

Examiners' Report  
June 2014

GCSE Design and Technology 5EP02 01

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June 2014

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## **Introduction**

It is encouraging to see that each year, students are better prepared for this paper than was the case the previous year. Fewer questions are being left blank and the understanding demonstrated by candidates is steadily improving. The question involving numerical calculation (Q14f) was well performed. The only surprise from the candidates was that very few were able to explain the function of the thyristor and especially the transistor, (Q11e and Q14e).

### Question 1 (a) (1)

Almost all candidates achieved the mark in this question. However, stating that a variable resistor is used to vary or alter resistance does not demonstrate an understanding of electronic products, and candidates should be encouraged to give a more technical response.

11 (a) The table below shows some equipment and components.

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

Equipment/Component	Name	Use
	Variable resistor	after amount of current being <del>restricted</del> restricted (1)



#### ResultsPlus Examiner Comments

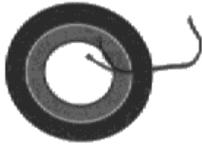
Almost all candidates achieved the mark in this question. However, stating that a variable resistor is used to vary or alter resistance does not demonstrate an understanding of electronic products, and candidates should be encouraged to give a more technical response.



#### ResultsPlus Examiner Tip

Use technical vocabulary, e.g. current.

### Question 1 (a) (2)

	Piezo-electric sensor	detects electricity (1)
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**ResultsPlus**

**Examiner Comments**

While many candidates correctly identified the piezo sensor as a pressure or strain sensor, too many candidates suggested it was a movement sensor.

	Piezo-electric sensor	To detect pressure, and movement (1)
---	-----------------------	---



**ResultsPlus**

**Examiner Comments**

The mark is awarded for 'to detect pressure'.



**ResultsPlus**

**Examiner Tip**

Don't use too many words - 'To detect pressure' is a perfect response.

### Question 1 (a) (3)

As the question stated that this was a light dependant component, candidates needed to show understanding by stating that it senses light levels, rather than just senses light.

	Light detecting Sensor	For sensing light levels
	(1)	



#### ResultsPlus Examiner Comments

The candidate has said the component for sensing light levels is a 'Light Detecting Sensor'. This does not show technical understanding and achieves no credit.



#### ResultsPlus Examiner Tip

Don't just rephrase the question!

### Question 1 (a) (4)

Candidates performed well on this question

	Ammeter.	To measure current
	(1)	



#### ResultsPlus Examiner Comments

The letter 'A' was a giveaway in this question, and virtually all candidates achieved the mark.



#### ResultsPlus Examiner Tip

Use all the clues you have - the letter 'A' tells you the answer!

### Question 1 (b)

Candidates performed well in the first part this question; any form of latching switch was an acceptable response, (although not PTM, PTB, tilt or rotary switches).

However, very few recognised the thyristor, with the most popular response identifying it as a diode.

(b) Name components A and B.

(2)

A Single Pole, Single Throw Switch.  
B ~~Diode~~ Thyristor



**ResultsPlus**

**Examiner Comments**

This response is perfect. The candidate has identified a suitable switch, and correctly identified the thyristor.



**ResultsPlus**

**Examiner Tip**

Give enough detail in your answers.

(b) Name components A and B.

(2)

A Switch  
B Diode (latching)



**ResultsPlus**

**Examiner Comments**

The response 'switch' lacks sufficient detail here, while 'diode' is incorrect.



**ResultsPlus**

**Examiner Tip**

Give enough detail, here the candidate has lost a mark by not saying what sort of switch is in the circuit.

### Question 1 (c)

PTM or push-to-make were the only acceptable responses here.

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

(1)

Push to make switch (PTM)



**ResultsPlus**

**Examiner Comments**

This response is accurate, and sufficiently detailed to achieve the mark.



**ResultsPlus**

**Examiner Tip**

Include sufficient detail to show that you know more than someone who hasn't studied the subject at GCSE level.

## Question 1 (d)

Virtually all candidates understood that the switch would turn the buzzer on. However, almost all candidates incorrectly suggested that the buzzer would turn off when the switch was released, showing a lack of understanding of the function of the thyristor.

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

(i) When it is pressed (1)

*When pressed the buzzer will make a noise*

(ii) When it is released (1)

*When released the buzzer will stop making a noise*



### ResultsPlus Examiner Comments

The vast majority of responses followed this format; the buzzer turns on, the buzzer turns off.



### ResultsPlus Examiner Tip

If you're not sure of the answer, it's worth a guess. This question was about buzzers, so it's pretty likely that it will buzz!

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

(i) When it is pressed (1)

*A buzzer sound is produced*

(ii) When it is released (1)

*will continue to be emitted. (1)  
The sound ~~was produced~~ ~~was produced~~ ~~was produced~~*



### ResultsPlus Examiner Comments

This is a correct response. The scribbling out suggests that the candidate wasn't sure initially, but they got there in the end.



### ResultsPlus Examiner Tip

It's always worth checking your answers if you have time at the end of the paper.

## Question 1 (e)

This question was aimed at the most able candidates. They had to recognise the thyristor in the circuit, as well as understand its operation in detail. A perfect response could refer to 'resetting' the thyristor, and 'turning off the buzzer'.

(e) Explain the function of  $S_2$  in the circuit.

(2)

$S_2$  is used to reset the thyristor and stop the alarm buzzer from sounding by shunting it.



**ResultsPlus**

**Examiner Comments**

Reset the thyristor - one mark, stop the buzzer from sounding - one mark - a perfect response.



