

Surname	Centre Number	Candidate Number
Other Names		0



GCSE – NEW

3601U10-1



FRIDAY, 24 MAY 2019 – AFTERNOON

**DESIGN AND TECHNOLOGY
UNIT 1
ENGINEERING DESIGN**

2 hours

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	10	
2.	10	
3.	15	
4.	20	
5.	20	
6.	25	
Total	100	

ADDITIONAL MATERIALS

In addition to this examination paper, you will need a calculator.

INSTRUCTIONS TO CANDIDATES

Answer **all** questions.

Write your name, centre number and candidate number in spaces at the top of this page.

Write your answers in the spaces provided in this booklet. If you run out of space, use the continuation page at the back of the booklet, taking care to number the question(s) correctly.

Use black ink or black ball-point pen.

Do not use pencil or gel pen.

Do not use correction fluid.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part question. You are advised to divide your time accordingly.

The total number of marks available is 100.

You are reminded of the need for good English and orderly, clear presentation in your answers. The quality of your written communication, including appropriate use of punctuation and grammar, will be assessed in your answer to question 4(b).

1. The picture below shows the International Organisation for Standardisation (ISO) logo.



(a) Describe **one** advantage to the consumer of labelling products with the ISO logo. [2]

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(b) The Trade Descriptions Act specifies how companies can describe their products or services.

(i) Explain what could happen to a company that does not accurately describe their product. [2]

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(ii) Outline the rights of a consumer who has purchased a product which has **not** been accurately described. [2]

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(c) Explain the difference between market pull and technology push.

[4]

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2. The picture below shows a disposable eco plate that will biodegrade in soil.



(a) Complete the sentence below by adding in the missing words.

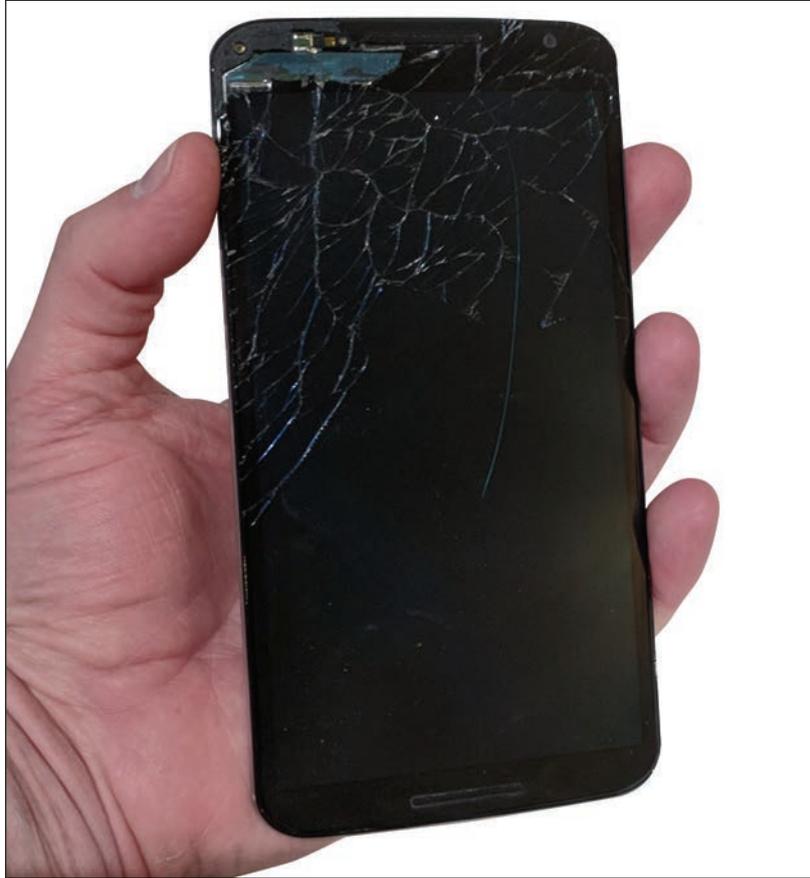
Sustainability in design terms means avoiding the overuse of
resources in order to maintain an ecological balance for generations. [2]

(b) Explain **one** advantage and **one** disadvantage of using disposable eco plates that biodegrade in soil. [4]

Advantage:
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Disadvantage:
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- (c) Repair is one of the 6 Rs of sustainability. Complex electronic products are often difficult to repair like the mobile phone shown below.



