



## **REPORT ON THE NOVEMBER 2019 EXAMINATIONS**

### **PIABC LEVEL 3 CERTIFICATE IN PACKAGING** (QN: 600/0455/1) **AND** **PIABC LEVEL 5 DIPLOMA IN PACKAGING TECHNOLOGY** (QN: 600/0017/X)

This report is concerned with the November 2019 examinations of both the PIABC Level 3 Certificate in Packaging (QN: 600/0455/1) and the PIABC Level 5 Diploma in Packaging Technology (QN: 600/0017/X).

# PIABC LEVEL 3 CERTIFICATE IN PACKAGING

## Unit A: The Fundamental Principles of Packaging

This Unit is assessed by a 2-hour examination in which candidates must answer five questions.

### Learning Outcome 1: Understand the role and functions of packaging

#### QUESTION 1

(This question is worth 25% of the marks for this unit)

*A sauce is packed in a labelled 1 litre glass jar with a metal lug closure. Six jars are collated into a shelf ready corrugated case, which are palletised 20 cases to a layer and stacked seven layers high. The pallet is stabilised with stretch wrap. The product is shelf stable at ambient temperatures.*

For this pack:

- A) List the SIX main functions of packaging. (6 x ½ marks)
- B) Explain how this primary package performs the functions of packaging (6 x 1½ marks) and why each one is important (6 x ½ mark).
- C) Explain how this secondary packaging performs the functions of packaging (5 x 1½ marks) and why each one is important (5 x ½ mark).

#### *Examiners Comments*

1. Summary of what was expected in the answer  
Marker 1 - Understanding of basic functions.  
Marker 2 - Part A – The answer expected the SIX factors of packaging to be identified. Part B – The answer expected a description of how the primary pack achieved each of the six packaging functions and a brief note on why the achievement of each function was important. Part C – The answer expected a discussion of how the secondary pack achieved each of the functions. The preservation function is achieved by the primary pack and may not be required, but protection of the primary pack to ensure it can maintain the preservation is important.
2. Overall comment on students' performance, quality of answers and how students could answer  
Marker 1 - Generally good – the students that took their time to answer scored well.  
Marker 2 - Students' performance was variable. Several candidates described the functions rather than how the pack achieved them. Few students discussed why the functions were important. Students must know the functions of the pack, ideally in the format presented within the course.

### Learning Outcome 2: Understand the major packaging materials and how they are combined to form packaging components

#### QUESTION 2

(This question is worth 25% of the marks for this unit)

- A) A liquid carton (such as a Tetra Pak) for a long-life apple juice is constructed from a multi-layer laminate material. Identify the materials layers in this pack and explain their function. (9 marks)
- B) List EIGHT different properties of a bottle to contain a carbonated soft drink. Against each property, compare the relevant merits of glass and polyethylene terephthalate (PET). (8 x 2 marks)

#### *Examiners Comments*

1. Summary of what was expected in the answer  
Marker 1 - Performance/character of packaging materials. Apply to real situation.

Marker 2 - Part A – An identification of the layers found in liquid cartons for long-life products, and an explanation of their function to the overall pack. Part B – An identification of 8 relevant properties of a bottle for a carbonated soft drink and then the comparison of performance of glass and PET, against these 8 properties.

2. Overall comment on students' performance, quality of answers and how students could answer
- Marker 1 - Part A – Generally answered well with clear understanding. Part B – Average score only. Not a clear understanding of the objective nor the word 'properties'. May need emphasis.
- Marker 2 - Part A – Most students provided reasonable answers however full details were lacking preventing full marks. Part B – A wide range of properties were identified; some were not relevant e.g. anti-fog. Some candidates considered different properties for glass and PET therefore not making the comparison in properties. Most candidates provided reasonable to good answers.

### **Learning Outcome 3: Understand the packaging development processes**

#### **QUESTION 3**

(This question is worth 20% of the marks for this unit)

- A) Describe, using examples, THREE different reasons for implementing a pack change by a packer/filler or brand owner. (3 x 1 mark)
- B) When developing packaging for a new chilled food product suitable for home freezing; identify SIX technical factors to be considered and explain why each is important. (6 x 2 marks)
- C) Identify FIVE typical roles/disciplines that should be involved in all packaging development projects. For EACH, briefly describe why they are required. (5 x 1 mark)

#### *Examiners Comments*

1. Summary of what was expected in the answer
- Marker 1 - Understand how products are developed and the various roles involved.
- Marker 2 - Part A – The question expected 3 examples of pack change to be discussed, with a clear reference as to why the change would be made. Part B – The question provides a specific product type. Students should discuss 6 technical issues/factors to be considered for this product. Part C – Identify and describe the role of 5 groups/individuals involved in the packaging development program.
2. Overall comment on students' performance, quality of answers and how students could answer
- Marker 1 - Parts A & C – scored well with clear understanding. Part B – students (generally) didn't understand the relevance in the question about chilled products being frozen.
- Marker 2 - Part A – Most candidates provided reasonable examples however specific rationale could have been more fully discussed. Part B – Most students made reasonable attempts at this part of the question. Some suggestions were not practical e.g. use of glass or considering requirement for freeze/thaw/freeze cycling which would not be sale. Part C – Most students provided reasonable answers however discussion of role could be expanded.

