Index Number:_____ SEC33/2A.18m

L-Università ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

SECONDARY EDUCATION CERTIFICATE LEVEL
2018 MAIN SESSION

SUBJECT:	**Design and Technology**
PAPER NUMBER:	IIA
DATE:	30th April 2018
TIME:	4:00 p.m. to 6:05 p.m.

Instructions and Information

Answer **ALL** ten questions. Each question carries 10 marks.

Non-programmable calculators are allowed

Formula:

V=IR

$$\textbf{Gear ratio} = \frac{\textbf{input speed}}{\textbf{output speed}}$$

$$\textbf{Gear ratio} = \frac{\textbf{output teeth}}{\textbf{input teeth}}$$

r.p.m: revolutions per minute

Design process

Question 1

Situation: The owner of an audio-visual shop called VA wishes to give away an eye catching remote control organiser to the customers buying a new TV set. The shop owner needs that the product holds three remote controls and a smart phone.
You are required to use either resistant materials **OR** textiles as a main area to design the product.

In the box below, tick the main area you will work on in your design for this section.

Resistant materials ☐ Textiles ☐

a. Write a Design Brief with reference to the above situation, specifying any additional aspects.

_____

_____

_____(3)

b. Collecting and analysing information is an important part of the design process. Write **THREE** design specifications that the designer should consider before starting the design of the remote control organiser. Give **ONE** reason for each.

	Design specifications	Reason
i.		(1)
ii.		(1)
iii.		(1)

c. Mention **TWO** details that can be communicated with a working drawing.

_____ (1)

_____ (1)

d. Write **TWO** reasons why it is important to plan your work before making the artefact.

_____ (1)

_____ (1)

(Total: 10 marks)

Question 2

a. In the spaces provided below, sketch **TWO** ideas which satisfy the design brief you developed in question 1a. You may draw separate diagrams to show different views of each idea. Include annotations, colour and overall dimensions to the sketches.

Idea 1

(4)

This question continues on the next page.

Idea 2

(4)

b. Choose **ONE** Idea and discuss briefly **TWO** factors that made you choose one of your ideas above the other.

i. _____

_____ (1)

ii. _____

_____ (1)

(Total: 10 marks)

Resistant Materials

Question 3

Figure 1 shows a cable car which is used to transport passengers between two hills. Part A is the upper part and Part B is the lower part of the cable car.

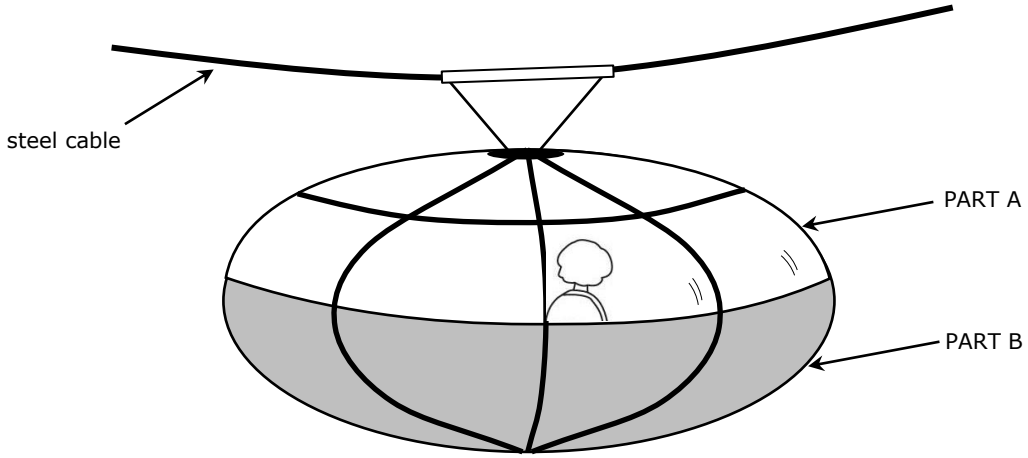


Figure 1: Cable car

a. Fill in Table 1 by stating **ONE** material property which each part should have. Each property should be mentioned only once.

Table 1

	PART A	**PART B**
Aesthetic property		
Physical property		
Mechanical property		

(3)

b. Name **ONE** suitable material which reflects the properties you stated above for Part A and Part B. A material can only be mentioned once.

i. PART A: _____

ii. PART B: _____(2)

This question continues on the next page.

c. The steel cable used to carry the cable car shown in Figure 1 is made up of several steel wires spun together.

i. Give **ONE** reason why this spun steel cable was chosen over a single-stranded thick wire.

_____

_____ (1)

ii. Briefly describe in Table 2, **ONE** method to carry out the following processes on the stated standard form of steel.

Table 2

Marking out an arc on sheet metal	_____ _____ (1)
Cutting out a metal pipe	_____ _____ (1)
Bending a metal wire	_____ _____ (1)
Joining two metal flat bars	_____ _____ (1)

(Total: 10 marks)

Question 4

Figure 2 shows parts of a possible pulley mechanism which can drive a cable car backward and forward to its destination. The DRIVER pulley is attached to a motor which provides rotational force and speed to make the system work.

