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Engineering Science 2

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Science Coursework

Due date: April 6th 9:00 AM

Question One

A). $V = 12\text{V}$

$R = 8\Omega$

$$\text{Power} = \frac{V^2}{R} = \frac{12^2}{8} = 18\text{ W}$$

C).: There's maximum power when the load resistance equals the internal resistance, in this case 4Ω .

D). $R = 100\Omega$

$$\rho = 9.81 \times 10^{-8}$$

$$R = \frac{\rho L}{a}$$

$$d = 0.1\text{ mm}$$

$$a = A \cdot r^2 = A \cdot (0.05 \times 10^{-3})^2$$

$$r = \frac{d}{2}$$

$$a = 7.85 \times 10^{-9}$$

$$a \cdot R = \rho L = (7.85 \times 10^{-9}) \times 100 = (9.81 \times 10^{-8}) \cdot L$$

$$L = \frac{(7.85 \times 10^{-7})}{(9.81 \times 10^{-8})} = 8.01\text{ m}$$

E). $a \cdot L = \text{Volume}$ $a = 7.85 \times 10^{-9}$ $L = 8.01\text{ m}$
 $(7.85 \times 10^{-9}) \times 8.01 = 6.28 \times 10^{-8}\text{ m}^3$

F). density = $21.45 \times 10^3 \text{ Kg m}^{-3}$
 Cost = £10000 / per Kg.

density $\times$ Cost $\times$ Volume = Cost of Platinum used.

$$(6.28 \times 10^{-8}) \times 10000 = (6.28 \times 10^{-4}) \times (21.45 \times 10^3) = 13.49$$

£ 13.49

G). X = Thickness width = $3.5 \times 10^{-4} \text{ cm} = 3.5 \times 10^{-6} \text{ m}$
 $L = 0.75 \text{ m}$
 $R = 125 \Omega$ $A = 3.5 \times 10^{-6} \cdot X$
 $\rho = 9.81 \times 10^{-8}$

$$R = \frac{\rho L}{a} = a = \frac{\rho L}{R} = X = \frac{\rho L}{3.5 \times 10^{-6} \cdot R}$$

$$X = \frac{(9.81 \times 10^{-8}) \cdot 0.75}{(3.5 \times 10^{-6}) \cdot 125} = 1.68 \times 10^{-4} \text{ m}$$

H). density = 21.45×10^3
 Cost = £10000 per Kg
 Thickness = 1.68×10^{-4}
 Length = 0.75 m
 $a = 3.5 \times 10^{-6} \text{ m}$

$$(3.5 \times 10^{-6}) \times 0.75 = 2.62 \times 10^{-6}$$

$$(2.62 \times 10^{-6}) \times (1.68 \times 10^{-4}) = 4.4 \times 10^{-10}$$

$$(4.4 \times 10^{-10}) \times 10000 \times (21.45 \times 10^3)$$

$$= 0.09 = \text{£}0.09$$

I). $d = 7.4 \text{ mm} = 0.0074 \text{ m}$ $R = 3.3 \Omega$ $R = \frac{\rho L}{a}$
 $a = \pi \cdot r^2$
 $r = 0.0037 \text{ m}$
 $L = 1000 \text{ m}$

$$\frac{a \cdot R}{L} = \rho = 1.42 \times 10^{-7} \Omega$$

$$\rho = \frac{(4.30 \times 10^{-5}) \times 3.3}{1000}$$

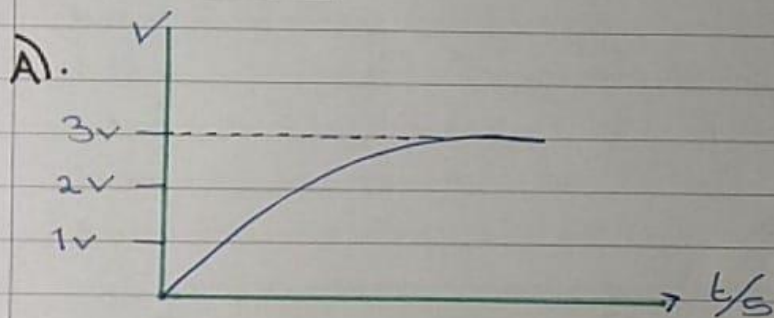
$a = 4.30 \times 10^{-5}$

J). Because the current will preferably go through the aluminium wires over the steel, this is exaggerated by there being 6 aluminium wires over the side steel wire.

