Design and Technology: Electronic Products
Unit 2: Knowledge and Understanding of Electronic Products

Friday 23 May 2014 – Afternoon
Time: 1 hour 30 minutes

Instructions
- Use black ink or ball-point pen.
- If pencil is used for diagrams/sketches it must be dark (HB or B). Coloured pens, pencils and highlighter pens must not be used.
- Fill in the boxes at the top of this page with your name, centre number and candidate number.
- Answer all questions.
- Answer the questions in the spaces provided – there may be more space than you need.

Information
- The total mark for this paper is 80.
- The marks for each question are shown in brackets – use this as a guide as to how much time to spend on each question.
- Questions labelled with an asterisk (*) are ones where the quality of your written communication will be assessed – you should take particular care on these questions with your spelling, punctuation and grammar, as well as the clarity of expression.
- You may use a calculator.

Advice
- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.
Answer ALL the questions.

For each question 1 to 10, choose an answer A, B, C or D. Put a cross in the box indicating the answer you have chosen. If you change your mind about an answer, put a line through the box and then mark your new answer with a cross.

1. The letters PCB stand for:
   - [ ] A primary circuit breaker
   - [ ] B printed circuit board
   - [ ] C prototyping copper block
   - [ ] D positive conducting bars

   (Total for Question 1 = 1 mark)

2. Which of the following metals is attracted to a magnet?
   - [ ] A aluminium
   - [ ] B brass
   - [ ] C copper
   - [ ] D mild steel

   (Total for Question 2 = 1 mark)

3. Resistors are used to:
   - [ ] A store current
   - [ ] B amplify current
   - [ ] C measure current
   - [ ] D restrict current

   (Total for Question 3 = 1 mark)

4. The legs of a transistor are called base, collector and:
   - [ ] A emitter
   - [ ] B anode
   - [ ] C cathode
   - [ ] D radiator

   (Total for Question 4 = 1 mark)
5  Identify the circuit symbol below.

☐ A  timer
☐ B  operational amplifier
☐ C  logic gate
☐ D  transistor

(Total for Question 5 = 1 mark)

6  Name the component shown in this picture.

☐ A  reed switch
☐ B  slide switch
☐ C  micro switch
☐ D  tilt switch

(Source: © Digi-key corporation)

(Total for Question 6 = 1 mark)
7 Which one of the following would be used to measure a battery to see if it is fully charged?

- A ammeter
- B voltmeter
- C capacitance meter
- D ohmmeter

(Total for Question 7 = 1 mark)

8 Which one of the following flowchart symbols is used to show a decision?

- A
- B
- C
- D

(Total for Question 8 = 1 mark)
9 Identify pin 1 of this 555 timer.

- A Ground
- B Vcc
- C Reset
- D Control voltage

(Total for Question 9 = 1 mark)

10 Which one of the following logic gates gives the truth table shown below?

<table>
<thead>
<tr>
<th>Input 1</th>
<th>Input 2</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

- A AND
- B OR
- C NAND
- D NOR

(Total for Question 10 = 1 mark)
The table below shows some equipment and components.

Complete the table below by giving the missing names and uses.

<table>
<thead>
<tr>
<th>Equipment/Component</th>
<th>Name</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable resistor</td>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>Piezo-electric sensor</td>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td></td>
<td>For sensing light levels</td>
<td>(1)</td>
</tr>
<tr>
<td></td>
<td>To measure current</td>
<td>(1)</td>
</tr>
</tbody>
</table>
The circuit diagram below shows a simple shed door alarm.

(b) Name components A and B.

A .................................................................
B .................................................................

(c) Name the type of switch used in this circuit as \( S_1 \) and \( S_2 \).

(d) State how the buzzer behaves when switch \( S_1 \) is pressed and then released.

(i) When it is pressed

(ii) When it is released

(e) Explain the function of \( S_2 \) in the circuit.
(f) Explain two advantages of using a buzzer rather than a loudspeaker. (4)

Advantage 1

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Advantage 2

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(g) The circuit designer wishes to change the circuit in order to reduce its environmental impact.

Name a power supply that would be more environmentally friendly than disposable batteries and give a reason for your choice. (2)

Name

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Reason

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(h) The case of the alarm will be injection moulded.

Explain why this is a suitable manufacturing process for the case. (2)

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(Total for Question 11 = 19 marks)
Many parents are concerned about how much time their children spend playing computer games. You have been asked to design a one-off prototype for a computer game timer that will tell a child when to stop playing.

Design the **casing only**. Do **not** design any circuits.

The specification for the computer game timer is that it must:

- have a computer theme
- be adjustable for different time periods
- have a warning method when time is up
- have a suitable power supply
- be able to be attached to and removed from the computer
- have a method of accessing the circuit for maintenance
- be made of a material suitable for a prototype
- be made using process(es) suitable for prototype manufacture.

In the spaces opposite, use sketches and, where appropriate, brief notes to show **two different** design ideas for the computer game timer that meet the specification points above.

Candidates are reminded that if a pencil is used for diagrams/sketches it must be dark (HB or B).

Coloured pens, pencils and highlighter pens must **not** be used.
Design idea 1

Design idea 2

(Total for Question 12 = 16 marks)
The picture below shows a remote control handset. It is used to control a projector through a wireless link.

(a) Explain how the handset is successful in meeting the following specification point:

It fits comfortably into the user’s hand.

(b) Explain two advantages of using an LCD screen for the handset.

Advantage 1

Advantage 2
Computer integrated manufacture (CIM) includes the use of Computer-aided design (CAD) and Computer-aided manufacture (CAM).

(c) Explain two advantages of using CAD and/or CAM for designing and manufacturing the remote control handset.

Advantage 1

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Advantage 2

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*(d) Evaluate high impact polystyrene (HIPS) against aluminium in terms of performance requirements and sustainability for the manufacture of the handset case.

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(Total for Question 13 = 16 marks)
14 The circuit diagram below shows how a lamp can be switched on and off.

(a) Name component X.  

(b) Explain the function of a thermistor.  

(c) Referring to its two inputs, describe how the operational amplifier (Op-Amp) works as a comparator.
(d) This circuit switches the light on at low temperatures.
   Explain how the lamp could be made to come on at high temperatures.  
   (2)

(e) Explain the function of the transistor in this circuit.  
   (2)

(f) The ammeter in the circuit reads 0.25A.
   Calculate the resistance of the lamp using Ohm's Law $V = I \times R$.
   Assume the transistor has zero resistance.  
   (3)

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......................... Ohms
Virtual modelling is often used when designing cases for electronic products. Discuss the advantages and disadvantages of virtual modelling when designing cases for electronic products. (6)