General Certificate of Secondary Education
June 2007

**DESIGN AND TECHNOLOGY**            **3551/F**
**(ELECTRONIC PRODUCTS) (SHORT COURSE)**
**Written Paper**
**Foundation Tier**                **F**

**AQA**

ASSESSMENT and
QUALIFICATIONS
ALLIANCE

Wednesday 13 June 2007     1.30 pm to 3.00 pm

Time allowed: 1 hour 30 minutes

| For Examiner's Use | | | |
|---|---|---|---|
| Question | Mark | Question | Mark |
| 1 | | 5 | |
| 2 | | 6 | |
| 3 | | | |
| 4 | | | |
| Total (Column 1) | | → | |
| Total (Column 2) | → | | |
| **TOTAL** | | | |
| Examiner's Initials | | | |

**Instructions**
- Use blue or black ink or ball-point pen. Use pencil only for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer the questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.
- Show the working of your calculations.

**Information**
- The maximum mark for this paper is 100.
- The marks for questions are shown in brackets.
- A list of formulae and other information, which you may wish to use in your answers, is provided on pages 2 and 3.
- You are reminded of the need for good English and clear presentation in your answers.

2

**You may need to use one or more of the following formulae when answering questions which include calculations.**

Potential Difference    Potential Difference = Current × Resistance    (V = I × R)

Series Resistors    $R_{total} = R_1 + R_2 + R_3$ etc

Electrical Power    Electrical Power = Current × Potential Difference    (P = I × V)

Potential Divider

$$Vs = \frac{R_2}{R_1 + R_2} \times V$$

where   Vs = signal value
V = supply voltage
$R_1$ and $R_2$ are resistance values
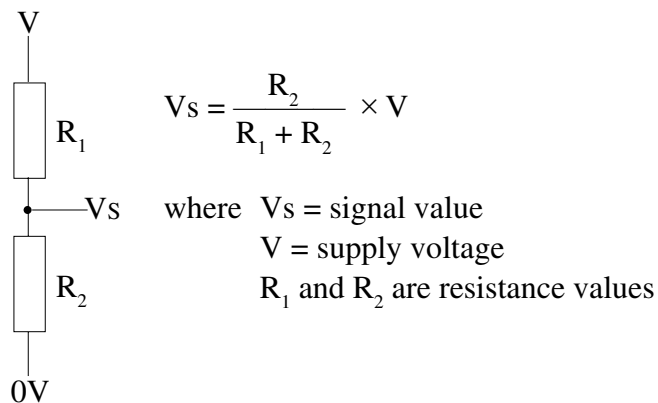
Time Constant    Time Constant ≃ Resistance × Capacitance    (T ≃ R × C)

Astable
Frequency for 555    $$f = \frac{1.44}{(R_1 + 2R_2) \times C}$$

Pulse duration    $$= \frac{1}{frequency}$$

**You may need to use the following information when answering some of the questions.**

Capacitor series        10, 22, 47

Resistor Colour Code

| Colour | Band 1 | Band 2 | Band 3 (No. of 0s) | Band 4 (Tolerance) |
|--------|--------|--------|--------------------|--------------------|
| Black  | 0      | 0      | None               |                    |
| Brown  | 1      | 1      | 0                  |                    |
| Red    | 2      | 2      | 00                 |                    |
| Orange | 3      | 3      | 000                |                    |
| Yellow | 4      | 4      | 0000               |                    |
| Green  | 5      | 5      | 00000              |                    |
| Blue   | 6      | 6      | 000000             |                    |
| Violet | 7      | 7      | –                  |                    |
| Grey   | 8      | 8      | –                  |                    |
| White  | 9      | 9      | –                  |                    |
|        |        |        |                    | Gold = 5%          |
|        |        |        |                    | Silver = 10%       |

**Turn over for the first question**

**Turn over ▶**
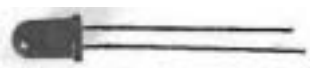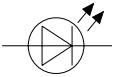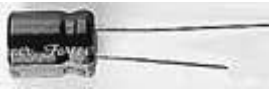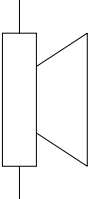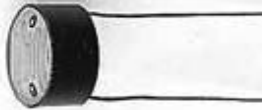
Answer **all** questions in the spaces provided.

This question is about component identification and function.

You are advised to spend about 15 minutes on this question.