K). There are 7 resistors in parallel.

$$\begin{aligned} \frac{1}{R_E} &= 6 \text{ aluminium} + 1 \text{ Steel} & V &= 75 \text{ V} \\ &= \frac{1}{1.1} + \frac{1}{1.1} + \frac{1}{1.1} + \frac{1}{1.1} + \frac{1}{1.1} + \frac{1}{1.1} + \frac{1}{3.3} = 5.75 \\ &= \frac{1}{5.75} = 0.17 & P &= \frac{V^2}{R} = \frac{75^2}{0.17} = 33088.23 \text{ W} \end{aligned}$$

Question Two



B). Since there's movement, when the plate is further away the potential difference decreases as is the opposite affect for when the plate is closer. Therefore the signal depends on the proximity of the plate.

C). $Q = ?$ $C = \frac{Q}{V} \Rightarrow Q = CV$

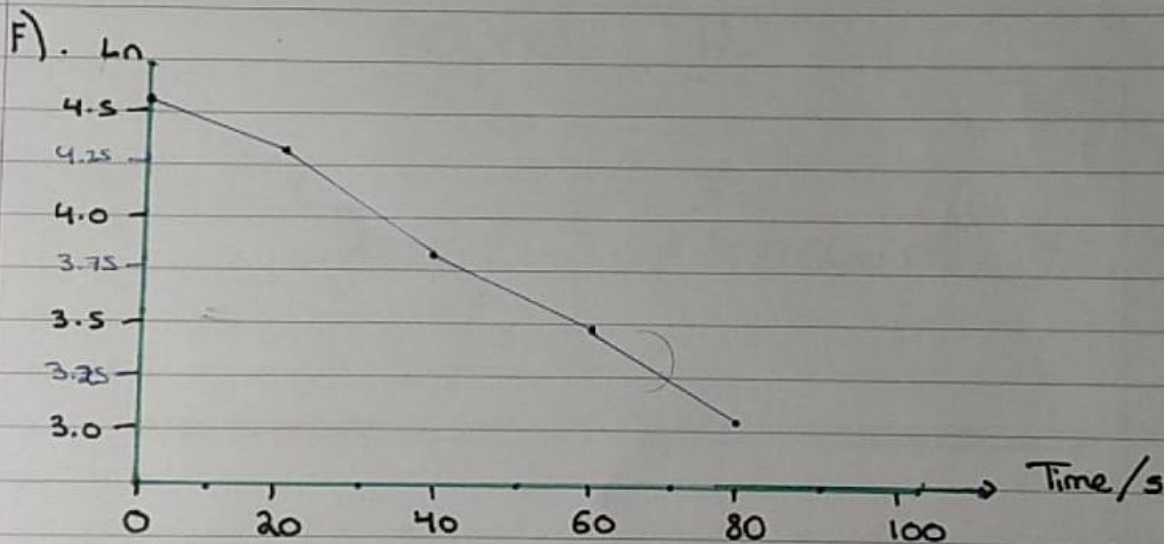
$$C = 0.22 \text{ F} \quad V = 95 \times 10^{-3} \quad Q = 0.22 \times (95 \times 10^{-3}) = 0.02$$

$$Q = 0.02 \text{ coulombs.}$$

D).: Since this particular voltmeter is not updating over time this gives the impression that it is faulty.

E).

Time/s	Voltage/mV	Ln	
0	95	4.55	
20	67	4.20	
40	46	3.82	$\ln(46) = 3.82$
60	33	3.49	$\ln(33) = 3.49$
80	22	3.09	$\ln(22) = 3.09$



G). ??

H). R_t Time Constant. Full to 37%.

$$e = 0.22 \text{ F} \quad 95 \times 0.37 = 35.15 \text{ mV}$$

$$\ln(35.15) = 3.56 \quad \text{time on graph at } \ln(3.56) = 54 \text{ s}$$

$$\text{time} = 54 \text{ s} \quad R = \frac{\text{time}}{C} = \frac{54}{0.22} = 245.45 \text{ } \Omega$$

There is no There no

Couldn't Get my head
round it

Sorry Arnaud.
