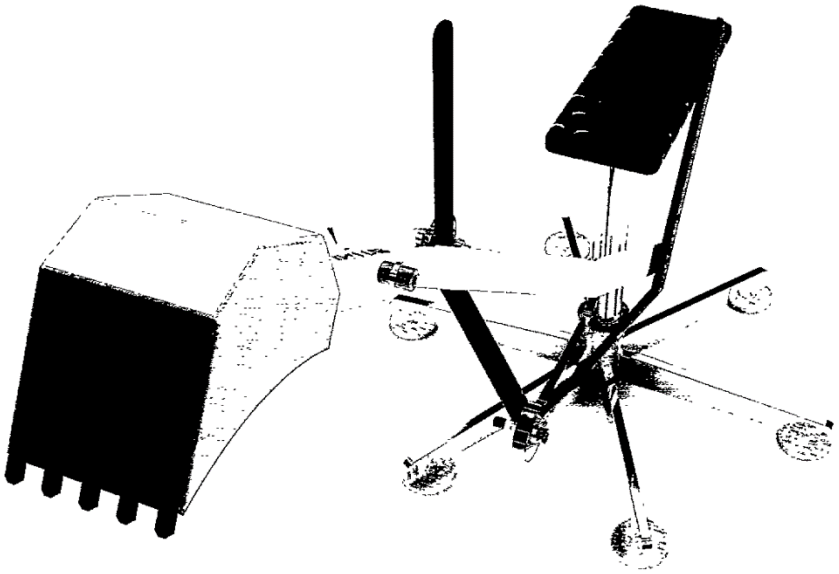
Total marks — 80

Attempt ALL questions

DO NOT WRITE IN THIS MARGIN

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.**

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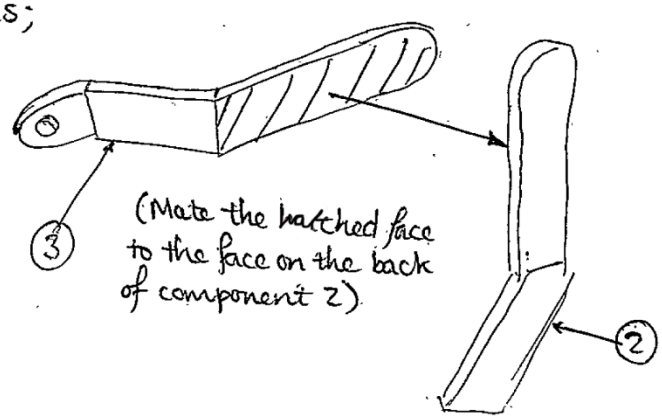
1. **(continued)**

MARKS | DO NOT WRITE IN THIS MARGIN

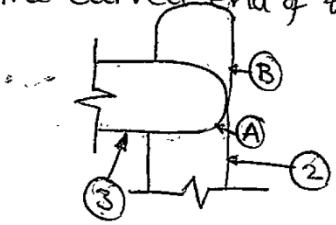
(a) Describe the 3D CAD constraints used to assemble the lever bend to the lever extension. You may use sketches to support your answer. 4

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

- Use a mate constraint to join the following faces;

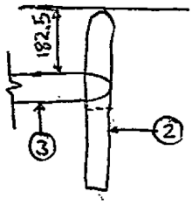


- Use a tangent constraint so that the straight edge of the 'lever bend' is tangent to the curved end of the 'lever extension'



~~(The curve A is~~
(The edge B is tangent to curve A)

- Generate a plane at the top of the lever bend oriented as shown below and mate the upper edge to the bottom of this plane offset downwards by 182.5mm. The plane should be parallel to the top face of the 'lever extension'.



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MARKS | DO NOT WRITE IN THIS MARGIN

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 Auxilluary View conveys the true shape of features so that the manufacturer can determine the actual shape of a component with bends where orthographic projections do not show this 1

(ii) View B Sectional View shows the manufacturer the thickness of the material used. 1

(iii) Dimension C Angle with Symetric Tollerance shows the manufacturer the angle which is to be achieved between the two edges and how accurately the angle must be achieved, in this case it must be within 2° of 150°. It shows the manufacturer the level of accuracy required so should advise them as to which methods of manufacture to use. 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 Native AutoDesk filetype for technical drawings, contains dimensional drawings. The dimensions could be edited to redesign seat. Provides the projection of the original design. 1

