Environmental issues

5.1 · Issues and impact · revision notes

How making, using and throwing away digital devices affects the environment, and how computers can also help to protect it. On Paper 1 this comes up as short 'Give' and 'State' questions, 2 to 4 mark 'Explain' questions set in a context, and sometimes a 6-mark 'Discuss' question.

Key facts

- **E-waste**: electronic and electrical devices that have been thrown away.
- Cover the whole life of a device: **manufacture**, **use** and **disposal**.
- Use: electricity for devices, networks and data centres (running and cooling servers).
- Reduce harm: repair, reuse, recycle, keep devices longer, power-saving settings, renewable energy.
- **Replacement cycle**: how often a device is replaced by a newer one.
- Manufacture: mining finite raw materials, energy and water use, pollution, carbon dioxide.
- Disposal: toxic substances (lead, mercury, cadmium) in landfill, unsafe processing abroad, wasted metals.
- Positive impacts: less travel, smarter energy use, environmental monitoring, efficient routes, less paper.

Notes

Making devices (manufacture)

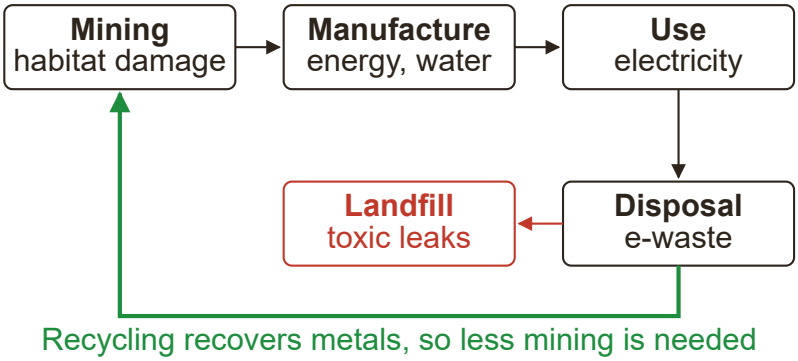
- Devices contain metals such as gold, copper, lithium and cobalt. These are **finite resources** that have to be mined.
- Mining destroys habitats, scars landscapes and can pollute rivers and soil with toxic chemicals.
- Factories use large amounts of **energy** and **water**. If the electricity comes from burning fossil fuels, carbon dioxide (a greenhouse gas) is released, adding to climate change.
- For phones and laptops, manufacturing is often the biggest part of the total carbon footprint, so keeping a device for longer makes a real difference.

Using devices (energy consumption)

- Every device uses electricity while it is switched on, and many use a little on standby.
- **Data centres** hold thousands of servers that run 24 hours a day. They use huge amounts of electricity to run the servers and to keep them cool, and cooling can also use a lot of water.
- Streaming, cloud storage and online gaming all rely on data centres and network equipment, so they use energy even if your own device is efficient.
- To reduce the impact: switch devices off, use sleep and power-saving settings, buy energy-efficient hardware, and power data centres with renewable energy so that less carbon dioxide is released.

Replacement cycle and disposal

- The **replacement cycle** is how often people replace a device with a newer one. New models, marketing, devices that are hard to repair and the end of software updates all make it shorter.
- A shorter replacement cycle means more devices are made (more mining, energy and pollution) and more are thrown away.



Every stage of a device's life affects the environment. A shorter replacement cycle means going round this loop more often.

- **E-waste** contains toxic substances such as lead, mercury and cadmium. In landfill these can leak into soil and groundwater, harming wildlife and people.
- Some e-waste is shipped abroad and broken up or burned without safety controls, releasing toxic fumes that harm workers' health.
- Devices that are not recycled waste valuable metals, so even more have to be mined.
- To reduce e-waste: repair devices, keep them for longer, sell or donate working devices and recycle at a proper e-waste facility.

How computers can help the environment

- Video calls and remote working reduce travel, so less fuel is burned.
- Smart meters and smart thermostats help people to see and cut their energy use.
- Sensors and computer models monitor pollution, weather and the climate, helping people to plan action.
- Route-planning software cuts the fuel used by delivery vehicles, and digital documents reduce paper use.

How to answer each type of question

Give / State: recall a problem or a solution

1 to 2 marks | Grade 3

1. Give exactly the number of points asked for.
2. Make each point specific: name the material, the type of pollution or the action.
3. One short line per point is enough.

Example. Give **two** environmental problems caused by mining the raw materials needed to make smartphones. (2 marks)

Model answer. Any two, 1 mark each: it destroys habitats or damages the landscape (1); it pollutes rivers or soil with toxic chemicals (1); it uses up finite resources such as cobalt or gold (1); it uses a lot of energy, releasing carbon dioxide (1).

