Total marks — 80

Attempt ALL questions

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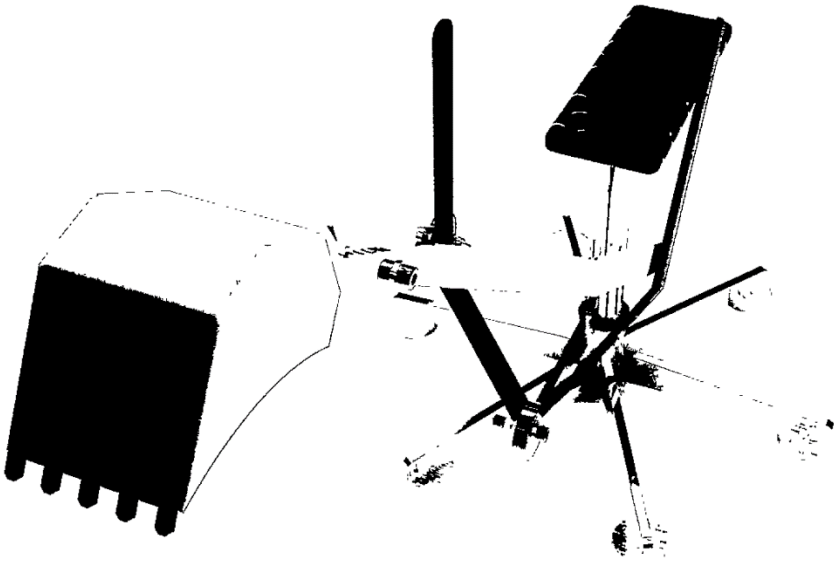
1. A manufacturing company has produced an excavator toy, which is shown below.



A CAD technician working for the company used bottom up modelling to create the individual parts. Sub-assemblies were then produced before being joined in the final model.

Drawings generated from the model are shown on the **Supplementary Sheets 1 and 2 for use with Question 1.**

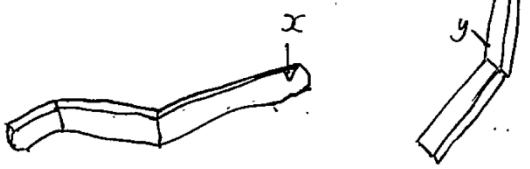
1. (continued)

MARKS | DO NOT WRITE IN THIS MARGIN

(a) Describe the 3D CAD constraints used to assemble the lever bend to the lever extension. You may use sketches to support your answer. 4

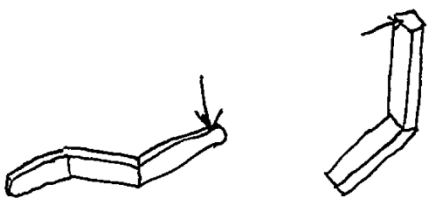
You should refer to the left-hand lever sub-assembly shown on **Supplementary Sheet 1 for use with Question 1(a).**

Use the mate command to attach surface x to surface y.



Use the align command to align the edge of the semicircle at surface x to the far edge of surface y.

Use an offset mate command (by 182.5mm) with the top of surface x and the very top of surface y.



The model should be fully assembled.

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1. **(continued)**

(b) On **Supplementary Sheet 2 for use with Question 1(b)** various views and a dimension have been annotated with the letters A to C.

Name each view or dimension **and** describe the information that it would provide to the manufacturer. You must use the correct British Standard terms.

(i) View A True Shape: Shows how the component actually looks, and not flattened for drawing. 1

(ii) View B Sectional end elevation: Provides the size of the fillet, which could not have easily been shown otherwise. 1

(iii) Dimension C Angle with tolerance: Shows the degree of accuracy required in the manufacture of the part. 1

1. (continued)

MARKS | DO NOT WRITE IN THIS MARGIN

(c) A problem has been identified with the seat of the excavator toy and a redesign is required. Specific information about the current seat is saved within the following file formats — .DWG, .STL and .3DS

Explain how the information contained in these files would be used in the redesign of the replacement seat.

