



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Certificate 2015

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, 2015

Technology

Higher Level

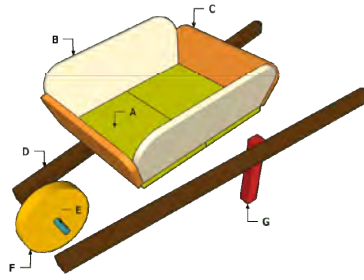
Marking Scheme

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

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

1. Name the type of drawing shown.

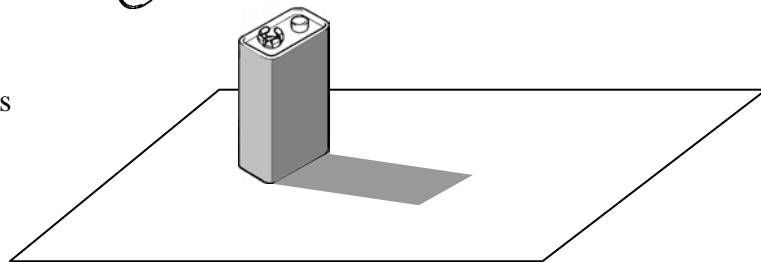


Answer: isometric, pictorial, perspective, exploded view, 4 marks

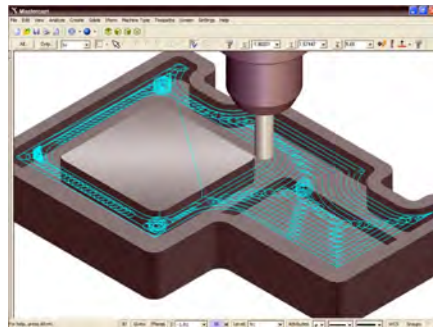
2. Use **two** rendering techniques on the sketch shown to suggest a light source at X.



Surface shading on battery: 2 mks
Shadow on the plane: 2 mks



3. State **two** advantages of using CAM to produce component parts.



(i)/(ii): accuracy, reproducible, speed, etc. 2 x 2marks

4. State **one** function of an *icon* in a graphic user interface.



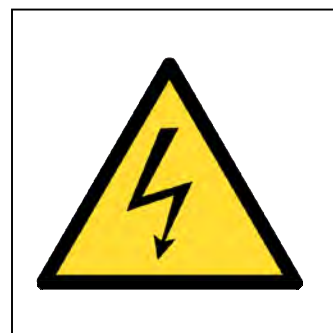
Function: visual identifier for an application / operation (print), etc.

Allows user to run an application / perform a command (print) using a pointing device, etc.

4 marks

5. Sketch the safety sign for an 'Electrical Hazard' in the space provided.

Sketch: 4 marks (2 + 2)



6. State **one** advantage and **one** disadvantage of using a manufactured board to make a project.



Advantage: uniformity of material, cost, size, no warping, etc. 2 marks

Disadvantage: blunt tools quickly, edges must be hidden/covered, dust (glue) can be hazardous, etc. 2 marks

7. State **two** hazards associated with using the jig saw shown.



(i)/(ii): user can cut through power cable, user can trip over power cable, blade can break if excess pressure applied, 2 x 2 marks

8. Name the alloy produced by combining the following metals:

(i) Copper and Zinc,

and

(ii) Tin and Lead.



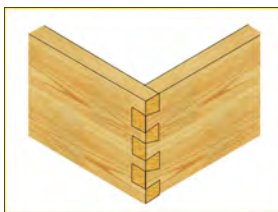
(i) Copper and Zinc.

Alloy: brass - 2 marks

(ii) Tin and Lead.

Alloy: solder - 2 marks

9. Name the type of wood joint show at (i) and at (ii).



(i)



(ii)

(i): dovetail joint - 2 marks

(ii): dowel joint - 2 marks

10. Name **one** natural fabric *and*

one synthetic fabric

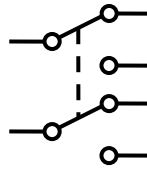
used to manufacture clothing.



Natural fabric: any valid material
Wool, cotton, hemp, linen, silk, etc.
- 2 marks

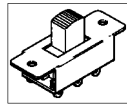
Synthetic fabric: any valid material
Polyester, nylon, rayon, acrylic, etc.
- 2 marks

11. The symbol for a DPDT switch is shown.



Explain the abbreviation 'DPDT'.

DPDT: Double Pole Double Throw - 4 x 1 marks

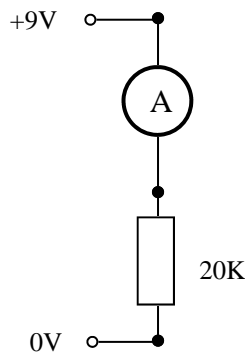


12. State the function of the tool shown.



Function: to remove hot solder from a circuit board (de-solder) - 4 marks

13. Calculate the current measured at A in the circuit shown.

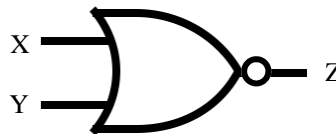


Current: $9 \div 20000 = 0.45$ milliamps - 4marks

(Reference to Ohms Law / formula $V \div R = I$, $9 \div 20$ - 2 marks)

14. The symbol for a NOR gate is shown. (OR followed by NOT)

Complete the truth table for the inputs shown.

