Diploma Programme
Programme du diplôme
Programa del Diploma

Design technology
Standard level
Paper 2

Friday 13 November 2015 (afternoon)

Candidate session number

1 hour

Instructions to candidates

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: answer all questions.
- Section B: answer one question.
- Write your answers in the boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is **[40 marks]**.

8815–6205

18 pages

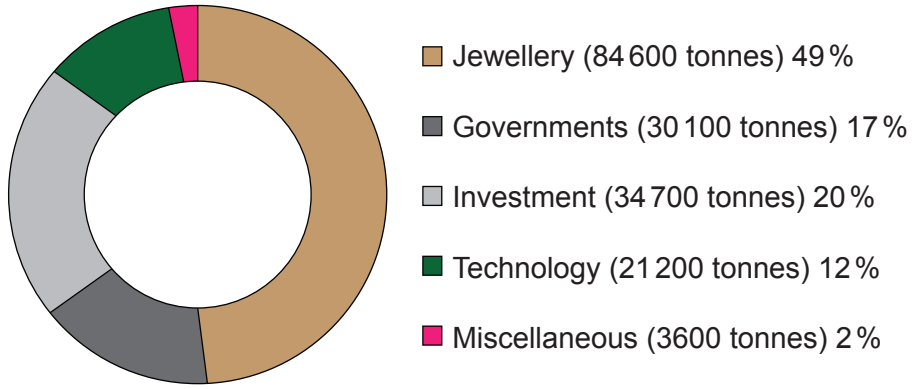
Section A

Answer **all** questions. Write your answers in the boxes provided.

1. Gold has been a valuable global material for thousands of years. Gold jewellery accounts for the majority of demand for the raw material, but gold is also attractive to investors and is increasingly being used in the electronics industry due to a purity value of 99.999 % and the ability to be drawn into a wire 10 μm (10 micron) in diameter. Gold is used to connect semi-conductors and electronic circuits. Gold is also used for coating plastic touchscreens of mobile phones which makes the phones lighter and more flexible than traditional glass screen phones. **Figure 1** is a chart showing the main uses of gold in 2012. **Figures 2** and **3** are charts relating to the demand for, and supply of, gold in 2012.

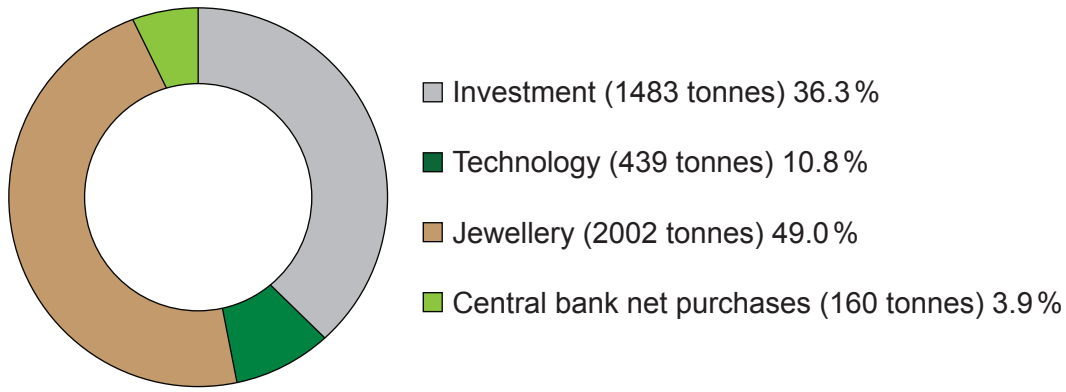
[Source: Adapted from *Royal Society of Chemistry: Resources That Don't Cost The Earth*, Sunday Telegraph Business Reporter Section (2012)]

Figure 1: Uses of gold (2012)



[Source: Statistics sourced from the World Gold Council]

Figure 2: Demand for gold (2012)



[Source: Statistics sourced from the World Gold Council]

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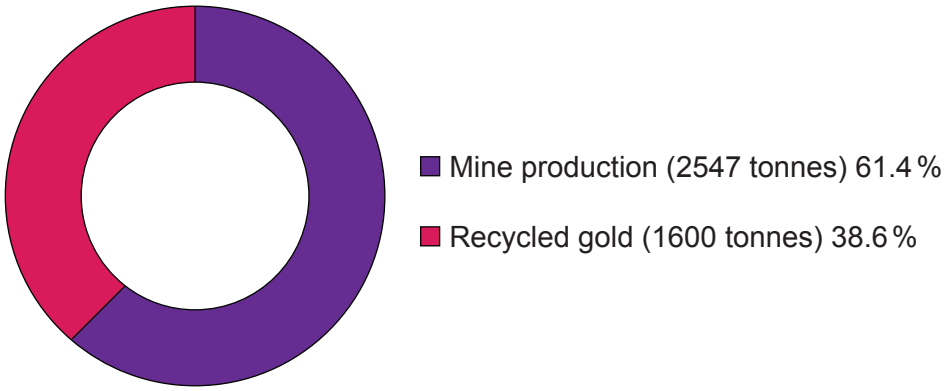
(Question 1 continued)

Figure 3: Supply of gold (2012)



[Source: Statistics sourced from the World Gold Council]

(a) (i) State the property important to create gold wire. [1]

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(ii) State the property important for the use of gold wire in electronic circuits. [1]

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(iii) Outline **one** benefit of the high purity of gold for electronic circuits. [2]

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(Question 1 continued)

