Mark scheme

Section A – Product Analysis

Q1)

Indicative content (not exhaustive):

- Polypropylene is lightweight, weatherproof, UV-resistant – ideal for long-term outdoor exposure.
- Timber looks natural but may degrade over time without maintenance.
- Timber allows better airflow – beneficial for composting – but may rot or warp.
- Injection moulded bin has fewer joints – less chance of failure or leakage.
- Timber bin allows for larger capacity and may be easier to repair/modify.
- Plastic bin is easier to clean and move due to lighter weight.

Q2)

Polymer compost bin:

£45 ÷ 420 L = £0.1071 → 10.7p per litre

(1 mark for method, 1 mark for correct rounding)

Timber compost bin:

£75 ÷ 600 L = £0.125 → 12.5p per litre

(1 mark for method, 1 mark for correct rounding)

Q3)

- Material sourcing: Timber must come from sustainably managed forests — influences supplier selection and possibly increases material costs.
- Design: May encourage simpler construction methods to minimise waste, and use of untreated or low-impact finishes to maintain sustainability.
- Manufacture: FSC chain-of-custody certification may be required through production stages, influencing factory processes.
- Marketing: FSC logo can be displayed on packaging and promotional materials, appealing to environmentally conscious consumers and giving the product a competitive edge.

Q4)

Sustainable Materials and Components:

- Selecting renewable or recycled materials (e.g. FSC timber, recycled aluminium).
- Reducing use of non-renewable or toxic substances (e.g. certain plastics or finishes).
- Designing for disassembly and repairability to extend product life.
- Considering local sourcing to reduce transport emissions.

Packaging:

- Avoiding excessive or unnecessary packaging.
- Using biodegradable, recyclable, or compostable materials.
- Minimising plastic use in favour of card, pulp, or plant-based alternatives.
- Designing packaging to be multi-functional or reusable.

Q5)

Concrete volume = Beam volume – Rebar volume
Rebar volume = 6 = (pi x 0.018^2 x 6)
Beam volume = 0.25 x 0.55 x 6
$0.79m^3$

Q6)

Constant reference to a detailed specification ensures concepts are appropriate.

- Focus groups and effective primary research ensures that concepts meet consumer demands.
- Rapid prototyping using 3D printing techniques allows clients and consumers to visualise concepts and make adjustments early on in the development process.
- Use of online shared documents to enable collaboration between workers.
- The use of concurrent engineering to ensure all members of the team are involved throughout the development will reduce lead time as errors can be found earlier.
- The use of critical path analysis allows the team to predict log jams and allocate staffing accordingly to prevent delays, this also ensures that all processes are started as promptly and early as possible.
- The use of a project management system to check the progress of all elements at regular intervals and redistribute staffing accordingly increases efficiency, (SCRUM).

- The use of a project management system to analyse all processes and reduce errors, (Six sigma).
- The use of virtual modelling of concepts prior to production reduces monetary investment and time in production processes that may be incorrect.

Section B – Commercial Manufacture

Q7)

- Dyson Electrical and electronic products using imagination and innovation to create stylish products that are also highly functional
- DC01 – the first dual cyclone vacuum cleaner 1993.
- Washing machine CR01 2000 with twin opposing drum technology for a quicker more thorough wash supposedly.
- Dyson digital motor 2004 – with high speed impeller. Used in later iterations of cleaners for improved efficiency.
- Dyson ball vacuum cleaner DC15 2005 – for improved manoeuvrability. Traditional cleaners have fixed wheel s and only go in straight lines.
- First Hand held cleaner 2006 – DC16 using root cyclone technology.
- Airblade AB01 2006 – hand dryer with airblade technology. Works by scraping water off washed hands, hygienic and drying hands in 10 seconds approx. Air multiplier fan AM012009 – no blades and multiplies air flow by 15 times.
- Dyson digital slim cordless vacuum cleaner 2018 – no cord connectivity. Power provided by high output lithium ion batteries effective for whole house cleaning

Q8)

- To ensure product safety, preventing harm to users and avoiding legal liability.
- To test durability or performance, ensuring the product meets its intended purpose over time.
- To check compliance with industry standards or regulations.
- To identify design weaknesses or potential points of failure before mass production.
- To gather data for quality control and refine manufacturing processes (maths link: statistical sampling, tolerances).