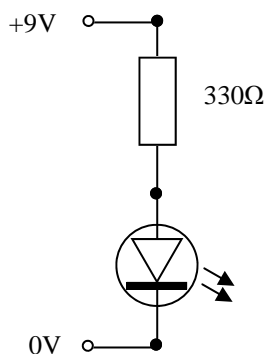


X	Y	Z
1	1	0
0	1	0

Outputs correct - 2 x 2 marks

15. When connecting an LED to a 9V supply a 330Ω resistor is used.

Explain why the resistor is required.



Answer: Limit current flowing through LED, prevent LED over heating, protective resistor, - 4marks

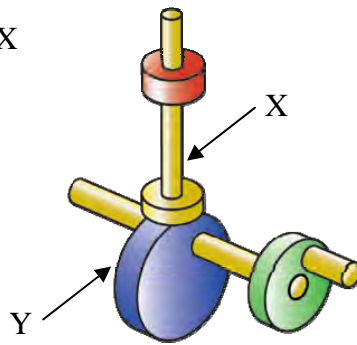
16. State **one** advantage and **one** disadvantage of using a chain drive in a mechanism.



Advantage: mechanism will not slip, will not easily break, etc. - 2marks

Disadvantage: requires lubrication, noisy, etc. - 2marks

17. Name the parts labelled X and Y of the mechanism shown.



X: Follower - 2marks

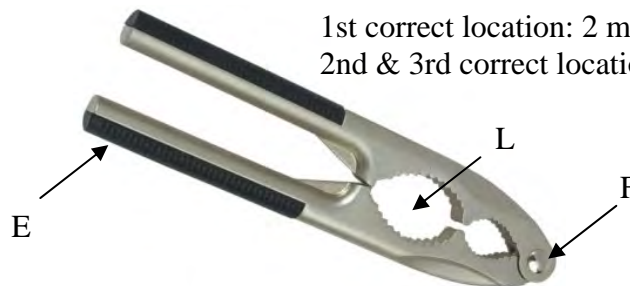
Y: CAM - 2marks

18. State the purpose of the bit shown.



Purpose: to countersink the head of a screw, etc. - 4marks

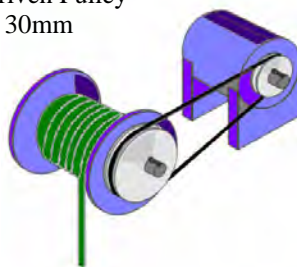
19. Indicate clearly the location of the Load (L), Effort (E) and Fulcrum (F) on the nutcracker shown.



1st correct location: 2 mks,
2nd & 3rd correct locations: 1mk & 1mk

20. Calculate the speed of the driven pulley from the information given.

Driven Pulley
Ø 30mm



Driver
Ø 15mm
150 RPM

Output speed: 75 RPM - 4marks

(Formula / ratio correct - 2marks
 $30 \times X = 15 \times 150$,
 (Driver/Driven) x Input speed.)

21. Outline **two** reasons why LED lights are replacing older light bulbs in homes and in public buildings.



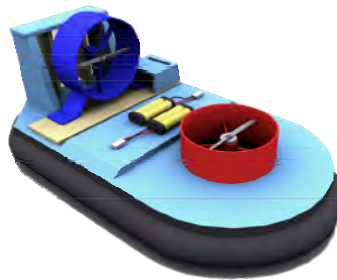
(i)/(ii): last longer, more energy /cost efficient, etc. 2 x 2marks

22. In relation to technology tasks, state **two** reasons why it is important to undertake 'Testing and Evaluation' of the completed product.



(i)/(ii): ensure product is safe, identify possible improvements/hazards, check completed product against brief specifications, etc. 2 x 2marks

23. Explain why **two** motors are used in the toy hovercraft design shown.



Answer: Motor for lift & motor for propulsion. 2 x 2 marks

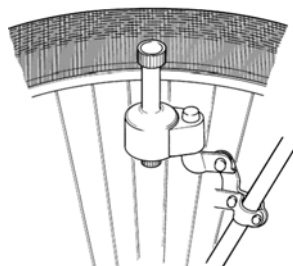
24. State **one** advantage and **one** disadvantage of using electronic tablets in schools.



