



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Certificate 2011

Marking Scheme

Technology

Higher Level



Junior Certificate Examination, 2011

Technology

Higher Level

Wednesday, 22 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

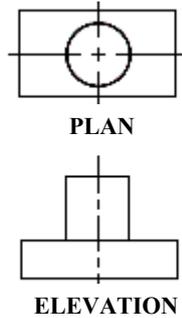
Examination Number

For Examiner	
Question	Mark
Section A	
Section B Q1 (a)	
(b)	
Q2 (a)	
(b)	
Section C Q3	
Q4	
Q5	
Q6	
Total	
Grade	

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

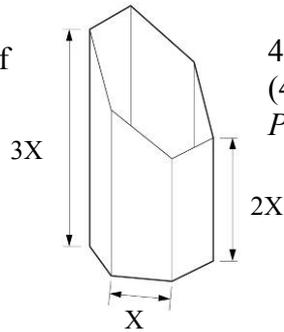
Section A Answer 25 questions from this section - all questions carry equal marks. **100 marks**

1. Name the type of drawing projection shown.

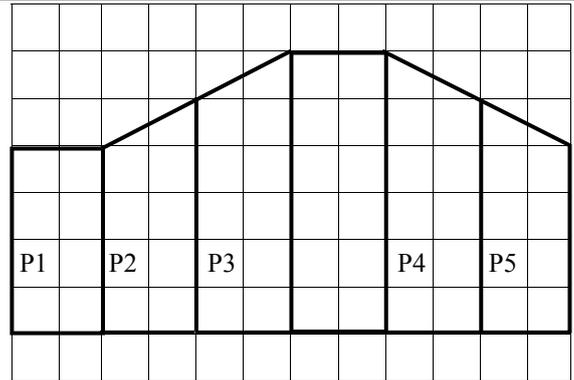


Projection: 3rd angle, orthographic, (4 mks)

2. Complete the development of the hexagonal container shown.



4 completed panel (4 x 1 mks)
P1 & 3 others



3. State **two** reasons why floppy disks are no longer in widespread use for data storage.



1st correct reason 2 marks
2nd correct reason 2 marks

Limited capacity, not reliable, etc.

4. State **two** ways in which data on a computer can be protected from unauthorised access.



1st correct reason 2 marks
2nd correct reason 2 marks

Password, encryption, hidden files, Biometric, etc.

5. State the meaning of **each** of the safety signs shown.



(i): 2 marks: Danger of electrocution

(ii): 2 marks: Wear a face mask

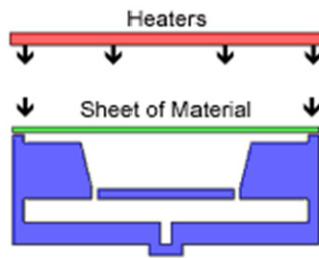
(i)

(ii)

6. Name the plastic shaping process shown

and

explain why only a thin sheet of plastic can be used in the process.



Process: 2 marks - Vacuum Forming

Reason: 2 marks - not possible to shape a thick piece of plastic.

7. In relation to plastics, explain the term **thermoplastic**.



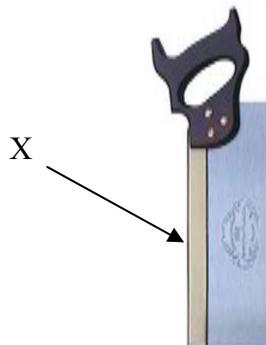
Thermoplastic: 4 marks

Can be reshaped by heating. (can be remelted and remoulded)

8. Name the type of saw shown

and

explain the purpose of part X on the saw.



Saw: 2 marks - tenon saw

X: 2 marks - prevent blade from Distorting (stiffening rib)

9. Name the tool shown

and

name a material which could be cut by the tool.



Name: 2 marks - Snips

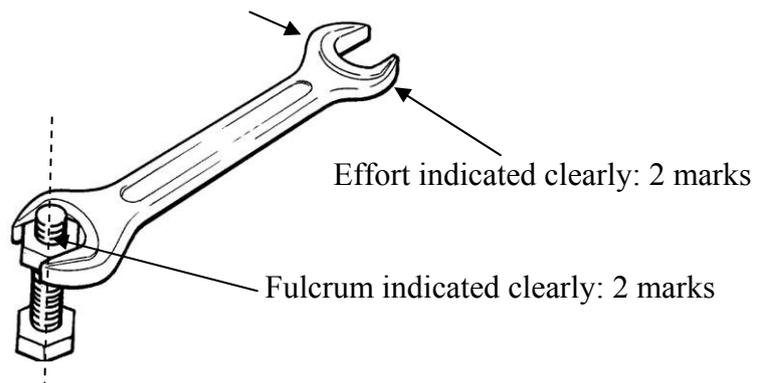
Material: 2 marks - metal, named metal

10. Indicate clearly on the sketch the location of:

(i) the fulcrum

and

(ii) the effort.



11. Name the electronic component shown

and

state the function of the component in a circuit.

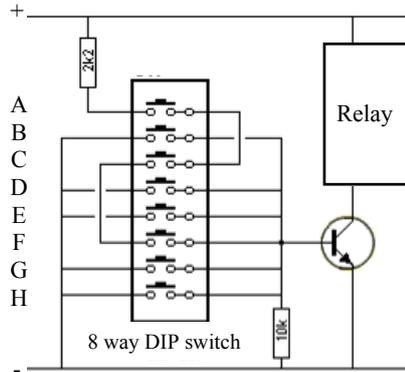


Name: 2 marks - Variable resistor, Potentiometer

Function: 2 marks - Potential divider, dimmer, volume control, speed control, to vary resistance, etc.

