



REPORT ON THE JUNE 2018 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 June 2018 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 students have to 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) The primary pack for 750g of breakfast cereal is a polyethylene bag inside a printed paperboard carton. Discuss how this pack performs the functions of packaging. (13 marks)
- B) Describe **SIX** hazards that a consumer electronic product could face during distribution from the manufacturer to the retailer (6 x 1 mark). Discuss how the packaging can mitigate the potential damage to the product from these hazards (6 x 1 mark).

Markers' Comments

Summary of what was expected in the answer

Marker 1:

Part A requires an explanation as to how the bag and box system perform the functions of packaging. The answer should detail how this packaging contains, protects, preserves, informs, sells and provides convenience. Part B requires a description of the 6 hazards; the hazards must be described not just listed. The way packaging can be used to mitigate against the effect of the hazards should be described.

Marker 2:

Part A - Functions to include are contain, protect and preserve. Be convenient at all stages of the supply chain. Inform, sell, be economically viable with due regard to the impact on the environment. Part B – main hazards are Vibration, Shock Compression (both static and dynamic), Moisture and Theft.

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

Marker 1:

All answers were reasonable. On some elements marks were lost for a lack of detail e.g. containing product.

Marker 2:

Generally well answered, important to identify and discuss as marks lost when no discussion.

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)

Markers' 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 students' performance, quality of answers and how students could answer better in the future

Marker 1:

All answers were reasonable. One student in the papers I marked did not attempt to answer Part C.

Marker 2:

Generally well answered but marks lost because material characteristics missing.

Learning Outcome 3: Understand the packaging development processes

QUESTION 3

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

- A) Outline the process of package development from concept to product launch. This is usually described in six steps. (6 x 1 mark)
- B) When developing the pack for a product:
- Discuss **FOUR** different types of information that must be known about the product. (4 x 2 marks)
 - Discuss **THREE** different types of information that must be known about the market. (3 x 2 marks)

Markers' Comments

Summary of what was expected in the answer

Marker 1:

Part A requires an outline of a packaging development process. It is important that the described process takes the product from consent to the launch of the product. Part B requires a discussion of 4 factors, about the product which are important for the development of the product (e.g. shelf life considerations, physical state, etc.). The factors of importance about the market could include market size, competitors, geographical area, etc. Some discussion is expected.

Marker 2:

Part A – Six steps to be described include defining the objective, developing the packaging brief, develop solutions, establish packaging materials and carry out pack testing, finalise the specifications, launch and review. Part B – information about the product and its market should include its physical state, how fragile, main chemical and biological properties, who will buy it, where it is to be sold and what is the size of the market.

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

Marker 1:

All answers were reasonable; some marks were lost for a lack of discussion.

Marker 2:

Part A – A full description of the six steps were needed, it helps to use examples to illustrate the answer. Part B – reasonably well answered, but again the use of examples in the discussion was missing.

Learning Outcome 4: Understand packaging costs and quality systems

QUESTION 4

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

- A) Describe **FIVE** cost elements which a business incurs in the manufacture and sale of biscuits wrapped in a plastic flow wrap (5 x 1½ marks). State whether they are fixed or variable (5 x ½ mark).
- B) Define profit. (2 marks)
- C) How does unacceptable quality affect profit? (3 x 1 mark)

Markers' Comments

Summary of what was expected in the answer

Marker 1:

Part A required a brief description of the 5 different cost elements and a statement to indicate if they are fixed or variable. Part B is a single definition of profit. Part C required a consideration and discussion of how poor quality could affect profit. The question expected at least 3 different impacts.

Marker 2:

Part A - Variable costs include raw material and packaging component costs along with labour, storage and energy. Fixed costs include rent and rates, equipment costs with depreciation plus indirect labour. Part B – profit could be defined as the difference between the amount earned and the amount spent in buying and manufacturing the product. Part C – Unacceptable quality can result in loss of sales and loss of brand loyalty.

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

Marker 1:

Generally answered well by students. A little more detail could be included in the description of the costs. A justification as to why the costs were fixed or variable would have helped.

Marker 2:

Part A was relatively straight forward, it just needed to relate to flow wrapped pack of biscuits.

