



GCSE – **NEW**

3601U10-1

FRIDAY, 24 MAY 2019 – AFTERNOON

DESIGN AND TECHNOLOGY

UNIT 1

ENGINEERING DESIGN

2 hours plus your additional time allowance

Surname _____

Other Names _____

Centre Number _____

Candidate Number 0 _____

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 the spaces provided on the front cover.

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

Use black ink, black ball-point pen or your usual method.

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]

1(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]

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

2. The picture opposite 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]

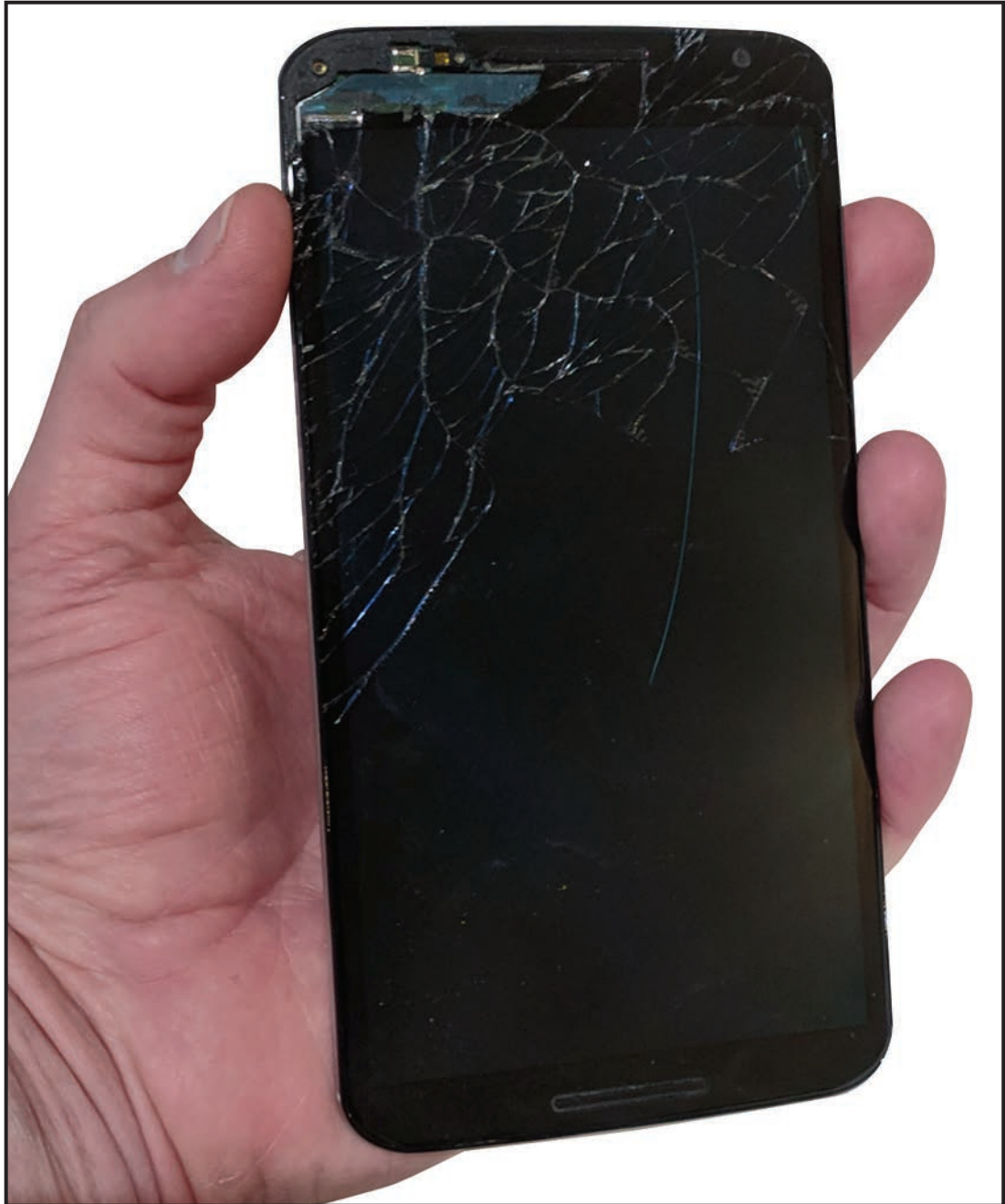


Biodegradable
10 INCH
Eco plate

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

Advantage: _____

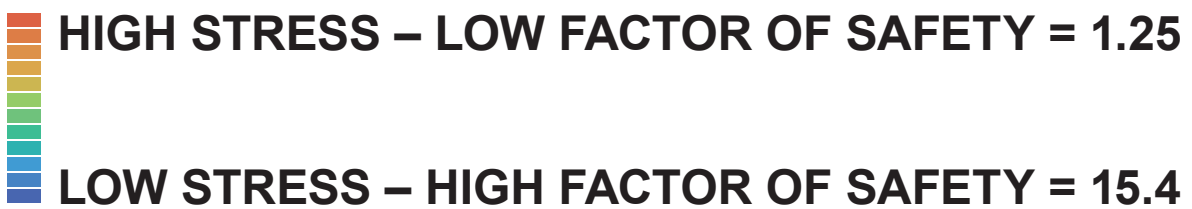
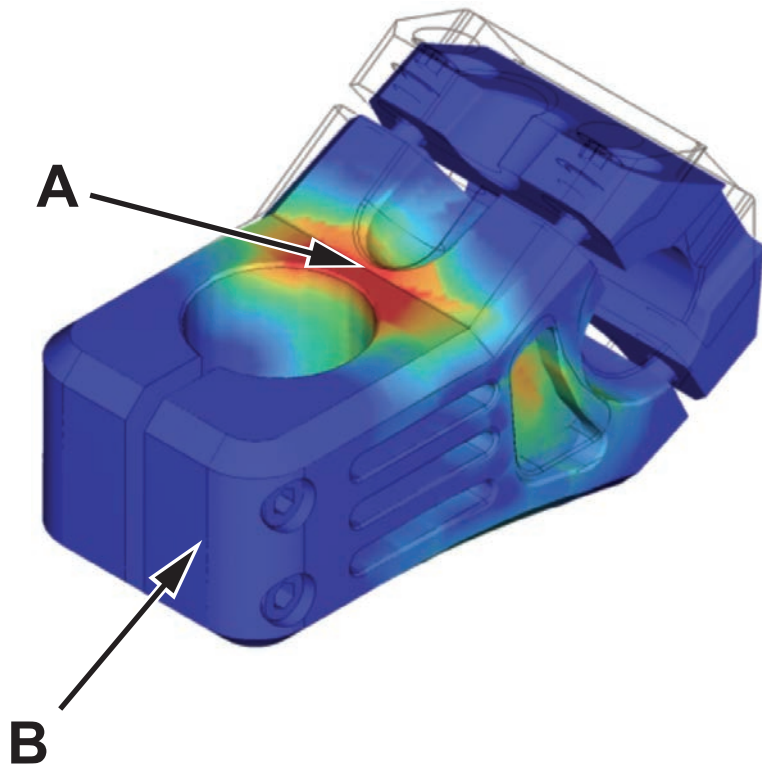
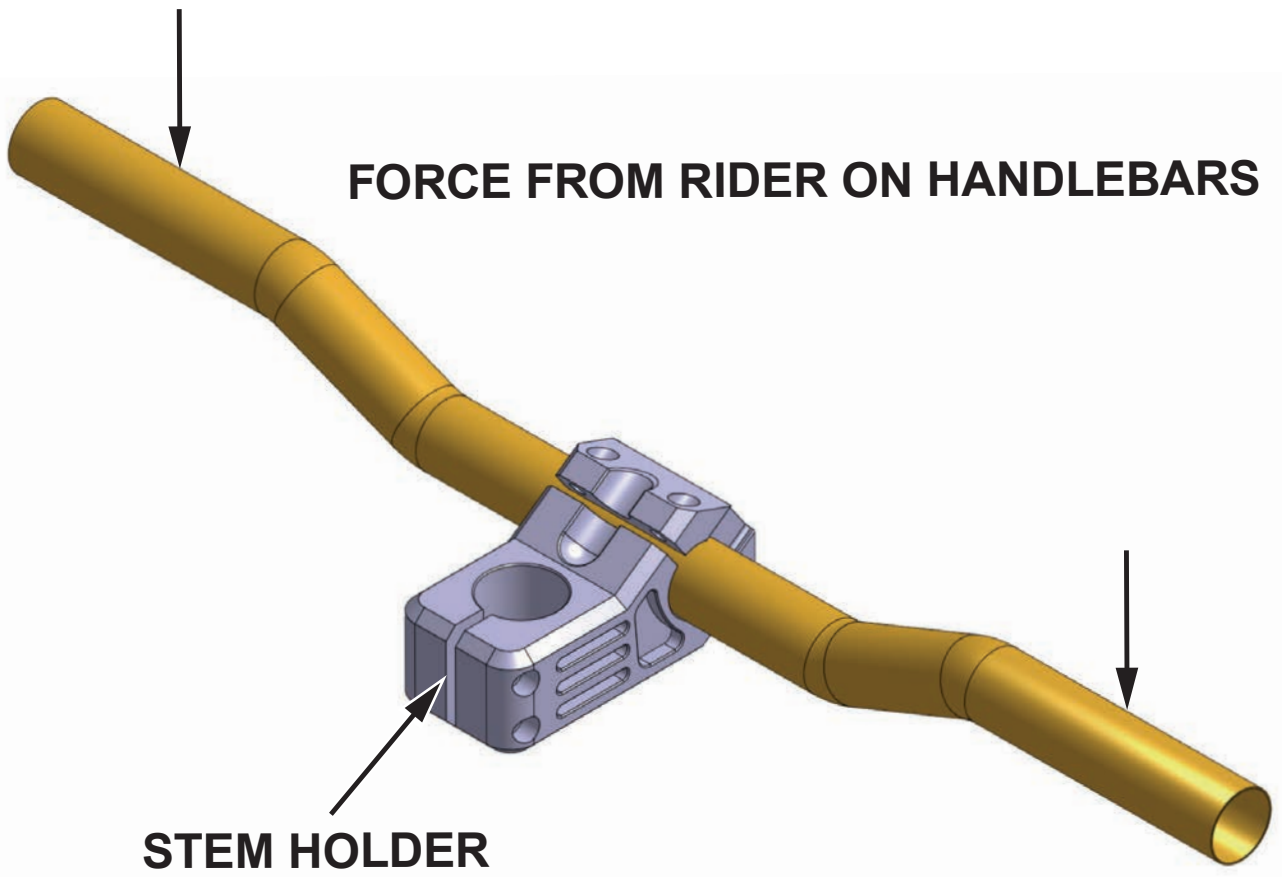
Disadvantage: _____