(i) .DWG Standard drawing format allowing for FEA/stress analysis to identify & then edit faults. 1

(ii) .STL Standard Tesselation Language is the file format used before 3D printing. This would allow the model to be printed and tested. 1

(iii) .3DS A standard 3D model file that would allow for physical testing/aesthetic changes to the design 1

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1. (continued)

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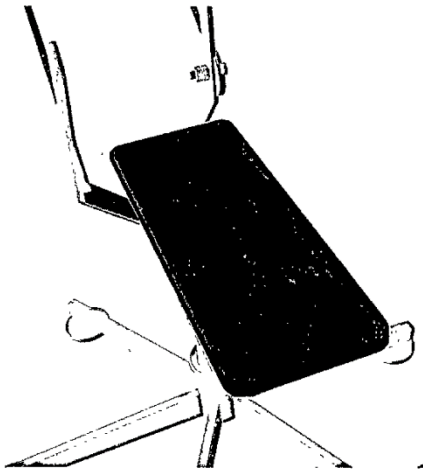
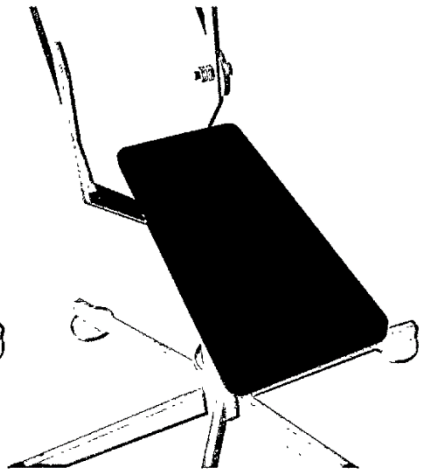
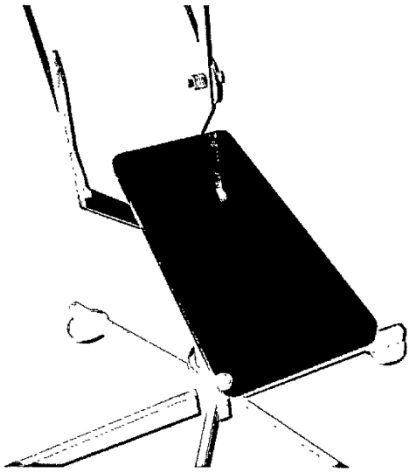
(d) A CAD illustration of the seat detail is produced. The stages of creating this detail are shown below. Stage 4 shows the final illustration.



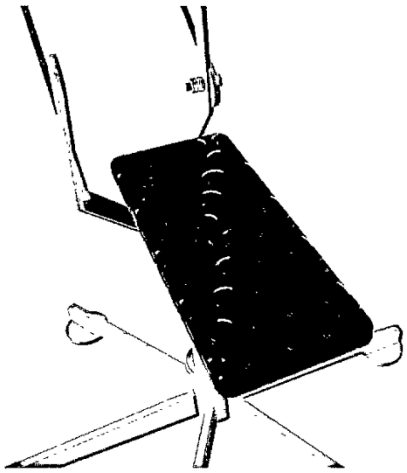
Stage 1



Stage 2



Stage 3



Stage 4

1. (d) (continued)

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Name the computer-aided techniques which have been applied between the following stages of the process and explain how they have been used.

(i) Stage 1 to Stage 2 1

Texture Mapping: Applying A 2D image to a surface to give the appearance of a texture.

(ii) Stage 2 to Stage 3 1

Applied Lighting: Realistic lighting styles have been applied, such as point/distant lighting to give a realistic look to the render.

(iii) Stage 3 to Stage 4 1

Bump mapping: Applying a 2D greyscale image to a model to give the appearance of surface relief.

[Turn over

1. (continued)

MARKS | DO NOT WRITE IN THIS MARGIN

(e) A presentation about the excavator toy is to be created in printed and digital media using a variety of file types.

(i) State the name of a file type that could be used to show an animation of how the excavator toy is assembled. 1

.mpeg

(ii) State the name of a **vector** file type that could be used to show a rendered image of the finished excavator toy. 1

.gif

(iii) The printed presentation takes the form of a poster, which includes both images and text.

Explain what would need to be considered by the designer prior to the poster being sent to the print technician. 3

All colours are created with CMYK (or Pantone) to create the most accurate print, as printers can only Print CMYK. All images and the document itself are to the correct size so there is no loss of quality through scaling.

All fonts/ images are embedded to ensure the correct final product is produced. PDF could be used for this

All bleed images should be extended past the crop marks to ensure the best print.

