

Write your name here

Surname

Other names

Centre Number

Candidate Number

**Pearson Edexcel  
Level 1/Level 2 GCSE (9–1)**

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# Design and Technology

## Component 1

Sample assessment material for first teaching

September 2017

**Time: 1 hour 45 minutes**

Paper Reference

**1DT0/1D**

**You must have:**

a calculator

a ruler

Total Marks

### Instructions

- Use **black** ink or ball-point pen.
- **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.
- Any diagrams may NOT be accurately drawn, unless otherwise indicated.
- You must **show all your working out** with **your answer clearly identified** at the **end of your solution**.

### Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets
  - use this as a guide as to how much time to spend on each question.

### Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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**SECTION A – CORE****Answer ALL questions. Write your answers in the spaces provided.**

- 1 The materials that products are made from are chosen because of their characteristics.

- (a) Figure 1 shows a table of products.

For each of the products shown, give a property of the material it is made from that makes the material suitable for the product.

The first one has been done for you.

Picture of product	Description of product	Property
	A polystyrene coffee cup	Good insulator of heat
(Source: © Feng Yu/Shutterstock)		
 www.shutterstock.com • 120292822	A cardboard box	(1)  (i) .....
 www.shutterstock.com • 513759271	An woolen hat	(1)  (ii) .....
 www.shutterstock.com • 215706583	An aluminum car body	(1)  (iii) .....

Picture of product	Description of product	Property
 shutterstock <small>www.shutterstock.com • 298315976</small>	A plastic drinks bottle	(1)  (iv) .....

**Figure 1**

(b) Figure 2 shows a race car.

The manufacturers of the car want to improve it by using carbon fibres.



Explain how the addition of carbon fibre could improve the race car.

(2)



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(c) Figure 3 shows a babies spoon and fork.



**Figure 3**

The spoon contains temperature responsive polymers.

Why is that categorised as a smart material and explain an advantage of using this material in the this product.

(2)

**(Total for Question 1 = 8 marks)**

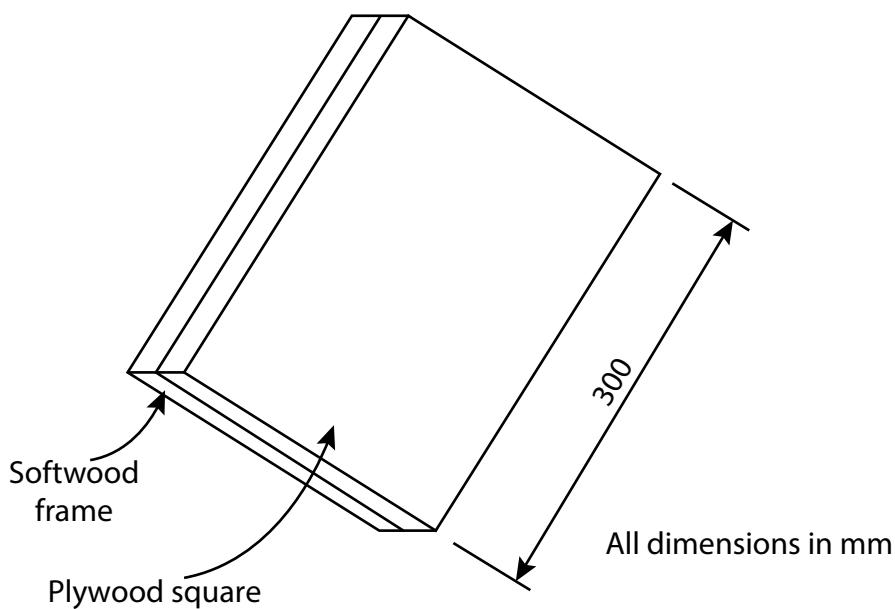
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- 2 Figure 4 shows a plywood square.

The plywood square will be covered with fabric to make a wall clock.



**Figure 4**

- (a) Explain **one** benefit for the environment using plywood rather than maple to make the wall clock.

(2)

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- (b) Plywood is available in 122 cm × 244 cm sheets.