Explain the function of self-repairing (micro-encapsulated) materials and how this would improve the sustainability of a mobile phone. [4]

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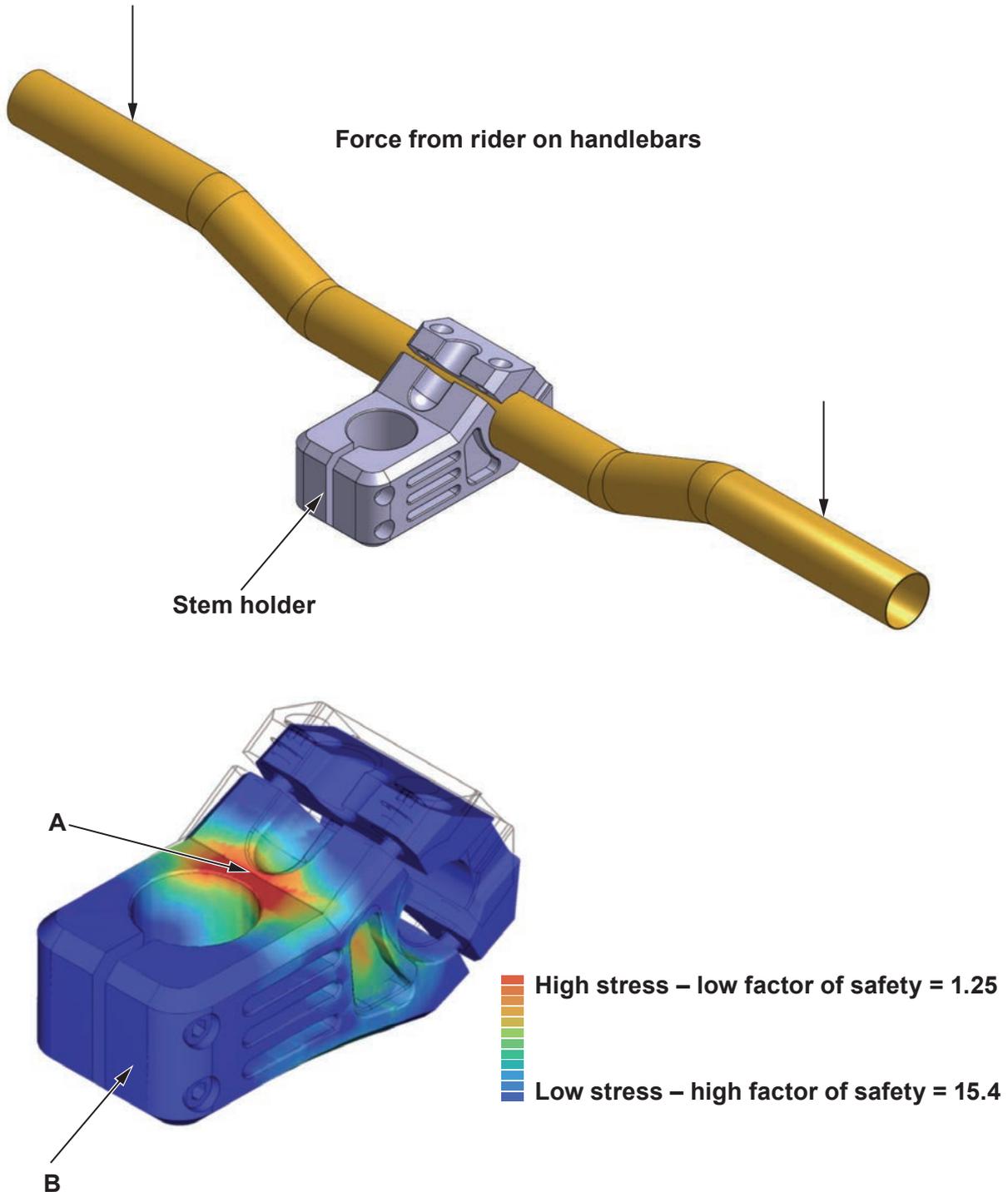
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3. Design Engineers use virtual testing when designing with 3D CAD. The first image below illustrates the handlebars and stem holder from a bicycle and how the force is applied. The second image shows the stress within the stem holder from the applied force.

