# Coimisiún na Scrúduithe Stáit
State Examinations Commission

# Junior Certificate 2018

# 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, 2018*

# Technology

## Higher Level

*Wednesday, 20 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 Ex- | |
|---|---|---|---|
| No. of Questions | | Mark | Total |
| | x | 4 | |
| | x | 3 | |
| | x | 2 | |
| | x | 1 | |
| | x | 0 | |
| | x | / | |
| Total (32) | | **Total** | |
| Disallowed | | Mark | Total |
| | x | 4 | |
| | x | 3 | |
| | x | 2 | |
| | x | 1 | |
| Total (max | | **Total** | |
| **Section A Total (1-2)**: | | | |

**Section A** Answer 25 questions from this section - all questions carry equal marks. **100 marks**
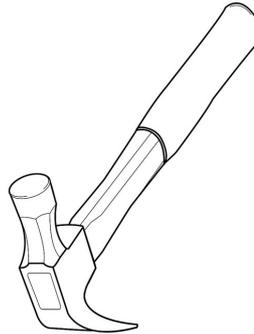
1. State **two** advantage of using CAD in design.
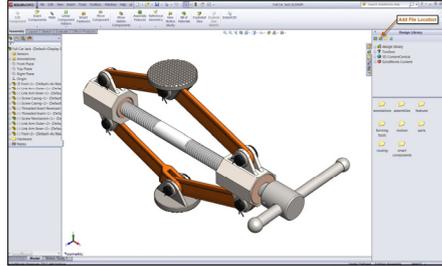
   (i) / (ii): 2 x 2 mks

   Easy to : change design / reprint / change texture / change colours, etc.

2. Use **two** rendering techniques to enhance the claw hammer shown.
   The handle is made from wood, the head is made from metal and the grip is made from rubber.

   2 x 2 mks

   Any **two** suitable rendering techniques

3. Explain the following computer abbreviations.

   (i) USB,

   (ii) CPU.

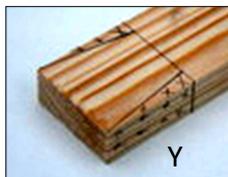   USB: 2 mks
   Universal Serial Bus

   CPU: 2 mks
   Central Processing Unit

4. Explain the markings at **X** and at **Y** on the wooden work pieces shown.

   X

   Y

   X : 2 mks
   Face Edge

   Y : 2 mks
   Waste material - Cut (here)

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

   (i)          (ii)

   (i): 2 mks
   Recycle

   (ii): 2 mks
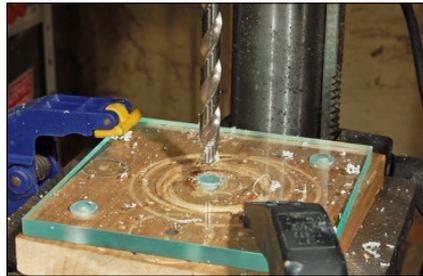   Wear Eye Protection

6. State **two** reasons why manufactured boards are more widely used, than native timbers, in furniture manufacture.

2 x 2 mks

Cost / Uniform material / no knots / large sizes available, etc.

7. State **two** specific precautions which should be observed when drilling acrylic.

2 x 2 mks

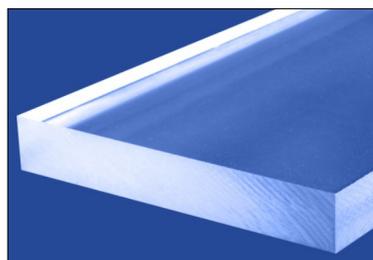Clamp workpiece / drill pilot hole / place waste timber under workpiece, etc.

8. Indicate clearly in the table shown, if the named material is natural or synthetic.

4 x 1 mk

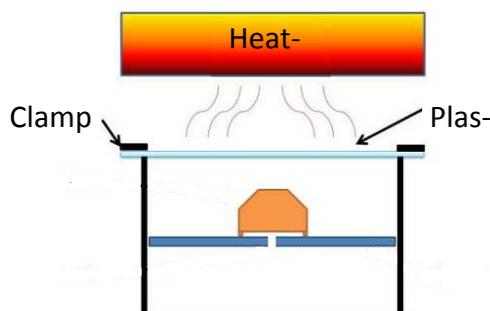| Material | Natural | Synthetic |
|----------|---------|-----------|
| Linen    | X       |           |
| Rayon    |         | X         |
| Acrylic  |         | X         |
| Hemp     | X       |           |

