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General Certificate of Education

Home Economics 5561/6561

HEC7

Mark Scheme

2008 examination - June series

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HEC7

Question 1

(a) (i) SMR is the percentage increase in weight when a bone-dry fibre or fabric is exposed to conditions of $21^{o}C$ and 65% relative humidity.

3

(ii) Percentage Moisture Regain = $\dfrac{\text{‘Wet’ weight} - \text{‘Dry’ weight}}{\text{‘Dry’ Weight}} \times 100$

3

(b)

(i) Natural fibres regain more moisture than man-made fibres. The synthetic fibres in turn absorb less water than the man-made fibres. The different values for the two sets of fibres are a result natural fibres having more sites available for the absorption of water molecules.

4

(ii) Man-made fibres are regenerated from cellulose so they do absorb some water. The synthetics absorb very little water because they are not produced from cellulose and there are very few sites on the synthetic fibres where water can become attached.

4

(iii) Cotton – 10.85g polyester – 10.25g

2

(c) Because of their structures, textile fibres swell to a much greater extent widthways than they do longways. Polyamide fibres are highly orientated (the molecules are closely packed together) and consequently there is little space between the polyamide polymer molecules for water to enter the structure. Conversely viscose rayon has a more loosely packed structure, the cellulose molecules in viscose fibres are not so highly orientated and there is more space between the polymer molecules. Because of this, viscose swells more both widthways and lengthways than do the other fibres. Also fibres such as cotton and viscose attract water into the fibres and this absorbed water fills the spaces and the fibres swell mainly in the widthways direction. Nylon tends not to attract water anyway as it is hydrophyllic and as a consequence both widthways and lengthways swelling is much less than it is for the other fibres shown.

9

Criteria banding (9 marks):

- A typical **good answer** (7 –9 marks) would show that the candidate has a good understanding of the structures of textile fibres and can link this knowledge to different moisture absorbancy properties of natural fibres, synthetic fibres and man-made fibres and the consequential swelling of fibres both widthways and lengthways.
- A typical **average answer** (4 –6 marks) would show some evidence of understanding of fibre structures and moisture absorbancy but does not relate fibre strucure and moisture absorbancy with fibre swelling.
- A typical **weak answer** (0 –3 marks) would show some evidence of understanding fibre structure but is unable to relate this to moisture absorbancy and fibre swelling.

Question 2

(a) Blending of fibres and reasons why linen does not blend with other fibres.

Linen fibres are long, strong, not very fine and rather stiff.
They are very inelastic, the percentage elongation at break is lower than that for cotton; only 1.8% when dry and 2.2% when wet.
To have good blending properties fibres, need to be fine and flexible, be fairly compatible in some (but not all) physical properties so that on blending, the good properties of the fibres in the blend are emphasised and the poorer properties of the component fibre are minimized.

Because of the rather course nature of linen fibres and the fact that they are very inflexible, linen (unlike cotton) does not blend well with other more elastic and flexible fibres such as polyester or polyamide.

9

Criteria banding (9 marks):

- A typical **good answer** (7 – 9 marks) shows good knowledge and understanding of the reasons why fibres are blended together to make good fabrics, especially the relevent physical properties of the component fibres. This good answer would also show knowledge of the properties of linen fibres and why some of these physical properties have an adverse affect on the ability of linen to blend with synthetic fibres such as polyamide and polyester.
- A typical **average answer** (4 – 6 marks) would show some evidence of why blending of natural and synthetic fibres is carried out but is unable to explain or give reasons why linen does not blend well with other fibres.
- A typical **poor answer** (0 – 3 marks) would show superficial knowledge about blending and would be unable to explain why linen does not blend well with other fibres.

(b) hollow fibres are used in thermal wear and duvets

Still air is an excellent heat insulator and the more still air which can be incorporated into fibres, yarns, fabrics and garments the warmer they will be. Hollow fibres and filaments such as ‘Viloft’ and ‘Quallofil’ have been developed for this purpose. These hollow fibres and filaments contain large volumes of trapped still air which acts as an insulator retaining body heat in thermal wear and sustaining warmth in bed. Conventional natural and synthetic fibres (apart from wool) do not always offer good insulation and the new hollow polyester duvet fillings offer many other advantages over traditional fillings.

6

Criteria banding (6 marks):

- A typical **good answer** (4 – 6 marks) would show evidence of understanding the principles of thermal insulation in fabrics and the role which large volumes of still air play in this. Appropriate examples of typical hollow fibres (see above) would be given.
- A typical **average answer** (3 – 4 marks) would show some understanding of thermal insulation in fabrics but would not show understanding of the relationship between still air and thermal insulation.
- A typical **poor answer** (0 –2 marks) would show little understanding of thermal insulation in fabric assemblies and how this insulating effect could be produced with hollow fibres.