### **Learning Outcome 4: Understand packaging costs and quality systems**

#### **QUESTION 4**

(This question is worth 15% of the marks for this unit)

- A) Discuss SIX factors you need to consider when ordering packaging components to optimise order quantities. (6 x 1 mark)
- B) Define fixed and variable costs (2 marks) and provide TWO examples of each (2 marks).
- C) Discuss why in the long run all costs are variable. (2 marks)
- D) Briefly describe THREE different types of quality costs and provide an example of each. (3 marks)

### *Examiners Comments*

1. Summary of what was expected in the answer  
Marker 1 - Factors affecting costs. Quality v. cost.  
Marker 2 - Part A – Discuss 6 factors which can contribute to the calculation of the economic order quantity e.g. cost of placing an order, storage costs, cost of stock out. Part B – Variable costs – charge with production levels. Fixed costs – don't charge with production levels. Part C – Question required a discussion of how in the long term all factors can be charged e.g. smaller/larger premises. Part D – Quality costs are often described in terms of prevention, appraisal and failure.
2. Overall comment on students' performance, quality of answers and how students could answer  
Marker 1 - Generally good understanding.  
Marker 2 - Most candidates made reasonable attempts at Part A. Several students became confused over definition of fixed and variable costs. Considering what costs change over time rather than production level, which also confused Part C. Few students identified the common description of preventative, appraisal and failure costs and instead identified different failure costs.

<p style="text-align: center;"><b>Learning Outcome 5: Understand the relationship between packaging and the environment</b></p>
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### **QUESTION 5**

(This question is worth 15% of the marks for this unit)

Identify FIVE methods of managing packaging waste and discuss their relative advantages and disadvantages. (5 x 3 marks)

### *Examiners Comments*

1. Summary of what was expected in the answer  
Marker 1 - Positive and negatives of packaging disposal/handling. Tools and techniques.  
Marker 2 - The question expects a discussion of relative merits of 5 waste management strategies for packaging waste. Reduce, Reuse, Recycle, Compose, Incinerate and Landfill.
2. Overall comment on students' performance, quality of answers and how students could answer  
Marker 1 - Generally average responses (possibly time affected?). Usual laziness in answers – i.e. not properly discussing and/or not giving advantages and disadvantages to examples.  
Marker 2 - Most students provided good answers covering the range of options. Marks were lost for lack of details.

# PIABC LEVEL 5 DIPLOMA IN PACKAGING TECHNOLOGY

## Unit 1: Packaging in Today's World

This unit is assessed by a 3-hour examination and candidates must answer six questions.

### Learning Outcome 1: Understand the role of packaging in the modern society

#### QUESTION 1

(This question is worth 10% of the marks for this unit)

- A) Discuss how globalisation has impacted on the packaging industry. (5 marks)
- B) Companies can be heavily criticised within the media if they are deemed to have not acted in a socially responsible manner. Discuss the actions companies can take to ensure that they are considered as socially responsible. (5 marks)

#### *Examiners Comments*

1. Summary of what was expected in the answer  
Marker 1 - Development of packaging and how it is affected by globalisation. Corporate social responsibility and packaging.  
Marker 2 - Part A - Factors to consider include: Sourcing materials globally, selling products globally, understand the customer base, opportunities for wider ranges of products / formats. Part B - Factors to consider include: Meeting all legislation requirements, being environmentally responsible. Ensuring good employment practice is adhered to. Plus, local engagement in the communities in which the operate or sell products.
2. Overall comment on students' performance, quality of answers and how students could answer  
Marker 1 - Generally average, but poor understanding of globalisation and how it impacts our industry.  
Marker 2 - Generally, a well answered question.

### Learning Outcome 2: Understand the structure and interactions of elements in the packaging supply chain

#### QUESTION 2

(This question is worth 20% of the marks for this unit)

- A) A company produces tinned tomato soup for distribution to leading supermarkets. Describe the supply chain for ALL packaging items that the packer filler is likely to use from raw materials to packaging components ready for despatch to the packer filler. (12 marks)
- B) Shock from drops can be a significant cause of damage to electrical products. Discuss how the risks of shock damage to a smart phone in distribution could be minimised. (8 marks)

#### *Examiners Comments*

1. Summary of what was expected in the answer  
Marker 1 - Supply chain of packaging materials and component. Interpretation of supply chain sectors.  
Marker 2 - Part A - A company produces tinned tomato soup for distribution to leading supermarkets. Describe the supply chain for ALL packaging items that the packer filler is likely to use from raw materials to packaging components ready for dispatch to the packer filler. Packaging items to consider include, along with a description of the supply chain: Tinplate three or two piece can and end - Steel extracted from ore in smelting plant and rolled into sheets. Tin coated / lacquered and formed into cans. + label, hot melt glue, corrugated SRP, pallet, stretch wrap. Part B - Shock from drops can be a significant cause of damage to electrical products. Discuss how the risks of shock damage to a smart phone in distribution could be minimised. A discussion on the design stage, a more robust product can be designed

with a knowledge of product fragility and hazards of distribution environment will enable cushioning to be designed to provide protection against anticipated shocks. Consider the collation packaging and or palletization to reduce risks of drops.

