



REPORT ON THE NOVEMBER 2023 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 2023 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).

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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 500g block of cheese is modified atmosphere packed on a flow wrap line with a printed flexible film. The pouch has a reclosure (zip) feature added during the process. The packaged blocks are collated into a shelf ready case. The finished cases are loaded onto a wooden pallet, stretch wrapped and labelled for transit.

For this pack:

- A) List SIX functions of packaging. (6 x ½ mark)
- B) Explain how the primary packaging performs these functions. (6 x 2 marks)
- C) Explain how the secondary packaging performs the basic functions (5 x 1½ marks) and why each one is important (5 x ½ mark).

Examiners Comments

Summary of what was expected in the answer

Marker 1 - Need to demonstrate an understanding of the role and functions of packaging in a given example, currently in the marketplace. Candidates needed to know the basic functions, and how these are applied to actual components in a packaging.

Marker 2 - Part A – List of the functions of packaging: contain, protect, inform, sell and convenience. Part B – Considering the primary pack explain how the flow wrap pack address each of the functions e.g. sealed film pack of adequate size contains the product. Preserve, gas flushing and barrier characteristics of film extend shelf life. Part C – Consider secondary pack - a shelf ready case – perform the functions of packaging. The preservation function is provided mostly by the primary pack and therefore is not required here. E.g. Shelf ready box container several blocks of cheese. The case closure prevents loss of product until opened and there contains the product.

Overall comment on candidates' performance, quality of answers and how candidates could answer better in the future

Only 2 candidates. One provided an excellent complete answer. The other provided a reasonable answer, identified the relevant functions of packaging however failed to discuss in enough detail how the pack performed these to gain high marks. Generally, very good answers – clearly this has been taught well.

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 branded spirit is packed in 70cl glass bottle. The bottle is placed in a printed metal presentation tube and 6 packs are collated in a corrugated case.

- A) Describe FIVE significant characteristics of each of these materials in relation to this application. (3 x 5 marks)
- B) Identify FIVE other packaging components which would be used in the complete packaging system of this product (5 x ½ mark). Identify the material from which each packaging component is made. (5 x ½ mark).
- C) Spirits may be sold in injection stretched blow moulded polyethylene terephthalate (PET) bottles. What are the characteristics of this material which make it acceptable for this application? (5 x 1 mark)

Examiners Comments

Summary of what was expected in the answer

Marker 1 - Part A requires a brief description of 5 material characteristics for each of the materials. These must be relevant to the particular given application. Part B requires a list of additional packaging items and their materials to identified (e.g. label, closure, stretch wrap, adhesive, pallet, etc.). Part C required the use of injection blow moulding PET for the application. The important characteristics of the material which make it suitable needed to be described.

Marker 2 - Part A – for example characteristics of glass to be described include transparency to enable product visibility, has an aroma barrier to prevent loss of flavour over a long shelf life and a heavy pack can add a feeling of quality. Part B – a glass bottle needs a closure and a label; the case is then palletised with stretch wrap and an ID label. Characteristics of an ISBM PET bottle include clarity, improved barrier through orientation and light weight.

Overall comment on candidates' performance, quality of answers and how candidates could answer better in the future

Only 2 candidates. One provided excellent answers for the elements of the question answered but only considered the material characteristics of the glass bottle and ignored the metal tube and corrugated case. The second candidate did consider all the materials but just stated material characteristics and failed to describe the importance in this particular application. One candidate didn't read question correctly and only answered one of three parts – otherwise, answers were good.

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

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. Candidates 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.

Overall comment on candidates' performance, quality of answers and how candidates could answer better in the future

Only 2 candidates. One provided excellent answers for the question. The second candidate did provide a reasonable answer to part A. Part B lacked much discussion and therefore marks were suppressed. They did not appear to understand part C and discussed the risk mitigation.

Generally good answers – clearly this has been taught well – one candidate seemed to forget to answer one part though!

LEARNING OUTCOME 4: UNDERSTAND PACKAGING COSTS AND QUALITY SYSTEMS QUESTION 4

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

- A) Briefly describe the difference between fixed and variable costs. (1 mark)
- B) A baked food manufacturer would incur fixed and variable costs in the daily operations of their business.
- List FOUR examples of variable costs. (4 x ½ mark)
 - List FOUR examples of fixed costs. (4 x ½ mark)
- C) Identify and describe FOUR factors that need to be considered in determining optimum stock holding levels. (4 x 1½ mark)
- D) What is the purpose of a specification and why is it important? (4 marks)

Examiners Comments

Summary of what was expected in the answer

Marker 1 - Part A – Definition of fixed and variable costs. Part B – Examples of fixed and variable costs. Some indication of why the costs are fixed or variable would be useful. Part C – A brief description of 4 issues to be considered in determining the optimum stock holding (e.g. space availability, delivery times, etc.) Part D – The answer should focus on the purpose of the specification rather than the information to be included.