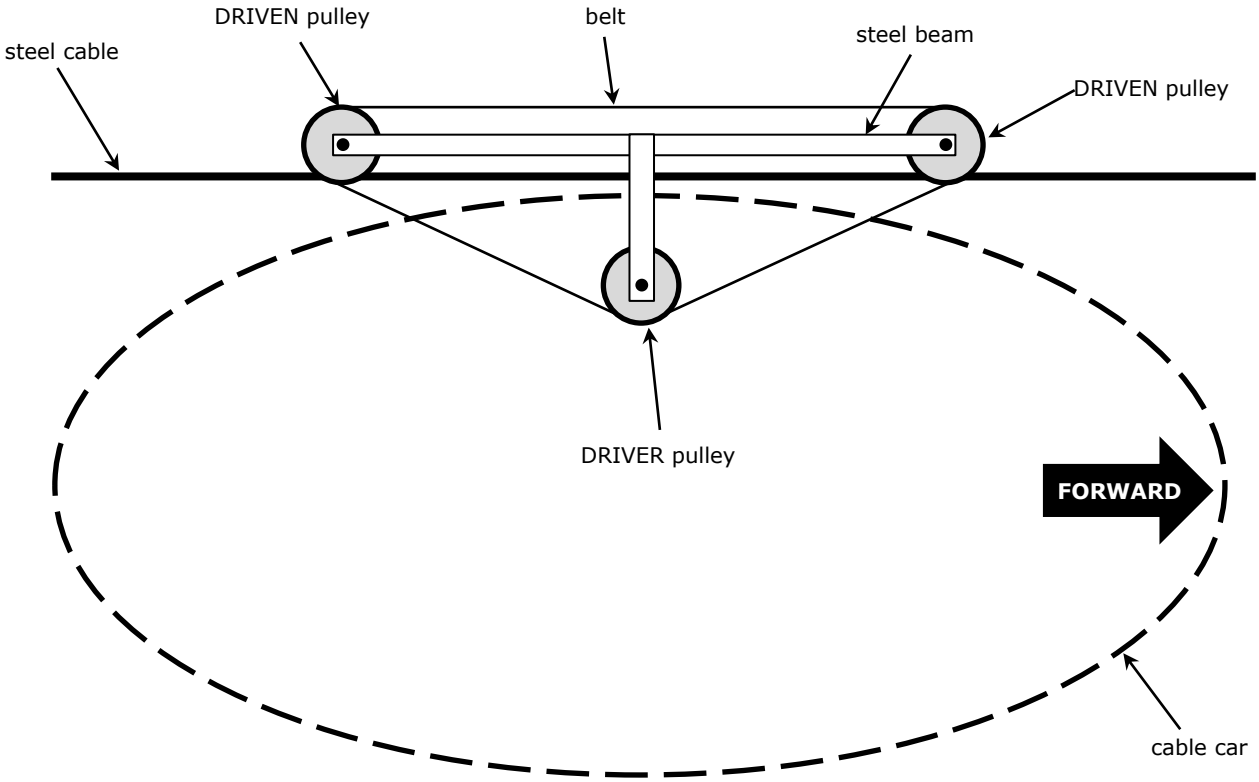


Figure 2: Cable car pulley mechanism

a. On Figure 2, draw an arrow on each pulley to show their direction of rotation when the cable car needs to move forward. (1)

b. Give **ONE** reason why a steel beam is needed between the DRIVEN pulleys.

_____

_____ (1)

c. In the mechanism shown in Figure 2, all pulleys have the same diameter. Explain what are the effects on the DRIVEN pulleys if:

i. the speed of the DRIVER pulley remains unchanged but its diameter is increased.

_____

_____ (1)

ii. the diameter of the DRIVER pulley remains unchanged but its speed is increased.

_____

_____ (1)

d. The motor attached to the DRIVER pulley rotates at a very high speed so gears are needed to reduce the speed.

i. The motor rotates at 1,200 r.p.m., but the DRIVER pulley is required to rotate at 240 r.p.m. If the input gear attached to the motor has 15 teeth, calculate the number of teeth that the output gear attached to the pulley should have.

(3)

ii. This gear system required an idler gear because the input and output shafts were distant from each other. State what other effect an idler gear has on a gear train.

_____

_____ (1)

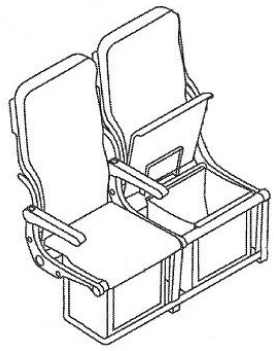
e. The current system has a great risk of failure since the cable car is hanging from only one point. In the space provided below, redesign the pulley mechanism shown in Figure 2, so that the cable car is safer.

(2)

(Total: 10 marks)

Electronics

Question 5



Under each seat of the cable car, one finds a small storage compartment, which is illuminated by a battery-operated system that turns on when the seat is opened. This system was not very effective since when the seat is forgotten open the light stayed on and wasted battery power. To save on battery power it was decided that a timing system should turn off the light source after a set time.

a. State which timing system would be ideal.

_____ (1)

b. Explain how your choice will help to save on battery power.

_____ (1)

Figure 3 shows a simple prototype circuit schematic of the system chosen.

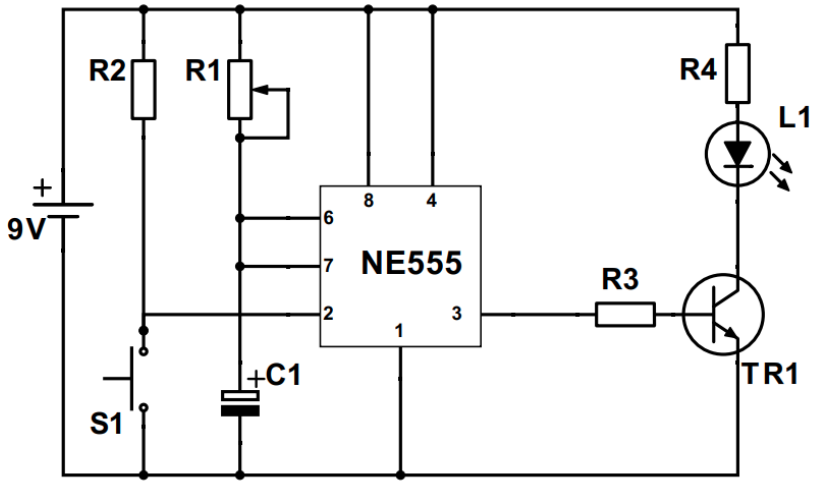


Figure 3

c. Name the components shown in Figure 3 as listed in the grid below:

R2	C1	S1	TR1

(2)

This question continues on the next page.

d. Number the **TWO** leads of the NE555 shown in Figure 4.