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) Define what is meant by an environmentally responsible pack. (3 marks)
- B) For each of the following groups in society; discuss their different viewpoints with regards to environmental responsible packaging (12 marks):
- The public
 - Policymakers
 - Local government
 - Packaging suppliers
 - Retailers

Markers' Comments

Summary of what was expected in the answer

Marker 1:

Part A required a defn of an environmental responsible pack. Part B required the student to consider the various viewpoints of stakeholders and to consider how their views may differ. A wide range of answers were acceptable but an explanation was required.

Marker 2:

An environmentally responsible pack should, amongst others, optimise packaging materials and energy, preventing product wastage.

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

Marker 1:

Most students provided reasonable answers.

Marker 2:

Good answers discussed the different viewpoints of how the public could be influenced by the media and focus groups. Also, how packaging suppliers perpetuate the impression that there are environmentally 'good' and 'bad' materials.

PIABC LEVEL 5 DIPLOMA IN PACKAGING TECHNOLOGY

Unit 1: Packaging in Today's World

This unit is assessed by a 3 hour examination and students have to 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) Identify **THREE** changes in society and discuss how packaging has evolved in response to these changes. (3 x 2 marks)
- B) Discuss **TWO** packaging related actions, which could contribute to a company's Corporate Social Responsibility policy. (2 x 2 marks)

Markers' Comments

Summary of what was expected in the answer

Marker 1:

Part A - Examples include development of white goods in the home (fridge, freezer, microwave) over the last 60+ years, the growth of the modern retailer and the impact of internet shopping. Part B – use materials from renewable resources; reduce waste to landfill and local sourcing to reduce distance travelled.

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

Marker 1:

Generally well answered, important to identify and discuss as marks lost when no discussion.

**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 (small seedlings no more than 2cm tall, 2cm diameter and 2cm 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)
- B) i) Briefly describe the stages of the journey (supply chain) from nursery to customer. (2 marks)
- ii) 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)

Markers' Comments

Summary of what was expected in the answer

Marker 1:

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 students' performance, quality of answers and how students could answer better in the future

Marker 1:

Most answers offered a reasonable pack to cope with the journey (e.g. clampack with corrugated sleeve). Interestingly, some answers forgot the address label.

Learning Outcome 3: Understand the functions of packaging

QUESTION 3

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

- A) Using examples; describe **FIVE** methods by which the shelf life of food products can be extended and discuss the implications for packaging for each method. (5 x 4 marks)
- B) The way in which a pack is handled (and the product used) is determined by the design of the pack itself. Packaging designers have the opportunity to build in features to make handling easy, convenient and safe.

Using examples; explain how the convenience function enables a product to be easily and safely handled in the following situations:

- On the filling line (3 marks)
- In storage, distribution and retail (3 marks)
- In use by the consumer (4 marks)

Markers' Comments

Summary of what was expected in the answer

Marker 1:

Part A - Methods included reducing the temperature which slows down chemical activity and development of micro-organisms. Therefore, the packaging must withstand being in a fridge or freezer, e.g. coated board, plastic copolymers to reduce brittleness in a freezer. Part B – The convenience function impacts on all stages of the supply chain so understanding a components weight and centre of gravity will be very important on a filling line, as will the ability to collate for ease of movement in distribution, followed by being easy to open, dispense and close.

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

Marker 1:

Part A - Some students misunderstood methods of preservation and described how packaging with improved barrier layers could improve shelf life. Although correct, marks were lost because the question asked for methods of preservation and the implications for packaging. Part B – generally well answered but sometimes examples were missed out, so marks were lost.

**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)

For **EACH** of the areas listed below; identify and discuss the impact of a different piece of legislation or regulations in relation to milk packaged in a plastic bottle:

- A) Development (3 marks)
- B) Filling (3 marks)
- C) Selling (3 marks)
- D) Use (3 marks)
- E) Disposal (3 marks)

NOTE: Please use a different piece of legislation or regulation for each. When quoting legislation other than the EU or UK, please state the relevant country.

Markers' Comments

Summary of what was expected in the answer

Marker 1:

In development direct food contact legislation needs to be considered so that the material does not contain any substance which could leach out and be harmful to health.

