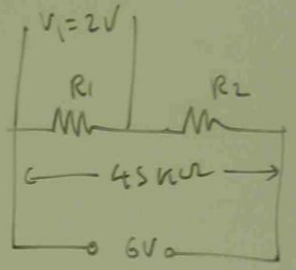


NON LINEAR POTENTIO METER



pb

A LINEAR POTENTIAL DIVIDER POT HAS A TOTAL RESISTANCE 45KΩ AND IS CONNECTED ACROSS A 6V SUPPLY. IF A VOLTAGE OF 2V IS REQUIRED WITH ONE END CONNECTED TO THE POSITIVE SIDE OF THE SUPPLY, WHAT WILL BE THE RESISTANCE VALUES ON EITHER SIDE OF THE TAPPING AND THROUGH WHAT FRACTION OF ITS TOTAL POSSIBLE MOVEMENT FROM THE POSITIVE END WILL THE SLIDER HAVE TO BE MOVED?



$$V_1 = V_t \times \frac{R_1}{R_1 + R_2}$$

$$2 = 6 \times \frac{R_1}{45K}$$

$$R_1 = 45 \times \frac{2}{6} = 18K\Omega$$

$$R_2 = R_t - R_1 = 45 - 18 = 27K\Omega$$

EXERCISE

(1) TWO RESISTORS BOTH OF 56 KΩ ARE CONNECTED ACROSS A 9V SUPPLY. THE VOLTAGE ACROSS ONE RESISTOR WILL BE

(a) 3V (b) 18V (c) 6V (d) 4.5V

(2) A 22 KΩ AND A 68 KΩ RESISTOR FORM A POTENTIAL DIVIDER ACROSS A 15V SUPPLY. THE VOLTAGE ACROSS THE 22 KΩ RESISTOR WILL BE

(a) 3.67V (b) 36.7V (c) 11.3V (d) 4.71V

(3) A POTENTIAL DIVIDER CONSISTS OF 120 KΩ AND 180 KΩ RESISTORS. IF THE VOLTAGE ACROSS 120 KΩ RESISTOR IS 3V, THE SUPPLY VOLTAGE IS (a) 5V (b) 7.5V (c) 6V (d) 12V

(4) THE MAXIMUM PERMISSIBLE CURRENT DRAIN ON A 12V SUPPLY IS 120 μA, AN OUT PUT OF 2.16V IS REQUIRED, A SUITABLE DIVIDER COULD BE MADE OF RESISTORS WITH VALUES OF

(a) 18 KΩ & 47 KΩ (b) 82 KΩ & 12 KΩ (c) 33 KΩ & 120 KΩ (d) 82 KΩ & 18 KΩ