**ResultsPlus**

**Examiner Tip**

Make your answers clear, but include enough to get all marks available.

(e) Explain the function of  $S_2$  in the circuit.

(2)

to circuit break B and so when both  $S_1$  +  $S_2$  are on the buzzer sounds.



**ResultsPlus**

**Examiner Comments**

'To break circuit B' is not a clear description of resetting the thyristor, so achieves no mark. The comment regarding  $S_1$  and  $S_2$  is inaccurate, achieving no mark.



**ResultsPlus**

**Examiner Tip**

Use technical language where you can.

## Question 1 (f)

This question was generally poorly answered, suggesting that very few candidates have had the opportunity to select their own components. The fundamental advantage of the buzzer is that it does not require a driving circuit, so fewer additional components are required, it turns saving expense, construction time and space on the circuitboard. It was interesting that the most common wrong response was that loudspeakers need to be 'programmed'.

(f) Explain **two** advantages of using a buzzer rather than a loudspeaker.

(4)

Advantage 1

A buzzer requires less current to work, so you can use it in a smaller, less powerful circuit.

Advantage 2

Buzzers are ~~easier to~~ <sup>more simple</sup> to integrate into a circuit, loudspeakers require a far more complex circuit to function properly and the circuit may not



**ResultsPlus**

Examiner Comments

Although advantage 1 is incorrect, the candidate then goes on to show an understanding that a speaker requires a complex driving circuit, whereas a buzzer does not.

(f) Explain **two** advantages of using a buzzer rather than a loudspeaker.

(4)

Advantage 1

A buzzer does not need an exciting sound to amplify unlike a loudspeaker.

Advantage 2

A buzzer ~~is~~ can be smaller ~~and more~~ <sup>useful</sup> to insert into a circuit.



**ResultsPlus**

Examiner Comments

While the candidate shows a vague understanding that a speaker needs a 'sound' to amplify whereas a buzzer generates its own sound, and the buzzer has size advantages, neither point is explained well enough to achieve a mark.

## Question 1 (g)

Almost all candidates suggested a suitable environmentally friendly power source, but many of the reasons given were cost or convenience advantages rather than environmental advantages which did not achieve a mark.

(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

Rechargeable batteries.

Reason

You can ~~use~~ charge them to ~~produce~~ reuse them.



**ResultsPlus**

**Examiner Comments**

Rechargeable batteries is a correct response, but being able to reuse them is not in itself an environmental advantage.

(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

Rechargeable batteries

Reason

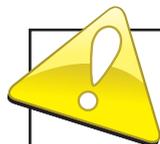
Batteries do not need to be discarded and new ones bought.



**ResultsPlus**

**Examiner Comments**

Discarding batteries would have an environmental impact, and so correctly addresses the question for full marks.



**ResultsPlus**

**Examiner Tip**

Make sure you're answering the question.

## Question 1 (h)

Despite there being twelve possible correct responses to this two-mark question, it was unfortunate that so many candidates provided answers such as 'faster' 'stronger' 'cheaper' 'easier', etc.

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

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

(2)

Injection moulding is suitable because it is cheap and easy as you can use the same mould over-again, Also it is fast as this Alarm may be mass produced.



**ResultsPlus**  
Examiner Comments

This response starts off badly, but at the end 'fast' and 'mass production' achieve both marks.



**ResultsPlus**  
Examiner Tip

Avoid non-technical words such as 'fast', 'efficient', 'quick', 'easy'.

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

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

(2)

This is a easy cheap way of making a stron case you will also be abel to shape the case easily.



