Diploma Programme
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Markscheme

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Digital society

Higher level

Paper 3

International Baccalaureate
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1. (a) Outline **one** way in which e-waste can cause harm to the environment if not
disposed of correctly. [2]

Answers may include:
- Toxins found in e-waste can leak into the ground of landfills after disposal.
- resulting in the generation of toxic fumes or the land being polluted.
- Toxic chemicals can be used in the extraction process of e-waste.
- Resulting in toxins seeping into the ground or surrounding area.
- Toxins can leak into the water supply if e-waste extraction sites do not have adequate measures in place.
- Resulting in polluted drinking water or polluted water for growing crops.
- Not all components are biodegradable.

Award [1] for identifying each way the e-waste can cause harm to the environment if not disposed of correctly and [1]if the development includes the word toxin or toxic gases up to
[2].

(b) Outline **one** way in which e-waste can cause harm to humans if not handled correctly. [2]

Answers may include:
- Toxins found in e-waste such as mercury, lead and cadmium can poison the body
  - Mercury – can impact the nervous system, kidneys and liver – impair vision, and affect the immune system
  - Lead – can lead to anemia, weakness, kidney and brain damage
  - Cadmium -can damage human lungs and is considered a cancer-causing agent
  - Fine dust from printer toners – Can cause lung irritation

- Toxins used in the extraction process can be damaging to human health
  - Hydrochloric acid or nitric acid are chemicals which can result in irritation to the eyes, skin, delayed pulmonary edema, pneumonitis, bronchitis, and dental erosion.
  - Cyanide can result in poisoning

Award [1] for identifying each way e-waste can cause harm to humans if not handled correctly and [1] for an explanation, as stated above, up to [2].

2. (a) Explain **two** reasons why only 20 % of e-waste is recycled. [4]

Answers may include:
- Cost of recycling e-waste may be higher than disposal
- For example, the cost of purchasing and maintaining the equipment needed, or the cost of labour required to operate the equipment may exceed the value of the recycled items.

- Accelerated growth of e-waste exceeds current recycling capacity.
- To increase the number of recycling centres and collection points.

- Lack of education
- For example, consumers may not be aware of what happens to the e-waste once they have disposed of it, or do not know which resources are being depleted and cannot be replaced.

- Lack of available e-waste collection services
- Consumers may not have access to facilities that allow for the collection or drop off of e-waste

- Lack of available e-waste extraction services
- The e-waste recycle centre may only be a collection point and is unable to send the e-waste to be extracted.

- In some countries, the sale of hardware components.
- Copper, for example, is sold as a source of income.

- Government may not prioritise spending on these centres
- Private organisations may not consider the centres profitable

- Lack of trust in e-waste recycle centres
- Consumers may not trust that recycle centres are recycling e-waste in a responsible manner / recycling centres have been in the news for unethical practices / recycling centres may lack transparency of operations.

- Legislation
- Countries may not have laws in place that determine how e-waste is handled / Countries may have laws in place that do not permit e-waste to be shipped to other countries / Countries may have the legislation to govern how e-waste is handled but it is not enforced

- Policies & Standards
- Lack of policies and take back schemes by hardware manufacturers / Policies may not be enforced / Policies may lack detail on the responsibility or accountability of hardware manufacturers

Award [1] for identifying a reason why only 20% of e-waste is recycled and [1] for a development of that reason up to [2].

Mark as [2] + [2].

(b)   *Computers You Can Trust* will ensure that the reconditioned electronic devices are in good working order before being delivered to a school.

Explain **one other** action that needs to be taken to ensure that the devices received from *Computers You Can Trust* will be usable by the school.   [2]

Answers may include:
- Setting up and configuring computers and laptops
- so they are able to operate on the school network / deleting data from previous documents or replacing the hard disk, etc.

- Annual Support
- to ensure computers and laptops remain in working order.

- Software installation
- installing new software for learning, updates eg for virus protection.

