1.12 Product life-cycle assessment

AQA 8552 · Calculator allowed · about 50 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions.

1 A designer examines a reusable water bottle from raw material extraction through manufacture and transport to use and end of life. Name the life-cycle stage that comes immediately after manufacture in this sequence. [1 mark]

(Total for Question 1 is 1 mark)

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2 A fictional product study assigns 10 invented impact points to making a product, 4 to its transport, 6 to its use, and 3 to its end-of-life treatment. A designer proposes changing the material name from Material X to Material Y and claims this guarantees recycling and lower impact. Explain why the supplied data do not support that claim, and calculate the current listed total. The data are teaching assumptions, not measurements. [4 marks]

(Total for Question 2 is 4 marks)

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3 A community workshop is choosing between two fictional portable display stands for the same 10-year service need. Stand A has a 12-point production impact, 2 points for transport and 2 points for end-of-life treatment; it lasts 5 years and cannot be repaired. Stand B has a 20-point production impact, 2 points for transport and 2 points for end-of-life treatment; it lasts 10 years and can be repaired, but no repair is needed in the stated period. Assume one whole stand is required at a time, identical replacement stands are available, and all points are invented teaching assumptions, not measurements. Recommend one stand by calculating the supplied total for 10 years, then justify your decision and state one limitation of this comparison. [6 marks]

(Total for Question 3 is 6 marks)

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4 A library is choosing between two fictional reading lights for the same 8-year service need. Both provide the same brightness and each light supplied has 6 invented impact points for transport and end-of-life treatment combined. Light P has 8 production points, lasts 4 years and uses 3 points per year in use. Light Q has 14 production points, lasts 8 years and uses 1 point per year in use. Assume one whole light is required at a time, replacement lights have the same listed impacts, and service is continuous for all 8 years. The points are invented teaching assumptions, not measured emission factors. Evaluate which light the library should choose using total listed points over 8 years, and explain one limitation of the decision. [6 marks]

(Total for Question 4 is 6 marks)

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5 A fictional life-cycle study records energy used while a lamp is switched on in a home. Name the life-cycle stage represented. [1 mark]

(Total for Question 5 is 1 mark)

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6 Fictional teaching data for one desk lamp assign 12 impact points to material supply, 8 to manufacture, 3 to transport, 20 to use and 2 to end of life. Add the stage impacts to find the total. These points are invented for this question and are not measured emission factors. [2 marks]

(Total for Question 6 is 2 marks)

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7 Two fictional lunch containers provide the same capacity and function for 6 years. For that matched service, Container A has a total of 30 invented impact points and Container B has 42. Calculate the difference and state which has the lower supplied total. The values are teaching assumptions, not measurements. [2 marks]

(Total for Question 7 is 2 marks)

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8 Two fictional phone stands do the same job. Stand A has 24 invented impact points per stand and lasts 4 years. Stand B has 30 invented impact points per stand and lasts 10 years. Assume each stand meets the need throughout its stated life and ignore partial stands. Calculate each stand's impact points per service year and identify the lower rate. Values are teaching assumptions, not measured factors. [3 marks]

(Total for Question 8 is 3 marks)

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9 A fictional school has a usable desk organiser that needs a repair. A repair kit has 4 invented impact points and extends its service by 12 years. A new organiser has 18 invented impact points and lasts 12 years. Assume both meet the same need for 12 years, no other impacts change, and all values are fictional teaching assumptions, not measurements. Compare the supplied points for repair and reuse with replacement, then state which is lower and by how much. [3 marks]

(Total for Question 9 is 3 marks)

10 A fictional kettle is designed with a replaceable switch. The switch fails after 3 years, while the kettle body is expected to last 8 years. The switch replacement kit is assigned 2 invented impact points and a new kettle 20 invented points. Assume repair adds 5 years of service, the replacement kettle lasts 8 years, and other stage impacts are outside this comparison. Explain one life-cycle advantage of repair and support it with a numerical comparison for a 8-year service need. These are teaching assumptions, not measurements. [4 marks]

(Total for Question 10 is 4 marks)

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11 A fictional delivery crate is used for 5 trips. A reusable crate has 9 invented impact points to make and 1 point per trip to clean and return. A single-use crate has 3 points to make per trip and no other impacts in this simplified dataset. Assume both protect the same goods for each trip and that all values are fictional teaching data, not measured factors. Calculate each option's total for 5 trips and recommend the lower supplied total. [4 marks]

(Total for Question 11 is 4 marks)

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12 Two fictional wall clocks provide the same function for a 12-year period. Clock A needs 2 clocks at 16 invented points each because each lasts 6 years. Clock B needs 3 clocks at 9 invented points each because each lasts 4 years. Assume replacements are available exactly when needed and use whole clocks only. Calculate each option's total for 12 years and compare. The points are invented teaching assumptions, not measured emission factors. [4 marks]

(Total for Question 12 is 4 marks)

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Mark scheme · 1.12 Product life-cycle assessment

Question 1

Transport/distribution of the product to its user	**B1**

Answer: Transport or distribution to the user.