Calculate how many 300 mm × 300 mm squares can be cut from the available sheet.

(3)

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(c) The clock face is covered with a blended fibre fabric.

Explain **one** advantage of blending fibres to make fabrics.

(2)

(d) Figure 5 shows a clock mechanism.



(Source: www.clockparts.co.uk)

**Figure 5**

Explain **one** benefit to the clock manufacturer of buying the clock mechanisms as standard components.

(2)

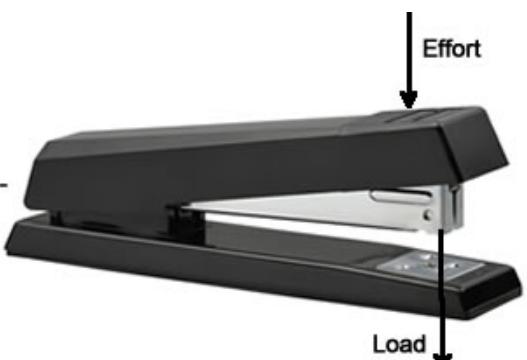
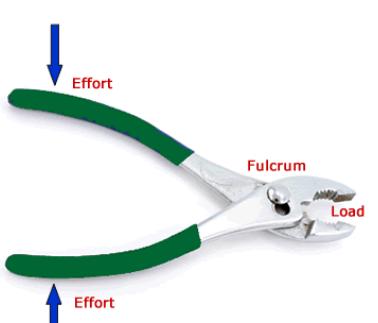
**(Total for Question 2 = 9 marks)**

- ### **3 Levers are classified as class 1, 2 or 3**

(a) Figure 6 shows two different products, both are types of lever.

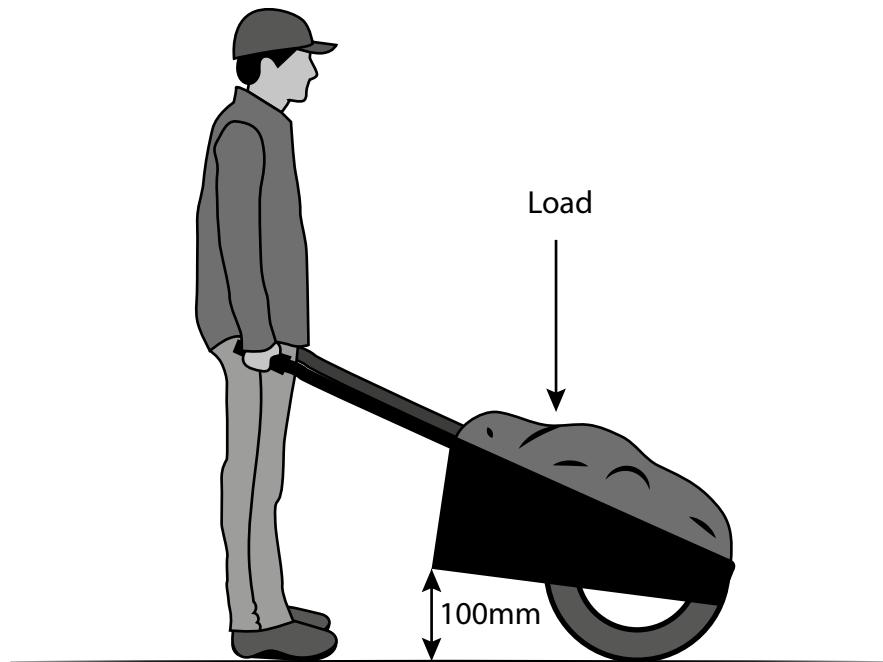
F is the fulcrum, E is the effort and L is the load.

For each of the products shown, name the type of lever.

Product	Type of lever
 <p>Pivot point - fulcrum</p> <p>Effort</p> <p>Load</p> <p>Stapler</p>	(1)
 <p>Pliers</p>	(i) ..... (ii) .....

**Figure 6**

(b) Figure 7 shows a loaded wheelbarrow.



**Figure 7**

Mechanical advantage (MA) is calculated by:

$$MA = \frac{\text{load}}{\text{effort}}$$

The velocity ratio (VR) is 4 and the effort is 100 N.