Advantage: no books to carry!, weight advantage, interactive, e-mail answers to teacher, access web, portable, etc. 2 marks

Disadvantage: cost, fragile if dropped, could be stolen, require frequent charging, ease of access to internet, etc. 2 marks

25. Name **two** energy conversions taking place in the bicycle dynamo (generator) shown.



(i)/(ii): kinetic to electrical, kinetic to sound, kinetic to heat, etc. 2 x 2marks

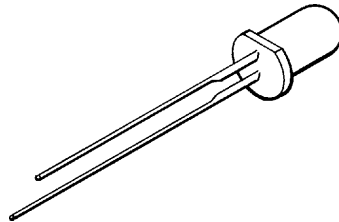
26. State **one** advantage and **one** disadvantage of the two-wheel barrow design shown, as compared with a single-wheel barrow.



Advantage: more stable over soft ground (load distribution), load is more stable, etc. 2 marks

Disadvantage: cost more, single wheel easier to turn, etc. 2 marks

27. Name the **two** features of an LED which identify the cathode (negative leg).



(i)/(ii): short leg, flat side, 2 x 2marks

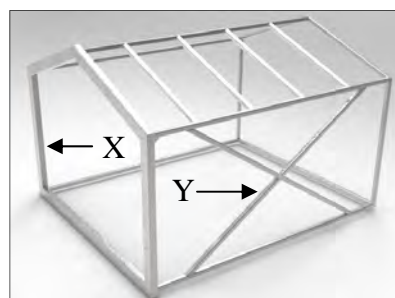
28. Name **two** appliances found in the home that use wireless technology.



(i)/(ii): phone, ipad, tv, fridge, washing machines, laptop, game console, etc.

2 x 2marks

29. Name the forces acting on the members labelled **X** and **Y**.



X: Compression - 2marks

Y: Tension - 2marks

30. Describe how the four 1.5V batteries should be connected to produce a total voltage of 6V.

Cells in series - 4marks



31. An isometric sketch of a chair is shown.

On the grid provided, complete the front elevation of the chair when viewed in the direction of arrow A.



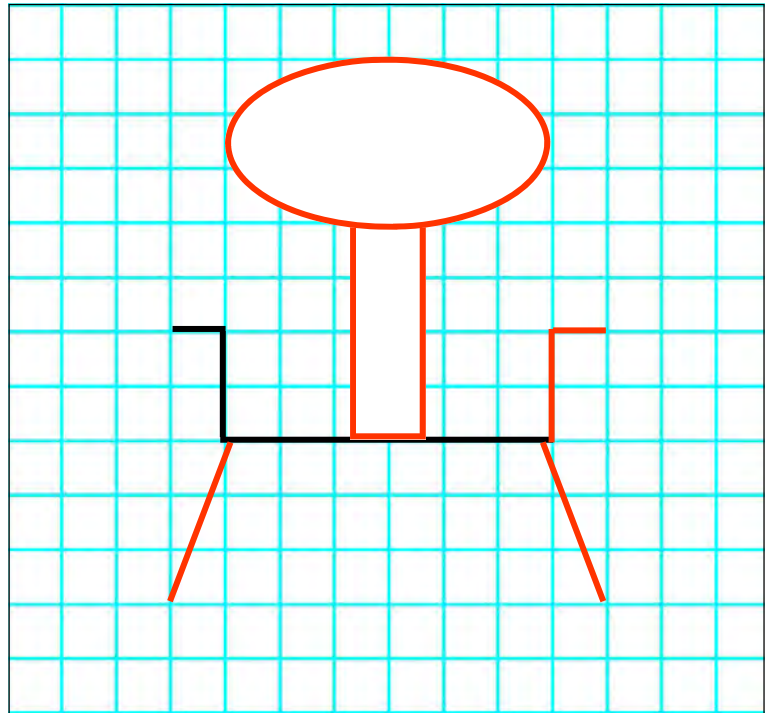
A

Parts in proportion/correct location:

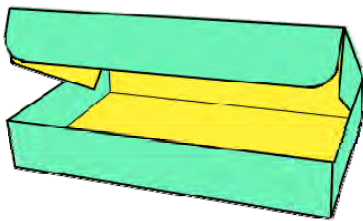
Upright & back - 2 (1+1) marks

2 x legs - 1 mark

1 x side arm - 1 mark



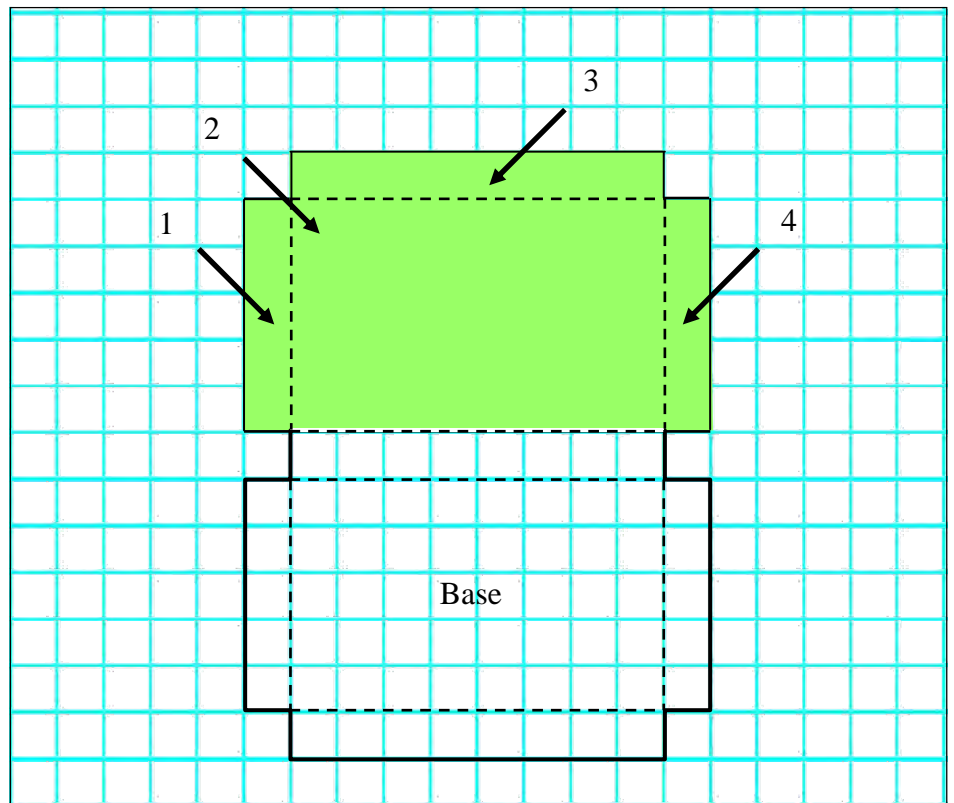
32. On the grid provided, complete the development of the food container shown.



Food container

4 panels:

4 x 1 mark





Junior Certificate Examination, 2015

Technology

Higher Level

Wednesday, 17 June
Afternoon, 2:00 - 4:00

MARKING SCHEME

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.

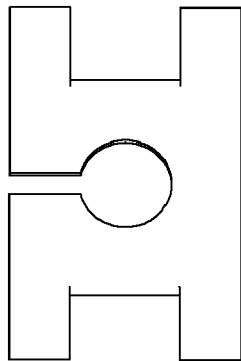
1 (a) The graphic shows a design for a toy car. The body is made from 200 x 50 x 50 mm red deal.



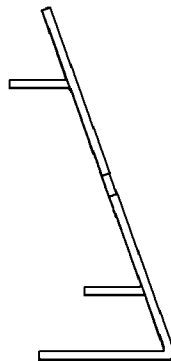
- (i) Make well-proportioned sketches of the following views:
1. An **elevation** in the direction of arrow **X**. [5 marks]
Note: The driver and steering wheel need not be included.
 Correct elevation: 2 mks, Wheels, body & aerofolils: 3 x 1 marks
 2. A **plan** in the direction of arrow **Y**. [5 marks]
 Correct plan-view: 2 mks, Wheels, main body, aerofolils: 3 x 1 mks
- (10 marks)
- (ii)
1. A hollow space is required, under the body of the car, to hold a battery, motor and gear box.
 Describe, using suitable sketches, how this space could be formed. [5 marks]
Name any tools required and state the processes used.
 Sketches: 2 mks, method used (3, 2, 1) - process & tool(s)
 2. If the aerofolils were made from acrylic instead of wood, describe how smooth edges could be created on the acrylic. [5 marks]
 Describe (2 process): reference to (cross) filing, (draw) filing, polishing edge.
 (3, 2)
- (10 marks)
- (iii) Outline **two** processes which might be used to finish the toy car to a standard similar to that shown in the graphic. [5 marks (3 + 2)]
 Named process: sanding, varnish, wax, stain & process outlined.
- (5 marks)

- OR -

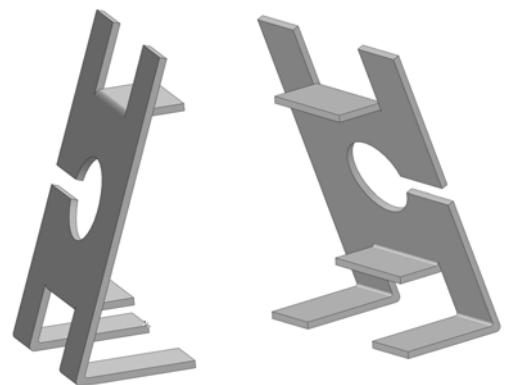
- 1 (b) The sketch shows a design for a night stand/charger holder for a smart-watch. The stand is to be manufactured from a single sheet of 3 mm acrylic.



