PIABC LEVEL 5 DIPLOMA IN PACKAGING TECHNOLOGY

Qualification Number: 600/0017/X

Qualification Specification

Updated: 20 March 2018
DESCRIPTION

The PIABC Level 5 Diploma in Packaging Technology is a nationally recognised qualification for those wishing to pursue a career in the packaging industry, or for those who are already in the industry and who wish to extend their knowledge and expertise. The qualification is broad, and provides an opportunity to study the principles of packaging, packaging materials and packaging processes.

The Diploma can also provide a very useful complementary qualification for those on HNC/D or degree programmes in packaging design, food science/technology, materials science/engineering, and logistic.
# CONTENTS

<table>
<thead>
<tr>
<th>Page No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive Summary ................................................................. 4</td>
</tr>
<tr>
<td>General Outcomes ........................................................................ 5</td>
</tr>
<tr>
<td>Target Group ............................................................................. 5</td>
</tr>
<tr>
<td>Qualification Level ................................................................. 6</td>
</tr>
<tr>
<td>Progression ............................................................................... 7</td>
</tr>
<tr>
<td>Staffing ...................................................................................... 7</td>
</tr>
<tr>
<td>Quality Assurance ........................................................................ 7</td>
</tr>
<tr>
<td>External Moderation .................................................................... 8</td>
</tr>
<tr>
<td>Programme Organisation .......................................................... 8</td>
</tr>
<tr>
<td>Programme Structure ............................................................... 9</td>
</tr>
<tr>
<td>Guidance on Learning and Teaching Strategy, Methods and Assessment .. 9</td>
</tr>
<tr>
<td>Unit 1: Packaging in Today’s World ........................................... 11</td>
</tr>
<tr>
<td>Unit 2: Packaging Materials and Components ................................ 15</td>
</tr>
<tr>
<td>Unit 3: Packaging Processes ...................................................... 20</td>
</tr>
<tr>
<td>Unit 4: Packaging Related Research Project .................................. 25</td>
</tr>
<tr>
<td>Qualification Certification ......................................................... 28</td>
</tr>
<tr>
<td>Glossary ...................................................................................... 29</td>
</tr>
<tr>
<td>Suggested Source Material ......................................................... 30</td>
</tr>
</tbody>
</table>
EXECUTIVE SUMMARY

The PIABC Level 5 Diploma in Packaging Technology is a nationally recognised qualification which provides learners with a broad knowledge of the principles, materials, processes and other elements of packaging production and use. Those achieving the Diploma will be able to apply this knowledge to solving problems and making decisions associated with the technical and aesthetic performance, cost, safety and legality of packaging materials and packed products.

Students can study for the complete qualification, or individual units, if they prefer. To achieve the full PIABC Level 5 Diploma in Packaging Technology, candidates need to successfully gain 48 credits made up of the following:

<table>
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Programmes leading to the Diploma can be organised and delivered by providers who have gained Centre and Award approval from PIABC. To achieve this they need to complete the PIABC Centre and Award Approval Procedures available from [www.piabc.org.uk](http://www.piabc.org.uk). In completing the documentation and the approval visit centres need to demonstrate their ability to deliver high quality education leading to the qualification. Centres are expected to employ robust quality assurance processes. PIABC will appoint its own moderators to ensure the effective operation of these processes, and the maintenance of standards of quality.

As a guide for entry onto programmes, candidates will normally be expected to have a minimum attainment of:

- 1 GCE A level and 5 GCSEs at grade A – C, including one science subject, plus the key skills of numeracy, communication and information technology;
- The Level 3 Certificate in Packaging;

Alternatively, candidates should be able to clearly demonstrate, for example through experience in the packaging industry, which they are likely to succeed in the programme of study.

Overall, it is expected that courses leading to the qualification will take approximately 120 taught or guided learning hours. Students will also be expected to carry out additional reading and other work to complete each unit and prepare for the examinations and other assessments, up to a total study time of approximately 480 hours.

Success in this qualification prepares students for progression in the packaging industry to a position where they can assume responsibility for packaging in a company at any point in the supply chain.
The Diploma can also provide a very useful complementary qualification for those on HNC/D or degree programmes in packaging design.

GENERAL OUTCOMES

The general objectives of the PIABC Level 5 Diploma in Packaging Technology are to:

1. Provide those employed, or who wish to be employed in the packaging and related industries with the skills, knowledge and understanding to underpin and enhance job experience.
2. Provide learners with a portable qualification to enable job movement throughout the industry.
3. Provide learners with a means of progression to higher level qualifications, e.g. MSc, MBA.
4. Provide employers throughout the Packaging and related industries with a firm basis for judging suitability of candidates.
5. Raise the status of those employed in the Packaging and related industries.

TARGET GROUP

This Level 5 qualification is appropriate for those wanting to enhance their employment and progression opportunities in the packaging and related industries.

There are thus two broad target groups:

1. People currently employed in parts of the industry who want to broaden their knowledge and understanding, and take on greater levels of responsibility. Due to the diverse nature of the packaging and related industries, it is difficult to define this target group in terms of precise job functions. Typically, candidates are likely to be working at the practitioner or manager level in any of the following disciplines:

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Type of company</th>
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<tbody>
<tr>
<td>Technical</td>
<td>Packaging manufacturer</td>
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<td>Packer/filler</td>
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<td></td>
<td>Retail</td>
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<tr>
<td>Technical sales/marketing</td>
<td>Packaging manufacturer</td>
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<td></td>
<td>Packaging machinery manufacturer</td>
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<tr>
<td>Quality assurance</td>
<td>Packaging manufacturer</td>
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<tr>
<td></td>
<td>Packer/filler</td>
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<td>Packaging machinery manufacturer</td>
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<tr>
<td>Design</td>
<td>Design Agency</td>
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</tbody>
</table>

2. People who are not currently employed in the industry, who may be following courses in associate subject areas such as packaging design, food science/technology, materials science/engineering, and logistics, will find that this programme broadens the scope of their studies.
QUALIFICATION LEVEL

The Diploma in Packaging Technology is a Level 5 qualification.