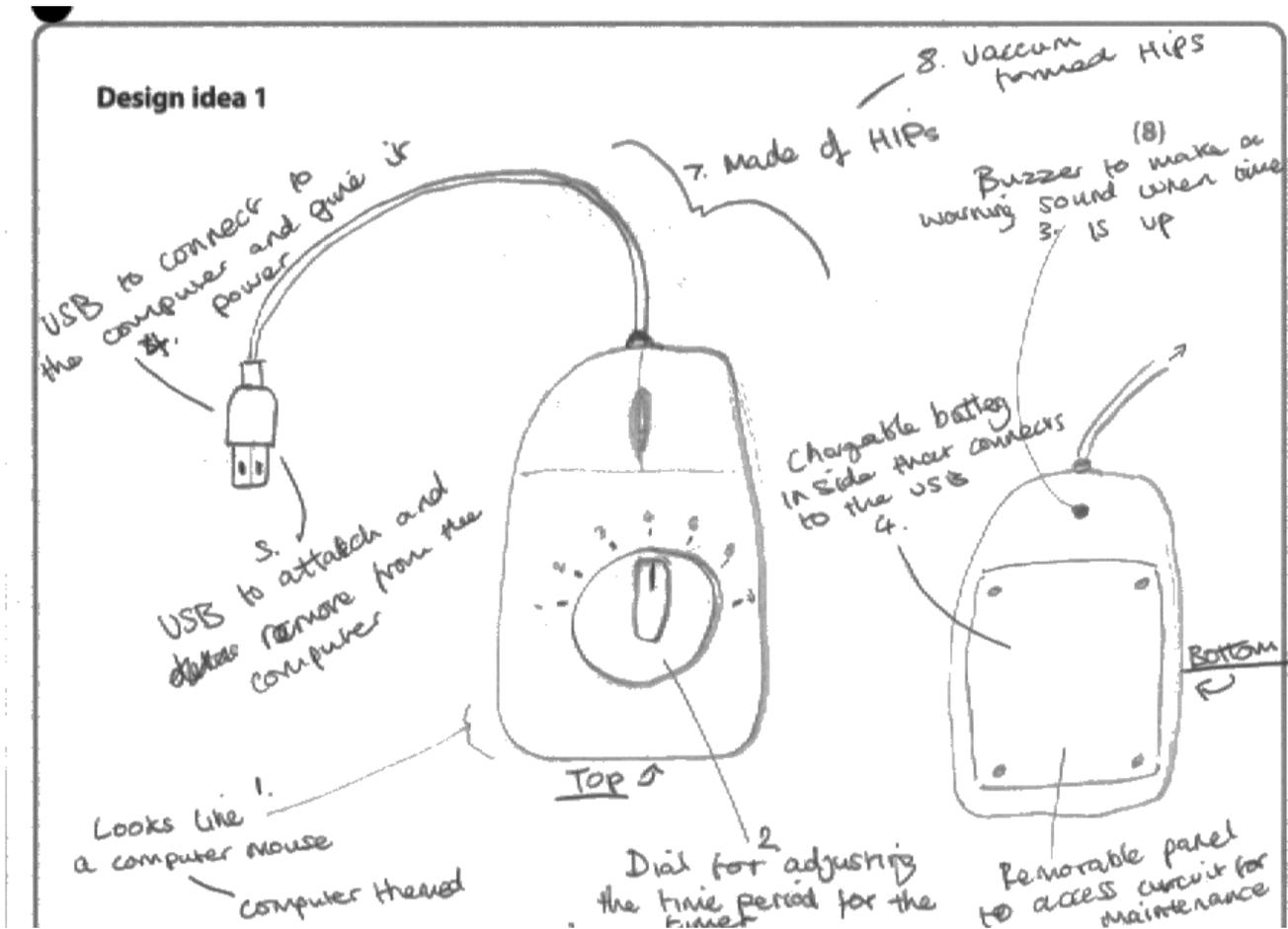
**ResultsPlus**  
Examiner Comments

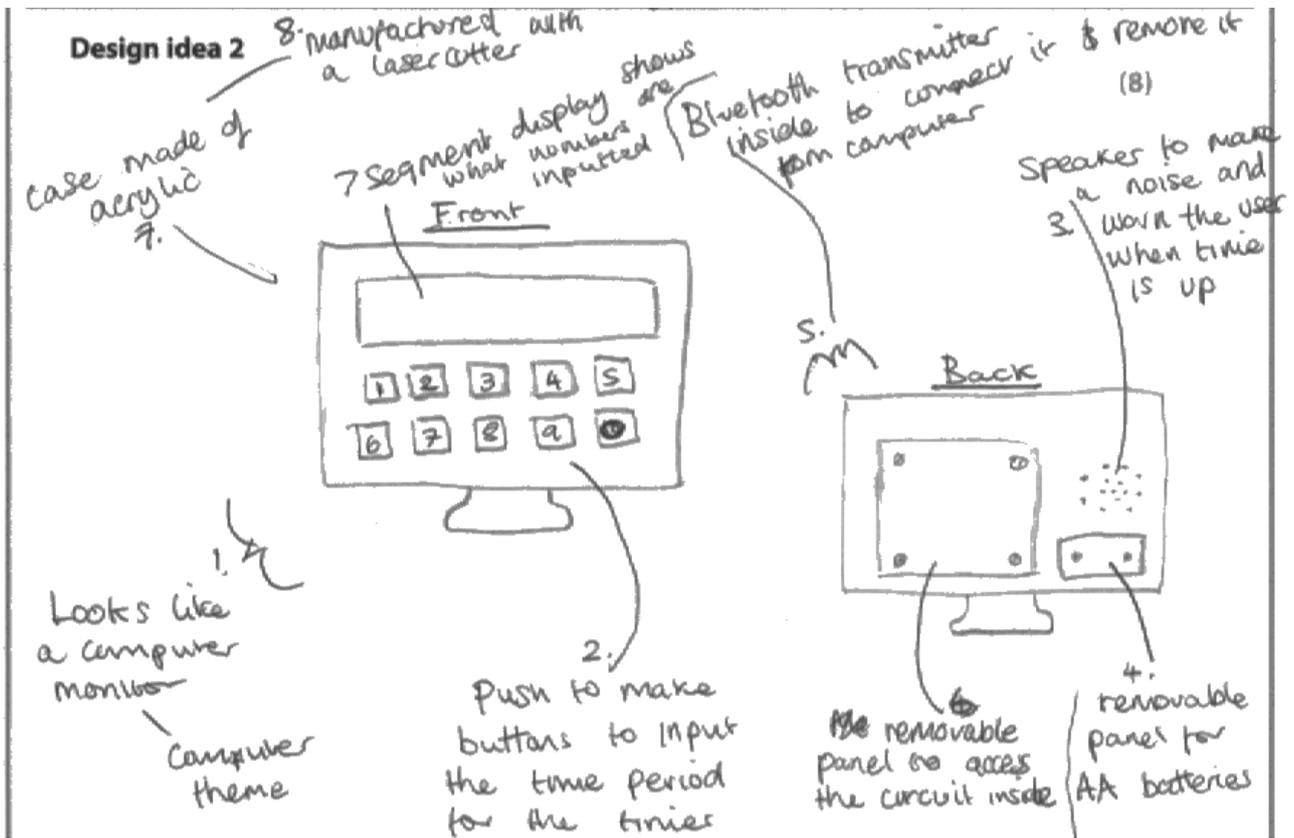
'Cheap, 'easy' and 'strong' do not achieve marks.

