



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

**Junior Certificate 2016**

**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.



*Junior Certificate Examination, 2016*

# *Technology*

## *Higher Level*

### *Marking Scheme*

*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**.

**Section A** Answer 25 questions from this section - all questions carry equal marks. **100 marks**

1. State the meaning of the graphics shown.



(i)



(ii)

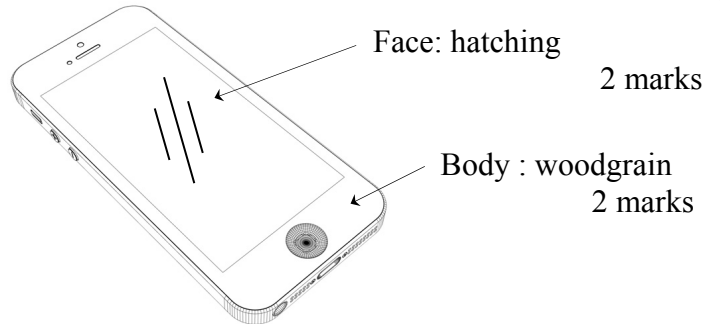
(i): Wool 2 marks

(ii): Bluetooth 2 marks

2. Use appropriate rendering techniques on the sketch shown to suggest:

(a) the face is made of glass,  
and

(b) the body is made of wood.



2 marks

2 marks

3. State **two** advantages of using a QR code as shown.



(i)/(ii):

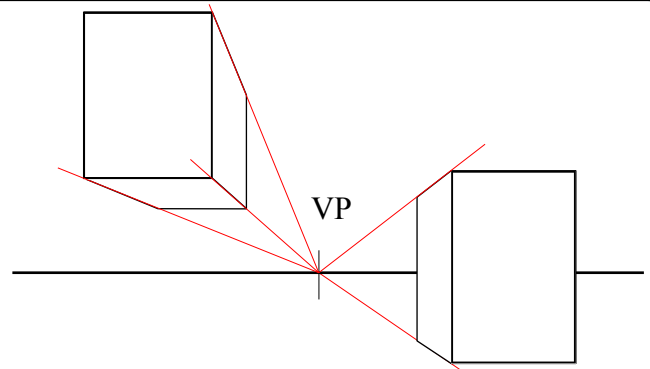
'Fast' access to website,  
No typing required, Quick,  
Access to product information/  
special features / offers, etc.

2 x 2 marks

4. Shown is a single point perspective. Locate the vanishing point.

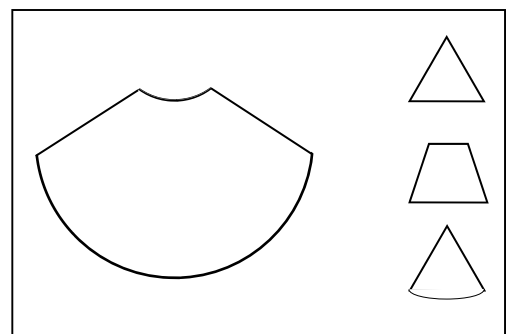
VP correctly located: 2 marks

2 correct construction lines: 2 marks



5. Sketch a development of the light shade shown, which is in the shape of a cone.

Correct shape 4 marks  
(top curve: 2 mks, bottom curve: 2mks)



6. State **two** properties of carbon fibre that makes it suitable for the manufacture of bicycle frames.



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

Lightweight, strength, durable, hard, rigid, rust proof, etc.

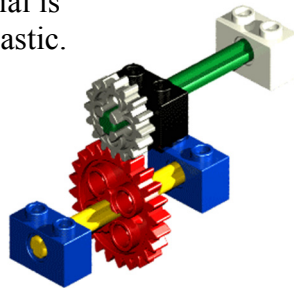
7. State **two** properties of solder that makes it suitable for joining electrical components.



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

Low melting point  
Good mechanical strength  
Conducts electricity  
Conducts heat  
Non-corrosive

8. Indicate clearly on the table shown if the named material is thermosetting or thermoplastic.



Plastic	Thermosetting	Thermoplastic
Acrylic		X
Nylon		X
Bakelite	X	
Polystyrene		X

4 x 1 marks

9. State **two** reasons why a finish should be applied to wooden products.



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

Protects wood,  
Attractive finish,  
Aesthetic, colourful, etc.

10. Name **two** properties of synthetic fabrics which make them suitable for use in sports wear.



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

Lightweight, colourfast,  
breathable, stretch, waterproof,  
strength, dyed easily, flexible,  
stain resistant, etc.

11. In relation to the switch shown, explain the terms:

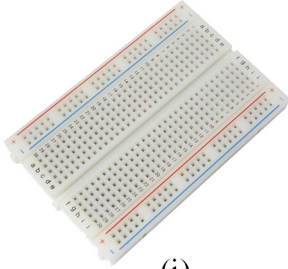
NO and COM.



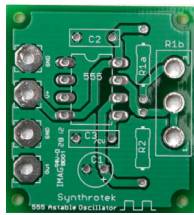
NO: Normally Open 2 marks

COM: Common 2 marks

12. Name the **two** types of electronic board shown.



(i)



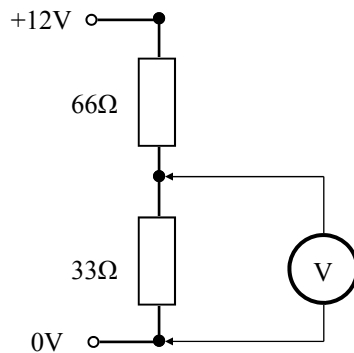
(ii)

(i): Breadboard 2 marks

(ii): Printed Circuit Board  
PCB, named board,

2 marks

13. Calculate the value of **V** in the circuit shown.



Voltage (V): 4(V) 4 marks

Alt::

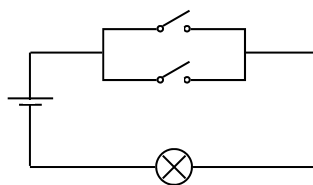
$$V = 12 \times (33 / (33 + 66)) \quad 2 \text{ marks}$$

$$V = 12 \times 1/3 \quad 2 \text{ marks}$$

$$V \times (R1 / (R1 + R2)) \quad 2 \text{ marks}$$

$$2:1$$

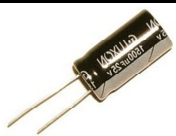
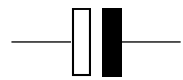

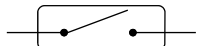
14. Name the logic gate represented by the circuit shown.



