Electrical Energy and Power Calculations Booklet   Name _____

These are your tools. Learn them, learn how to use them.

charge flow = current x time	$Q = I\,t$
potential difference = current x resistance	$V = I\,R$
power = potential difference x current	$P = V\,I$
power = (current)^2 x resistance	$P = I^2\,R$
energy transferred = power x time	$E = P\,t$
energy transferred = charge flow x potential difference	$E = Q\,V$

charge	time	potential difference	current	power	energy	resistance
Q	t	V	I	P	E	R
coulombs	seconds	volts	amperes	watts	Joules	ohms
C	s	V	A	W	J	Ω
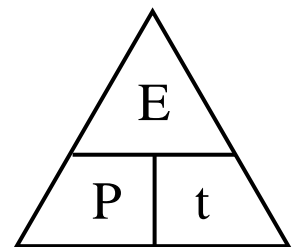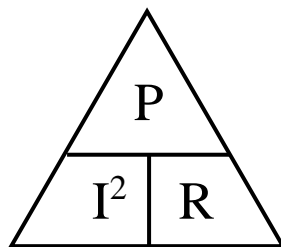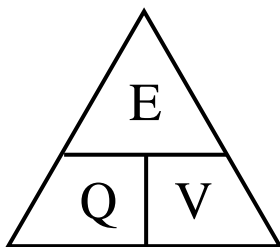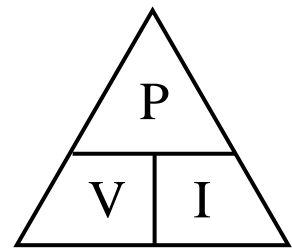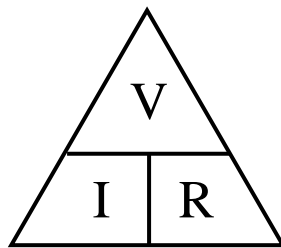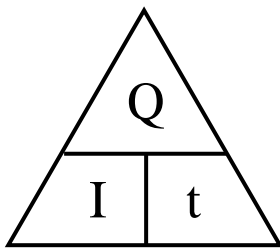
To solve problems, follow the procedure below.

- Identify the information you have and what you have been asked to calculate.
  Use a table like the one below and write in the values given.
  Add a question mark for the value to be calculated.

Q	t	V	I	P	E	R

- Work out which equation is needed to carry out the calculation.
- Write down the equation using symbols.
- Rearrange the equation if needed so the value to be calculated is the subject.
- Write out the equation again with values substituted for the numbers.
- Use a calculator to work out the answer.
- Write the answer down to a sensible number of digits rounding up or down.
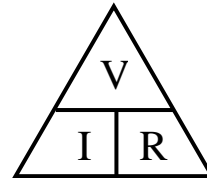- Add the correct unit for the quantity you have calculated.

Example Question

A light bulb has written on its side **120 V** and **5 A**
a)   Calculate the resistance of the bulb.
b)   Calculate the power used of the bulb.
c)   Calculate the charge that flows through the bulb in 10 min
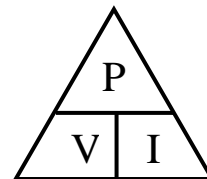d)   Calculate the energy transferred by the bulb in 10 min.

a)

Q	t	V	I	P	E	R
		120	5			?

$R = V/I \quad = \quad 120/5 \quad = \quad \underline{24 \ \Omega}$

b)

Q	t	V	I	P	E	R
		120	5	?		24

$P = VI \quad = 120 \times 5 = \underline{600 \ W}$

c)   10 min = 10 x 60 = 600 s

Q	t	V	I	P	E	R
	600	120	5	600	?	24
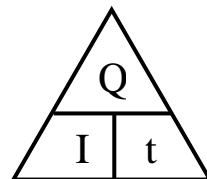
$Q = It \quad = 5 \times 600 = \underline{3000 \ C}$

d)

Q	t	V	I	P	E	R
3000	600	120	5	600	?	24
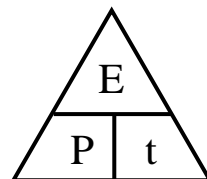
$E = Pt \quad = 600 \times 600 = \underline{360,000 \ J}$

or alternatively

d)

Q	t	V	I	P	E	R
3000	600	120	5	600	?	24
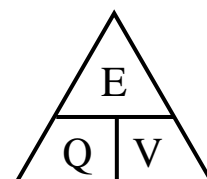
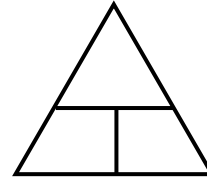$E = QV \quad = 3000 \times 120 = \underline{360,000 \ J}$

Question One

A phone charger has written on its bottom **24 V** and **2 A**

a) Calculate the resistance of the bulb.
b) Calculate the power used of the bulb.
c) Calculate the charge that flows through the bulb in 2 min
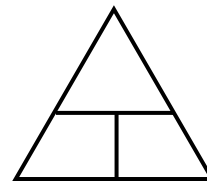d) Calculate the energy transferred by the bulb in 2 min.
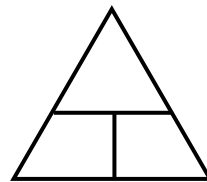
a)

