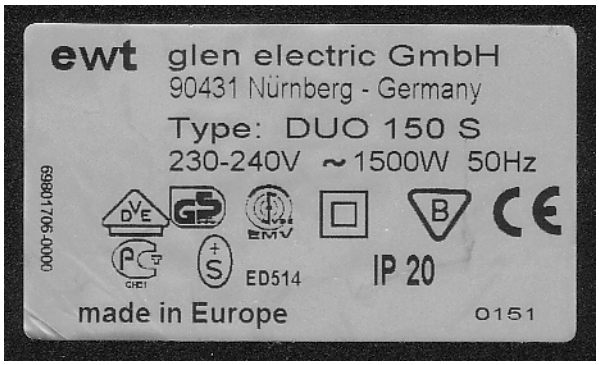
A storiette out of every day life

Early in the morning, you turn on the fan heater, so the new day starts cuddly warm in the bathroom, the cold building lot is yet far away Absorbed in thought you move into the kitchen, where the fresh coffee smells, everything is fine, until your brother comes out of the bath and sneaks: *"He left on the fan heater again!"* You answer quite cool: "That's none of your business! Better take care of your *not done* homework!" Now, your mother mixes in: "But it's of my business! More precisely my purse's business!" You stay quite cool since you make big bucks as an systems mechanic SHK (apprentice) and think you're able to join in a conversation financial matter: "So what, I will pay for it, if it recurs!" Your mother (quite cheesed off): "You have no idea of how much such things cost, you never did take part in any electricity bill! It is very expensive, if the fan heater is operating all day long. Heating by means of electricity is high-priced!" Finally, you want to have some peace and quiet and counter: "Ok, how much is the bill, tell me and I will give you the money?!"

Well, did you talk pretty big or is it actually about peanuts?

The text on the fan heater's type label is:



First of all, we're interested in this info:

1500 W means : P = 1500 Watt (P = Power)

P stands for electric power and is to be calculated by the help of this formula:

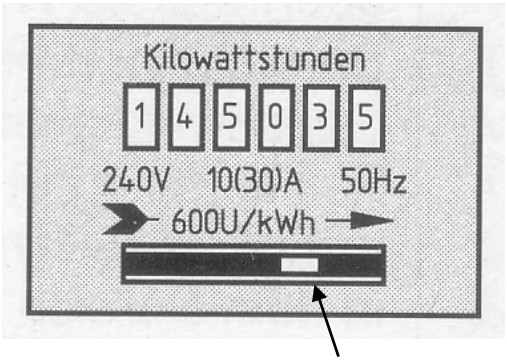
$$P = U \bullet i$$

Power = Voltage multiplied by elcetric stream .

The unit is Watt (W).

The current supply-company demands 15 Cent per electric power consumption unit.

The electric meter counts the consumed „work-unit“ (kilowatt-hour = kwh)



Checkmark on the wheel
When the wheel is spinning, the checkmark hikes from left to right

kWh means:

k → kilo → multiplied by thousand

W = Watt

h = hour

This means, that if we let the lamp (with a power of 100 W) burn continually for 10 hours, then we consumed 1000 Wh (Watt hour)

$$W = P \times t$$

Work = Power multiplied by time

The unit is Watt-hour (Wh)

Atttention:

The unit of Power is Watt (W), unfortunately “W” is also in use for the name for work – and the unit for work is Wh (Watt-hour)

Do you take my point now?

And again:

P (Power) with the unit W (Watt)

W (Work) with the unit Wh (Watt-hour)

Work = Power multiplied by time

W = P x t

= 100 Watt multiplied 10 hours

= 1000 Wh

W = 1 kWh (= 1 kW 1 an hour long, or: 1000 W an hour long)

So, it would cost 15 cent all in all, because of the public utility demands for 15 cent per 1 kWh delivered energy

We would have to pay the same, if we would leave a lamp on for 13 hours and 20 minutes.

Work = Power multiplied by time

$W = P \times t$

$= 75 \text{ Watt} \times 13,\overline{3} \text{ hours}$ $13,\overline{3}$ means 13,33333333...