The efficiency of the system is given by:

$$\text{Efficiency} = \frac{MA}{VR} \times 100\%$$

The system is 85% efficient.

Calculate the maximum load that can be lifted.

(3)

- (c) Explain **one** reason why the length of the handles on the wheelbarrow would be increased.

(2)

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- (d) Explain **two** benefits that just-in-time (JIT) manufacturing could have for the manufacturer of the wheelbarrow.

(4)

1 .....

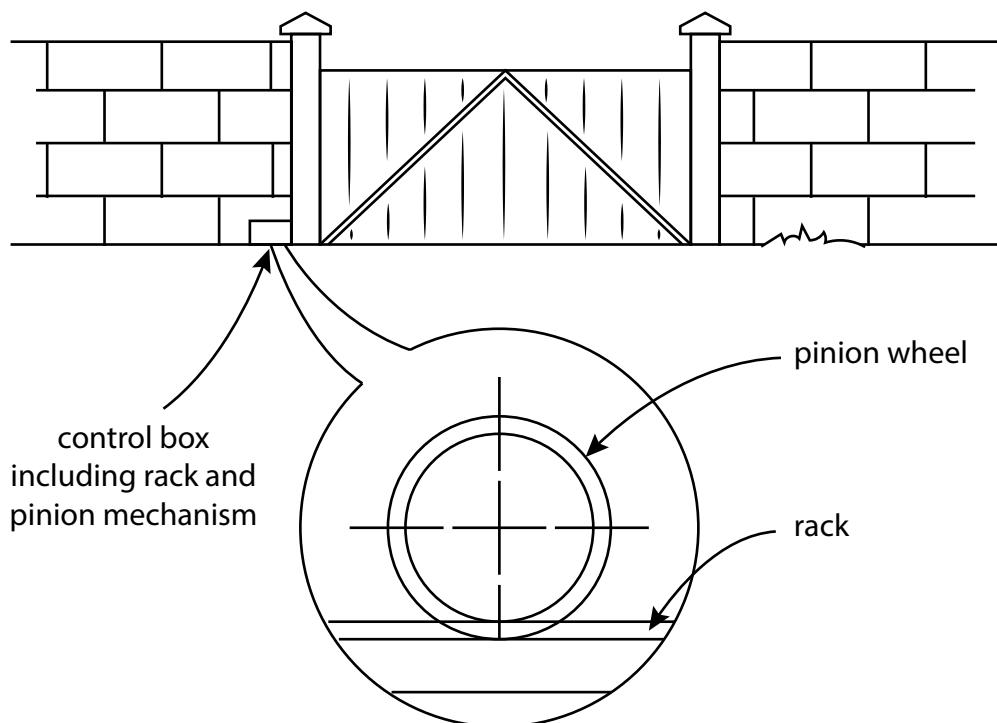
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2 .....

**(Total for Question 3 = 11 marks)**

**4** Figure 8 shows a gate.

The gate is moved by an electric motor in combination with a rack and pinion mechanism.



**Figure 8**

(a) Give **one** other application of a rack and pinion mechanism.

(1)

(b) The gate needs to move 6 m to open fully.

The pinion wheel has a radius of 120 mm.

Calculate the number of revolutions the pinion wheel must rotate in order to open the gate fully.

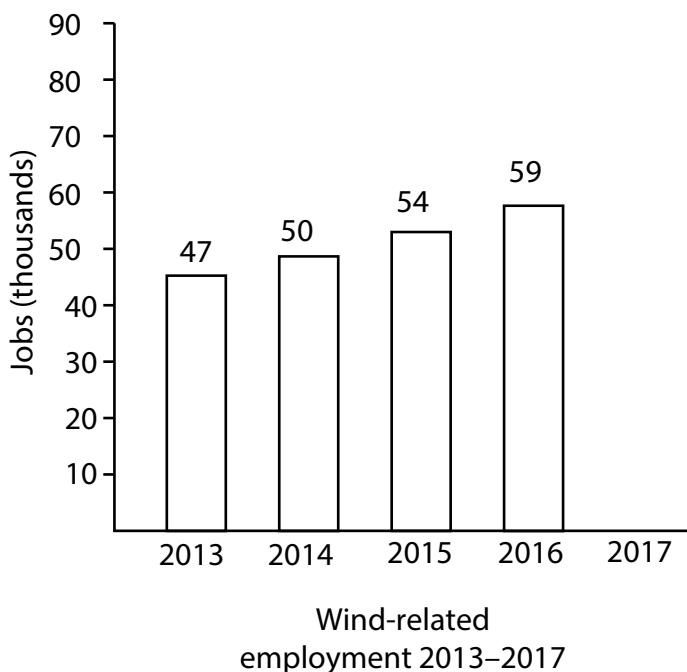
Give your answer to the nearest whole number.