Marker 2 - Understand contributing factors to costs in supply chain. Understand types of costs. Understand costs of quality and implications.

Overall comment on candidates' performance, quality of answers and how candidates could answer better in the future

Only 2 candidates. Both candidates provided good answers but not exceptional. Marks were lost for not providing descriptions / discussions to expand on the areas identified and for having somewhat vague answers which were in the correct area but lacked specific relevant information. Quite good answers in general – some marks lost through lack of depth in answers.

**LEARNING OUTCOME 5: UNDERSTAND THE RELATIONSHIP BETWEEN
PACKAGING AND THE ENVIRONMENT
QUESTION 5**

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

- A) Discuss what is meant by an 'environmentally responsible' pack. (2 marks)
- B) From an environment perspective, discuss FIVE advantages (5 x 1 mark) and FIVE disadvantages (5 x 1 mark) of using glass as a packaging material for carbonated beverages.
- C) Identify THREE tools/techniques commonly used for assessing the impact of packaging on the environment. (3 x 1 mark)

Examiners Comments

Summary of what was expected in the answer

Discussion what is an 'environmentally responsible' pack. From an environment perspective, discussion on advantages/disadvantages of using glass as a packaging material for carbonated beverages. Finally, identification of tools/techniques commonly used for assessing the impact of packaging on the environment.

Overall comment on candidates' performance, quality of answers and how candidates could answer better in the future

Only 2 candidates. One candidate provided an excellent answer. The second provided a reasonable answer but lost marks for failing to expand on the answers. Some factors identified were did not have enough detail to assess their validity. Generally, quite good answers – a few marks lost for lack of depth.

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) Using FOUR different examples; explain how packaging has developed in response to changes in society. (4 x 1 mark)
- B) Briefly describe how packaging policy can contribute towards a company's corporate social responsibility. Illustrate your answer with THREE different examples. (3 x 2 marks)

Examiners Comments

Summary of what was expected in the answer

Marker 1 - Understand the impacts of societal development on packaging needs. Understand globalisation with regards to packaging response. Understand where packaging development and use fits into CSR.

Marker 2 - Part A - Factors to consider include: An ageing population require easy open packs and working parents use convenience foods. Part B - A factor to consider includes: The use of minimal or optimisation of the packaging. Reducing excessive packaging will reduce pressure on resources used and reduce the number of materials which consumers must dispose of, either to recycling or landfill.

Marker 3 - Part A – Candidates should describe how packaging responds to change in society. They should use 4 examples to illustrate their answer. Part B - Candidates are expected to discuss how decisions on the packaging used by a company can contribute to CSR.

Overall comment on candidates' performance, quality of answers and how candidates could answer better in the future

Generally scored quite well – in both sections.

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 garden nursery sells 10 plug plants (a young plant ready to be grown on by the buyer no more than 5cm tall, 5cm diameter and 5cm deep) with growing instructions by mail order. The pack must fit through a letterbox.

- A) Considering the needs of such a product; propose a pack to ensure it arrives in good condition. (3 marks)
- Ba) Briefly describe the stages of the journey (supply chain) from nursery to customer. (2 marks)
- b) Discuss FOUR major hazards the packed product may encounter, how they are caused (4 x 1 mark), their effects (4 x 1 mark) and how the packaging used could minimise the damage (4 x 1 mark).
- C) Briefly describe the types of transit trials and laboratory simulations which could be used to assess the pack's performance in the supply chain. (3 marks)

Examiners Comments

Summary of what was expected in the answer

As this is a live, fragile product to be delivered by mail or courier, it was important to establish the stages the packed product would follow. An appreciation that hazards such as shock, vibration and changes in relative humidity and temperature could severely affect the product was paramount. Therefore, the packaging would need to protect and preserve the product of a journey of potentially several days. It also needs to fit through a letterbox and survive the drop onto the door mat!

Overall comment on candidates' performance, quality of answers and how candidates could answer better in the future

Mostly the candidates understood the question and what was required – Part C seemed most testing for the candidates.

LEARNING OUTCOME 3: UNDERSTAND THE FUNCTIONS OF PACKAGING QUESTION 3

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

- A) For both of the following, describe an appropriate primary pack and discuss how the primary packaging performs the functions of packaging:
- beer (8 marks)
 - fresh beef steaks (8 marks)
- B) Describe an appropriate returnable secondary pack used to deliver fresh product into supermarkets and discuss how it performs the functions of packaging. (8 marks)
- C) Describe how changes in temperature and humidity could cause packaging deterioration. (6 marks)

Examiners Comments

Summary of what was expected in the answer

Marker 1 - A clear understanding of the basic functions of packaging and how these are applied to real life packaging structures.