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

Marker 1:

Most students answered this well. It was though important to discuss the impact of the legislation / regulations in relation to the milk in a plastic bottle.

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

QUESTION 5

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

- A) Discuss what you understand as an environmentally responsible pack. (5 x 1 mark)
- B) Minimising packaging waste by reducing the amount of packaging used is often proposed as an environmentally responsible design solution for packaging. Discuss the factors working for and against this possible solution. (10 marks)

Markers' Comments

Summary of what was expected in the answer

Marker 1:

An environmentally responsible pack should, amongst others, optimise packaging materials and energy, preventing product wastage.

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

Marker 1:

Good answers discussed the impact of reducing the amount of packaging used against the increased damage which might occur to the product.

Learning Outcome 6: Understand the relationship between packaging and marketing

QUESTION 6

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

- A) From a marketing point of view, companies are said to be production led, sales led, or marketing led. Briefly discuss what each of these terms means and give an example of each type of company. (3 x 1 mark)
- B) i) What are the 4 'P's of marketing? (1 mark)
- ii) Briefly discuss how each of these terms is relevant to fast moving consumer goods. (4 x 1½ marks)

Markers' Comments

Summary of what was expected in the answer

Marker 1:

Part A - Marketing led companies usually sell fast moving consumer goods such as food, drink and toiletries. Part B – The 4 'P's of marketing are Product, Price, Promotion and Place.

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

Marker 1:

Generally well answered but marks lost because relevant examples were not used.

Unit 2: Packaging Materials and Components (Paper A)

Paper A is worth 70% of Unit 2 and is assessed by a 3 hour examination. Students have to answer five questions. Students have the option to answer two out of three question for both Learning Outcomes 1 and 3.

<p>Learning Outcome 1: Understand the properties of materials which make them suitable for packaging</p>

This Learning Outcome is worth 40% of the marks for this paper and students were required to answer two of the following three questions: 1, 2 & 3

QUESTION 1

For each of the following **FOUR** product/pack types:

- Pharmaceutical tablet in a white plastic blister pack with an aluminium push through lid
 - Long life milk in a multi layer carton with an aluminium layer
 - Ready-to-cook meal in a foil tray
 - Bar of chocolate with a folded aluminium wrap
- A) State, with reasons, a typical gauge of aluminium foil which would be suitable and explain the important properties which the foil will deliver. (4 x 1½ marks)
- B) State and explain the function of all additional materials and components required in the primary packaging. (4 x 1½ marks)
- C) Choosing **TWO** of the above products, propose a primary packaging material solution which does not contain aluminium foil (2 x 1 mark). Discuss in detail the advantages and disadvantages of your proposals (2 x 3 marks).

Markers' Comments

Summary of what was expected in the answer

Marker 1:

Part A requires the student to state and justify an appropriate gauge of foil for each application. The relevant properties of this gauge of foil should be described. Part B requires all the other materials to be used in these packs to be identified and their function discussed. This should include all elements of the primary pack (e.g. outer cartons, labels etc.). Part C requires an alternative, aluminium free pack to be suggested for 2 of the packs. The relative merits of the given and alternatives packs should be discussed.

Marker 2:

Part A – for example a bar of chocolate is likely to be wrapped in 7 micron foil, however, an absolute barrier is not needed but dead fold very important. Part B – the bar needs a paper sleeve to contain and provide brand identity with other information. Part C - An alternative could be an OPP wrapper, possibly with a metallised layer.

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

Marker 1:

Most students provided reasonable answers. Few correctly identified correct gauge of material for all items.

Marker 2:

Students' knowledge of the gauge of foil was generally poor. The question requires a critical understanding of where and why it is appropriate to use aluminium foil and what alternatives there are.

QUESTION 2

A carbonated orange fruit drink can be packed in plastic, metal and glass containers.