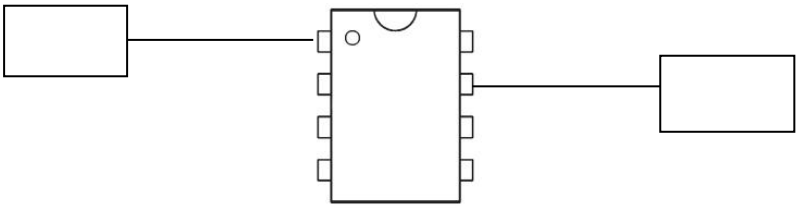


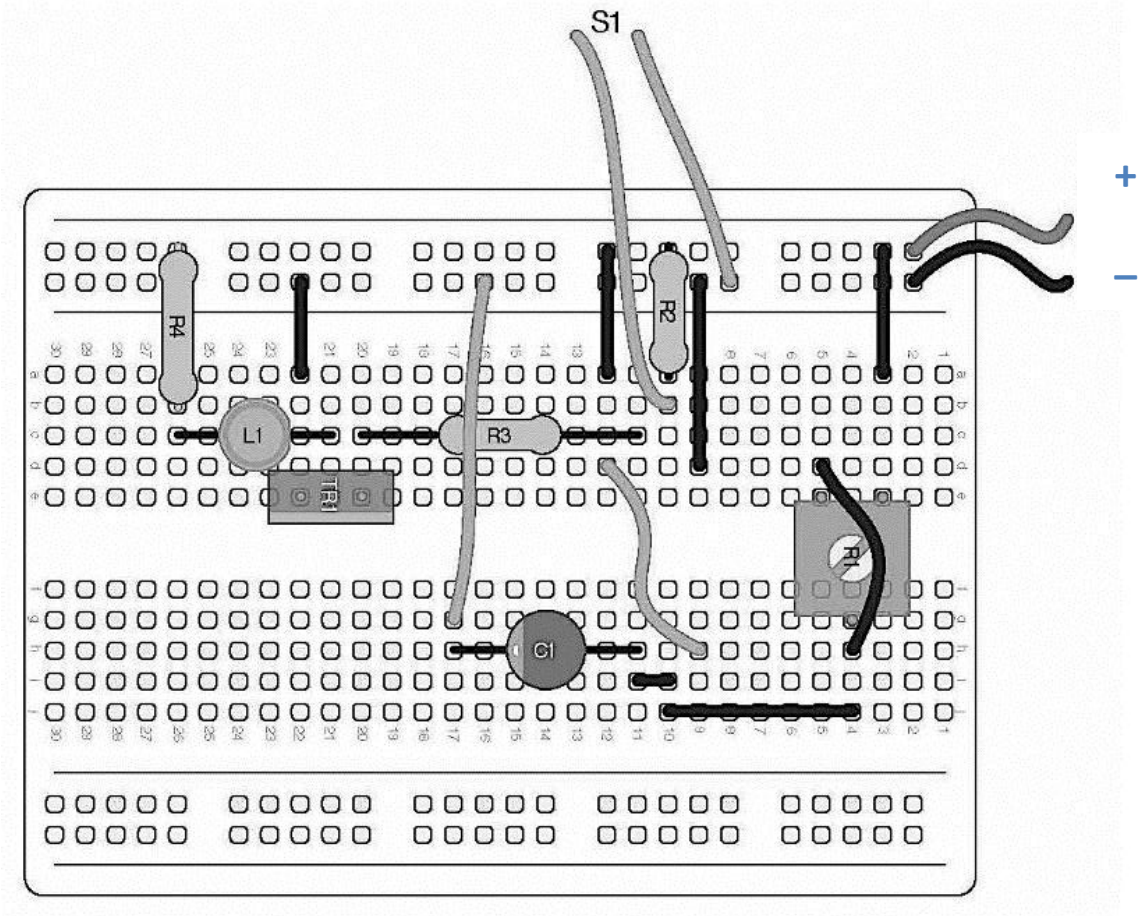
Figure 4 (1)

e. The circuit shown in Figure 3, is being built on breadboard as shown in Figure 5. State **ONE** advantage of using this type of board.

_____

_____ (1)

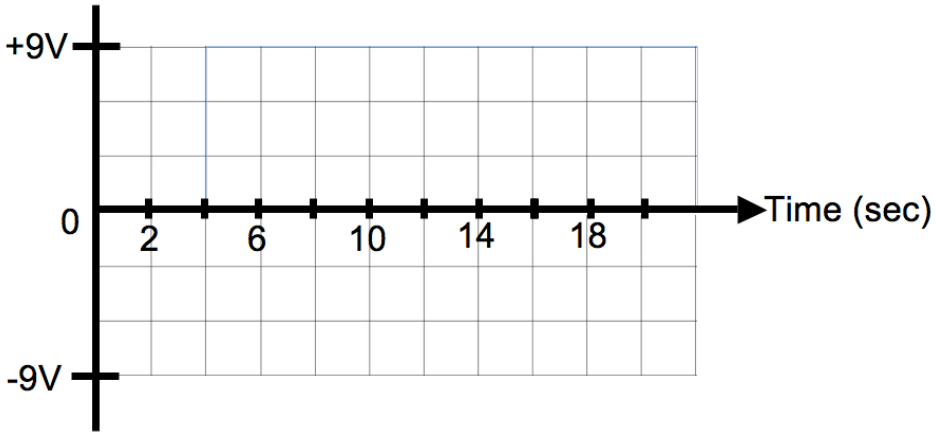
f. Complete the circuit by placing the missing component.



(2)

Figure 5

g. As soon as S1 is triggered the LED lights up and after 8 seconds, it goes off. Draw on Graph 1 the signal showing the output described.



Graph 1

(2)

(Total: 10 marks)

Question 6

a. The voltage drop of LED L1, is of 3.5v, when a maximum current of 350mA flows through it.