Marker 2 - Part A – Beer - glass bottle/Crown Closure/Paper label. Gas barrier properties and sealing, Branding through labelling, colour, and shape. Fresh beef steak - modified atmosphere packaging such as PP/EVOHPP tray with film lid and label - Gas barrier properties and sealing, material transparency and anti-fog, also incorporation drip absorbance for blood. Part B – E.g. Plastic tray with lid, must be able to clean and have compression protection & strength, with ease of handling throughout supply chain. Need for high return rate to ensure efficient cost. Part C - Examples include low temperatures can increase brittleness of plastics as the polymer chains have restricted ability to move, high temperature when and stress can cause creep leading to failure of seals because the polymer chains can “flow”. Paper very sensitive to moisture changes. Increased moisture content reduces strength and stiffness. Bonds between fibres are weakened. Moisture changes can change paper dimensions.

Overall comment on candidates' performance, quality of answers and how candidates could answer better in the future

Mostly the candidates clearly understood the question and scored well.

**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) Discuss how the intellectual property created during the development of packaging can be protected by legislation. (5 marks)
- B) Discuss how packaging practices has evolved over time in response to changes in legislation, regulations and standards. Use FOUR examples to illustrate your answer. (4 x 2 marks)
- C) Identify FOUR possible consequences of failing to comply with legislation. (4 x ½ marks)

Examiners Comments

Summary of what was expected in the answer

Marker 1 - Know the principles of the key legislation – and be aware of the requirements to obey and the punishments if not obeyed.

Marker 2 - Part A required a discussion on the use of patents, trademarks and copywrite legislation and its application to packaging items. Some discussion is required e.g. what elements are applicable to what legislation and the levels of protection provided. Part B four different examples are required of how packaging practices have been altered by changes in legislation or standards. Candidates were expected to identify the legislation or standard and describe how it influences packaging practices. Part C any 4 legal or commercial implications of having failed to meet minimum standards is acceptable.

Overall comment on candidates' performance, quality of answers and how candidates could answer better in the future

Mostly good scores - a few dropped marks on Part A for lack of detail.

**LEARNING OUTCOME 5: UNDERSTAND THE FACTORS THAT AFFECT THE IMPACT OF
PACKAGING ON THE ENVIRONMENT
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

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.

Overall comment on candidates' performance, quality of answers and how candidates could answer better in the future

Mostly the candidates understood the question and what it was asking for – however, very few gained full marks in any of the three sections.

**LEARNING OUTCOME 6: UNDERSTAND THE RELATIONSHIP BETWEEN
PACKAGING AND MARKETING
QUESTION 6**

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

- Aa) Identify the 4P's of marketing. (4 x ½ mark)
- b) Explain the relationship between packaging design and each of the 4P's. (4 x 1 mark)
- B) Using examples; identify the characteristics of a strong brand and discuss how this is supported by the packaging used. (4 x 1 mark)

Examiners Comments

Summary of what was expected in the answer

Marker 1 - Functions of marketing – relationship to packaging – impact of packaging on promotion.

Marker 2 - A) Identification of 4 Ps and then a description on how each is influenced by packaging or influences packaging. B) A discussion of the characteristics of a strong brand and how packaging supports these characteristics.

Overall comment on candidates' performance, quality of answers and how candidates could answer better in the future

Nearly all the candidates understood the question and what it was testing – and gave easily revised answers.

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 had the option to answer two out of three questions for both Learning Outcomes 1 and 3.

LEARNING OUTCOME 1: UNDERSTAND THE PROPERTIES OF MATERIALS WHICH MAKE THEM SUITABLE FOR PACKAGING

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

- A) Liquid milk can be packed in glass bottles, high-density polyethylene (HDPE) bottles and paper based liquid cartons. Describe each pack type and evaluate its use for this application. (3 x 4 marks)
- B) A dairy produces milk in high-density polyethylene (HDPE) bottles, cream in polypropylene (PP) pots, and cheese in a polyethylene (PE)/nylon laminate flow wrap. They want to move to using a single plastic material for all products. Justify why polyethylene terephthalate (PET) is the suitable material that they should select. Highlight the problems this may cause. (8 marks)

Examiners Comments

Summary of what was expected in the answer

Marker 1 - Part A – For each of the pack types the answer should include a description of the complete pack including closure and any labelling. The characteristics of this pack should be evaluated for the product. Part B – For each product the answer should highlight how the PET pack could compare to the existing pack. Any alternatives required should be discussed.

Marker 2 - Part A - Candidates were expected to describe each pack type e.g. Container glass bottle with foil lid and evaluate its use for the application, e.g. can be easily cleaned and hence is appropriate for re-filling. Inert, will not interact with the product and cannot be resealed once opened. Part B - The answer should consider how the material can be used for each application. How will the properties change, is an alternative processing method required, what will be the impact on the product. For example, bottles can easily be made from PET, may need to be IBM rather than EBM, so can't include handles. PET has improved oxygen barrier characteristics, higher strength.

Overall comment on candidates' performance, quality of answers and how candidates could answer better in the future

Marker 1 - Candidates did not provide information that was fully relevant or showed a full understanding of the question.