- A) For each of these materials; identify suitable pack types to contain the drink. (3 marks)
- B) With reference to the properties of the drink, explain how each of these containers are able to provide a shelf life of at least 12 months. (3 x 3 marks)
- C) Discuss the advantages and disadvantages of using plastic to contain this product from a functional, environmental, commercial and aesthetic perspective. (8 marks)

Markers' Comments

Summary of what was expected in the answer

Marker 1:

Part A expected the pack type to be identified including materials, manufacturing method and closure method (e.g. injection stretch blown PET bottle with screw cap closure (e.g. PET)). Part B required the packs described in Part A to be discussed and demonstrated to be appropriate for the product. Barrier properties seal integrity and product resistance should be included. Part C requires plastic probably PET bottle to be evaluated. Comments were expected on its functional, environmental, commercial and aesthetic characteristics.

Marker 2:

The drink could be packed in an ISBM PET bottle with a HDPE or PP closure. The material provides a good barrier to CO₂ and moisture but not O₂. It is not affected by the fruit acid, however, the bottle is likely to be clear so UV light could affect the product.

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

Marker 1:

A popular question, most students answered well. In Part C students who structured their answer on the 4 aspects tended to get better marks. Several students failed to discuss coatings on metal cans.

Marker 2:

Well answered but marks lost by students not mentioning that that the containers need a closure. Saying a material has a gas barrier is correct but must explain which gas and why.

QUESTION 3

- A) Identify and describe the function of the raw materials commonly used in container glass manufacture. (5 marks)
- B) The following products are usually packed in glass packaging:
- a) Refillable carbonated soft drink bottle
 - b) Perfume
 - c) Jam
 - d) Ampoules for injectable drugs
 - e) Sparkling wine

For each of the above products; discuss why glass is the preferred material and what other materials could be used. (5 x 3 marks)

Markers' Comments

Summary of what was expected in the answer

Marker 1:

Part A requires the main ingredients of glass to be identified and their function stated (i.e. what the ingredient does to the glass). Part B requires the relevant properties of glass for each application which make glass the preferred material to be discussed. This could include how the container interacts with the closure system. There needs to be a clear link back to the particular product. Alternative materials/packaging systems for this product should be considered and its performance compared the glass container.

Marker 2:

Part A - Ingredients include silica sand, soda ash, limestone and alumina along with colours and cullet. Functions of each material also required. Part B – for perfume the properties must have an excellent odour/gas and alcohol barrier. As glass is inert it will not degrade over time as the product is likely to be stored and used over a long period of time.

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

Marker 1:

Generally answered well by students. Several students provided limited or incorrect descriptions of the ingredients function. In Part B some students failed to consider the relevant performance between the glass and the alternative.

Marker 2:

Part A – generally well answered albeit the functions of the ingredients were sometimes mixed up. Part B – Marks lost because there was not an explanation how a property affects the product.

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

Markers' Comments

Summary of what was expected in the answer

Marker 1:

Part A required a description of either the free radical additional polymerisation of LDPE or the catalyst (Z-N process) polymerisation of HDPE. Most students opted for free radical process. This process required a description of the initiation, propagation and termination phases of this process. Part B required each term to be explained e.g. a description of what co-polymerisation is, and an explanation as to the impact this can have on polymer properties.

Marker 2:

Part A - Either free radical or Z-N catalyst polymerization processes could have been used. Part B – for example, orientation of the molecules by stretching will align the molecular chain in the direction of stretch and can affect properties such as gas transmission rate, tensile strength and crystallinity.

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

Marker 1:

Most students provided reasonable answers. Part A was answered well but few descriptions had the clarity to get full marks. In Part B students often left out parts of the questions (i.e. either a description of the term or the impact this has a material properties. Several students confused tacticity and orientation.

Marker 2:

Polymerisation generally well answered. A greater understanding of the terms and their effect on polymer characteristics was needed.

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 students were required to answer two of the following three questions: 5, 6 & 7

QUESTION 5

- A) Describe the production of a metal can for a carbonated beverage from coil of material to can bodies packed ready for despatch to the packer filler. (12 marks)
- B) Describe the production of a ring pull can end for a carbonated beverage can from coil of material to can ends ready for despatch to the packer filler. (4 marks)
- C) Justify why the use of this container and closure is appropriate for a carbonated drinks product. (4 marks)

Markers' Comments

Summary of what was expected in the answer

Marker 1:

Part A requested a description of the process from reels of materials to the finished can body. While most students described the DWI process 3 piece cans were also acceptable. Answers were expected to identify the key processing steps up to and including palletisation for despatch. Part B required a description (including material) of the manufacture of a ring pull can end; the main processing steps are required in the correct order. Part C required the students to explain why a ring pull can is an appropriate pack format for a soft drink (e.g. strength barrier properties, corrosion resistance, convenience, etc.).

