Autumn Term

P5 Electricity in the home

Aiming for Grade 4

OLD BUCKENHAM HIGH SCHOOL

Achieving excellence together

Extended Homework Assignment

Name: _____

Set: _____

Instructions

A printed copy should be handed into your teacher.

The knowledge required to complete this assignment will be supported in class in lessons of the half term.

Worked example 1

Calculate the potential difference across a lamp and the power of the lamp if the lamp has a resistance of 15 Ω and the current through it is 0.1 A.

Step 1: Write down what you know.

resistance = 15 Ω

current = 0.1 A

Step 2: Calculate the potential difference.

potential difference V (V) = current I (A) × resistance R (Ω)

= 0.1 A × 15 Ω

= 1.5 V

Step 3: Calculate the power.

power supplied P (W) = current I (A) × potential difference V (V)

= 0.1 A × 1.5 V

= 0.15 W

Worked example 2

Calculate the energy transferred by a lamp with a power of 100 W in 2 hours and the number of units of electricity added to your electricity bill in that time.

Step 1: Write down what you know.

power = 100 W

time = 2 hours = 2 h × 3600 s/h = 7200 s

Step 2: Calculate the energy transferred.

energy transferred E (J) = power P (W) × time t (s)

= 100 W × 7200 s

= 720 000 J (2 significant figures)

Step 3: Convert power to kW and time to hours.

power = 100 W = 0.1 kW

time = 2 hours

Step 4: Calculate number of kWh (units).

number of units = power (kW) × time (h)

= 0.1 kW × 2 h

= 0.2 kWh

Tasks

Mains electricity and electrical safety

You are going to write a leaflet about electrical safety for primary school students.
The leaflet should contain the following information:

- why mains electricity is dangerous
- what is behind an electrical socket
- what is inside a plug
- how an earth wire protects them
- how a fuse protects an appliance
- what a circuit breaker is and how it works
- why plugs and a lot of appliances in the home have a plastic case.

You should include diagrams where possible, and a short quiz at the end for them to test what they have learnt.

Power, current, energy, and fuses

All the electrical appliances in your home have a power rating. This means that a certain amount of charge will flow through them in a given time. If the appliance has a plug, then the plug will contain a fuse.

Complete the table by:

A calculating the power using the potential difference and current (see worked example 1)

B writing down the fuse required by each device (fuses available are: 3A, 5A, and 13A).

Appliance	Potential difference in V	Current in A	Power in W	Fuse needed in A
kettle	230	8.7		
hair drier	230	6.5		
microwave oven	230	3.5		

Appliances, cost, and efficiency

In your home, electrical devices transfer energy to do jobs that you need to do – such as dry your hair or clothes, provide entertainment, or cook food. Through your electricity bill, you pay for these jobs to be done.

Here is a list of some of the appliances that you use, and an estimate of how long you might use them for in a day.

You can work out the number of units of energy (in kWh) consumed by each device if you know the device's power rating (in kW), and the time the device runs for (in hours). Complete the table:

Appliance	Power	Time in h	Power in kW	Units in kWh
iron	1.1 kW	2	1.1	
washing machine	500 W	1	0.5	
vacuum cleaner	500 W	0.5	0.5	
TV	100 W	4	0.1	
laptop	40 W	4	0.04	
low-energy light bulb	11 W	12	0.011	

Questions

Mains electricity and electrical safety

1 Complete these sentences by circling the correct word(s):

a Direct current, like the current from **a battery / the mains**, is current that flows **backwards and forwards / in one direction**. (*2 marks*)

b Alternating current, like the current from **a battery / the mains**, is current that flows **backwards and forwards / in one direction**. (*2 marks*)

2 Compare a fuse and a circuit breaker.

.....

.....

..... (*3 marks*)

3 Suggest one safety difference between a kettle with a metal case and a kettle with a plastic case.

.....

..... (*1 mark*)

Power, current, energy, and fuses

4 Complete the table with the values of potential difference and resistance. (*2 marks*)

Remember, there are 1000 mA in 1 A, and 1000 Ω in 1 kΩ.

Current	Resistance	Potential difference in V	Power in W
1 A	1 Ω		
2 A	0.1 Ω		
100 mA	10 Ω		
3 A	1 kΩ		

5 Another equation for power is:

power P (W) = (current I (A))^2 × resistance R (Ω)

Think about the method that you used to fill in each row of the table to explain why this equation is true.

.....

..... (*2 marks*)

6 **a** Calculate the energy transferred by a 10 kW oven that cooks a chicken in 2 hours.

.....

.....

.....

..... (*2 marks*)

b Write down the energy transferred by 1 C of charge if the oven works on a potential difference of 230 V.

..... (*1 mark*)

Appliances, cost, and efficiency

7 Explain why the efficiency of an appliance is always less than 100%.

.....

..... (*2 marks*)

8 You can calculate the output power of an appliance if you know the input power and the efficiency.

output power = efficiency × input power

a An electric motor is 60% efficient and has an input power of 1 kW.
Calculate the output power.

..... (*1 mark*)

b Suggest one reason that energy is wasted.

..... (*1 mark*)

c Suggest which energy store is filled by the wasted energy.

..... (*1 mark*)

9 Explain how you could calculate the contribution that using a particular appliance makes to your electricity bill.

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..... (*2 marks*)

10 Explain why more efficient devices will reduce your electricity bill.

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..... (*2 marks*)