Marker 2 - A number of candidates scored poorly as they did not seem to understand what was meant by 'paper-based liquid cartons'.

Marker 3 - Few provided a complete description of the various container including closures and labels. The performance of the materials / formats was considered but few candidates provided full answers. In considering the issues to moving to PET some justification was provided however few candidates discussed how the performance and operations would have to be modified.

QUESTION 2

- 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

Summary of what was expected in the answer

Discussion on how the selection of raw materials, additives and pulp processing can influence the characteristics of paper: Material selection includes hardwood which have shorter fibres (1 – 1.5 mm) which will produce weaker papers. Additives include fillers e.g. chalk which improve the print surface and reduce cost. In pulping chemical separation produces little damage to fibres increasing strength. Removal of lignin and other materials reduced yield. Can provide strong and bright white papers. With beating and refining increased beating will increase tensile strength, burst strength and uniformity. B) Identification and description how SIX paper properties can be measured: Measuring paper properties include the Cobb test method for water absorbency and ply bond strength using the Scottbond Method.

Overall comment on candidates' performance, quality of answers and how candidates could answer better in the future

Marker 1 - Some candidates got fibre length around the wrong way in Part A. A number of candidates mentioned measuring board weight and thickness which is checked but usually for reference as modern starches and paper additives makes this less important.

Marker 2 - Lack of detail in many candidates' answers, losing significant marks.

Marker 3 - There was a wide range in the marks awarded for this question with both excellent and poor answers provided. In Part A candidate's lost marks few developed answers enough to gain full marks. Commentary was often limited, in particular only a few candidates discussed the impact of beating on paper characteristics. In Part B most candidates identified a range of properties but only a few discussed how they could be measured.

QUESTION 3

Fruit jams and preserves are often packed in glass jars.

- A) Identify the ingredients used to manufacture of a glass jar and describe their function. (6 marks)
- B) Discuss why glass is the preferred material for this type of product. (6 marks)
- C) Identify and discuss how the disadvantages of glass can be overcome. (4 marks)
- D) Fruit jams and preserves are also packed in flexible film and rigid plastics. Briefly discuss the advantages of these materials/formats for this product. (4 marks)

Examiners Comments

Summary of what was expected in the answer

Marker 1 - Understand how glass is made. Understand the benefits and risks of using glass. Compare glass to plastic – advantages and disadvantages.

Marker 2 - Part A - For example Soda Ash acts as flux lowers melting temperature but makes glass water soluble. Part B - One aspect is that glass can be heat sterilised and hot filled in excess of 100C as is normal for this product. Part C - Glass can suffer from fracture / chipping. The container design can reduce the likelihood on damage events by having stable designs. Part D - Rigid plastic with a heat-sealed lid can be used for single serving packs. Laminated films can provide good shelf-life but cannot be reclosed. Significant weight saving on single serving glass jars.

Marker 3 - Part A – The 6 main ingredients used in flint container glass manufacture need to be identified and their function described. Part B – Requires a discussion of the reasons why most jams are packed in glass containers. Part C – This question requires the negative properties of the use of glass as packaging to be identified and the methods used to reduce the impacts of these characteristics. Part D – Alternative formats and materials for packing jams need to be identified and discussed. The advantages of these formats over glass should be discussed.

Overall comment on candidates' performance, quality of answers and how candidates could answer better in the future

Marker 1 - Candidates who answered this question all achieved double digit marks.

Marker 2 - Generally good responses throughout – consistently good scores and understanding.

Marker 3 - Most candidates provided reasonable to excellent answers. Most candidates were able to identify the main glass ingredients and describe their function. A few failed to describe the functions correctly. In describing why glass was the appropriate material for jams some candidates failed to consider the nature of the product, coloured glass is seldom used for jams. While most candidates could identify a range of issues with the use of glass some did not address how these issues could be mitigated. Most candidates were able to discuss a few benefits of using plastic based packaging but using a limited range of issues and details limited marks for some.

LEARNING OUTCOME 2: UNDERSTAND THE SYNTHESIS AND PROPERTIES OF POLYMERS

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

QUESTION 4

- A) Describe the polymerisation of Polyethylene (PE). (5 x 1 mark)
- B) Explain the following terms and discuss their effect on polymer characteristics:
- a) Orientation (2½ marks)
 - b) Tacticity (2½ marks)
 - c) Crystallinity (2½ marks)
 - d) Molecular weight (2½ marks)
 - e) Branching (2½ marks)
 - f) Co-polymerisation (2½ marks)

Examiners Comments

Summary of what was expected in the answer

Marker 1 - Part A required a description of the polymerisation of PE (either LDPE or HDPE).

Description should consider initiation, propagation, and termination of the process. Part B required a description of the meaning of a range of terms describing polymer structures. A description of the term and the impact that this characteristic has on polymer properties is expected. Examples would be useful.