2. Overall comment on students' performance, quality of answers and how students could answer  
Marker 1 - In Part A the common error was not pick out all the packaging components affected.  
Marker 2 - In Part A some students discussed the supply chain for a filled can of tomatoes and in Part B the understanding of the design criteria and distribution testing was not well answered.

### Learning Outcome 3: Understand the functions of packaging

#### QUESTION 3

(This question is worth 30% of the marks for this unit)

- A) Vitamin tablets can be packed in a blister pack and carton or a plastic bottle. Discuss how both of these packaging formats perform the functions of packaging. (13 marks)
- B) A branded shower gel is packed for distribution through a major supermarket. Describe an appropriate primary, secondary and tertiary package for this product and discuss how the functions of packaging are achieved by each. (11 marks)
- C) Discuss the factors which will cause the following packs to degrade:
- Plastic bottle for bleach (2 marks)
  - Corrugated case used for delivery of a laptop computer (2 marks)
  - Decorated metal chocolate biscuit box (2 marks)

#### Examiners Comments

1. Summary of what was expected in the answer  
Marker 1 - Functions of packaging. Role of packaging with functions. Degradation factors of materials.  
Marker 2 - Part A - A discussion on all the functions including commercial and environment. For example  
Contain: Bottle sealed with a cap to prevent loss of contents. Blister pack heat sealed individual pills into blister depressions. Protect: Bottle is more rigid against compression hazards. Blister pack provides protection from pill to pill contact against vibration or shock. Effective seals provide protection from contamination. Part B - A description of the packaging system could be as follows - Primary pack: Plastic bottle, label or printed bottle, closure. Secondary pack: corrugated shelf ready case and labels. Tertiary pack: pallet, stretch wrap, ID labels. Followed by how each meets the functions of packaging. Part C - For example a plastic bottle may have an interaction with the product which may cause ESC and UV light can make the colour fade. A corrugated case will suffer from reduced strength as moisture levels increase and a metal box could corrode with exposure to moisture and be dented by knocks and bangs.
2. Overall comment on students' performance, quality of answers and how students could answer  
Marker 1 - Generally sound. Wide spread of answer quality. Some very lazy attempts.  
Marker 2 - Reasonable answers but students did not always go through all the different functions so lost marks.

### Learning Outcome 4: Know the principles of the key legislation, regulations and standards relating to the packaging supply chain

#### QUESTION 4

(This question is worth 15% of the marks for this unit)

- A) A pre-printed film is used to flow wrap prepared salads. Discuss FOUR different legal requirements, each from a different piece of legislation, which this film must comply with. (4 x 3 marks)
- B) For the above product, discuss THREE possible consequences of failing to comply with the legislative requirements. (3 x 1 mark)

### *Examiners Comments*

1. Summary of what was expected in the answer  
Marker 1 - Legislation surrounding packaging. Consequences of non-compliance.  
Marker 2 - Part A - A pre-printed film is used to flow wrap prepared salads. Discuss FOUR different legal requirements, each from a different piece of legislation, which this film must comply with. Legal requirements include: Plastics in contact with food regulations which requires the level of transmission of constituents from the pack to the product to be controlled. Others include the Food Safety Act, Food Labelling Regulations and Weight and Measures Legislation.  
Part B - Need to consider fines such as compensation to injured parties also damage to reputation and lost sales.
2. Overall comment on students' performance, quality of answers and how students could answer  
Marker 1 - Part B – Very good throughout. Part A – Wide spread of knowledge. Some creative guesses!  
Marker 2 - Most students answered this reasonably well, but marks lost as the reference to a piece of legislation was vague and without an explanation.

<p style="text-align: center;"><b>Learning Outcome 5: Understand the factors that affect the impact of packaging on the environment</b></p>
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### **QUESTION 5**

(This question is worth 15% of the marks for this unit)

- A) Explain what is meant by an environmentally responsible pack. (3 marks)
- B) Provide a definition for life cycle assessment. (2 marks)
- C) Identify FIVE methods of managing packaging waste and discuss their relative advantages and disadvantages. (5 x 2 marks)

### *Examiners Comments*

1. Summary of what was expected in the answer  
Marker 1 - Environmental impacts. Disposal methods.  
Marker 2 - Part A - An environmentally responsible pack is one considered in conjunction with its contents for the damage both can cause to the environment. It gets the product from production to consumption with the minimum use of materials and energy and generating the least amount of waste. It should be resource efficient throughout the distribution chain and prevent product wastage by optimising packaging materials and energy used and enable recovery. Part B - Life cycle assessment (LCA) is a management tool allowing the collection and evaluation of data on the inputs and outputs of materials, energy and waste of a product over its entire life cycle. By using it you can calculate a product's possible impact on the environment. Part C - A full discussion was required on the following methods - Reduce/source optimisation, Reuse/refill, Recycle, Landfill, Waste to energy (Incineration with Energy Recovery) and Recovery through composting.
2. Overall comment on students' performance, quality of answers and how students could answer  
Marker 1 - Generally good scores (apart from 2-3 weaker candidates) – some lower scores in Part B look to be due to time pressure.  
Marker 2 - Reasonable answers, but marks lost when answer lacked depth.

