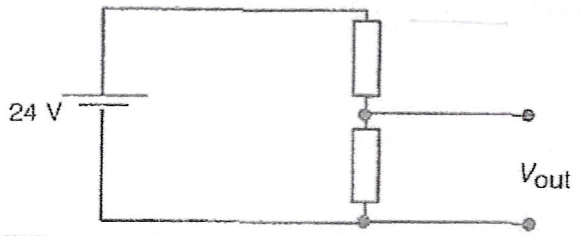
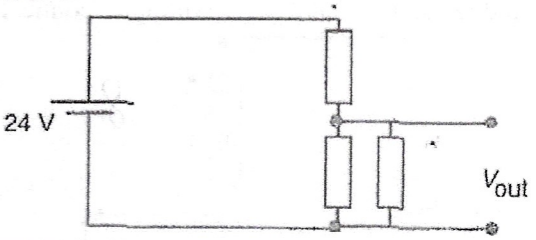
Question 333 to 338

Find V_{out} for these circuits. All the resistors have the same value.

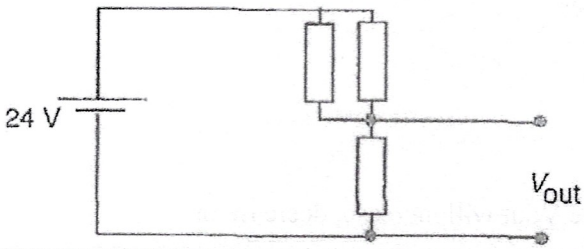
333



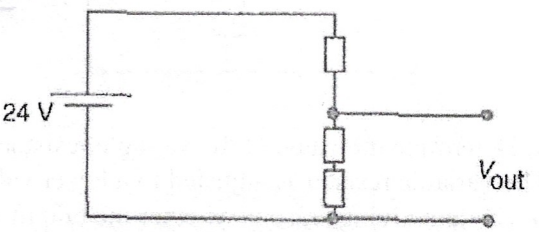
334



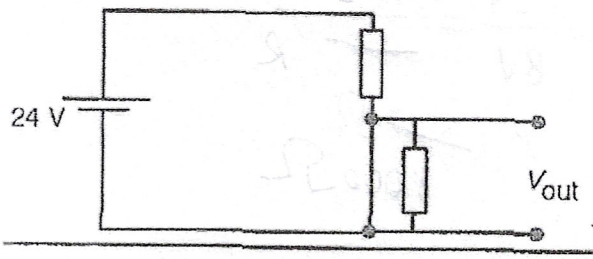
335



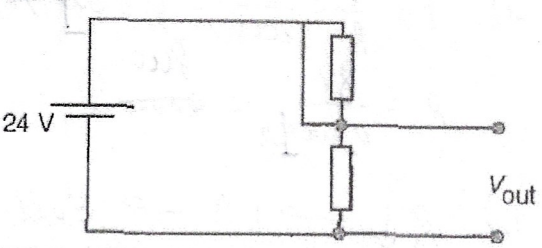
336



337



338



333 12 V

334 8 V

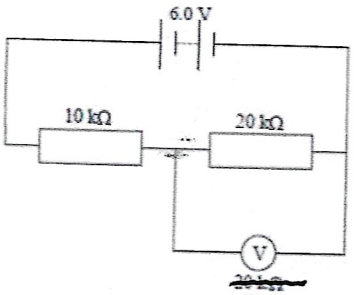
335 16 V

336 16 V

337 0 V

338 24 V

In the circuit shown below, the battery has an e.m.f. of 6.0 V.
The reading on the voltmeter is - ? Ignore value of the resistance for voltmeter. Assume that it is infinite.



Ratio of the resistors $\frac{10k\Omega}{20k\Omega} = \frac{1}{2}$

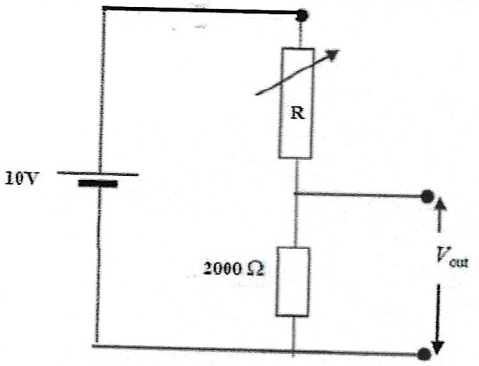
6 V in ratio 1:2 = 2V : 4V

Voltage across 20kΩ 4V

or

$V_{out} = \frac{R_{out}}{R_{total}} V_{in} = \frac{20}{30} \times 6 = 4V$

A 10 V power supply is connected in series with a variable resistor and a standard fixed resistor of 2000 Ω. A voltmeter connected across the variable resistor reads 8 V



a. Determine the value of the variable resistor
The variable resistor is adjusted to a lower value.
b. Explain giving reasons whether the output voltage Vout will increase, decrease or stay the same.

a) $V_{2000} = 10 - 8 = 2V$

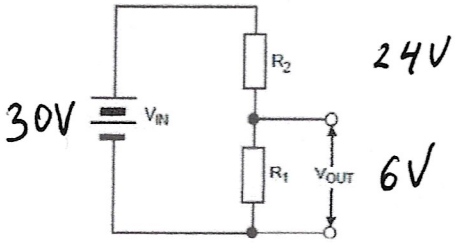
$I = \frac{V}{R} = \frac{2}{2000} = 0.001A$ $\quad R = \frac{8V}{0.001A} = 8000\Omega$

$\frac{8V}{2V} = \frac{R}{2000}$

$R = 8000\Omega$

b) $R \downarrow \longrightarrow I \uparrow \longrightarrow V_{out} \uparrow$

Voltage divider circuit shown in Figure below, where $V_{IN} = 30$ V.



1. If $R_1 = 5$ kΩ what is the value of the resistance R_2 that is required to get $V_{OUT} = 6$ V?

$\frac{24}{6} = \frac{R_2}{5000}$ $R_2 = 20 k\Omega$

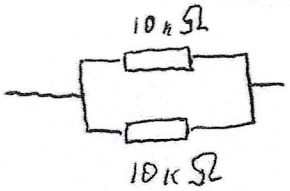
2. If R_2 is 15 kΩ, calculate the current and V_{OUT}.

$R_t = R_1 + R_2 = 20 k\Omega$

$I = \frac{V}{R_t} = \frac{30}{20000} = 0.0015 A$

$V_{out} = 0.0015 \times 5000$
$= 7.5 V$

3. You wire up the circuit of Figure above but only have 10 kΩ resistors available. Explain how you construct the $R_1 = 5$ kΩ resistor using only 10 kΩ resistors, and include a **sketch** to show the connections between the appropriate number of 10 kΩ resistors.



$\frac{1}{R} = \frac{1}{10} + \frac{1}{10} = \frac{2}{10}$

$R = 5$