In the space allocated below, answer **BOTH** of the following questions (6a.i.,6a.ii.). Show your working.

i. Calculate the required voltage drop across R4. (1)
ii. Calculate the ideal value of R4. (3)

i.	ii.

This question continues on the next page.

Figure 6 shows again the circuit discussed in the previous question (the same as Figure 3). In case of an emergency, this system can be removed from the storage compartment and be used as a torch.

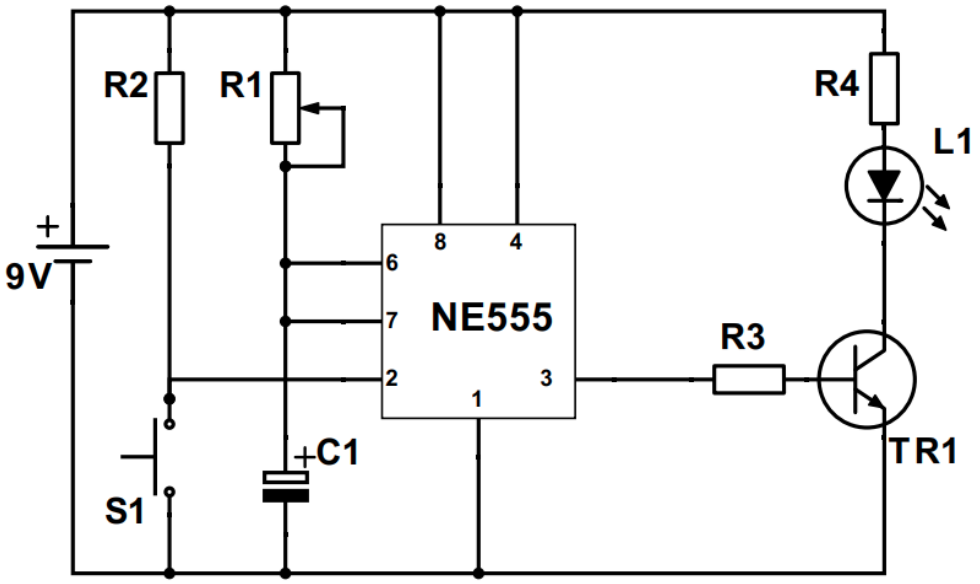


Figure 6

b. Add a latching switch and wires to the circuit in Figure 6 to bypass the timing circuit and turn ON L1 indefinitely. (3)

c. Explain the difference between a push-to-make switch and a latching switch.

_____

_____ (1)

d. It was noted that one LED did not emit enough light to illuminate the storage compartment and a second LED needs to be added. Design a way to add a second LED on Figure 6 to increase the brightness of the system as much as possible. Answer on Figure 6. (2)

(Total: 10 marks)

Food

Question 7

A brand new company is introducing a new preserved fruit product.

a. There are a number of ways in which food can be preserved. Name **ONE** method which is commonly used when preserving jams.

_____ (1)

b. List **THREE** reasons why packaging in the food industry is important.

_____

_____

_____ (3)

c. Give **TWO** advantages and **TWO** disadvantages of using glass as a material for the jam packaging.

Advantages	Disadvantages

(2)

d. Suggest **FOUR** quality control procedures that should be included when producing this jam.

_____

_____

_____

_____ (4)

(Total: 10 marks)

Question 8

You were asked to design an in-flight meal for a new airline.

a. One of the meals that you are planning to produce is chicken breast and vegetables.

i. Suggest a healthy cooking method to cook the vegetables. Give **ONE** reason for your choice.

Cooking method	Reason
(1)	_____ _____ _____(2)

This question continues on the next page.

ii. Chicken is the main source of protein in this dish. State the main function of this nutrient.

_____ (1)

iii. Mushroom sauce is added to the dish. Suggest **ONE** ingredient that can be added to thicken the sauce.

_____ (1)

b. Name **TWO** special dietary conditions that one should consider when planning the meal.

_____

_____ (2)

c. It is very important that the dishes are produced according to HACCP system. What does HACCP stand for?

_____ (1)

d. List **FOUR** steps of HACCP that will be followed when producing this dish.

_____

_____

_____

_____ (2)

(Total: 10 marks)

Textiles

Question 9

A textiles company named 'Home Textiles' designed a new laundry bag, made from fabric, to be sold on the market.

a. State which natural fibre is best used to produce a fabric laundry bag. Give **ONE** reason for your answer.

Fibre: _____ (1)

Reason:_____

_____(1)

b. Name the origin of the fibre you mentioned in question 9a.

_____(1)

c. Describe **ONE** way how the fibre mentioned in question 9a is converted to fabric.

_____

_____

_____ (1)

d. In the space provided, draw **TWO** annotated sketches showing how different types of fastening methods can be used to close this laundry bag. (4)

i.

ii.

e. Describe which structural component can be used to make the laundry bag stand up on its own.

_____

_____(2)

(Total: 10 marks)

Question 10

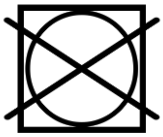
a. Describe how the word LAUNDRY can be added to the fabric.

_____

_____(2)

This question continues on the next page.

b. The following symbols are found on the label of the laundry bag. Give the meaning of these symbols.

	_____ (1/2)
	_____ (1/2)
	_____ (1/2)
	_____ (1/2)

c. Write down the steps that must be followed to produce strong and neatly sewn handles for the laundry bag which are made from the same type of fabric of the bag.

Step 1. _____ (1)

Step 2. _____ (1)

Step 3. _____ (1)

Step 4._____ (1)

d. How can you produce the laundry bag to be eco-friendly?

_____

_____

_____(2)

(Total: 10 marks)

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MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

SECONDARY EDUCATION CERTIFICATE LEVEL
2018 MAIN SESSION

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PAPER NUMBER:	IIB
DATE:	30th April 2018
TIME:	4:00 p.m. to 6:05 p.m.

Instructions and Information

Answer **ALL** ten questions. Each question carries 10 marks.