## Question 2

This question was much better answered than in previous years. Very few candidates gave a single response and there was far less repetition than has been the case in the past. Candidates should be careful to address the specification criteria logically; a significant number of candidates gave more than one power supply or material but failed to offer a response in other places. Most candidates could volunteer a computer theme such as a VDU or keyboard shape, visual or audible warnings, specific power supplies and circuit access mechanisms. They were familiar with a range of materials and forming methods suitable for manufacturing a one-off prototype.

However, candidates were less successful at suggesting how the time period could be changed; ('knob' is not an electrical component), and many candidates proposed attaching the device to the computer with a loose cable, which would have been of little benefit. Injection moulding is not an appropriate one-off prototype and did not achieve a mark.





## ResultsPlus

Examiner Comments

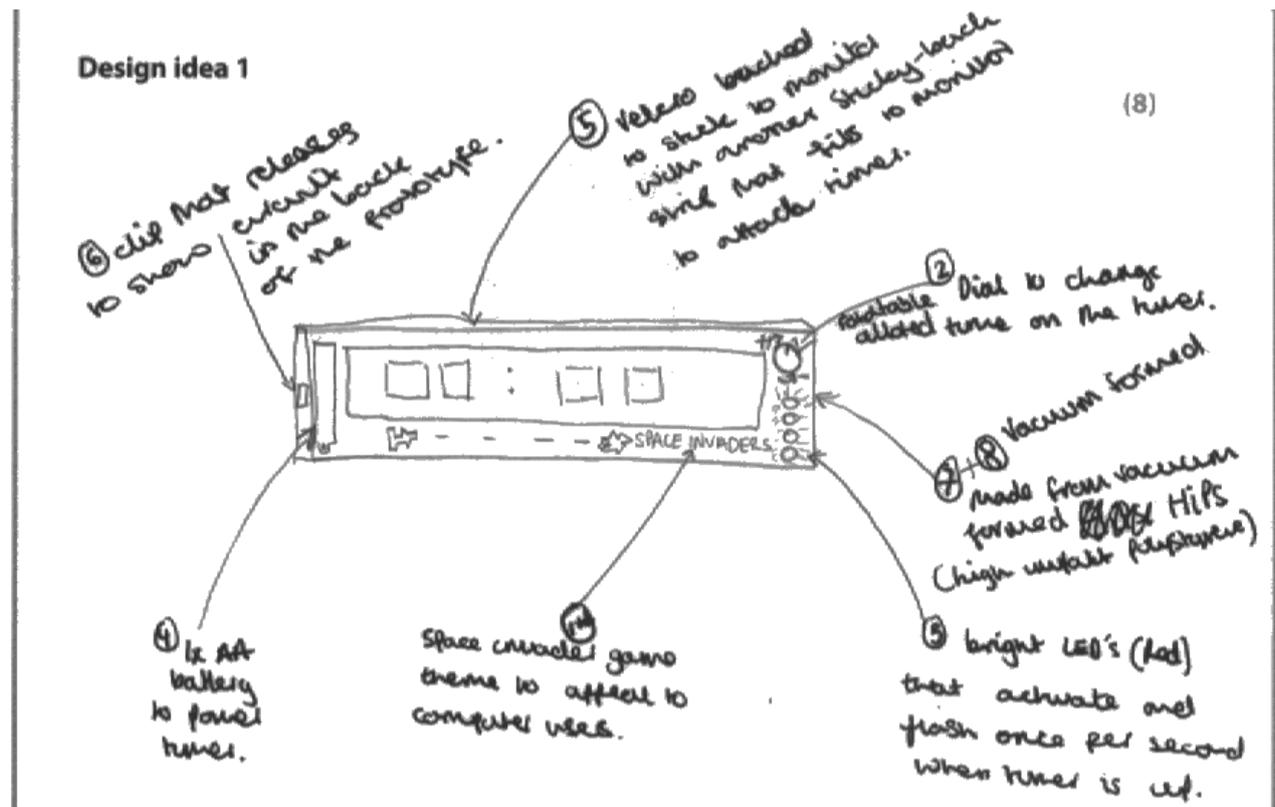
This is a high quality response, although a couple of marks have been lost by connecting the timer with a USB cable or a Bluetooth connection, and having a 'removable' section without suggesting how it would be removed. Numbering the eight responses helps both the candidate and the examiner to ensure that all specification points are addressed.