- Providing training for staff and students to use the laptops
- so they can incorporate their use into their teaching.

Award [1] for identifying an action that needs to be taken to ensure these devices can benefit the students in the Primary School and [1] for a development of that reason up to [2].

3. Susan Jones has been reading about circular economies and is looking for a long-term solution to Greenview School's e-waste problem. She is considering a hardware manufacturer that has an environmentally sustainable vision.

Discuss whether hardware manufacturers should be accountable for the e-waste created by the disposal of their products. [8]

Answers may include:

Reasons why hardware manufacturers should be accountable:
- Release of newer models of hardware – entice consumers to buy the 'latest version'
- Built in early obsolescence e.g., Companies not supporting older versions of hardware e.g., stocking parts, limited extensions of warranty
- Manufacturers may not be supporting the right to repair movement
- Cost of repair is not economically viable
- Quality of hardware is low – requiring more frequent replacement

Reasons why hardware manufacturers should not be accountable
- Consumers are choosing to purchase new hardware
- Consumers are not taking care of their hardware e.g., carelessness
- Consumers are not managing their hardware correctly e.g.; poor file management may lead to consumers needing to buy more technology e.g., more storage space or replace the computer
- Lack of education about hardware management
- Software developers - Technological developments mean that outdated hardware cannot support latest software
- Software developers – software upgrades need better graphics and processors

Please use the markband on page 7.

The following markband should be used with responses to question 3.

HL Paper 3, question 3	
Marks	**Level descriptor**
0	The work does not reach a standard described by the descriptors below.
1–2	- The response shows a limited understanding of the demands of the question. - The response is of limited relevance. The response is descriptive and consists mostly of unsupported generalizations. - The response has limited organization.
3–4	- The response shows some understanding of the demands of the question. - The response is primarily descriptive with some evaluation demonstrated but this is not sustained or fully supported. - The response is partially organized.
5–6	- The response shows adequate understanding of the demands of the question. - The response demonstrates adequate evaluation that is relevant and supported. - The response is adequately organized.
7–8	- The response is focused and shows an in-depth understanding of the demands of the question. - The response demonstrates sustained evaluation that is relevant and well-supported throughout. - The response is well-structured and effectively organized.

4. Greenview School has to choose between two interventions to address the challenge of effectively managing its e-waste problem:
   - **Intervention 1:** Dispose of e-waste using the e-waste recycling company *Recycle4U*.
   - **Intervention 2:** Donate the technology to the non-profit organization *Computers You Can Trust* to be refurbished and reused by schools in Africa.

   Recommend which of the interventions Greenview School should choose. [12]

   Beware of boilerplate / pre-rehearsed / cookie cutter responses.

   Answers may include:
   Evaluation of E-waste Disposal by the recycling company Recycle4U

   Equity: (Source A)
   - Collections/deliveries may not always be possible depending on the distance of the school to the Recycle4U centre.

   Acceptability: (Sources A & C)
   - Sending e-waste for recycling is acceptable by the community with the school gaining a good reputation for their Eco-initiatives.
   - Recycling is considered acceptable if recycling methods are ethically carried out and there is transparency in operations e.g. appropriate PPE, safe dismantling of products.
   - Recycling would not be acceptable if the e-waste was sent to developing countries.

   Cost: (Sources A & C)
   - Recycle4U may charge the school for accepting the computer hardware before recycling.
   - The school may incur collection costs in transporting the e-waste to the recycle centre.
   - The school will incur costs in data erasure before sending for recycling.
   - Recycle centres may purchase e-waste from Schools.
   - Potential environmental costs if e-waste is not processed correctly.
   - Potential costs to human health if proper PPE is not used by those handling e-waste.