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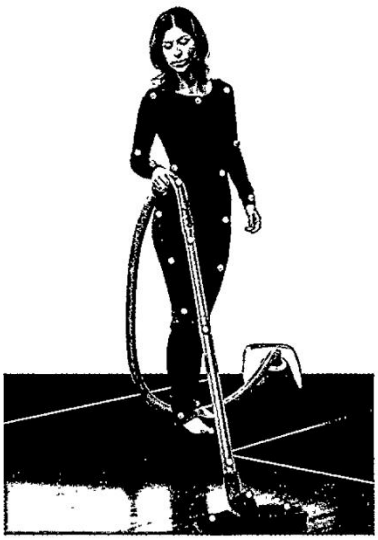
2. A vacuum cleaner manufacturer uses **motion capture** technology as a test procedure to ensure that their products are easy and comfortable to use.

An image of the test is shown below.



(a) Motion capture has advantages and disadvantages.

(i) Describe three **advantages** of motion capture technology to the manufacturer. 3

Gives very realistic movement, as it is capturing a human. Allows the company to view the ergonomics of their product. The captured footage can be used in advertising for the product.

2. (a) (continued)

MARKS | DO NOT WRITE IN THIS MARGIN

(ii) Describe three **disadvantages** of motion capture technology to the manufacturer. 3

Motion Capture Software is very expensive. The Software also requires training to use.

[Turn over

2. (continued)

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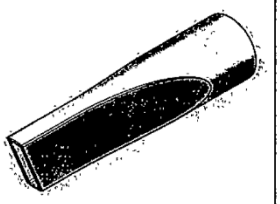
(b) After testing, the manufacturer wants to design a new nozzle. Two designs are being considered.

You should refer to **Supplementary Sheets 3 and 4 for use with Questions 2b(i) and (ii)**. Nozzle 1 is shown on Supplementary Sheet 3. Nozzle 2 is shown on Supplementary Sheet 4.

Describe the 3D CAD modelling techniques used to create the two replacement nozzles. You may use sketches to support your answer. Dimensions do **not** need to be included in your responses.

(i) Nozzle 1 5



in a new sketch, create a circle.
on a parallel plane to this, sketch a rectangle with the same centre point.

Use the extrude, add material, tool to extrude the circle towards the rectangle.

Use the loft tool to connect the rectangular sketch and the cylinder.

Use the shell tool, leaving a wall thickness, ~~wall at each end~~ all the way through, ensuring no end wall is left.
Use the fillet tool on the edges of the rectangular end (interior & exterior). Also fillet along the loft curve to create a smoother edge.

2. (b) (continued)

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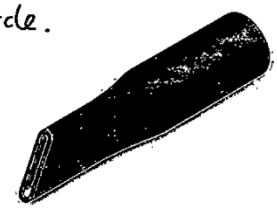
(ii) Nozzle 2

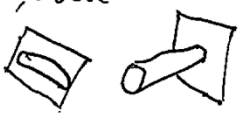
4

In a new sketch, create a circle.



Create an angled plane some distance away and sketch a rounded rectangle, with the same centre point.

Extrude, add material, the circle towards the rectangle.



Use the Loft command to connect the two.

Use the shell tool to hollow the object, and removing the ends.

Use the fillet tool on the inside of the front of the nozzle to smooth it.

[Turn over

2. (continued)

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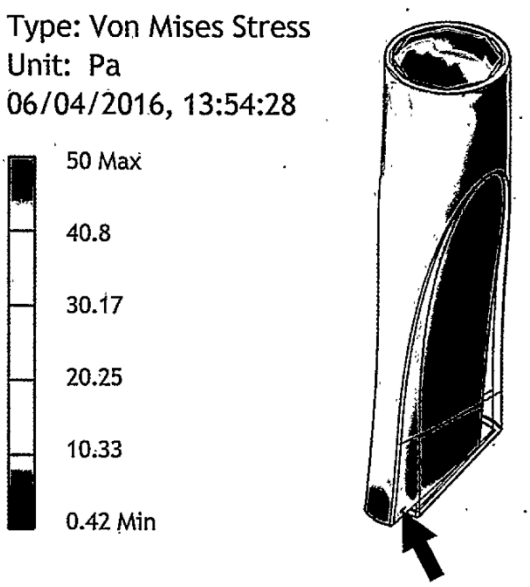
The 3D CAD models of the nozzles are being tested using Finite Element Analysis (FEA) methods.

The results of the test on Nozzle 1 are shown below.