9. Name **two** processes which should be used to finish the edges on an acrylic work piece.

Process 1/2 : 2 x 2 mks

Filing / steel wool / polish

10. Name the plastic shaping process shown.

Heat-

Clamp        Plas-

Process: 4 mks
Vacuum Forming

11. Name the electronic components shown.

(i) LDR : 2 mks
(Light Dependent Resistor)

(ii) Capacitor : 2 mks

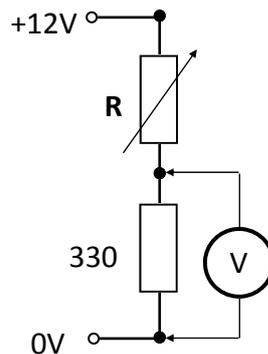(i)　　　　(ii)

---

12. State the units used to measure:

(i) Power,

(ii) Current.

(i) Watt : 2 mks

(ii) Amperes (Amp): 2 mks

---

13. Calculate the required value of R in the circuit shown to produce a value V = 3V.
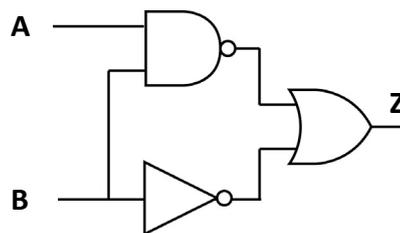
+12V

R

330    V

0V

Answer 990 (no units) : 4 mks

Alt: 2 mks for correct expression but incorrect solution.

$(330/(R + 330)) \times 12 = 3$

$330/(R + 330) = 3/12$

---

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

A

B

Z

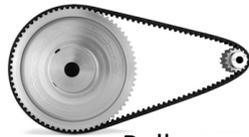| | INPUT | | OUTPUT |
|---|---|---|---|
| | **A** | **B** | **Z** |
| | 1 | 1 | 0 |

A: 2 mks    B : 2 mks

---

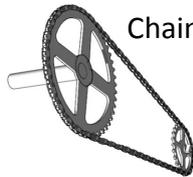15. Electrical solder is an alloy. Explain the term **alloy**.

Alloy: 4 mks
Mixture of metals ( no named metals required)

16. State **two** advantages to using the pulley and belt system shown over using a chain drive.
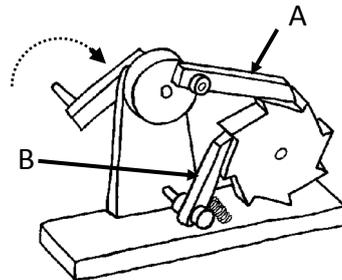
Pulley and belt

Chain drive

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

Advantages:
no lubrication required / easy to fit / less noise / cost less, etc.

17. State the purpose of the component parts labelled **A** and **B** in the mechanism shown.

A

B

A: 2 mks
Purpose: to advance the toothed wheel

B: 2 mks
Purpose: to prevent the toothed wheel moving in reverse

18. State the mechanical advantage of the block and tackle system shown,

*and*

calculate how far the rope **R** must travel to raise the load by 2 meters.

R

Load
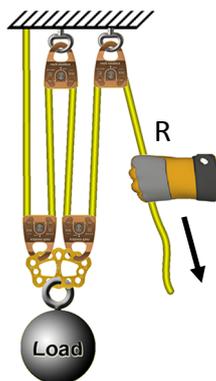
MA = 4 : 2 mks

Distance = 8 : 2 mks
(2 x 4 = 8 (meters))

19. In the gear train shown, state the purpose of gear **B** ,

*and*

calculate the speed of rotation of gear **C**.

B: 20T    C: 20T
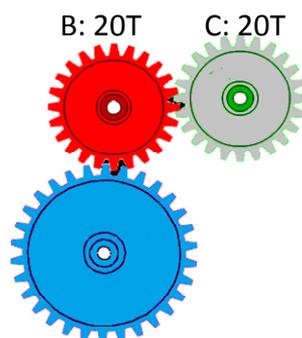
Driver A: 30T / 100

Gear B: Purpose : 2 mks
Allow A & C travel in same direction

Gear C: Speed = 150 (RPM): 2 mks

(30T x 100 RPM = 20T x Speed)

20. Name the gear shown,

*and*

give a reason why the gears shown would be used in a gear train.

Name: 2 mks
Bevel (gears)

Reason: 2 mks
Change direction of rotation by 90°

21. State **two** precautions which should be taken to prevent 'malware' from infecting a computer.



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

Precautions:
install anti-virus software / do not visit untrusted sites / do not use un-certified software / do not open unknown email attachment, etc.