12. The relay, in the circuit shown, will only operate when a certain set of switches are closed.

Indicate if the switches listed should be 'open' or 'closed' to activate the relay.



SWITCH	OPEN	CLOSED
A		Closed
C		Closed
E	Open	
G	Open	

4 correct settings - 4 x 1 marks

13. State the units used to measure:

(i) Current

and

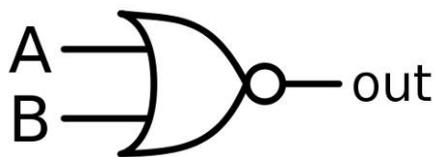
(ii) Potential Difference.



Current: 2 marks - Amps

Potential Difference: 2 marks - Volts

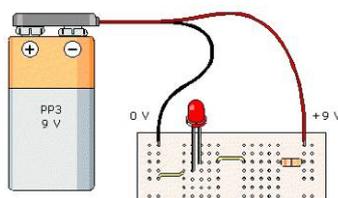
14. Complete the truth table for the logic gate shown.



Truth Table: 2 x 2 marks

A	B	out
1	1	0
0	1	0

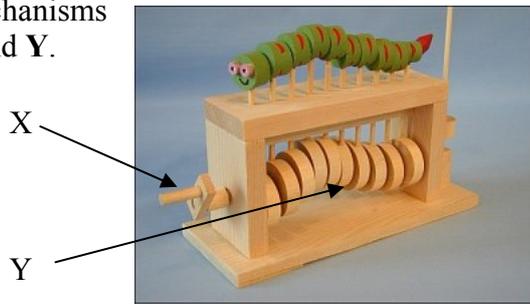
15. Assuming all components are in working order, give **two** reasons why the LED in the circuit shown might not light.



1st correct reason 2 marks
2nd correct reason 2 marks

LED inserted incorrectly,
Wires not in correct sockets
(circuit not completed),
value of R too large, etc.

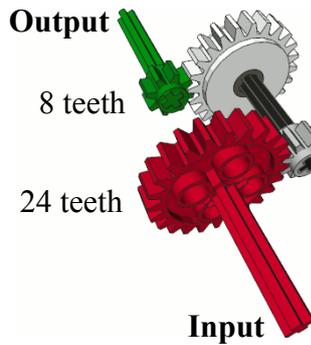
16. Name the mechanisms shown at X and Y.



X: 2 marks - crank

Y: 2 marks - CAM

17. If the input shaft is turning at 180 RPM, calculate the speed of the output shaft.



24 teeth

Speed:

$$24T \times 180RPM = 540RPM \times 8T$$

(2 marks)

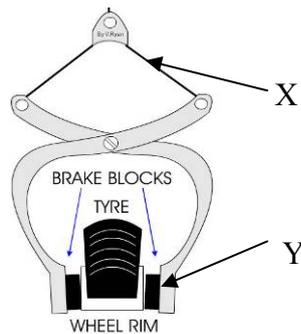
8 teeth

$$540RPM \times 24T = 8T \times 1620RPM$$

(2 marks)

Valid calculation - 2 marks

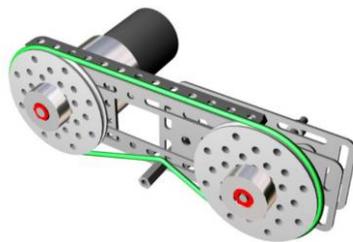
18. Name the forces acting at X and at Y on the bell-crank mechanism shown.



X: 2 marks - Tension

Y: 2 marks - Compression

19. State **two** advantages of the pulley and belt system shown over a chain and sprocket system.



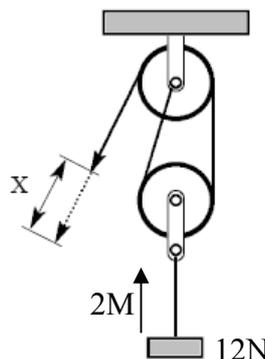
1st correct advantage 2 marks
2nd correct advantage 2 marks

Can slip, cost, easily replaced, no lubrication required, quiet, etc.

20. How much effort is required to lift the 12 N load shown?

and

how many metres of rope X will have to be pulled to lift the load 2 metres?



Effort: 2 marks - 6 N

Metres: 2 marks - 4 meters

21. Name **two** safety features found in modern cars.



1st correct safety feature 2 marks
2nd correct safety feature 2 marks

Air bags, SIP, crumple zones, ABS, etc.

22. State **two** energy conversions taking place when an electric motor is running.



1st correct conversion 2 marks
2nd correct conversion 2 marks

Electrical to Sound,
Electrical to Heat,
Electrical to Kinetic, .

23. State **two** safety precautions which should be observed when using a jig saw.



1st correct precaution 2 marks
2nd correct precaution 2 marks

Goggles, Piece supported,
Power lead secured, etc.

24. Name the technology which allows 'SatNav' devices to determine a location.



Technology: 4 marks - GPS

25. State **two** ways in which technology has changed the music industry in recent years.



1st correct change 2 marks
2nd correct change 2 marks

MP3 players, Music files can be downloaded from web, etc.

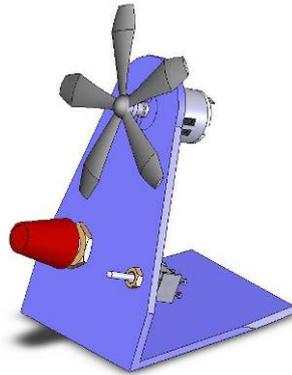
26. State **two** reasons why it is important to invest in renewable energy.