<p style="text-align: center;"><b>Learning Outcome 6: Understand the relationship between packaging and marketing</b></p>
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### **QUESTION 6**

(This question is worth 10% of the marks for this unit)

Discuss FIVE different activities or tools used in the market research process to identify consumer needs. Give examples to explain your answer. (5 x 2 marks)

### *Examiners Comments*

1. Summary of what was expected in the answer  
Marker 1 - Packaging and marketing interaction knowledge.  
Marker 2 - Part A - Market research activities and tools include determining product viability both economically and technically. Assessing consumer needs, use SWOT and Gap analysis plus demographic and psychographic studies.
2. Overall comment on students' performance, quality of answers and how students could answer  
Marker 1 - No-one scored very high – possibly due to time pressure? Otherwise, those that had studied the marketing module did quite well. Those that scored poorly, clearly did not have the detail, but did understand the question.  
Marker 2 - Generally good answers but important to give a description of the activity with examples.

## **Unit 2: Packaging Materials and Components (Paper A)**

Paper A is worth 70% of Unit 2 and is assessed by a 3-hour examination. Candidates must answer five questions. The paper has seven questions and the candidates have the option to answer two out of three questions for both Learning Outcomes 1 and 3.

<p><b>Learning Outcome 1: Understand the properties of materials which make them suitable for packaging</b></p>
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**This Learning Outcome is worth 40% of the marks for this paper and candidates were required to answer two of the following three questions: 1, 2 & 3**

### **QUESTION 1**

For each of the following packed products, justify the suitability of the given material:

- A) An injection blow moulded polyethylene terephthalate (PET) bottle to contain washing up liquid. (4 x 1 mark)
- B) A polyamide/polyethylene (PA/PE) film to vacuum pack meat. (4 x 1 mark)
- C) High density polyethylene extrusion (HDPE) blow moulded bottle to contain bleach. (4 x 1 mark)
- D) A thermoformed sheet of crystalline polyethylene terephthalate (CPET) for a ready meal. (4 x 1 mark)
- E) Metallised biaxially orientated polypropylene (BOPP) film for the packaging of nuts. (4 x 1 mark)

### *Examiners Comments*

1. Summary of what was expected in the answer  
Marker 1 - The question requires the justification of the selection of the material for the pack. The justification should take into consideration the material and any relevant processes (e.g. orientation). The justification of the material can take marketing, technical or manufacturing requirements into consideration.  
Marker 2 - Justification as follows for example for Part A - An injection blow moulded polyethylene terephthalate bottle to contain washing up liquid has a good moisture barrier. It is transparent allowing customer to see the product. Strong, good impact strength does not break when dropped. Stiff and dimensionally stable in the neck area allowing for excellent seal between the neck finish and the closure.
2. Overall comment on students' performance, quality of answers and how students could answer  
Marker 1 - A wide range of answers were provided from excellent, full mark answers to relatively poor answers. Students claimed properties materials do not have e.g. good O<sub>2</sub> barrier from HDPE, clarity from CPET. Few students considered the characteristics of the material for the manufacturing method.  
Marker 2 - Some good answers but generally a poor understanding of the packed product material properties.

## QUESTION 2

- A) List the ingredients used in the manufacture of glass bottles to pack a UV sensitive product (6 x ½ mark) and explain how they affect the properties of the glass (6 x ½ mark).
- B) Discuss why glass is the material of choice for packing perfume. (8 x 1 mark)
- C) The pharmaceutical industry classifies glass as I, II and III; describe the differences and applications of these types. (3 x 2 marks)

### *Examiners Comments*

1. Summary of what was expected in the answer  
Marker 1 - Part A – The student should identify the main ingredients of container glass and describe the function of each material. Colours for producing amber glass should be included. Part B – The student should discuss why glass is an appropriate packaging material for perfume packaging. The properties of glass material and the forming process can be included. Part C – The student should describe the 3 types of pharma glass and provide pharma applications for each.  
Marker 2 - Part A - Raw materials include silica sand provides the structure for the glass, soda ash (sodium carbonate) which lowers the glass transition temperature and cullet which reduces the amount of energy to melt the glass. Part B - Glass can be moulded into a unique shape to represent the brand, providing a perception of quality to the product by the consumer. It is inert and a barrier to odour, alcohol and moisture. Part C - Type I is borosilicate High hydrolytic and heat resistance. Completely inert and used in medicinal applications in the form of vials. Type II is normal soda glass but is dealkalised and used for eye drops. Type III is standard alkaline glass and used for cough medicines and tablets.
2. Overall comment on students' performance, quality of answers and how students could answer  
Marker 1 - Students generally answered this question well. Marks were lost for not describing the function of the glass ingredients and not providing pharma applications of pharma glass types.  
Marker 2 - Generally, well answered but answers to Part C were either very good or very poor.