- 3. Design Engineers use virtual testing when designing with 3D CAD. The first image opposite 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.



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

(b) Complete the table opposite 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.	

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

(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: _____

3(c) (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: _____

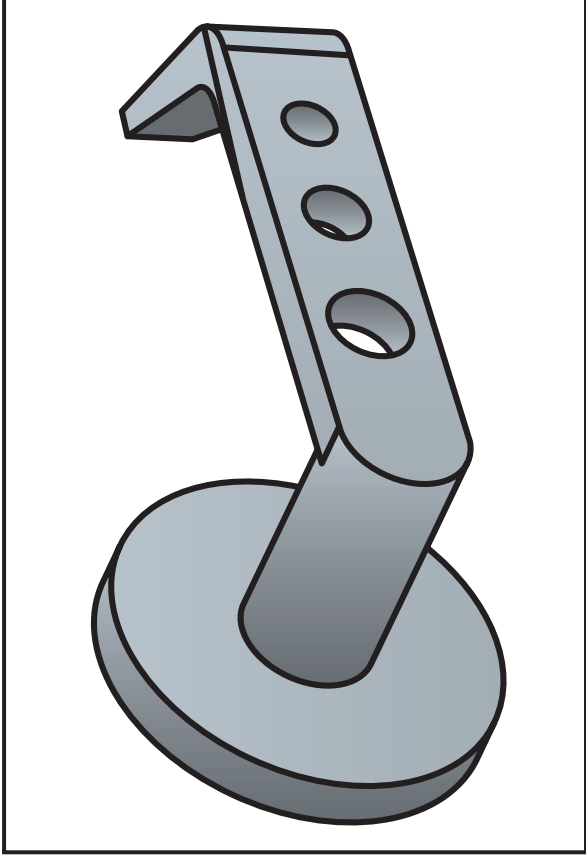
- 4. The images opposite show an existing door handle and a new prototype design.
 - (a) To test the performance of the new design, a prototype handle was made using a CNC milling machine.
 - (i) Explain ONE advantage and ONE disadvantage of using a CNC milling machine compared to a 3D printer. [4]