1st correct reason 2 marks
2nd correct reason 2 marks

Fossil fuels are limited, Wind / Solar etc. are renewable, Renewable less polluting, cost, etc.

27. State **two** reasons why a completed task project (such as the desk fan shown) should be evaluated.



1st correct reason 2 marks
2nd correct reason 2 marks

Safety check, Test against brief specs, check for design faults, etc.

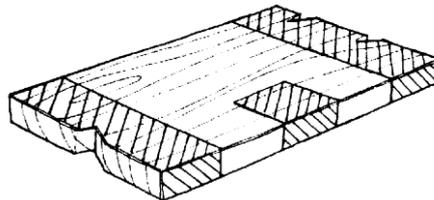
28. In relation to manufactured boards, explain the terms **MDF** and **Veneer**.



MDF: 2 marks - medium density fibre-board

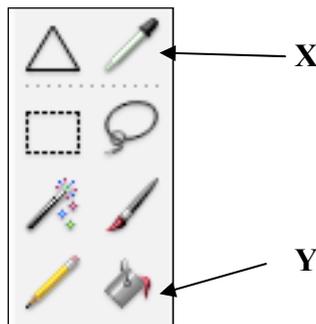
Veneer: 2 marks - thin layer of wood/ plastic on the surface/ edge of another material.

29. Explain the meaning of the hatched lines in the sketch shown.



Meaning: 4 marks - indicated material to be cut away, waste material.

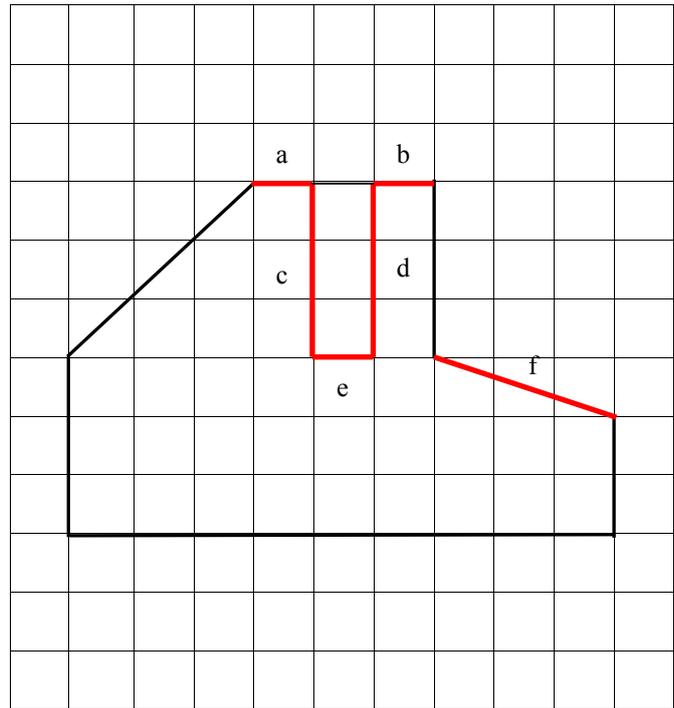
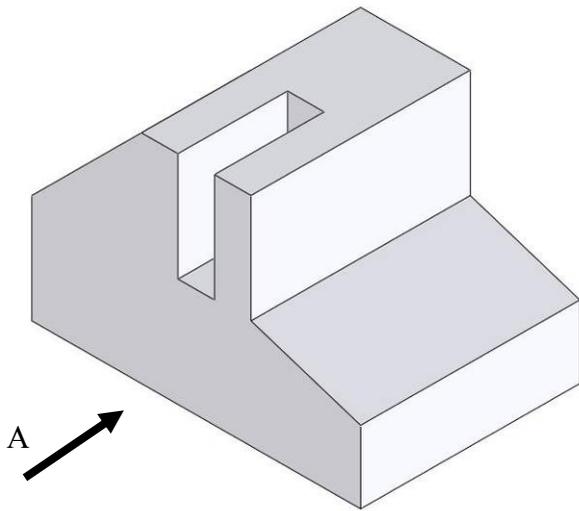
30. Explain the function of the symbols **X** and **Y** shown, found in a graphics application menu.