**1** (a) Complete the table below by giving the names and symbols of the components shown in the photographs. The first one has been completed for you.

| Component | Name | Symbol |
|---|---|---|
| | LED | |
| (i) | Diode | |
| (ii) | | |
| (iii) | | |
| (iv) | Push to Make Switch | |
| (v) | | |
| (vi) | | |
| (vii) | | |
| (viii) | LDR | |

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*(12 × 1 mark)*

(b)  Certain types of electronic components must be put in the circuit the correct way round (polarised) whilst other types of electronic components do not (non-polarised).

In the table below, tick the correct box for each component. The first one has been done for you.

| | Component | Polarised | Non-polarised |
|---|---|---|---|
| | Diode | ✔ | |
| (i) | Push to Make Switch | | |
| (ii) | Fixed Resistor | | |
| (iii) | Light Emitting Diode | | |
| (iv) | Buzzer | | |
| (v) | Electrolytic Capacitor | | |
| (vi) | Thermistor | | |
| (vii) | Transistor | | |

*(7 × 1 mark)*

**19**

**Turn over for the next question**

**Turn over ▶**

This question is about research and analysis.

You are advised to spend about 10 minutes on this question.

**2** (a) Describe **two** methods a student could use to find information about existing electronic games.

Method 1 ................................................................................................................

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Method 2 ................................................................................................................

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*(4 marks)*

(b) In order to find out the features which might be wanted by people who play electronic games, a survey could be conducted.

Write **three** different questions a student could ask and give a reason for **each** to show how this will help with the design of the product.

An example is given.

Example:

      Question – Should the game be portable?

      Reason – This will affect the size, weight and possible power source.

Question 1 ..............................................................................................................

Reason ...................................................................................................................

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Question 2 ..............................................................................................................

Reason ...................................................................................................................

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Question 3 ..............................................................................................................

Reason ...................................................................................................................

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*(6 marks)*

(c) From the survey it would appear most people would prefer to use a battery-powered game.  Give a reason why.

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*(2 marks)*

$\overline{12}$

**Turn over for the next question**

**Turn over ▶**

This question is about LEDs and resistors.

You are advised to spend about 10 minutes on this question.

**3** LEDs are quite often connected to flying leads in projects. **Figure 1** shows an LED ready to be connected to two wires.

**Figure 1**



Anode ⟶                ⟵ Cathode
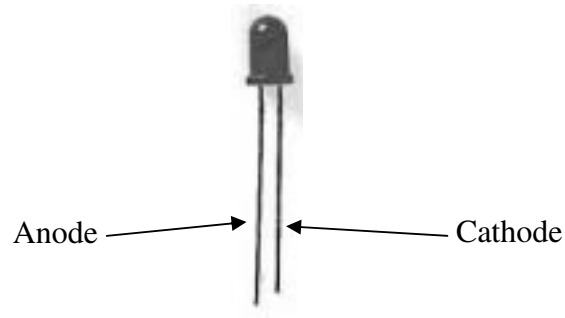
(a)   Using notes and sketches, describe how you would attach flying leads to the LED so that no short circuits could occur.

Use the space below to complete your answer.

*(5 marks)*
*Quality of notes and sketches (2 marks)*

(b) What Quality Control test could be done once the flying leads are connected to the LED?

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*(1 mark)*

(c) Using notes and sketches, describe a technique that could be used to connect the flying leads to a circuit board to give greater strength to the soldered joint.

*(3 marks)*

(d) An LED is usually protected by a fixed resistor. A 390 ohm fixed resistor is a suitable one.

Give the colour bands which identify the resistor as 390 ohms.

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*(3 marks)*

**Turn over for the next question**

**Turn over ▶**

14

This question is about monostable circuits.

You are advised to spend about 20 minutes on this question.