22. Name **two** ways in which technology has helped prolong the shelf life of food products.



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

Irradiate food / dehydrate food / freeze dry food / nitrogen atmosphere packaging, etc.

23. State **two** reasons why the mobile phone has commonly replaced the digital camera when taking photographs.



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

Almost always available, Ease of use / easy up-load (share) / easy to alter image, etc.

24. The image shows a VR headset.

Explain the abbreviation VR,

*and*

state **one** beneficial use of this technology.



VR: 2 mks
Virtual Reality

Use: 2 mks
One benefit: immersive experience / more realistic training tool/ better gaming experience, etc.

25. Name the mechanism used to animate the toy caterpillar shown.



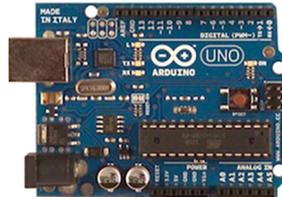Mechanism: 4 mks (2 + 2)
Cam and Follower

26. State **two** advantages to using a smart watch over a traditional watch.

2 x Advantages: 2 x 2 mks

Additional (named) functions available not on a traditional watch: Fitness / health monitoring / communications / etc.

27. State **one** advantage and **one** disadvantage of using a programmable board in producing a circuit for a student task.

Advantage: 2 mks
Circuits faster to construct / easier to construct / no soldering errors / more functions available, etc.

Disadvantage: 2 mks
Difficult to problem solve errors / much more expensive / student may not understand circuit, etc.

28. From the list of hi-tech companies below, select the company associated with each named person.

Companies: Tesla Motors, Amazon, Facebook , Google.

Mark Zukerberg: Facebook 2 mks

Elon Musk: Tesla Motors 2 mks

29. Give t**wo** reasons why people are encouraged to replace bulbs of type **A** with those of type **B**.

A          B

Reason 1, 2: 2 x 2 mks

Reasons: More efficient / longer life / environmentally friendly, etc.

30. When writing a student Task Portfolio state **two** reasons why at least two design ideas should be included.

Reason 1, 2: 2 x 2 mks

Reasons: Allow for a choice between two alternative mechanisms / circuits / structures , etc.