Advantage: _____

Disadvantage: _____



Existing design



Prototype design

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

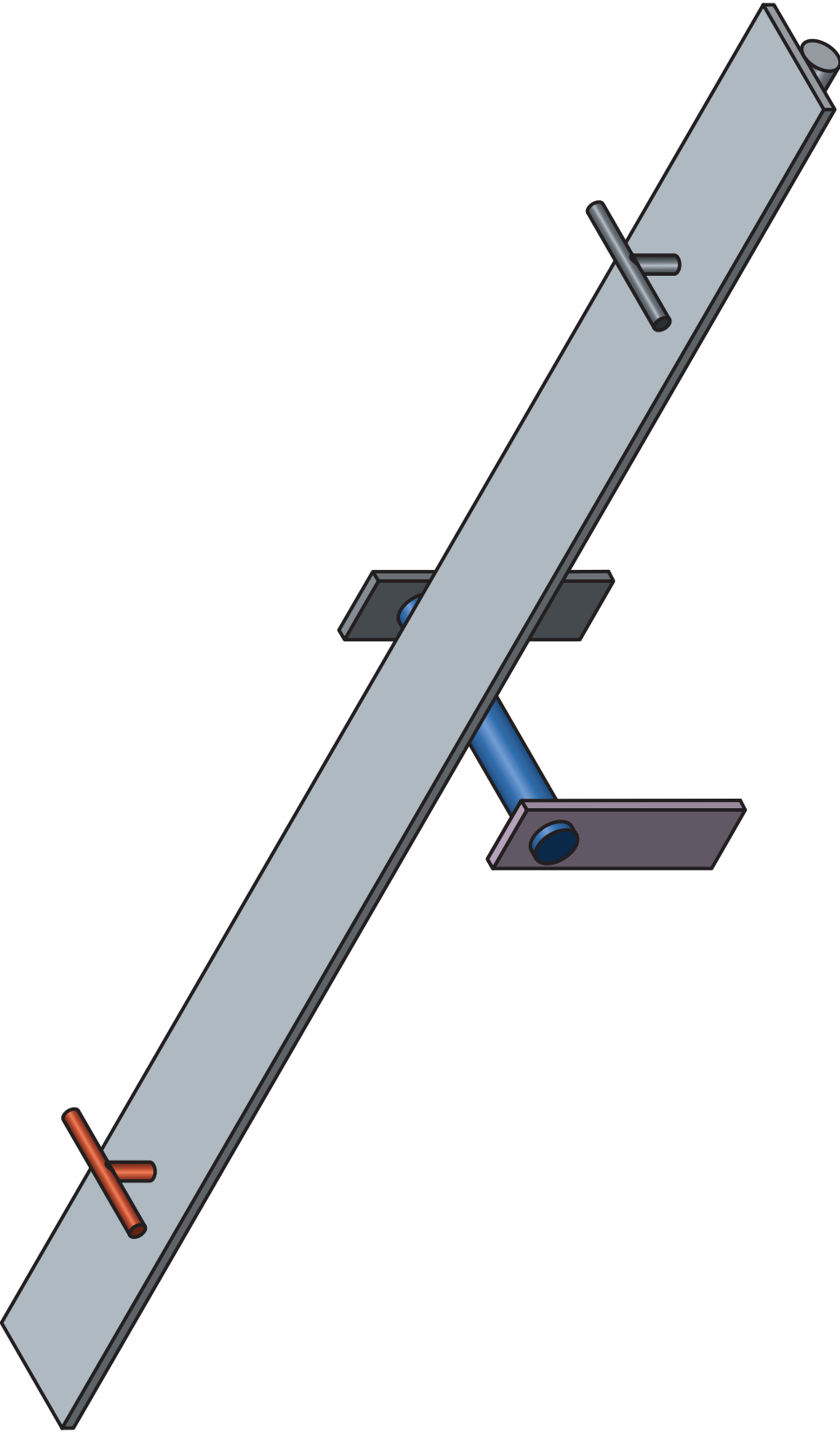
(i) Circle the correct classification for the lever used in the seesaw. [1]