(ii) .STL Contains information about the triangulated faces of the model. Morphing the 3D design in this file could help edit the seat. Can be used to get a 3D model of the original design like a mesh. 1

(iii) .3DS Contains a 3D representation of the original design. Could be used to assess shortfalls of the original design to help plan improvements. 1

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1. (continued)

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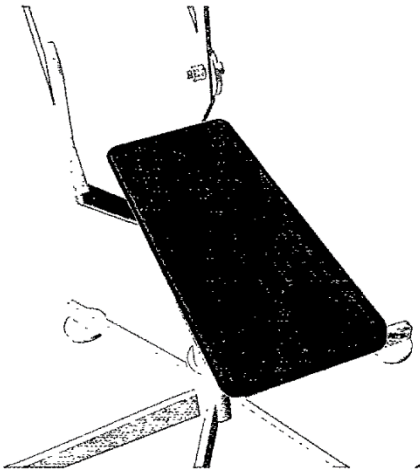
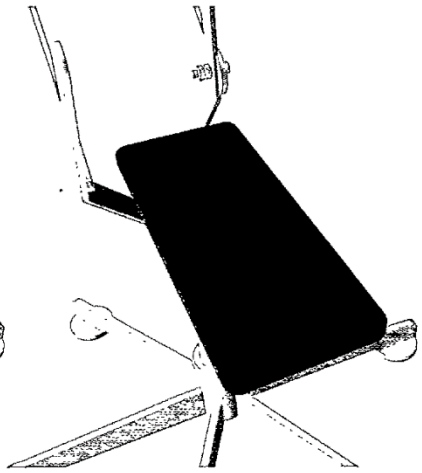
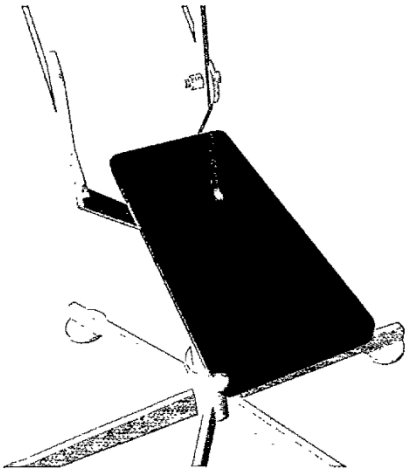
(d) A CAD illustration of the seat detail is produced. The stages of creating this detail are shown below. Stage 4 shows the final illustration.



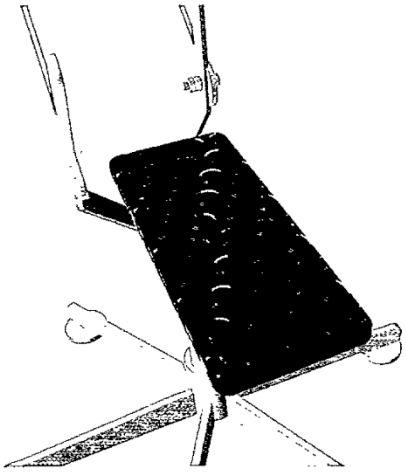
Stage 1



Stage 2



Stage 3



Stage 4

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1. (d) (continued) MARKS DO NOT WRITE IN THIS MARGIN

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 has been used to replace the wooden texture with a solid red texture (like wrapping red wallpaper round the object)

(ii) Stage 2 to Stage 3 1

Specularity has been added to the seat so that it shows reflections (high specularity, clearer reflections)

(iii) Stage 3 to Stage 4 1

Bump mapping has been used to create the impression of surface which is not perfectly flat, this is done using mathematical algorithms to adjust the lighting on each pixel creating the effect of an uneven surface without increasing polygon count.

[Turn over

X7357701 07

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

.wmv

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

~~.pdf~~ .ai (Adobe Illustrator)

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

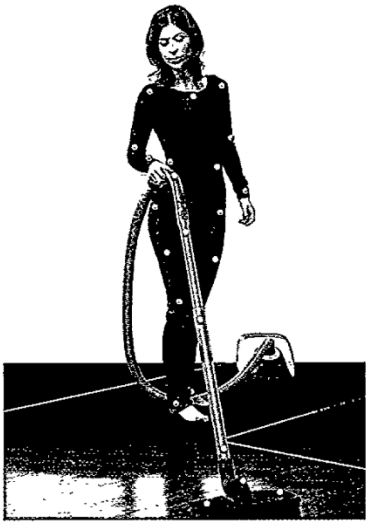
Explain what would need to be considered by the designer prior to the poster being sent to the print technician. 3

They need to consider weather it is camera ready. To ensure edge to edge & printing anything that is to reach the edge of the page should bleed over by 3mm. All fonts should be provided to the printer or converted into vector images if they are used. All images should either be vector images or if they are raster be 300dpi (dots per inch) or more. Crop marks should be on the page so the print technician knows where to trim post-print as should registration marks to allign the plates of the printer.