(b) (i) Outline which aspect of demand for gold is likely to increase at a fast, consistent rate during the next ten years. [2]

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(ii) Outline **one** reason why gold used for jewellery may not be recycled even though the jewellery becomes unfashionable. [2]

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(c) (i) State **one** advantage of touchscreens for mobile (cell) phones being more flexible than glass. [1]

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(Question 1 continued)

(ii) Explain why increasing the amount of gold that is recycled from technology may be difficult. [3]

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2. (a) State why timber is a natural composite material. [1]

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(b) Compare the use of pine wood with mahogany as materials for flooring in relation to safety for users. [3]

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3. (a) State what is meant by "pseudo-elasticity" with reference to shape memory alloys (SMAs). [1]

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(b) Explain why composite materials are usually difficult to recycle. [3]

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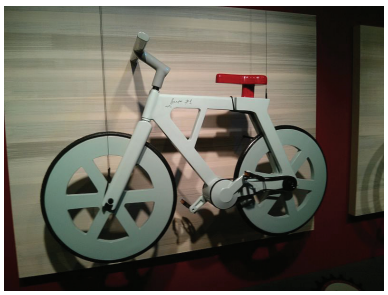
Section B

Answer **one** question. Write your answers in the boxes provided.

4. **Figure 4** shows the cardboard bicycle designed by Izhar Gafni an Israeli inventor and cycling enthusiast. He was inspired to design the bicycle when he learnt that another inventor had managed to design a canoe from cardboard. The cardboard for the bicycle has a special coating manufactured from organic materials which renders the material waterproof and fireproof. All components of the bicycle are made from recyclable materials and there are no metal parts. The bicycle only has a single gear. The bicycle can be manufactured for approximately £10 ($15) and sponsorship has been gained so it can be given away free to people in developing countries. Different sizes of the bicycle will be available and there are plans to use a similar technique to design a cardboard wheelchair.

Figure 4: Cardboard bicycle



[Source: https://upload.wikimedia.org/wikipedia/commons/thumb/9/98/Cardboard_Technologies_cardboard_bicycle.jpg/800px-Cardboard_Technologies_cardboard_bicycle.jpg by Marcus Qwertyus]

(a) (i) State the physical property of cardboard which makes it appropriate to use for the bicycle in **Figure 4**. [1]

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(ii) Outline **one** limitation of the surface finish of the cardboard bicycle in relation to life cycle. [2]

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(Question 4 continued)

(iii) Outline **one** limitation of the use of the cardboard bicycle by people in developing countries who need it as a main form of personal transport. [2]

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(b) (i) State the ideas generating technique which acted as a stimulus for the design of the cardboard bicycle. [1]

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(ii) Discuss the design of the cardboard bicycle in relation to safety. [3]

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(Question 4 continued)

(c) (i) Outline the scale of production for the cardboard bicycle. [2]

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(ii) Discuss the ergonomics of the cardboard bicycle in relation to physiological factors, psychological factors (perception) and anthropometrics. [9]

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5. **Figure 5** shows the Spoutnik microwave oven manufactured by Fagor (Spain). The oven is named after the Sputnik satellite which was the first satellite launched into the Earth's orbit. A feature of the Spoutnik oven is the shape which creates more space for cooking large food products such as whole chickens and the user has the benefit of a 360˚ view of food being cooked.

Figure 5: Spoutnik microwave oven

[Source: Spoutnik microwave manufactured by Fagor]

(a) (i) State the ideas generating technique which acted as the stimulus for the design of the microwave oven in **Figure 5**. [1]

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(ii) Outline why it is unlikely that most users would benefit from the 360˚ view of food being cooked. [2]

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(Question 5 continued)

(iii) Outline how the Fagor company might meet energy labelling requirements for the Spoutnik oven in a global marketplace where the requirements vary depending on the geographical location. [2]

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(b) (i) State the product life cycle stage for microwave ovens. [1]

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(ii) Explain **one** limitation of the design of the microwave oven in **Figure 5** for integrating it into a contemporary kitchen layout. [3]

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(Question 5 continued)

(c) (i) Outline the physical property important for the choice of a suitable material to ensure the safety of the body of the microwave oven in **Figure 5**. [2]

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(ii) Explain how the design team might use the strategies of user trial, user research and performance test as part of the research and development phase for the Spoutnik microwave oven. [9]

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6. **Figures 6** and **7** show the Teanest compact table and chairs set by designer Jody Leach. The two chairs tuck neatly under the table (**Figure 7**). The furniture is manufactured from composite timber (plywood) and is designed to be self-assembled (flat-pack). It is available in white, black or red with a protective finish (varnish).

Figure 6: Teanest table and chairs

Figure 7: Teanest table and chairs (compact)

[Source: www.jodyleach.com. Used with permission.]

(a) (i) State the manufacturing technique used to join together the components of the table and chair set. [1]

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(ii) Outline the design for manufacture (DfM) strategy which has been a dominating constraint on the design brief for the table and chairs. [2]

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(Question 6 continued)

(iii) Outline how mass customization could improve the appeal of the table and chairs for consumers. [2]

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(b) (i) State the most appropriate type of drawing to use with instructions to show consumers how to self-assemble the table and chairs. [1]

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(ii) Discuss the design of the table and chairs in relation to planned obsolescence. [3]

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(Question 6 continued)

(c) (i) Outline the impact of research and development (R&D) costs on the final cost of the table and chairs. [2]

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(ii) Discuss **three** considerations for the design of the table and chairs in relation to cost-effective manufacturing. [9]

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