Marker 2 - Part A the question could be answered using either free radical polymerisation for LDPE or polymerisation at low temperature and pressure using an organometallic catalyst for HDPE. Part B for example crystalline regions provide areas with a degree of order. The molecules in the crystalline regions pack close together in a structured format. The close packing increases the density of the material. Other properties affected include clarity, gas and moisture transmission, stiffness.

Overall comment on candidates' performance, quality of answers and how candidates could answer better in the future

Marker 1 - All candidates answered this question.

Marker 2 - Candidates varied greatly in quality of answers – some very poor attempts and no clear understanding (in depth at least).

Marker 3 - Most candidates answers ranges from very poor to excellent. Candidates mostly lost marks for failing to provide descriptions of the terms and the impact on polymer properties or for providing descriptions which not relevant to the terms.

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) Describe, with the use of diagrams, the production process of a wrinkle walled foil container from an aluminium ingot to despatch of containers to the customer. (14 marks)
- B) Compare and contrast wrinkle walled foil containers versus pressed paperboard containers for take away meals. (6 marks)

Examiners Comments

Summary of what was expected in the answer

Marker 1 - Part A – A significant amount of the marks for the question are Part A, hence the high degree of detail is required on the manufacturing process. The answer should describe the hot rolling process from ingot to rolled sheet 5mm thick. The roll-to-roll rolling to reduce the thickness of the sheet to the required thickness 150mm. The pressing process to produce the tray. The packaging of the tray ready for despatch. Part B – A comparison of pressed paperboard tray versus aluminium wrinkled walled tray. E.g. aluminium faster thermal transfer. Paperboard required coating to provide moisture/grease barrier, etc.

Marker 2 - Part A required a description of the casting and rolling processes including alloys and the annealing and tempering processes. How the reel of foil is finished followed by the wrinkle wall production process. Part B required a comparison between a wrinkle wall container and a paperboard tray for takeaway food. Considerations should include Wrinkle wall foil containers are lightweight which reduces costs, it gains heat but also loses heat quickly and the designs maximize strength. Paperboard containers have good insulation properties, has good creaseability but requires coating to make it suitable for liquids and fatty products.

Overall comment on candidates' performance, quality of answers and how candidates could answer better in the future

Marker 1 - Recommend candidates watch videos of foil manufacture from ingot to foil and if possible, press forming of foil containers.

Marker 2 - Most answered part a poorly – some using irrelevant details. Not sure whether the question was misread or confusing. Seemed clear to me.

Marker 3 - Few candidates answered this question. The answers were weak. Candidates did not describe the range of steps in reducing the aluminium ingot into thin sheets and simply described rolling. That this is a hot and cold process requiring annealing, lubrication ingot rolling and roll to roll sheet rolling. The forming process was confused by some candidates as a thermoforming process. Most of the candidates were able to discuss differences in aluminium and paper-based trays but most also included barrier characteristics. While these are differences in the materials this is not relevant for this pack format which does not provide a hermetic seal.

QUESTION 6

- 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

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.

Overall comment on candidates' performance, quality of answers and how candidates could answer better in the future

Marker 1 - The majority of the candidates who answered this question also answered well but many thought the adhesive on corrugated board was added to the liners whereas it is added to the corrugated medium after it has been corrugated.

Marker 2 - Popular question – and generally good responses throughout – some confusion, however, over single walled corrugated.

Marker 3 - Candidate answers varied from poor to reasonable. The descriptions of the corrugating process often lacked detail. Few candidates tried to use diagrams to support the descriptions. Several candidates described the adhesive being added to the liners rather than to the fluting. Few candidates provided full answers. While most candidates provided a description of die cutting and or slotter creaser operation the answers lacked detail and little attempt was made to compare the processes. Most candidates provided a selections of corrugated case faults however the discussions failed to provide the detail required for high marks.

QUESTION 7

Snack foods, such as roasted nuts, are often packed in bi-axial orientated polypropylene (BOPP) laminates.

- A) Describe the manufacture of bi-axial orientated cast extrusion polypropylene from polymer granules to reels of material. (15 marks)
- B) Describe how BOPP can be metalized. (2 marks)
- C) Discuss how metalized BOPP can be combined with other materials to produce an appropriately printed pack for a snack product. (3 marks)

Examiners Comments

Summary of what was expected in the answer

Marker 1 - Part A required a detailed description of the manufacturing process for BOPP cast film. This required detailed description of the extrusion process and the formation of the film through a slot die. Key process controls are expected to be commented on. The orientation process applied to the film needed to be described. Part B required a brief description of the vacuum coating of aluminium to plastic film. Part C required a discussion of potential laminates, based on PP which could be used for snack products such as nuts.

Marker 2 - Part A the answer required a detailed description of polymer granules being melted in the extruder before casting through a slot die and casting onto a chilled drum, followed by machine and transverse orientation, plus inspection and packing operations. Part B an explanation of vacuum metallisation is required. Part C an explanation could cover how one material is reverse printed before lamination to the metallised layer and an understanding that a heat seal layer is required.