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

4 Faces shown completed : 4 x 1 mks.
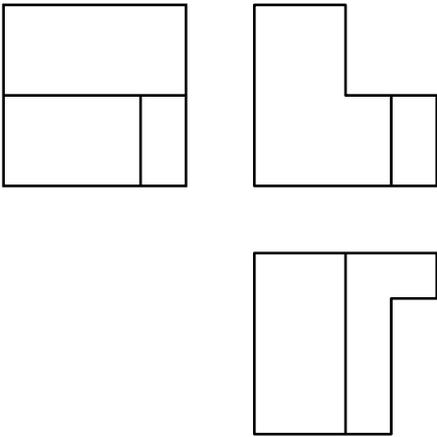


Orthographic projection
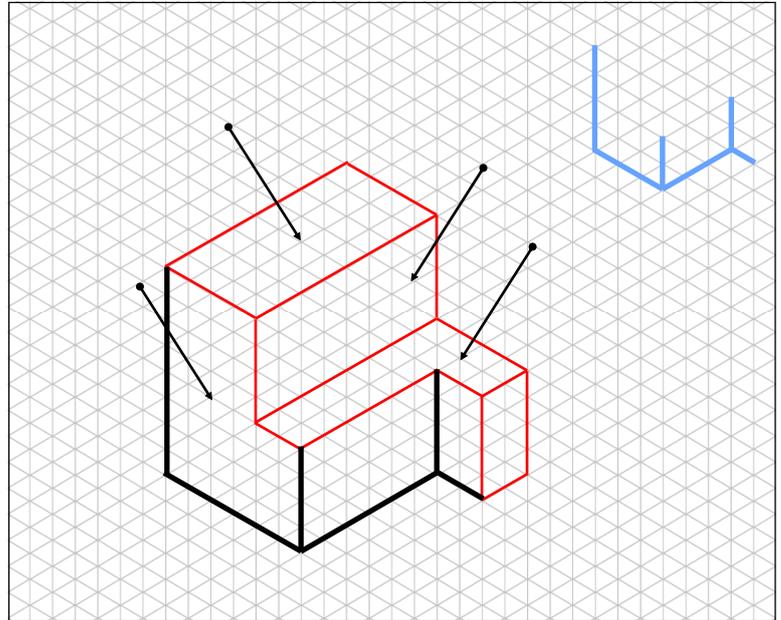


32. The sketch below shows a development of a cube.
Complete the isometric view of the same cube.

2 Faces shown completed : 2 x 2 mks
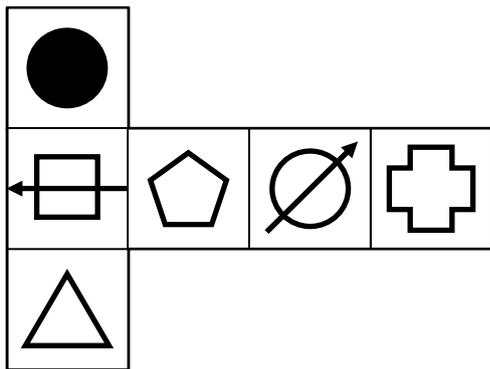


Development
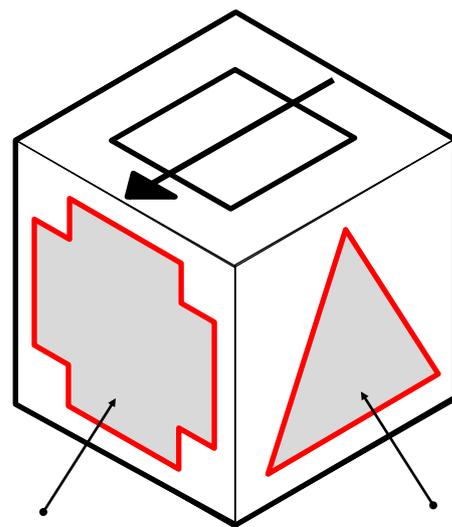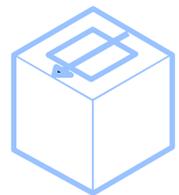


Isometric View

*Coimisiún na Scrúduithe Stáit*

State Examinations Commission

*Junior Certificate Examination, 2018*

# Technology

*Higher Level*

*Wednesday, 20 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 lever micro switch.