(4)

Use  $\pi = 3.142$

Formula for circumference =  $\pi d$

- (c) Figure 9 shows a graph of the approximate number of people employed in wind-power-related industries between 2013 and 2017.



**Figure 9**

Analyse the graph.

Calculate the expected increase in the number of people employed in wind-power related industries in 2017, based on the current trend.

(1)

increase = .....

- (d) The manufacturer considered two different power supplies to power the electric gates.

Figure 10 shows data for these power supplies.

Factor	Wind	Mains electricity
Storage method	Battery	None required on National Grid
Upfront costs	£4000	Nil
Cost per kwh	Nil	14.372 pence
Annual standing charge	Nil	£142

**Figure 10**

Analyse the data provided.

Discuss the issues that the manufacturer would need to consider when making the decision about which power supply to choose.

(6)

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**(Total for Question 4 = 12 marks)**

**TOTAL FOR SECTION A = 40 MARKS**

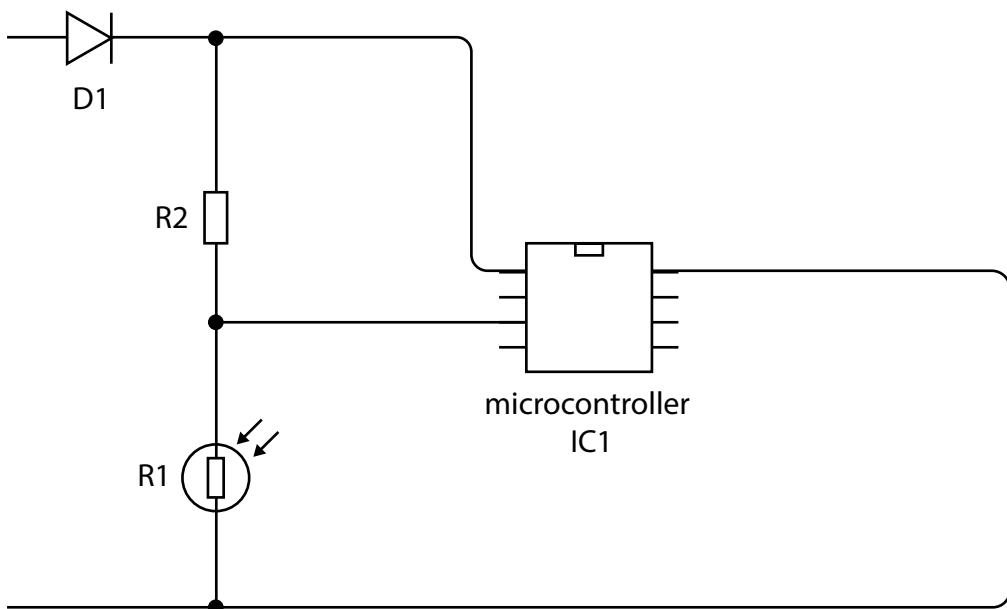
## SECTION B – SYSTEMS

**Answer ALL questions. Write your answers in the spaces provided.**

- 5 Figure 11 shows a design solution and some additional information for a new light sensing microcontroller circuit, for an automatic drawer alarm.