$= 1000 \text{ Wh}$

$\underline{W = 1 \text{ kWh}}$

In our case (Heater) this means therefor, that we first have to calculate the embodied energy:

$W = P \times t$

$= 1500 \text{ Watt} \times 12 \text{ hours}$

$= 18000 \text{ Wh}$

$\underline{W = 18 \text{ kWh}}$

Total costs = number of embodied units multiplied x costs per unit

$$\text{Total costs (€)} = \text{number of embodied units (kWh)} \bullet \frac{\text{costs (€)}}{\text{1 unit (kWh)}}$$

$= 18 \text{ kWh} \times \frac{15 \text{ Cent}}{1 \text{ kWh}}$ We can shorten the kWh, so the result is:

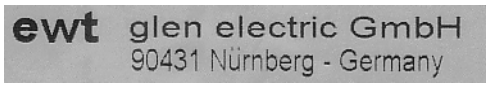
$= 18 \times 15 \text{ Cent}$

Total costs = 270 Cent = 2,7 Euro

How often is this going to happen, before there is an affect on your purse?

And now for the “hieroglyphics” (secret signs) you can also find on the label:

1. Write down the meaning of the designations, most of them you will find in your textbook!



Meaning:

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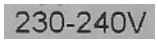

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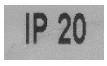
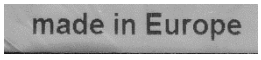


Meaning:



Meaning:

Tasks:

2 The label reads the following information:

230 – 240 V
200 W
50Hz

A At which voltage may the instrument be operated?

B How big ist the power of the instrument?

C How „big“ is the current, that flows (at 240 V) through the wire of the instrument?

D How high are it power costs, if the instrument works for 2 hours? 1 kWh costs 15 Cent.

E How high are it power costs, if the instrument works for 3,5 hours?

F How high are it power costs, if the instrument works for 24 minutes?

3 The label of the appliance reads the following information:

230 – 240 V
ßßßßßß W This information is illegible!
50Hz

This instrument was operated for 45 minutes (at 240 V) and consumed 2,250 kWh meanwhile.

A At which voltage may the instrument be operated?

B How big is the power of the instrument?

C How „big“ is the current, flowing through the wire of the instrument??

D How high are it power costs, if the instrument works for 2 hours?

Addendum to the term of Power (P) and Work (W)

Electric power represents the ability, Work can be done. You can for example do some work. May you do some work that is worth 30 € per hour, but if you don't go to your place of work, you so spend no time at your place of work (by working), you won't get any money.

There's a lot of people, who aren't able to do this work, they won't get any money, even if they would go to your place of work and try to do the work.

You are able to, but you have to go to your place of work and spend time there, to bring your ability (of power) = efficiency "to bear" for awhile, not until then your work is done.

If you do lots of work in a short time, you ought to get a lot of money in a short time. Somebody else who does half of the work at the same time, ought to get half of the money. The reality is quite different, but for electrical engineering it is true:

An electromotor with a power (=efficiency) of 300 Watt moves a load of 200 kg each hour from the ground floor to the fourth floor of an apartment building. This electromotor is in operation for 2 hours.

Another electromotor with a power (=efficiency) of 600 Watt moves a load of 400 kg each hour (twice as much) from the ground floor to the fourth floor of an apartment building. This electromotor is in operation only for an hour (half as much), but the work done is the same. The "electricity costs" are the same for both of the electromotors, although the second motor only needed half of the time. But there's a hitch: this motor "showed" twice of the efficiency, he brought twice of the effiency to bear.

It depends on in which time something is done, the faster it is done, the higher the efficiency. Efficiency is work per time.

$$\text{Power (P)} = \frac{\text{Work (W)}}{\text{Time (t)}}$$

Solutions without units:

0,833.....	12,5m or 0,0125	6	230-240	3kW or 3000W		200	90
Tested safety	alternating Voltage	interference-suppressed	protection class 2	Conforme Europien	230-240	Swiss safety sign	International Protection 1: body > 12 mm 0: No protection against water
Association of German Electricians	10,5 Cent	6 Cent	1,2 Cent	12,5 A To 13,04 A	90 Cent (6kWh)		