## ResultsPlus

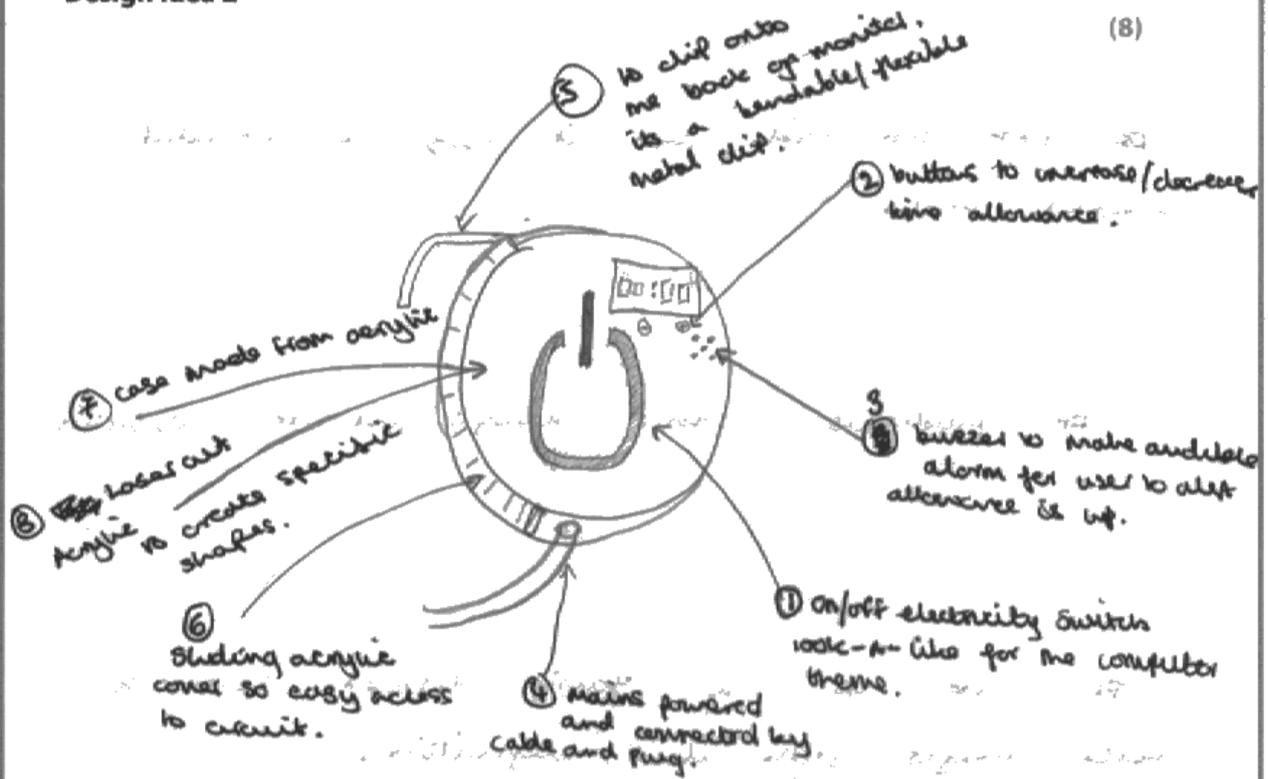
Examiner Tip

Number your points to make sure you've covered all eight.



Design idea 2

(8)

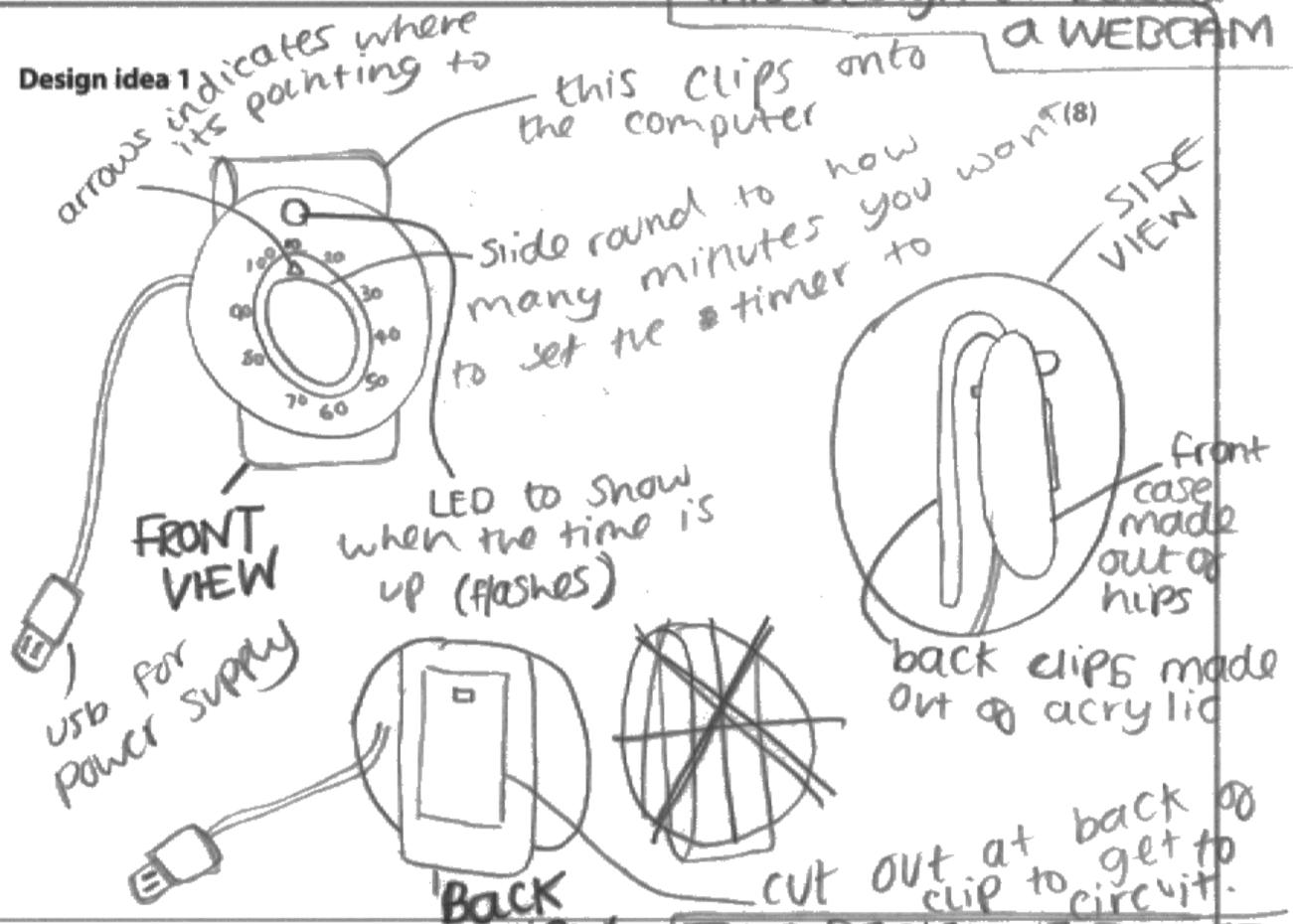


**ResultsPlus**  
Examiner Comments

This is a very clear response that achieved full marks.