## QUESTION 3

- A) Discuss how the selection of raw materials, additives and pulp processing can influence the characteristics of paper. (14 marks)
- B) Identify and describe how SIX paper properties can be measured. (6 x 1 mark)

### *Examiners Comments*

1. Summary of what was expected in the answer  
Marker 1 - Part A requires a discussion of the various factors which can affect the properties of paper. The factors are separated into fibre source, additives and the pulp processing operations. The impact on the strength, printability, colour should be considered. Part B requires the identification of 6 paper properties and a description of how those characteristics can be assessed (i.e. the method of testing).  
Marker 2 - Part A - Material selection includes the different types of fibre used and their properties e.g. hardwood has shorter fibres (1 – 1.5 mm) which will produce weaker papers. Additives include bleaching agents to increase whiteness with fillers such as chalk to give an improved print surface and reduced cost. Pulping processes include mechanical, chemical and semi chemical. Mechanical is a quick process, damages the fibres reducing strength but high yield. It contains lignin which may discolour over time. Beating and refining also affect the characteristics such as tensile strength, air porosity and moisture absorbency. Also provides a smoother print surface. Part B - Tests include the Cobb test method to assess water absorbency, burst and tensile strength. Also, coefficient of friction (slip).
2. Overall comment on students' performance, quality of answers and how students could answer  
Marker 1 - Student performance was highly variable, with both good and poor answers. Most answers identified hard and softwood, but some did not consider recycled materials. A range of additives were generally identified. Processing methods sometimes only considered pulping methods but did not consider the beating and refining.

Marker 2 - Some excellent answers but generally candidates did not understand how materials, additives and the pulping processes can significantly affect the characteristics of paper.

**Learning Outcome 2: Understand the synthesis and properties of polymers**

**QUESTION 4**

(This question is worth 20% of the marks for this paper)

- A) Describe what a polymer is. (2 marks)
- B) Describe, with use of diagrams, the polymerisation process for the production of low-density polyethylene (LDPE). (10 marks)
- C) Explain how each of the following affects the properties of a polymer:
- Copolymerisation (2 marks)
  - Chain branching (2 marks)
  - Choice of monomer(s) (2 marks)
  - Glass Transition Temperature (2 marks)

*Examiners Comments*

1. Summary of what was expected in the answer
- Marker 1 - Part A – requires a description of what a polymer is. Part B – requires a description of free radical initiated additional polymerisation process. This should include the creation of the free radical, the initiation of the polymerisation process, the chain growth and termination. Part C – requires an explanation of the given characteristics and a discussion of how these influence the properties of the materials.
- Marker 2 - Part A - Polymers are large, complex structures made by adding smaller molecules (mers) together. Poly means many, Mer means a unit. Polymer: many units. Part B - Free radical addition polymerisation used for LDPE. Describe structure of monomer C<sub>2</sub>H<sub>4</sub>. The process has three stages: initiation, propagation, and termination. Full description required. Part C - For example: the glass transition temperature T<sub>g</sub> is the point at which the amorphous polymeric material freezes. There is no chain movement is possible below T<sub>g</sub>. Mechanical behaviour becomes glass like – brittle.
2. Overall comment on students' performance, quality of answers and how students could answer
- Marker 1 - Most students provided reasonable to good answers to all parts of this question. Marks were lost for lack of detail or failure to relate to characteristics of materials. A few students provided answers which suggested that they didn't understand the question.
- Marker 2 - Parts A and B generally well answered but some candidates did not understand Part C.

**Learning Outcome 3: Understand the conversion of raw materials into packaging materials and packaging components**

**This Learning Outcome is worth 40% of the marks for this paper and candidates were required to answer two of the following three questions: 5, 6 & 7**

**QUESTION 5**

- a) Briefly describe FOUR different types of materials used to make rigid metal packaging and their typical applications. (4 x 2 marks)
- b) Describe, with the aid of a diagram, the manufacture of the body of a printed 3-piece metal can from receipt of unprinted reels of metal to despatch of cans for a retorted food product. Detailed description of the printing process is not required. (12 marks)

*Examiners Comments*

1. Summary of what was expected in the answer

Marker 1 - Part A – Requires 4 materials used to make rigid metal packs to be described and examples of typical packs for each identified. Part B – Required the description of the manufacture of a 3-piece can from reels of materials to packed cans ready for despatch to packer filler. The can body should be printed, but details are not required.

Marker 2 - Part A - Materials include blackplate, tinfoil, tin free steel and aluminium. For example: blackplate has no additional metallic coating so has poor natural resistance to corrosion even when coated with a lacquer. Used without internal lacquer for products such as wax oil or grease. Part B - A detailed description of a three-piece can process flow was required including appropriate quality checks at various parts of the process. For example, the process starts with a coil of tinfoiled steel. A shear line cuts the coil into large sheets, coating with internal lacquer and curing. Printing of design on outside face. Once cured, slitting to size, forming, welding, flanging and can makers end seamed on. Wall beading, leak test then layer packed using layer pads, strapped and palletised.

