# Internal resistance practice question answers

**1.** As $I$ rises terminal voltage of A falls **(1)**
due to internal resistance of A/ "lost volts" **(1)** 2

(i) 'Lost volts' $V = Ir = 10.0 \times 0.40 = 4.0$ V **(1)**

$V_B = 28.0 - V_A = 28.0 - (20.0 + 4.0) = 12.0$ **(1)** 2

(ii) $P = VI = 28.0 \times 10.0 = 280$ *W*
Power supplied = 280 *W* **(1)** 1

(iii) $P = I^2r = 10.0^2 \times 0.40 = 40$ *W*
Power wasted =40 *W* **(1)** 1

(iv) Eff = $\frac{280}{320}$ = 0.88 = 88% **(1)** 2

Advantage = Renewable supply/last longer **(1)**

Disadvantage =Depends on illumination/high internal resistance/large array needed for power required **(1)** 2

**[10]**

**2.** Explanation: .

$I = E/r + R$ **(1)** 1

Appropriate formula for cell E9:

C9 * D9 OR $RI$ OR 1 Ω × 4 A **(1)** 1

Appropriate formula for cell F 11

D11 *E11 OR $VI$ OR 3A × 6V OR C11 * D11 *D11
OR $RI^2$ OR 2 Ω × (3 A)$^2$ **(1)** 1

Short circuit current:

6 A **(1)** 1

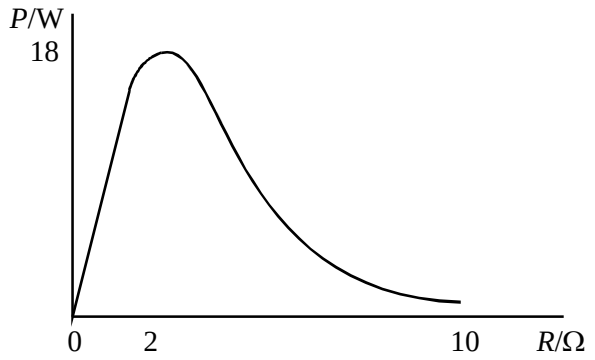
Explanation:

$r$ and $R$ in series → potential division **(1)** 1

as $R$ ↑, $r$ constant → $R$ has greater share of 12 V **(1)** 1

OR other valid argument

Sketch graph of power against resistance:




18 **(1)**
2 **(1)**
Shape including asymptote **(1)** 3

Comment:

Maximum when $R = r$ **(1)**

in accordance with maximum power theorem **(1)**

OR $P \rightarrow 0$ as $R \rightarrow \infty$ **(1)** Max 2

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**3.** Meaning of m

$\times 10^{-3}$ **(1)** 1

Calculation of resistance for reading 3

$R = V/I$ OR $R = 74 \times 10^{3}$ V $\div$ 150 $\times 10^{-9}$ A [ecf for milli] **(1)**

$R = 4.9 \times 10^{5}\ \Omega$ **(1)** 2

Calculation of power for reading 4

$P = I \times V$ OR $P = \frac{V^2}{R}$ OR $P = I^2R$ **(1)**

$= 210 \times 10^{-9}$ A $\times 57 \times 10^{-3}$ **(1)** 2

$= 1.2 \times 10^{-8}$ W

Plotting points on graph

Two correct points **(1)**
Third correct point **(1)**
Best fit straight line for points as they appear on student's graph **(1)** 3

Predicting short-circuit current

Correct from graph, e.g 450 nA **(1)** 1

Suggested e.m.f

Correct from graph, or table, 110 mV **(1)** 1

Explanation of why voltage falls

Cell has internal resistance/ "lost volts" **(1)**

"Lost volts" = $Ir$, so lost volts increase as current increases
OR
$V = E - Ir$, so $V$ decreases as $I$ increases **(1)** 2

**[12]**

**4.** Explanation of assumption that voltmeter does not affect values

Voltmeter has very high resistance/takes very small current **(1)** 1

Current through X

4.8 A ÷ 6 = 0.8 A

OR 48 V ÷ 60 Ω = 0.8A **(1)** 1

Value missing from E7

$P = IV$

$P$ = 4.4 A × 53 V = 233 W **(1)** 1

Description of appearance of lamp X as lamps switched on

Gets dimmer

from table, voltage decreasing / current in X decreasing / power per lamp decreasing **(1)**

So $P$ decreases **(1)** 3

Formula for cell C6

$I = \varepsilon / R_{tot}$ **(1)**

$I$ = 120 / (15 + B6) **(1)** 2

Effect of internal resistance on power

Power has a maximum value **(1)**

when external resistance = internal resistance **(1)** 2

**[10]**