**Fig. 1**

Acrylic

Y

X

**Elevation X**
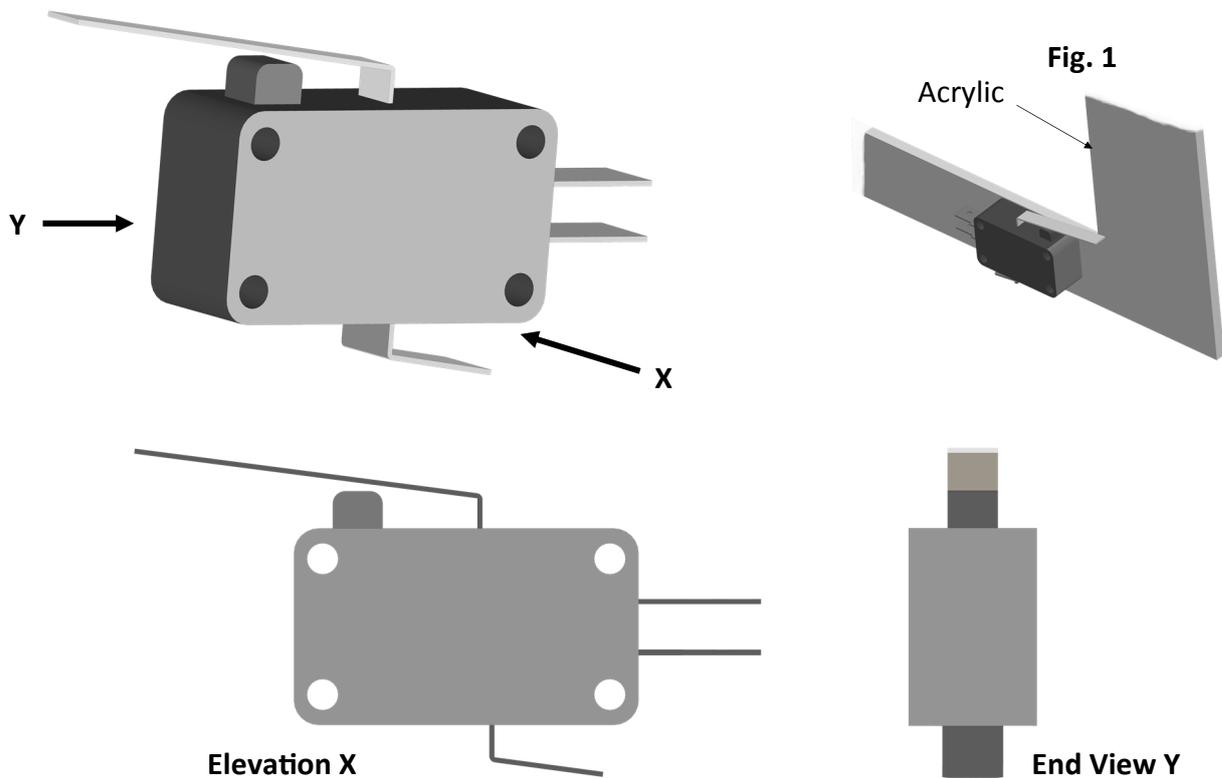
**End View Y**

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

1.      An **elevation** in the direction of arrow **X**.
            *Correct Elevation [5 marks]*

2.      An **end view** in the direction of arrow **Y**.
            *Correct End View [5 marks]*

(10 marks)

(ii)    The micro switch, acting as a limit switch, will be mounted on acrylic in a
        student project.

1.      Explain the function of a **limit switch** in a project.
            *Function [3 mks] - stop a circuit operation*
2.      Explain the advantage of the lever in a micro switch.
            *Advantage [3 mks] - small force will trigger switch*
3.      Explain how the micro switch should be mounted on the acrylic shown.
        (*Name any tools required and state the processes used.*)
            *Named  appropriate tool [2 mks], Appropriate process stated [2 mks]*

(10 marks)

(iii)        The electrical contacts on the micro switch are labelled: NO, NC and COM.
            Explain the meaning of each of these abbreviations.
                *NO: Normally open [2 mks], NC: Normally closed [2 mks],*
                *COM: Common (connection) [1 mk]*

(5 marks)

**- OR -**

1 (b)    The graphics show a design for parts of an office stapler.
         The top is to be manufactured from 3 mm acrylic.
         The staple holder and base are to be manufactured from steel.



Stapler

Top

Y

X
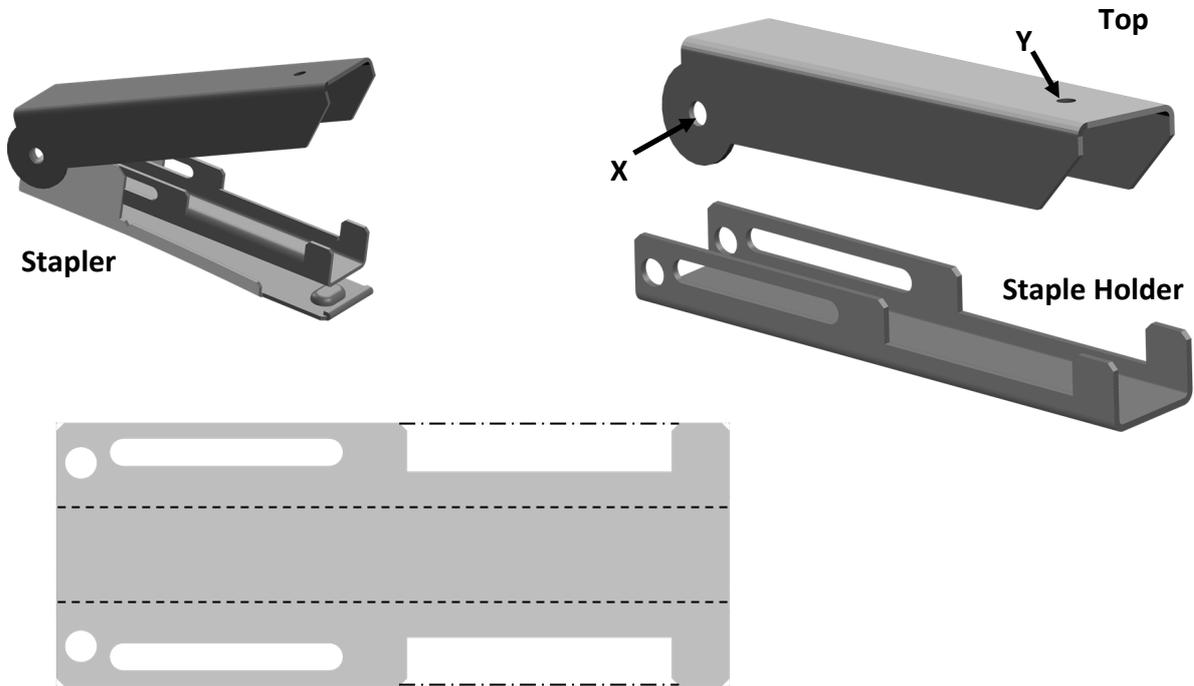
Staple Holder

(i)      Make a well-proportioned sketch of the **development** of the **staple holder**
         Indicate clearly on your sketch the position of all cutting and bend lines.
                *Correct Development [6 mks], Bend lines [2mks], Cutting lines [2 mks]*
                                                                        (10 marks)