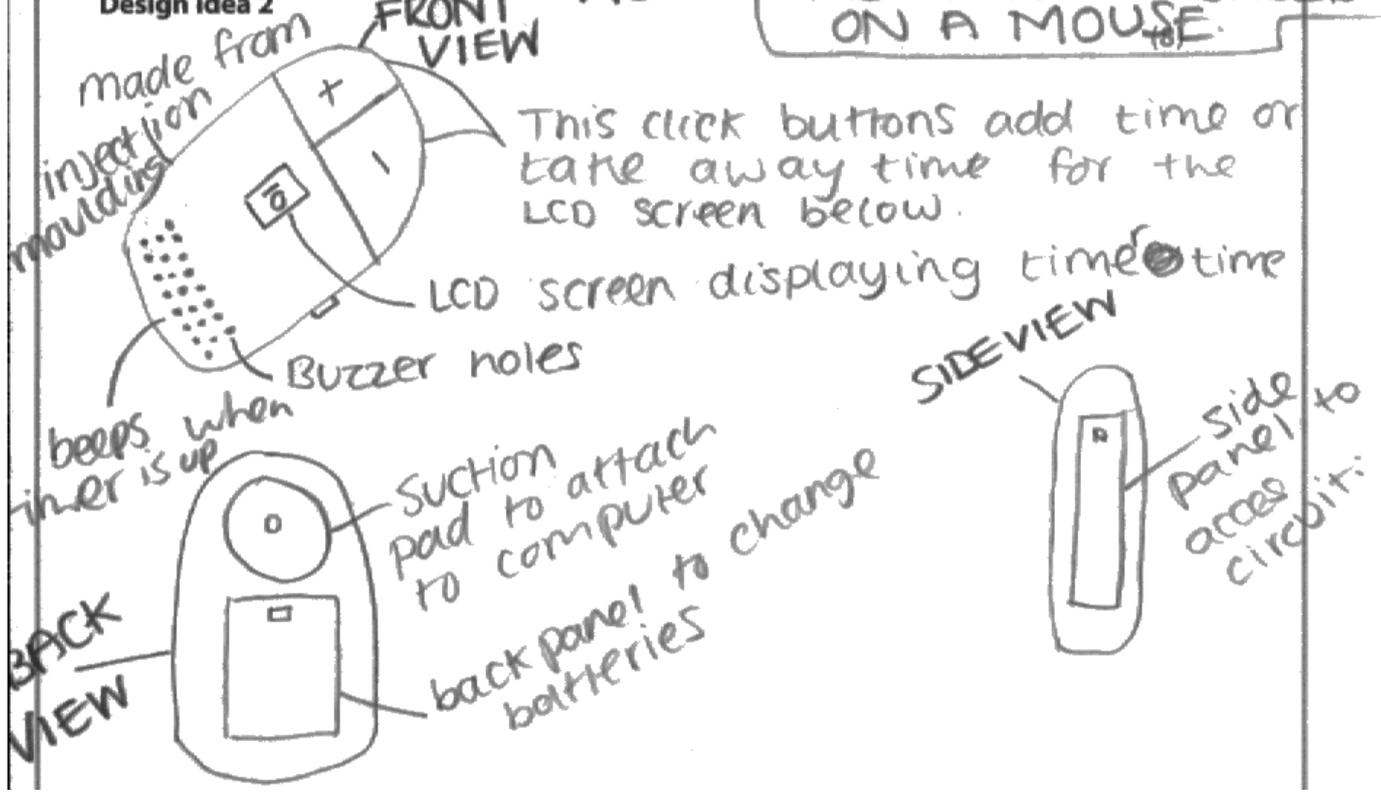
This design is based on a WEBCAM

Design idea 1



Design idea 2

THIS DESIGN IS BASED ON A MOUSE





**ResultsPlus**

**Examiner Comments**

While this response achieved over 50%, it lacks clarity. The candidate does not appear to have approached the eight points in a logical manner and talks about 'sliding round', 'click buttons' and 'removable panels' rather than 'rotary switch', 'push-to-make switch' and 'unscrewable panels', which fails to show subject-specific knowledge. They have also suggested using injection moulding for a one-off prototype.



**ResultsPlus**

**Examiner Tip**

Again, show that you know the technical names for components and materials.

### Question 3 (a)

Virtually all candidates explained that the handset was small and rounded, therefore would fit into the user's hand comfortably without digging in.

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

It fits comfortably into the user's hand.

(2)

The device is slim yet long to with a rounded edge, comfortably fit into a hand



**ResultsPlus**

**Examiner Comments**

The candidate has mentioned 'rounded edge' and 'comfort', and so achieved both marks.

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

It fits comfortably into the user's hand.

(2)

It is not too wide and it has a rounded shaped back.



**ResultsPlus**

**Examiner Comments**

This candidate has achieved one mark by pointing out that the handset is rounded, but failed to suggest why that is beneficial.



**ResultsPlus**

**Examiner Tip**

Don't forget to explain your response.