Candidates require the skills, knowledge and understanding to show competence in applying technical, aesthetic and commercial principles to a range of complex and varying tasks.

Candidates are required to analyse problems, determine root cause, and recommend and implement effective solutions, with a substantial degree of personal responsibility and accountability.

Candidates may have direct responsibility for others, or may have responsibilities within a team.

This qualification requires the learner to understand complex elements from the packaging process, for example packaging design, materials and production methods, and how these combine in practical packaging operations. It will prepare the learner to operate as a professional packaging technologist and/or manager in companies in different parts of the packaging supply chain, where they will be expected to able to deal with new and novel problems. The qualification also prepares students to advise others about alternative appropriate solutions to packaging problems, and to identify the critical factors associated with the advice that is given.

When work for this qualification is assessed, it is important to realise that evidence will be sought which demonstrates these features.

Level 5 Descriptor

Summary

Achievement at Level 5 reflects the ability to identify and use relevant understanding, methods and skills to address broadly-defined, complex problems. It includes taking responsibility for planning and developing courses of action as well as exercising autonomy and judgement within broad parameters. It also reflects understanding of different perspectives, approaches or schools of thought and the reasoning behind them.

Knowledge and Understanding

- Use practical, theoretical or technological understanding to find ways forward in broadly-defined, complex contexts
- Analyse, interpret and evaluate relevant information, concepts and ideas.
- Be aware of the nature and scope of the area of study or work
- Understand different perspectives, approaches or schools of thought and the reasoning behind them

Application and action

- Address broadly-defined, complex problems.
- Determine, adapt and use appropriate methods and skills
- Use relevant research or development to inform actions
- Evaluate actions, methods and results
Autonomy and accountability

- Take responsibility for planning and developing courses of action, including, where relevant, responsibility for the work of others
- Exercise autonomy and judgment within broad parameters

Source: Level descriptors for positioning units in the Qualifications and Credit Framework tests and trials. Version 2: 2006. QCA.

PROGRESSION

Success in this qualification prepares students for progression in the packaging industry to a position where they can assume responsibility for packaging in a company at any point in the supply chain.

STAFFING

It is expected that staff involved with the delivery of the course will be appropriately qualified and/or experienced in packaging. The PIABC approval process requires prospective centres to provide details of the staff involved in delivery and assessment including their qualifications and relevant training/employment experience, plus staff development arrangements. Whilst these details are passed on to the External Moderator appointed by the Awarding Organisation, it is the Centre’s responsibility to ensure tutors’ qualifications are both bona fide and appropriate to the level of the qualification.

QUALITY ASSURANCE

PIABC requires that each centre has a quality assurance and enhancement procedure in respect of the programme, and a means of monitoring its implementation.

There should be a team that is responsible for preparing an annual self-assessment of the programme and for monitoring the improvement measures resulting from this.

This self-assessment process should use evidence from different sources including:

- Candidate self-evaluation
- The views of external individuals and organisations, for example those companies sending learners
- Staff working on the award

In addition, it is also expected that there will be an internal moderation procedure to ensure standardisation of unit delivery. This will include the following elements:

- Classroom observation
- Peer review of award materials
- Moderation of any internally assessed elements

There should be a named and appropriately qualified individual (Centre Co-ordinator) who has the necessary authority, with whom the awarding body can liaise directly on all matters of management, administration and quality assurance.
EXTERNAL MODERATION

PIABC will appoint external centre monitors to visit centres in order to ensure the maintenance of standards of quality. The role of the centre monitor includes:

- Liaison between the centre and PIABC to ensure standardisation in terms of the quality of award delivery
- Providing advice and support for the Centre in understanding and implementing the requirements of the units and the PIABC

Centre monitors will carry out at least one visit to each centre per year, and will formally report on the outcome of this visit to the Centre and PIABC. All items contained in the report will be discussed with the Centre during the visit, and any action that the Centre needs to take will be agreed at that stage.

Any visits in addition to the annual visit may incur an additional fee.

PROGRAMME ORGANISATION

It is anticipated that the qualification will require a minimum of 120 guided learning hours for satisfactory completion.

The organisation of the award is at the discretion of the Centre and will take into account the aims, aspirations and experience of the candidates.

Centres are encouraged to choose the most suitable curriculum model for their candidates. Whilst the sequential delivery of units is a possibility and may provide the most straightforward way of determining completion of individual units, it may be that some degree of integration of units will occur, or that other methods of delivery are more appropriate to meet the needs of candidates. It should be noted however that each unit will be individually assessed.

Centres must ensure that adequate arrangements are in place for supporting candidates. This could be either through separate tutorial sessions or through the use of time within structured study sessions. Centres using on-line or other forms of open learning must ensure that appropriate tutorial support is provided for candidates.

In relevant circumstances, centres are recommended to provide information and guidance to their candidates on the availability and type of employment the programme may lead to and on the progression routes available for further education and training in packaging.
PROGRAMME STRUCTURE

In designing the diploma, the QCF principles of unit design have been applied i.e. each unit has an informative title, a level, a credit value, learning outcomes and assessment criteria. The assessment process is based on those learning outcomes and assessment criteria. The learning and teaching strategy must be designed so that candidates have the opportunity to meet the learning outcomes in an effective manner by demonstrating that they can achieve the assessment criteria.