X: 2 marks -
function: sample/select/pick a colour

Y: 2 marks -
Function: to fill a area with a selected colour

31. Complete the elevation of the object shown when viewed in the direction of arrow A.

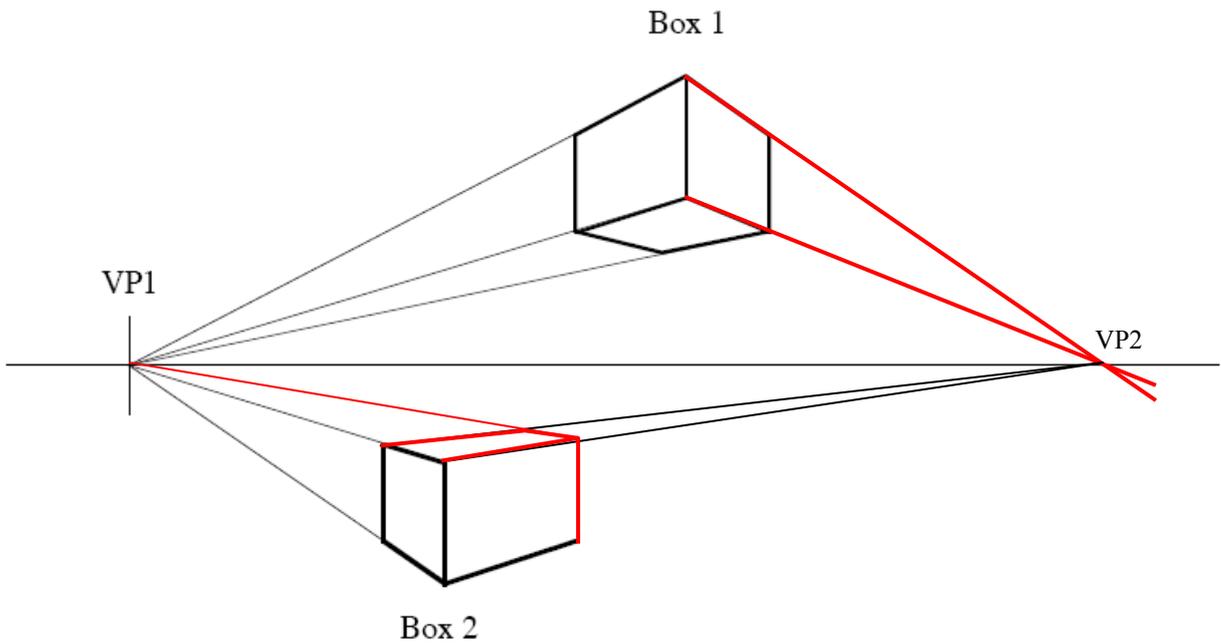


Correct location and size of the following lines:

- 1 mark: a & b 1 mark: c & d
- 1 mark: e 1 mark: f

32. Locate the second vanishing point VP2 and complete the perspective of Box 2.

- Correct location of VP2 : 2 marks
- Completed perspective : 2 marks (4 lines = 2 marks)





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Section B and Section C

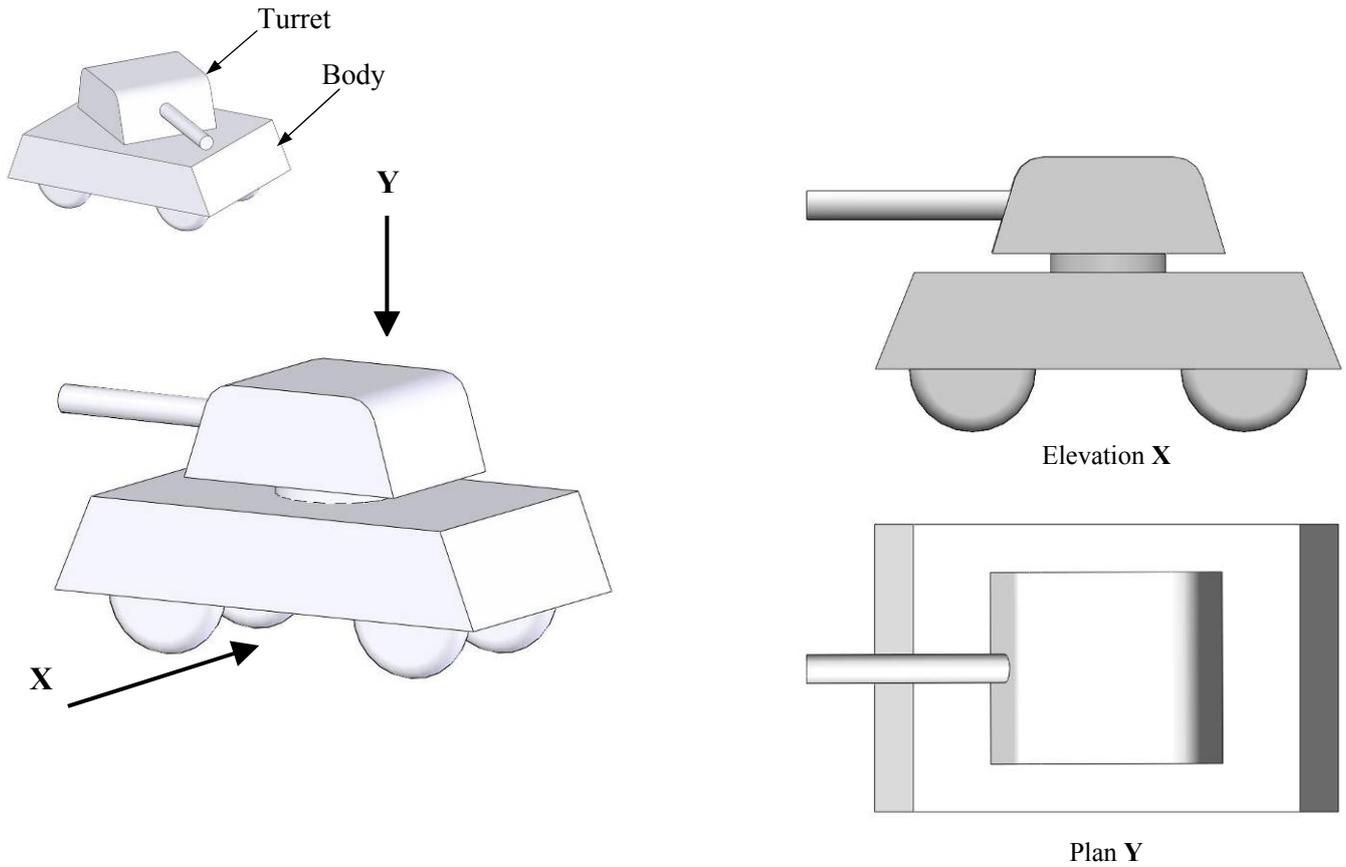
Section B - 50 marks

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 graphics show a design for a model tank.