Answer: OR gate

4 marks

15. Sketch the symbol for **each** electronic component shown.

Component	Symbol
	Capacitor symbol: 2 marks 
	Reed switch symbol: 2 marks (SPST most common) 

16. Name the gear system used on the drill chuck and key shown.

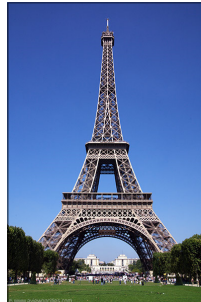


Gear system: Bevel gear 4 marks

17. Name the type of structure shown at (i) and at (ii).



(i)



(ii)

(i): Shell (structure) 2 marks

(ii): Frame (structure) 2 marks

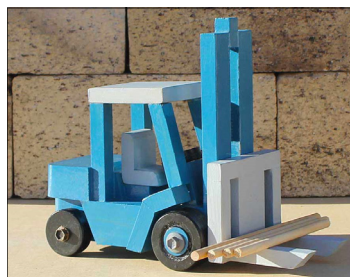
18. Give **two** reasons why toothed belts are used instead of chains in printers.



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

Quiet / easy to replace,  
no lubrication required,  
lightweight, cleaner,  
Lower cost, Efficient, etc.

19. Give a reason why a chain and sprocket system instead of a pulley system is used in a forklift.



Reason: Chain will not slip/ stretch,  
stronger,  
carry greater weight.

1 x 4 marks

20. Name the type of saw shown at (i) and (ii).



(i)



(ii)

(i): Tenon Saw 2 marks

(ii): Coping Saw 2 marks

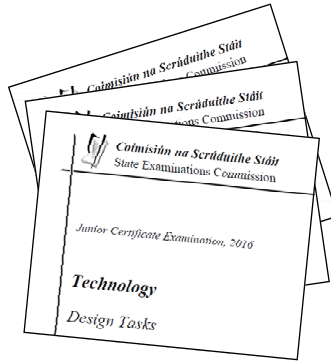
21. Give **two** reasons why additives are used in processed foods.



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

Add preservatives / sweeteners, flavour enhancers, artificial colour, vitamins, minerals, more appealing, etc.

22. In relation to the technology task folder, give **two** reasons why it is important to sketch a number of solutions to your chosen task.



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

Explore more than one option for structure / mechanism / circuit  
Explore alternative solutions which are safer / less expensive / less complex, etc.

23. State the purpose of the button shown, commonly found in technology workshops.



Answer: Electrical isolation switch,  
Emergency cut off switch,  
Safety /Emergency switch,  
Stops power to machine in an emergency,  
Use in Emergency.

4 marks

24. Give **two** practical uses of voice recognition technology.



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

Hands free commands,  
aid to persons with disability,  
unlock device, security,  
generates text without typing,  
etc.

25. Name **two** types of pollution caused by jet aircraft.

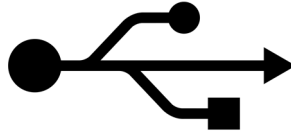


(i)/(ii): 2 x 2 marks

Noise (pollution)  
Exhaust / fumes  
Air (pollution)



26. Name the technology represented by the icon shown



Name: USB (Universal Serial Bus)  
2 marks

and

state **one** use of that technology.

Use: Connect peripheral devices to computer, information storage, memory sticks, charge a device, etc.  
2 marks

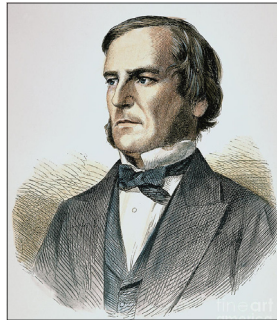
27. Give **two** important features which must be considered when designing food packaging.



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

Information re: Contents / Manufacture / BB date, Attractive design, Durability, Hygienic, Non-toxic, Waterproof, Air tight, etc.

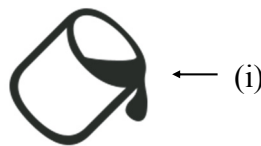
28. Name the professor of mathematics at Queen's University Cork (UCC), whose work paved the way for digital computing and modern electronic devices.



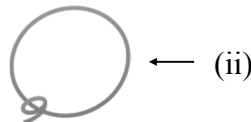
1815 - 1864

Name: (George ) Boole 4 marks

29. State the function of the symbols labelled (i) and (ii) shown, found in the menu of a graphics application.



(i): Fill (paint) an area with colour  
2 marks



(ii): Select ('Lasso') an area  
2 marks

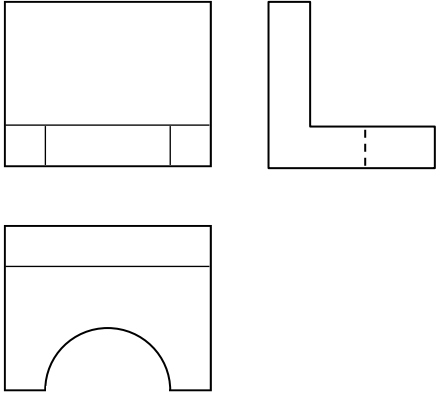
30. State **one** reason why wind generators are not 100% efficient in converting wind energy to electrical energy.