Overall comment on candidates' performance, quality of answers and how candidates could answer better in the future

Marker 1 - Recommends that candidates watch a cast BOPP production video.

Marker 2 - Very average scores to Part A by majority of candidates (through lack of detail or confusion of detail).

Marker 3 - Candidate answers varied from poor to reasonable. The description of the manufacturing processes lacked the detail need for high marks. Most candidates provided very brief answers which were supported by simplified diagrams. While these basic process outlines were often correct, they contained minimal detail and could have been completed in a single sentence. A few candidates did not appear to understand the processes. The use of diagrams showing the cross section of the extruder and the slot die would have been useful. Many of the answers were brief, they were mostly the last question answered and therefore candidates may have been running out of time.

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.

LEARNING OUTCOME 4: UNDERSTAND THE RAW MATERIALS, PROPERTIES AND APPLICATIONS OF PACKAGING ADHESIVES

QUESTION 1

(This question is worth 30 marks for this paper)

- A) Describe the differences between mechanical and specific (chemical) adhesion. (2 x 3 marks)
- B) Define the following terms (3 x 1 marks) and describe their importance to packaging adhesives (3 x 2 marks):
- Tack
 - Open time
 - Viscosity
- C) Identify and briefly describe the factors that affect the choice of an adhesive type for a packaging application. (5 marks)
- D) What is a hot melt adhesive? (2 mark)
- E) Identify the constituent parts of a typical hot melt adhesive used on an automated packing line for sealing corrugated cartons and explain their properties. (8 marks)

Examiners Comments

Summary of what was expected in the answer

Part A required the differences between mechanical and chemical adhesion such as in mechanical adhesion the adhesive flows into small surface irregularities whereas chemical adhesion is often linked to smooth surfaces and uses minute regions of positive and negative charges to create the bond. Part B required definitions and an explanation of tack, open time, and viscosity. For example, Open time is the time window from application of the adhesive for which the adhesive will have sufficient tack to provide form an effective seal. If the open time is too short the materials to be stuck may not be able to be brought into contact with the adhesive quickly enough to form effective seal. If too long the bond may move before adhesive has set. Part C required candidates to identify and briefly describe the factors that affect the choice of an adhesive type for a packaging application. Factors include Chemistry & physical nature of surfaces to be bonded, method of application, machine speed, pot life and rate of assembly, open & tack times. Part D A hot melt adhesive is a thermoplastic material which softens on heating and solidifies on cooling. Part E expected a breakdown of the constituent parts including polymers - for strength and resins for tack and adhesion.

Overall comment on candidates' performance, quality of answers and how candidates could answer better in the future

There was a wide range in the marks awarded for this question with both excellent and poor answers provided. Excellent answers were able to provide concise definitions / details and then elaborate on how these characteristics were important for packaging applications. The poor answers often discussed around the topic and failed to focus on the key information which was required. This question expected clear definitions and explanations of key concepts which the poorer answers did provide.

LEARNING OUTCOME 5: UNDERSTAND THE DIFFERENT TYPES OF LABELS AND THE MATERIALS USED

QUESTION 2

(This question is worth 30 marks for this paper)

A soft drink is packed in a glass bottle with an oval shaped label.

- Aa) Discuss FIVE important properties of the paper substrate for an oval wet glue paper label. (5 x 1 mark)
- b) How would these properties be assessed? (5 x 1 mark)
- B) Describe the production process for an oval wet glue paper label from concept to labels ready for despatch (excluding paper manufacture). (10 marks)
- C) Discuss the advantages and disadvantages of the following as an alternative method of decoration:
- Pressure sensitive labels (5 x 1 mark)
 - Shrink sleeves (5 x 1 mark)

Examiners Comments

Summary of what was expected in the answer

Marker 1 - Part A – A discussion of 5 materials properties of the paper used in the label is expected (e.g. porosity, stiffness, water, absorbance, whiteness, and smoothness). The properties must be described, and the method of measurement discussed. Part B – The manufacturing process from concept through to label ready despatch should be described. It should include design, material selection, process selection, pre-press activities, plate manufacture, proofing, printing, die cutting, QC, and packing. Application to container is not required. Part C – Wet glue paper labels should be compared and contrasted with both PSL and shrink sleeves.

Marker 2 - Knowledge of man label types, their application, and advantages/disadvantages with regards to each other.

Marker 3 - Part A - Properties include porosity, stiffness, and surface smoothness. Part B - A description of a wet glue paper label NOT a pressure sensitive paper label. Part C - Pressure sensitive labels are quick and clean to apply but there is a lot of waste from backing liner. Shrink sleeves can be reverse printed to reduce scuffing and increase gloss. No adhesive is required and can incorporate tamper evidence. However, are polymer based and requires all round label application which may increase material usage.