Q9)
Find y = mx + c

m = -0.2
c = -100

y = -0.2x -100

Speed = 0 (y = 0)

0 = -0.2x - 100

500ppm

Q10)
Indicative Content:

- Calvert helped design pictograms and typefaces (e.g. Transport font) for road signs that are clear and legible at speed.
- Use of consistent layouts, shapes, and colours to aid instant recognition and driver safety.
- Designs considered accessibility and universal understanding (e.g. simplified symbols for schoolchildren and pedestrians).
- Her work embodies function-led design — simple, readable, and user-focused.

Q11a)
1. Product owner
2. Scrum master / project leader / project manager
3. Developers / development team / designers

Q11b)

- Holistic project management strategy
- Teamwork is at the centre of the process
- Control over the empirical process (transparency, evaluation and adaptation)
- Self-organisation (increases the level of independence of the team) / feedback from workers / daily team meetings / scrum sessions
- Assessment of team performance
- Team goals
- Led by scrum master / leader / project manager

- Collaboration (awareness, clarity and distribution)
- Feedback at every stage
- Value based prioritisation (value and importance to end users and the manufacturer to determine order of completion)
- Timeboxing (allocating and scheduling time to activities)
  Sprints (short release cycles with planning, daily monitoring and reviews) to achieve smaller broken down tasks
- Iterative development (constant/ongoing adjustment and revision of design to create the best product possible) continuous improvement
- Scrum values: commitment, courage, focus, openness and respect
- Consumer feedback to update designs

Q12)

- Software technology has allowed multiple functions to be assigned to a single control panel
- Advanced/miniaturised/improved integrated circuits allow more components on a single chip
- Faster processors have allowed advanced functionality and multitasking
- Advanced battery technology results in smaller and lighter batteries
- Advanced liquid crystal displays/OLED displays are thinner
- Advanced liquid crystal displays/OLED/'always on' displays require less current therefore reduce battery size
- Modern materials including alloys and carbon fibre can be of thin wall construction
- Modern materials reduce the need for an internal structure allowing for a more compact containment of components
- Inductive charging removes the need for a charging socket
- Use of solid state 'on chip' memory/storage
- No moving parts reduces space requirements
- Wireless/Bluetooth technology reduces the need for ports for earphones/headphones/connectors
- Touch screen technology means that keyboards or traditional controls are not required
- Modern circuits consume less power allowing smaller batteries to be used
- Sensors to monitor health and fitness are now small enough to be incorporated into the watch e.g. blood oxygen sensor, ECG sensor, optical heart sensor (HRM), gyroscope, accelerometer, altimeter, GPS

- Microphones and speakers are now small enough to be incorporated into the watch
- Automation of production lines and use of nanolithography in electronic chip production
- Lightweight components reduce weight for wearing on the wrist
- Use of QTCs allows curved screens and edge to edge displays
- Higher resolution images and displays

Q13a)
Fairtrade logo

Q13b)
Function of the Fairtrade organisation and what work does it do:

- ensures that workers in developing/third world countries get a fair price for their work/products
- better price for products at source/origin
- improving pay for workers in developing countries
- improving working conditions for workers and their families in developing countries
- supporting workers with poorer health and safety legislation than workers in first world developed countries
- improving education and access to social care in developing countries
- empowering workers in the developing world to have power and influence over their lives
- gives small scale farmers access to global markets • Supports sustainability.

Credit specific examples, eg

- Fairtrade Cotton – Cotton farmers are paid a living wage which allows them to survive and earn enough money to feed their families.
- Communities are often given help in setting up local amenities such as schools, wells etc.

Q14.

Definition of primary research:

- Involves the collection of research first-hand
- Information you have collected yourself
- Completed by the author of the research
- All forms of field research

Examples of primary research:

- Interviews – telephone, social media and face to face
- Questionnaires
- Material testing
- Product analysis
- Measuring – useful sizes
- Surveys
- Focus groups

Definition of secondary research:

- Involves the use of data and research collected by another person or 3rd party
- Data and information presented by another person
- Use of material someone else has initially collated and put together
  Also known as desk research

Examples of secondary research:

- Use of books, magazines, periodicals
- Looking at the work of other designers and companies
- Published anthropometric and ergonomic data
- Materials/component catalogues
- TV programmes and social media outlets
- Consumer sources eg watchdog

Q15)

5.6kg Copper x 4 = 22.4
1.4kg Zinc x 3.10 = 4.34
Total = £26.74