2. Overall comment on students' performance, quality of answers and how students could answer  
Marker 1 - Students did not answer Part A well. There appeared confused over tin, steel and tinfoil. Example of applications were not always considered. Most students provided a reasonable process, but some details were missed. Several students ignored palletisation of products. A few students were confused with the sequencing of the process activities (e.g. when printing would be undertaken).

Marker 2 - Generally answered poorly because the manufacturing process was not covered in enough detail nor in the right sequence.

## QUESTION 6

- A) Describe, with the aid of diagrams, the manufacture of a coloured extrusion blow moulded plastic container to hold 4.5 litres of motor oil. In your answer describe the process from receipt of raw materials to despatch of finished container to the filler and justify a suitable material for the container. (15 marks)
- B) What are the advantages and disadvantages of the extrusion blow moulding process? (5 marks)

### *Examiners Comments*

1. Summary of what was expected in the answer

Marker 1 - Part A - requires the description of the extrusion blow moulding process from granules of polymer to finished product ready for despatch to the packer filler. Key elements are the extruder, die and blow moulding process. Part B – required the listing of the advantages and disadvantages of the EBM process as compared to alternative methods to produce containers.

Marker 2 - Part A - Material likely to be HDPE or possibly PP copolymer as both materials are relatively low cost, have good barrier properties against motor oil, are easy to blow mould and are stiff enough. A description of process from receipt of materials where they will QC checked. with annotated diagrams of the plasticating extruder, the extrusion head and bottle blowing. Bottles are quality checked, e.g. air pressure for holes, verticality, bore of neck, then packed and labelled onto layer pads and stretch wrapped on a pallet or packed in a PE bag liner in a CFB outer (or equivalent) for delivery to customer. Part B - Advantages of EBM include a wide variety of container shapes, sizes and neck openings, with a high rate of production. Disadvantages include inconsistent neck formation due to blowing and topping & tailing actions with limited control over wall thickness.

2. Overall comment on students' performance, quality of answers and how students could answer  
Marker 1 - A wide range of performances was evident from students. Few identified QC on the incoming materials, most could attempt to describe the extruder, but the blowing process was not well described in general. A couple of students described alternative processes, which was not acceptable as the question asked for the EBM process.

Marker 2 - Part A was poorly answered because there was not enough detail about the process and the materials used. Part B had some excellent answers but generally candidates did not understand the process to be able to give advantages and disadvantages.

## QUESTION 7

- A) Briefly describe the manufacturing process for single walled corrugated board. (9 marks)
- B) Evaluate the methods available to produce a case blank for a regular slotted case style 0201 from formed corrugated material. (5 marks)
- C) Discuss THREE common faults in corrugated cases which may be created in the box cutting, creasing and folding operations. (6 marks)

### *Examiners Comments*

1. Summary of what was expected in the answer  
Marker 1 - Part A – required a description of the operation of a corrugator to produce single walled board from rolls of paper. A diagram of the corrugator would be useful, but a discussion of the processing steps is also required. Part B – this section required a description and comparison of flat and rotary die cutting and slotter creaser case making processes. Part C – this requires a description of 3 common faults on corrugated boxes caused during the box cutting and folding operations.  
Marker 2 - Part A - Process to cover a description of first single facer including conditioning of paper of suitable grade. Corrugation of fluting, application of starch adhesive, pressure application to form bond. Carried over bridge. Then double backer added to create the board, slit to width and cut to length required for sheets. Sheets stacked. Part B - Methods include Cutter Creaser where creases are added by creasing wheel and slots cut with slotter. Also, rotary and flatbed die cutters. The die process gives better dimensional accuracy. Flatbed better than rotary but rotary is faster. Part C - Faults include slot depth not to crease line, either under cut or over cut. Case flaps will not fold in or will leave a hole in the case corner. Excessive glue leaking out from manufacturers joint and sticking the flat packed case together so it cannot be erected or too little adhesive and case joint failing.
2. Overall comment on students' performance, quality of answers and how students could answer  
Marker 1 - This was an unpopular question with few students attempting the question. The question was poorly answered. Students did not understand the process for constructing corrugated board. Many important steps were omitted, and others were incorrect. This was the last question attempted for all students so time may have been a contributing factor.  
Marker 2 - Students lost marks because they did not describe the process of manufacturing corrugated sheet followed by the conversion process correctly. Some faults described but not enough detail provided of what the consequences are.

## **Unit 2: Packaging Materials and Components (Paper B)**

Paper B is worth 30% of Unit 2 and is assessed by a 2-hour examination. Candidates must answer three questions.