MARKS | DO NOT WRITE IN THIS MARGIN

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

It can very accurately track the movement of a person or object. It can be used to apply a texture over a person (texture mapping) as is done in the video games industry allowing the appearance of the person or product to be later edited for promotional use. It helps show how the person and the product interact so can help analyse the ergonomics of the product informing design alterations.

This data can be saved and later analysed.

MARKS | DO NOT WRITE IN THIS MARGIN

2. (a) (continued)

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

It requires very expensive equipment and software so is propably not the most cost effective option. It requires the physical product to be produced whereas computerised testing does not. Not all people interact with the product the same way (for example, different sized hands), this means lots of different people would have to be brought in to test it thouroughly.

[Turn over

2. (continued)

MARKS | DO NOT WRITE IN THIS MARGIN

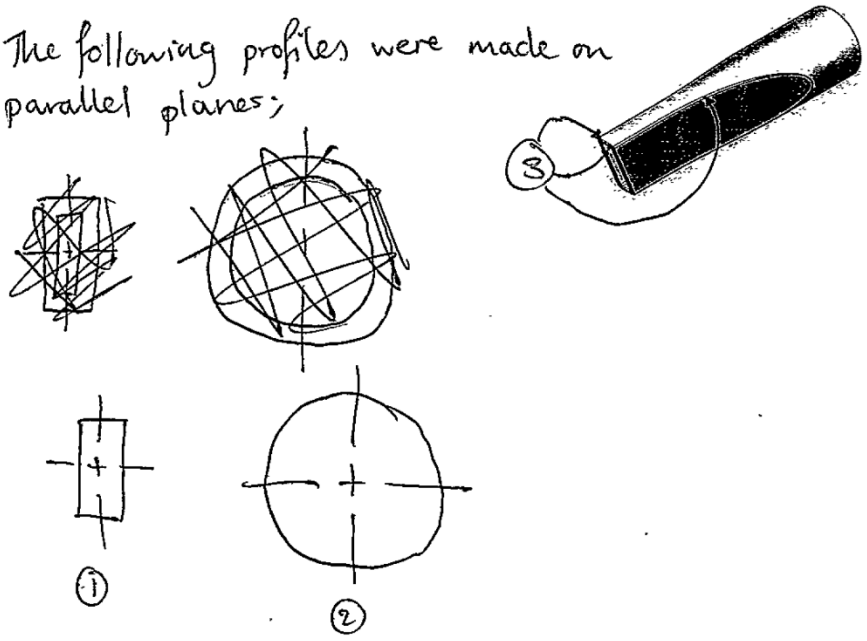
(b) After testing, the manufacturer wants to design a new nozzle. Two designs are being considered.

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.

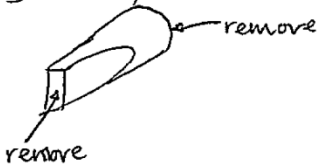
(i) Nozzle 1 5

The following profiles were made on parallel planes;



Loft was used to join them.

The design was then shelled using the shell command removing the flat faces at either end:



Fillets were then applied the the edges shown in ③.

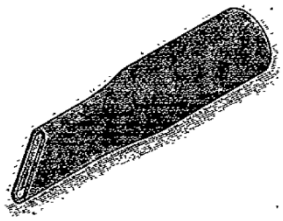
A chamfer was applied to the front to get the angular finish on front of nozzle.

Azeta

2. (b) (continued)

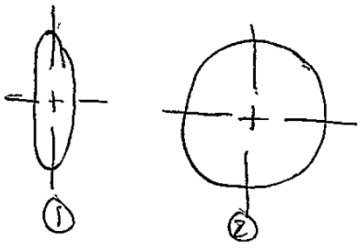
MARKS | DO NOT WRITE IN THIS MARGIN

(ii) Nozzle 2 4



~~Create 2 planes~~

Create 2 planes (parallel)
Sketch the following on each plane respectively.