If a product is over stressed it may break. Products are usually designed with a factor of safety of two (2) meaning it is at least twice as strong as needed.



(a) Describe in detail **one** advantage of virtual testing using a CAD system compared to traditional physical product testing. [2]

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(b) Complete the table below by inserting **True** or **False** next to each of the statements related to the CAD model. [6]

Statement	True or False
The design is most likely to fail at point A .	
Material could be removed to reduce the weight at point B .	
The design will bend upwards under load.	
The blue colour indicates areas of low stress.	
The design passes the specification factor of safety target of twice maximum stress.	
This product would be safe to use under these forces.	

(c) (i) Name a suitable material to manufacture the bike stem holder. [1]

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(ii) Bolts are used to clamp the stem holder in place securely. Name a suitable material for the bolts and explain why this material is suitable. [3]

Named material:

Explanation:

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- (iii) A logo or brand name is required as part of the aesthetic finish of the product. Name a technique for applying a logo to the product and outline the main manufacturing steps. [3]

Named technique:

Explanation:

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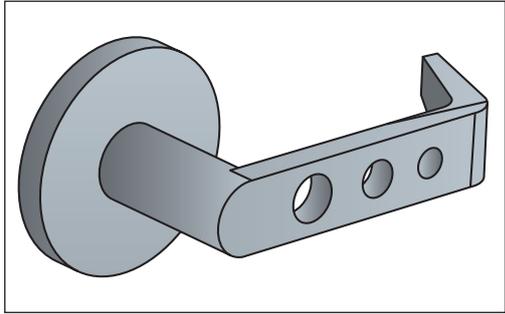
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Turn over

4. The images below show an existing door handle and a new prototype design.

	
<p>Existing design</p>	<p>Prototype design</p>

(a) To test the performance of the new design, a prototype handle was made using a CNC milling machine.

(i) Explain **one** advantage and **one** disadvantage of using a CNC milling machine compared to a 3D printer. [4]

Advantage:

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Disadvantage:

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(ii) An additional prototype handle is to be created by metal casting.

Describe a process of metal casting the handle. [6]

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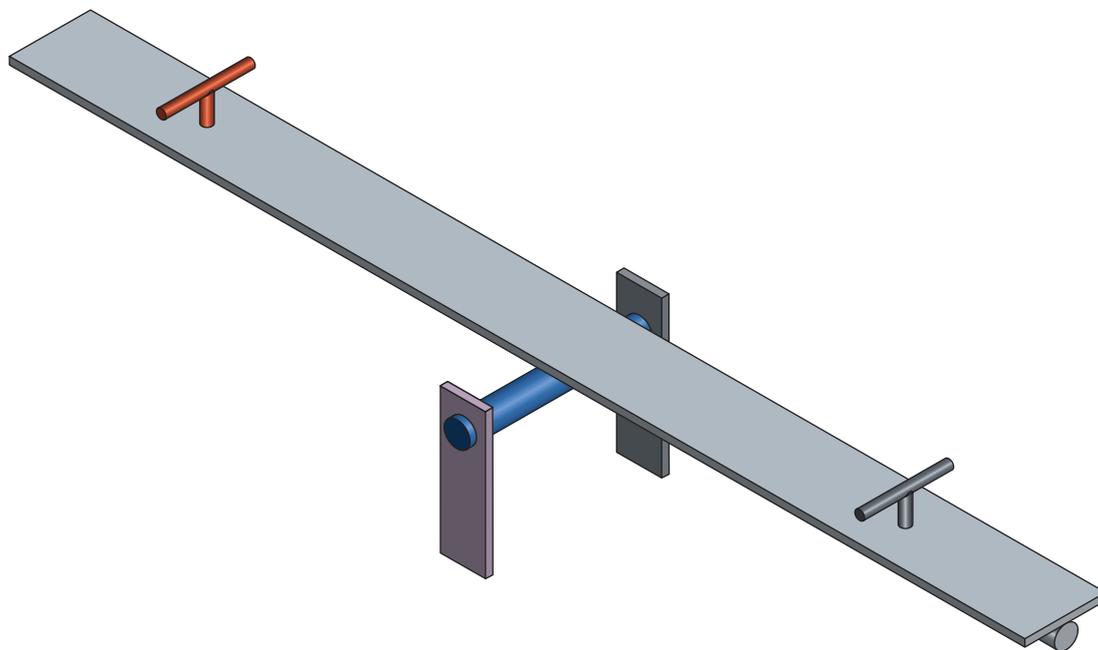
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5. (a) Study the image of a seesaw shown below.



