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Design & Technology
AQA A-Level

Polymer enhancement

Materials required for questions

- Pencil
- Rubber
- Calculator

Instructions

- Use black ink or ball-point pen
- Try answer all questions
- Use the space provided to answer questions
- Calculators can be used if necessary
- For the multiple choice questions, circle your answer

Advice

- Marks for each question are in brackets
- Read each question fully
- Try to answer every question
- Don’t spend too much time on one question

Good luck!

Q1. What is the primary role of UV stabilisers in polymers?

A Enhance flexibility

B Prevent degradation from sunlight

C Increase biodegradability

Q2. Bio-batch additives are incorporated into polymers to:

A Improve resistance to high temperatures

B Speed up the decomposition process

C Enhance electrical conductivity

Q3. Which product would most likely contain UV stabilisers?

A Disposable cutlery

B Patio furniture

C Milk bottles

Q4. Carrier bags designed to decompose more quickly often include which additive?

A Bio-batch materials

B UV stabilisers

C Plasticisers

Q5. Describe the purpose of the following polymer additives:

- fillers
- plasticisers **(2 x 2 marks)**

Fillers

Plasticisers

Q6. Explain why bio-batch may be added to a polymer used in the manufacture of single-use carrier bags **(2 marks)**

Answers

Q1. B
Q2. B
Q3. B
Q4. A

Q5.
Two marks for a detailed response that clearly describes the purpose of the named polymer additive.

Fillers:

- can be used to add bulk to a product therefore reducing the amount of raw polymer needed
- can be used to reduce the cost of the product, as fillers are generally cheaper than the raw polymer
- can be used to improve the performance characteristic of a polymer, such as the tensile strength of nylon being improved by using a glass filler.

Plasticisers:

- can be added to a polymer to improve its plasticity therefore making it less brittle. This allows the polymer product to flex or stretch, eg PVC hose pipe can be easily coiled for storage.
- can be added to a polymer to reduce its viscosity therefore improving its ability to flow when in a liquid state, eg a polymer being used in redistribution manufacturing process such as injection moulding.

Q6.

- Carrier bags are single-use products so a bio-batch additive will help accelerate the breakdown of the carrier bag after it has been disposed of.
- Carrier bags generally have an oxy-degradable additive where the breakdown will begin with exposure to oxygen limiting their contribution to landfill.
- The inclusion of a bio-batch additive means that the carrier bag can decompose in between 3 and 6 months leaving no toxic residue or plastic particles.