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DESIGN TECHNOLOGY
STANDARD LEVEL
PAPER 3

Wednesday 12 November 2008 (morning)

1 hour

Candidate session number

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INSTRUCTIONS TO CANDIDATES

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all of the questions from two of the Options in the spaces provided. You may continue your answers on answer sheets. Write your session number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.
- At the end of the examination, indicate the letters of the Options answered in the candidate box on your cover sheet and indicate the number of answer sheets used in the appropriate box on your cover sheet.

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Option A — Raw material to final product

A1. The Maglev train (**Figure A1**) is a levitating train that hovers and is/or propelled by electromagnets that are superconductors. The success of the train is due to the superconductors that levitate and propel the train. **Figure A2** shows the interior of one passenger carriage including the nylon seats, laminated windows and the painted mild steel body.

Figure A1: Maglev train

Figure A2: Interior of one passenger carriage

[Source: http://www.rtri.or.jp/]

(a) State **one** characteristic of the glass used in the train passenger carriage windows. *[1]*

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(b) Outline **one** reason relating to the ease of maintenance for the use of nylon in the seat covers for the passenger train. *[2]*

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(c) Explain the structure of laminated glass for use in the train's passenger carriage windows. *[3]*

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A2. (a) State **one** reason why wrought iron led to an engineering expansion. *[1]*

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(b) Describe why the mild steel body of the Maglev train needs to be treated. *[2]*

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A3. Discuss **two** benefits of using superconductors for the operation of levitating trains. *[6]*

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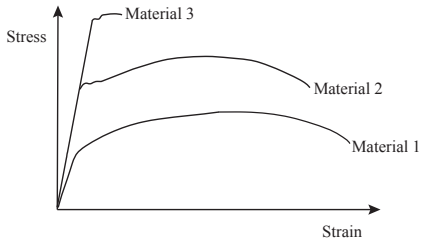
Option B — Microstructures and macrostructures

B1. **Figure B1** shows a stress-strain graph for a number of different materials. Such graphs can inform manufacturing decisions. Serving trays are found in many school cafeterias. They are often made of thermoset plastics (see **Figure B2**) or by deformation of metal alloys (see **Figure B3**).

Figure B1: Stress-strain graph



[Source: www.thefabricator.com/]

Figure B2: Serving tray made of thermoset plastic

[Source: www.adelphi.uk.com]

Figure B3: Serving tray made by deformation of metal alloys

[Source: www.adelphi.uk.com]

(a) State **one** characteristic of a material used for the production of the serving trays for use in the school cafeterias. *[1]*

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(b) Outline **one** reason why a thermoset plastic and not a thermoplastic is used for the production of the serving tray. *[2]*

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(c) Explain how the molecular structure of a thermoset plastic contributes to problems in relation to recycling of the material on disposal. *[3]*

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B2. (a) Define *alloy*. *[1]*

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(b) Describe the effect of alloying on the ductility of a metal alloy. *[2]*

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B3. Explain the significance of both the elastic region and the plastic flow region in the plastic deformation of the material used for the manufacture of the serving trays. *[6]*

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Option C — Appropriate technologies

C1. Smokestack industries, as shown in **Figure C1**, are heavy industries that produce a lot of pollution that is emitted through large "smokestacks". Iron and steel production plants, are examples of energy intensive, heavily polluting industries which use coal in the manufacturing process.

Figure C1: Smokestack industrial production

[Source: www.superstock.com]

(a) Define *non-renewable resources*. *[1]*

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(b) Outline **one** reason why iron and steel production continue to use non-renewable resources. *[2]*

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(c) Explain **one** difficulty of governments legislating to enforce the use of renewable energies instead of coal. *[3]*

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C2. (a) Define *sustainable development*. *[1]*

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(b) Identify **one** aspect of market pull that has encouraged heavy industry to address sustainability issues. *[2]*

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C3. Discuss **two** characteristics that would make smokestack industries an appropriate choice of technology in a country. *[6]*

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Option D — Food technology

D1. Jerky is a meat (beef, poultry, fish or game) product that is nutrient rich, convenient and has an extended shelf life (**Figure D1**). It is produced by, thinly cutting the meat, salting, and then smoking and/or drying it. It is often stored in a re-sealable plastic bag (**Figure D2**) that has a food label.

Figure D1: Jerky meat

[Source: www.askthemeatman.com]

Figure D2: Re-sealable plastic bag

[Source: Pacific Gold (Oberto Sausage Company)]

(a) State **one** organoleptic property that will be affected in the production of Jerky from fresh meat. *[1]*

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(b) Outline **one** reason why the high salt content of Jerky might discourage its consumption. *[2]*

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(c) Explain how dehydration extends the shelf life of meat. *[3]*

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D2. (a) Define *food spoilage*. *[1]*

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(b) Outline **one** lifestyle factor that led to the development of dried foods such as Jerky. *[2]*

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D3. Explain **two** benefits to the consumer of the Jerky packaging. *[6]*

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Option E — Computer-aided design, manufacture and production

E1. **Figure E1** shows a CAD system often used in the textile industry. **Figure E2** is a scarf, which is an example of an artefact that can be made with CAD/CAM.