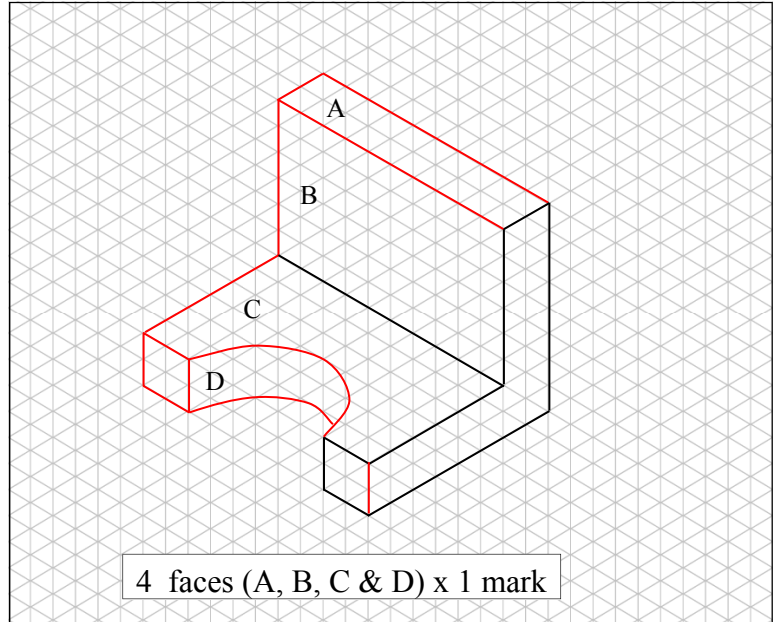
Reason: Energy loss to heat / noise

4 marks

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

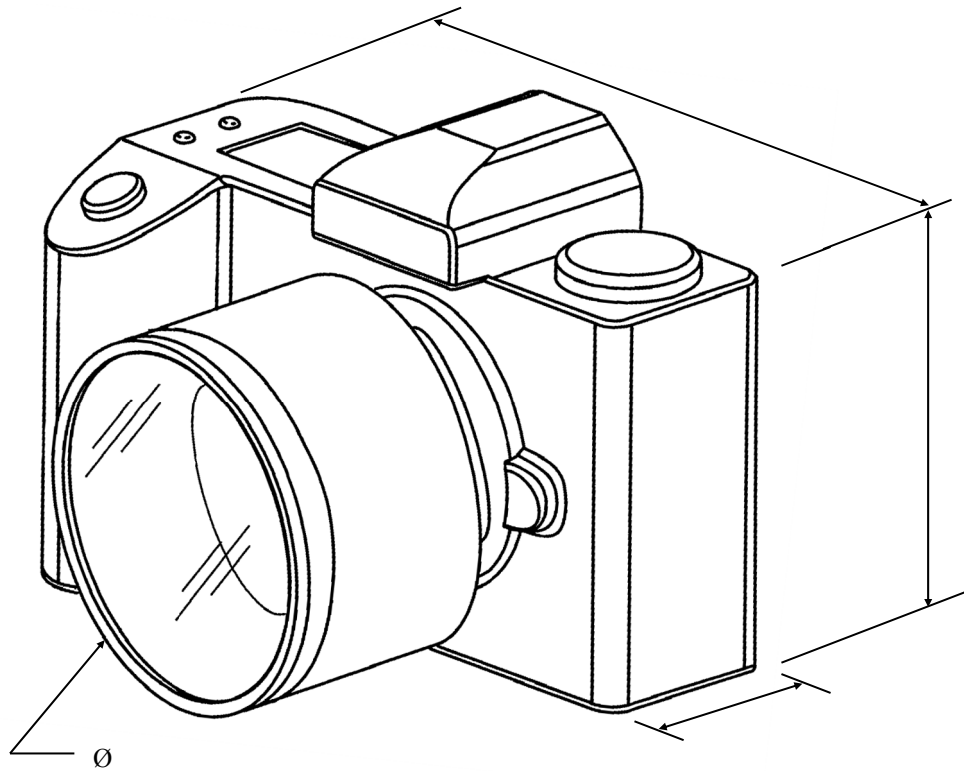


Orthographic projection



4 faces (A, B, C & D) x 1 mark

32. Insert **four** key dimensions on the sketch provided.



Any 4 valid dimensions ( arrow heads & leader lines shown): 4 x 1 mark



*Junior Certificate Examination, 2016*

# *Technology*

## *Higher Level*

**MARKING  
SCHEME**

*Wednesday, 22 June*  
*Afternoon, 2:00 - 4:00*

### *Section B and Section C*

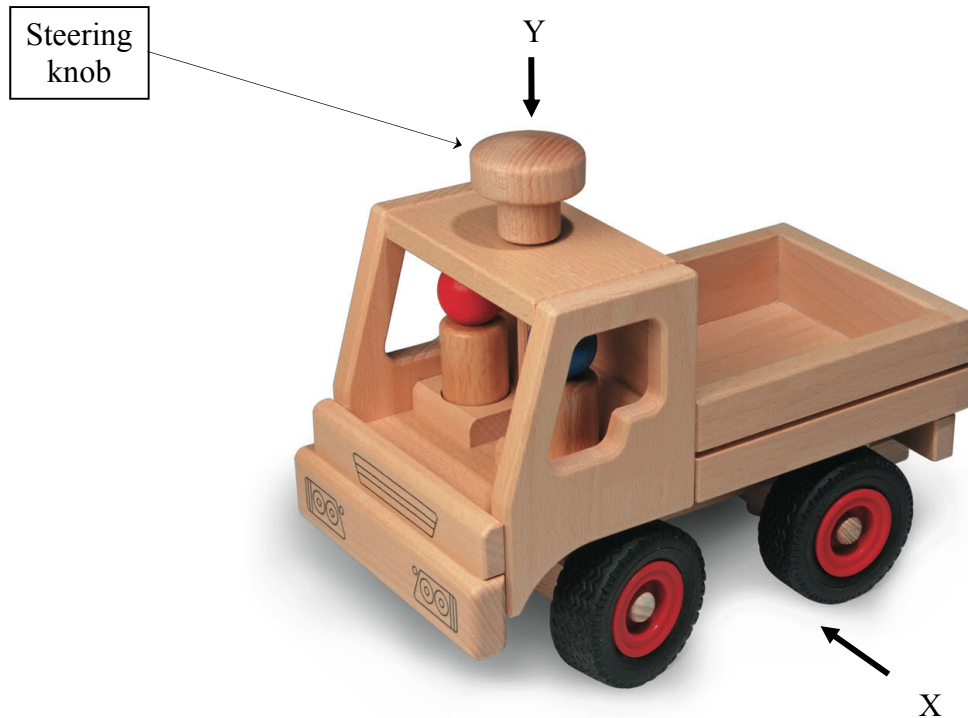
*Section B - 50 marks*

*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 toy truck. The body is 150 mm long and is made from oak.