Loft them together then apply an extrusion to each flat faced end of the model. Then shell the model removing the two flat faces.
Use a chamfer to get the angle on the front of the nozzle.

~~Use fillets or morphing~~

Use morphing to achieve the smooth finish removing all harsh edges on the body of the ~~m~~ nozzle.
Fillet the ~~inside~~ edges of the front of the nozzle.

[Turn over

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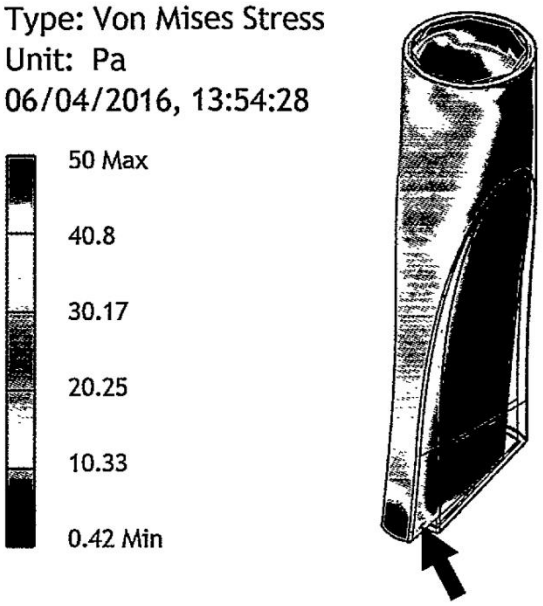
2. (continued)

MARKS | DO NOT WRITE IN THIS MARGIN

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.



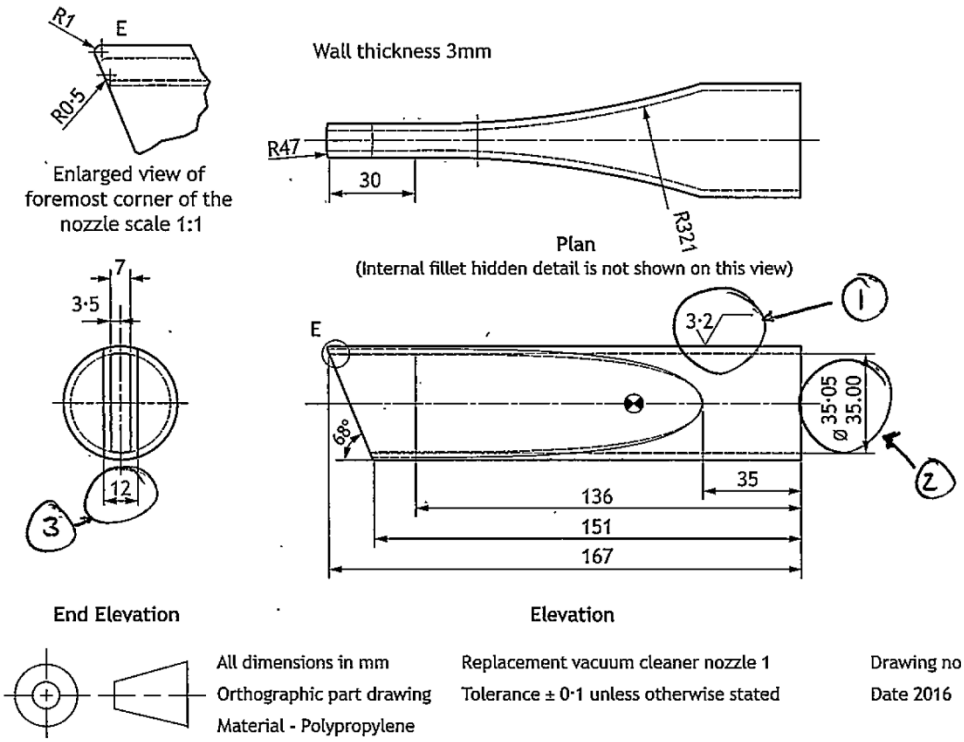
(c) Describe four set-up requirements that are necessary **before** the FEA simulation test can begin. 4

The model must be produced and all materials used must be defined. The software must be told what it mapping (i.e. displacement, Von Mises Stress etc.). A force or pressure must be selected and applied to an area of the design.

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

(1) Information about the texture of the suface given by (3.2√) shows the finish that is required to be applied to the face.

(2) Functional tollerence shows the degree of accuracy required at parts of the design would result in a more accurate machine being used in the CAD CAM process.

