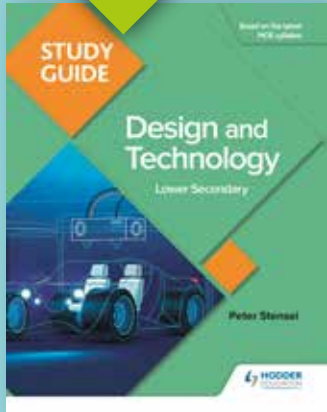


STUDY GUIDES

Study Guides: Design and Technology Lower Secondary / Upper Secondary

Excel in the latest Design and Technology syllabus 7059 with our comprehensive study guides, which integrate both textbook and workbook materials and reflect the two main areas of assessment: Design and Technology, so students can have a hands-on and immersive learning experience.



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Plastics

Most of the plastics we use today are made from crude oil, which is a fossil fuel; it takes millions of years to form. Plastics come in different forms such as films, sheets, fibres, rods, tubes, granules, foams and resin.

Thermoplastics and Thermosetting Plastics

There are two main groups of plastics: thermoplastics and thermosetting plastics (also known as thermosets). Thermoplastics soften when heated and can be shaped. On cooling they harden. This process of softening and hardening can be repeated.

Thermosetting plastics cannot be re-shaped by heating once they are formed.

Thermoplastics can be reheated and reshaped over and over again. When thermosetting plastics have set, they cannot be reshaped.

QUESTION

Most thermoplastics can be recycled. Some of the plastic recycling symbols are shown below. Can you state the type of plastic identified by each symbol? What other symbols are there?

107

Acrylic

Acrylic is a thermoplastic with excellent strength, stiffness and optical clarity. It is available in many colours and a wide range of thicknesses. Spectacle lenses, car light covers, signboards, baths and display stands are some of the many products made from acrylic.

Acrylic display stand for nail polish

Thermoplastics are widely used to make products because:

- it is usually more cost effective to make products from plastic than from wood or metal;
- most plastics have a high strength to weight ratio;
- no additional finish is needed to protect plastics;
- plastic products are easily mass produced.

RESEARCH TASK

Draw two plastic products in your home. Can you identify the type of plastic used to make the product? What properties of the material make it suitable for the product?

Product 1

Product 2

Polystyrene

Polystyrene is a widely used thermoplastic available in rigid form (high impact polystyrene) and as a foam (expanded polystyrene). Rigid polystyrene can be transparent or coloured and is used to make food containers, food packaging, plastic cutlery, linings for fridges, disposable cups and many other products. Expanded polystyrene is buoyant, lightweight and is a good thermal insulator. It is used for packaging of fragile products, fast food containers and as a modelling material for making 3d prototypes.

Polystyrene yoghurt pots

108

Think thoroughly and test the practical application of theory with design challenges.

Cover all theoretical aspects of the examination from hands-on experience of research tasks.

PLASTICS IN THE ENVIRONMENT

The widespread use of plastics for packaging and disposable products is causing serious problems for our planet. Some concerns with the use of plastics include:

- Plastics made from crude oil can take hundreds of years to decompose.
- Many plastic will release poisonous gases if burnt.
- A lot of our waste plastic ends up in landfill sites, releasing greenhouse gases when exposed to the sun.

There are serious problems with plastic in our oceans, which is harming all types of marine life.

- Microscopic plastic particles containing toxins can enter the food chain, affecting marine life and human health.

BIOPLASTICS

In recent years bioplastics have been developed, which are often made from corn or vegetable starches. Bioplastics are therefore sustainable and they are fully biodegradable, which means less harm to the environment. A bioplastic bag will degrade in three to six months. In the future we will probably see many new types of bioplastics.

DESIGN CHALLENGE

Design a logo for a bioplastic bag. Your logo should emphasise the ability of the material to biodegrade. Two examples are shown below.

110



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Managing Your Project Work

As you embark on your Design Project, you will need to decide how you are going to manage your work. You are required to work in an A3 size format so you will need some good quality A3 paper or a sketchpad. It is also advisable to have a folder to prevent your work becoming creased or damaged. You are going to work entirely on paper then an A3 presentation display folder with individual A3 sheets is a good option. Alternatively, you may choose to manage your work digitally using an online service such as Google Drive to store your work. To use Google Drive, you will need to create a Google account.

A Google account will give you access to a range of very useful apps, including Docs for creating documents, Slides for creating presentations and Forms for creating and organising questionnaires and surveys. Work is automatically saved to Google Drive, though it is also possible to download files to your own computer if needed. Working digitally in this way means your work will be safe and you will be able to access it from anywhere with an internet connection.

Creating a Digital Design Folder Using Google Slides and Sharing it With Your Teacher

To create your digital design folder, sign in to your Google account, click on the Slides app, choose 'Start a new presentation' then select 'Blank'.

Sign in to your Google account, then click here to access the Google apps.

Select down to find the Slides app then click it to launch Slides.

Select 'Blank' to start a new presentation.

To set your document up in A3 format, choose Page Setup under the File menu, select the Custom option then type in 42 x 29.7 centimetres. Name your presentation, e.g. 'Design Folder'.

Type File > Page setup

Type in 42 x 29.7 cm under the Custom option.

Name your presentation here, it is automatically saved in My Drive.

109

Guide students through their design project with exemplar materials and templates.

Functions of a Structure

A structure provides one or more of four main functions. These include:

- supporting
- spanning
- containing
- protecting

A chair is designed to **support** the weight of a person sitting on it. The structures should be strong enough to hold together, even if the person tilts back while sitting on it.

Food and drinks are **contained** in many different types of packaging. The packaging may need to be watertight, greaseproof or have good thermal insulation properties to keep the contents hot or cold.

Corrugated card cartons are widely used to **protect** products during transportation. The flaps help to strengthen the carton while the corrugation absorbs small knocks and bumps.

QUESTION

Four common types of bridges are shown on the right. Paste a photograph below of a bridge in your local area. State the type and location of the bridge.

111

Loads and Forces

Structures are designed to withstand different types of force:

external forces — forces that act on a structure

internal forces — forces that act within a structure

Forces act in many different ways. Weight is a force arising from gravity. A structure must be strong enough to support its own weight and any other forces acting on it.

Wind force is useful for moving boats and turning the blades of wind turbines but it also has the potential to destroy buildings, uproot trees and overturn large vehicles.

Structures must be able to resist the forces of sudden impacts. Sports bats and rackets, toys, fizzy drink bottles and many other products are carefully designed to withstand impact forces. Vehicles are designed with crumple zones to absorb the energy of an impact, thereby protecting passengers in the event of an accident.

STATIC AND DYNAMIC LOADS

A force on or within a structure that has a constant size, position and direction is called a **static load**. Examples of static loads include a book on a bookshelf or a case of flowers on a table. A force on a structure that changes size, position or direction is called a **dynamic load**. A child on a moving swing is a dynamic load on the frame of the swing.

Forces that act on or within a structure are called **loads**. What are the loads acting on the Marina Bay Sands hotel shown above?

112

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