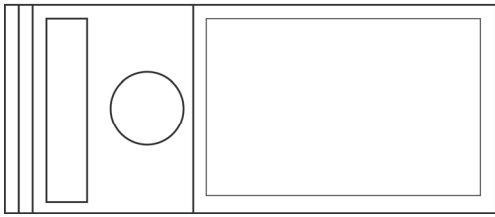


- (i) Make well-proportioned sketches of the following views:
1. An **elevation** in the direction of arrow **X**. [ 5 marks ]  
*Note: The driver and passenger need not be included.*
    - Elevation: 5 mks.
    - Wheels, cab, back, knob, front plate/undercarriage: 5 x 1 marks
  2. A **plan** in the direction of arrow **Y**. [ 5 marks ]
    - Plan-view: 5 mks.
    - Cab, back, steering knob, front plate, windscreen: 5 x 1 mks
- (10 marks)
- (ii)
1. Describe, using suitable sketches, how the side window openings could be formed. [ 5 marks ]  
*Name any tools required and state the processes used.*
    - Sketches (2 mks), process (2 mks) & tool(s) (1 mk)
  2. A windscreen is required for the front of the cab.  
 Describe, using suitable sketches, how to manufacture the windscreen and attach it to the cab. [ 5 marks ]
    - Sketches(2 mks), process (2 mks) & tool(s) (1 mk)
- (10 marks)
- (iii) The truck steering is controlled by turning the knob on the roof of the cab. Describe, using suitable sketches, how this steering can be achieved.  
*Name any mechanisms required.* [ 5 marks ]
  - Suitable mechanism sketched: 2 mks, How to achieve steering: 3 marks.

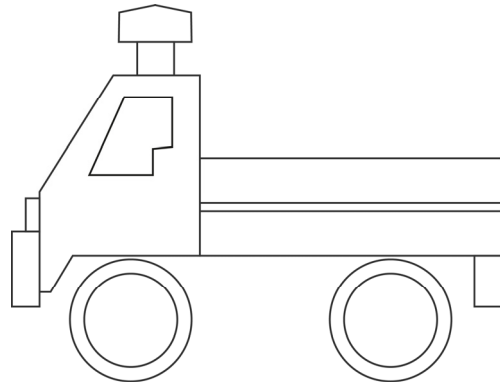
(5 marks)

Q 1(a)

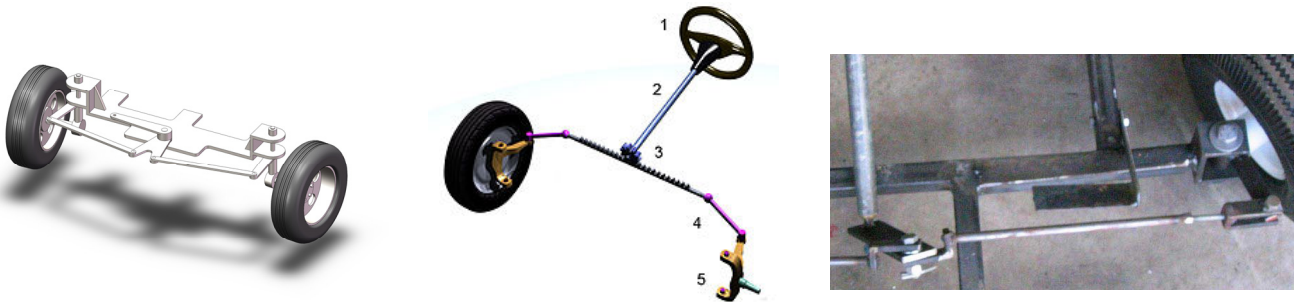
PLAN [ 5 marks]



ELEVATION [ 5 marks]

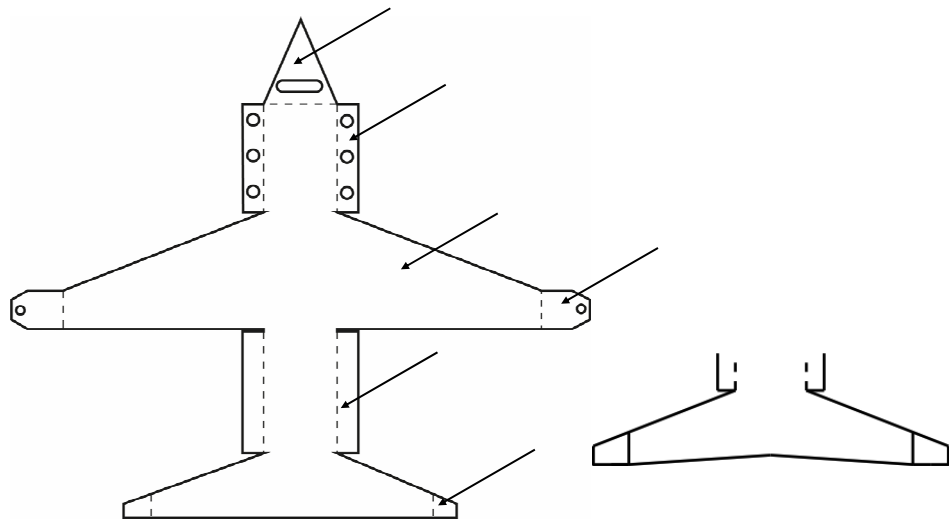


(iii) Steering mechanism [ 5 marks]

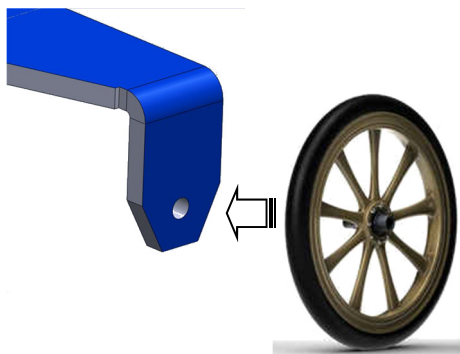


Q 1(b)