Class 1

Class 2

Class 3

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

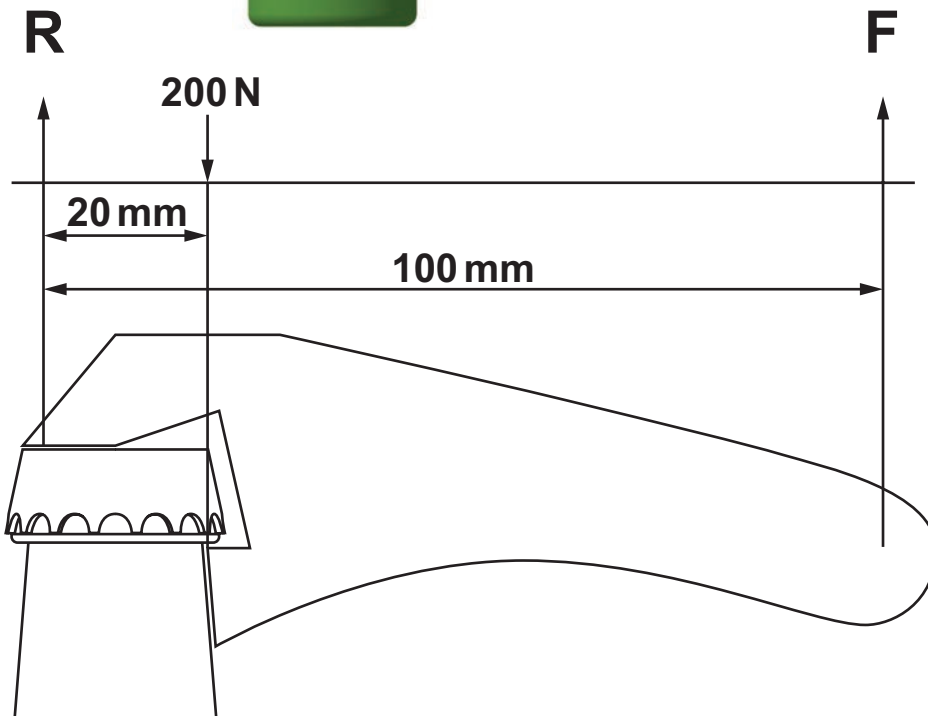


5(a) (iii) In the space below draw and label a diagram of the seesaw mechanism. [3]

HARDWOOD HANDLE



**STAINLESS STEEL
BODY**



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



- (i) Name of input sensor.

[1]

- (ii) Name of output component.

[1]