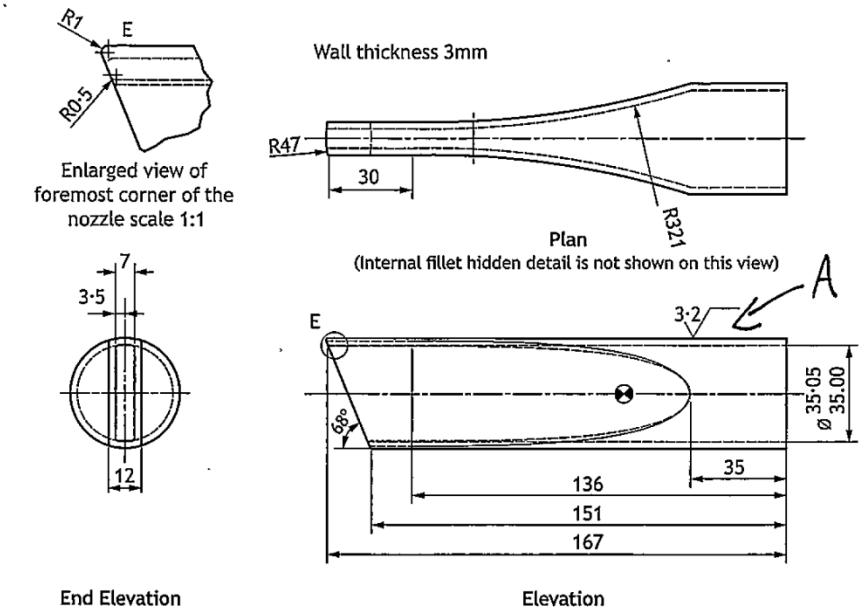
(c) Describe four set-up requirements that are necessary **before** the FEA simulation test can begin. 4

Gravity is set. Weights & materials are Any external forces (i.e. gravity) are set. All parts are given materials with set strengths. Any displacement is quantified and set. All forces are given a strength.

2. (continued)

MARKS | DO NOT WRITE IN THIS MARGIN

An orthographic CAD drawing of Nozzle 1 is shown below.



(d) Identify three pieces of information which have been included in the orthographic views shown above and explain how they would allow the nozzle to be manufactured using CAD CAM processes. 3

Tolerances allow for a degree of accuracy in the production of the nozzle while allowing it to still work correctly.
The machining symbol (labelled A) giving details on the machining of the surface.
Dimensions allow for the nozzle to be created to the correct size to be assembled and work fully.

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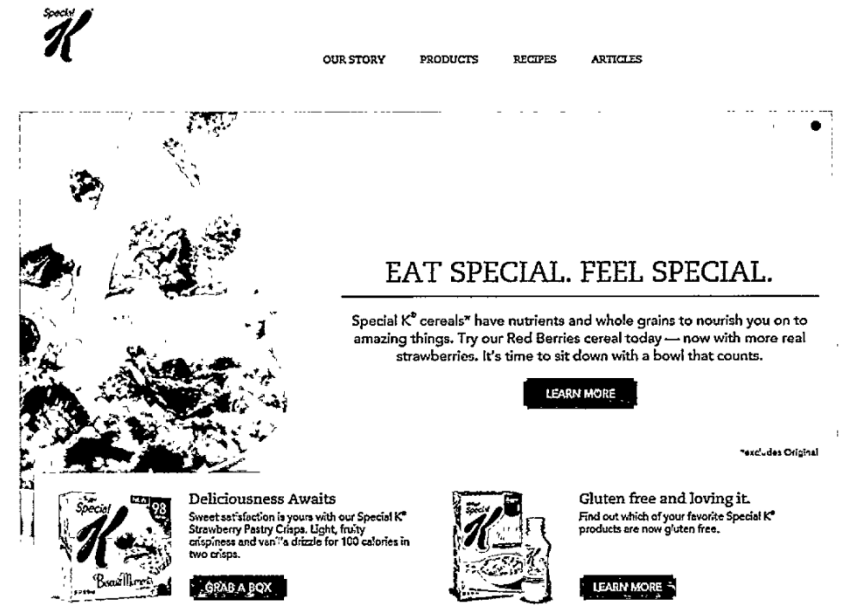
3. A company has launched a series of products that carry the same branding.

The graphic designer has maintained the brand across a range of products and a website using design elements and principles.