Non-programmable calculators are allowed

Formula:

V=IR

$$\textbf{Gear ratio} = \frac{\textbf{input speed}}{\textbf{output speed}}$$

$$\textbf{Gear ratio} = \frac{\textbf{output teeth}}{\textbf{input teeth}}$$

r.p.m: revolutions per minute

Design process

Question 1

Situation: The owner of an audio-visual shop called VA wishes to give away an eye catching remote control organiser to the customers buying a new TV set. The shop owner needs that the product holds three remote controls and a smart phone.

You are required to use either resistant materials **OR** textiles as a main area to design the product.

In the box below, tick the main area you will work on in your design for this section.

Resistant materials ☐ Textiles ☐

a. Write a Design Brief with reference to the above situation, specifying any additional aspects.

_____

_____

_____(3)

b. Collecting and analysing information is an important part of the design process. Write **THREE** design specifications that the designer should consider before starting the design of the remote control organiser. Give **ONE** reason for each.

	Design specifications	Reason
i.		(1)
ii.		(1)
iii.		(1)

c. Mention **TWO** details that can be communicated with a working drawing.

_____(1)

_____(1)

d. Write **TWO** reasons why it is important to plan your work before making the artefact.

_____(1)

_____(1)

(Total: 10 marks)

Question 2

a. In the spaces provided below, sketch **TWO** ideas which satisfy the design brief you developed in question 1a. You may draw separate diagrams to show different views of each idea. Include annotations, colour and overall dimensions to the sketches.

Idea 1

(4)

This question continues on the next page.

Idea 2

(4)

b. Choose **ONE** Idea and discuss briefly **TWO** factors that made you choose one of your ideas above the other.

i. _____

_____ (1)

ii. _____

_____ (1)

(Total: 10 marks)

Resistant Materials

Question 3

Figure 1 shows a cable car which is used to transport passengers between two hills. Part A is the upper part and Part B is the lower part of the cable car.

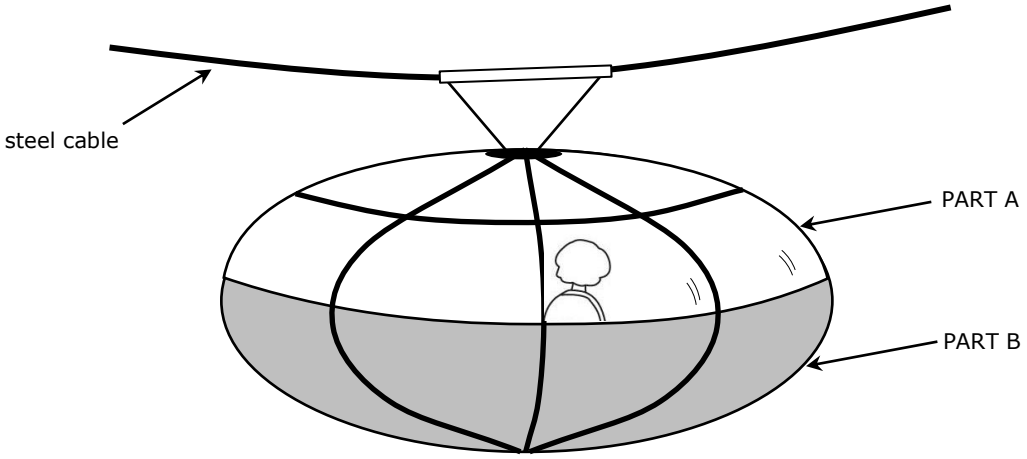


Figure 1: Cable car

a. Fill in Table 1 by stating **TWO** material properties which each part should have. Each property should be mentioned only once.

Table 1

	PART A	**PART B**
PROPERTY 1		
PROPERTY 2		

(2)

b. Name **ONE** suitable material which reflects the properties you stated above for Part A and Part B. A material can only be mentioned once.

i. PART A: _____

ii. PART B: _____ (2)

c. The steel cable used to carry the cable car shown in Figure 1 is made up of several steel wires spun together.

i. Give **ONE** reason why this spun steel cable was chosen over a single-stranded thick wire.

_____

_____ (1)

ii. In the space provided below, sketch and name **ONE** other standard form of steel apart from wire.

NAME:
SKETCH:

(2)

iii. In Table 2 below, mention the tools you would use to carry out the following processes on the standard form of steel you have mentioned in Question 3cii.

Table 2

MARKING OUT	_____ _____ (1)
CUTTING OUT	_____ _____ (1)
DRILLING	_____ _____ (1)

(Total: 10 marks)

Question 4

Figure 2 shows parts of a possible pulley mechanism which can drive a cable car backward and forward to its destination. The DRIVER pulley is attached to a motor which provides rotational force and speed to make the system work.