Marker 2:

This was a relatively straight forward question which could have been answered either by 2 piece DWI or as a 3 piece welded can.

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

Marker 1:

Most students provided reasonable answers. The sequence of operations was sometimes in error (e.g. printing after being necked in). While the main DWI process was usually described in adequate detail the processing steps after this were sometimes weak.

Marker 2:

As most drink cans are made by DWI, the process was not particularly well described. Sometimes it helps to use a flow diagram, draw each stage; then describe what is happening at each stage.

QUESTION 6

- A) Describe in detail the production of an injected moulded 500ml container for fresh cream from granular polymer to finished product. (8 marks)
- B) Compare and contrast the processes involved in the manufacture of a fresh cream container by injection moulding and thermoforming and the effect on the properties of the container. (6 x 1 marks)
- C) Identify and justify the key performance information to be included on a specification of an injection moulded fresh cream container. (6 marks)

Markers' Comments

Summary of what was expected in the answer

Marker 1:

Part A required a description of the injection moulding process to produce a cream tub. The answer should include the raw materials preparation and the polymer melting and injection into the mould. The mould design should be considered. After the part is manufactured it needs to be packed, labelled and despatched. Part B was a comparison of IM to thermoforming for the manufacture of this product. This did not require a detailed description of the process but more a comparison of the processes and finished products produced by the different processes. Part C required functional/performance characteristics of this product, which could be used on a specification to be briefly discussed.

Marker 2:

Part A – A description of raw materials and additives used through the plasticating extruder, into the mould cavities, cooling and ejection. Followed by QC checks, collation and packing ready for dispatch. Part B – for example - IM uses 1 machine whereas thermoforming uses 2 machines. Material distribution can be controlled well in IM whereas thermoforming allows complex laminate constructions to be used. Part C – key dimensional, material and decoration (if printed or in mould labelled) details required, along with key performance information.

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

Marker 1:

This was not a popular question. Answers were acceptable but the process detail was often limited. Part B & C were generally answered well.

Marker 2:

Reasonably answered but marks lost because not enough detail included.

QUESTION 7

- A) Describe the production process for making kraft paper for use as a liner in a corrugated case. Start with felled trees and finish with rolls of paper ready to despatch to the corrugated board manufacturer. (15 marks)
- B) How can the properties of paper and paperboard be varied on paper and paperboard forming machines? (5 marks)

Markers' Comments

Summary of what was expected in the answer

Marker 1:

Part A required the student to describe the paper making process from felled trees to rolls of paper. The process description needs to include debarking, pulping and beating. Additives can be added. The forming stage can be either fourdrinner or vat methods, but the process description needs to be including initial drainage, pressing fiber between felts, drying coating and calendaring. Part B is a discussion on how paper properties can be modified on the paper forming machine e.g. the fourdrinner machine. Issues to consider include thickness, weight, orientation, coatings, moisture content, surface finish, etc.

Marker 2:

Part A – process includes chipping, chemical digestion, pulp preparation and additives. Followed by the paper making process (fourdriner or cylinder). Coatings and calendaring before slitting down from master reel. Part B – this is about the process taking place in the paper making machine, not the pulp treatments. Properties affected include fibre orientation, caliper and surface treatments.

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

Marker 1:

Most students made a reasonable attempt. A few descriptions lacked the detail to obtain reasonable marks.

Marker 2:

Students lost marks because they did not describe the process correctly, often missing key elements such as chemical digestion, fibrillation and the different types of additives used. A better understanding of how the properties of the paper can be varied is also required.