The diploma is divided into four units as shown below:

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</table>

Full details follow below for each Unit, comprising:

- Title, level, credit value and recommended guided learning hours
- Unit overview
- Learning outcomes and assessment criteria
- Detailed content matched to learning outcomes and assessment criteria
- Assessment guidance

GUIDANCE ON LEARNING AND TEACHING STRATEGY, METHODS AND ASSESSMENT

Applicable to all Units

Packaging technology is a practical subject, based on theoretical principles. As far as possible, it is important that the course is taught by relating the underlying theory to practical examples and applications. Two factors which will help in this regard are:

1. The use of lecturers with direct experience in the packaging and related industries. Specifically for “Packaging Materials and Components”, lecturers with experience in the relevant packaging manufacturing (converter) sector are likely to offer the most appropriate level of practical knowledge. This must, of course, be balanced against a sound understanding of the theoretical principles, as anecdotal experience alone is unlikely to meet the requirements of the course.

2. Factory visits should be undertaken, to packaging manufacturers and users where learners can see packaging processes and make the link between theoretical principles and practical applications. Familiarity with different packaging settings will be assumed in elements of the qualification’s assessment. DVD illustrations of processes should also be used as part of the teaching regime. A further and invaluable source of information is the Internet and there are many web sites which demonstrate important aspects of packaging manufacture and use. Lecturers should
be encouraged to use this material, always making sure due acknowledgment is given to the source.

Whilst all units are designed to be “stand alone” some items for example sustainability, quality and legislation appear as common themes across more than one unit. This should be recognised by tutors and links made in those cases where candidates are working across more than a single unit.

Those learners employed in the packaging and related industries, will come to the course with varying levels of existing knowledge and/or practical experience of some parts of the syllabus. Lecturers should utilise this, through group work and other structured interactive activities, thus encouraging the sharing of knowledge which has the potential to lead to a high level of understanding.

The relation of theory and practice is a theme that will be reflected in the assessments for each unit and for the programme as a whole. Therefore in structured learning and individual work, candidates should be aware of the requirement to develop a practical dimension to their understanding.
Unit 1: Packaging in Today’s World

Credit Value – 10 credits
Guided learning hours – 25 hours

Overview:

This Unit will introduce learners to the subject of packaging by examining what packaging is used for and what it does for the product and the user, both within its broad social, economic and marketing context, and meeting its specific functional and aesthetic requirements. Emphasis is placed on understanding product properties and the different and sometimes conflicting requirements and expectations at each stage of the life of the product, and thus deriving packaging solutions to meet these requirements and expectations. Factors which affect the safety and legality of packed products are considered, along with ways of ensuring compliance, and the need to recognise and address environmental impact.

In order to gain this unit the candidates must meet the following learning outcomes.

<table>
<thead>
<tr>
<th>Learning Outcomes:</th>
<th>Assessment criteria:</th>
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</thead>
<tbody>
<tr>
<td>what you need to know/understand</td>
<td>what you need to do</td>
</tr>
<tr>
<td>1. Understand the role of packaging in the modern society</td>
<td>1.1 Relate the development of packaging to changes in society worldwide</td>
</tr>
<tr>
<td></td>
<td>1.2 Assess the impact of globalization and the growth of the modern retailer on packaging</td>
</tr>
<tr>
<td></td>
<td>1.3 Evaluate the impact of corporate social responsibility on packaging</td>
</tr>
<tr>
<td>2. Understand the structure and interactions of elements in the packaging supply chain</td>
<td>2.1 Describe in detail the whole packaging supply chain in detail for a given packaged product</td>
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<tr>
<td></td>
<td>2.2 Assess how each part of the packaging supply chain interacts with other parts</td>
</tr>
<tr>
<td></td>
<td>2.3 Evaluate the role of packaging in mitigating the effects of hazards faced by packed products in the supply chain</td>
</tr>
<tr>
<td>3. Understand the functions of packaging</td>
<td>3.1 Explain in detail the functions of packaging</td>
</tr>
<tr>
<td></td>
<td>3.2 Assess the role of packaging in terms of its functions</td>
</tr>
<tr>
<td></td>
<td>3.3 Assess the success of particular packs in meeting differing functions</td>
</tr>
<tr>
<td></td>
<td>3.4 Describe the factors which cause packaging deterioration</td>
</tr>
<tr>
<td>4. Know the principles of the key legislation, regulations and standards relating to the packaging supply chain</td>
<td>4.1 Explain how legislation, regulations and standards impact on packaging</td>
</tr>
<tr>
<td></td>
<td>4.2 Evaluate the consequences of failure to comply with legislation and regulations</td>
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</table>
5. Understand the factors that affect the impact of packaging on the environment

5.1 Evaluate environmental impact for a given packed product
5.2 Evaluate different ways of measuring the impact of packaging on the environment
5.3 Explain the concept of "end of life" in relation to a range of packaging materials and the different options available for each

6. Understand the relationship between packaging and marketing

6.1 Describe the functions of marketing
6.2 Assess the relationship between packaging and marketing
6.3 Using a given example explain the impact of packaging on product promotion and advertising

Indicative Content

1. Understand the role of packaging in modern society

- The development of packaging related to developments in society – changing patterns of consumption and their impact on packaging
- How and why packaging, common packaging materials and packaging components have developed and their role in modern society
- Consequences of globalisation for packaging use and packaging manufacture
- The development of packaging related to the growth of the modern retailer
- The development of the notion of corporate social responsibility (CSR) and what it means
- Why does the packaging supply chain have to be concerned with CSR?