Elevation



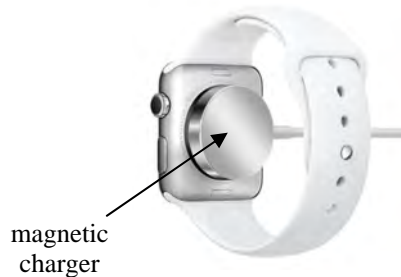
End View



Pictorial Views

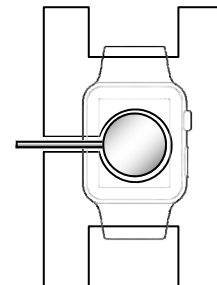


Pictorial view of smart watch



magnetic charger

View showing magnetic charger attached to watch

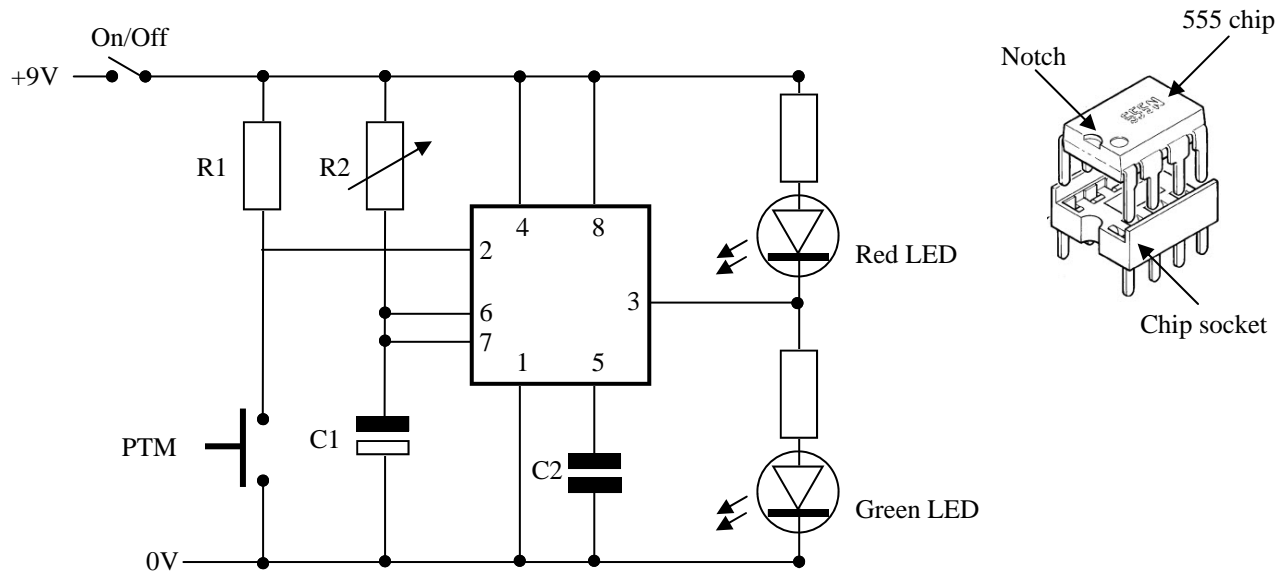


Elevation of stand showing watch and charger

- (i) Make a well-proportioned sketch of a **development** of the stand. Indicate clearly on your sketch the position of all cutting and bend lines. Correct development: 5 marks. Correct location of bend lines: 3 marks. Correct location of internal cutting lines: 2 marks. (10 marks)
- (ii) 1. Explain, using sketches, the steps required to manufacture the stand from the acrylic sheet. [5 marks (sketch 2 marks, method 3 marks)]
Name any tools required and state the processes used.
(Method: tool : 1 mk, process 2 mks. Marking out, cutting, strip heater, finish)
2. Describe how smooth edges could be created on the acrylic stand. [5 marks]
Describe (2 process): reference to (cross) filing, (draw) filing, polishing edge. Steel wool, etc. (3, 2) (10 marks)
- (iii) A modification is required to keep the charger securely in place on the stand when the watch is removed. Describe, using sketches, a design modification to solve this problem. [5 marks (Design modification sketch 3 marks, modification described 2 marks)]

(5 marks)