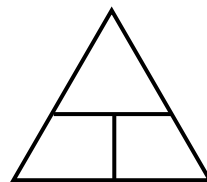| Q	t	V	I	P	E	R

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b)

Q	t	V	I	P	E	R

_____

c)

Q	t	V	I	P	E	R

_____

d)

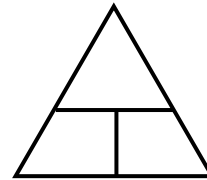| Q	t	V	I	P	E	R

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Question Two

A loud speaker has written on its back **60 V** and **15 Ω**

a)   Calculate the current used by the speaker.
b)   Calculate the power of the speaker.
c)   Calculate the charge that flows through the speaker in 30 s
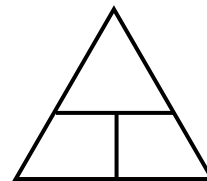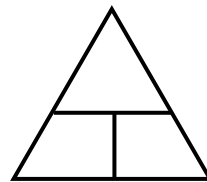d)   Calculate the energy transferred by the speaker in 30 s.
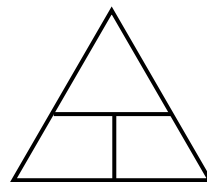
a)

Q	t	V	I	P	E	R

_____

b)

Q	t	V	I	P	E	R

_____

c)

Q	t	V	I	P	E	R

_____

d)

Q	t	V	I	P	E	R

_____

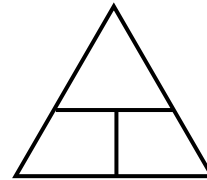# Question Three

An electric motor has written on its back **10 A** and **20 Ω**

a)   Calculate the potential difference used by the motor.
b)   Calculate the power of the motor.
c)   Calculate the charge that flows through the motor in 10 min.
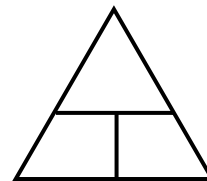d)   Calculate the energy transferred by the motor in 10 min.
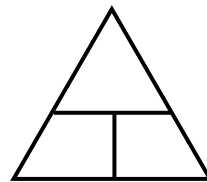
a)

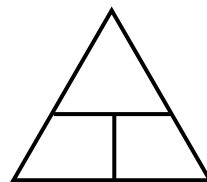| Q	t	V	I	P	E	R

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b)

Q	t	V	I	P	E	R

_____

c)

Q	t	V	I	P	E	R

_____

d)

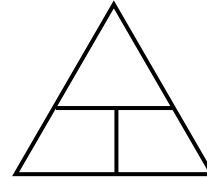| Q	t	V	I	P	E	R

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Question Four

A 230 V mains hair drier used 144,000 J of electrical energy in 4 min.
a)   Calculate the power of the hair drier.
b)   Calculate the current used by the hair drier.
c)   Calculate the resistance of the hair drier.
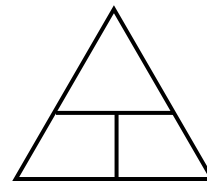d)   Calculate the charge that flowed through the hair drier.

a)

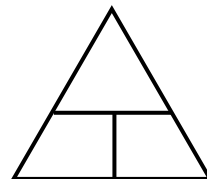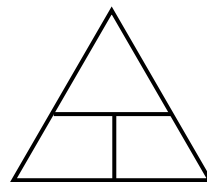| Q	t	V	I	P	E	R

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b)

Q	t	V	I	P	E	R

_____

c)

Q	t	V	I	P	E	R

_____

d)

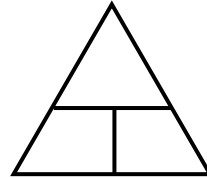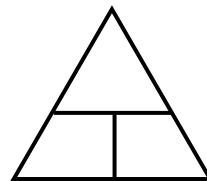| Q	t	V	I	P	E	R

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Question Five

A 3A phone charger used 6000 J of electrical energy in 3 min.
a)   Calculate the power of the charger.
b)   Calculate the potential difference of the charger.
c)   Calculate the resistance of the charger.
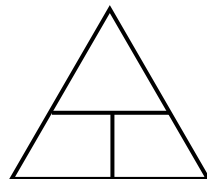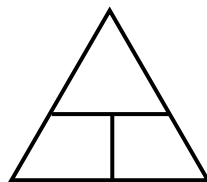d)   Calculate the charge that flowed through charger.

a)

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b)

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c)

_____

d)

_____

Question Six

A microwave oven has written on its back **230 V** and **920 W**
It takes the oven **3 min** to heat up a pasty.

a)   Calculate the current used by the oven.
b)   Calculate the resistance of the oven.
c)   Calculate the charge that flowed through the oven.
d)   Calculate the energy transferred by the oven.

a)

b)

c)

d)

Extension: Write your own four-part question where you need to use the equation $P = I^2 R$ as the first step.
Include a fully worked answer to your question.