Special K website homepage

(a) Identify four design elements or principles and explain how they have been used in the web page shown above. 4

1 Unity of all of the red and beige helps to tie all of the items together in an appealing and rhythmic manner.

2 Depth has been used by overlapping the top section with the lower one, making the page more appealing and flowing.

3 White space has been used to give a more relaxing, easy-reading design that is appealing to the eye by looking less cluttered.

3. (a) (continued) MARKS | DO NOT WRITE IN THIS MARGIN

4 Colour gradients have been used on the two lower sections to allow the eye to comfortably flow using rhythm.

(b) It is important that the branding on the web page exactly matches that on the product packaging. Three examples of this packaging are shown below.

Coated cardboard packaging for biscuits

Plastic packaging for individual cereal bars

Coated cardboard and foil yoghurt container with plastic lid

Describe three factors that a company may have to consider when maintaining consistency across digital and printed media. You must mention specific printed and digital media in your responses. 3

Different printing processes will be required for the products. The cereal bar and the plastic packaging ~~and coated cardboard~~ is ~~are~~ likely to use flexography due to the substrate choice ~~variety~~. Whereas the cardboard is likely to use rotogravure due to it's high speed and efficiency with long / large print runs. Screens can only display in RGB so the website will require this colour space, whereas the printed media will require CMYK for the printers, so colour conversion will need to be done with PMS or set colour.

3. (continued)

MARKS | DO NOT WRITE IN THIS MARGIN

(c) A camera-ready copy of the biscuit packaging is produced.

Describe four requirements of a camera-ready copy for commercial printing. 4

All text fonts are embedded. All sizes & orientations are final. All colours are exactly specified / converted as required. The document is converted to a PDF before sending. All images are of sufficient quality so as not to appear blurry / pixellated. All bleed image are suitably bled off the document.

(d) State a suitable printing process to mass produce the cardboard biscuit packaging. 1

roto - gravure

3. (continued)

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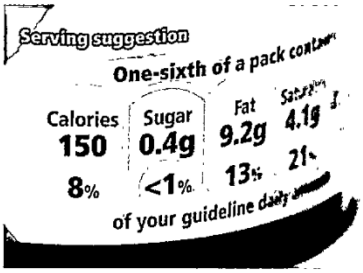
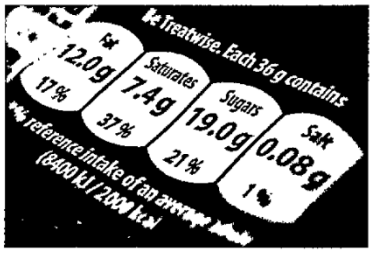
(e) Food manufacturers are required to display nutritional information on food packaging.

Two examples are shown below.



Label 1



Label 2

Explain, with reference to the labels shown above, how graphic techniques have been used to make the nutritional information as clear as possible. 4

Simple sans-serif fonts are used to allow easy reading. Contrasting colours are used to aid readability. Label 1 colour codes the different information boxes for eye-catching readability. High consistency of font & font colour ~~for~~ to aid unity and rhythm in reading. The numbers in the boxes are ~~[illegible]~~ in a larger font size to help them be read as they are the most important part.

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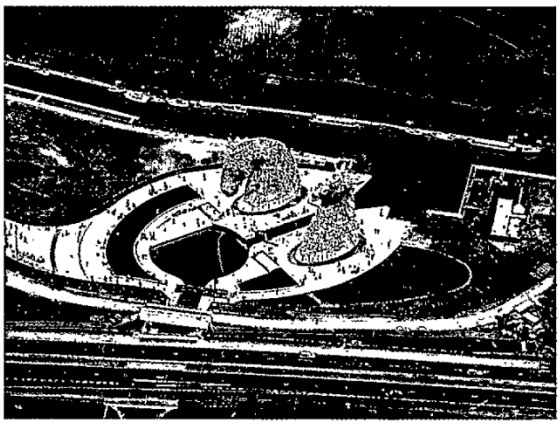
MARKS | DO NOT WRITE IN THIS MARGIN

4. The Kelpies and surrounding Helix Park have become a popular tourist attraction in the heart of Scotland.



Aerial photograph of the Kelpies and the visitor's map of the Helix Park

(a) Prior to the construction of the Kelpies and Helix Park, three different surveys were undertaken.

Name three surveys and explain their purpose in ensuring the success of this project. 6

Survey 1 Feature Survey

Purpose To show all existing land features, such as roads, paths, benches, street lights etc. that will need to be removed or deigned around.