The GENIE 08 microcontroller has 8 legs (known as pins) and these are used as follows:

Pin	Description
1	Power supply voltage (1.8–5.5V only)
2	Programming input (PR)
3	Analogue input A4 or digital in/out G4
4	Digital input G3 or (optional) reset
5	Analogue input A2 or digital in/out G2
6	Analogue input A1 or digital in/out G1
7	Digital output G0 and Status output (ST)
8	Ground (zero volt) supply voltage



**Figure 11**

(a) The circuit needs to be improved to include the following specification points.

The circuit must:

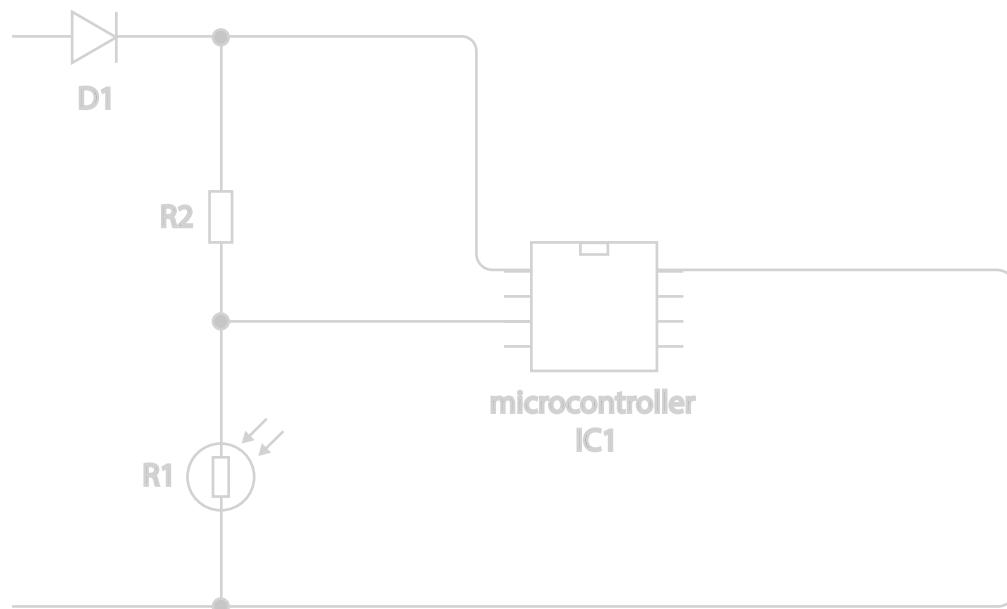
- have an on/off switch that latches
- be connected to the correct supply voltage and 0V
- have a piezo transducer and 2 LEDs outputs, connected to the microcontroller correctly, to indicate when the light levels change.

Use notes and/or sketches to show how the circuit could be modified to include these three specification points.

You will be marked on how you apply your understanding of design and technology, not your graphical skills.

Use the outline of the original design solution to show your modifications.

(6)



(b) Figure 12 shows a drawer alarm and some information about it.

The drawer alarm must be suitable for teenagers protecting their diaries.



Externally attached 9V battery	LED lighting
Easy to press push to make button	Acrylic case top and bottom
Runs on non rechargeable batteries	LDR mounted on the top

**Figure 12**

Analyse the night light.

Explain two ways in which the alarm meets or fails to meet the criteria for children to use it and take it to bed.

(4)

1 .....

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2 .....

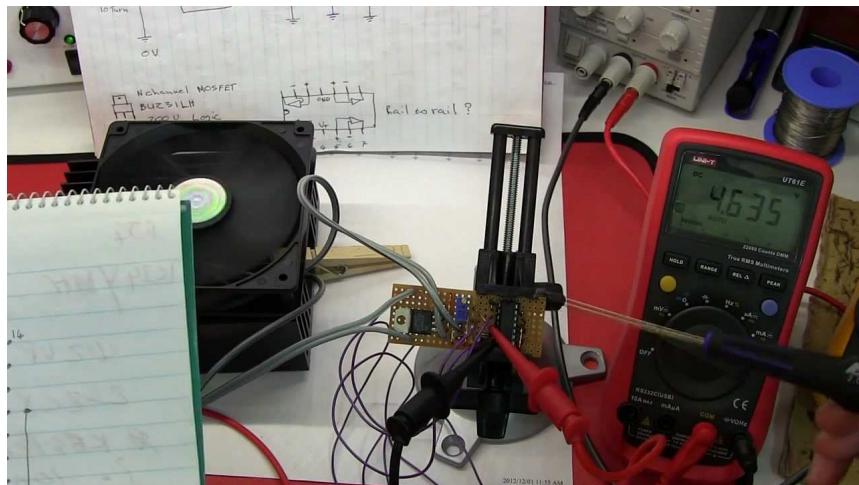
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**(Total for Question 5 = 10 marks)**