Question 2

Adds the supplied values: 10 + 4 + 6 + 3	**M1**
Current listed total = 23 fictional points	**A1**
States that changing a material name alone does not show whether collection, sorting or processing for recycling is available	**B1**
Explains the claim needs comparable stage data and a specific end-of-life route; the supplied data give no alternative values or evidence of actual recycling	**B1**

Answer: 10 + 4 + 6 + 3 = 23 fictional points. Renaming the material does not establish that a local collection and processing route exists. The claim also lacks comparable impacts for the proposed version, so neither recycling nor a lower total is demonstrated.

Question 3

A needs 10 / 5 = 2 stands during the period	**M1**
A total per stand is 12 + 2 + 2 = 16 points, giving 2 x 16 = 32 points	**A1**
B needs one stand lasting 10 years	**M1**
B total = 20 + 2 + 2 = 24 points	**A1**
Recommends B on supplied totals, which are 8 points lower, and links the choice to meeting the full 10-year service with no replacement	**B1**
States a relevant limitation, such as omitted use impacts, uncertain life/reliability, real transport/end-of-life routes or that fictional points are not measured environmental evidence	**B1**

Answer: A requires two stands: each totals 12 + 2 + 2 = 16 points, so 2 x 16 = 32 points. B requires one stand and totals 20 + 2 + 2 = 24 points. I recommend B for the stated 10-year need: it is 8 points lower on these supplied totals and avoids a replacement. The comparison omits use impacts and relies on fictional values, so it is not a measured environmental assessment.

Question 4

P needs 8 / 4 = 2 lights over 8 years	**M1**
P total = 2 x 8 production + (8 x 3) use + (2 x 6) transport/end of life = 52 points	**A1**
Q needs one light over 8 years	**M1**
Q total = 14 + (8 x 1) + 6 = 28 points	**A1**
Recommends Q on supplied totals, 24 points lower, and explains the lower use impact outweighs its higher production impact in this scenario	**B1**
Gives a relevant limitation, such as fictional values, uncertain actual use/lifetime, omitted repair or different end-of-life routes; does not claim material name proves recyclability	**B1**

Answer: P needs two lights: 2 x 8 + (8 x 3) + (2 x 6) = 52 points. Q needs one: 14 + (8 x 1) + 6 = 28 points. I recommend Q for this stated service because its total is 24 points lower; its higher production value is outweighed by its lower use value here. This relies on fictional values and assumed lifetimes, so it is not evidence of actual environmental performance.

Question 5

Use/in-service stage	**B1**

Answer: The use stage.

Question 6

Adds all five supplied stage values: 12 + 8 + 3 + 20 + 2	**M1**
45 fictional impact points	**A1**

Answer: 12 + 8 + 3 + 20 + 2 = 45 fictional impact points.

Question 7

Subtracts 30 from 42	**M1**
12 points; A is lower by 12 points for the same stated 6-year service	**A1**

Answer: 42 - 30 = 12 points. Container A has the lower supplied total by 12 points.

Question 8

Calculates A: 24 / 4	**M1**
A = 6 points per service year	**A1**
Calculates B = 30 / 10 = 3 points per service year and identifies B as lower	**A1**

Answer: A: 24 / 4 = 6 points per service year. B: 30 / 10 = 3 points per service year. B has the lower rate.

Question 9

Identifies repair and reuse total as 4 points for 12 years of service	**B1**
Identifies replacement total as 18 points for 12 years of service	**B1**
Calculates 18 - 4 = 14 and states repair and reuse is lower by 14 points under the assumptions	**A1**

Answer: Repair and reuse: 4 points. Replacement: 18 points. Repair is lower by 18 - 4 = 14 points for the same 12-year service.

Question 10

Identifies replacing a failed switch as repair that keeps the usable kettle body in service	**B1**
Uses the stated 2-point repair-kit value and 20-point whole-kettle value	**B1**
Compares supplied totals: repair kit 2 points versus replacement kettle 20 points for the stated 8-year need	**B1**
Concludes repair is lower by 18 points on this limited comparison, subject to stated assumptions/boundary	**B1**

Answer: Replacing the switch keeps the usable body in service. On the stated comparison, the repair kit is 2 points and a new kettle is 20 points, so repair is lower by 18 points for the 8-year need. This conclusion covers only the supplied values and assumes the repair succeeds.

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Question 11

Reusable: 9 + (5 x 1)	**M1**
Reusable total = 14 points	**A1**
Single-use: 5 x 3	**M1**
Single-use total = 15 points; recommends reusable as lower by 1 point for these 5 trips	**A1**

Answer: Reusable: 9 + (5 x 1) = 14 points. Single-use: 5 x 3 = 15 points. The reusable crate is lower by 1 point for five trips in this simplified dataset.

Question 12

A requires 12 / 6 = 2 clocks	**M1**
A total = 2 x 16 = 32 points	**A1**
B requires 12 / 4 = 3 clocks	**M1**
B total = 3 x 9 = 27 points, lower by 5 points	**A1**

Answer: A: 12 / 6 = 2 clocks; 2 x 16 = 32 points. B: 12 / 4 = 3 clocks; 3 x 9 = 27 points. B is lower by 5 points over 12 years.

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