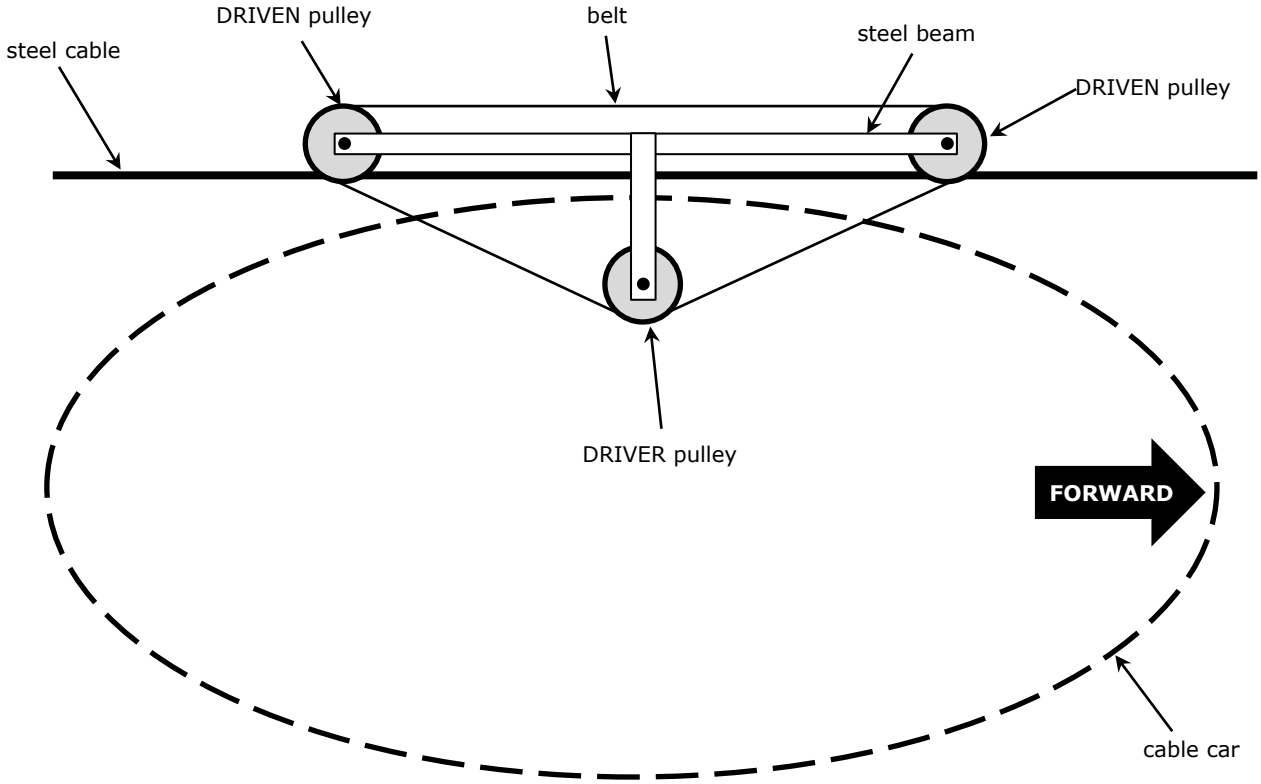


Figure 2: Cable car pulley mechanism

a. On Figure 2, draw an arrow on the DRIVER pulley to show its direction of rotation when the cable car needs to move forward. (1)

b. In the mechanism shown in Figure 2, all pulleys have the same diameter. Explain the effect on the DRIVEN pulleys if the diameter of the DRIVER pulley is increased.

_____

_____ (2)

c. The motor attached to the DRIVER pulley rotates at very high speed so gears are needed to reduce the speed.

i. If the input motor rotates at 1,200 r.p.m., but the output gear is required to rotate at 240 r.p.m., calculate the gear ratio needed to achieve this output. (2)

ii. Draw a labelled sketch of the gear system according the gear ratio found in Question 4ci.

(2)

iii. This gear system will use an idler gear. Explain what an idler gear is.

_____

_____(1)

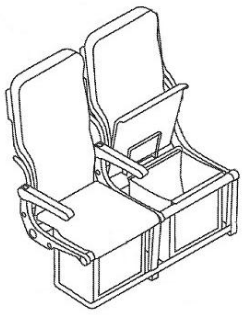
d. The current system has a great risk of failure since the cable car is hanging from only one point. In the space provided below, redesign the pulley mechanism shown in Figure 2, by adding more pulleys so that the cable car is safer.

(2)

(Total: 10 marks)

Electronics

Question 5



Under each seat of the cable car, one finds a small storage compartment, which is illuminated by a battery-operated system that turns on when the seat is opened. This system was not very effective since when the seat is forgotten open the light stayed on and wasted battery power. To save on battery power it was decided that, if the seat is left open, a timing system will turn off the light source after a set time.

a. State which of the following timing systems would be ideal: Monostable (one cycle) or Astable (continuous cycles).

_____(1)

b. Instead of using a bulb, it was decided to use an LED. Explain how this choice will help to save on battery power.

_____

_____(1)

Figure 3 shows a simple prototype circuit schematic of the system chosen.

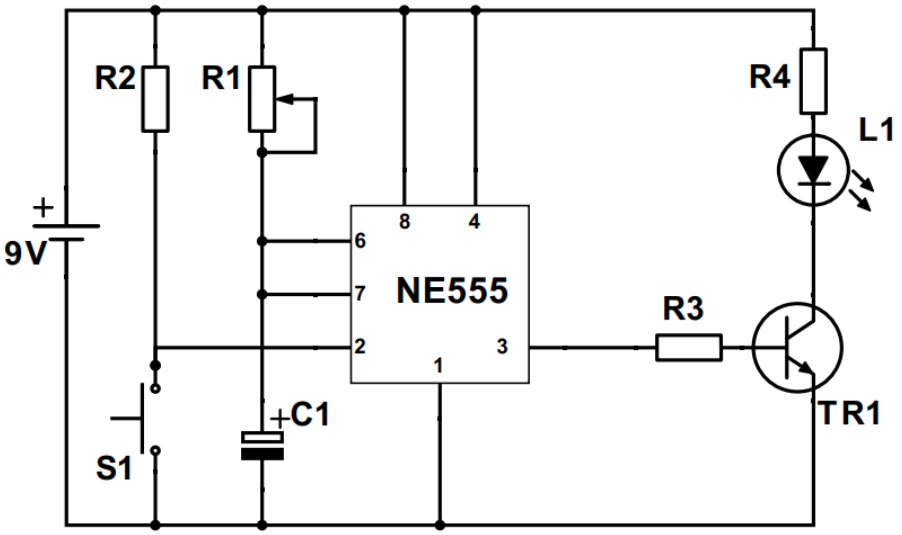


Figure 3

c. Name the below components as shown in Figure 3.

R2: _____ TR1: _____ (2)

This question continues on the next page.

d. Number the lead of the NE555 shown in Figure 4.

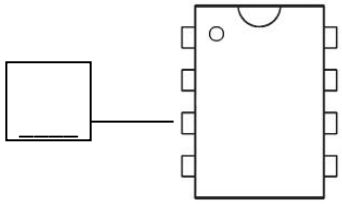


Figure 4 (1)

e. The circuit shown in Figure 3, is being built on breadboard as shown in Figure 5. Since a breadboard is a solder-less board, state **ONE** advantage of using this prototyping board.