Unit 2: Packaging Materials and Components (Paper B)

Paper B is worth 30% of Unit 2 and is assessed by a 2 hour examination. Students have to 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) Justify an appropriate adhesive and describe how a bond is achieved for each of the following:
- Construction of corrugated board (4 marks)
 - Label on returnable beer bottle (4 marks)
 - Chocolate bar wrapper (4 marks)
 - Adhesive tape (4 marks)
- B) A multi-ply paper sack is formed by folding the layers of paper into a tube and sealing with a PVA adhesive. These seals on the sack are failing in use.
- a) Discuss the possible causes of this seal failure. (5 x 2 marks)
 - b) Describe how the performance of the joint could be assessed. (4 marks)

Markers' Comments

Summary of what was expected in the answer

Marker 1:

Part A for each example an appropriate adhesive must be selected for the application. This justification for the use of that particular adhesive must be made. The process of the development of the bond should be described e.g. starch is gelatinised by heat and bond strength increases as moisture is lost. Part B a wide range of possible reasons for an adhesive bond to fail exist. Students are expected to consider a range of reasons and explain how these can lead to bond failure. The reasons should consider adhesive problems, substrate issues and processing conditions. The methods and considerations for evaluating seal performance should be considered. Tensile tests will require consistently prepared samples, environmental conditions must be considered. Types of test and methods of evaluation should be discussed.

Marker 2:

Part A – for example a chocolate bar wrapper can be cold sealed with latex. Based on rubber compounds it will easily stick to itself (no heat required) and has no odours. Part B (a) – range of possible causes of failure including surface coatings preventing good adhesion, failure of paper structure and simply not enough adhesive applied. Part B (b) – tensile testing, understanding environmental conditions.

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

Marker 1:

Most students provided good answers to this question with some very high marks achieved. Poor answers did not identify particular adhesives types, and failed to provide justification for answers.

Marker 2:

Wide range of marks. Students' knowledge on how corrugated board is produced was good or non-existent. Generally, knowledge of seal failure was answered well, but there was a lack of understanding how the performance of a joint could be assessed.

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) For sauces packed in glass jars; describe the advantages and disadvantages of using:
- glue applied paper labels (6 x 1 mark)
 - full body shrink sleeve labels (6 x 1 mark)
- B) With the use of examples; describe the types of face materials, adhesives and carrier webs used for pressure sensitive labels (PSL). (12 marks)
- C) Discuss the benefits of injection in-mould labelling for the manufacture of an ice cream container. (6 x 1 mark)

Markers' Comments

Summary of what was expected in the answer

Marker 1:

Part A requires a description of the advantages and disadvantages of using a paper label to which glue must be applied, and a full body shrink sleeve. Several advantages and disadvantages of each type of label are required. Part B required a discussion of the different face materials which are used in PSL labels. This requires a discussion of the types of paper and plastics used and some comments on their advantages and disadvantages of particular materials. Similar discussions are required for the adhesives used and the backing materials. Part C requiring a description of the advantages of using injection in mould labels for ice cream containers. The advantages must be specific to the application.

Marker 2:

Part A – advantages of paper labels include lower unit cost, ability to emboss but susceptible to moisture gain. Part B – the question gave the construction of a PSL. The answer required knowledge of the different types materials used. For example, adhesives could be based on acrylics, rubber, rubber hot melt or styrene butadiene styrene and could be permanent, peelable, repositionable or suitable for a deep freeze. Part C – benefits include good adhesion to container and all round decoration.

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

Marker 1:

Parts A & C were answered well with most students scoring highly. In Part B many students provided little detail about the specific materials and their characteristics.

Marker 2:

Generally well answered but knowledge of the different types of materials used in the construction of a PSL label could be improved.

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:
- 1) Roll on pilfer proof closure (7 marks)
 - 2) Induction heat seal with wad closure (7 marks)
 - 3) 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 closures are assessed. (3 marks)

Markers' Comments

Summary of what was expected in the answer

Marker 1:

Part A requires a description of 3 types of closure system. Each type of closure should be described with the aid of an annotated diagram. The materials need to be stated and key design considerations identified. The method of application should be described. The seal which prevents leakage should be discussed. Part B requires 3 types of child resistant closure to be described. The mechanism which provides child resistance must be clearly described. Part C requires a description of the method for assessing child resistance.