### Question 3 (b)

Yet again, this question saw far too many candidates suggesting weak responses such as 'cheaper', 'stronger', 'brighter'. It is difficult to know if the candidates feel these responses are correct or are guesses, (which is certainly better than no response at all). Correct responses require an understanding that LCD displays are coloured, have high resolution and low power requirements. Candidates who did give valid reasons tended to explain them well and thereby achieved the second mark.

*in to the user's hand*

(b) Explain **two** advantages of using an LCD screen for the handset. (4)

Advantage 1

so that the user will know what he's/she's *pressed*

Advantage 2

to make it easier to ~~press~~ operate.



**ResultsPlus**  
Examiner Comments

This response shows no understanding of LCD screens.

*also the back is rounded you use a better grip*

(b) Explain **two** advantages of using an LCD screen for the handset. (4)

Advantage 1

It is more appealing to the user as they can clearly see the information being displayed.

Advantage 2

There also a lot thinner than other screen types and can display higher resolution (PPI) and show full color.



**ResultsPlus**  
Examiner Comments

This candidate clearly understands the benefits of LCD screens, although their response is a little jumbled. The clarity of the display [1] makes it look more attractive [1]. A better response would then have said the colour or the high resolution display makes it easier to read, or its thinness makes it easier to build into a smaller handset.



**ResultsPlus**  
Examiner Tip

For an 'explain' question, make sure that you give a point and then explain it.

### Question 3 (c)

Candidates clearly understand the benefits of CAD/CAM, and most scored highly in this question. There are still a significant minority who suggest CAD is faster than drawing by hand, whereas it is only the editing and correcting that is faster if the designer is skilled in both techniques.

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.

(4)

Advantage 1

You only have to pay one person to design it on a computer and then the machines will mass-produce it.

Advantage 2

CAM is less likely to make mistakes whereas people labouring may make more this will cost the company more so CAM is more efficient.



**ResultsPlus**

Examiner Comments

There is no awardable material here. Mass production techniques are highly automated, so the candidate's suggestion that 'people labouring may make mistakes' is not appropriate.



**ResultsPlus**

Examiner Tip

Don't assume that computers are the only way of achieving high quality.

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.

(4)

Advantage 1

It is alot quicker than manually drawing designs out by hand. 3D modelling can be used.

Advantage 2

Circuits can be designed and tested virtually before money is potentially wasted building a prototype that does not work.



**ResultsPlus**

**Examiner Comments**

In their first point, the candidate has just achieved both points by saying that CAD is faster when 3D modelling is used.

The second point is clear; virtual testing saves having to build prototypes.

### Question 3 (d)

It was encouraging to see that far fewer candidates left this question blank or just wrote a couple of lines compared to responses seen in previous years. While candidates considered appropriate performance characteristics, they often incorrectly suggested that HIPS is more durable or heavier than aluminium.

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

(6)

Hips (high impact polystyrene) would be good for the handset as it can be sustainably manufactured by laser cutting the exact amounts of the material required before vacuum forming it into shape. The wasted materials are minimised. Unlike Hips, Aluminium conducts electricity so using it for the casing of the handset could prove dangerous as there is a risk of an electric shock. Manufacture with aluminium is also less sustainable as it can not be vacuum formed and instead has to be shaped through annealing which is a more time consuming and unenvironmentally friendly as it requires a renewable fuel.

(Total for Question 13 = 16 marks)



**ResultsPlus**

**Examiner Comments**

This is a very weak response. The only valid point is that aluminium conducts electricity. The quality of written communication is reasonable, so two marks are awarded.



**ResultsPlus**

**Examiner Tip**

Don't use bulletpoints or lists for the QWC questions or you'll lose marks.

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

(6)

HIPS is cheaper, <sup>to buy</sup> so the handset could be cheaper ~~to~~ to make with it, resulting in higher profit. HIPS can be vacuum formed while aluminium cannot - this is a fast manufacturing method. Aluminium is tougher so it is more resistant to impacts. HIPS does not conduct electricity while aluminium does so there is no danger of the casing becoming live with HIPS. Aluminium is heavier so it would be easier to hold for a long time with HIPS. HIPS is available in a wide range of colours but aluminium is shinier and better-looking to many people as well as seeming higher quality. HIPS is made from oil, a non-renewable resource, so it is less sustainable than aluminium. Both materials can be recycled.



**ResultsPlus**

**Examiner Comments**

By discussing lower material cost, ease of manufacture and electrical conductivity, as well as having a good quality of written communication, this candidate has achieved the full six marks.



**ResultsPlus**

**Examiner Tip**

Use most of the available space if you want to achieve high marks in the 'evaluate' questions.

## Question 4 (a)

Virtually all candidates identified the resistor/fixed resistor.

## Question 4 (b)

Again, most candidates could accurately suggest that the thermistor changes its resistance as temperature changes,

(b) Explain the function of a thermistor.

A thermistor detects the <sup>temperature</sup> heat going through the circuit and balances the circuit current which activates the lamp. (2)



**ResultsPlus**

**Examiner Comments**

One mark - the candidate has mentioned temperature, but not resistance.

(b) Explain the function of a thermistor.

A thermistor changes resistance based on the temperature of the room. (2)



**ResultsPlus**

**Examiner Comments**

The candidate is aware of the significance of both resistance and temperature, and so achieved both marks.

## Question 4 (c)

Candidates generally knew that the operational amplifier compares its two inputs, but their definitions tended to lack clarity. Very few reported that the difference between the inputs is then amplified before the output stage.