(3) Dimensions allow the machines that are producing the component the sizes they must adhere to so the product is the right scale & functions as intended.

X7357701154

MARKS | DO NOT WRITE IN THIS MARGIN

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 has been achieved by repeating the colour red throughout the page, helps create brand identity + guides eye through page.

2 Line has been used to act as a visual bridge between the headline + body text below it to guide the eye down the page from headline to body text.

3 Repetition has been used (the shape of the 'learn more' boxes is repeated) this unifys the page and helps the user identify the buttons on the page they can interact with.

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

4 White space has been used at the top of the page to direct the eye down the page to the focal point – the large image + headline. It also prevents a cluttered design and makes it easier to read.

(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

Their website will be shown on monitors using RGB colourspace which may not exactly match the colours on the ~~card~~ product packaging (i.e. red on website may not match red on biscuit package) as printing ~~used~~ uses CYMK colourspace. Different printing techniques may be needed to print on cardboard for biscuit package than plastic for cereal bars (i.e. offset lithography for cardbord + flexography for plastic.). The description of the biscuits on the packaging should match their description on the website to avoid false advertising. Pantone matching system should be used to get an exact colour match for the red on the biscuit, cereal bar & yogurt containers.

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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

The filetype should be appropriate for commercial printing (i.e pdf). To ensure edge to edge printing there should be a 3mm bleed off the edge of the area. Crop marks should be applied so the printers know where to trim the paper post-print. Registration marks should be shown to allign the plates of the printer. All fonts should be provided to the printer or converted to vector images. All images should be vector or if raster should be at least 300dpi (dots per inch).

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

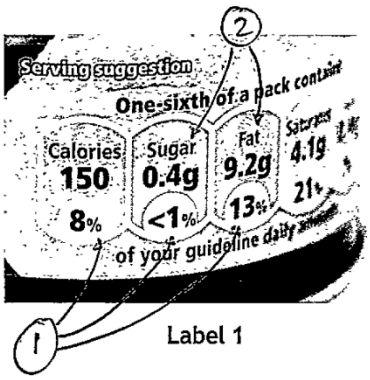
~~Offset Lithography~~ Offset Lithography

3. (continued)

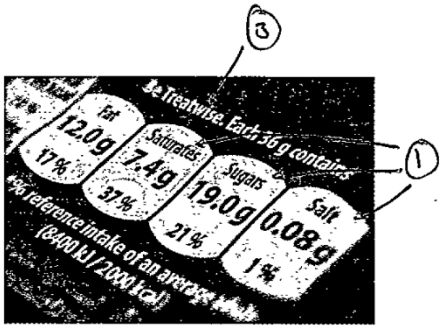
MARKS | DO NOT WRITE IN THIS MARGIN

(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

(1) Repetition has been used in both labels 1 & 2, the shape containing each value is the same in their respective designs so readers understand it is related. Label 1 uses colour to (2) draw the readers attention to the nutritional information, It helps the text stand out as the background behind it is consistant. Could be a colour coding system so the reader can quickly identify if the food is healthy (i.e. red is bad, green is good). ~~Label Design 2 used~~

(3) Label 2 uses reverse to that the nutritional data stands out and is able to be quickly read against the ~~dark~~ dark background without straining the eyes.

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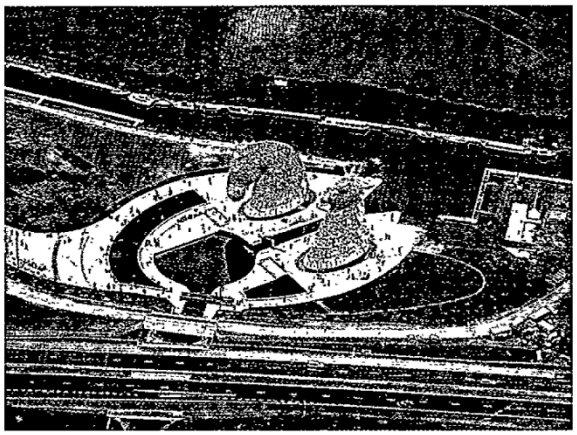
MARKS | DO NOT WRITE IN THIS MARGIN

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 Topographical Survey

Purpose Shows contours and drainage to help plan to prevent flooding or water build up. Identifies existing features which may need to be removed or worked around during construction. Shows the area of land that the construction must be within. Shows existing ~~reds~~ roads so that the park can be built in an accessible location.