(ii)     Explain, using sketches, the steps required to manufacture the **top**
         from 3 mm acrylic sheet.
         (*Name any tools required and state the processes used.*)
                *Manufacture: [6 mks] - Marking out, cutting, drilling, stripheater.*

(iii)    Describe, using sketches, how to produce the holes marked **X** and **Y**, in the **top.**
         (*Name any tools required and state the processes used.*)
                *Drill: [4 mks] - Markout, pilot hole, clamp / support, drill*
                                                                        (10 marks)

(iv)     Staple strips are easily broken if not stored correctly.
         Sketch a suitable design for a container to solve this problem.
         *Sketch suitable container [5 mks] - 5/3/1*
                                                                        (5 marks)
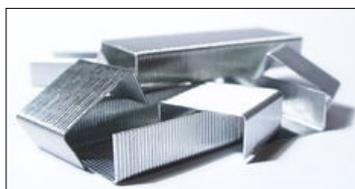


Broken staple strips

2 (a)  The 555 timing circuit design shown is to be used in a novelty toothbrush holder.
The circuit will turn on a motor, for a set time, to animate the novelty figure when the switch **B**,
connected to pin 2, is pressed.
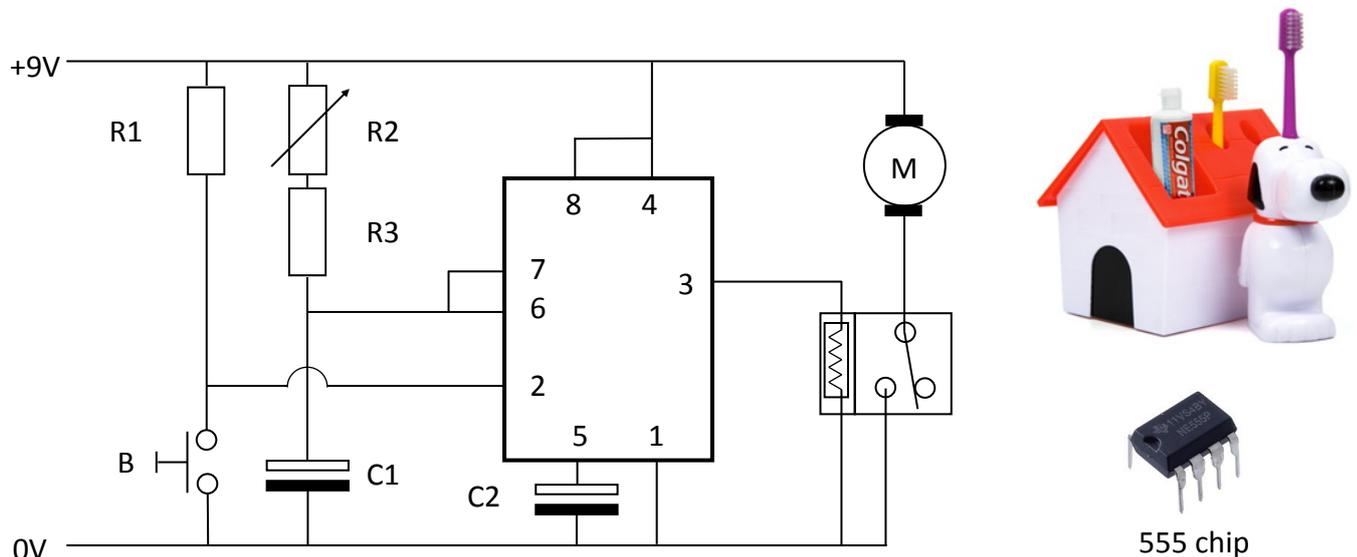


(i)     Two switches are available for use at B. One is labelled **PTM** and one is labelled **PTB**.
Which one should be used in this situation and explain the meaning of the label.
         *Switch: PTM [2mks], Push to make [2 mks]*                                    (4 marks)

