



**Coimisiún na Scrúduithe Stáit**  
**State Examinations Commission**

**Junior Certificate 2017**

**Marking Scheme**

**Technology**

**Higher Level**

## **Note to teachers and students on the use of published marking schemes**

Marking schemes published by the State Examinations Commission are not intended to be standalone documents. They are an essential resource for examiners who receive training in the correct interpretation and application of the scheme. This training involves, among other things, marking samples of student work and discussing the marks awarded, so as to clarify the correct application of the scheme. The work of examiners is subsequently monitored by Advising Examiners to ensure consistent and accurate application of the marking scheme. This process is overseen by the Chief Examiner, usually assisted by a Chief Advising Examiner. The Chief Examiner is the final authority regarding whether or not the marking scheme has been correctly applied to any piece of candidate work.

Marking schemes are working documents. While a draft marking scheme is prepared in advance of the examination, the scheme is not finalised until examiners have applied it to candidates' work and the feedback from all examiners has been collated and considered in light of the full range of responses of candidates, the overall level of difficulty of the examination and the need to maintain consistency in standards from year to year. This published document contains the finalised scheme, as it was applied to all candidates' work.

In the case of marking schemes that include model solutions or answers, it should be noted that these are not intended to be exhaustive. Variations and alternatives may also be acceptable. Examiners must consider all answers on their merits, and will have consulted with their Advising Examiners when in doubt.

## **Future Marking Schemes**

Assumptions about future marking schemes on the basis of past schemes should be avoided. While the underlying assessment principles remain the same, the details of the marking of a particular type of question may change in the context of the contribution of that question to the overall examination in a given year. The Chief Examiner in any given year has the responsibility to determine how best to ensure the fair and accurate assessment of candidates' work and to ensure consistency in the standard of the assessment from year to year. Accordingly, aspects of the structure, detail and application of the marking scheme for a particular examination are subject to change from one year to the next without notice.



**Coimisiún na Scrúduithe Stáit**  
State Examinations Commission

*Junior Certificate Examination, 2017*

# **Technology**

## **Higher Level**

**Wednesday, 21 June**  
**Afternoon, 2:00 - 4:00**

### **Section A**

**Instructions:**

1. Answer **Section A** (short answer questions). 100 marks
2. Answer either **(a) or (b)** from each question in **Section B**. 50 marks
3. Answer **one** question from **Section C**. 50 marks
4. Hand up this paper at the end of the examination along with answer sheets for **Section B** and **Section C**.

**Centre Number**

**Examination Number**

*Write your examination number  
in the box provided on this page.*

SECTION A		For the Examiner	
No. of Questions		Mark	Total
	x	4	
	x	3	
	x	2	
	x	1	
	x	0	/
	x	/	/
Total (32)		<b>Total 1:</b>	
Disallowed		Mark	Total
	x	4	
	x	3	
	x	2	
	x	1	
Total (max 7)		<b>Total 2:</b>	
<b>Section A Total (1-2):</b>			

**Section A** Answer 25 questions from this section - all questions carry equal marks.

**100 marks**

1. A view of a mobile phone is shown.

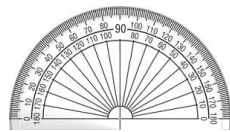
Name the type of view shown and state **one** advantage of this type of view.



View: 2 marks  
*Exploded view, isometric*  
(Perspective : 0)

Advantage: 2 marks  
*All parts visible,*  
*Parts & location visible*

2. Name the **two** drawing instruments shown.



(i)



(ii)

(i): 2 marks *Protractor*

(ii): 2 marks *Compass*  
*(Divider: 1)*

3. State **one** way in which data on a computer can be protected from unauthorised access.

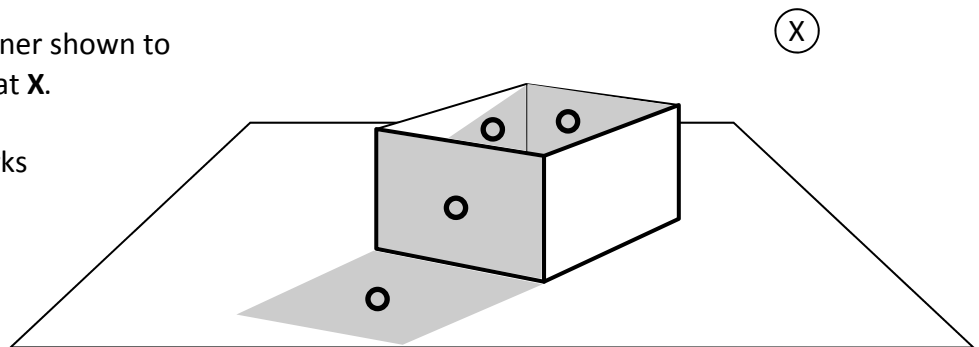


Answer: 4 marks

*Password protection,*  
*data encryption,*  
*Security software.*

4. Shade the open container shown to suggest a light source at X.

*Box shading: 3 x 1 marks*  
*Shadow: 1 marks*



5. State the meaning of **each** of the graphics shown.



(i)

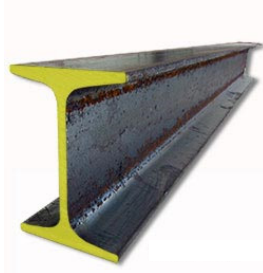


(ii)

(i): 2 marks *Bluetooth (device)*

(ii): 2 marks *QR code,*  
*Quick Response code*  
*(Barcode: 0)*

6. State **two** advantages of using steel beams, with the profile shown, when constructing buildings.



2 Advantages: (i)/(ii) 2 x 2 marks

*Reduced weight (relative to solid beam),  
Lower cost beam, reference to strength.  
Beam (profile) can resist bending.*

7. State **one** advantage and **one** disadvantage of using MDF in constructing a project.



Advantage: 2 marks

*Low cost, no knots, uniform material,  
easy to work, large sizes available, etc.*

Disadvantage: 2 marks

*May require protective finish,  
Safety issues when working material,  
Reference to waterproof, etc.*

8. State **two** properties of a material suitable for the manufacture of the handle shown.



2 Properties: (i)/(ii) 2 x 2 marks

*Heat insulator, Easy to shape/form,  
Material will not melt, rust, chip,  
non-slip, easy to grip, etc.*

9. Name **one** modern material used in sports car design

*and*

state why this material is used.