- (i) Circle the correct classification for the lever used in the seesaw. [1]

Class 1

Class 2

Class 3

- (ii) Define the term 'equilibrium' in relation to the seesaw. [1]

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- (iii) In the space below draw and label a diagram of the seesaw mechanism. [3]

(c) Evaluate the functional and mechanical properties of stainless steel that makes it appropriate for the bottle opener. [5]

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(d) A hardwood handle is bonded to the stainless steel body of the bottle opener.
Evaluate how this benefits the user and impacts on recyclability. [5]

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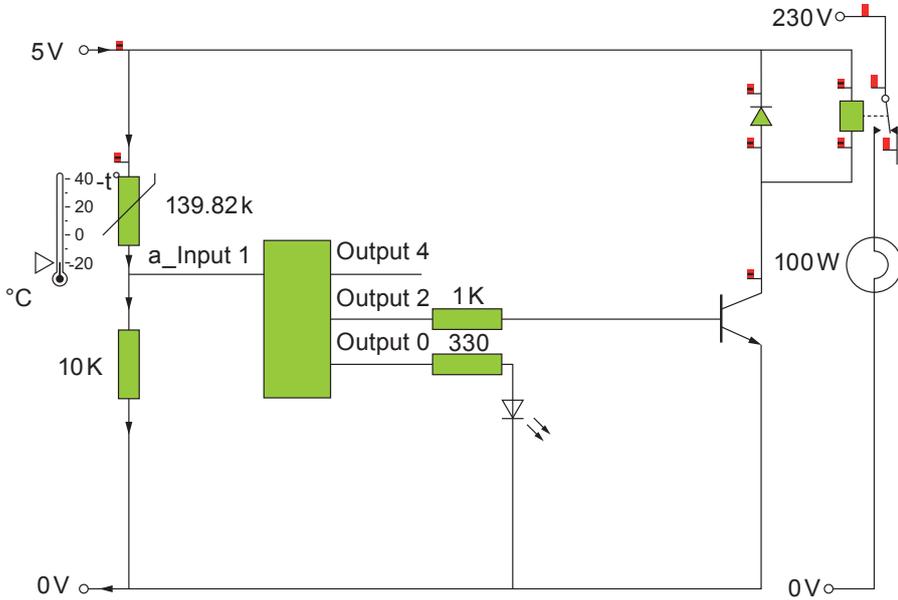
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6. (a) A microcontroller circuit diagram for a reptile enclosure is shown below. The light also provides heat for the enclosure.



- (i) Name of input sensor. [1]
 - (ii) Name of output component. [1]
- (b) The microcontroller circuit is used to control the temperature in a reptile enclosure.
- (i) Circle whether the input sensor is a digital or analogue device. [1]