(ii)    Using a sketch, indicate how the pins 1 and 5 on the 555 chip are identified.
         *Correct location of pin 1 [2 mks], correct location of pin 5 [2 mks] \**        (4 marks)

(iii)   Name the components which can be used to change the time delay in
this circuit.
         *Component(s): Resistor R2/R3 [2 mks],  Capacitor C1 [2 mks]*                  (4 marks)

(iv)    The relay attached to pin 3 is labelled **SPDT**.  Explain this label.
Sketch the pin arrangements for a **DPDT** relay.
         *Label: SPDT—Single Pole Double Throw [2 mks]*
         *DPDT relay sketch [4 mks]     \*\**                                           (6 marks)

(v)     An additional component is normally connected across the coil of the relay
to protect the chip.  Name and draw the symbol for this component.
         *Name: Diode [2 mks], Symbol [2mks]*                                           (4 marks)

(vi)    The resistors used in this circuit a have a gold coloured forth band.
Explain the meaning of this band.                                                      (3 marks)
         *Gold band: tolerance, resistance is +/- 5% of value based on other bands [3 mks]*
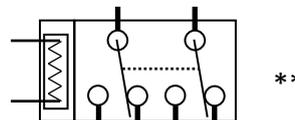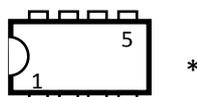
**- OR -**

2 (b)  The graphics show mechanisms in a model recovery truck.

Tyre circumference = 50 × 3.14 mm



Model Recovery Truck

**A**
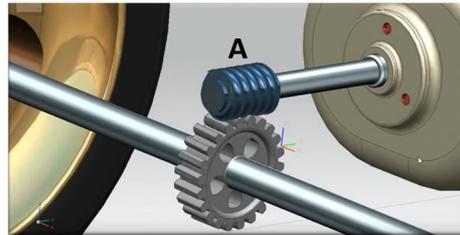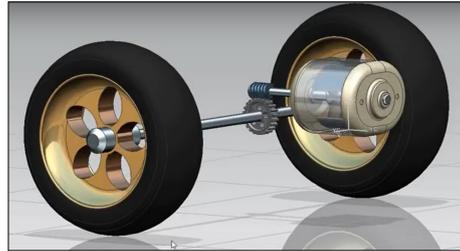
**30 Teeth**

(i)  Name the gear shown at **A**.
     State **two** advantages to using this type of gear to move the truck.
          *A: Worm gear [2 mks],*
          *2 Advantages: [2 x 2mks] - high torque, no slippage, 90 turn, slow speed*

(6 marks)

(ii)  If the motor, attached to gear A, turns at 420 RPM and the tyres have a
      circumference of 50 x 3.14 mm, calculate the distance travelled by the truck in 1 minute.
          *Distance: 220 mm [6 mks]*                                    (6 marks)

(iii)  Name the mechanism **B** used
       in the car jack shown.
          *B: Rack & Pinion [2 mks]*

       If the mechanism rises by
       5 mm per tooth, calculate
       how many rotations of
       the handle is required to
       lift a car by 400 mm.

          *Rotations: 8 [6 mks]*

**B**

10T

5 mm / tooth
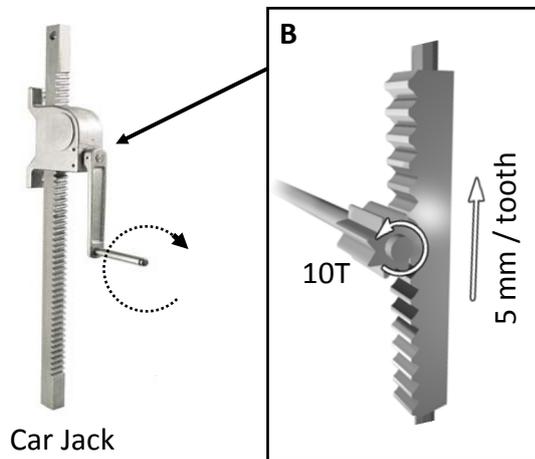
Car Jack

(8 marks)

(iv)  Name the forces, labelled X, Y and Z , which can be applied to the component parts
      of mechanisms.
          *X: Compression  [2mks]*
          *Y: Tension [2mks]*
          *Z: Shear [1mk]*

**X**          **Y**          **Z**          (5 marks)

2(b) (ii)   *If the motor, attached to gear A, turns at 420 RPM and the tyres have a circumference of 50 x (22/7) mm, calculate the distance travelled by the truck in 1 minute.*