- 6 Figure 13 shows a prototype for a new circuit.

The circuit is made as a one-off prototype on stripboard.



**Figure 13**

- (a) (i) Explain **one** reason why stripboard is used to make a prototype circuits.

(2)

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- (ii) Explain **one** reason why a multimeter was used to test elements of the prototype circuit.

(2)

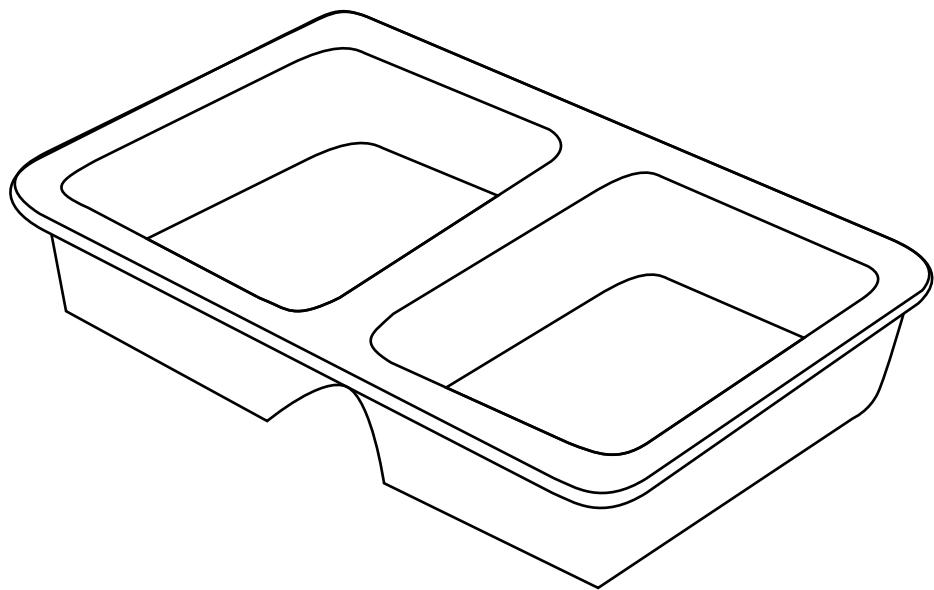
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(b) Figure 14 shows a plastic case for the circuit board.

The plastic case is a one-piece, fold-together case, made using the 3D printing process.



**Figure 14**

Use notes and/or sketches to show the process of 3D printing the case.

You will be marked on how you apply your understanding of design and technology, not your graphical skills.

(4)

(c) Explain **one** reason why 3D printed might not be the best method for producing the case.

(2)

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(d) The circuit is going to be mass produced.

Name **two** methods that can be used to mass produce the circuit.

For each method, explain one advantage to the manufacturer of using this method.

(6)