Material: 2 marks

*Carbon fibre, Composites, new Alloys,  
Smart material, etc.*

Reason: 2 marks

*New properties (lightweight, complex  
shapes possible, easy to repair, etc.)*

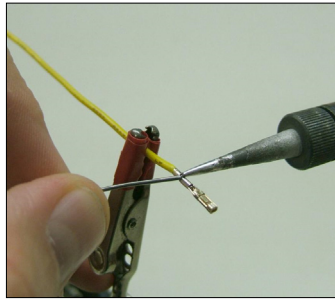
10. Name the process used to manufacture the safety helmet shown from a single piece of plastic.



Process: 4 marks

*Injection moulding, Vacuum forming*

11. State **two** specific safety precautions which should be observed when soldering electronic components.

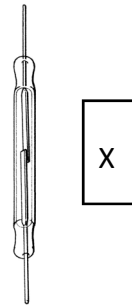


2 Precautions: (i)/(ii) 2 x 2 marks

*Fumes: ventilation,  
Hot tip: appropriate holder,  
Components held appropriately,  
Reference to hair / mask / glasses, etc.  
(gloves: 0)*

12. The switch shown can be activated by component X.

Name component X.

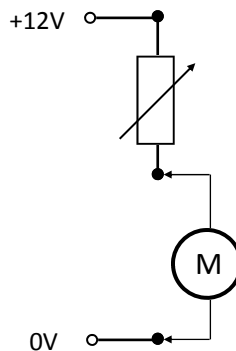


X: Magnet 4 marks

13. In the circuit shown, state what is being measured by the meter M

and

name the units used in this measurement.



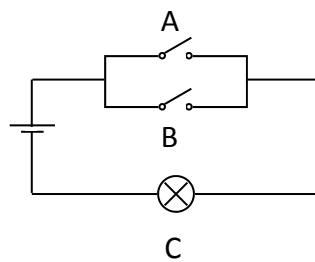
Answer: 2 marks

*Current*

Units: 2 marks

*Amps , Amperes. (A: 1)*

14. Complete the truth table for the circuit shown.



4 x 1 marks

INPUT		OUTPUT
A	B	C
Open	Open	Off
Open	Closed	On
Closed	Open	On
Closed	Closed	On

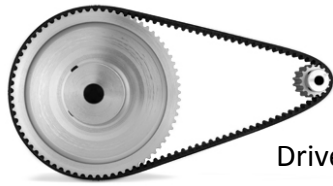
15. What property of a thermistor changes with changing temperature?



Property: 4 marks

*Resistance  
(Temperature: 0)*

16. In the system shown, if the driver is rotating at 100 RPM, calculate the speed of the driven wheel.



Driver 60 T

Driven 15 T

Answer: 4 marks 400 (RPM)

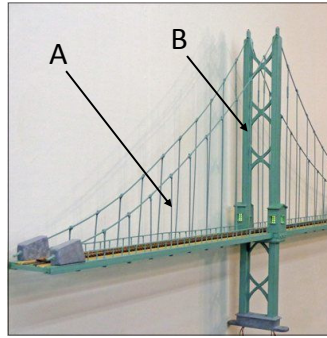
Alt: 2 marks

$$60 T \times 100 \text{ RPM} = 15 T \times X$$

$$(60 \times 100)/15 = X$$

Driver/Driven x Input speed

17. Name the forces experienced by the cable (A) and by the tower (B) in the suspension bridge shown.



A: 2 marks Tension

B: 2 marks Compression

18. Name the tool shown

and

state the function of this tool.

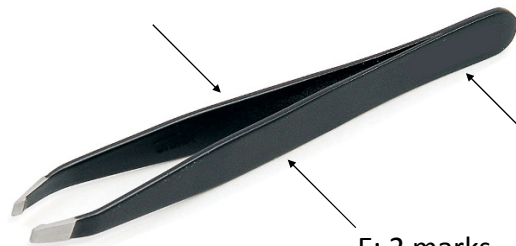


Name: 2 marks Countersink bit

Function: 2 marks

Countersink a screw head, Allow screw head to be flush with wood.

19. Indicate clearly on the tweezers shown the location of the fulcrum (F) and the effort (E).



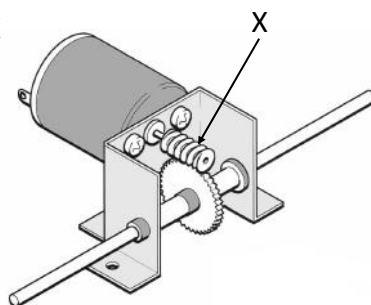
F: 2 marks

E: 2 marks

20. Name the gear shown at X

and

state **one** advantage of using this gear in this situation.



X: 2 marks Worm Gear

Advantage: 2 marks

Large speed reduction, Locks drive shaft, Drive shaft cannot run in reverse, Large torque, no slippage.

21. Give **two** reasons why plastics should be recycled.



2 Reasons: (i)/(ii) 2 x 2 marks

*Plastic does not break down in the environment, Plastics are pollutants, Recycling is environmentally friendly, Oil (source of plastic) is limited, etc.*

22. Name **two** energy conversions taking place when a drone is in flight.



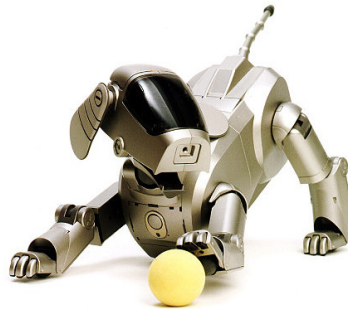
(i)/(ii) 2 x 2 marks

From: 1 mark To: 1 mark

*Electrical Kinetic / Sound/ Light*

*Kinetic Heat / Sound*

23. State **two** uses for an integrated chip (IC) in modern toys.



2 Use: (i)/(ii) 2 x 2 marks

*Input Data Processors (Voice, etc), Output Processors (Sound, etc), CPU, Data storage, etc.*

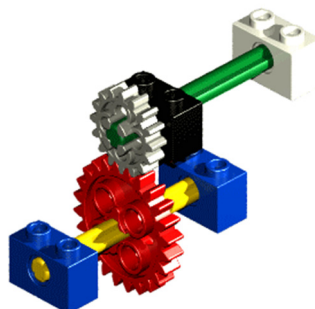
24. State **two** ways in which smart TVs have changed the way in which we watch television.