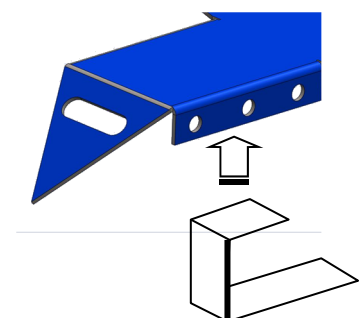
DEVELOPMENT [ 10 marks]



(ii) Attach wheel [ 5 marks]

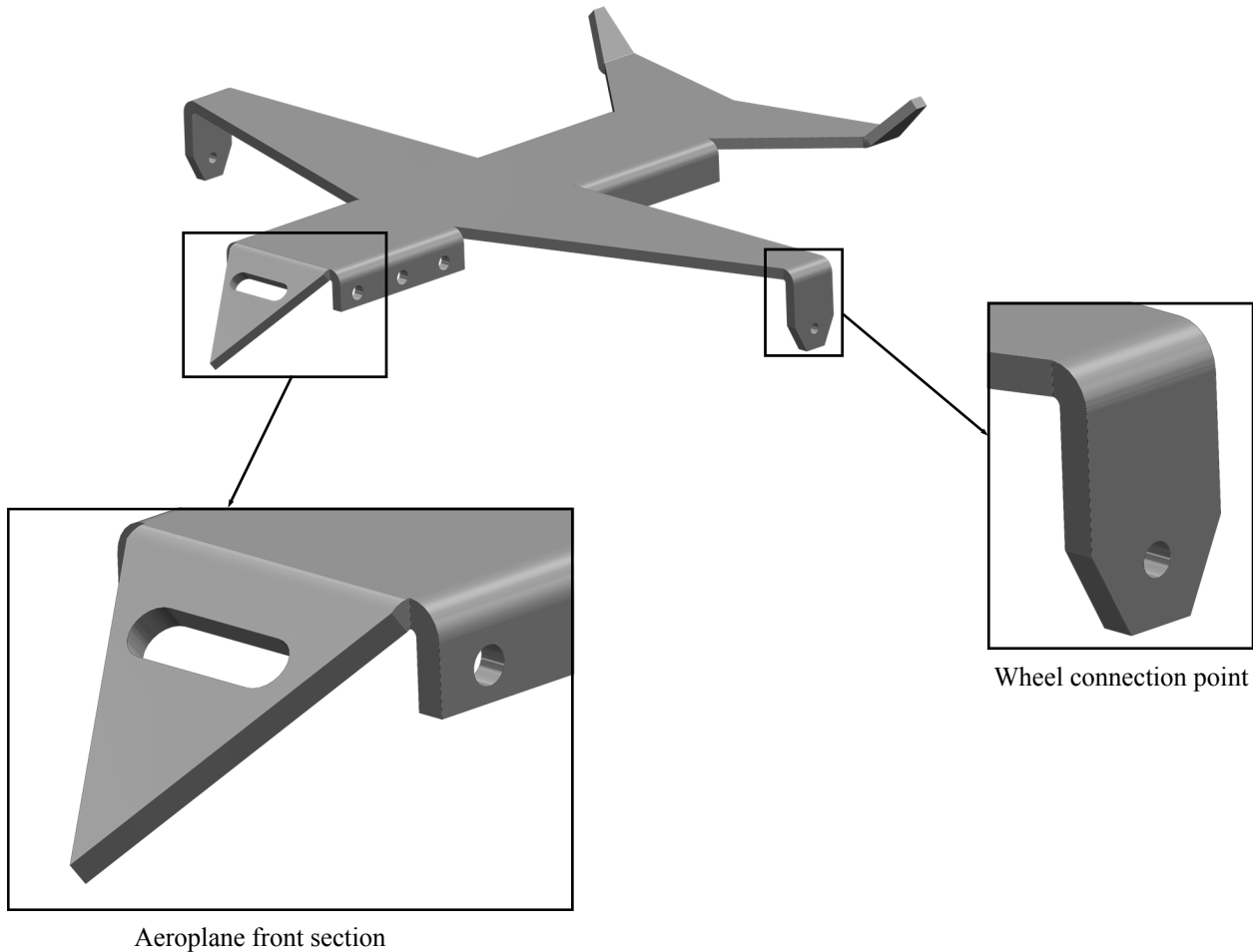


(iii) Design nose skid [ 5 marks]



- OR -

- 1 (b) The graphics show a design for a toy aeroplane.  
The toy is to be manufactured from a single sheet of 3 mm acrylic.



- (i) Make a well-proportioned sketch of a **development** of the aeroplane. Indicate clearly on your sketch the position of all cutting and bend lines.
- Correct location of 6 panels on development: 6 marks  
[ Nose / Front undercarriage / Rear panel / Body / Wing flaps / Tail flaps.]
  - Correct proportions: 2 marks, Correct Bend Lines: 2 marks
- (10 marks)