Marker 2:

Part A – ROPP's are usually made from a printed soft temper aluminium sheet, deformed to create the shell, usually with a tamper evident ring or skirt at the bottom. A wad is also inserted to ensure a good seal. An annotated diagram of the closure being applied to a container was required with a suitable example of use such as with a wine bottle. Part B – There are a variety of child resistant closures such as push and turn and squeeze and turn caps. Also closures where an arrow need to be lined up with a similar arrow on the container. Part C - Child-resistant packaging is packaging that is difficult for a child younger than 52 months to open (or gain access to the contents) in a reasonable period but not difficult for an adult — up to and including seventy years old — to use properly.

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

Marker 1:

This question was generally answered well. A few students failed to provide details of the required closure systems and failed to achieve high marks.

Marker 2:

Part A – generally well answered but correctly annotated diagrams need to be improved. Part B – A mixture of answers and knowledge of how CR closures are assessed was generally not well understood.

Unit 3: Packaging Processes

This unit is assessed by a 2 hour examination and students have to answer five questions.

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

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

There are many reasons why packaging designs change. Choose **FIVE** of these reasons; discuss why the change may be required and in each case explain what must be considered. (5 x 4 marks)

Markers' Comments

Summary of what was expected in the answer

Marker 1:

Students had to discuss 5 reasons why pack design would be required to be changed. These reasons should be different and cover a broad range of issues. For each reason for pack change the student should explain what factors need to be taken into consideration.

Marker 2:

Part A – reasons include the launch of a new product which means product/pack compatibility needs to be assessed. Cost saving exercises such as material weight reduction requires testing to ensure the functions of packaging are still met.

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

Marker 1:

Few students scored very highly, and most achieved good pass level answers. To score highly a diverse range of issues need to be considered, changing print on pack to provide promotional offer, marketing change or to meet new legal standards will be repeating much of the same considerations. Poorly scoring students provided little explanation or arguments.

Marker 2:

Generally well answered by students. It is important to use examples to illustrate the answer as part of the discussion.

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) Identify and justify printing processes for the following applications:
- Corrugated case (2 marks)
 - Aluminium soft drinks can (2 marks)
 - Hemispherical screw on cap for personal care (2 marks)
 - A wrapper for a leading brand of chocolate-based snacks (2 marks)
 - Paperboard tray for a small bakery to brand their packs (2 marks)

Note to students: You are expected to use a different printing process for each of the above.

- B) Describe **SIX** common printing defects. (6 x 1 mark)
- C) Briefly describe **TWO** methods of transferring ink to a substrate using digital printing techniques. (2 x 2 marks)

Markers' Comments

Summary of what was expected in the answer

Marker 1:

Part A expected the student to propose a suitable printing process for each application. The proposed solution then should be justified for its use in this particular application. This requested some description of key issues with the required printing and then how the technical details of the proposed solution are appropriate. Part B required a description of 6 different printing faults. Answers need to demonstrate that the students understand what these faults were. Part C was specifically asking for a description of the ink transfer methods available for digital printing e.g. laser toner transfer from charge down drum or drop on demand ink.

Marker 2:

Part A - Range of printing options available. For a hemispherical screw on cap for personal care, tampo printing is the most suitable albeit rather slow. Part B – Defects include colour variation, misregister, moire and dot gain. Part C – methods include xerography, inkjet both drop on demand and continuous.

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

Marker 1:

Part A was answered reasonably well. Justification could often been strengthened. Some very short answers were provided. Part B was again reasonably answered by most students. Some provided a good level of detail on each defect, however several others failed to provide a strong argument. Part C was poorly answered. Very few students were able to describe a single ink transfer method in any detail.

Marker 2:

Reasonable answers but important to justify printing methods.

Learning Outcome 3: Understand packaging machinery and packaging line operations

QUESTION 3

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

- A) A large contract wine bottler packs a range of still wine in glass bottles. Describe the packaging process from materials supplied to the packer filler to packed wine ready to despatch to the retailers. (15 marks)
- B) A key performance indicator for the packer filler is the overall equipment efficiency (OEE). Discuss what this is (2 marks) and how it can be improved (3 x 1 mark).