2. Understand the structure and interactions of elements in the packaging supply chain

- Knowledge of the structure of the whole packaging supply chain (raw material to end of life)
- Packaging as a means of delivering cost effective solutions for moving goods from production to the final user
- Understand the complexity of the journey map for multiple handling and extended distribution systems taking account of packaging manufacturing processes and the storage and distribution of packaging materials and components.
- Use of coding and traceability systems e.g. bar codes; RFID
- Identifying, measuring and monitoring the main hazards, their causes and effects which may compromise the quality, hygiene, safety and legality of the packed product
• Defining product fragility and damage levels, e.g. breakage, scratching, scuffing, of both product and pack. Quantifying fragility and acceptable damage levels

• Key properties of packaging (high level overview only) and the controls needed to minimise product damage and interference.

• Simulating journey hazards in the laboratory and carrying out tests and transit trials.

3. **Understand the functions of packaging**

• Major functions that packaging is required to fulfil and the ability to evaluate each function for a given use/application.

• Functions of packaging: contain, protect, preserve, convenience, providing information and selling. Also consider environmental and commercial issues.

• Using a range of examples, show how particular packs meet different packaging functions

• Discuss how deterioration can affect pack performance

• Investigate instances of where and how this might occur

4. **Know the principles of the key legislation, regulations and standards relating to the packaging supply chain**

• Principles of the key legislation, regulation and standards (globally) which applies to the packed product

• Overview of global legislative requirements, specifically Europe, USA and Japan. Compatibility of legislation in EU, USA, Australasia and Japan.

• Drivers for legislation, regulation and standards

• Differences between legislation, rules/regulations, standards and good practice

• Examples of legislation, regulation and standards relevant to packaging covering for example: product quality and health hazards; protection of the workforce; honesty in trade; environmental; dangerous goods; pharma labelling; product labelling requirements; materials and articles in contact with product; children’s products; consumer protection; alcohol; health and safety.

• Consequences of failure to comply with legislation for the pack itself and the company in general

• Ensuring and managing compliance throughout the supply chain
5. **Understand the factors that affect the impact of packaging on the environment**

- Factors which affect the impact of packaging on the environment
- Placing the environmental impact of packaging in context with its role in society and its economic role in conserving product resources and value (e.g. Packaging “optimisation”)
- Tools for evaluating environmental impact through different measures (e.g. life cycle analysis, for a total packed product).
- The concept of “end of life” and “cradle to cradle” in relation to packaging.
- Packaging in the industrial, commercial and domestic waste stream. Comparisons of methods of handling, composting, reuse, recovery and recycling as applied different packaging materials. Issues with landfill.

6. **Understand the relationship between packaging and marketing**

- Define marketing and the marketing function
- Basic marketing concepts e.g. the “marketing mix” (7 P’s). Traditionally known as the 4 Ps – Product, Price, Place and Promotion. As marketing became more sophisticated discipline, a fifth ‘P’ was added – People. And recently, a further two ‘P’s were added, mainly for the service industries – Process and Physical Evidence.
- For a range of different packed products, discuss the inter-relation between the pack and the product’s brand image
- Branding and the impact of packaging on product promotion and advertising.
- Importance of consistency of communication across brand elements
- The inter-relation between the pack, promotion and advertising in different products
- Use of market research tools and techniques to identify customer needs

**Assessment**

This unit is assessed by a written examination of 3 hours consisting questions written against the learning outcomes.

This is a graded unit with pass, merit and distinction being available.

In order to gain a **pass** in the unit candidates must meet all the learning outcomes and achieve an overall mark of **50-59%**.

In order to gain a **merit** in the unit candidates must meet all the learning outcomes and achieve an overall mark of **60-69%**.
In order to gain a **distinction** in the unit candidates must meet all the learning outcomes and achieve an overall mark of **70%+**.

Examinations are offered twice a year in June and November.
Unit 2: Packaging Materials and Components

Credit Value – 18 credits
Guided learning hours – 55 hours

Overview:
In this Unit learners study the main packaging materials: glass, metals, paper/board and plastics, along with pack closures, adhesives and labels.

The raw materials, manufacturing processes and conversion processes used for high volume packaging materials and components are studied. Material properties are discussed, with an emphasis on linking back to “Packaging in Today’s World” where performance properties required to meet the functions of packaging were considered. The properties and uses of the common packaging plastics are investigated, along with ways in which their properties can be modified to broaden their range of performance and uses. Pack closures and the factors affecting seal integrity are also covered in this Unit, along with adhesives and the typical materials used for labels.

Performance throughout all stages is considered, including packaging line (especially material/machine interfaces), storage and distribution, display and sale, use and disposal by the final consumer.

Market uses and applications, along with the influencing factors which affect current and future usage are also reviewed.

In order to gain this unit the candidates must meet the following learning outcomes.