_____

_____ (1)

f. Look carefully at the circuit in the breadboard below. Using a blue pen, label the following components:

Transistor	Potentiometer	NE555 timer IC	Capacitor

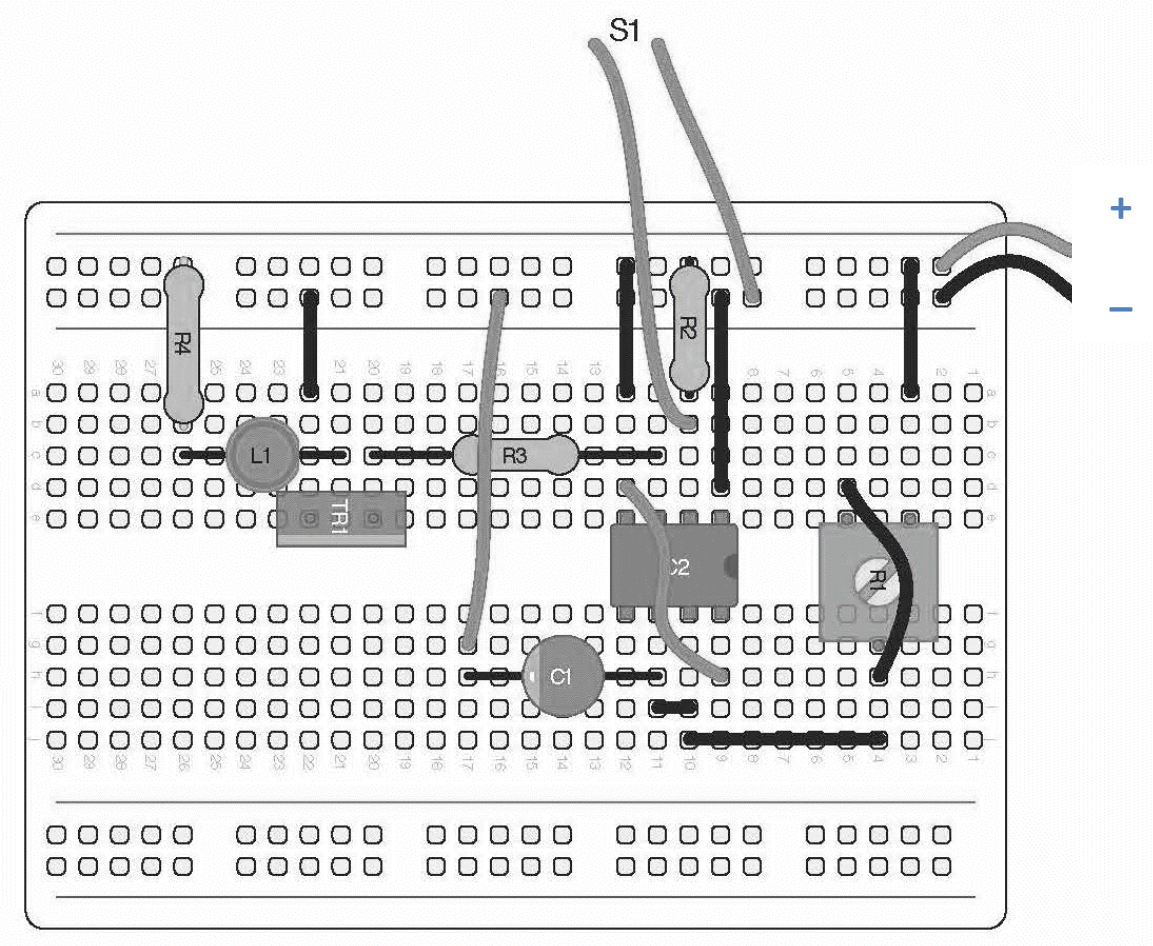
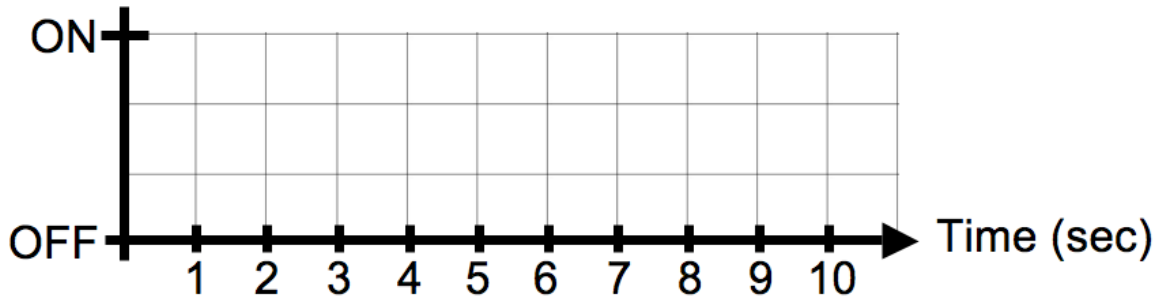


Figure 5

(2)

g. As soon as the switch is pressed and the circuit is triggered, the LED lights up and after 5 seconds, it goes off. Draw on Graph 1 the signal showing the output described.



Graph 1

(2)

(Total: 10 marks)

Question 6

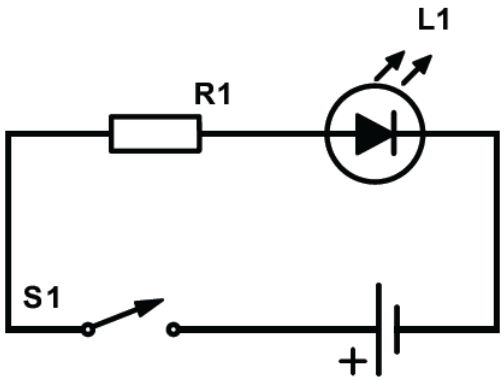


Figure 6

a. What is the purpose of resistor R1 shown in Figure 6?

