



AWARE

educating for e-waste recycling

Exercises on e-waste

Medium



Introduction to e-waste and circular economy

We use and need many electrical devices every day, and as long as they are working, we don't pay much attention to them. What happens when they break? We immediately notice if a lamp burns out, our washing machine breaks or our phone smashes on the ground. A broken or unusable device or machine becomes e-waste or WEEE (Waste Electrical and Electronic Equipment).

When a big, new machine, like a washing machine or a freezer is delivered, the delivery company will often take the old device away to be recycled. Smaller devices like mobile phones and electronic toys tend to remain stored in our dresser drawers and closets for a longer time. Do you know how many unused mobile phones or other electronic devices are there in your home?

Recycling even the smaller devices would be good, though. All electronic devices contain valuable materials that could be used again if recycled properly. When a device is recycled, it is taken apart and all the different materials it contains are separated. Responsible recycling also takes care of potentially dangerous materials that could harm the nature, animals or people if not treated properly.

The difficulty with recycling comes from the wide variety of materials that make up e-waste. A smartphone can contain as much as 50-60 different elements. A high percentage of the common metals, like aluminium and copper, are recycled. For some materials, efficient recovery can be either too difficult or too expensive.

While most of us would not throw away jewelry containing precious metals such as gold, silver or platinum, we don't pay quite as much attention to broken appliances. It has been estimated that up to 7 % of the world's gold may currently be contained in e-waste. Currently only about one third of WEEE in the EU is collected and managed properly. There is still room for improvement!

We Europeans generated 12.3 Mt of WEEE in 2016. This equals to the mass of 1,200 Eiffel towers. Per person, this amounts to 16.6 kg every year - as much as over 100 average mobile phones or about one fifth of a washing machine, for example.

It is important to recycle, but even more important to try to avoid generating waste in the first place. Manufacturing a device, even when using recycled material, still consumes energy and resources. If possible, repairing and otherwise prolonging the lifespan of a device is a good thing.



Questions

1. Give some examples of e-waste.

2. How do electronic products become e-waste?

3. How could the amount of e-waste be reduced?

4. Which materials may e-waste contain?

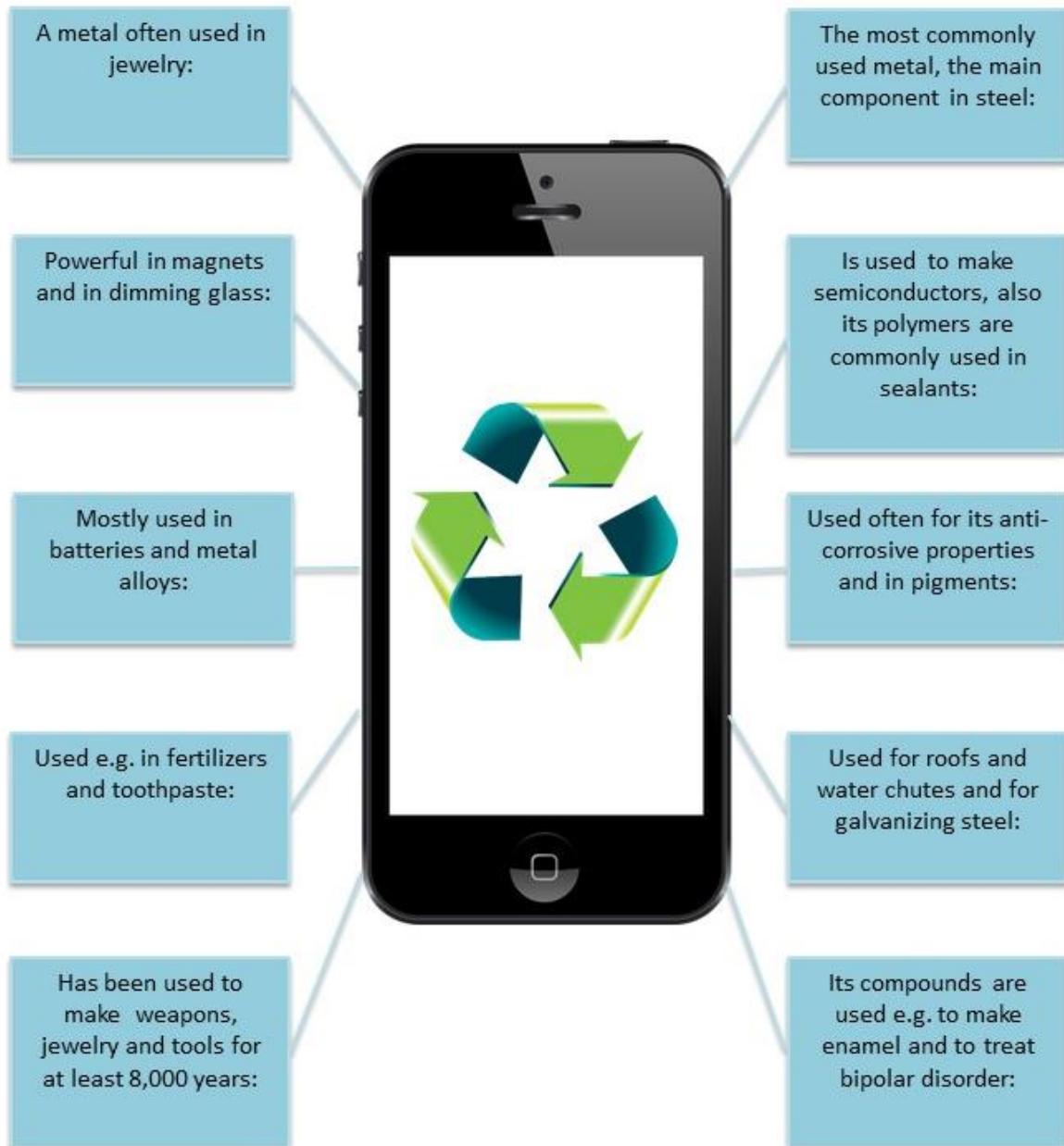
5. Why should e-waste be recycled? Check the boxes that correspond with the **four best reasons** in the table below:

To recover valuable materials	
To save money	
To have more room for new electronic devices at home	
To reduce the amount of materials disposed in landfills	
To avoid harmful substances ending up in the environment	
To appear eco-friendly in front of other people	
To save virgin natural resources	
To create more jobs for people working with recycling	
To participate in social media campaigns	

Can you think of other good reasons for recycling e-waste?



Some of the materials contained in a smartphone and their other uses



Iron	Chromium	Gold	Nickel	Copper
Zinc	Phosphorus	Lithium	Neodymium	Silicon



Combine the term and definition

Fill in the letter corresponding to the correct definition in the table below:

Resources that are found in nature and include for example water, land (stone, minerals etc.) and living organisms (wood, plants etc.) among many others. All manufactured products are composed of these.	
Collecting and processing of waste material into new materials and objects.	
Electronic devices that are broken or otherwise discarded.	
Rare elements such as gold, silver and platinum, which have high economical value.	
Organic polymeric materials typically made from oil. Can be molded into different shapes and are thus used for various items such as food packaging and phone casings.	
Economic system that aims at eliminating waste and the continual use of resources.	

- A WEEE or e-waste
- B Precious metals
- C Circular economy
- D Plastics
- E Natural resources
- F Recycling

Kahoot: numbers on e-waste

Take a short quiz in Kahoot which shows the scale of e-waste today:

<https://bit.ly/2w75C5c>



Urban mining

Complex electronics such as smart phones can contain up to 50-60 different elements from the periodic table. Many of these elements are valuable such as gold and silver used in printed circuit boards, or laborious to produce/extract such as many rare earth elements which are mainly produced in China.

Urban mining means recovery of metals from used electronics and other waste streams. For example, 1 ton of old mobile phones can contain up to 300-400 grams of gold, which is 100 times the concentration of gold in ores. An interesting example of urban mining is the Olympic medals in 2020 Tokyo Olympics, which are to be made from the country's urban mines - made up of millions of discarded smartphones and other consumer electronics.



Figure 1. Potential value of raw materials in e-waste is estimated to be over 55 billion euros! (Figure from Global E-waste monitor 2017)

Task 1. Calculate how many smart phones one person uses in his/her lifetime if the device is replaced with a new one every second year. What if the device is replaced with a new one every third year instead?

Task 2. How many unused smart phones, tablets and laptops are there in your home? Calculate the amount of precious metals and their value in these devices based on the information in the Tables below. What if every pupil in your school had the same amount of unused devices in their home, how much would that add up to?

Table 1. Content of some precious metals in selected electronic devices.¹

Device	Gold (g/unit)	Silver (g/unit)	Platinum (g/unit)	Copper (g/unit)
Smart phone	0.038	0.244	0.004	14
Tablet	0.044	0.05		27
Notebook	0.22	0.25	0.004	135

Table 2. The prices of pure metals.²

	Gold	Silver	Platinum	Copper
Metal price €/kg	46 170	525	25 000	5

¹ data from Cucchiella et al., 2015 <https://www.sciencedirect.com/science/article/pii/S1364032115005808>

² in February 2020, for current prices see for example information on London metal exchange <https://www.lme.com/>



About AWARE

This content has been created as a part of AWARE project. The purpose of the AWARE project is to spread information on e-waste and circular economy among schoolchildren of different ages and teachers. For more information, please visit

<https://aware-eit.eu/>

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