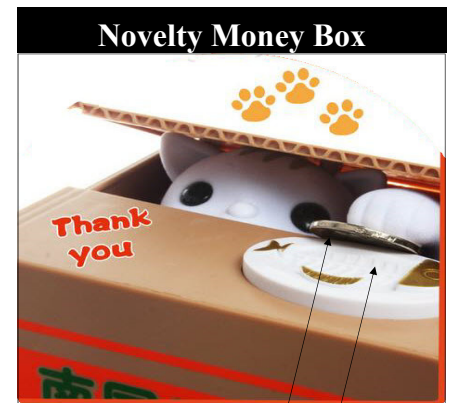
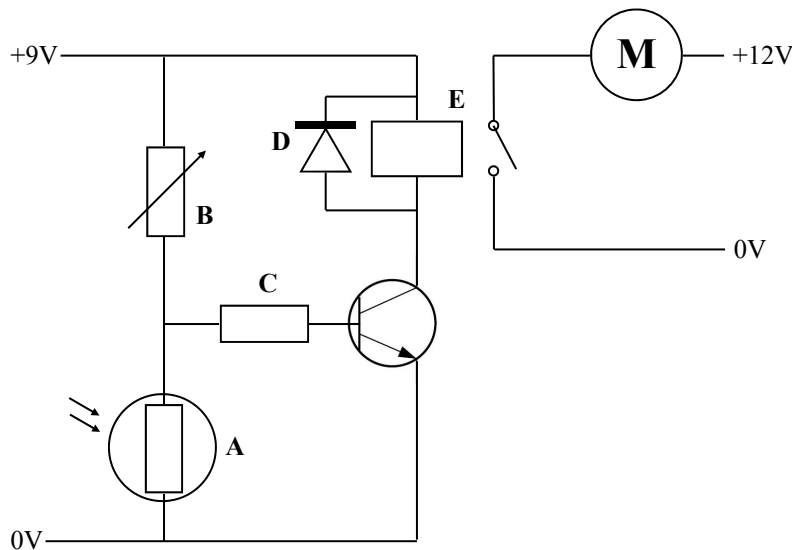
- (ii) 1. Explain, using sketches, the steps required to manufacture the aeroplane front section from the 3mm acrylic sheet.  
*Name any tools required and state the processes used.* [5 marks ]
- Sketches (2 mks), process (2 mks) & tool(s) (1 mk)
2. Describe, using sketches, how a suitable wheel could be attached to the aeroplane at the wheel connection point shown. [5 marks ]
- Sketches (2 mks), process (2 mks) & tool(s) (1 mk)
- (10 marks)

- (iii) A design modification is required to prevent damage to the nose of the aeroplane, when the aeroplane is pushed along the ground.  
Describe, using sketches, a suitable nose skid to solve this problem. [ 5 marks ]
- Design modification: Sketch (3 marks), suitability (2 marks).
- (5 marks)

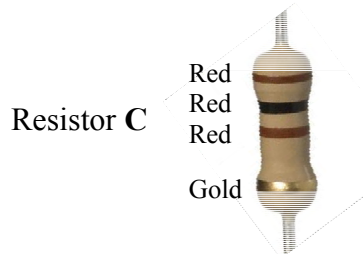
2 (a) The circuit design shown will be used in a novelty money box.

The following actions will be performed by the circuit when a coin is placed on the sensor:

- Sensor circuit activated,
- Motor turns,
- Arm of toy cat (attached to motor) draws coin into box,
- Sensor circuit deactivated,
- Motor stops.



Coin      Sensor

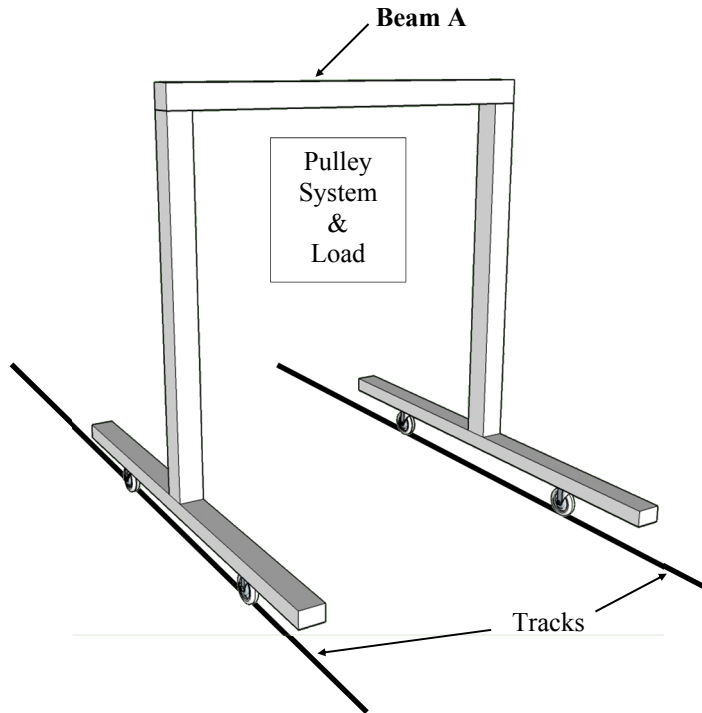


Resistor Colour Codes	
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Grey	8
White	9

- (i) Name the components labelled **A** and **D** in the circuit. (6 marks)  
 • A: LDR /Light sensor [ 3 marks ], D: Diode [ 3 marks ]
- (ii) Explain why components **B** and **E** are required in the circuit. (6 marks)  
 • B: (VR) used to set trigger level / sensitivity [ 3 marks ]  
 • E: (Relay) used to operate motor circuit / 2nd higher voltage circuit [ 3 marks ]
- (iii) Resistor **C** has coloured bands as shown above. (6 marks)  
 Using the resistor colour code table, calculate the value of this resistor and state its tolerance.  
 • C: 2200Ω / 2.2k / 2k2 - [ 1,1,2 marks ]  
 • Tolerance: ± 5% - [ 2 marks ]
- (iv) State **one** functions of the transistor in this circuit. (7 marks)  
 • Act as a *switch* to turn on relay or *amplify* small change in light levels/current.  
 [ Correct answer 7 marks ]

- OR -

2 (b) The graphic shows a design for a working model of a lightweight workshop gantry crane. The crane will allow small loads to be lifted and moved around a workshop.



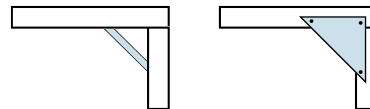
- (i) Sketch **two** possible cross sections for beam A to support a vertical load. Your design must ensure the beam is lightweight and will resist bending. (6 marks)  
 • 2 x valid designs (lightweight & resist bending. [ 2 x 3 marks ])



(ii) Copy the crane design shown and sketch clearly additional members to:

- (a) further support beam A. • Valid sketch [ 3 marks ]

Support Beam A - struts / plate



and

- (b) increase the stability of the crane. • Valid sketch [ 3 marks ] (6 marks)

Increased stability - struts / ties

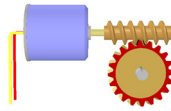




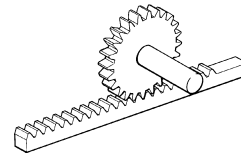
- (iii) Sketch and name the parts of a suitable motorised mechanism to move the crane slowly forward and backward along tracks in the workshop. (6 marks)
- Sketch [ 3 marks ], name mechanism [ 3 marks ]

Suitable slow motorized mechanism

Worm drive, rack & pinion, linear actuator, etc.