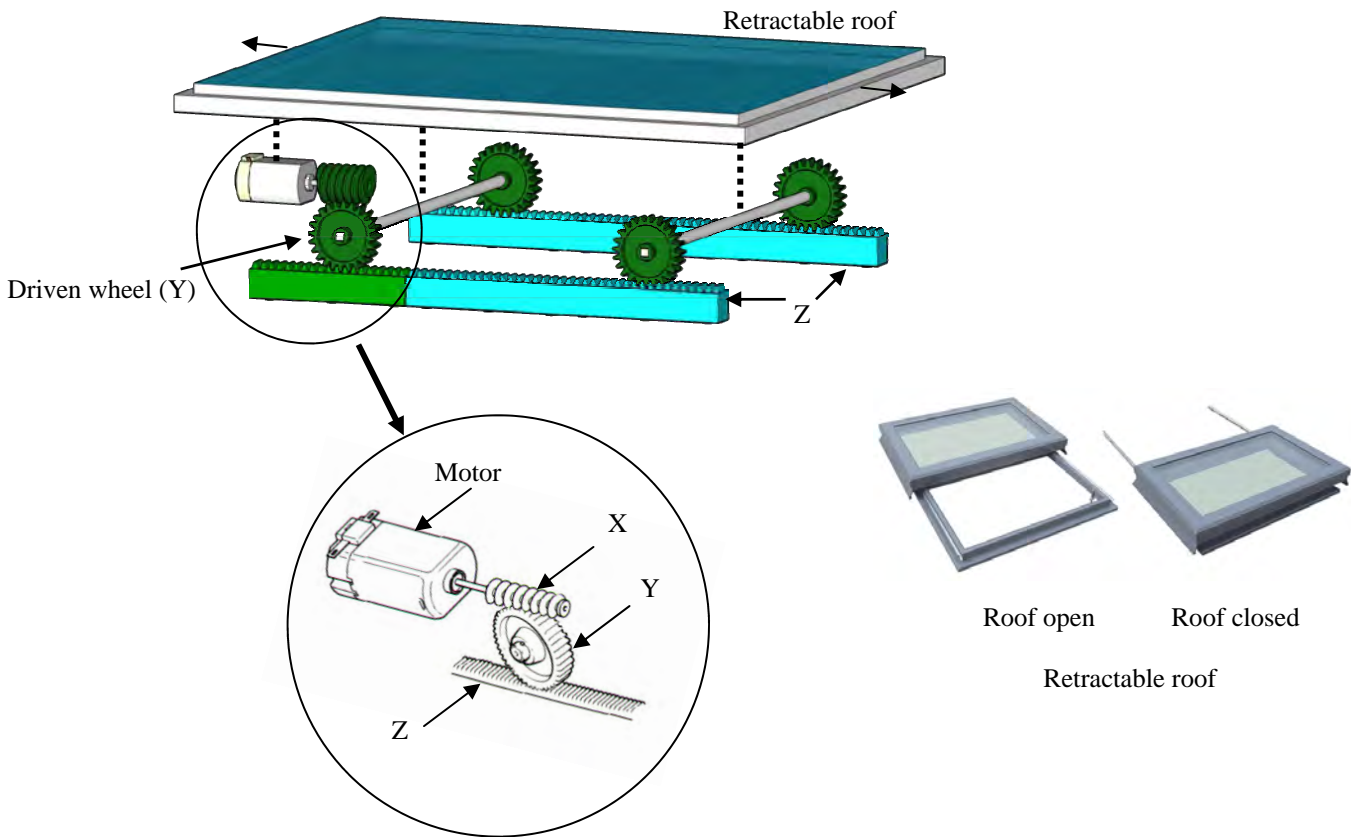
- 2 (a) In order to help conserve water use in a shower, the 555 timer circuit shown will be used to indicate that 4 minutes have passed. The timing circuit, when started by pushing the PTM switch, will turn on the green LED for 4 minutes and after that time will turn on the red LED.



- (i) Explain the purpose of the notch on the 555 chip.
(4 marks: allow identification of pin no.1)
- (ii) Explain why the use of a chip socket is recommended when soldering this circuit.
(4 marks: risk of heat damage to chip if soldered directly to board, ease of insertion/removal of chip.)
- (iii) State **two** advantages in using a printed circuit board over copper stripboard to construct this circuit.
(5 marks (3 +2): faster /neater to construct circuit, errors in locating components reduced, risk of bridging tracks on breadboard eliminated, etc.)
- (iv) Explain the difference between the **On/Off** and **PTM** switches.
(4 marks (2 +2): on/off toggle switch to On or Off position - switch remains in that position, PTM circuit complete only when switch depressed - releasing switch breaks circuit)
- (v) How could the 4 minute time delay be increased?
(4 marks: increase value of R2 or C1)
- (vi) What change could be made to the circuit to produce a sound after the 4 minutes have passed?
(4 marks: what/where - connect buzzer (or suitable component) from pin 3 to +V, Replace red LED or in parallel with red LED.)

- OR -

- 2 (b) The sketch shows a mechanism to open and close a retractable roof. The motor and gear wheel (Y) are attached to the retractable roof. The roof and mechanism moves along the toothed track Z when opening or closing.



- (i) Name the parts of the mechanism shown at X and at Z.
State **one** advantage of using this mechanism to open and close the roof.
X: worm drive 3 marks, Z: rack 3 marks, advantage: 4 marks
(torque, speed, size, no slip.) (10 marks)
- (ii) The roof rests on four gear wheels, one of which (Y) is driven by the motor. Sketch and name a suitable mechanism to link *all four* gear wheels such that they are all driven by the single motor.
Appropriate mechanism sketched: 5 marks (5, 3,2,1) (5 marks)
- (iii) Use the following information to calculate the speed at which the roof moves:
motor speed 45 RPM, gear wheel Y 30 teeth, toothed track Z 5 teeth/cm. (5 marks)
- 1 rotation of worm = roof advances 1 tooth on rack
In 1 minute 45 rotations of worm = roof advances 45 teeth on rack
 $45 \text{ teeth} \div 5 \text{ teeth/cm} = 9 \text{ cm}$
- (iv) Sketch and name the component parts of a suitable alternative mechanism to open and close the roof.
Appropriate alternative mechanism sketched: 5 marks (5, 3,2,1) (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 and Society

- (a) For any **two** of the following:

medicine, sport, commerce, entertainment (music or film)

outline **two** developments in those areas which have been influenced by recent changes in technology.