(i) Make well-proportioned sketches of the following views:

1. An elevation in the direction of arrow **X**.
Correct Elevation: 2 marks, Proportions Correct: 3 marks
2. A plan in the direction of arrow **Y**.
Correct Plan: 2 marks, Proportions Correct: 3 marks

10 marks

- (ii) 1. Describe, using suitable sketches, the steps required to make the acrylic lower section (body) of the model.
Suitable sketch : 2 marks, 3 Valid Steps : 3 x 1 marks.
2. Describe, using suitable sketches, a method to attach the wheels to the body.
Suitable sketch : 2 marks, 3 Valid Steps (method): 3 x 1 marks.

10 marks

- (iii) Sketch and name a suitable mechanism which will allow the turret to rotate through 360°.
Suitable sketch : 2 marks, Correct named mechanism : 3 marks.

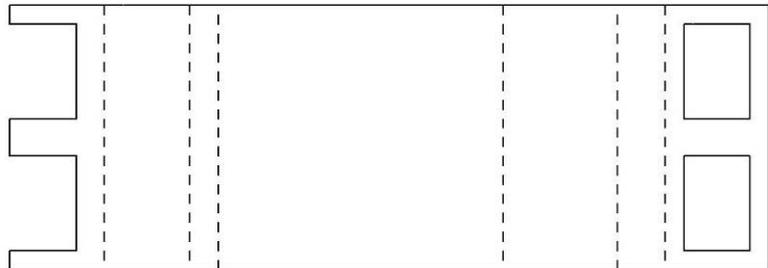
5 marks

- OR -

- 1 (b) The graphics show a design of a holder for two video game controllers. The design is to be made from one piece of acrylic.

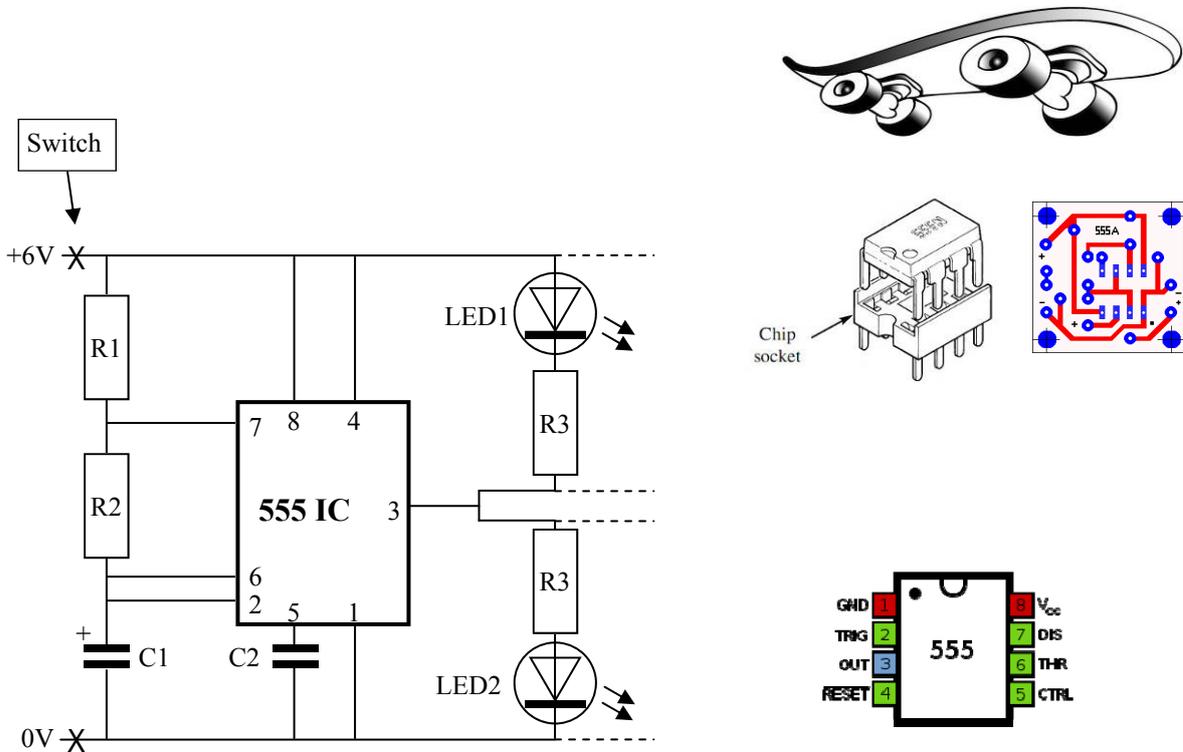


Nunchuck
Controller



- (i) Make a well-proportioned sketch of the **development** of the holder. Indicate clearly on your sketch the position of all bend lines.
Correct Development: 2 marks, Proportions Correct: 3 marks
Correct position of any 5 Bend Lines: 5 x 1 marks
10 marks
- (ii) 1. Explain, using sketches, how the slots on the holder could be cut out.
Suitable sketch: 2 marks, Any three valid steps: 3 x 1 marks
(stated/shown: marking out, pilot hole, cutting, finishing, etc.)
2. The holder design is to be modified to hold the Nunchuck controller shown. Describe using sketches how this could be achieved.
Suitable sketch: 2 marks, Valid modification: 3 (3, 2, 1) marks
10 marks
- (iii) When testing the completed holder, the back panel was found to break easily. Using sketches, suggest a suitable method to prevent this from occurring.
Suitable sketch: 2 marks, Any valid method: 3 (3, 2, 1) marks
5 marks

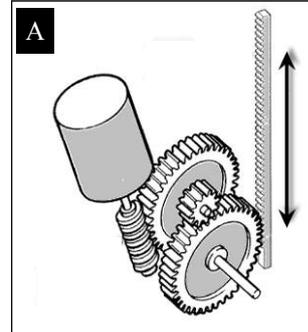
2 (a) The sketch shows an electronic circuit for a flashing LED circuit to be mounted on the underside of a skateboard. (LED1 will flash, then LED 2 will flash, then the sequence will repeat).



