# Quiz 6b

Note Title 31/05/2011

An electric lawnmower uses 130 W of power when cutting medium height grass (see figure 1). If battery has an EMF of 15V and the resistance of the motor is 1.2 Ω, find:

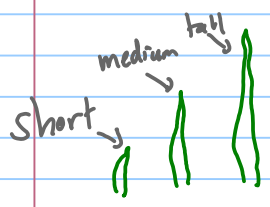


Figure 1: Grasses of varying heights

a.) The initial current drawn by the motor.

b.) The back EMF generated while cutting the grass.

**Bonus** If the lawnmower runs into a patch of tall thick grass what will happen to:

i) The current drawn by the motor?
ii) The back EMF generated?

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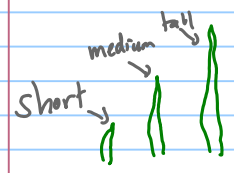


Figure 1: Grasses of varying heights

a) The initial current drawn by the motor.

$V_{Back} = 0 \quad \therefore \mathcal{E} = Ir$ ✓ $\quad I = \frac{\mathcal{E}}{r} = \frac{15V}{1.2\Omega}$

$= 12.5\,A$ ✓

b.) The back EMF generated while cutting the grass.

$P = I^2 r \qquad I = \sqrt{\frac{P}{r}} = \sqrt{\frac{130W}{1.2\Omega}} = 10.4\,A$ ✓

$V_{Back} = \mathcal{E} - Ir$ ✓ $= 15V - (10.4A)(1.2\Omega)$

$= 2.5\,V$ ✓

Bonus

If the lawnmower runs into a patch of tall thick grass what will happen to:

i) The current drawn by the motor?

Thicker grass takes more energy to cut $\therefore P\uparrow$

Since $\underset{\uparrow}{P} = \underset{\uparrow}{I}^2 \underset{\text{const.}}{r}$ $\quad \therefore$ current increases

ii) The back EMF generated?

Since $\underset{\downarrow}{V_{Back}} = \underset{\text{const.}}{\mathcal{E}} - \underset{\uparrow}{I}\underset{\text{const.}}{r}$ $\quad \therefore V_{Back}$ decreases

Meta-Bonus

This makes sense because when the lawnmower cuts thicker grass the motor turns _____.
(slower / faster)