(c) Referring to its two inputs, describe how the operational amplifier (Op-Amp) works as a comparator.

(3)

As the positive current voltage travels through the circuit it is compared against the temperature from the thermistor is compared against the brightness a user wants the lamp and the Op-Amp will boost the ~~temp~~ current if not enough <sup>heat/cold is</sup> produced by the thermistor. as produced by the thermistor.



### ResultsPlus Examiner Comments

The op-amp compares voltages, not temperatures or light levels. It then amplifies the voltage consistently, rather than amplifying the current when it is needed. This response is too vague to achieve marks.



### ResultsPlus Examiner Tip

Make your response clear and accurate.

(c) Referring to its two inputs, describe how the operational amplifier (Op-Amp) works as a comparator.

(3)

The operational amplifier in this circuit will compare the current in the negative and positive inputs and then allow current through ~~it~~ ~~the~~ or not through it if the current in the positive and negative inputs is the same or different.



### ResultsPlus Examiner Comments

This response shows an understanding of positive and negative inputs to achieve two marks. Mention of amplification would have achieved a third mark.

## Question 4 (d)

By this stage in the paper, questions are becoming more challenging, which was reflected in the responses to this question. Many candidates suggested increasing voltages, changing resistances or adding transistors. Few candidates answered this question correctly.

(d) This circuit switches the light on at low temperatures.

Explain how the lamp could be made to come on at high temperatures.

(2)

Change the amount of resistors and re-program the operational amplifier.



**ResultsPlus**

**Examiner Comments**

This candidate shows no understanding of the op-amp, achieving no marks.



**ResultsPlus**

**Examiner Tip**

It's always worth a guess if you don't know!

(d) This circuit switches the light on at low temperatures.

Explain how the lamp could be made to come on at high temperatures.

(2)

move the thermistor to the positive input for the op-amp as the negative is inverting



**ResultsPlus**

**Examiner Comments**

This response shows a clear understanding of the operational amplifier and achieves full marks.

## Question 4 (e)

While many candidates responded correctly here, is it disappointing to see that after two years studying a GCSE in Electronic Products, many students still do not understand the function of the transistor. It does not reduce current, protect components, or even 'share the current two ways'.....

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

(2)

To ~~keep~~ stop the circuit  
conducting electricity.



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

(2)

A transistor stops electricity going  
the wrong way and it sends it ~~the~~ one  
way round. Forward bias means the  
electricity only goes the way ~~of~~ the transistor ~~is~~.



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

(2)

The transistor will reduce the current  
therefore stopping the bulb from  
blowing up.



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

(2)

The transistor is an electronic switch that turns on the lamp when given the right correct output from the output op-amp.



**ResultsPlus**

**Examiner Comments**

The candidate understands that the transistor acts as a switch for the lamp - full marks.



**ResultsPlus**

**Examiner Tip**

Make sure that you know what all of the common components do.

### Question 4 (f)

The vast majority of students achieved full marks in this question.

(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)

$$V = I \times R \quad \triangle$$
$$9 = 0.25 \times R$$
$$9 \div 0.25 = 36$$



**ResultsPlus**

**Examiner Comments**

This is a typical response for this question.



**ResultsPlus**

**Examiner Tip**

Include your working out - that way you'll still get most of the marks even if your calculations are wrong.

## Question 4 (g)

Students are clearly aware of the benefits of CAD, and can report them clearly. Those who failed to achieve high marks in this question tended to relate their responses to mass production rather than virtual modelling. Candidates continue to suggest that CAD is faster than traditional methods, whereas it is the editing, repeating and deleting that is faster; the original drawing process is as labour-intensive as traditional methods.

\* (g) 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)

There are many advantages and disadvantages to doing virtual modelling when designing cases for electronic products. Advantages are that you can visualise the case on a computer without actually making it. ~~You~~ You don't have to keep wasting materials making cases for a chair that they might not like, you can just show them the computerised model. You can do all sorts of experimenting with the case when its virtually modelled like changing the colour and adding parts on etc.

Disadvantages are that you need a trained person to do the modelling and pay them for it. You aren't able to ~~really~~ actually feel what the product is like and physically touch it. Virtual modelling can take a long time to do and a long time to render the cases. ~~You~~ You need a fast computer to do it.



**ResultsPlus**  
Examiner Comments

The candidate has discussed visualisation, saving materials, and the need for additional training. Good QWC ensures that this response achieves full marks.

\* (g) 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)

Virtual modelling is when a person or persons create a three dimensional representation of what they wish to produce. Virtual modelling can be useful because it cuts out a large part of the prototype stage, this saves companies lots of money as the prototypes can be created on the computer. However, there are certain things that simply cannot be checked on a 3D software program. Some things that need testing may not be fully tested and this leads to flaws later on in the designing process. Also the feel of the product can only be guessed, a real prototype case for a phone must be made before it is mass produced.



**ResultsPlus**

**Examiner Comments**

This candidate has been awarded two marks. They implied a saving by needing no physical materials for modelling, but this point is poorly made, and QWC is weak, so the candidate only just achieved the marks.



**ResultsPlus**

**Examiner Tip**

Discuss your points clearly and make sure they're relevant.

## **Paper Summary**

In summary, candidates are performing well in this paper. Centres are preparing students appropriately with regard to the knowledge required for success and the way in which to answer the various types of question used in the paper. Candidate responses are generally of a high standard, particularly for the design question (Q12) and the extended writing questions (Q13d and Q14g).

## **Grade Boundaries**

Grade boundaries for this, and all other papers, can be found on the website on this link:

<http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx>

Ofqual



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