(worm drive)

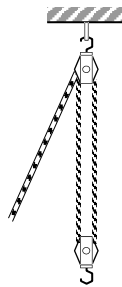


(rack & pinion)

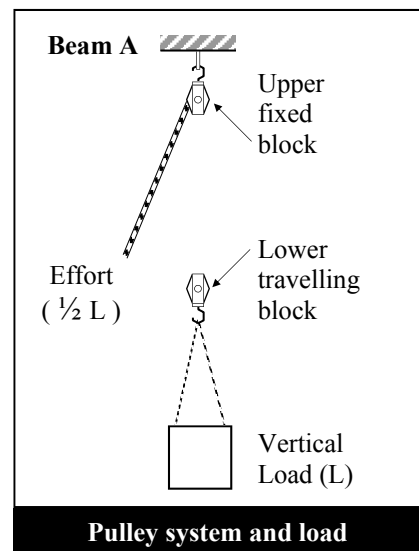
- (iv) The design will use a pulley system to lift small loads.

- (a) Sketch a design for a pulley system which will require an effort of  $\frac{1}{2}$  of the load
- Valid pulley design sketched [ 4 marks ]

Pulley system  
( 2 ropes )



and



- (b) includes a mechanism to hold the raised load at a fixed height.
- Valid mechanism sketched [ 3 marks ]

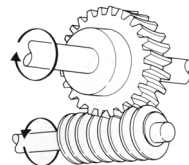
(7 marks)

Non-slip

(ratchet & pawl )



(worm & wheel)



## 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**.

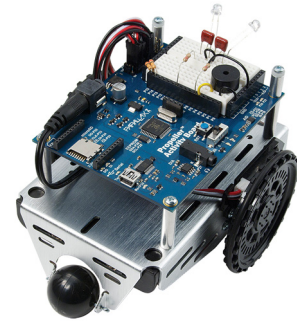


### 3. Technology & Society

- (a) ‘Bike-rental schemes have become popular in many large cities. Registered users can collect and return bikes to a number of secure locations around the city. These schemes are encouraged by local authorities and are supported by a smart phone app.’
- (i) Outline **two** reasons why local authorities encourage people to use these bikes.  
• [ 2 x 5 marks ] Traffic congestion, pollution, environmentally friendly, efficient mode of transport, health, etc.
- (ii) Outline **two** ways in which a smart phone app might support this scheme.  
• [ 2 x 5 marks ] Make payment for bike usage easier, identify location of bikes, check availability of bikes, identify bike user, SatNav, etc.
- (iii) Outline **two** technologies needed to operate these schemes.  
• [ 2 x 5 marks ] Internet / Web, Electronic money transfer, GPS, wifi, etc.
- (30 marks)
- (b) Many consumer products are advertised as including ‘Green Technologies’.
- Outline **two** ‘Green Technologies’ which might be included in consumer products.  
• [ 2 x 5 marks ] Parts can be recycle, product manufactured with non-toxic components, Product is energy efficient, Maximise energy efficiency, etc.
- (10 marks)
- (c) Outline **two** ways in which technology is used by today’s consumers when buying products.  
• [ 2 x 5 marks ] Electronic money transfer, on-line purchase, track and trace, check availability (stock) on line, product purchase using smart phone, On-line price comparison, on-line (ticket) booking, contactless payments, etc.
- (10 marks)

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

- (a) The robot shown can be built from a kit containing:  
a programmable microcontroller, suitable sensors,  
two geared motors with drive wheels, a free turning wheel,  
a battery and a frame.



- (i) Outline the purpose of the microcontroller.  
• [ 6 marks ] process input / output, motor control, etc.
- (ii) Outline how the microcontroller is programmed.  
• [ 6 marks ] Code written (flowchart created) with application (on PC) & transferred / downloaded to microcontroller.
- (iii) Briefly outline how the robot can perform **each** of the following actions:
- move forward and turn right [ 6 marks ]  
Forward (3 marks) - 2 motors operate together,  
Turn right (3 marks) - right motor stop & left motor forward.
  - avoid an obstruction. [ 6 marks ]  
Stop, reverse, turn right, forward, turn left, forward.  
(Sensors detect obstruction, sub-routine activated to run sequence of movements to avoid obstruction.)
- (iv) Sketch a design change necessary to allow the robot to travel over soft ground.  
• [ 6 marks ] Sketch valid solution (tracks / wider wheels)

(30 marks)

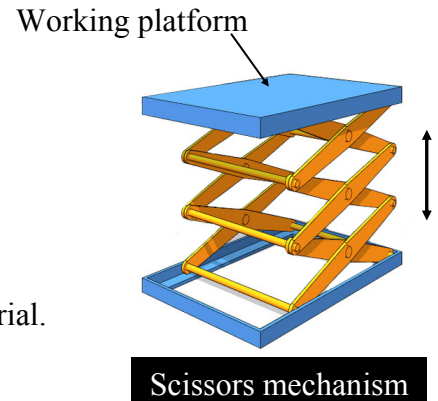
- (b) Robotic devices are available to perform a variety of tasks.

- (i) Using suitable examples, outline **two** tasks for which robots are well suited.  
• [ 2 x 5 marks ] Outline (3 marks), Example (2 marks)  
Dangerous tasks: military bomb disposal, planetary exploration,  
investigation damage in small space, etc.  
Continuous production ( factory ), precision production, etc.
- (ii) Outline **two** impacts which the increased use of robotic machines could have on society.  
• [ 2 x 5 marks ] +/- free up people from repetitive tasks, dangerous work,  
increase production efficiency / cost reduction, loss of jobs, AI, etc.

(20 marks)

## 5. Design & Manufacture

A student intends to manufacture a working model of a scissor platform based on the image shown.