<table>
<thead>
<tr>
<th>Learning Outcomes: what you need to know/understand</th>
<th>Assessment criteria: what you need to do</th>
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</thead>
</table>
| 1. Understand the properties of materials which make them suitable for packaging | 1.1 Compare and contrast the properties of packaging materials.
1.2 Assess the advantages and disadvantages of using a material or combination of materials for packing a particular product
1.3 Evaluate the properties that encourage and/or limit the use of: a) particular raw materials; b) packaging components; or c) processes |
| 2. Understand the synthesis and properties of polymers | 2.1 Describe the basic principles of polymer chemistry
2.2 Explain which factors influence polymer properties |
| 3. Understand the conversion of raw materials into packaging materials and packaging components | 3.1 Describe in detail conversion processes from raw material to finished component |
|  | 3.2 Compare alternative conversion processes used to produce specific components |
|  | 3.3 Explain the role of coatings and treatments for a given material |
|  | 3.4 Produce a specification for a given component or material and describe methods of testing to evaluate performance |
| 4. Understand the raw materials, properties and applications of packaging adhesives | 4.1 Describe the theories of adhesion |
|  | 4.2 Compare the performance of different types of adhesives |
|  | 4.3 Justify the use of a particular type of adhesive for a given product |
| 5. Understand the different types of labels and the materials used | 5.1 Describe the construction, materials, manufacture and use of a given type of label |
|  | 5.2 Compare the advantages and disadvantages of different label types |
| 6. Understand closure systems and the factors that affect seals | 6.1 Describe the functionality of different types of pack closures and seals |
|  | 6.2 Justify the use of a particular pack closure system |
|  | 6.3 Assess the factors that affect closure efficiency and integrity, and how these are evaluated |

**Indicative Content**

1. **Understand the properties of materials which make them suitable for packaging**
   - Comparative properties and uses of:
     - Glass: Type I, II & III
     - Metals: Aluminium; Steel (tin plate, black plate & tin free steel)
     - Paper & board including regenerated cellulose.
     - Plastics/Polymers: The common packaging polymers/co-polymers: polyethylene, polypropylene and polystyrene families, polyvinyl chloride, polyethylene terephthalate, polyesters, thermoplastic elastomers
     - Other polymers used in packaging include: polyvinylidene chloride, Ionomers, polyamide, polyethylene naphthalate, styrene copolymers, polycarbonate, ethylene vinyl acetate, ethylene vinyl alcohol, poly vinyl acetate fluoropolymers, thermoplastic elastomers, and biopolymers.
- Properties and uses, both rigid and flexible where applicable, advantages and disadvantages
- Processing, treatment and preparation of raw materials
- Use of recycled materials and impact on material performance
- Comparison of the use of different material types in terms of properties, performance with due consideration of environmental and commercial aspects as a basis for making an informed and justified selection of the most appropriate material for a range of uses.
- The uses of one or more of the main materials in combinations as packaging material. The functions and advantages of different materials in combination.
- An overview of “new” and “smart” materials being developed for packaging applications and their advantages and disadvantages.

2. **Understand the synthesis and properties of polymers**

- Understand the synthesis of polymers from the monomer and the basic raw materials and the addition polymerisation process for the following:
  
  Low Density Polyethylene (LDPE), High Density Polyethylene (HDPE), Polypropylene (PP), Polystyrene (PS) and Polyvinyl Chloride (PVC)

- Understand the factors which influence the way polymers perform:
  - thermoset vs. thermoplastic vs. thermoplastic elastomer;
  - homopolymers vs. copolymers;
  - chain structure and molecular arrangement;
  - effect of crystallinity and polarity on polymer properties;
  - polymerisation and the role of initiators/catalysts.

**Additives**

- Compare the performance properties of different polymers (see list above in LO 1) in relation to the product packed and the environment within the distribution chain.

- Improvement of polymer properties by orientation, combining materials and coating.

3. **Understand the conversion of raw materials into packaging materials and packaging components**

- Main approaches to packaging manufacture for each major raw material from the basic material itself to the finished product

- Quality aspects, typical defects, on-line and off-line inspection processes. Packing, labelling and traceability of batches.

- Alternative materials and processes for specific performance requirements
The use of re-cycled materials

Materials used for coating, coating processes and why coatings are used.

An overview of the decorative processes used for each material.

The different parts of a packaging specification – specification checklist

Product/pack compatibility requirements

Qualitative and quantitative aspects of a specification

The influence of product/pack compatibility

Complete specifications for different packaging requirements

Do’s and don’ts of producing specifications

Introduction to pack testing techniques and applications

Advantages and disadvantages of various tests

4. Understand the raw materials, properties and applications of packaging adhesives

Theories of adhesion: mechanical, specific/chemical, diffusion.

Raw materials, performance properties, uses.

Basic definitions: tack, open time, setting time, viscosity, solids content.

Major adhesive types: starch and derivatives, emulsions (e.g. PVA), casein, cold seal, acrylic, curing adhesives, pressure sensitive, hotmelts.

Adhesive application methods.

Comparisons of performance and cost.

Specifications for adhesives

Market overview: development of adhesives and reason for use, threats and opportunities.

Draw up the requirements for a good bond and explain how to test for bond strength as part of a production line operation. Factors affecting bond strength, testing bond strength, trouble shooting adhesive problems.

Applications of the common packaging adhesives and how to select appropriate adhesives for a range of uses.
5. **Understand the different types of labels and the materials used**
   - Major label types available and the common materials used
   - Advantages and disadvantages, common uses.
   - Important material properties for each major label type.
   - A comparison of the performance of different label and material type.
   - Designing, developing and specifying for labels.

6. **Understand closure systems and the factors that affect seals**
   - Major pack closure types and the materials used
   - Identification of important material properties for effective seal.
   - Special closure applications: child resistance, tamper evidence, measuring and dispensing features.
   - Closure efficiency and integrity and the functions of packaging, possible conflict with consumer convenience (e.g. easy opening).
   - Decoration processes available.
   - Designing, specifying, evaluating performance.
   - Trouble shooting closure problems
   - Various ways in which packs are closed and, for each, the factors which influence seal efficiency and integrity.
   - Evaluating closure performance: different types of testing.

**Assessment**

This unit is assessed by 2 written examinations of 3 hours (covering Learning outcomes 1, 2 and 3) and 2 hours (covering learning outcomes 4, 5 and 6). Both examinations consist of questions written against the learning outcomes.

This is a graded unit with pass, merit and distinction being available.