Overall comment on candidates' performance, quality of answers and how candidates could answer better in the future

There was a wide range in the marks awarded for this question with both excellent and poor answers provided. In Part A candidate's lost marks as they did not focus on the characteristics of the paper substrate and discussed wider label issues such as dimensions and adhesives which are not substrate characteristics. A few candidates did not consider how the specific characteristics would be assessed. In Part B some candidates lost marks for describing other labelling systems including PSL labels rather than plain paper label manufacture. Part C was generally answered well.

**LEARNING OUTCOME 6: UNDERSTAND CLOSURE SYSTEMS
AND THE FACTORS THAT AFFECT SEALS
QUESTION 3**

(This question is worth 30 marks for this paper)

- A) Describe, with the use of appropriate diagrams, the closure system, including materials, design, and application method, for the following closure mechanisms and give an example where each closure type is used:
- Roll on pilfer proof closure (7 marks)
 - Induction heat seal with wad closure (7 marks)
 - Crown closure (7 marks)
- B) Identify THREE types of child resistance packaging and explain how child resistance is achieved. (3 x 2 marks)
- C) Briefly describe how child resistant packaging is assessed. (3 marks)

Examiners Comments

Summary of what was expected in the answer

Part A - Crown cork closures are typically made from metal, such as tin-free steel, with suitable coatings on both the inside and outside. They have a sealing wad inside the closure which may be cork, a compressible plastic, or a flowed-in liner of soft plastic material (plastisol) around the inner circumference of the cap. The closure is preformed and then placed over the neck of the container, often using magnets, and the outer circumference is compressed around the lip of the bottle and the edges tucked under a retaining ring on the lip to secure the closure in place, leaving a characteristically ribbed effect. Crown corks are typically used for sealing glass bottles containing carbonated beverages and are ideally suited to withstand the internal pressure of such products. Part B - One example is a child resistant flip top closures – Usually has a tamper evident mechanism which needs to be removed, often with a band which is attached to both the container and the bottle. Closure needs to be rotated until indicator arrows align to permit opening of the container. Requires hand/eye co-ordination to open container. Part C - Description of how child resistant packaging is assessed - Children of specified ages 42-51 months given time to try to open containers. Each child is given a pack and asked to open it, after five minutes they watch a silent demonstration and then they try to open the pack for a further five minutes. For the pack to pass the test, 85% of the panel must fail to open it before the demonstration and 80% must fail to do so after it. Children are then given demonstration on how to open container and then provided more time to gain access. Adults, 50-70 years old, are provided with complete packs including opening instructions. After a period of familiarization 90% of the panel must open and properly reclose the pack in one minute or extract one unit in one minute depending on the type of pack and the standard.

Overall comment on candidates' performance, quality of answers and how candidates could answer better in the future

There was a wide range in the marks awarded for this question with both excellent and poor answers provided. Candidates lost marks on closure descriptions by missing key details such as how a seal is achieved or errors in the application methods. With the child resistant closures some candidates focused on the force required to open closure systems rather than the need for complex actions.

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

Summary of what was expected in the answer

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.

Overall comment on candidates' performance, quality of answers and how candidates could answer better in the future

Marker 1 - All candidates answered well.

Marker 2 - Generally good responses throughout – all candidates scored well.

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) Explain how the three primary colours are mixed to form the three process colours. (1 mark)
- B) Explain how printing uses these three process colours to produce photographic images. (3 marks)
- C) What is the key colour and what is its function? (1 mark)
- D) Describe, with aid of diagrams, the flexographic printing and finishing process for a 4-colour, varnished and foil blocked reel of pressure sensitive labels. (11 marks)
- E) The above label could be produced on digital equipment. What are the advantages and disadvantages of this process compared to flexographic printing? (4 marks)

Examiners Comments

Summary of what was expected in the answer

Part A – candidates should explain how primary colours are combined to produce process colours (e.g. green+blue=cyan). Part B – Process colour printing applies the colours in dots. The proportion of dots of different colours creates the appearance of a wide range of colours. Dot patterns for

colour are different to prevent moire patterns. Part C – Key colour is usually black, or another dark colour. Enables greater range of tones to be achieved. Part D – Printing will require 4 printing stations and varnish. Foil blocking will be a separate operation. Ink picked up and transferred to anilox roller which controls ink quantity. Excess ink removed. Ink transferred to raised surface of the printing plate and then onto the substrate. Substrate supported by impression roller. Ink dried between printing stations. Hot foil blocking uses heat die to press foil material onto film. Heat melts adhesive and sticks foil onto the material in the heated areas. Part E – Discuss several advantages and disadvantages of digital printing (e.g. no plates required, fast set up, reduced waste, consistent colour, speeds are slower, expensive inks, limited colours, varnish and foil applied later).

Overall comment on candidates' performance, quality of answers and how candidates could answer better in the future

Marker 1 - All candidates scored well except one who scored poorly on all questions. Recommend that candidates watch videos of a print line and identify the various parts of a print station.