(a) <u>sodium perborate in washing powders</u>

Sodium perborate is present in many washing powders and it acts as a mild bleaching agent. Sodium perborate is essentially a stable compound of sodium borate and hydrogen peroxide. When it is added to washing powders and mixed with hot water the hydrogen peroxide present releases oxygen which oxidises ('bleaches') stains in the soiled clothing especially whites. Unfortunately a temperature of $60^{o}C$ is required to fully release the oxygen from the perborate and in these days of energy conservation and high energy prices, washing at $60^{o}C$ is not popular. Modern washing powders now have an activator (TAED) present which helps to produce active oxygen at lower temperatures such as $40^{o}C$.

4

(b) <u>Effect of flame retardants on the flammability of cotton</u>

Cotton cellulose contains the flammable elements carbon, oxygen and hydrogen. Dry cotton is very flammable and burns with a yellow flame. Before laws were passed through parliament here making it illegal for shops to sell untreated cotton in children's nightwear, many children died in house fires because they were wearing cotton nighties and pyjamas. Light cotton fabrics contain a lot of air, ignite easily and burn quickly. There are several ways of making cotton less flammable and flame-retardant finishes are now used in cotton nightwear. Most of these flame-retardant treatments change the way cotton burns and lessen the chances of the cotton fabrics catching fire. Marks and Spencer in the UK use 'Pyrovatex' finished cotton for their products while the military use a 'Proban' type of finish to make military uniforms and clothing more resistant to burning.

6

Criteria banding (6 marks):

- A typical **good answer** (4 – 6 marks) would describe why cotton (especially 100% cotton nightwear) is so very flammable and then go further to describe the nature of the currently used range of flame retardants and how they change the way cotton burns. The flame retardants change the chemistry of the burning process so that a char is produced instead of a rapidly burning material. Better candidates may give examples.
- A typical **average answer** (3 – 4 marks) would indicate that cotton was very flammable without giving an explanation of why this is the case. Chemical flame retardants for cotton may be mentioned but only a superficial explanation of how they operate could be described. Little real detail of how they change the burning of cotton will be described.
- A typical **poor answer** (0- 2 marks) would lack any real detail of the nature of burning cotton and how flame retardants modify the burning behavior of cotton fabrics.

Question 3

(a) what is a 2/2 twill fabric?
Twill fabrics are those where the weave repeats over one or more of the weft yarns. They all have a series of diagonal lines (twills) on one side of the fabric due to the interlacing of the yarns. A 2/2 twill is an **even sided** fabric in which 2 warp yarns float over the **same number** of weft yarns (2) that it floats under. The diagonal lines in even sided twills appear equally prominent on both sides of the fabric.
(***marks will be awarded for a correct drawing of this fabric***)

2

(b) warp and weft knit fabrics

Weft knits
(i) Very extensible and have good elasticity
(ii) Weft knits will ladder when a thread is broken
(iii) Weft knits drape well but weft knit garments are easily pulled out of shape, especially when wet

3

Warp knits
(i) These are much less elastic than weft knits but they are stronger and resemble woven fabrics more closely than do weft knits
(ii) Warp knitting does not ladder
(iii) They are better at keeping their shape than weft knits
(iv) Warp knitting can be carried out very quickly and fabrics produced by this process are cheaper than woven fabrics.

3

(c) wearer trial results

Silk shirt (32%)
- silk is a light fabric which is cool to wear in warm conditions and warm in cool conditions, most popular shirt
- excellent ‘feel’ against the skin
- silk is shiny and the fine filaments are quite strong
- it absorbs moisture well and dries quickly

65% polyester/35% cotton (30%)
- ‘classic’ blended shirting fabric very widely used
- benefits of both fibres in the blend
- comfortable and hard wearing
- easy care fabric

100% cotton (15%)
- third most popular fabric and is widely used
- perceived comfort of 100% cotton
- discomfort when wet/damp (high SMR)

100% linen (8%)

- perceived comfort of a natural fibre but below 10%in choice
- high SMR cool in summer
- creases badly when wet

55% wool/45% cotton (7%)

- only 7% of consumers preference shirt not comfortable
- fabric clammy and too hot in summer/indoors (central heating)
- not easy-care

85% polyester/15% cotton (5%)

- perceived (high synthetic) and not found comfortable
- low SMR uncomfortable indoors and in hot weather
- not enough cotton to influence blend properties warp knit fabric

100 % polyamide (3%)

- not unexpected least comfortable shirt warp knit harsh against skin
- warp knit fabric enhancing discomfort with 'lowish' SMR
- polyamide (nylon-synthetic) has perceived and found discomfort **12**

(other valid reasons will be given marks)

Criteria banding 12 marks:

- A typical **very good answer** (10 –12 marks) would describe in detail the information shown above with respect to the wearer trial results which highlighted different preferences for different fibres and fibre blends in shirting fabrics. In the answer details of scientific and other reasons why specific fabrics were chosen over others relating to comfort will be discussed and how different fabric structures can influence the comfort of shirts should also be discussed. Detailed explanations and proper discussion of these points will be written in the answer
- A typical **good answer** (7 – 9 marks) will highlight the major points described above although detailed scientific reasons why choices were made will not be so detailed. Some evidence showing that the comfort of shirting fabrics is influenced by fibre type and fabric structure should be given.
- A typical **average answer** (4 – 6 marks) should give reasons why different fibres and fabrics influence fabric comfort and this discussion should relate to the results in the table and summary given above. Some scientific knowledge about fibres and fibre blends should be given.
- A typical **poor answer** (0 – 3 marks) will show some evidence that fibre properties affect fabric comfort and also that consumer preferences for different fibres, blends and fabrics came out of the wearer trial results.