In order to gain a **pass** in the unit candidates must meet all the learning outcomes and achieve an overall mark in the two papers of **50-59%**.

In order to gain a **merit** in the unit candidates must meet all the learning outcomes and achieve an overall mark in the two papers of **60-69%**.

In order to gain a **distinction** in the unit candidates must meet all the learning outcomes and achieve an overall mark in the two papers of **70%+**.

Examinations are offered twice a year in June and November.
Unit 3: Packaging Processes

Credit Value - 10 credits
Guided learning hours – 32 hours

Overview:

In this Unit, participants study in detail packaging machinery and packaging line operations.

The Unit also introduces participants to many of the management functions associated with the design, development, production and use of packaging materials and components. These include design, decoration, line operations and quality systems.

The main decoration processes will also be covered and how they relate to the main packaging materials. An understanding of colour, pre press processes and inks will also be covered. The advantages and disadvantages of each process are discussed, allowing students to select the most appropriate process for a range of packaging materials and components.

Throughout this Unit there is a requirement for a high level of knowledge and understanding of materials properties, as studied in “Packaging Materials and Components”.

In order to gain this unit the candidates must meet the following learning outcomes.

<table>
<thead>
<tr>
<th>Learning Outcomes: what you need to know/understand</th>
<th>Assessment criteria: what you need to do</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Understand the packaging design and development process</td>
<td>1.1 Describe the design and development process as applied to a specific example</td>
</tr>
<tr>
<td></td>
<td>1.2 Describe factors which must be considered when developing packaging for new and existing products and identify the roles of different associated disciplines</td>
</tr>
<tr>
<td></td>
<td>1.3 Explain how test programmes are developed, managed and evaluated</td>
</tr>
<tr>
<td>2. Understand the main printing and decoration processes used in packaging</td>
<td>2.1 Describe a specified printing process and compare the advantages and disadvantages against the alternatives</td>
</tr>
<tr>
<td></td>
<td>2.2 Explain the basic physics of colour</td>
</tr>
<tr>
<td></td>
<td>2.3 Summarise the stages of the print preparation and approval processes</td>
</tr>
</tbody>
</table>
### 3. Understand packaging machinery and packaging line operations

| 3.1 | For a given operation describe a packaging line from delivery of components to removal of the finished product, including any off-line operations |
| 3.2 | Assess the factors that impact packaging line efficiency and describe how they might be mitigated |
| 3.3 | Describe the operation of filling or packaging assembly machines |

### 4. Understand how quality systems impact on packaging

| 4.1 | Describe in detail a quality management system |
| 4.2 | Explain how to evaluate the potential risks to the quality, safety and legality of the final packed product |
| 4.3 | Evaluate the role of specifications in a quality management system |
| 4.4 | Explain, for a given pack, what tests would be conducted to ensure pack quality |

### Indicative Content

1. **Understand the packaging design and development process**
   - Graphic and functional design and the functions of packaging
   - Data capture from consumers/retailers to assist with design and material usage.
   - The processes of gathering information in order to develop a new pack, or change an existing pack, drawing up the packaging brief, designing for specific processes, materials and equipment, agreeing standards.
   - Design for marketing and brand requirements, colour schemes and families of packaging.
   - Materials to be used - conventional and more recent alternatives, anti-counterfeiting, prevention of theft techniques, and RFID.
   - Economic considerations - income and expenditure, fixed and variable costs, break-even, profit and selling price.
   - Environmental considerations – packaging optimisation, end of life issues.
   - Communicating information.
   - Managing the packaging development process: defining requirements, agreeing levels of responsibility, decision-making, time scales, agreeing deadlines.
   - Typical major roles and their functions – e.g. designer; marketeer; brand owner; PR company.
   - Developing and managing test programmes to evaluate how products perform on the packaging line and in the supply chain, time requirements for testing.
2. Understand the main printing and decoration processes used in packaging

- Printing processes: letterpress, dry offset letterpress, flexographic, gravure, lithographic, screen, tampo, digital.

- For each process: control of substrate, plate type, ink type, ink transfer, drying, setting standards, maintaining colour consistency.

- Other major processes: varnishing, lacquering, hot and cold foil blocking, embossing, heat transfer printing, ceramic decals.

- Advantages and disadvantages, applications and pack types.

- Basics of physics of colour:
  - Colour printing: use of CMYK, juxtaposition of dots, dot size and print quality, screen angles, limitations of CMYK, use of special colours and bespoke colour palettes or enlarged colour gammet (ECG) systems e.g. Hexachrome™.

- The process steps in design and reproduction
  - Print preparation processes: artwork and copy development, scanning, image assembly and setting, plate making. Developments in pre-press operations, Design management and control, CAD/CAM, computer to print and computer to plate techniques.

- Approval processes: proofing options, limitations of proofs, copy checking, image assembly check, setting approved standards and sign off procedures.

- Specifying requirements, quality aspects, typical defects, on-line and off-line inspection processes. Packing, labelling and traceability of batches.

3. Understand packaging machinery and packaging line operations

- Mapping out a packaging line, showing each sequential station in the line. Basics of operation of:
  - Start of line activities
  - Fillers (solids, liquids, pastes).
  - Cappers (screw thread, ROPP, induction seal, push fit etc.)
  - Labellers (wet glue, self adhesive, sleeves, neck collars, tags).
  - Cartonners (horizontal and vertical feed, glued end, tuck flap, auto-erect etc.).
  - Form, fill and seal operations: vertical, horizontal flow wrappers, sachet forming.
  - Miscellaneous: twist wrapping, bunch wrapping, roll wrapping, adding inserts etc.

- Coding and traceability systems for all levels of packaging.