Markers' Comments

Summary of what was expected in the answer

Marker 1:

Part A required a description of an appropriate packing line for wine. All main elements were required from filling, capping, labelling and coding, secondary packing and palletisation. Quality checks must be considered at the appropriate points. Part B expected a description of what overall equipment efficiency is, in general and the 3 elements which contribute towards its calculation. Suggestions as to how OEE can be increased were required.

Marker 2:

Part A – Straight forward process from goods inwards to goods outwards. A flow diagram helped to ensure stages were not missed out. Part B – $OEE = Availability \times Performance \times Quality Rate$. Improved by better equipment availability through improved maintenance to reduce breakdown.

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

Marker 1:

Part A was answered reasonably by all students. A few provided exceptional answers containing significant detail of all elements of the process. Part B was reasonable however several students failed to define what OEE is.

Marker 2:

The process was reasonably answered but a better understanding of OEE is required.

QUESTION 4

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

- A) Describe **THREE** methods for level filling of liquids into containers and discuss their relative benefits and limitations. (3 x 3 marks)
- B) Describe, with aid of a diagram, the filling and sealing of 50ml hand cream into a flexible plastic printed tube. (6 marks)
- C) Discuss **FIVE** methods to apply variable or lot marking data to packaging and explain the benefits of each. (5 x 1 mark)

Markers' Comments

Summary of what was expected in the answer

Marker 1:

Part A required a description of 3 types of level filling for a liquid. These descriptions should clearly indicate how a constant level is achieved. The advantages and disadvantages of these systems should be discussed with respect to containers, material viscosity and other product details e.g. carbonation. Pressure, vacuum and gravity fillers should be described. Part B required a discussion of the filling and sealing of a flexible tube of hand cream. This answer should consider how a cream should be measured into the tube e.g. piston filler, and how the tube would be sealed. Part C requires 5 methods of adding variable data e.g. data code to packs. Some comments of the benefits of each method should be made. Methods could include inkjet, laser, embossing thermal transfer, or perforations of labels or materials.

Marker 2:

Part A - Three methods include vacuum, gravity and pressure fillers. Part B – An annotated diagram to explain how empty tubes are brought to line, filled from the top and heat sealed with integral batch data, then ejection and collation. Part C – variable data can be applied using laser coding, ink jet, debossing with and without foil.

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

Marker 1:

Few students provided excellent answers. Many students did not discuss how a constant level would be achieved by their described filling methods. Several students failed to understand that flexible tubes are filled through the base of the tube and then sealed.

Marker 2:

Level filling of liquids was straight forward along with variable data technologies; however, tube filling could have been answered better.

Learning Outcome 4: Understand how quality systems impact on packaging

QUESTION 5

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

- A) Provide a definition of quality which can be used for developing a quality management system. (2 marks)
- B) Discuss the difference between quality control and quality assurance. (2 marks)
- C) Briefly describe the main elements of a quality management system. (10 x 1 mark)
- D) While Philip Crosby promoted the concept of zero defects, others suggested specifications include acceptable quality levels. Discuss the merits of these alternative philosophies. (6 marks)

Markers' Comments

Summary of what was expected in the answer

Marker 1:

Part A required a defn of quality which could be used for a QMS (e.g. fit for purpose). Part B required the student to explain the difference in quality control – checking to ensure only acceptable quality is released and quality awareness, the system in place to ensure product is produced correctly. Part C required a discussion of the main elements that would be found in a QMS such as an ISO 9000 system. PRTD required a discussion of the relative merits of zero defects philosophies and AQL. What is the impact of accepting some products produced are defective?

Marker 2:

A definition of quality should include fitness for purpose along with the totality of features to meet customers' requirements. The difference between QC v QA. A quality management system (QMS) requires elements such as a policy document, organizational structure and roles, document and data control, work instructions and training etc. A good answer needed to discuss the costs of defects and operational systems required to reduce them.

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

Marker 1:

Most students provided reasonable to good answers for Parts A, B & C. In Part D good students described the 2 approaches but very few developed arguments about their relative merits. Students struggled with defining a defect, and related no defects to mean no tolerance, which then coloured their answers.

Marker 2:

Parts A & B reasonably answered, but answers for the QMS and the philosophy of zero defects v AQL's could have been better.