6(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

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

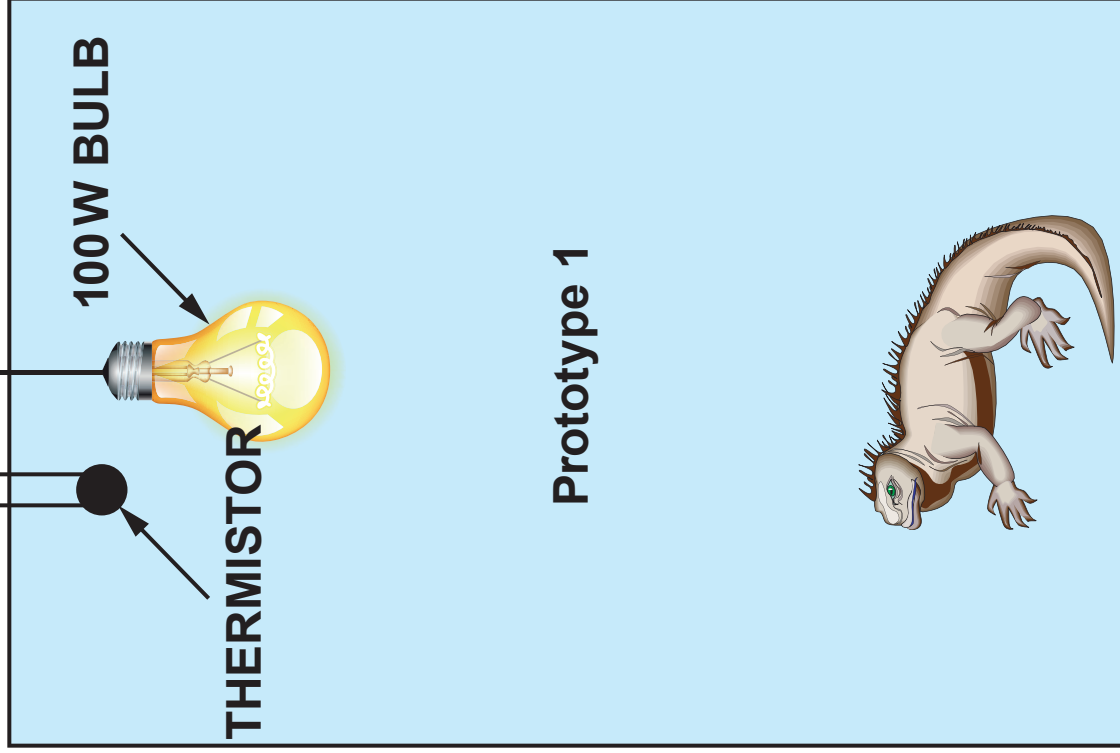
6(d) Two prototype designs as shown opposite have been created to test the performance of the reptile enclosure. The prototypes will test how well the systems keep the enclosure at the appropriate temperature.

(i) State WHICH prototype design will function better. [1]

(ii) Explain WHY this prototype design functions better. [2]