   Feasibility:
   - Recycle Centre may only be a collection centre for e-waste as dismantling of e-waste is not economically feasible.
   - Extraction of raw materials from e-waste is still a technical challenge e.g. cobalt recovery rates are just 30%.
   - E-waste contains many toxic chemicals. (Source C)

   Innovation:
   Recycle4U may have invested in innovative technology to include.
   - Robots for e-waste sorting.
   - E-waste can be converted into power.

   Ethics: (Sources A & C)
   - School Policies need to be in place to ensure that the e-waste collected does not consist of other waste.
   - School Policies – need to ensure that data is wiped before recycling.
   - Country Policies need to be in place to ensure Recycle4U does not ship the e-waste to less developed countries where dismantling of e-waste is done in poor conditions.

Evaluation of Donating E-Waste to the non-profit organisation, *Computers-You-Can-Trust*, to be refurbished and reused by poorer communities

Equity: (Sources B & D)
- Computers-You-Can-Trust – should have policies in place to ensure that donated computers go to those in need.
- Donated computers will reduce the digital divide, with poorer communities having access to technologies they could not previously afford.
- The quality of the computers donated, may not meet the needs of the community e.g. old, slow processors.

Acceptability: (Sources A, B & C)
- Donating computers to a charity is considered a good outreach to the community project and will improve the reputation of the school.
- School Finance Officers may not approve of donations, as a sale of computers could earn the school money.
- Environmental benefits of donating (see source).
- Recipients of the donated computers may not be adequately set up to utilize the donations.
- Donated computers may not be set up in the language of the recipient.

Cost: (Source A & B)
- The school may incur costs in transporting hardware to the charity.
- The school will incur costs in data erasure before donating.
- The charity will incur costs of refurbishing and may rely on donations to fund their operations.
- The charity/recipient school may be liable for taxes by the recipient country.
- The recipients of the donated computers may incur additional costs e.g. rise in electricity bills, internet connectivity.
- The recipient school may need to employ staff for IT support & training.
- The recipient school may incur more environmental costs when the donated computers stop working and need disposing of.

Feasibility: (Source B)
- Refurbishing computers is feasible, providing all components are working correctly and there are spare parts available.
- Older computers may not be possible to refurbish when spare parts are no longer available.
- Recipient organization may not have the required skills to use the donated computers.
- Recipient countries may not find it socially acceptable to receive donations.
- Political barriers can prevent the donated computers getting to the right recipient.

Innovation:
This innovation is not new and has been carried out for many years

Ethics: (Sources A & B)
- School Policies – need to ensure that data is wiped before donating.
- School Policies – need to ensure that the organization chosen for donations is approved.
- Charity Policies– must ensure there is transparency when selecting recipients.
- Charity Policies – must have policies for refurbishing, delivery and implementation have ethical practices and meet the countries requirements.
- Country Policies are needed to ensure donated computers are in good working order and not e-waste mislabeled.

Important: Please note that an example must be given to show that the student has carried out independent research in order to achieve 8 points.

Use the markband below.

The following markband should be used with responses to question 4.

HL Paper 3, question 4	
Marks	**Level descriptor**
0	• The work does not reach a standard described by the descriptors below.
1–3	• The response shows a limited understanding of the demands of the question. • The response consists mostly of unsupported generalizations with limited relevant knowledge. • No recommendations are presented or those that are presented have only limited support. • The response has limited organization.
4–6	• The response shows some understanding of the demands of the question. • The response demonstrates some knowledge, but this is not always relevant or accurate and may not be used appropriately or effectively. • Recommendations are presented with some support although this is not sustained and only partially effective. • The response is partially organized.
7–9	• The response shows adequate understanding of the demands of the question. • The response is adequately supported with relevant and accurate knowledge. • Recommendations are presented and effectively supported. • The response is adequately organized.
10–12	• The response is focused and shows an in-depth understanding of the demands of the question. • The response is well-supported throughout with relevant and accurate knowledge. • Recommendations are presented and well-supported with a clear consideration of possible trade-offs and implications. • The response is well-structured and effectively organized.