Explain two problems or benefits

2 to 4 marks | Grade 5

1. Each point earns 1 mark and its linked explanation earns 1 more.
2. State the problem, then use 'so' or 'which means' to give its effect on the environment.
3. Make your two points different, e.g. one about toxic substances and one about wasted resources.

Example. A council runs a collection point for old laptops. Explain **two** reasons why laptops should be recycled instead of being sent to landfill. (4 marks)

Model answer. Laptops contain toxic substances such as lead and mercury (1), which can leak out of landfill into soil and water and harm wildlife (1). Laptops contain valuable metals such as gold and copper (1); recycling recovers these, so less new mining is needed (1).

Explain the impact of a decision in an unfamiliar context

2 to 4 marks | Grade 6

1. Find the decision in the context and say what it changes, e.g. devices are replaced sooner.
2. Follow the chain: more devices made, more materials and energy used, more e-waste.
3. Use details from the context in every point.

Example. A games console company releases a new model every two years and switches off online services for older models after three years. Explain the environmental impact of this decision. (3 marks)

Model answer. Owners replace their consoles sooner, so the replacement cycle gets shorter (1). More new consoles are manufactured, using mined raw materials and energy and releasing carbon dioxide (1). More old consoles are thrown away, increasing e-waste, which contains toxic substances (1).

6-mark 'Discuss' the environmental impact

6 marks | Grade 8

1. Plan quickly: list the harms (manufacture, use, disposal) and the benefits.
2. Write about both sides, applying every point to the context.
3. Develop each point with a consequence instead of listing many single words.
4. Finish with a short, justified conclusion.

Example. A city council plans to replace its paper parking tickets with a smartphone app, and to fit a sensor in every parking space so that drivers can find a free space. Discuss the environmental impact of this plan. (6 marks)

Model answer. Marked in levels: the top level needs a balanced answer with developed points applied to the plan, and a conclusion. A strong answer might say: The app removes the need for paper tickets and ticket machines, so less paper and fewer machines are needed. Drivers can go straight to a free space instead of circling, which cuts fuel use and air pollution. However, thousands of sensors must be manufactured, using mined metals and energy, and their batteries will need replacing, creating e-waste. The app relies on servers in data centres that use electricity all day and night. Some drivers may replace their phones to run the app. Overall, the plan is likely to help the environment if the sensors last many years and are recycled properly, because the fuel saved by thousands of drivers every day is a continuing benefit.

Don’t lose marks

- Writing 'it is bad for the environment' without saying how (which material, which pollution, where).
- Saying 'recycle it' without explaining what recycling saves or prevents.
- Confusing e-waste (thrown-away hardware) with digital clutter such as old emails or files.
- Saying computers give off carbon dioxide: the carbon dioxide comes from generating the electricity from fossil fuels.
- Only writing about harms in a 'Discuss' question and ignoring the benefits.

More tips

Memory tricks

- Make it, use it, bin it: cover all three stages of a device's life (manufacture, use, disposal).
- For solutions think of the 4 Rs: Reduce, Reuse, Repair, Recycle.
- Toxic metals in e-waste: lead, mercury, cadmium.
- Build a chain for every point: action, then what it causes, then the harm to the environment.

Exam technique

- For a 2-mark 'Explain', give a point and a linked consequence, e.g. 'uses a lot of electricity, so more carbon dioxide is released if it comes from fossil fuels'.
- Apply your answer to the context in the question (a school, a data centre, a phone maker).
- In a 6-mark 'Discuss', cover both positive and negative impacts and end with a conclusion that follows from your points.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 3 — **Define e-waste**
E-waste is electronic and electrical equipment that has been thrown away, such as old phones, laptops and chargers.

Grade 3 — **Give environmental problems of making devices**
Mining raw materials damages habitats, factories use a lot of energy and water, and both cause pollution.

Grade 4 — **Give ways to cut computers' energy use**
Switch devices off when not in use, use sleep and power-saving settings, and buy energy-efficient hardware.

Grade 5 — **Explain the harm caused by e-waste**
Toxic substances such as lead and mercury can leak from landfill into soil and water, and valuable metals are wasted.

Grade 5 — **Explain why data centres use so much energy**
Thousands of servers run 24 hours a day and must be kept cool, often using electricity generated from fossil fuels.

Grade 5 — **Explain how computers can help the environment**
For example, video calls cut travel, smart meters help people use less energy and sensors monitor pollution.

Grade 6 — **Explain the effect of short replacement cycles**
Replacing devices more often means more are manufactured (materials, energy, emissions) and more become e-waste.

Grade 8 — **Weigh up a technology's overall environmental impact**
In a 6-mark answer, balance the harms against the benefits in the given context and reach a justified conclusion.

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