[2 x 5 marks (5, 3,2,1): 2 developments for **each** selected area - **2 x 10mks**]

(20 marks)

- (b) ‘The majority of Irish energy needs come from fossil fuels and these are finite resources’

- (i) Outline **two** reasons why we should be concerned about our use of fossil fuels. [2 x 5 (5, 3, 2, 1): **10 marks**]
Pollution/environment, limited national resource, cost, security of supply, etc.

- (ii) Outline **two** alternative energy sources available for energy production in Ireland. [2 x 5 (5, 3, 2, 1): **10 marks**]
Wind, water, thermal, nuclear.



Fossil
Fuels

(20 marks)

- (c) ‘Many of the foods which are available in our supermarkets have benefited from modern technologies’.

Using **one** named example in **each** case, outline how new technologies have changed: (**10 mks**: 4 + 3 +3)

food production, food processing and food storage.

New food production methods - farm mechanisation , GM, disease control, etc.

New food processing methods - vacuum packing, freeze drying, radiation, packed in nitrogen, additives, etc.

New food storage -freezer, chillers, drying (dehydrating), longer shelf life by eliminating microorganisms of decay, etc.



(10 marks)

4. Control Systems & Technology and Society



(a) In the case of **each** of the following:

driverless cars and unmanned aerial vehicles (drones)

(i) Outline how ‘input sensors’ are used in their operation.

[**10 marks**: 2 x 5 marks (5, 3, 2, 1)]

Input sensor -GPS, proximity sensors, altimeter, tilt sensor, speed sensor, etc.

Outline how each sensor used in each example.

(ii) Outline **one** advantage and **one** disadvantage in developing these technologies.

[**10 marks**: 2 x 5 marks (5, 3, 2, 1)]

One advantage drone -survey inaccessible areas, search and rescue, etc.

or

One advantage car -safety, driver error eliminated, ‘drivers’ not tired , etc.

One disadvantage drone -privacy, safety, regulation, etc.

or

One disadvantage car -high cost, driving ‘experience’ removed, etc.

(iii) In **both** cases, outline why control systems are required for their operation.

[**10 marks**: 2 x 5 marks (5, 3, 2, 1)]

Control system required to alter direction of movement or speed of drone/car to maintain safe path/avoid collision, concept of data received by sensors used to control operation of device, etc.

(30 marks)

(b) Robotic devices are commonly used on factory production lines.

(i) Outline **two** advantages of using robots in this situation.

[**10 marks**: 2 x 5 marks (5, 3, 2, 1)]

Accuracy, no errors, longer production times, etc.

(ii) Explain, giving **two** reasons, why robotic manufacturing is more commonly used in first world countries.

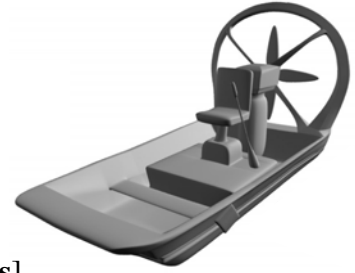
[**10 marks**: 2 x 5marks (5, 3, 2, 1)]

Cost of labour low, required infrastructure not available, expertise to set up and operate plant not readily available, etc.

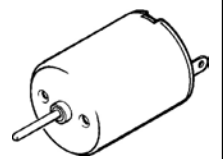


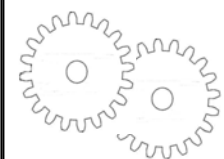
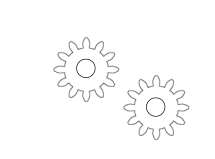
(20 marks)

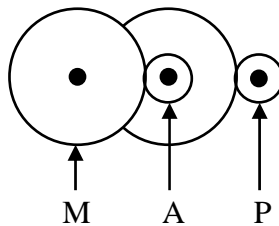
5. Design and Manufacture

A student intends to manufacture a toy airboat with a flat hull based on the design shown.