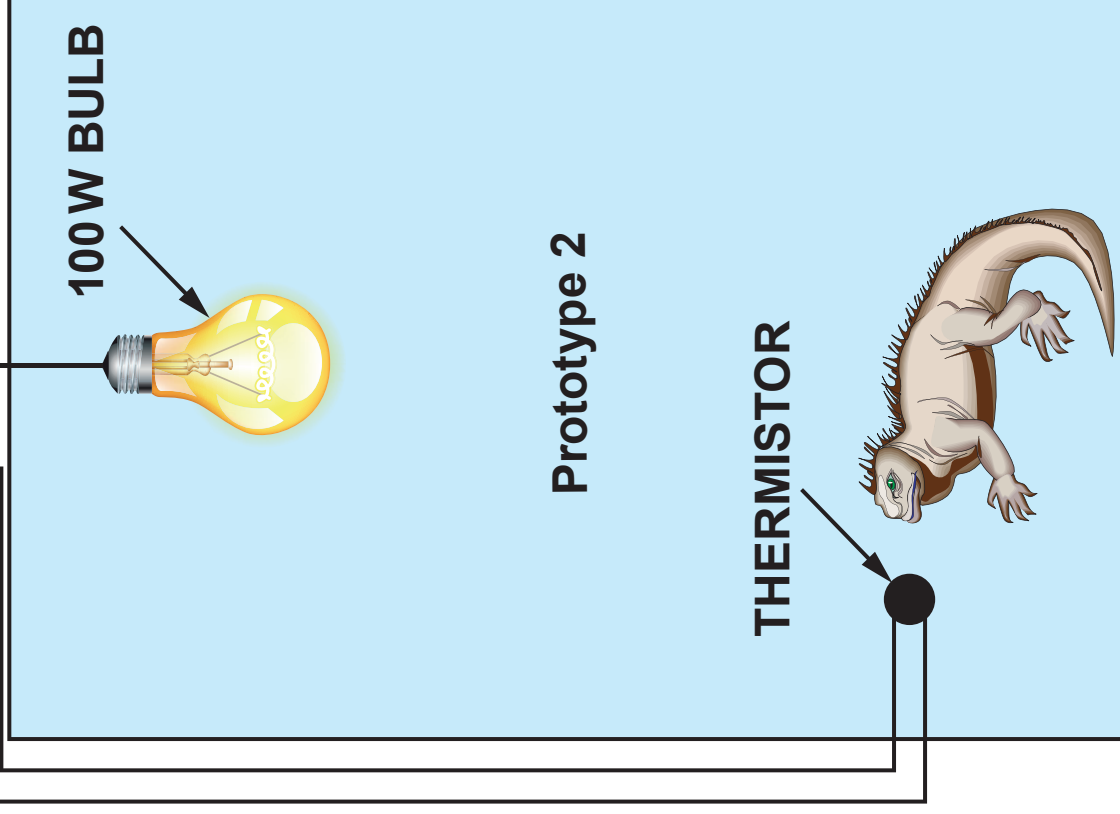
CONTROL

CIRCUIT →



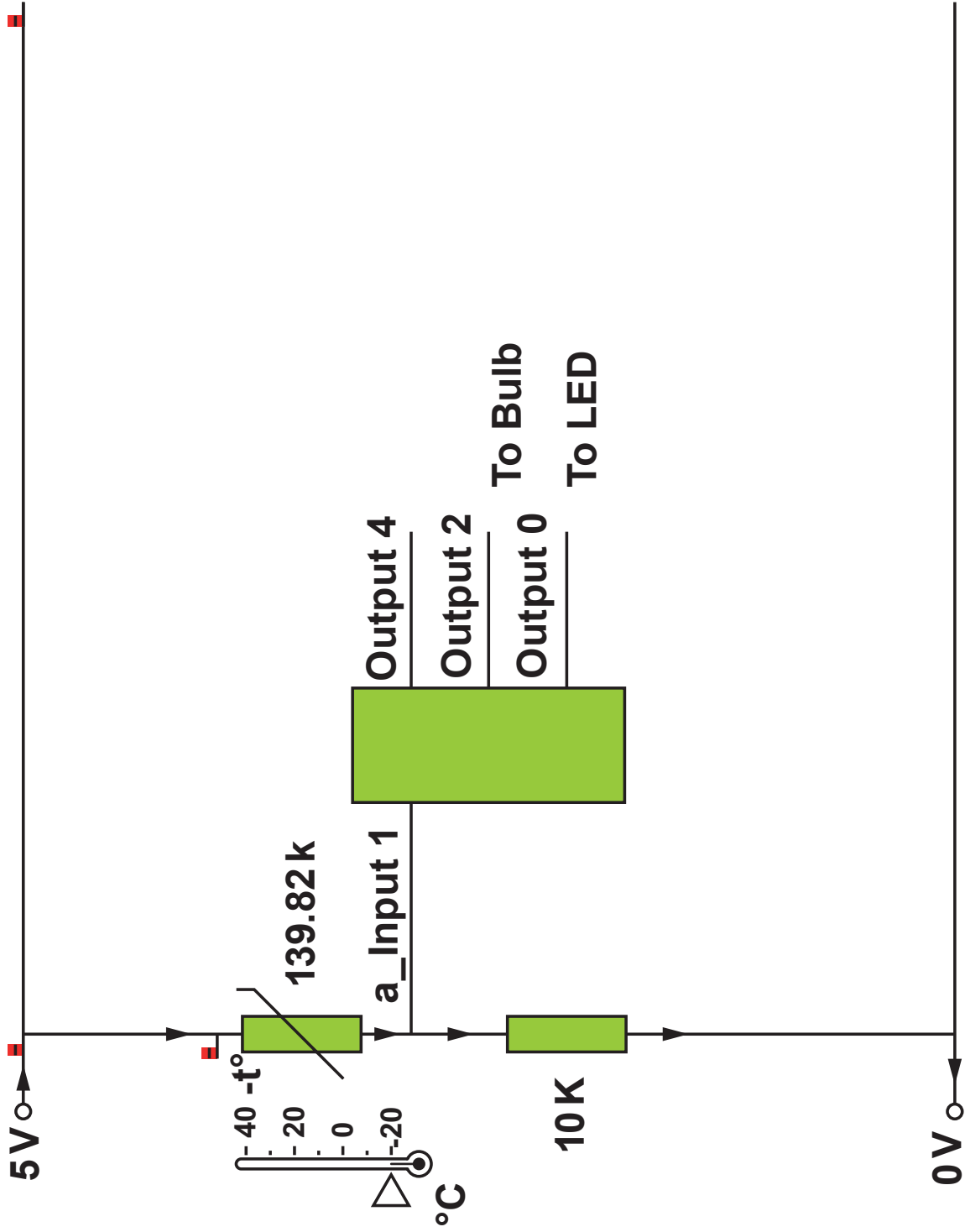
CONTROL

CIRCUIT →



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

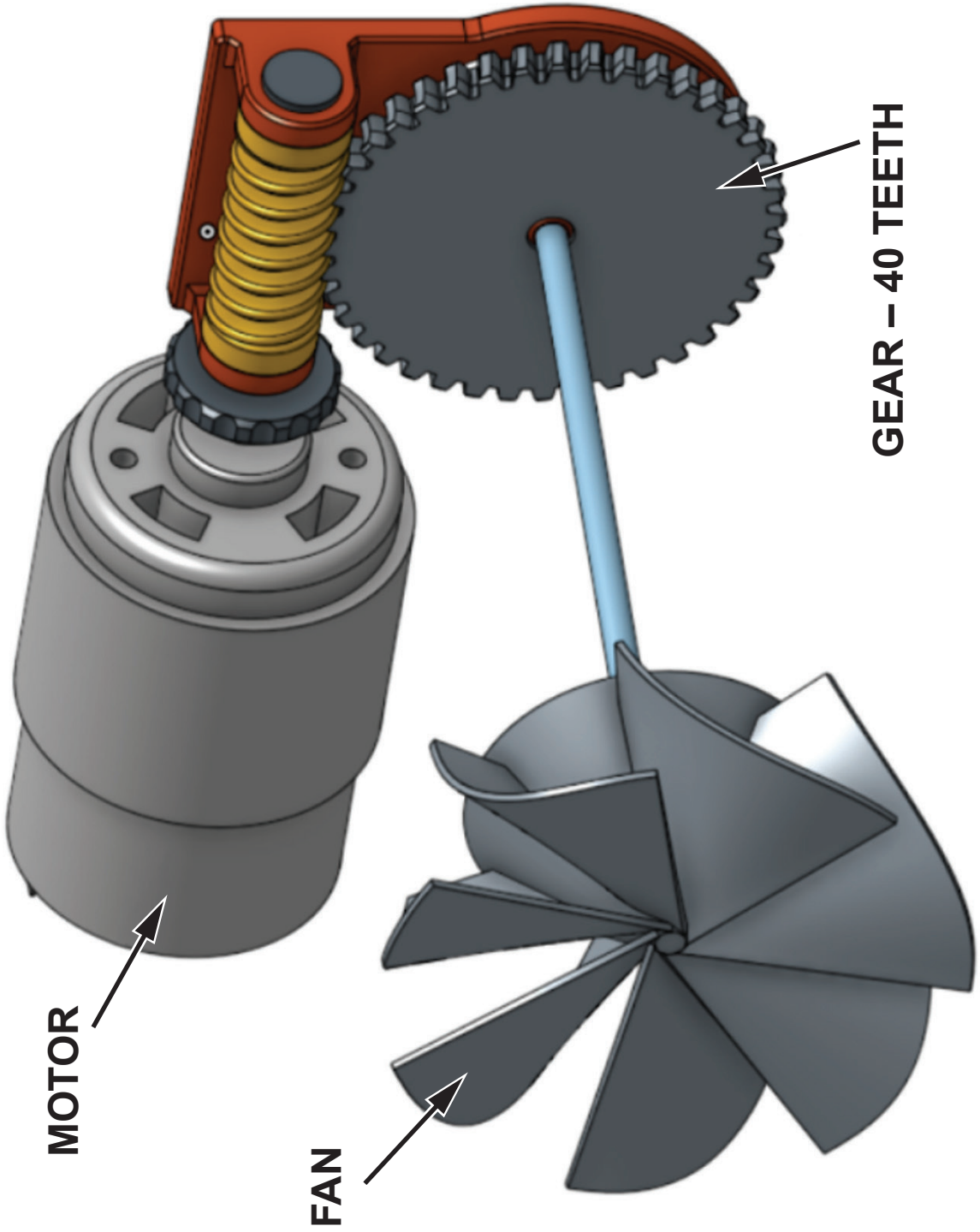
On the diagram opposite draw and label the new components to power the fan connecting from output pin 4. [6]



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 opposite:

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

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



MOTOR

FAN

GEAR - 40 TEETH

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

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