(d) polyester/silk blends

Evidence from the wearer trial results above suggests that the best combination of fibre properties for high comfort and excellent wash and wear properties in shirts and blouses could be provided using silk and polyester in blends. The silk would provide aesthetics, good handle and comfort while the polyester would give good wash and wear properties, crease and wrinkle resistance and durability. If microfibre polyester was available it would blend extremely well with silk as microfibre polyester fibre dimensions and some physical properties would be very compatible with silk. 50/50 blends of microfibre polyester with silk in properly blended yarns would give excellent wash and wear qualities.

5

25

Question 4

(a) <u>treatments to make 100% cotton wrinkle and crease resistant</u>

- very cheap urea/formaldehyde resins are still being used in third world countries to improve the crease resistance of 100% cotton. These finishes essentially fill the spaces between the cellulose molecules in cotton fibres and although improving the cotton they have some poor side effects on the fabric and the compounds used are hazardous.
- other, more up to date and much more effective crease resistant finishes, are used for better quality 100% cotton shirt and blouse fabrics. Substances such as DMDHEU and related compounds which crosslink cellulose in the fibre and are significantly better than U/F.
- Blending with polyester gives fabrics which have excellent wearing quality and good wrinkle and crease resistance.
  (other relevent processes and treatments, if appropriate, will be given marks)

6

(b) <u>core-spun polyester/cotton threads and yarns</u>

Filament core/staple fibre wrap core-spun yarns are characterised by the presence of filaments in the centre of the yarn completely surrounded by a wrap of staple fibres. Core-spun yarns with a polyester filament core and a sheath of combed cotton fibres are very widely used in bedsheets and for knitted fabrics. The filament polyester core gives strength and the cotton sheath, which contacts the skin, provides comfort. These core-spun yarns have better cover and pilling resistance than fibres which contain intimately blended polyester and cotton fibres or 100% cotton yarns with comparable yarn size and for use in sewing threads they give excellent properties.

5

(c) <u>melt spinning with three examples</u>

Textile yarns containing the synthetic fibers polyester, polyamide, polypropylene etc are all produced by melt-spinning. These thermoplastic materials can be extruded through a spinnerette when in a molten state. The filaments produced are then normally stretched under tension to orientate the fibres improving their strength and flexibility. On cooling, the filaments can be used as they are or they can be cut into staple fibre for blending with natural fibres. Only materials which are thermoplastic and stable when molten, can be melt-spun. A very recent development in melt spinning is in the production of microfilaments of polyester and polyamide. These filaments are extremely fine having counts of less than 1 decitex per filament. They are finer than the finest silk.

5

(d) <u>nature of wool fibres and shrinkage of wool fabric</u>.

When examined using a microscope on low power, wool fibres are very different from those of cotton, viscose or the synthetics. The surface of each wool fibre is covered with overlapping scales called epithelial scales rather like the tiles on a roof with the scales pointing upward from the base of the fibre to the tip.
The protruding edges of the epithelial scales give wool fibres a roughness in the tip-to-root direction and the felting and consequential shrinkage of wool fabrics is due to this surface roughness. Felting occurs most readily when wool fabrics are agitated in the presence of heat and moisture especially during washing in hot water (> 50^{o}C) using heavy-duty detergents. The tips of the scales become tangled up with the scales of adjacent fibres as the fabric is agitated and

the scales are unable to separate again. These effects cause shrinking to occur and this shrinkage cannot be reversed. Untreated100% wool garments may shrink by up to 2/3 sizes if the garments are carelessly washed in hot water. Modern finishing treatments for wool can be used to prevent shrinkage occurring during washing but the aesthetics and handle of the wool are affected.

(a figure or drawing of a wool fibre will be credited)

9

Criteria banding 9 marks:

- A typical **good answer** (6 – 9 marks) will provide a good detailed account (possibly with a sketch), on the structure of a wool fibre and how this scaly structure affects the fibre behaviour (ie restricted movement) during washing.
- A typical **average answer** (4 – 6) marks will describe a wool fibre, showing the scale structure and, without providing a detailed account, explain how wool shrinks during washing.
- A typical **poor answer** (0 – 3 marks) will have a limited description of a typical wool fibre and some attempt will be made (little detail) to show how the structure of wool fibres affects the washing properties of wool fabric.