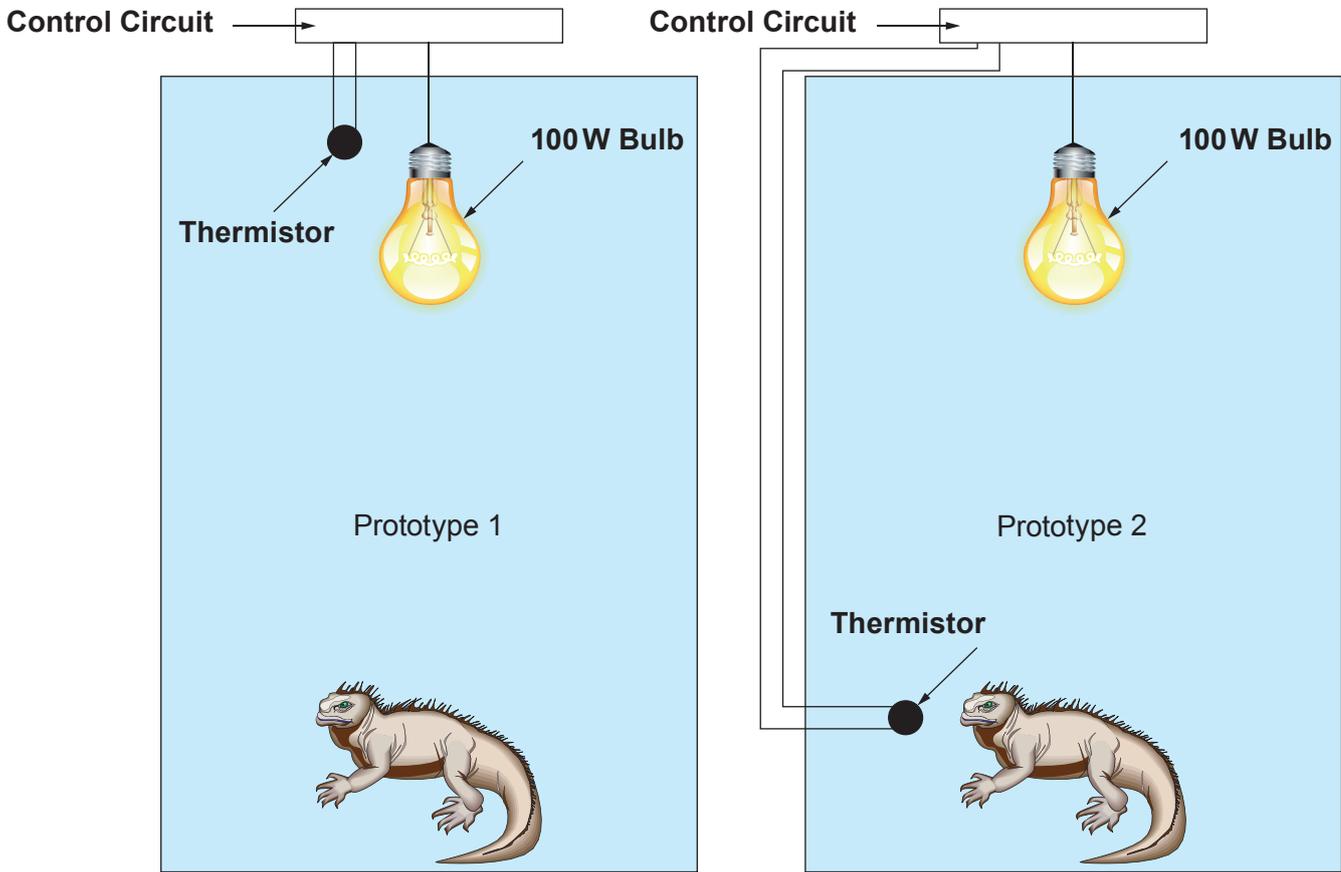
digital	analogue
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 - (ii) Explain the advantages of using a reprogrammable PIC microcontroller when creating a prototype. [2]

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- (c) Describe how the control system could be calibrated so that the lamp will switch on at 20 degrees. [3]
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- (d) Two prototype designs as shown below have been created to test the performance of the reptile enclosure. The prototypes will test how well the systems keep the enclosure at the appropriate temperature.



- (i) State **which** prototype design will function better. [1]

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- (ii) Explain **why** this prototype design functions better. [2]