- End of line activities: cases, trays, shrink wrapping, banding, palletising, stretch wrapping etc.
• For each operation listed above, study the critical product and material performance requirements, product/material/machine interfaces and tolerances for a range of products and packaging materials.

• Requirements and contents of material, equipment and machinery specifications.

• Factors which need to be considered when selecting packaging machinery.

• Specifying packaging machinery: considerations for line design, capital investment, timescale, staffing levels, support activities required, understanding of basic cost of machinery, including maintenance, relating machine specification and expected performance to material specification and performance.

• The key operational elements of common packing lines.

• Different types of on-line and off-line support on the packaging line, identifying the key responsibilities of each.

• Problem solving on the packaging line.

• Calculation of line efficiency from given data on individual equipment speeds and consideration of how line efficiency may be improved to maximise line speed. Measurement of performance using key performance indicators.

4. **Understand how quality systems impact on packaging**

• Understand and define “quality” and have the ability to evaluate how different quality systems operate.

• A critical understanding of ‘fit for purpose’

• Specifications and standards e.g. the **BRC/IOP Global Standard for Packaging and Packaging Materials; ISO Standards**.

• Quality systems, operation in practice.

• The fundamentals of writing a Quality and Process control manual to be used in the control of Standards.

• Application of packaging Technical Standards in a technical environment.

• Evaluating the potential risks and hazards to the quality, hygiene, safety and legality of the final packed product.

• AQLs, critical, major and minor defects, product manufacturing tolerances.

• Record keeping.

• Supplier audits and development of quality and hygiene standards with suppliers.

• Legal aspects and the defence of ‘due diligence’.

• The role played by good specifications in assuring quality.
• Importance of calibrated tests and test equipment.
• On line automatic inspection, off line inspection, laboratory testing, batch testing.
• Calibration and use of certified calibration authorities.

Assessment

This unit is assessed by a written examination of 3 hours consisting questions written against the learning outcomes.

This is a graded unit with pass, merit and distinction being available.

In order to gain a pass in the unit candidates must meet all the learning outcomes and achieve an overall mark of 50-59%.

In order to gain a merit in the unit candidates must meet all the learning outcomes and achieve an overall mark of 60-69%.

In order to gain a distinction in the unit candidates must meet all the learning outcomes and achieve an overall mark of 70%+.

Examinations are offered twice a year in June and November.
Unit 4: Packaging Related Research Project

Credit Value – 10 credits
Guided learning hours – 10 hours

Overview:

Professional practitioners in the packaging industry are faced with different tasks and problems throughout their working life and a programme that prepares people for that type of role needs to ensure that they develop the skills of applying knowledge and expertise to the solving of such real life problems.

This Unit is designed to enable candidates to apply what they know and have learned about packaging to a concrete research project perhaps in their own company. This involves specifying what is to be learned, carrying out research and tests and reporting on their findings.

Tutors can play a key role in all stages of the organisation and completion of the project providing support and advice to candidates. Colleagues in the workplace and beyond and fellow students are also invaluable sources of support.

In order to gain this unit the candidates must meet the following learning outcomes by being able to demonstrate that they can carry out the tasks listed in the assessment criteria.

<table>
<thead>
<tr>
<th>Learning Outcomes: what you need to know/understand</th>
<th>Assessment criteria: what you need to do</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The learner will organize and carry out a packaging related research project</td>
<td>1.1 Selects an appropriate packaging topic and set the objectives</td>
</tr>
<tr>
<td></td>
<td>1.2 Produces a plan</td>
</tr>
<tr>
<td></td>
<td>1.3 Describes the methods used to research the chosen topic</td>
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<td></td>
<td>1.4 Justifies the choice of topic and the methodology</td>
</tr>
<tr>
<td></td>
<td>1.5 Carries out the background reading</td>
</tr>
<tr>
<td>2. The learner shows how to use relevant theory/knowledge to explore a packaging project</td>
<td>2.1 Explains the relevant theory/knowledge</td>
</tr>
<tr>
<td></td>
<td>2.2 Relates theory/ knowledge to the research project</td>
</tr>
<tr>
<td></td>
<td>2.3 Uses examples/illustrations to support the arguments given</td>
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<tr>
<td></td>
<td>2.4 Presents findings</td>
</tr>
<tr>
<td></td>
<td>2.5 Justifies conclusions through evidence and logical argument</td>
</tr>
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<td></td>
<td>2.6 Evaluates the influence of current Information</td>
</tr>
<tr>
<td>3. The learner demonstrates how to present a research report</td>
<td>3.1 Produces a report on the project</td>
</tr>
<tr>
<td></td>
<td>3.2 Demonstrates appropriate writing skills</td>
</tr>
<tr>
<td></td>
<td>3.3 Uses appropriate technical terminology</td>
</tr>
<tr>
<td></td>
<td>3.4 References findings using a standard bibliographical system</td>
</tr>
</tbody>
</table>
Indicative approach

1. The learner will organize and carry out a packaging related research project

   • Choose a topic to allow detailed research and with defined objectives i.e. what it is hoped to find out and achieve; possible links to current job role and usefulness to the company; set clear and defined objectives; proposed audience.

   • Produce a detailed plan that is time bound with definite monitoring points; plan is realistic; availability of background literature.

   • Consider alternative methods; need for method to be clear enough for others to repeat the work; types of activities e.g. colleague interviews, questionnaires, factory visits, line observation.

   • Have clear reasons for choice of topic e.g. personal interest, employer support, and improved career prospects.

   • Use a range of information available and considered; different information sources e.g. books, journals, and internet.