Marker 2 - Generally good responses throughout, with exception of Part B. No student gave full required 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) Describe a production line for packing sliced cooked meats, from the supply of packaging materials into the store to finished product ready to despatch to the customer. (14 x 1 mark)
- B) A key performance indicator for the packer filler is the overall operating efficiency (OEE). Discuss what OEE is (2 marks) and how it can be improved (4 marks).

Examiners Comments

Summary of what was expected in the answer

Marker 1 - General understanding of the flow of work in a manufacturing process. Knowledge of how efficiencies are measured and improved.

Marker 2 - Part A – The answer requires a description of the packing line and associated operations. The main operations should be described in an appropriate sequence. On-line and off-line quality checks should be included. Part B – A definition of OEE and description of how it could be calculated should be included. A discussion of how OEE could be improved is required.

Overall comment on candidates' performance, quality of answers and how candidates could answer better in the future

Marker 1 - All candidates answered well except one candidate who provided a very poor answer to all questions. Most candidates were not aware that sliced foods, especially meat and cheese are actually sliced and packed on one line, product slicing machines have been around for many years and integrate well into HFFs packing lines.

Marker 2 - Generally good responses throughout.

QUESTION 4

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

- A) Gravity, vacuum, or pressure can be used to fill liquids into containers. Describe these filling methods and discuss their relative merits. (3 x 3 marks)
- B) a) Describe the operation of a thermoform fill and seal machine, which is used to produce and pack single serving pots of milk for the catering market. (6 marks)
- b) What are the advantages and disadvantages of the above process compared to using bought in preformed pots? (5 x 1 mark)

Examiners Comments

Summary of what was expected in the answer

Marker 1 - Knowledge of, and comparison of, different filling methods. Knowledge of the key process methods of thermoform F/S machines. Advantages/Disadvantages FFS v. Preformed.

Marker 2 - Part A – The description of the 3 filling systems should provide a general description of the process including details on how the level control can be achieved. The description should include a discussion of the limitations and benefits of the various process. Part B – a) A description of the thermoform fill seal equipment operation is expected including pot formulation, filling, sealing, and cutting from the base web. b) The relative merits of TFFS and use of pre-formed pots should be discussed. Issues could include space requirements, transport costs, hygiene, and quality control.

Overall comment on candidates' performance, quality of answers and how candidates could answer better in the future

Marker 1 - Most candidates answered this question well, one candidate actually described a Tetra Brik AFFS machine very well but sadly this is a paper fed machine and not a thermoform fill, seal machine. Some candidates seemed to struggle understanding how a thermoform fill, seal machine worked. A small number talked about sheet feed, cutting after thermoforming and some described a blow moulding operation.

Marker 2 - Generally sound responses throughout – but no exceptionally good nor bad scores.

LEARNING OUTCOME 4: UNDERSTAND HOW QUALITY SYSTEMS IMPACT ON PACKAGING **QUESTION 5**

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

- A) Discuss what is meant by QUALITY in a quality management system. (2 marks)
- B) Identify (5 x ½ mark) and discuss FIVE core areas which need to be addressed in a quality and process control manual (5 x 1½ marks).
- C) Discuss the factors that need to be considered to determine the cost of quality. (8 marks)

Examiners Comments

Summary of what was expected in the answer

Marker 1 - A) Discussion on what is meant by QUALITY in a quality management system: a totality of characteristics and features which bear upon the ability of a product or service to meet customers' requirements or expectations. B) A quality and process control manual should include a Quality Policy which demonstrates management commitment to process and a focus on quality improvement. Also needs Document Control & Records which ensures the required records are kept is an important part of quality management. Document control is required to ensure that appropriate versions of all documents are available where and when required. C) Factors include the prevention costs which can include all the costs associated with assuring the product is made correctly. These can include training costs, costs associated with purchase of high-quality raw materials, costs involved with maintaining or upgrading machinery to produce more reliable products and costs

involved in ensuring that the customer's expectation and wants are fully addresses in the development of the product. Need to discuss all the appraisal costs in ensuring that the product produced is the product that was expected to be produced. All inspection costs, labour equipment required to conduct inspection. Also discuss the failure costs both internal (before product leaves factory) and external (after product leaves).

Marker 2 - A) Required a def of quality, that may be used in a QMS rather than a common everyday def. B) Candidates were required to identify and discuss FIVE areas or sections which would be expected to be found in a QMS/control manual. For each area the relevance and importance of this to achieving quality should be highlighted. C) Candidates were expected to provide a description of quality cost. One common classification in prevention, appraisal, internal failure, and external failure. Examples of costs for each should be discussed. Alternative classifications may be acceptable.

Overall comment on candidates' performance, quality of answers and how candidates could answer better in the future

Marker 1 - Almost all candidates had one or more problems with all sections of this question.

Marker 2 - Some good responses throughout – but a number of really poor scores.