2 Ways: (i)/(ii) 2 x 2 marks

*Access to Internet, Access to Apps, Multiple inputs - cable, satellite, security cameras, Backlighting, etc.*

25. State **two** reasons why plastic is used to manufacture components in the system shown.

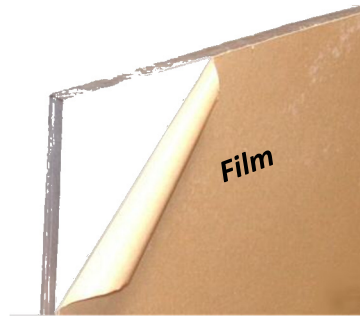


2 Reasons: (i)/(ii) 2 x 2 marks

*Easy to mass produce, low cost, Lightweight, can be coloured, etc.*



26. State the purpose of the film on the acrylic sheet shown.



Purpose: 4 marks

*Protect acrylic sheet during project manufacture, etc*

27. State **one** advantage and **one** disadvantage of using a hot melt glue gun to join acrylic sheets.



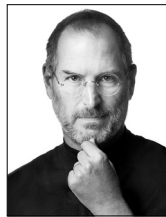
Advantage: 2 marks

*Forms a fast joint between materials*

Disadvantage: 2 marks

*Can produce a poor / unsightly finish to a product, etc.*

28. Name the technology company most associated with each of the people shown.



Steve Jobs

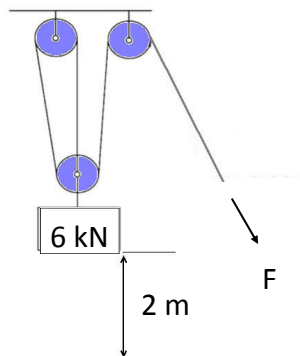
Steve Jobs: 2 marks     *Apple*



Bill Gates

Bill Gates: 2 marks     *Microsoft*

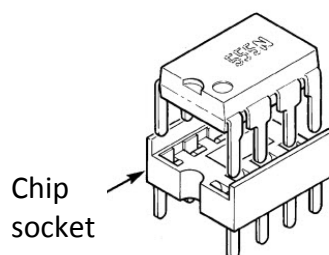
29. Calculate the force  $F$  required to lift the 6 kN load a height of 2 m using the pulley system shown.



$F$ : 4 marks     2 kN

*Alt:  $6/3 = F$  2 marks*

30. State **one** reason why a chip socket should be used when attaching a chip to a circuit board.

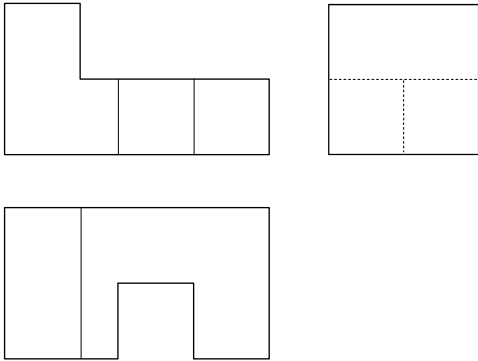


Reason: 4 marks

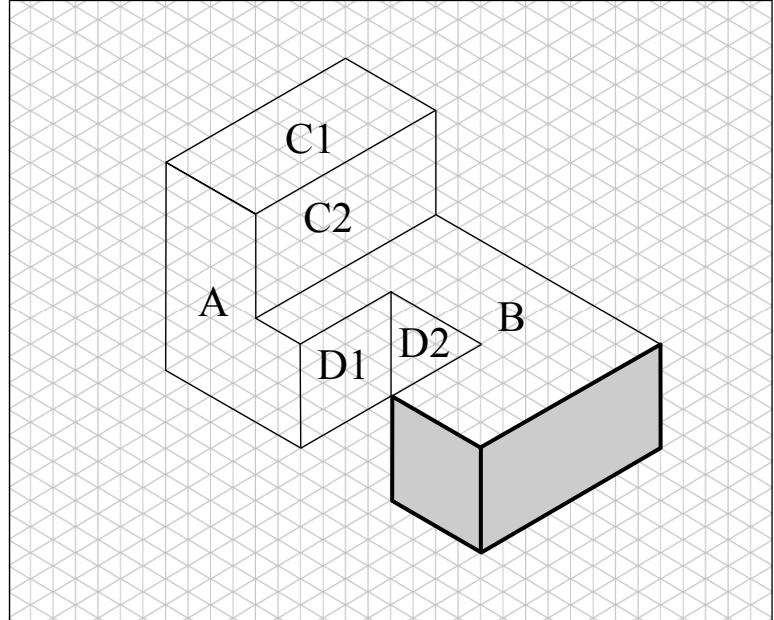
*Prevent heat damage to the chip (when building the circuit),  
Allows the chip to be easily inserted / replaced, etc.*

31. An orthographic projection of a bracket is shown.  
On the grid provided, complete the isometric view of the bracket.

4 x 1 marks: A, B, (C1 & C2) and (D1 & D2)

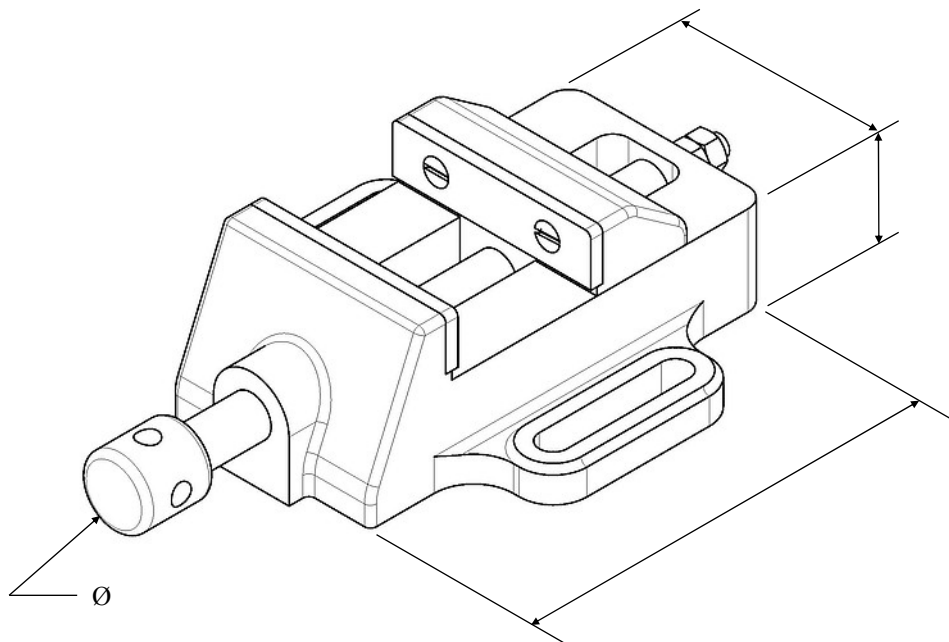


Orthographic projection



32. Insert **four** main dimensions on the sketch of the drill vice shown.

Any four valid dimensions (correctly annotated : Arrow heads & leader lines) 4 x 1 marks