4. (continued)

MARKS | DO NOT WRITE IN THIS MARGIN

(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

They could use 3D printing technologies to produce a physical model which could be tested to identify weaknesses and shortcomings of the design. They could use the physical model to see how the material affected the durability of the design.

Could ajust the model (using morphing) to make it look better or do adjustments on the advice of the other proffessionals present.

(ii) structural engineer 2

They could use FEA (finite element analysis) to see how the 3D model would react to different forces that would act on it when constructed (i.e. high winds). They could use the model to identify which materials would be suitable to support the design.

Could consider the aerodynamic and how wind would affect the model using CFD (computational fluid dynamics)

(iii) construction trades 2

They could use the model to work out how it would be built from the ground up like where they would need scafolding and which parts would need assembled on-site. Would let them see how different parts of the design fit together and how they would attach them during construction.

MARKS | DO NOT WRITE IN THIS MARGIN

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

- Producing a website can draw in people searching the internet (reaching a different audience to paper media/old media), a website is accesible 24/7 making it easier for consumers to view and learn about a product.
- Interactive screens can be used to engage the consumer as it creates a more hands on feel allowing the consumer to decide how they explore the product; this makes the product more appealing.
- They could use videos (.wav) or 3D virtual reality experiences (VRML) to show off the product. A video can convey a lot of information very fast compared to text and is generally more interesting. Using VR allows the viewer to interact with the product ~~an~~ in a virtual world creating excitement about the product. High quality graphic communications will create a good impression with the audience.

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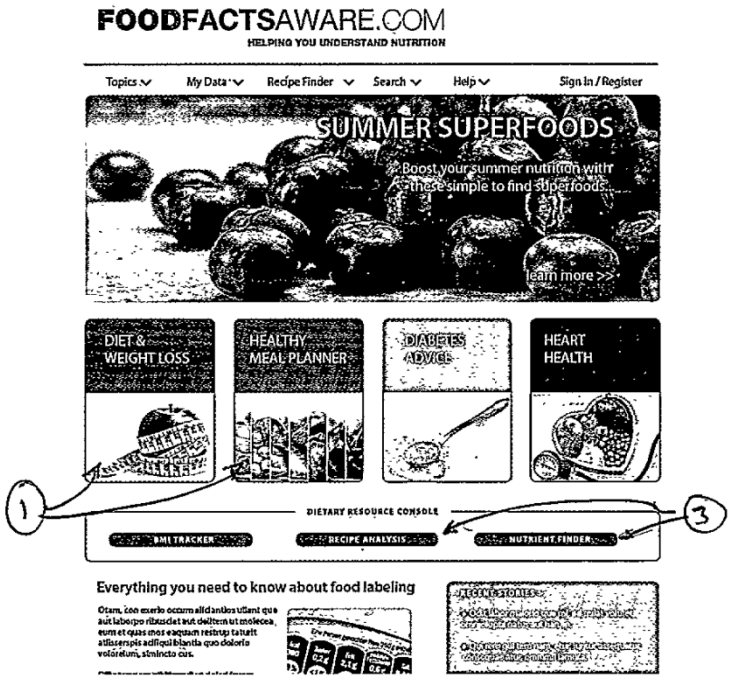
5. (continued)

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

White space has been used to make the layout clear, uncluttered and easy to use. ~~By using harmonising colours the page~~ The page's symetric ballance draws the eye down the centre of the page enabling them to see almost all the information. The use of large images helps break up the text and conveys the theme visually.

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5. (b) (continued) MARKS | DO NOT WRITE IN THIS MARGIN

(ii) User interface 3

Large buttons with images (ie. 'Diet & Weight loss') draw the reader to them. The use of different colours for them makes it clear they can be clicked/interacted with. The arrows indicate the drop down menus so it is clear that they can be selected. The use of the same repeated shape for buttons ③ on the 'dietary food console' help to convey they can be selected and are seperated by white space so the reader knows they're distinct. This all makes it easy to use.

(iii) Graphic media file formats 3

Lots of images are on the page, they are large and clear so likely vector images with a .ai (Adobe Illustrator) filetype (or similar). The interviews with proffessionals will be videos most likely so ~~.wav files can~~ .wmv files can be used to convey the information. The annotated photographs could be .png as this (portable network graphic) is a widely accessible filetype requiring little software to open. Printable fact sheets may be .pdf as this is a universally recognised easy to open filetype.

[END OF QUESTION PAPER]