Exercise 12
EMF and Internal Resistance

1 B
2 B
3 E
4 B
5 a emf =12V
The emf is measured in open circuit ie switch open –no current

1

b I $emf = tpd + lost\_volts$

$lost\_volt = 12 - 9.6$

$lost\_volt = 2.4$

$I = \frac{V}{r}$

$I = \frac{2.4}{2}$

$I = 1.2A$

2

ii $R = \frac{V}{I}$

$use - tpd$

$R = \frac{9.6}{1.2}$

$R = 8\Omega$

1

c Two 8Ω resistors in parallel = 4Ω

$R_{total} = R + r$

$R_{total} = 4 + 2$

$R_{total} = 6\Omega$

$I = \frac{V}{R}$

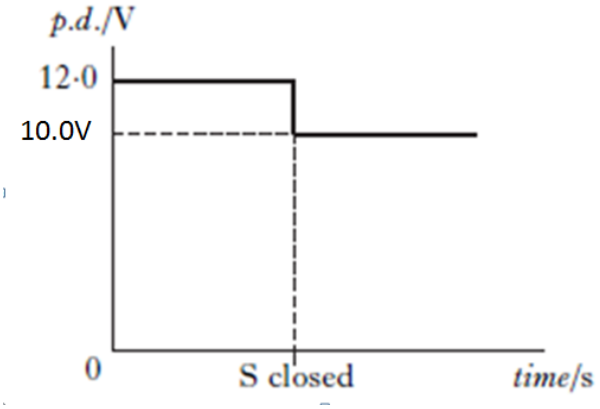
$I = \frac{12}{6}$

$I = 2.0A$

$tpd = I \times R$

$tpd = 2.0 \times 5$

$tpd = 10V$



2

6 a i $R_{total} = R + r + r$

$R_{total} = 3.6 + 0.2 + 0.2$

$R_{total} = 4\Omega$

ii $I = \frac{V}{R}$

$I = \frac{1.5+1.5}{4}$

$I = 0.75A$

ii $P = I^2 \times R$

$P = 0.75 \times 0.75 \times 3.6$

$P = 2.0W$

b As the internal resistance of the cells increases → total resistance increases →current falls→ 1^2R falls → Power falls

7 a i An emf of 10V means that the cell gives esch coulomb of charge 10J of energy
10V=10J/C

2

ii $emf = tpd + lost\_volts$

$10.0 = 7.50 + lost\_volts$

$lost\_volt = 10.0 - 7.50$

$lost\_volt = 2.50V$

$R = \frac{V}{I}$

$R = \frac{2.50}{1.25}$

$R = 2.00\Omega$

3b

b i Voltmeter reading decreased since:
Parallel combination reduces external resistance R → total resistance decreases → current falls → Ir across load falls
Or
The potential division of the emf will chance in proportion th ethe size of the resistors. Load now smaller taking a smaller share of emf

2

ii

$$R_{total} = \frac{V}{I}$$

$$R_{total} = \frac{6.0}{2.0}$$

$$R_{total} = 2.0\Omega$$

$$\frac{1}{R_t} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$\frac{1}{2.0} = \frac{1}{6.0} + \frac{1}{R_2}$$

$$\frac{1}{2.0} - \frac{1}{6.0} = \frac{1}{R_2}$$

$$R_2 = 3\Omega$$

3

8 a I

$$emf = tpd + lost\_volts$$

$$emf = IR + lost\_volts$$

$$10 = 3 \times 1.5 + lost\_volts$$

$$10 - 5.5 = IR + lost\_volts$$

$$lost\_volts = 5.5V$$

ii

$$r = \frac{lost\_volts}{curremt}$$

$$r = \frac{5.5}{3}$$

$$r = \frac{lost\_volts}{curremt}$$

$$r = 1.8\Omega$$

b

As R increases the total current I increases → the lost volts Ir will also decrease. 2

30