- (i) Describe, with the aid of sketches, the steps required to manufacture the scissor mechanism from a suitable material.  
*Name any tools required and state the processes used.*
- [ Any two manufacturing steps: 2 x 7 marks +1 ]
  - Sketches(3 mks), process (3 mks) & tool(s) (1 mk)

(15 marks)

- (ii) Describe, with the aid of sketches, a mechanism to raise and lower the platform.
- [ 5 marks ]
- Any valid mechanism: Rack and Pinion, Worm gear, linear actuator, Pneumatic / hydraulic ram, etc.

Indicate clearly how to prevent the platform collapsing under load.

- [ 5 marks + 5 marks ]
- Any valid locking mechanism shown / stated: Ratchet and Pawl, Worm, etc.  
Indication as to how this mechanism operate.

(15 marks)

- (iii) When the platform was fully raised the model was found to be unstable. Describe **two** modifications to prevent this happening.
- [ 2 x 5 marks ]
- Any **two** valid modifications: increase area of base (horizontal extensions), increase weight of base, limit height, etc.

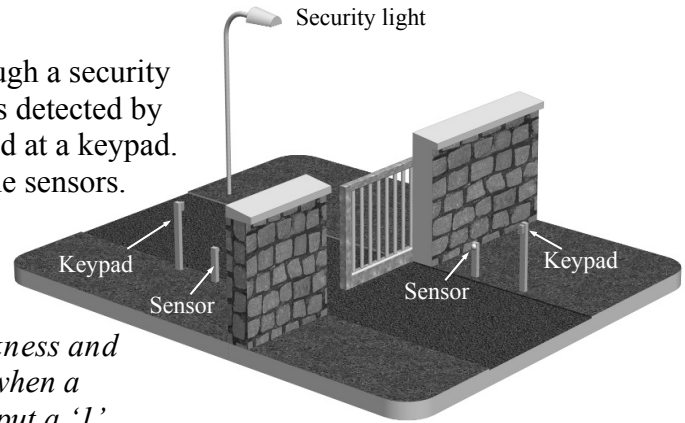
(10 marks)

- (iv) Outline **two** safety features which should be included in the design of the model.
- [ 2 x 5 marks ]
- Any **two** valid safety feature:
- Guard rail on working platform,
  - audible / visual warning when operating, limit/tilt switches,
  - arning if platform is not stable ( off centre), guard on motor, etc.

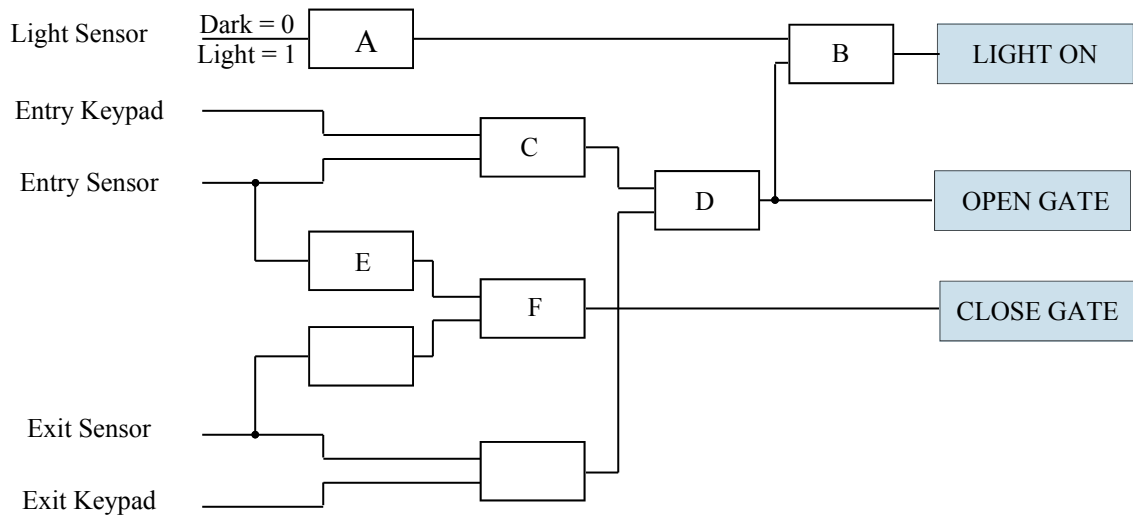
(10 marks)

## 6. Control Systems

- (a) A system diagram, to control entry and exit through a security gate, is shown. The gate will open if a vehicle is detected by the entry or exit sensor and a valid code is entered at a keypad. The gate will close if no vehicle is detected by the sensors. A security light will switch on at night if the gate is opening.



**Note:** The light sensors will output a '0' in darkness and a '1' in daylight. The keypads will output a '1' when a valid code is entered. The entry sensors will output a '1' if a vehicle is detected.



- (i) Name the logic gates required at A, B, C, D, E and F.  
[ 6 x 3 marks ]

A	B	C	D	E	F
NOT	AND	AND	OR	NOT	AND

- (ii) Draw a truth table for the logic gates at C and at D.

C: AND [ 4 x 1 marks ]

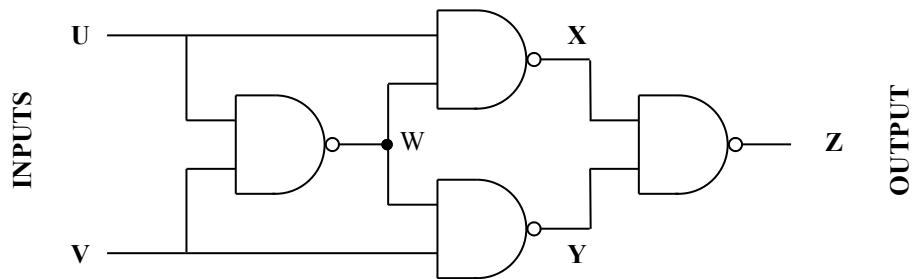
X	Y	Z
1	1	1
1	0	0
0	1	0
0	0	0

D: OR [ 4 x 1 marks ]

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

(26 marks)

- (b) A NAND gate is a combination of an AND gate and a NOT gate.  
NAND gates can be combined to form other logic gates.



Copy the truth table below into your answerbook.  
Complete the table for the inputs shown.

Input U	Input V	W	X	Y	Output Z
1	1	0	1	1	0
1	0	1	0	1	1

[ 8 x 3 marks ]

(24 marks)