Higher EMF and Internal Resistance Answers

1. a) **EMF** – Energy given to each coulomb of charge **as it passes through the source**.

b) **TPD** – Energy given to each coulomb of charge.

c) **Lost Volts** – The voltage dropped across the internal resistance in a supply.

d) $E = V + Ir$
$E = IR + Ir$
$E = I(R+r)$

2. a) $I = 0.2A$.

b) $V = 4.8V$.

c) Lost Volts = 3.2V.

d) They add up to the Emf.

3. a) A current now flows which drops some of the voltage across the internal resistance.

b) $R = 28\Omega$.

c) $r = 8\Omega$.

4. a) EMF = 2V.

b) $r = 6\Omega$.

c) $R = 4\Omega$.

d) $I = 0.2A$.

5. a) Graph which cuts the Y–axis and the X-axis. **(Negative gradient!!!)**

b) i) EMF = 7.5V.

ii) $r = 25\Omega$.

c) $I_{sc} = 300mA$.

6. a) i) I = 0.25A.
ii) V = 5.5V.
iii) Lost Volts = 0.5V.

b) Total Resistance has decreased.
Current will increase.
Lost Volts will increase as r is constant. (Lost Volts = Ir)

7. a) The EMF is the energy supplied to each coulomb of charge as it passes through the source.

b) i) I = 5A.
ii) V = 1.6V.
iii) r = 0.08Ω.

c) The rate of heat energy supplied increases from 8W to 11.1W.
Another resistor in parallel reduces the resistance and increases the current.
Use **E = I (R+r)** to find the **current** and then use **P =** $\mathbf{I^2R}$ to calculate the new power.

8. a) EMF = 12V means that 12 Joules of energy are given to each coulomb of charge as they pass through the source.

b) i) R = 3Ω.
ii) V = 11.8V. Using **E = I (R+r)** to find the **current** and then use **V = IR**.

c) i) R_T = 0.166Ω.
ii) I = 72.3A.

9. a) i) V = 1.2V.
ii) Lost Volts = 0.3V.

b) i) V = 4V.
ii) r = 0.5Ω.

10. a) Lost volts = 0.10V.

b) r = 2.5Ω.

c) i) R = 47.5Ω.

ii) Resistance R decreasing increases the current I.
The lost volts will increase as lost volts = Ir.
As the lost volts increases the V_{tpd} decreases.

11. a) i) EMF = 4.8V.

ii) r = 2Ω.

b) i) I_{sc} = 240A.

ii) P = 55.5W.

12. a) EMF = 6V. This means that the battery will supply 6J of energy for every coulomb of charge passing through the source.

b) i) I = 0.2A then calculate to find R_2 = 8Ω.

ii) V = 5.6V.

c) When the switch is closed the external resistance decreases.

The current flowing in the circuit will increase.

This increases the lost volts and so the terminal pd will decrease.

13. a) i) R = 13Ω.

ii) Current through the circuit will give lost volts across the internal resistance.

This will reduce the reading on the voltmeter which now reads the V_{tpd}.

b) External resistance in parallel gives a lower resistance.

The current and also the lost volts will increase.

This will then reduce the reading on the voltmeter which is the V_{tpd}.

14. a) i) R + r = 4Ω.

ii) I = 0.75A.

iii) P = 2W.

b) If the power output is less the current would be less.

From $\mathbf{P = I^2R}$,the load resistance R is constant.

15. a) EMF = 12V.

b) i) I = 1.2A.

ii) R = 8Ω.

c) Graph below.