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*Junior Certificate Examination, 2017*

# ***Technology***

## ***Higher Level***

***Wednesday, 21 June***  
***Afternoon, 2:00 - 4:00***

### ***Section B and Section C***

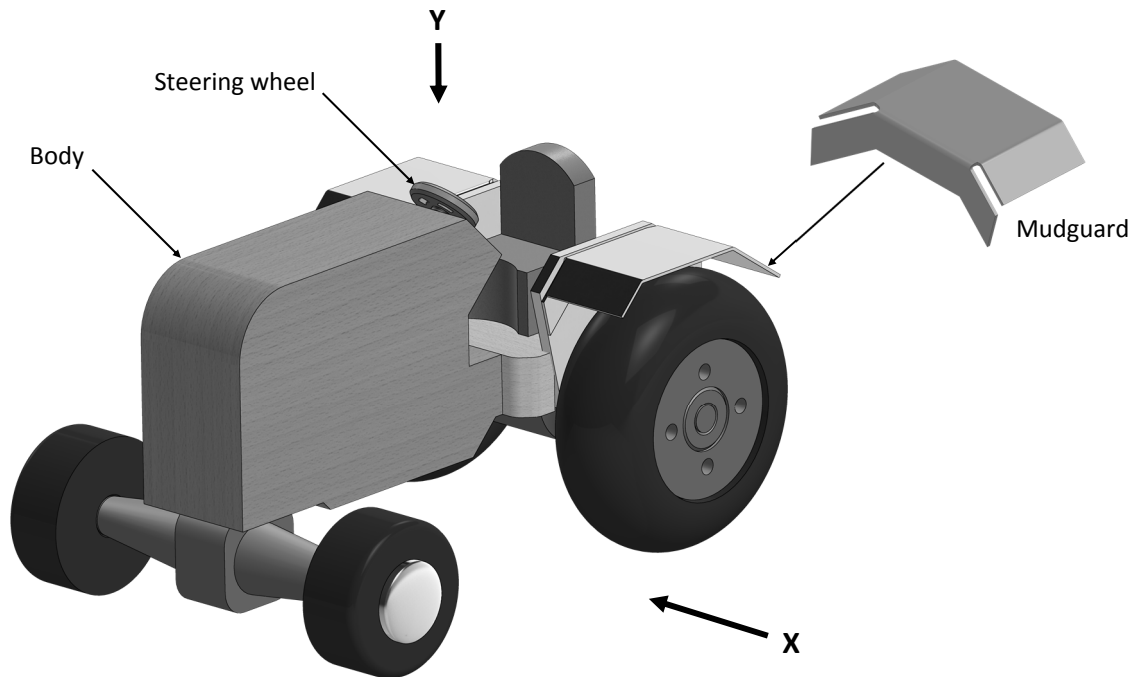
*Section B - 50 marks*

*Section C - 50 marks*

***Instructions:***

1. Answer either **(a)** or **(b)** from each question in **Section B**.
2. Answer **one** question from **Section C**.
3. Hand up **Section A** with your answer sheets to this paper.

1 (a) The graphic shows a design for a toy tractor. The toy is made from wood, metal and plastic.



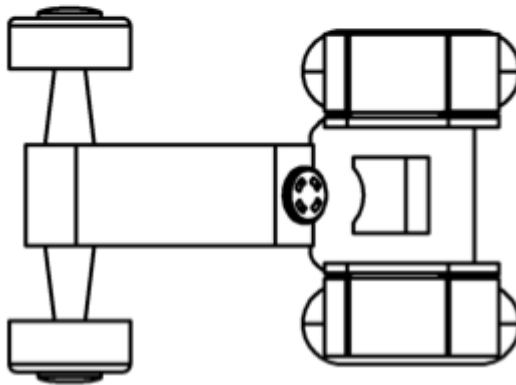
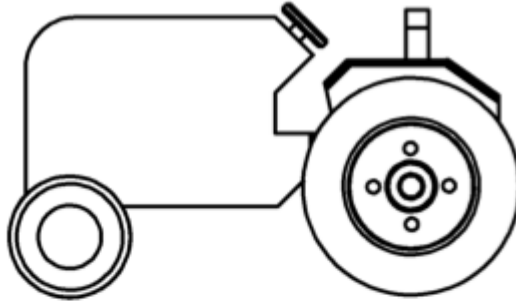
- (i) Make well-proportioned sketches of the following views:  
(The steering wheel need not be included)
- An **elevation** in the direction of arrow **X**.
    - Elevation: 5 marks (5 x 1). Wheel (front), wheel (back), body, mudguard, seat. (10 marks)
  - A **plan** in the direction of arrow **Y**.
    - Plan: 5 marks (5 x 1). Wheels (front), axel (front), body, mudguards, seat. (10 marks)
- (ii)
- Mudguards are shown in the design above. Suggest a suitable material for the mudguards and explain using notes and sketches how they could be attached to the body of the toy tractor. *Name any tools required and state the processes used.*
    - Suitable material: 2 marks. (Acrylic / metal not wood)
    - Method of attachment: 3 marks (Sketch, Tool & Process) (Glue: 1 max)
  - Make a well-proportioned sketch of a **development** of the mudguard. Indicate clearly on your sketch the position of all cutting and bend lines.
    - Correct Development: 5 marks. (Dev(1), Cutting lines(1) & Bend lines(3)) (10 marks)
- (iii) A design modification is required to add an exhaust to the tractor. Sketch a suitable exhaust and suggest how to attach your design to the body of the tractor. *Name any tools required and state the processes used.*
- Exhaust sketch: 2 marks. Method of attachment: 3 marks (Tools (2) & Process (1)) (5 marks)

Section B: Q1(a)

Steering wheel need not be included.