- (i) Using a sketch, explain how the pins 1 and 5 can be identified on the 555 IC.
Correct identification of Pin 1: 3 marks, Pin 5: 2 marks. See sketch above
- (ii) The circuit requires an on/off switch.
 Indicate clearly where this switch should be placed in the circuit.
Correct location 'X' of switch: 5 marks See location above
- (iii) State **two** advantages to placing this circuit on a PCB instead of using copper stripboard.
*First valid advantage: 3 marks, second valid advantage: 2 marks.
 Reduce errors in building circuit, Faster to build circuit, etc.*
- (iv) State **two** reasons why a chip socket should be used when mounting the 555 IC on a circuit board. *First valid reason: 3 marks, second valid reason: 2 marks.
 Easy to insert/remove chip, Chip not subject to heat (soldering iron), protect chip.*
- (v) Blue LEDs will be used in this circuit (Blue LED: $V_f = 3V$, $I_{max} = 20mA$).
 Explain why protective resistors, R3, are required for the LEDs.
Correct explanation: 3 marks. Limit voltage across LED, Limit current through LED
- (vi) Additional LEDs and resistors can be attached to the circuit in parallel with LED1 and LED2. Explain why these extra LEDs should be connected 'in parallel' and not 'in series'. *Correct explanation: 2 marks
 Insufficient current to light LEDs in series, In series all parts must work or none will work, etc.*

- OR -

2 (b) A student intends to build a model tipper-truck based on the graphic shown. The combined mechanism, shown at A, will be used to raise and lower the tipper.



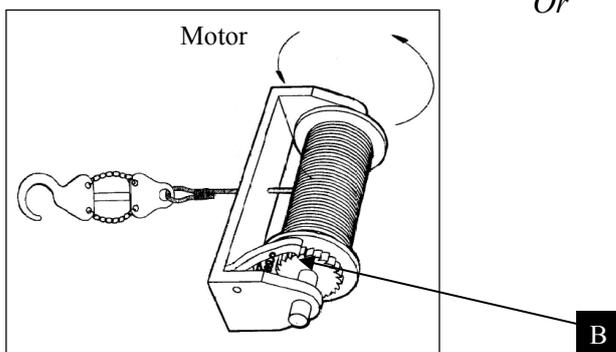
- (i) Name the **two** mechanisms attached to the motor at A.
Two mechanism correctly named: 3 marks (1st), 2 marks (2nd).
Rack & Pinion, Worm Gear, Compound Gear.
- (ii) State **two** benefits of using this lifting mechanism to raise and lower the tipper.
Two benefits correctly stated: 3 marks (1st), 2 marks (2nd).
Locking, Compact, High Torque, Safety, etc.
- (iii) *Hydraulic systems* are used to raise and lower the tipper on commercial trucks. Explain the term 'hydraulic'. *Hydraulic explained: 5 marks. Liquid powering system.*
- (iv) The pulling system shown below will be attached to the front of the truck. Name the mechanism at B and explain the function of this mechanism.
Mechanism B correctly named: 3 marks, Function correctly explained: 2 marks.
Ratchet & Pawl, Pawl prevents drum slipping, Lock, etc.
- (v) If the motor attached to the pulling system turns at 300 RPM, calculate the approximate distance moved by the hook in 1 minute. (Cable Drum Ø10 mm).

$$\begin{aligned} \text{Calculation: } & \text{Circumference} \times \text{RPM} \text{ (2 marks)} \\ & = 2 \times 3.14 \times 5 \times 300 \\ & = 9420 \text{ mm} \text{ (3 marks)} \end{aligned}$$

Or

$$2 \times (22/7) \times 5 \times 300 = 9428.6 \text{ mm}$$

$$2 \times 3 \times 5 \times 300 = 9000 \text{ mm}$$



Pulling System

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 and Society



- (a) Green technologies are very important in everyday life.
- (i) Explain, using **two** examples, why technologies should be “green”.
(1st example 5(3,2) marks, 2nd example 4 (2,2) marks)
Non polluting, renewable, environmentally friendly, etc.
- (ii) Explain, using **two** examples, where green technologies are used in modern homes.
(1st example 4(2,2) marks, 2nd example 4(2,2) marks)
Lighting, Heating systems, Construction material, Solar, etc.
- (iii) Explain, using **two** examples, where green technologies are used in industry.
(1st example 4(2,2) marks, 2nd example 4(2,2) marks)
Energy Sources (Fuels), Energy recovery, Waste recovery, Recycling, etc.
- (25 marks)
- (b) Outline **two** changes which technology has brought to **each** of the named activities in recent years:
- (i) intercity transport, *(1st change: 3 marks, 2nd change: 2 marks)*
High speed trains, on-line ticket systems, Short haul aircraft, etc.
- (ii) food production, *(1st change: 3 marks, 2nd change: 2 marks)*
Genetic engineering, GPS linked farm machines, etc.
- (iii) home-entertainment systems. *(1st change: 3 marks, 2nd change: 2 marks)*
Satellite dishes, Movies on demand, 3D, HD, Wii, Screens, etc.
- (15 marks)
- (c) Explain, using **two** suitable examples, the positive impact which the Internet has on society.
(Example stated and explained - 1st impact: 5(3,2) marks, 2nd impact: 5 (3,2)marks)
On-line shopping / courses, Price comparisons, High speed access to/ distribution of information, etc.
- (10 marks)

4. Control Systems & Technology and Society

Robotic devices are commonly used in the manufacturing industry and in space exploration.