- (a) (i) Describe, with the aid of sketches, the steps required to manufacture the hull of the boat from a suitable material. *Name any tools required and state the processes used.*
 (2 appropriate steps sketched: 2 x 3 mks)
 - marking out, cutting, joining, vac forming, etc.
 (2 appropriate tools/process named: 2 x 2 mks) [**10 marks**]
- (ii) Outline **two** safety features which should be included in the design of the airboat.
 (2 safety features outlined: 2 x 5 marks) [**10 marks**]
- (iii) Describe, with the aid of sketches, how the fan and motor assembly could be attached to the hull of the boat.
 (describe appropriate means of attaching fan to hull—sketched: **5 marks**)
 (describe appropriate means of attaching motor to hull—sketched: **5 marks**)
 (30 marks)
- (b) (i) Describe, with the aid of sketches, how you would construct a drive system (motor, gear train and propeller) to produce the highest possible output speed from the following components:
 (describe appropriate drive system—sketched: **10 marks**)

Motor	Propeller	Axle	2 x 40 tooth gears	2 x 10 tooth gears
				



- (ii) If the motor turns at 100RPM, calculate the speed of the propeller for the gear arrangement you have shown.

$$M(100\text{RPM}) \times 40T = (A)400 \text{ RPM} \times 10T$$

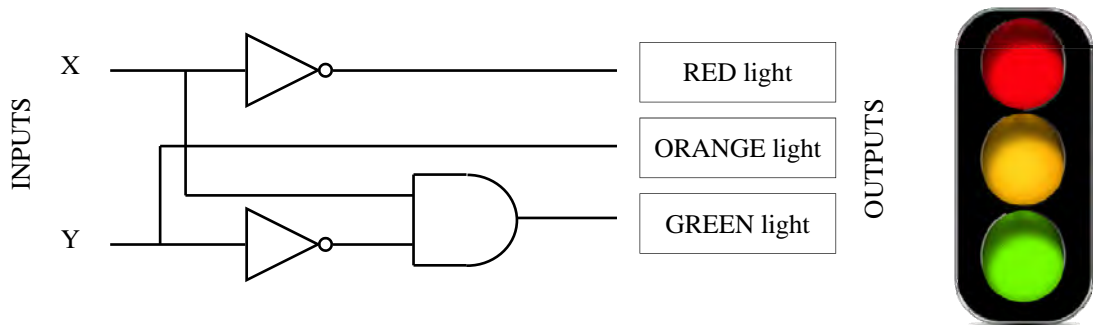
$$(A)400 \text{ RPM} \times 40T = (P)1600 \text{ RPM} \times 10T$$

: **10 marks**

(20 marks)

6. Control Systems

- (a) A system diagram to control a set of traffic lights is shown.
A coloured light will switch on if a '1' output is received from the system and will switch off if a '0' output is received.

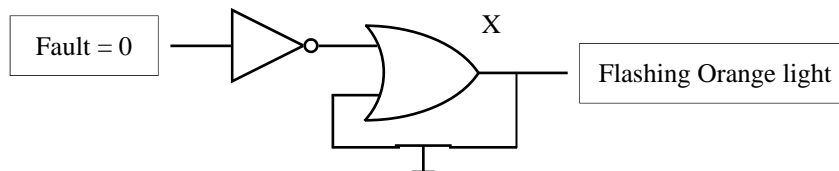


- (i) Copy the truth table below into your answerbook.
Complete the table to indicate which lights will be switched on/off for each input shown.

X	Y	Red	Orange	Green	
1	1	off	on	off	2,2,1
1	0	off	off	on	2,2,1
0	1	on	on	off	2,2,1
0	0	on	off	off	2,2,1

(20 marks)

- (ii) The system diagram below is used to activate a flashing orange light if a fault develops in the traffic light system at (a) above.



Name the special arrangement of gate X shown and explain why the PTB switch is used with this arrangement.

X: Latch (5 marks),

Explain PTB (5 marks (5,3,1))

(10 marks)

Output from OR gate is a '1' if a fault is detected.

Output loops back to input of OR gate, keeping output at '1' even if fault = 1.

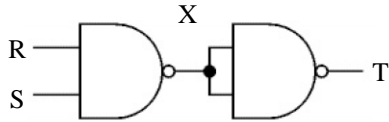
Pushing PTB (push to break) switch will send a '0' to input of OR gate and stop the orange light flashing.

- (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.

Using a truth table in each case, identify the gates produced by the
NAND gate combinations shown.

(20 marks)

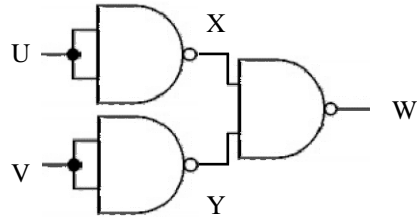
(i)



INPUT			OUTPUT	
R	S	X	T	
1	1	0	1	2 mks
1	0	1	0	2 mks
0	1	1	0	2 mks
0	0	1	0	2 mks

(i) identified as an AND gate: 2 mks

(ii)



INPUT				OUTPUT	
U	V	X	Y	W	
1	1	0	0	1	2 mks
1	0	0	1	1	2 mks
0	1	1	0	1	2 mks
0	0	1	1	0	2 mks

(ii) identified as an OR gate: 2 mks