Figure E1: CAD system

[www.marcomstech.com]

Figure E2: Scarf

[Source: www.chinawholesalegift.com]

(a) State **one** advantage of using a CAD software package in the design of the scarf. *[1]*

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(b) Describe how CAD can be integrated with CAM to produce a scarf. *[2]*

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(c) Explain **one** way CAD/CAM impacts on consumer choice of scarves. *[3]*

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E2. (a) Define *mass customization*. *[1]*

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(b) Outline **one** advantage of mass customization for the manufacturer. *[2]*

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E3. Evaluate **two** issues facing a textile company that wishes to upgrade from a mechanized system to a fully integrated CAD/CAM system. *[6]*

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Option F — Invention, innovation and design

F1. Thomas Edison, who invented the incandescent light bulb (**Figure F1**) is considered to be an example of an "Inventor – Entrepreneur". Since his initial design the light bulb has been redesigned many times. The halogen lamp in **Figure F2** is an example of a redesign.

Figure F1: Incandescent light bulb

[Source: www.globalwarmingart.com]

Figure F2: Halogen lamp

[Source: www.pegasusassociates.com]

(a) Define *invention.* *[1]*

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(b) List **two** reasons why Edison's lamp was a dominant design. *[2]*

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(c) Explain **one** reason why Thomas Edison is considered an inventor – entrepreneur. *[3]*

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F2. (a) Define *market pull*. *[1]*

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(b) Describe **one** change that could be made to the design specification of the light bulb in Figure F1 to make it more environmentally friendly. *[2]*

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F3. Explain how the characteristics of technophobes and technophiles affect their adoption of new technologies. *[6]*

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Option G — Health by design

G1. The motor vehicle has become an integral part of many people's lifestyles as they have come to rely on it for a range of work and recreational activities. As a result, it has had a significant effect on society and the environment. **Figure G1** shows car congestion.

Figure G1: Car congestion

[Source: www.thepanamanews.com]

(a) State **one** pollutant present in car exhaust. *[1]*

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(b) Outline the function of a catalytic converter that is used in cars. *[2]*

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(c) Explain the role of legislation in encouraging motor vehicle research and development. *[3]*

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G2. (a) Define *user-centred design*. *[1]*

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(b) Outline **one** advantage of using elastomers in tissue implants. *[2]*

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G3. Discuss the concepts of reuse and repair in relation to hearing aids. *[6]*

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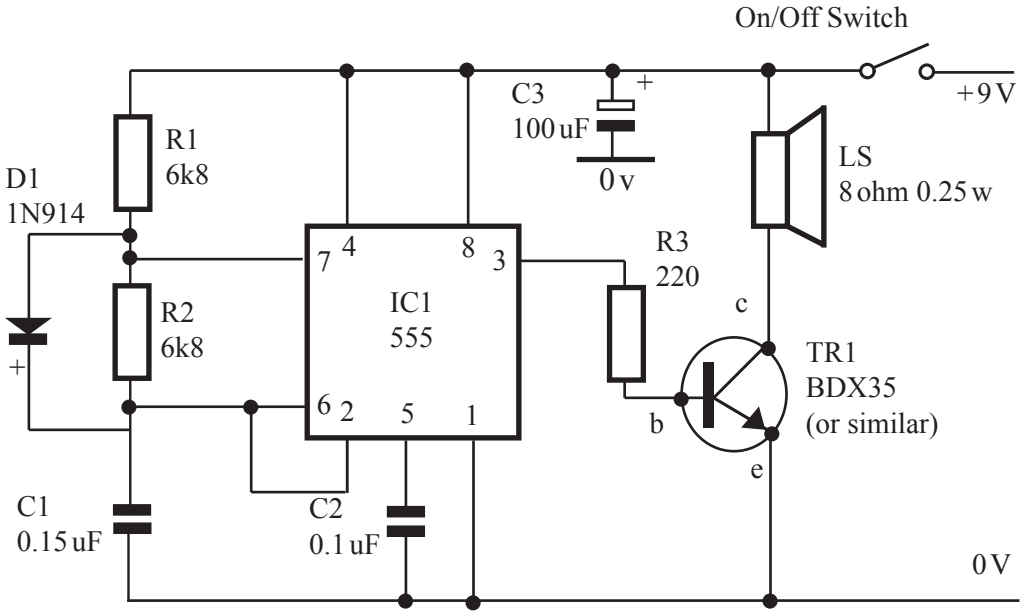
Option H —Electronic products

H1. **Figure H1** is a circuit diagram of an alarm.

Figure H1: Circuit diagram of an alarm



(a) State the voltage of the power source for the diagram in Figure H1. *[1]*

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(b) Describe the function of the resistor at R3 in the diagram in Figure H1. *[2]*

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(c) Explain how the circuit operates to trigger the alarm. *[3]*

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H2. (a) State the component that would be used to provide feedback in a temperature sensing circuit. *[1]*

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(b) Outline **one** major difference between an open-loop and closed-loop circuit. *[2]*

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H3. Discuss **two** impacts of the miniaturization of electronic circuits for the design of computers. *[6]*

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