4  **Figure 2** shows an incomplete circuit diagram for a monostable using a 555 Timer I C.
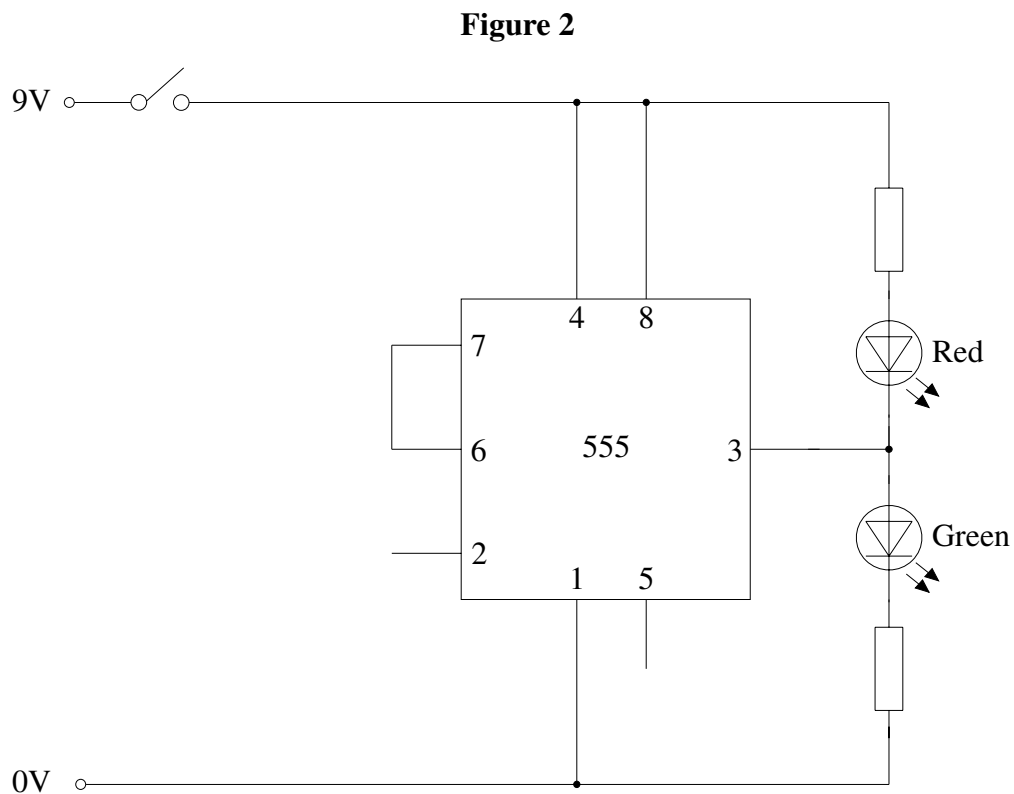
**Figure 2**



(a)  Complete the circuit diagram for a monostable in **Figure 2** by

(i)  adding a 100 K fixed resistor and a 22 µF capacitor to Pins 6 and 7 to give a time
constant of approximately 2 seconds, *(3 marks)*

(ii)  adding a fixed resistor and a suitable switch to Pin 2 so as to trigger the 555 Timer
I C when the switch is pressed.  Clearly label the resistor to show its value.
*(4 marks)*
*Quality of drawing (2 marks)*

(b)  Describe what happens to the LEDs when the circuit is switched on and then triggered.

   (i) circuit switched on

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   *(2 marks)*

   (ii) circuit triggered

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   *(2 marks)*

(c)  Connect a buzzer to the output, Pin 3, of the 555 Timer I C shown in **Figure 3**, so that the buzzer will sound when the trigger switch is pressed.

**Figure 3**



*(2 marks)*

15

**Turn over ▶**
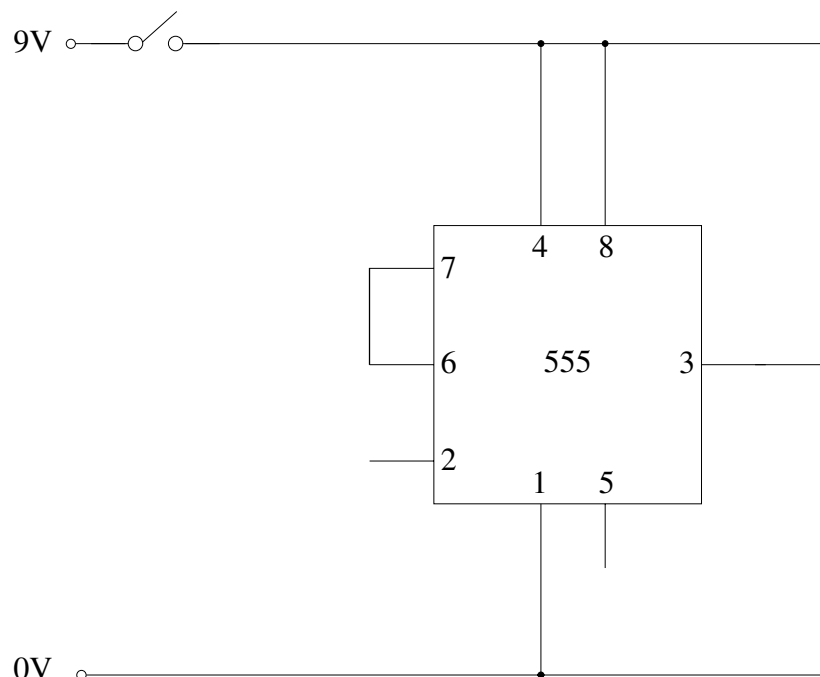
This question is about designing the case for a product.

You are advised to spend about 25 minutes on this question.