Elevation: 5 marks ( 5 x 1 mk)

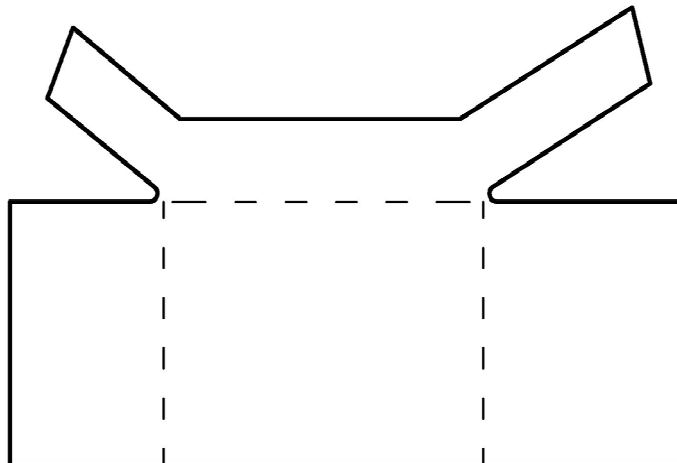
Wheel (front), wheel (back), body, mudguard & seat.



Plan: 5 marks ( 5 x 1 mk)

Wheel (front), front axels, body, mudguards & seat.

Mudguard Development

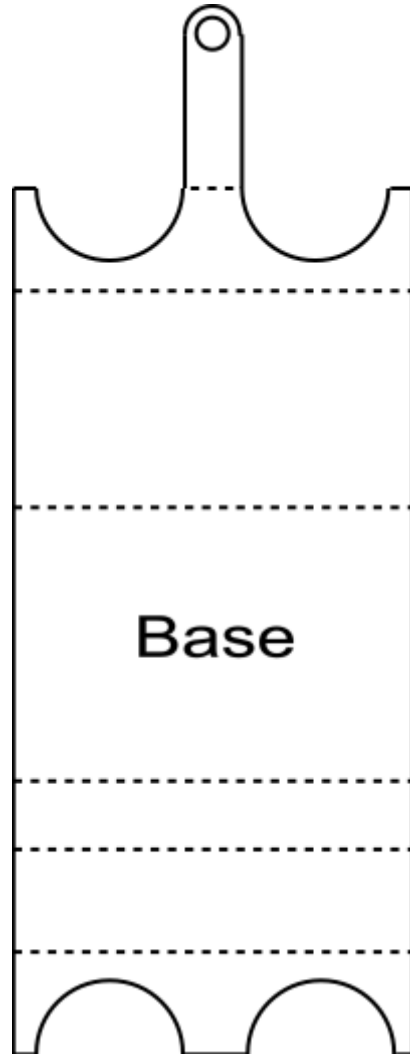


Section B: Q1(b)

Development

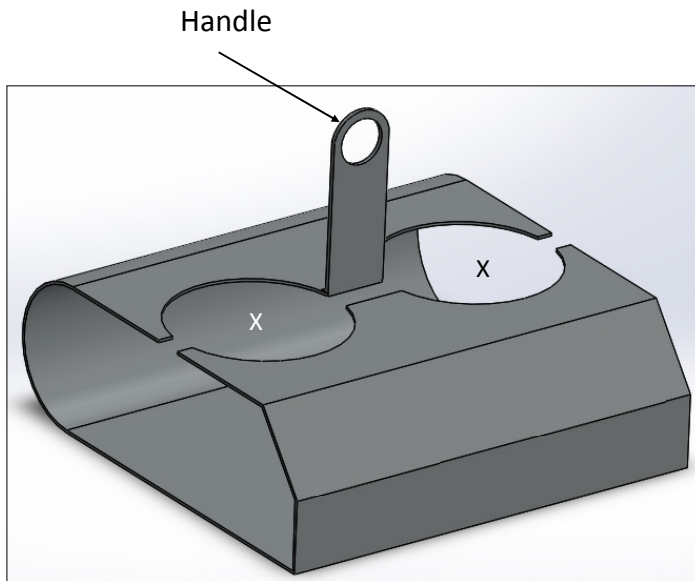
7 panels

6 bend lines

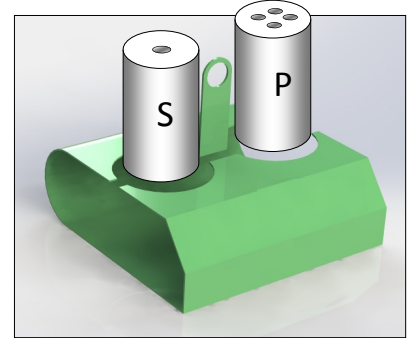


- OR -

1 (b) The graphics show a design for a salt and pepper stand to be manufactured from 3 mm acrylic.



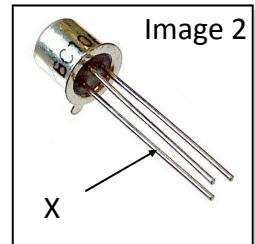
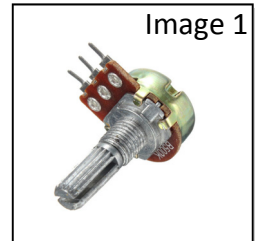
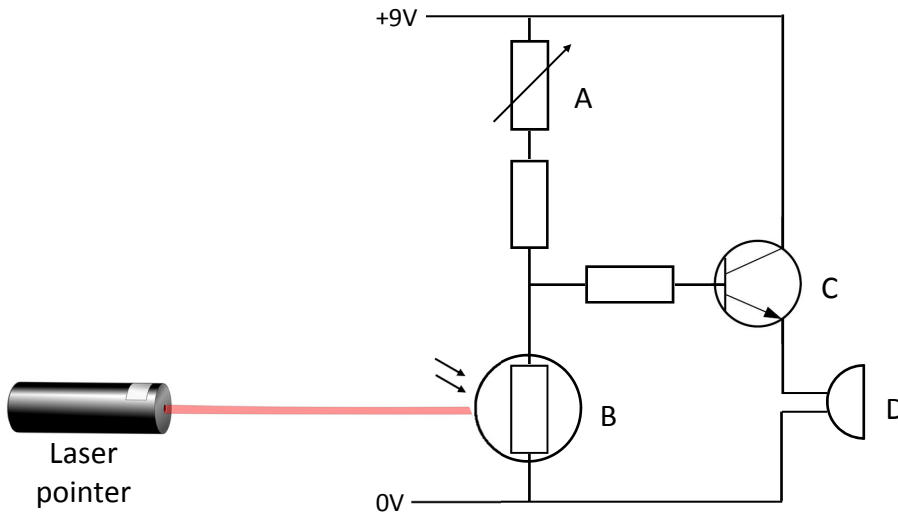
Salt and pepper stand