Method 1

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Method 2

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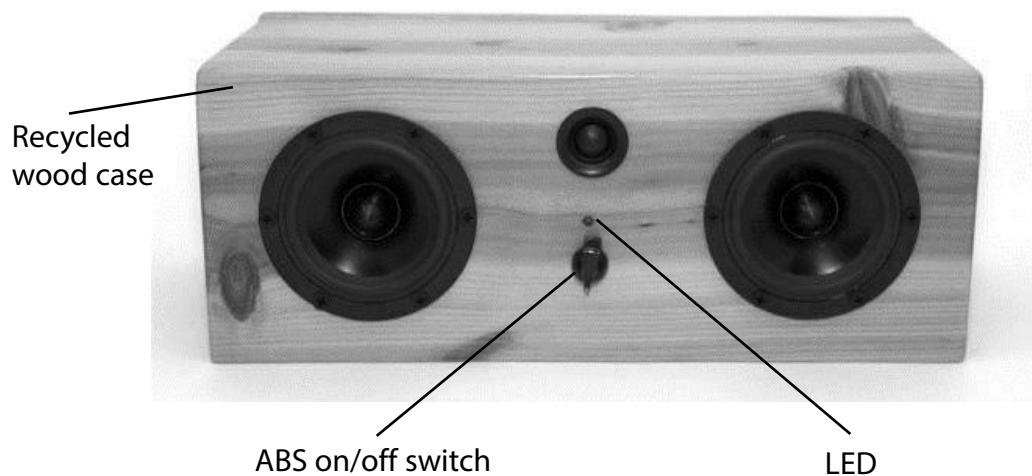
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**(Total for Question 6 = 16 marks)**

- 7 Figure 15 shows Bluetooth® speakers.

The speakers can be connected to mobile devices, such as phones, in order to play music.



**Figure 15**

- (a) The case for the speakers has a hole for a light-emitting diode (LED).

The LED is wired to the main circuit board inside the case.

Give **one** method providing adequate strain relief to the wired connections.

(1)

(b) A large number of resistors are used in the main circuit board.

Explain **two** reasons why resistors with different tolerances are used in the main circuit board.

(4)

1 .....

2 .....

- (c) The LED uses a current limiting resistor.

Ohm's law:  $V = I \times R$

Supply voltage = 12V

The LED requires 2V at 20 mA and a resistor is chosen to meet this requirement.

Calculate the range of values that this resistor may have if it has a gold band, indicating a tolerance of 5%.

(5)

Answer .....  $\Omega$ . to .....  $\Omega$

(d) Explain **two** reasons why acrylonitrile butadiene styrene (ABS) is an appropriate material/component for the on/off switch.

(6)

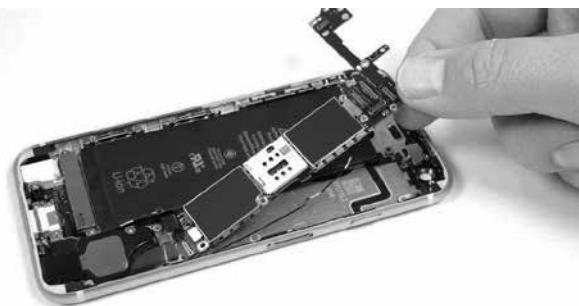
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**(Total for Question 7 = 16 marks)**

- 8** Figure 16 shows a mobile phone with the back removed to show its circuitry.



(Source: [www.cnet.com/news/iphone-6s-teardown-reveals-upgrades-galore-similar-hardware-layout/](http://www.cnet.com/news/iphone-6s-teardown-reveals-upgrades-galore-similar-hardware-layout/))

**Figure 16**

- (a) (i) Explain **one** reason why platinum and tungsten were used.

(2)

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- (ii) The mobile phone case is made from polypropylene.

Explain **one** working property of polypropylene that makes it suitable for the mobile-phone case.

(3)

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(b) Explain **two** benefits to the manufacturer of using a system of automated quality-control checks.

(4)

1 .....

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2 .....

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(c) Here is a new mobile phone. Figure 17 shows some information about the mobile phones.



(Source: © Isamare/Shutterstock)

<b>Features</b>	5.8" durable glass display. Waterproof.
<b>Materials used</b>	Glass Stainless steel Lithium cobalt oxide Copper Neodymium magnets
<b>Use of recycled materials</b>	10% recycled metals
<b>Recyclability</b>	Requires specialist recycling facility
<b>Weight</b>	174 grams

**Figure 17**

Analyse the information in Figure 17.

Evaluate the mobile phone in terms of their ecological footprint.

(9)

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**(Total for Question 7 = 18 marks)**

**TOTAL FOR SECTION B = 60 MARKS**

**TOTAL FOR PAPER = 100 MARKS**

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