**5**   A simple case design for a steady hand game is shown in **Figure 4** which could house a similar circuit to the one developed in **Question 4**.

(a)   On **Figure 4** label suitable materials for the track, wand and handle.

**Figure 4**



Track material ..............................

Wand material ..............................

Handle material ..............................
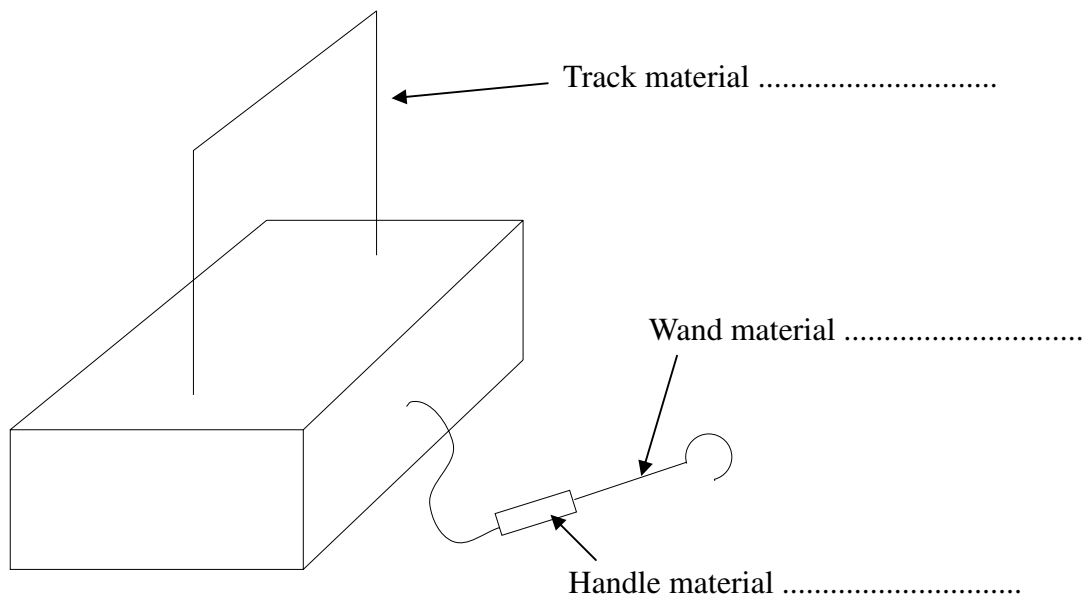
*(3 marks)*

(b)   Suggest **three** improvements to the design in **Figure 4** above.

1 ...................................................................................................................................

2 ...................................................................................................................................

3 ...................................................................................................................................

*(3 marks)*

(c) Using sketches and notes, show how you would improve the design of the case for the steady hand game using the following specification points.

   (i) a suitable specific material for the case                                         *(2 marks)*

  (ii) your suggested improvements from part (b)                              *(6 marks)*

(iii) the position of the **two** LEDs                                               *(1 mark)*

(iv) sound holes for a buzzer                                                    *(1 mark)*

  (v) a suitable on/off switch                                                 *(2 marks)*
*Quality of communication (3 marks)*

Chosen specific material ........................................................................................................

Use the space below to complete your answer.

**Turn over ▶**

(d)   Evaluate your case design for its suitability for commercial production in batches of 100. Give reasons for any changes you suggest.

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*(6 marks)*

27

This question is about the social, moral and environmental aspects of electronic games.

You are advised to spend about 10 minutes on this question.

**6**   Electronic games have changed the way we spend our leisure time.

(a)   Describe how electronic games have changed in recent years.

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*(3 marks)*

(b) Explain the impact electronic games are said to have had on personal health and on social and family life.

(i) Personal health ..................................................................................................................

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*(2 marks)*

(ii) Social and family life ......................................................................................................

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*(2 marks)*

(c) The rapid rate of change of electronic products means that some products soon become out of date.

(i) What advantages does this have for the manufacturer?

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*(3 marks)*

(ii) What disadvantages does this have for the manufacturer?

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*(3 marks)*

13

**END OF QUESTIONS**

**There are no questions printed on this page**