Stand with salt and pepper containers

- (i) Make a well-proportioned sketch of the **development** of the stand. Indicate clearly on your sketch the position of all cutting and bend lines.
- Development: 10 marks . 7 panels :Correct location /proportion (7 x 1 marks)  
6 Bend lines (3 marks).
- (10 marks)**
- (ii)
1. Explain, using sketches, the steps required to produce the openings X, for the salt and pepper containers, in the 3 mm acrylic sheet. *Name any tools required and state the processes used.*
    - Sketche(s): 2 marks , method used: Process (1+ 1), Tools (1)
  2. Describe, using sketches, how to manufacture the stand from 3 mm acrylic sheet. *Name any tools required and state the processes used.*
    - Sketche(s): 2 marks , method used: Process (1+ 1), Tools (1)
- (10 marks)**
- (iii) A design modification is required to prevent the handle from bending when the stand is lifted. Describe, using sketches, a suitable modification to solve this problem.
- Sketche(s): 3 marks, Suitable strut/tie : 2 marks
- (5 marks)**

- 2 (a) The circuit design shown is to be used in a security system.  
If the laser beam shining on component B is interrupted, the system is activated.

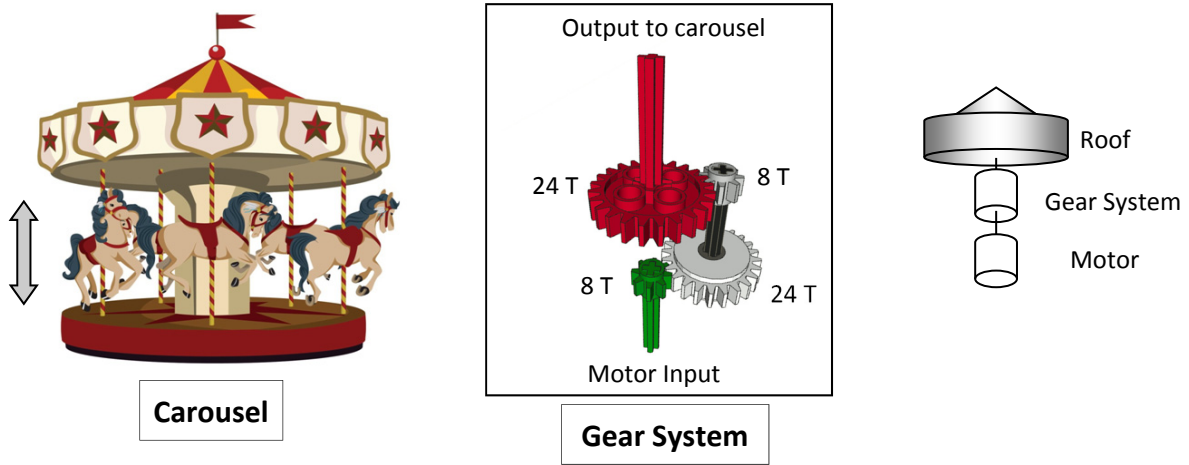


- (i) Name the components labelled **A**, **B**, **C** and **D** in the circuit.  
 ● A: Variable resistor (Pot), B: LDR, C: Transistor & D: Buzzer. (4 x 2 marks)  
 (8 marks)
- (ii) Explain why component **A** is required in the circuit.  
 ● A: Set the circuit trigger level, Bias potential divider, (etc.). 4 marks  
 Component **A** has three pins (as shown in Image 1).  
 Explain which pins should be used when constructing this circuit.  
 ● Middle leg & either one of the two outer legs. 2 x 2 marks  
 (8 marks)
- (iii) Identify the leg of component **C**, marked X (closest to the tab) as shown in Image 2.  
 ● X: Emitter 3 marks  
 State **one** function of component **C** in this circuit.  
 ● Function : Act as a switch / Amplify small base current: 3 marks  
 (6 marks)
- (iv) A suggested modification to this circuit requires that component **D** should be 'Latched'.  
 In relation to this circuit explain the term 'Latch'.  
 ● Latch explained: 3 marks  
 When component D activated by interrupted beam, a 'latch' will keep component D operating even if beam is restored. Latch must be reset to arm the circuit again.  
 (3 marks)

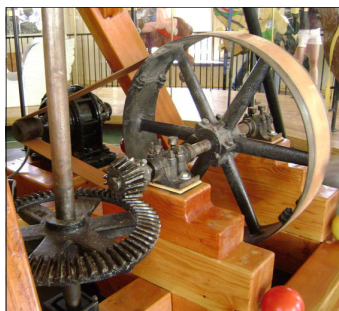


- OR -

- 2 (b) The graphic shows a design for a working model of a fairground carousel.  
A motor drives a gear system, contained in the central support, which turns the carousel.  
The horses move up and down using a mechanism linked to the turning carousel.



- (i) If the motor turns at 360 RPM calculate the speed of rotation of the carousel.  
●  $360 \text{ RPM} / 9 = 40 \text{ RPM}$  . 6 marks (6 marks)  
*Alt:  $360 \times 8 = 24 \times Z1 (120)$  :3 marks.  $120 \times 8 = 24 \times Z2 (40)$  :3 marks  
Alt:  $\text{Driver/Driven} \times \text{Driver/Driven} \times \text{Input speed}$ .  $8/24 \times 8/24 \times 360$*
- (ii) The speed of rotation of the carousel is too high using the system shown.  
Sketch a modification to the gear system shown to reduce the speed of rotation of the carousel to 10 RPM.  
● Modification required to reduce speed from 40 RPM to 10 RPM  
Suitable extra gear system with a ratio of 1:4 / (6 marks)
- (iii) Sketch a design for a mechanism to allow the horses to move up and down as the carousel turns.  
*Name the parts of any mechanism used in your design.*  
● Suitable mechanism: Sketched 4 marks , Parts named correctly 4 marks. (8 marks)
- (iv) The image below shows two mechanisms used in a real world carousel.  
Name **one** of these mechanisms.  
● One Mechanism named: Bevel gear / Pulley & Belt system. (5 marks)



## Section C - 50 Marks

Answer **one** question from this section – all questions carry equal marks.

