

TAP 115- 3: Kinds of light bulb

People use electric light bulbs for many purposes, from a torch used to light up a path home, to aircraft searchlights. These lamps differ tremendously in the power they use.

1. All bulbs are stamped with two different values, for instance 36 W, 12 V. What do these numbers tell you?
2. You can also use these values to calculate the current and the resistance of the bulb filament. The table below shows these values for five different bulbs. Use a suitable formula to calculate the missing values.

Bulb	Power / W	pd / V	Current / A	Resistance / Ω
Headlamp	36	12		4
Torch bulb	0.09	3	0.03	
Filament bulb	100	230		529
Flashlight bulb	4.5	9	0.5	
Energy Saving bulb	24	230		

Fuse protection

3. Explain why appliances are protected by a fuse and explain how the fuse provides this protection.
4. The table shows the power rating and voltage as marked on a number of appliances. Calculate the operating current of each appliance. Suggest a suitable fuse value for each appliance choosing from the fuse values given.

Appliances	Power rating	pd / V	Operating current / A	Suggested fuse values choosing from 3 A; 5 A, 13 A
Iron	1200 W	230		
Vacuum cleaner	900 W	230		

Headlamp	48 W	12		
Jug kettle	2.4 kW	230		
Radio	100 W	230		
Travel kettle	340 W	120		
Microwave cooker	1.4 kW	230		

Practical advice

These are a set of mainly pre-16 level revision questions. Some could be used as 'warm-up' exercises after the summer break. The use of real numbers, including the mains voltage of 230 V provides an opportunity to think about the use of calculators and significant figures in answers.

Answers and worked solutions

1. Power in watts – rate of energy use; operating potential difference in volts, pd at which it is designed to work.

2.

Bulb	Power / W	pd / V	Current / A	Resistance / Ω
Headlamp	36	12	3.0	4.0
Torch bulb	0.09	3	0.03	100
Filament bulb	100	230	0.43	530
Flashlight bulb	4.5	9	0.5	18
Energy Saving bulb	24	230	0.10	2200

3. To prevent too much power passing through the cable (the fuse is to protect the cable not the appliance) - the fuse melts.

4.

Appliances	power rating	pd / V	operating current / A	Suggested fuse values choosing from 3 A; 5 A, 13 A
Iron	1200 W	230	5.2	13
Vacuum cleaner	900 W	230	3.9	5
Head lamp	48 W	12	4.0	13
Jug kettle	2.4 kW	230	10	13
Radio	100 W	230	0.43	3

Travel kettle	340 W	120	2.8	3*
Microwave cooker	1.4 kW	230	6.1	13

*The surge that takes place when you switch on any kettle *might* cause the fuse to blow, due to the lower cold resistance of the element when you first switch on, if you fit a 3 A fuse. In real life (not exams) fuses blow at roughly twice the rated value!

External references

This activity is adapted from Advancing Physics Chapter 2, 30S