- (i) Explain, giving **two** reasons, why robotic devices are preferred in these situations.

(1st reason 5 (3,2)marks, 2nd reason 5 (3,2)marks)

Conditions in space not suited to humans, etc.

- (ii) In relation to robotic arms, explain what is meant by 'degrees of freedom'.

(Explanation: 7 (7, 5, 2) marks)

Ability to move / rotate in many directions using multiple joints, etc.

- (iii) Explain how robotic devices are 'instructed' to perform a task.

(Explanation: 7 (7, 5, 2) marks)

Robotic device follows a written programme controlling the movement of the joints and the opening / closing / rotating of manipulators, etc.

- (iv) Explain why **sensors** are important in guiding robotic devices used for manufacturing.

(Explanation: 6 (6, 4, 2) marks)

Provide feedback to indicate the location / position of an arm / manipulator, etc.

- (vi) Explain, giving **two** reasons, why robotic manufacturing is more likely to be used in first world countries.

(1st reason 5 marks, 2nd reason 5 marks)

Robotic manufacture used by Hi-tech industries which are based in the First World, Investment / Skills are only available in the First World, etc.

- (vii) Outline **two** other areas where robotic devices are commonly used.

In each case state **one** reason for the selection of a robot in the stated area.

(1st Area outlined 3 marks, One reason stated 2 marks)

2nd Area outlined 3 marks, One reason stated 2 marks)

Area: Bomb disposal, Deep-Sea exploration, Manufacture Industry, etc.

Reason: Safety, Accuracy, etc.

(50 marks)

5. Design and Manufacture

A student is required to manufacture a working model of a motorised car-park barrier as shown in the diagram. The barrier will be opened by a security keycard.



- (a) (i) Describe, with the aid of sketches, the steps required to manufacture the barrier from acrylic. Name the tools and processes used.

*Suitable sketches (2 x 3): 6 mks, Correct named steps (3 x 2): 6 mks,
Named tools (3 x 1): 3 mks*

- (ii) Describe, with the aid of sketches, **two** suitable mechanisms to raise and lower the barrier. Name the mechanisms used.

*1st mechanism Suitable sketch : 2 marks, Correct named mechanism : 3 marks.
2nd mechanism Suitable sketch : 2 marks, Correct named mechanism : 3 marks.*

- (iii) Explain why a DPDT relay and limit switches are recommended in the design.
(Explanation: DPDT 3 marks, Limit switches 2 marks)

(30 marks)

- (b) (i) Explain briefly how a keycard system allows the barrier to open.

*Valid Explanation: 7 (3 + 2 + 2) marks
Unique combination of switches, magnetic strip, coded chip, read by sensor, (3 marks)
Activates circuit to turn on motor, (2 marks)
Barrier lifts. (2 marks)*

- (ii) Explain **one** security limitation of this system.

*Valid Explanation: 7 (7, 5, 2)marks
- Cards can be duplicated (skimmed), stolen and used, etc.*

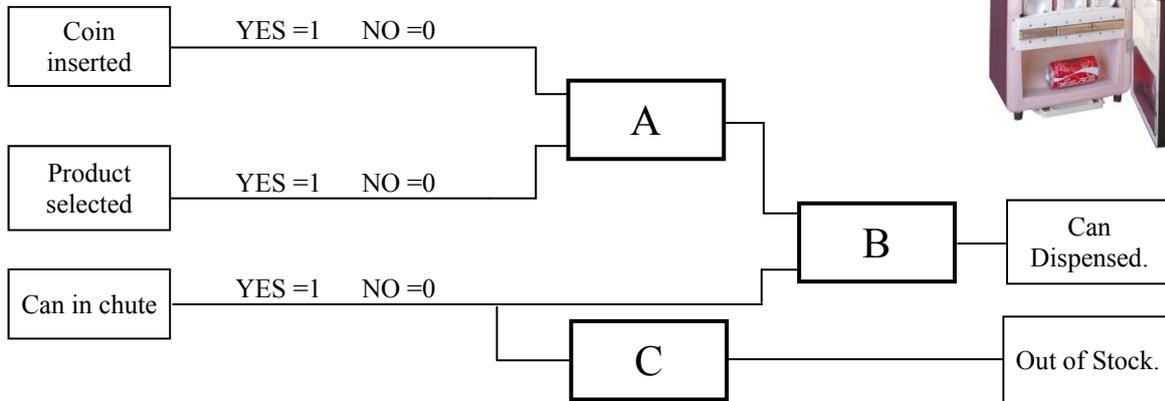
- (iii) Outline **one** other modern security system used to overcome the stated limitation.

*One system outlined 6 (6, 4, 2) marks -
Biometric systems, chip & pin, car reg. plate read by computer, etc.*

(20 marks)

6. Control Systems

The system shown is used in a soft-drinks dispensing machine. A soft drink is dispensed if the correct coin is inserted, the type of soft drink is selected and the drink chute contains a can.

