The Real Cell Problem Page 1 of 2

AS Physics

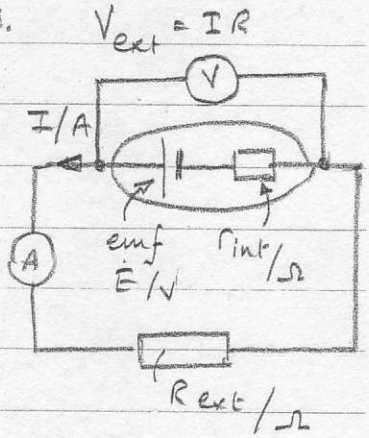
Dear Real Cell, I have this problem with my partner Voltmeter ...

1. A cell with emf 1.50 V, and internal resistance 0.8 Ω is connected to a 6 Ω external resistance. What current flows? (3)

2. A cell, emf 1200 mV, is connected to a 4 Ω resistor, and a 280 mA current flows. What is the cell's internal resistance? (3)

3. A cell has emf of 1.60 V, and internal resistance 0.4 Ω. What external resistance must be connected to take a current of 750 mA? (3)

4. A voltmeter is connected across a cell and reads 1280 mV. The meter reading drops by 65 mV when the cell is connected to an 8 Ω resistor. What is the cell's internal resistance? (4)



5. A cell has an emf of 1560 mV. A voltmeter connected across the cell reads 1425 mV when a current of 350 mA is taken from the cell.

(a) Why has the cell pd decreased? Where have the "lost volts" gone? (

(b) What is the cell's internal resistance? (3)

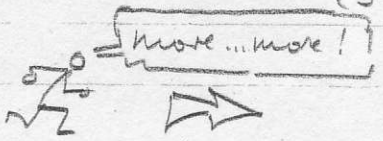
6. You have a cell with emf 1650 mV. You want it to deliver 1.35 A current without the cell pd falling below 1300 mV. What is the maximum internal resistance of the cell? (3

7. A student has two cells, each with emf 1.60 V and 0.6 Ω int. resistan

(a) Draw diagrams to show them connected in (i) Series, (ii) in parallel. Calculate the emf and internal resistance of each combination. (6)

(b) The student connects 1 cell to a 25 Ω resistor. What current flows (

(c) The student thinks, "Hmm.... if I use two cells in series I'll get twice the current." What current does the student get? Is it double? Can you explain your answer? (5)



Real Cell Problems

8. A student connects a variable resistor to a cell, and measures cell p.d. and current. She gets these results...

Current / A	0.96	0.38	1.20	0.16	0.64	0.78
cell p.d. / V	0.92	1.32	0.73	1.50	1.16	1.02

(a) draw a diagram of the circuit she used (3)

(b) Plot the graph of cell p.d. (y axis) against current (x axis) (6)

(c) Use the graph to find the cell emf and internal resistance (3)

TZN NOV '04

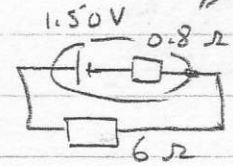
Q... 1/3 2/3 3/3 4/4 5/5 6/3 7/14 8/12 Total 47

TZN NOV '04

Real Cell Problem Page — Answers

AS Physics

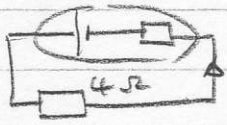
1. Hmm... diagram?



$E = I(R+r)$ ①

$I = E/R_T = 1.5/6.0+0.8 = 0.22$ A ① ① 2 s.f.!! /3

2.



$E = IR + Ir$ ①

$Ir = E - IR$

$r = \frac{E-IR}{I} = \frac{1.200-(0.28\times4)}{0.28}$ ①

$= 0.286\ \Omega$ ①

or....

$1.200 = (0.28\times4) + (0.28\times r)$

$= 1.12 + (0.28r)$

$r = 0.080/0.28$

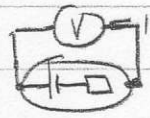
$= 0.286\ \Omega$

3. $E = IR + Ir$ ①

$1.60 = (0.75\times R) + (0.75\times 0.4)$ ① $= 0.75R + 0.3$

So $R = 1.60 - 0.3/0.75 = 1.73$ ① Ω /3

4.

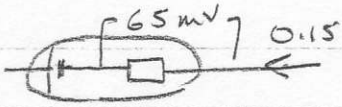


1st bit... find the current

So $I = V/R = \frac{1.215}{8}$ ① $= 0.152$ ① A

1280 − 65 = 1215 mV

2nd bit... now find r

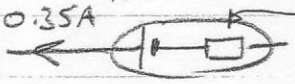


$r = \frac{V}{I} = \frac{65\times10^{-3}\ V}{0.152}$ ① $= 0.428\ \Omega$ ① /4

5. (a) Cell pd decreased because a p.d. across the internal resistance ① to drive current through the cell chemicals ① /2

(b) $E = IR + Ir$ ... the quick way!! Think!

So $r = \frac{V}{I} = \frac{135\times10^{-3}}{0.35}$ ① $= 0.39\ \Omega$ ①



① /3

/5

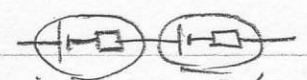
6. At $I = 1.35$ A cell p.d. = 1.300 V.

So "lost" p.d. across int. resistance = 1.650 − 1.300 = 0.350 V ①

So $r_{int} = V/I = \frac{0.35}{1.35}$ ① $= 0.26$ ① Ω /3

(or... $E = IR + Ir$ .... $1.65 = (1.35\times R) + (1.35\times r)$... long way round....)

7. (a) S ≡



$E = 3.2$ V $r = 1.2\ \Omega$ P ≡

$E = 1.6$ V $r = 0.3\ \Omega$

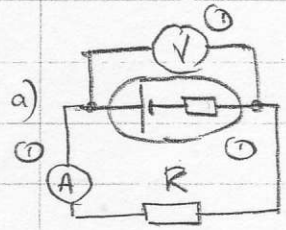
(b) $E = I(R+r)$ So $I = E/R+r = 1.6/25.6 = 0.0625$ A (3)

(c) 2 cells in series.... $I = E/R+r$ ① $= (2\times1.6)/(25+2\times0.6)$ ① $= 0.122$ A ①

Current is a bit less than double ① ... because emf is doubled... but an extra ① internal resistance

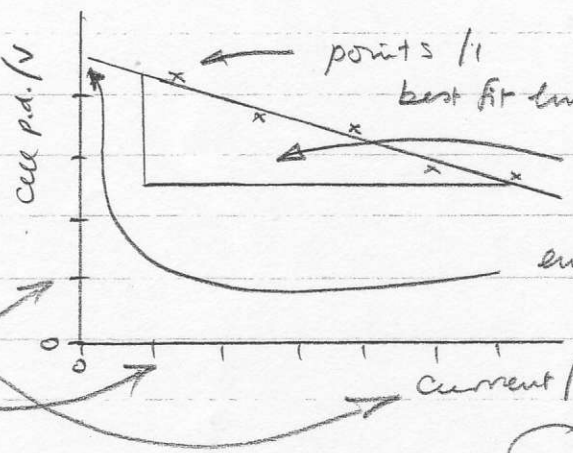
Q.7 /14

8. a)



① ① ① ①

(b)



points /1

best fit line /1

gradient /1

r = slope − 0.72 − 0.76 Ω

emf = intercept = 1.60 − 1.65 V ①

labels /2

Scales /2

graph /6

emf + r /3

all /47

TLN Dec '04