<p style="text-align: center;"><b>Learning Outcome 4: Understand the raw materials, properties and applications of packaging adhesives</b></p>
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### **QUESTION 1**

(This question is worth 30 marks for this paper)

- A) Describe THREE theories of adhesion. (3 x 3 marks)
- B) Adhesives often must “set” after application. Describe three processes by which adhesives set and provide an example of each. (3 x 3 marks)
- C) Corrugated cases are often constructed using a different adhesive for construction of the corrugated board, the creation of the manufacturer’s joint and closing the flaps once the case is filled. Justify the use of a particular adhesive for each of these applications. (3 x 3 marks)
- D) Explain why more adhesive does not always mean improved bond performance. (3 marks)

### *Examiners Comments*

1. Summary of what was expected in the answer  
Marker 1 - Part A - In mechanical the adhesive flows into surface irregularities and then sets. Adhesive is mechanical keyed into surface. In chemical, bonding is produced by electrical forces between molecules. The action is over very small distances so require smooth surface for good surface contact. Molecular diffusion is between two surfaces where surfaces can merge and produce a bond. Part B - Processes include loss of solvent, loss of water, loss of heat and chemical curing. For example: hot melts are melted polymer. As the melt is cooled the polymer solidifies and sticks the materials together. E.g. PE based hot melt. Part C - For example: corrugated board uses a starch adhesive. Water based paste set by heating and water loss. Economical to use. Does not reduce quality of recycled pulp made from board. Part D - Explanations include more adhesive can slow down the setting time leading to a joint which can then creep and open. There may be more solvent to evaporate, or hot melts will take longer too cool.
2. Overall comment on students' performance, quality of answers and how students could answer  
Marker 1 - Generally well answered.

<b>Learning Outcome 5: Understand the different types of labels and the materials used</b>
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### **QUESTION 2**

(This question is worth 30 marks for this paper)

- A) A bottle of wine is labelled with a glue applied metalised paper label, which has been printed and embossed.
1. Describe an appropriate paper for this application. (2 marks)
  2. Discuss the material properties to be considered when specifying, manufacturing and applying this label. (6 marks)
- B) Discuss the advantages and disadvantages of shrink sleeves compared to self-adhesive (pressure sensitive) paper labels. (16 x 1 mark)
- C) Discuss the benefits of using in-mould labelled containers for butter and yellow fat products. (6 marks)

### *Examiners Comments*

1. Summary of what was expected in the answer  
Marker 1 - Part A - An appropriate paper is usually a high-quality virgin white or bleached kraft paper. Recycled paper grades also available. Paper would be highly. Factors to consider with a discussion include Surface smoothness, Opacity, Stiffness, Porosity, Water absorbency, Grain direction. Part B - Advantages and disadvantages include the shrink sleeve covers the whole body but expensive. It is good for awkward shaped containers and will form to container contours and provide all round decoration. Sleeves are usually reverse printed, so scuffing is minimised. However, shrink sleeves are difficult to emboss and specialised inks required (ability to shrink). Proprietary and patented technologies with specialised equipment to shrink. Orientation usually in one major direction only. Part C - Benefits include the label can be manufactured from same material as container. Label placed in mould and then container material injected in. No need to label on filling line. Provides good almost all-round decoration. Good adhesion to container.
2. Overall comment on students' performance, quality of answers and how students could answer better in the future  
Marker 1 - Part A was answered poorly with candidates misunderstanding what a glue applied label is.

## Learning Outcome 6: Understand closure systems and the factors that affect seals

### QUESTION 3

(This question is worth 30 marks for this paper)

1. 70cl glass bottle of wine
2. A printed plastic wrap for an ice cream bar
3. A metal retort can of soup
4. A two ply paper sack containing 10-litres of cat litter (clay)
5. A plastic bottle for tomato ketchup

For EACH of the above packed products:

- Describe, using a diagram where appropriate, how you would achieve a closure. (5 x 4 marks)
- Explain why you would use the chosen method for the products. (5 x 1 mark)
- How would you assess the closure efficiency and integrity for the products? (5 x 1 mark)

#### *Examiners Comments*

1. Summary of what was expected in the answer  
Marker 1 - For example: with a 70cl glass bottle of wine a ROPP (roll on pilfer proof) or barrier “cork” with tamper evident feature, or pre-formed screw cap with tamper evident feature. All need to seal with neck finish. Why chosen – the ROPP is easy to remove and replace by hand – multi serving – resistant to water and alcohol, barrier to same, aesthetics. Check by leak test, tamper evident test, ease of opening, seal integrity on reclosing.
2. Overall comment on students’ performance, quality of answers and how students could answer  
Marker 1 - Generally well answered.

## Unit 3: Packaging Processes

This unit is assessed by a 2-hour examination and candidates must answer five questions.

## Learning Outcome 1: Understand the packaging design and development process

### QUESTION 1

(This question is worth 20% of the marks for this unit)

- A) Describe the stages of the design and development process to launch single portion, snacking, bars of cheese from initial concept to launch. (9 marks)
- B) Identify and describe the roles of SIX associated disciplines involved in the process. (6 x 1 mark)
- C) Identify, and briefly explain, FIVE different tests that could be used to show the compatibility of the cheese and packaging through life. (5 x 1 mark)

#### *Examiners Comments*

1. Summary of what was expected in the answer  
Marker 1 - Part A – requires a description of the packaging development process. This is often presented as a 6-step process. The activities included in each phase must be described. Part B – requires the identification and description of 6 roles/disciplines involved in the pack development process. As terminology differs from organisation to organisation the description of activities is vital. Part C – requires a brief explanation of 5 tests that would be used on the pack. These are likely to be varied. Justification of test may be required.
2. Overall comment on students’ performance, quality of answers and how students could answer  
Marker 1 - Most students provided reasonable answers to all parts of this question. Students lost marks in Part C for only providing details of 3-4 tests or repeating tests. While most

students provided good answers to Part A a few did not describe a development process and instead listed a range of questions to be considered.