4. (a) (continued)

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Survey 2 Topographical survey

Purpose To show soil types, any rock outcrops or any existing buildings that will need to be removed or designed around.

Survey 3 Underground Survey

Purpose To identify and underground features such as pipes/cables or any unstable land that could ~~off~~ affect the project.

4. (continued)

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(b) Many professionals from the built environment sector were involved in the design and construction of the Kelpies sculptures. These included a model maker, structural engineer and a representative from the construction trades.

During the project they all made use of a computer generated 3D model of the sculptures.

Describe two ways the following professions could make use of the 3D computer model. **You must give different answers for each profession.**

(i) model maker 2

to create a 3D printed model for use in design modifications, and also in promotional material. To create a model for destructive testing to test for design faults.

(ii) structural engineer 2

to perform FEA on the model to test the strength of the build. To perform CFD on the model to monitor airflow around the structure.

(iii) construction trades 2

To asses the materials required by different professionals for the construction. To view how the structure will look when fully assembled to aid in the assembly

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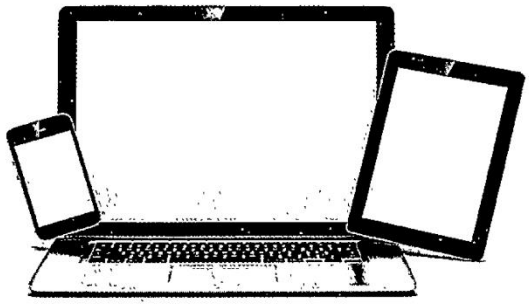
5. Advances in technology have changed the way in which we access information.



(a) Describe three ways an advertiser can use digital media to appeal to the consumer. 3

Internet adverts are always a way to catch someones eye, particularly pop-up adverts.

Using digital media gives the company being advertised a more "green" or eco-friendly look in the public image.

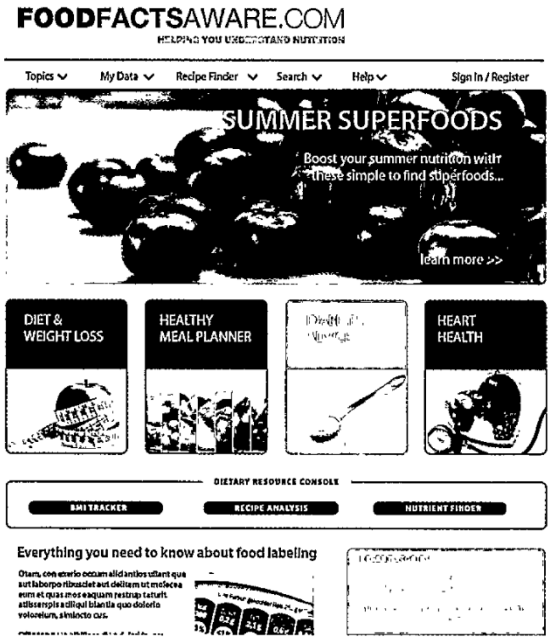
There is a far larger audience online, providing a far larger viewership for advertising.

Digital media is far more accessible for people to use.

5. (continued)

MARKS | DO NOT WRITE IN THIS MARGIN

A website called "foodfactsaware.com" helps consumers understand more about information displayed on food packaging. The web page shown in the image below features drop down menus allowing consumers to access additional content. This takes the form of video interviews with professionals, printable fact sheets on nutrition and annotated photographs explaining food labelling.



(b) Explain how the web designer has made the website shown above informative and easy to use, with reference to the following.

(i) Web page layout 3

Clear, simple sections to allow easy navigation. ~~Contrasting colours for each section to help distinguish them.~~ Easy, collected dietary resource console to keep similar information together. Large image and heading at the top to bring in the eye then allowing it to flow down the page.

5. (b) (continued)

MARKS | DO NOT WRITE IN THIS MARGIN

(ii) User interface 3

Easy and compact drop down menus are very simple and take up less space. Colour separated sections to help distinguish this. "Learn more" is in the same colour and font as the sub-heading, allowing it to be more easily connected/ recognised and used.

(iii) Graphic media file formats 3

Videos are very useful and dynamic for educating people.
Fact sheets are a printable, interactive way for users to learn from the website.
Annotated photos are simple and easy to use, and a very visual education method.

[END OF QUESTION PAPER]

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