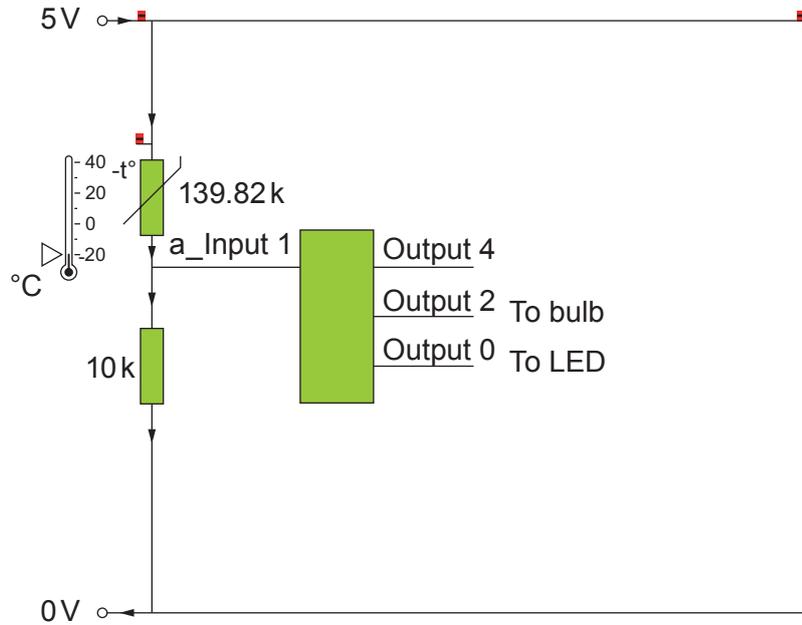
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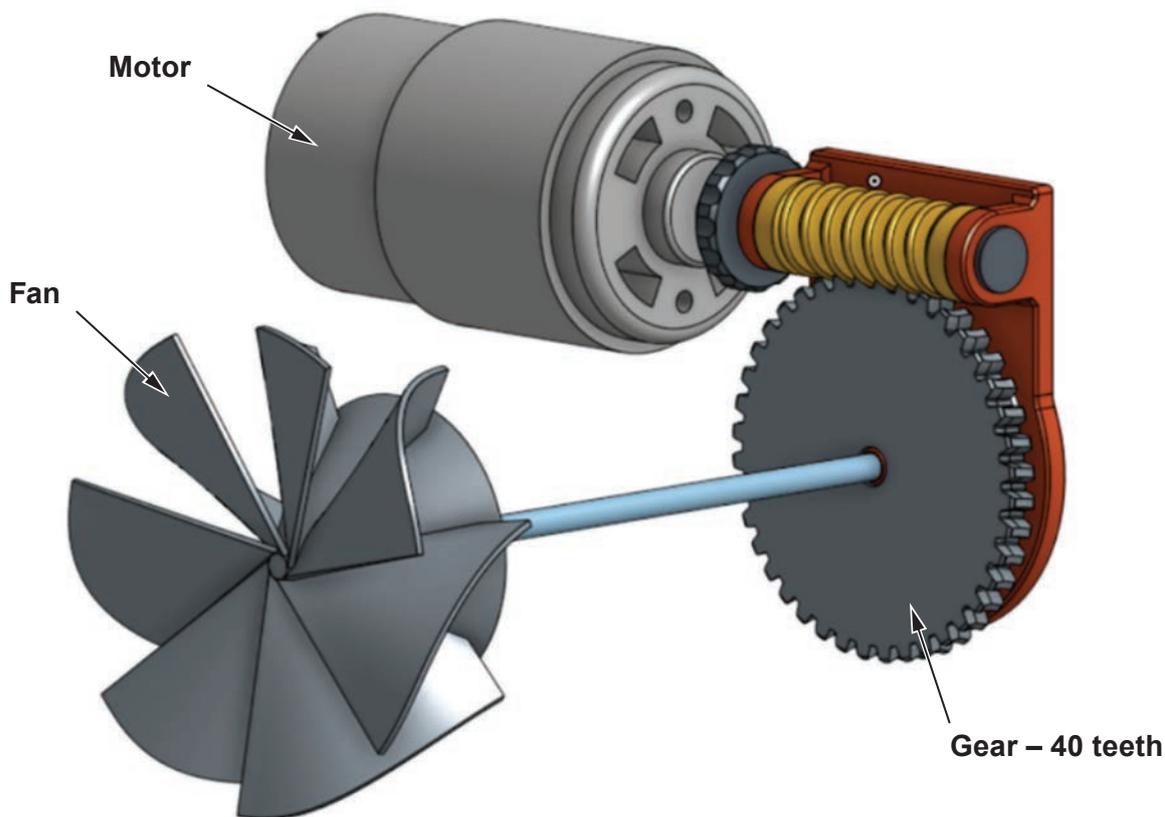
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- (iii) The design team believe they can improve the control system by adding a **fan** for a third prototype.

Draw and label the new components to power the fan connecting from output pin 4.
[6]



- (e) The third prototype was found to be noisy due to the fan spinning too fast. The design team have added the gear system shown below:



- (i) Name the gear system used. [1]

- (ii) Explain why this is a good choice to slow the fan down. [2]

- (iii) The motor spins at 1200RPM. The gear has 40 teeth. Calculate the rotational velocity of the fan. [2]

- (iv) Draw and label a diagram showing how the fan can have a rotational velocity (RV) of 40 RPM. [3]

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