2. The learner shows how to use relevant theory/knowledge to explore a packaging project

   • Ensure the project has a theoretical basis that is clearly explained in a way that demonstrates the candidate understanding of the topic.

   • Be clear how the theory is related to the project.

   • Ensure quality and coherence of arguments.

   • Use a range of presentation methods used e.g. written report, tables, graphs, illustrations, diagrams, photographs.

   • Draws conclusions which are clear and follow from the evidence presented.

3. The learner demonstrates how to present a research report

   • Produce a report which is fit for purpose and appropriate to the chosen audience.

   • Ensure that the report is appropriately formatted and that grammar and spelling are accurate.

   • Use technical terminology accurately to enhance report and explain technical terms where necessary.

   • Use a recognised referencing system e.g. Harvard.
Assessment

This unit is assessed through the production of a research project on a topic chosen by the candidate. PIABC would advise candidates to get approval of a topic by their centre before writing the project.

Success in producing the project allows candidates to demonstrate that they have achieved the learning outcomes and met the assessment criteria.

Candidates should note that evidence of Learning Outcome 1 should appear in the appendices and be referred to in the introduction of the report.

A word count of 5,000 words is suggested for guidance only.

The project is graded unit with pass, merit and distinction being available.

The project is marked using criterion referenced scheme of pass, merit and distinction.

A copy of the grading criteria is available from PIABC (piabc@iom3.org) or can be downloaded from the PIABC website (www.piabc.org.uk).

Projects can be submitted to PIABC 4 times a year on the 1st of February, May, August and November. It is recommended that the project is planned and started whilst completing the taught sessions (where applicable) and that tutors provide students with continuing support.
QUALIFICATION CERTIFICATION

PIABC Level 5 Diploma in Packaging Technology

Please note for all candidates registered with PIABC before 31 December 2017 the qualification certification will be PIABC Level 5 Diploma in Packaging Technology (QCF).

The full award is available at Pass, Merit or Distinction to candidates who successfully complete all the units.

The final qualification grade is worked out as follows:

- For all units achieved at a Pass level, 5 points are awarded towards the final Diploma grade.
- For all units achieved at the Merit level, 10 points are awarded towards the final Diploma grade.
- For all units achieved at the Distinction level, 15 points are awarded towards the final Diploma grade.

When all points are aggregated, the following will determine the overall qualification grade:

- Pass 20 – 34 points
- Merit 35 – 49 points
- Distinction 49+ points

**Examples:**

- **Candidate 1:** 3 passes; 1 merit. 3 units x 5 points plus 1 unit x 10 points = 25 points, therefore overall pass
- **Candidate 2:** 2 passes; 1 merit; 1 distinction. 2 units x 5 points, plus 1 unit x 10 points, plus 1 unit x 15 points = 35 points therefore overall merit
- **Candidate 3:** 1 pass; 2 merits; 1 distinction. 1 units x 5 points plus 2 units x 10 points plus 1 unit x 15 points = 40 points, therefore overall merit
- **Candidate 4:** 1 pass; 3 distinctions. 1 unit x 5 points, plus 3 units x 15 points = 50 points therefore overall distinction

**Unit Certification:** Unit certification is available to candidates who successfully complete full individual units, but who do not wish to complete the full award.
### GLOSSARY

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning outcome</td>
<td>This describes what a learner needs to know, understand or do as a result of the process of learning</td>
</tr>
<tr>
<td>Assessment criteria</td>
<td>These are the requirements learners are expected to meet to demonstrate that a learning outcome has been achieved.</td>
</tr>
<tr>
<td>Indicative content</td>
<td>Indicative content provides examples of the range of content learners are expected to cover in programmes preparing them for assessment.</td>
</tr>
<tr>
<td>Indicative approach</td>
<td>Indicative approach provides an example of the steps learners may take in developing and producing a project.</td>
</tr>
<tr>
<td>Primary Packaging</td>
<td>'Primary' or 'Sales' packaging is packaging which forms a sales unit for the user or final consumer, for example, a box containing soap powder.</td>
</tr>
<tr>
<td>Secondary Packaging</td>
<td>'Secondary' or 'Grouped' packaging is that which contains a number of sales units, for example, a cardboard outer containing a number of boxes of soap powder.</td>
</tr>
<tr>
<td>Tertiary Packaging</td>
<td>'Tertiary' or 'Transport' packaging is packaging that is used to group secondary packaging together to aid handling and transportation and prevent damage to the products, for example, the pallet and shrink wrap used to transport a number of cardboard outers containing boxes of soap powder.</td>
</tr>
<tr>
<td>Packaging</td>
<td>Packaging is defined as &quot;all products made of any materials of any nature to be used for the containment, protection, handling, delivery and preservation of goods from the producer to the user or consumer.&quot;</td>
</tr>
<tr>
<td>Life Cycle Analysis</td>
<td>Life Cycle Analysis is a technique that quantifies the environmental burdens of a total pack in terms of its consumption of raw materials and energy, and the emissions to air, water and the solid waste stream, during its life.</td>
</tr>
<tr>
<td>Life Cycle Assessment</td>
<td>A Life Cycle Assessment is a qualitative interpretation of Life Cycle Analysis results that classifies and evaluates the effect of these results on environmental concerns such as global warming, ozone depletion and acid rain.</td>
</tr>
<tr>
<td>Marketing</td>
<td>Marketing is the management process responsible for identifying, anticipating and satisfying customer requirements profitably. (Source: Chartered Institute of Marketing)</td>
</tr>
</tbody>
</table>
SUGGESTED SOURCE MATERIAL

A comprehensive list of source materials and references that may be used to support learning for the PIABC Level 5 Diploma in Packaging Technology is available from PIABC.