This section relates to **Technology & Society**, **Control Systems** and **Design & Manufacture**.

### 3. Technology & Society

- (a) “According to new EU targets, Ireland will have to cut its greenhouse gas emissions by a third by 2030.”



The most recent emission figures for Ireland show:

**Agriculture** is the single largest contributor to the overall emissions, at 29.2% of the national total, followed by **Energy** (power generation & oil refining) at 21% and **Transport** also at 21%.

Select **two** of the areas identified above and **in each case** outline **two** technologies which could help to reduce our greenhouse gas emissions.

- Agriculture, Energy or Transport - 2 areas selected.  
2 technologies identified in each area, 2 x 2 x 5 marks. (same technology used twice: 0)  
Technology for greenhouse gas reduction outlined. (quality of answer 5, 3, 1)

**(20 marks)**

- (b) “Many schools use modern technologies in the day to day operation of the school.”

Outline **two** ways in which technology has changed the way schools operate.

- 2 technologies identified. 2 x 5 marks.  
For each technology change outlined (Old/New). (quality of answer 5, 3, 1)  
(Attendance, IT, Security, Water conservation, lighting, ipad, interactive whiteboards, etc.)

**(10 marks)**

- (c) “Many modern household devices can connect to a network wirelessly, allowing them to send and receive data.”

Name **two** household devices which can use this technology and outline **two** advantages of this type of technology for a consumer.

- 2 devices named/identified. 2 x 1 marks.  
Two advantages outlined. 2 x 4 marks. (quality of answer 4, 2, 1)

**(10 marks)**

- (d) “*Always-on* mobile communications have become a feature of modern life.”

Outline **one** advantage and **one** disadvantage of *always-on* mobile communication.

- One advantage: 5 marks, One disadvantage: 5 marks  
(quality of answer 5, 3, 1)

**(10 marks)**

#### 4. Control Systems and Technology & Society



(a) The NAO humanoid robot shown is programmable, interactive and can act independently of a human controller.

(i) Outline **two** ways in which this robot could 'interact' with people.

- 2 interaction technologies outlined. 2 x 5 marks.

(quality of answer 5, 3, 1)

Robotic input outlined, robotic output outlined.

Ex. Sound - input voice recognition, output respond to voice command.

(ii) Outline **two** functions of a microprocessor in this robot.

- 2 functions outlined. 2 x 5 marks.

(quality of answer 5, 3, 1)

Microprocessors as part of a circuit/mechanism can

control movement, control sound response to voice input,

control appropriate response to visual input, etc.

**(20 marks)**

(b) Robotic devices have become more popular in recent years.

Examples include: industrial robots, military robots, medical robots and transport robots.

(i) In the case of any **two** of the examples above, outline the functions of these robots.

- 2 examples, function outlined. 2 x 5 marks.

(quality of answer 5, 3, 1)

Industrial: repetitive, accurate, faster, etc.

Military: safety, remote operation, expendable, etc.

Medical: precision, remotely operated, etc.

Transport: passenger safety, best route, no driver fatigue, etc.

(ii) In the case of any **one** of the examples above, outline **one** advantage and **one** disadvantage of using these robots.

- One example, one advantage & one disadvantage outlined. 2 x 5 marks.

(quality of answer 5, 3, 1)

(iii) In relation to robotics, explain any **two** of the following terms:

**sensor, actuator, feedback, control software.**

- 2 terms explained. 2 x 5 marks.

(quality of answer 5, 3, 1)

Sensor: Input device to detect - sound, light, movement, heat, etc.

Actuator: Device to bring about movement - convert electrical input to mechanical output,

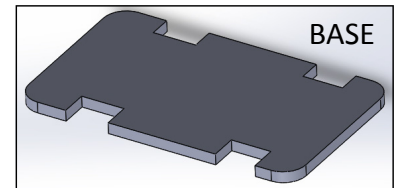
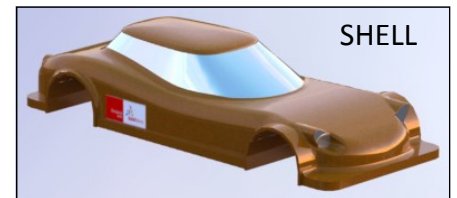
Feedback: Method to sense position, temperature, light, etc. and use that information to determine if a robotic device should continue or change operation.

Control s/w: Programme (Application) which will use data from sensors and feedback data to operate actuators, etc.

**(30 marks)**

## 5. Design & Manufacture

A student intends to manufacture a motorised model car based on the design shown.



- (a) (i) Describe, with the aid of sketches, the steps required to manufacture the body shell from a suitable material.  
*Name any tools required and state the processes used.*

- Manufacturing steps. [15 mks]  
(quality of answer 5, 3, 1)  
Sketches - 5 marks, manufacturing process (mould, vacuum forming) - 5 marks,  
Tools & processes identified correctly (Finish) - 5 marks.

- (ii) Describe, with the aid of sketches, how the body shell could be easily attached and detached from the base shown. (glue:0)

- Attach / Detach. [10 mks]  
(quality of answer 5, 3, 1)  
Sketches - 5 marks, valid method - 5 marks.

(25 marks)

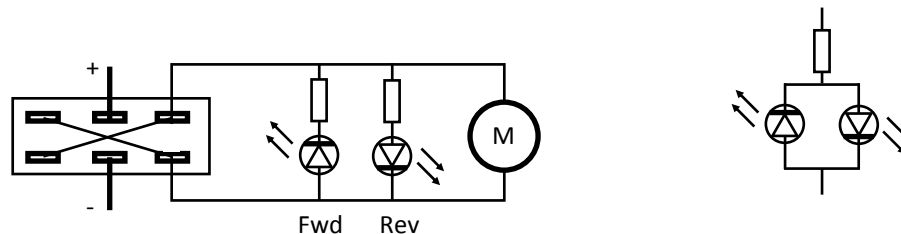
- (b) (i) Describe, with the aid of sketches, how the model could be motorised using a DPDT switch and a motor with an attached gearbox.