_____

_____(1)

b. Calculate the value of R1 when the voltage drop across R1 is 4V and a current of 20mA is flowing through the circuit:

(3)

The circuit in Figure 7 was modified.

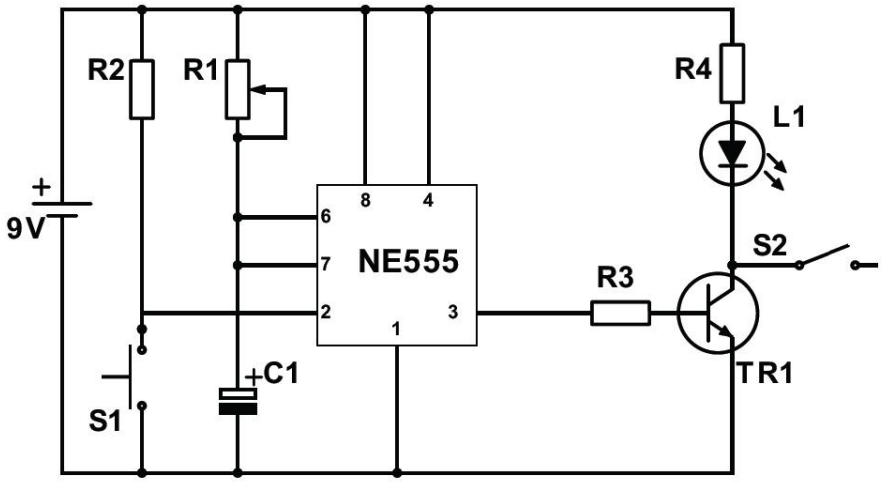


Figure 7

In case of an emergency, the system shown in question 5, can be removed from the storage compartment and be used as a torch.

c. Join the second terminal of switch S2 to the circuit in Figure 7 to turn **ON** L1 indefinitely. (Draw solution on Figure 7) (3)

d. It was noted that one LED did not emit enough light to illuminate the storage compartment and a second LED needs to be added. Draw a second LED, in parallel to L1 on Figure 7 to increase the brightness of the system. (Draw solution on Figure 7) (3)

(Total: 10 marks)

Food

Question 7

A brand new company is introducing a jam, as a new preserved fruit product.

a. List the **THREE** different types of micro-organisms that can spoil the jam.

_____ ; _____ ;

_____ . (3)

b. List **TWO** conditions for the micro-organisms to grow.

_____ ; _____ . (2)

c. Name **ONE** method which is commonly used when preserving jams.

_____(1)

d. Give **ONE** advantage and **ONE** disadvantage of using glass as a material for the jam packaging.

Advantage: _____ (1)

Disadvantage: _____ (1)

e. List **TWO** compulsory pieces of information that should be included on the labelling of the jam jar, according to EU legislation.

_____ _____ (2)

(Total: 10 marks)

Question 8

You were asked to design an in-flight meal for a new airline. One of the meals that you are planning to produce is chicken breast, rice and vegetables.

a. Mention **ONE** healthy cooking method to cook the vegetables.

_____(1)

b. Describe the cooking method you chose in the above question.

_____

_____(2)

c. Fill in the blanks.

i. Chicken is the main source of _____ in this dish. This nutrient is very important for the _____ of the body. (2)

ii. _____ was included in this dish to add carbohydrates. (1)

iii. _____is added to the mushroom sauce to thicken the sauce. (1)

iv. Chicken is replaced by _____ for vegetarians. (1)

This question continues on the next page.

d. Suggest **ONE** important safe and hygienic practice you need to follow whilst producing this dish.

_____(1)

e. Suggest **ONE** method of production for the airline dish.

_____(1)

(Total: 10 marks)

Textiles

Question 9

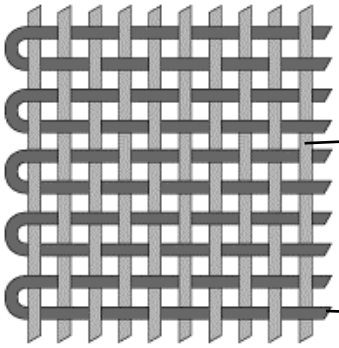
A textiles company named 'Home Textiles' designed a new laundry bag, made from fabric, to be sold on the market.

a. This laundry bag is made from cotton fabric. Name **TWO** properties which make cotton ideal for a laundry bag.

i. _____(1)

ii. _____(1)

b. Label the following diagram showing the type of fabric construction used for the laundry bag.



i. Name the type of fabric construction:

_____ (1)

ii. _____ (1/2)

iii. _____ (1/2)

c. In the space provided, draw **ONE** annotated sketch of **ONE** type of fastening method that you would add to the laundry bag. (4)

d. Describe the function of interfacing when used for the laundry bag.

_____

_____

_____(2)

(Total: 10 marks)

Question 10

a. Name **TWO** methods of how the word LAUNDRY can be added to the fabric.

i. _____ (1)

ii. _____ (1)

b. Name the appropriate tool you should use to cut fabric.

_____(1)

c. Describe **ONE** way how you can recycle fabric.

_____

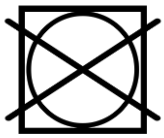
_____

_____(2)

This question continues on the next page.

d. The following symbols are found on the label of the laundry bag. Give the meaning of these symbols, from the following word bank.

Do not bleach	dry clean only	machine wash
dry flat	warm ironing	do not tumble dry

	_____ (1/2)
	_____ (1/2)
	_____ (1/2)
	_____ (1/2)

e. Using numbers, list down the correct order of the following steps that must be followed to produce the laundry bag, in Table 3. (3)

Table 3

Instructions	**Order**
Sew and turn handles right side out.	
Cut fabric pieces according to pattern.	
Sew handles to main part of the laundry bag.	
Iron the laundry bag.	
Sew hem of the main part of the laundry bag.	
Sew the body pieces together.	

(Total: 10 marks)