**Learning Outcome 2: Understand the main printing and decoration processes used in packaging**

**QUESTION 2**

(This question is worth 20% of the marks for this unit)

- A) Define and explain the following printing terms:
- Hue (1 mark)
  - Brightness (1 mark)
  - Saturation (1 mark)
- B) Explain how printing processes use the process colours (CMYK) to produce photographic images. (5 marks)
- C) Describe, with aid of diagram, the offset lithographic printing process for a 3-colour and varnished carton. (12 marks)

*Examiners Comments*

1. Summary of what was expected in the answer  
Marker 1 - Part A – requires a range of definitions. Part B – requires a description as how process printing is achieved with CMYK colour printing. The apparent colour is achieved by varying the dot pattern of the CMYK colours. Factors which impact on this need to be discussed including screen size and angle, dot shape and dot size/frequency. Part C – requires a description on the litho printing process for the given product. A detailed description of a single printing unit is required, along with a description of how the processes can be combined into the required process.
2. Overall comment on students' performance, quality of answers and how students could answer  
Marker 1 - The answers provided by students varied greatly. While most provided reasonable/good answers some students clearly did not understand the process. Some students appeared not to fully understand the question and provide general answers.

**Learning Outcome 3: Understand packaging machinery and packaging line operations**

**QUESTION 3**

(This question is worth 20% of the marks for this unit)

- A) Pain relief tablets for retail are packed in a blister pack with a leaflet and carton. Describe a packaging operation for this product from bulk tablets to packed product ready for despatch to major retailer's distribution hub. (16 x 1 mark)
- B) Discuss the benefits and risks with Just In Time (JIT) manufacturing philosophy. (4 x 1 mark)

*Examiners Comments*

1. Summary of what was expected in the answer  
Marker 1 - Part A – requires a description of the packaging line from the delivery of materials to the packer filler to packed produce ready for despatch. The main elements of the manufacturing process need to be included as should quality checks, coding, etc. Part B requires a discussion of the advantages and disadvantages of JIT production.
2. Overall comment on students' performance, quality of answers and how students could answer  
Marker 1 - Most students provided good answers to the question. Several students did not include QC. Some students provided flow diagrams only, but additional comments are required to gain high marks.

#### QUESTION 4

(This question is worth 20% of the marks for this unit)

- A) Describe how weight-based filling systems can be used to meter products. (3 marks) What types of products is this technology suitable for? (2 marks)
- B) Evaluate the advantages and disadvantages of pre-formed trays with tray sealer compared with trays manufactured in thermoform fill seal equipment. (5 marks)
- C) Discuss FIVE methods of adding variable data to product packaging. (5 marks)
- D) Evaluate the relative merits of stretch and shrink wrapping for stabilising pallets loads of unitised products. (5 marks)

#### *Examiners Comments*

1. Summary of what was expected in the answer  
Marker 1 - Part A – required a description of a weight-based filling system such as a multi head weigher, and the identification of suitable materials which could be filled with the described system. Part B – required an evaluation of the advantages and disadvantages of preformed trays as opposed to trays formed on a form fill machine. The analysis should consider technical, economic and practical concerns. Part C – required a discussion of 5 methods to add variable data to packs e.g. best before dates, lot codes. The discussion requires more than the types to be identified. Part D – required the relative merits of stretch and shrink wrap to for stabilising pallet loads of products. The answer should focus on the differences between these systems.
2. Overall comment on students' performance, quality of answers and how students could answer  
Marker 1 - Most students achieved reasonable marks in this question. Marks were lost for lack of detail. IN Part D some students discussed the benefits of shrink/stretch wrap in general but did not compare their characteristics.

<b>Learning Outcome 4: Understand how quality systems impact on packaging</b>
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#### QUESTION 5

(This question is worth 20% of the marks for this unit)

- A) Define Quality Control and Quality Assurance and explain the difference between the two. (4 marks)
- B) Explain the difference between critical, major and minor defects. Using a glass bottle as an example; identify two of each type of defect. (3 x 2 marks)
- C) Discuss the purpose of a packaging specification. (7 marks)
- D) Explain what a tolerance is and why it is important to set appropriate tolerances for a packaging component. (3 marks)

#### *Examiners Comments*

1. Summary of what was expected in the answer  
Marker 1 - Part A – required the difference between QC and QA to be identified and explained. Part B – required a description of what constitutes a critical, major and minor defect. Examples of each class of defect on a glass bottle should be provided. Part C – required the purpose of a packaging specification to be discussed. The purpose does not require a list of the various items of information which can be included to be described. Part D – required an explanation as to why tolerances are required and the importance of setting the tolerances at the required level.
2. Overall comment on students' performance, quality of answers and how students could answer  
Marker 1 - Most students provided good answers to this question. Marks were lost for just providing examples of defect types in Part B without a description of each category. In Part C some candidates focused on providing details of what is included in the specification rather than focusing on its functions.

**PIABC Limited**  
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