- Motorising. [15 mks] Must include sketches.  
Sketching (5) & Wiring (X:5) DPDT switch - 10 marks,  
additional connections to battery & motor - 5 marks.



- (ii) Describe a modification to include a suitable circuit which will turn on the front lights when moving forward and the rear lights when moving backward.

- Modification. [10 mks]  
Forward - front lights: 5 marks  
Reverse - rear lights: 5 marks

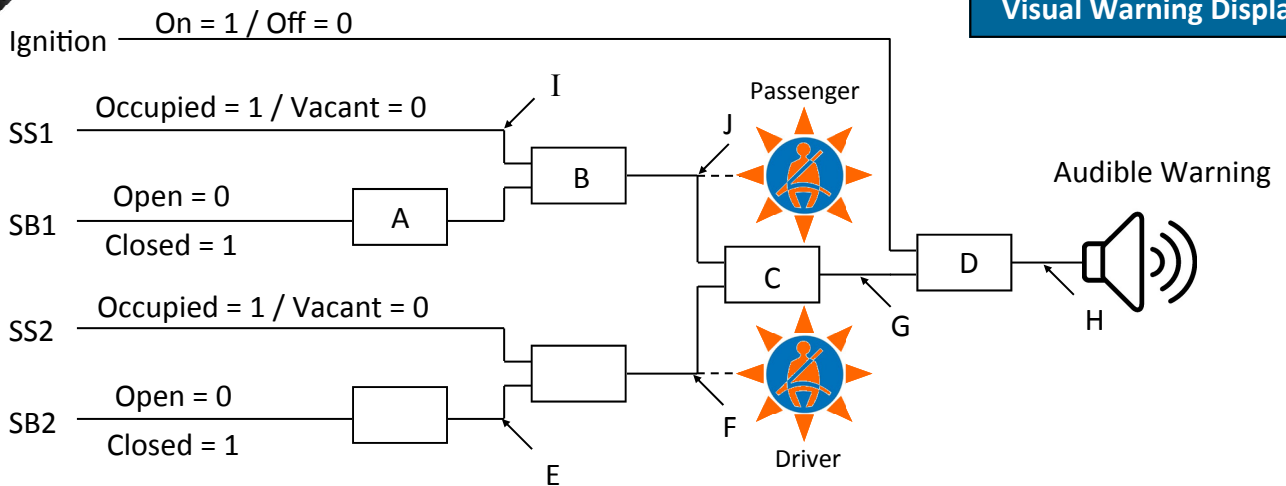
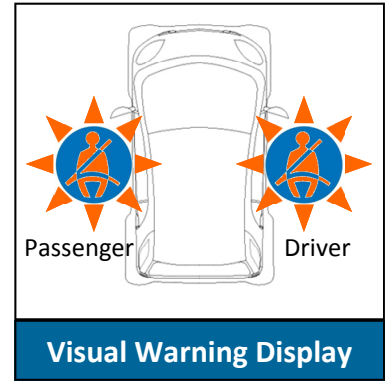


(25 marks)

## 6. Control Systems

- (a) A system diagram, to monitor the seat belt usage in a **two seat** smart car, is shown. The system will produce both a visual and an audible warning if a seat is occupied but the seat belt is not closed.

Each seat sensor (SS) will output a '1' when that seat is occupied and a '0' if vacant. Each seat belt sensor (SB) will output a '1' if that belt is closed and a '0' if open.



- (i) Name the logic gates required at A, B, C and D.  
A: **NOT** gate, B: **AND** gate, C: **OR** gate and D: **AND** gate. 4 x 4 marks

- (ii) Draw a truth table for each of the logic gates at A and D.  
A: NOT 4 marks (2 x 2)      D: AND gate 4 marks (4 x 1)

1	0
0	1

1	1	1
1	0	0
0	1	0
0	0	0

(24 mark)

- (b) For the system shown, copy and complete the truth table for the following situation:  
(indicate if each of the positions marked are at '1' or '0')

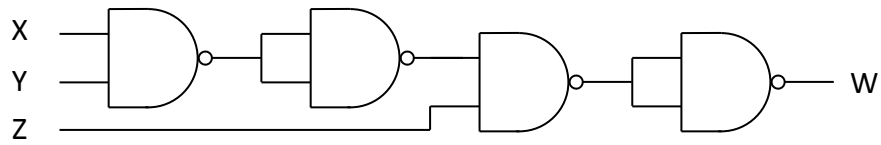
'The ignition switch is on, the driver seat is occupied but the seat belt is open, while the passenger seat is vacant but the seat belt is closed.'

E	F	G	H	I	J
1	1	1	1	0	0

6 x 2 marks

(12 marks)

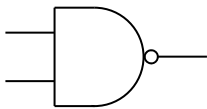
- (c) A NAND gate is a combination of an AND gate and a NOT gate.  
Copy and complete the truth table below for the combination of gates shown.



INPUT			OUTPUT
X	Y	Z	W
1	1	1	1

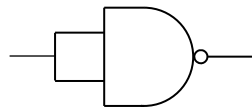
5,5,4 marks

(14 marks)



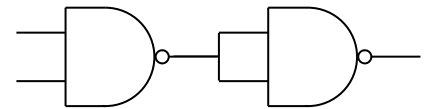
1	1	0
1	0	1
0	1	1
0	0	1

Fig 1



1	0
0	1

Fig 2



1	1	1
1	0	0
0	1	0
0	0	0

Fig 3

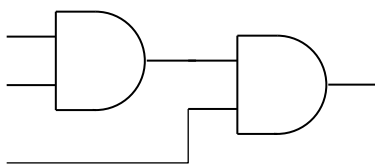
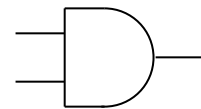


Fig 4

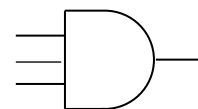


Fig 5

X	Y	Z	W
1	1	1	1
1	1	0	0
1	0	1	0
1	0	0	0
0	1	1	0
0	1	0	0
0	0	1	0
0	0	0	0

Fig 6