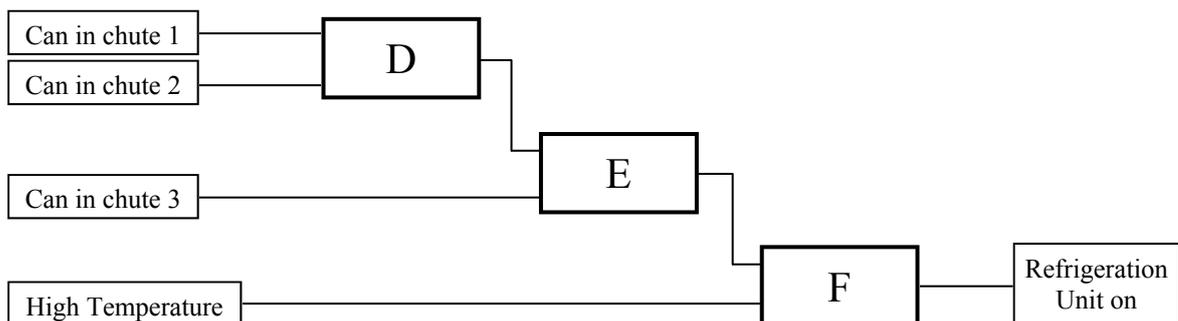


- (a) (i) Identify the logic gates required at **A**, **B** and **C**.
A = AND gate (3 marks), B = AND gate (3 marks) & C = NOT gate (2 marks).
- (ii) Sketch and complete the truth tables for logic gates **A** and **C**.
Truth table: (12 marks) - 4 x 2 mks (2 mks per line) & 2 x 2 mks (2 mks per line)

<i>A = AND truth table</i>		
<i>Input 1</i>	<i>Input 1</i>	<i>Output 1</i>
<i>Input 1</i>	<i>Input 0</i>	<i>Output 0</i>
<i>Input 0</i>	<i>Input 1</i>	<i>Output 0</i>
<i>Input 0</i>	<i>Input 0</i>	<i>Output 0</i>

<i>C = NOT truth table</i>	
<i>Input 1</i>	<i>Output 0</i>
<i>Input 0</i>	<i>Output 1</i>

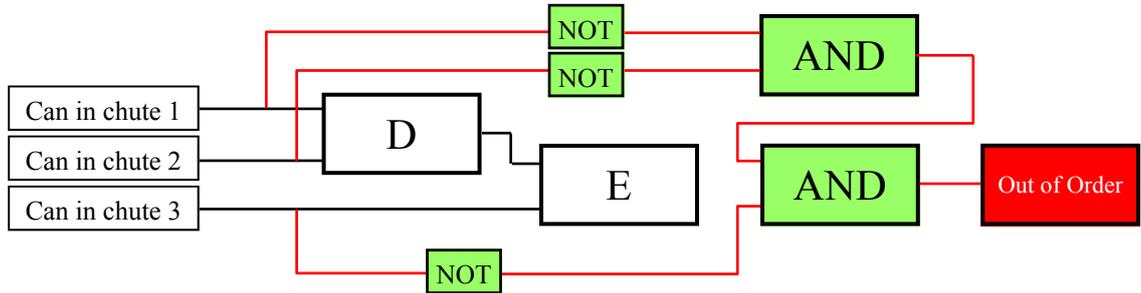
- (b) An additional system is required which will activate a refrigeration unit if any one of the chutes contains a can and a high temperature is detected.



- (i) Name the component which will detect a high temperature.
Thermistor (4 marks)
- (ii) Identify the gates required at **D**, **E** and **F**.
D = OR gate (3 marks), E = OR gate (3 marks) & F = AND gate (2 marks).

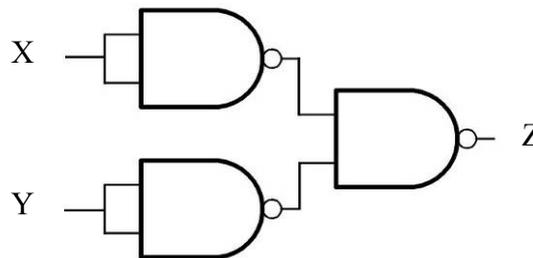
(iii) Sketch a modification to this system which will turn on an 'Out of Order' light if all three chutes are empty.

Suitable modification: (8 marks)



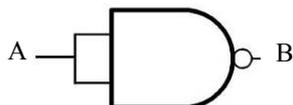
(c) NAND logic gates can be combined to generate other logic gates. Use a truth table to determine the type of logic gate produced by the combination shown below.

(50 marks)

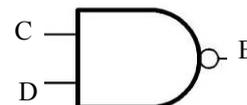


Truth table: (10 marks) - 4 x 2 mks (2 mks per line) + 2 mks (correct ans = OR)

OR Truth table		
Input X = 1	Input Y = 1	Output Z = 1
Input X = 1	Input Y = 0	Output Z = 1
Input X = 0	Input Y = 1	Output Z = 1
Input X = 0	Input Y = 0	Output Z = 0



NOT truth table	
Input A = 1	Output B = 0
Input A = 0	Output B = 1



NAND Truth table		
Input C = 1	Input D = 1	Output E = 0
Input C = 1	Input D = 0	Output E = 1
Input C = 0	Input D = 1	Output E = 1
Input C = 0	Input D = 0	Output E = 1

