MODULE I IMPACTS AND THE LAW · I3

Environmental impacts and e-waste: mark scheme

21 marks · OCR J277 spec 1.6.1 (impacts of digital technology on wider society: environmental issues; examples of digital technology and how it impacts on society; discuss the impact of technology)

How to use. Questions 1 to 3: one mark per bullet up to the maximum shown. **/** separates alternatives; **//** separates alternative answers for the same mark. Words in (brackets) are not needed for the mark. **...** at the start of a bullet means it expands the bullet before it. Question 4 is marked with levels of response: decide the band first, then the mark within it. Answers that only say "pollution", "bad for the environment" or "better for the planet" with no detail are not enough (NE). Names of particular toxic substances are not required anywhere.

QUESTION	ANSWER	MARKS	GUIDANCE
1(a) J277 1.6.1	Mining rare metals: Making the device Servers running day and night with air conditioning: Using the device Harmful substances leaking from printers in landfill: Disposing of the device Factory energy and water for microchips: Making the device Computers shipped abroad and burned to recover metal: Disposing of the device	**5**	1 mark per correct row. A row with two or more ticks scores 0.
2(a) J277 1.6.1	Electronic / electrical devices / equipment that have been thrown away / discarded / are no longer wanted // unwanted / old / broken computers / phones / digital devices that are disposed of	**1**	Must show it is electronic / electrical equipment and that it is being got rid of. Do not accept "electronic waste" alone (repeats the term). Accept a correct example linked to being thrown away (e.g. "old phones people throw away").
2(b) J277 1.6.1	Devices contain toxic / harmful / hazardous substances / chemicals / heavy metals (e.g. lead, mercury, cadmium) ... ... which can leak / seep into the soil / ground / water (supply) / rivers // pollute land / water ... harming / poisoning plants / wildlife / animals / people (who live nearby) Valuable / rare / precious metals / materials are not recovered / are wasted ... ... so more have to be mined (to make new devices), which damages the environment Devices do not break down / are not biodegradable // landfill sites fill up / more land is used for landfill	**2**	1 mark per bullet to max 2. Two separate valid points can score 2. Do not accept "it causes pollution" alone (NE): the answer must say what pollutes or what is polluted. Credit any other valid reason.

QUESTION	ANSWER	MARKS	GUIDANCE
3(a) J277 1.6.1	Recycle them (so materials / metals can be recovered and reused) // send them to an (approved / specialist) e-waste recycler Refurbish / repair them and reuse / resell them Donate / give / sell them to people / charities / community groups / other organisations who can still use them Remove / reuse working parts (e.g. as spare parts / to repair other computers) Return them to the manufacturer / supplier (through a take-back scheme)	**2**	1 mark each to max 2. The two ways must be different (e.g. "donate" and "give away" = 1 mark). Credit any other valid way. Do not accept "throw them away", "put them in the bin" or "send them to landfill". Do not accept "wipe the data" (not an environmental action).
3(b) J277 1.6.1	Fewer new computers need to be bought / made ... ... so less mining of (rare / precious) metals / raw materials // less energy / water used in manufacturing // fewer carbon emissions / greenhouse gases (from factories / transport) Fewer computers are thrown away // less e-waste is produced ... ... so less goes to landfill // fewer toxic substances leak into the soil / water // less e-waste is shipped abroad / burned	**2**	1 mark for a benefit, 1 mark for a linked expansion (...), max 2. If two benefits are given, mark the first. Accept "less waste" for the benefit mark; the expansion must say what harm is avoided. Do not accept "saves money" (not environmental).
3(c) J277 1.6.1	Older computers may use more electricity / energy (than newer, more energy-efficient models) // more (carbon) emissions from generating the extra electricity Older computers may break down more often // need more repairs / replacement parts (which have to be made) Slower computers may take longer to do tasks, so they are switched on for longer and use more electricity	**1**	1 mark for any valid environmental drawback. Credit any other valid environmental drawback. Do not accept drawbacks that are not environmental (e.g. "slower", "security risk", "staff unhappy") unless linked to energy use or the environment.
4* J277 1.6.1	Levels of response: use the band descriptors and indicative content below.	**8**	Mark the response as a whole. A response does not need every point in the indicative content to reach the top band.

Question 4* band descriptors

Band	Descriptor
Band 3 (High) 6 to 8 marks	Accurate, detailed knowledge of a wide range of environmental impacts. Applied clearly and consistently to the bus company's plan, with explicit examples (e.g. the ticket machines, the sensors, the data centre, the paper). Weighs up positive and negative impacts, and covers more than one stage (making, using, disposing). Points are expanded with a reason or consequence. A clear, logically structured line of reasoning that leads to a supported conclusion.
Band 2 (Mid) 3 to 5 marks	Reasonable knowledge of a range of environmental impacts, mostly accurate but sometimes underdeveloped. Applied to the plan, but one or two chances are missed. Covers positive or negative impacts; the top of the band needs at least one of each. Some points are expanded. A line of reasoning with some structure; any conclusion is only partly supported.
Band 1 (Low) 1 to 2 marks	Basic knowledge, with some inaccuracies. Little application to the plan: points could apply to any technology. Mostly unsupported assertions (e.g. "it is better for the environment"). Unstructured.
0 marks	No attempt, or nothing worthy of credit.

Question 4* indicative content (not prescriptive or exhaustive; credit any other valid point)

Positive environmental impacts	Negative environmental impacts
• No paper tickets or printed timetables: less paper and ink used, fewer trees cut down, less paper waste. • Fuel-use data lets the company spot wasteful driving, idling or routes, so it can use less fuel and cut exhaust emissions. • Location data can be used to plan more efficient routes and timetables (e.g. fewer near-empty buses). • Air-quality sensors monitor pollution along the routes, so the company or the city can act on polluted areas (e.g. send cleaner buses there). • Live bus times in the app may encourage more people to take the bus instead of driving, reducing traffic and emissions. • Most passengers already own a phone, so no new device is needed for them. • Old ticket machines can be recycled, refurbished or used for spare parts instead of going to landfill.	• Making the sensors and servers needs rare or precious metals to be mined, and uses energy and water, with carbon emissions. • Servers in the data centre run all the time and need cooling, so they use a lot of electricity (more emissions if it is not from renewable sources). • Sensors on every bus also use power and will eventually fail and need replacing. • The removed ticket machines become e-waste; if sent to landfill, toxic substances can leak into soil and water, or the machines may be exported and burned. • Sensors, servers and phones all become e-waste at the end of their life. • Some passengers may buy a new phone to use the app, increasing manufacturing and e-waste. • Phones must be charged to use the app (small extra electricity use).
Possible conclusions (any supported conclusion is acceptable): the benefits are likely to outweigh the costs if the old machines are recycled and the data centre uses renewable energy; or the plan is only better for the environment if the sensor data is actually used to cut fuel use; or the extra hardware and the always-on data centre may cancel out the paper saved.	

Total: 21 marks