*Distance: 220 mm [6 mks]*

| Motor turns @ 420 RPM | => | Worm turns @ 420 RPM |
|---|---|---|
| | => | 30T turns @ 420/30 RPM = 14 RPM |
| | => | Tyre turns 14 times in 1 minute |

| Circumference of tyre | = | 2πR   (R radius) |
|---|---|---|
| | = | Dπ    (D diameter) |
| | = | 50 x 3.14 |
| | = | 50 x (22/7) |

| Distance travelled | = | 50 x (22/7) x14 |
|---|---|---|
| | = | 2200 mm |
| | = | 220 cm |

2(b) (iii)   *If the mechanism rises by 5 mm per tooth, calculate how many rotations of the handle is required to lift a car by 400 mm.*
*Rotations: 8 [6 mks]*

| Height | = | 400 mm | => | Rack moves by 400/5 teeth |
|---|---|---|---|---|
| | | | = | 80 teeth |
| | | | => | Pinion turns by 80/10 turns |
| | | | = | 8 turns |
| | | | => | handle turns 8 times |



Car Jack

B

10T

5 mm / tooth

## 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)  (i)  Outline **two** reasons why car manufacturers
are phasing out engines which run on fossil fuel.
*Reasons [2 x 5] - Pollution, Global warming, CO₂ emissions, Resources, etc.   (5/3/1)*


   (ii)  Outline **two**  technologies to replace fossil fuel engines and briefly describe how they operate.
*2 Technologies /described: [2 x 5 mks] - Electric, Hybrid, Solar, Hydrogen, etc. (5/3/1)*

                                                                                        (20 marks)


(b)  (i)  Name **two** technologies required for the convenient and
efficient operation of  'bike rental' schemes in large cities.
*2 Technologies named [2 x 5 mks] - Credit card, GPS, Web technologies*


   (ii)  Outline how these **two** technologies operate.
*Operation of the 2 Technologies [2 x 5 mks] - on-line registration,*
*bike pick up with code, usage logged, charge based on usage, security , etc. (5/3/1)*

                                                                                        (15 marks)


(c)  The way in which we interact with computers has changed over time.
From:        Keyboards  (typed commands)        *to*        Computer mice (point and click)
                                                          *to*
             Touch screens (multi-touch gestures)   *to*        Voice command (Alexa / Echo).


   (i)  Name **two** household systems which can be controlled by voice command.
*2 systems named [ 3 + 2 mks] - music, heating system, lights, Siri, Cortina, etc.*


   (ii)  Outline **two** advantages to using this new technology in the home.
*2 Advantages: [2 x 5 mks] - hands free, multitasking, zone control, etc. (5/3/1)*


                                                                                        (15 marks)

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

(a) (i) Outline **two** reasons why robotic devices are now commonly used in industrial manufacture.

*Reasons: [2 x 5 mks] -   Accuracy, repetive, higher output, no breaks!,*
*operate in dangerous situations, etc.        (5/3/1)*

(ii) Outline **two** ways in which robotic devices are particularly suitable for space and planetary exploration.

*Ways: [2 x 5 mks] -      no life support requirement, no food/waste,*
*operate in environments not suited to human life , etc.      (5/3/1)*

**(20 marks)**

(b) Robotic devices require:
- mechanical components
- sensing components
- an operating programme.

Explain, using a suitable example, why **each** component is required.

*Explain /Example /Why:       Mechanical: any movement mechanism*
*[3 x 5 mks] -                 Sensing: any sensor technology (GPS / position, etc.)*
*(5/3/1)                       Operating system: controlling operations I/O*

**(15 marks)**

(c) Driverless cars are complex robotic devices requiring a form of artificial intelligence (AI).

(i) Outline **two** advantages to driverless cars.

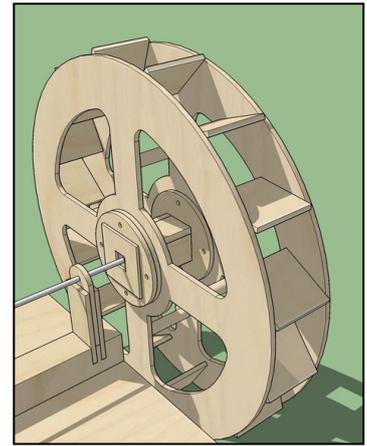*2 Advantages: [2 x 5 mks] - safety, efficiency, etc. (5/3/1)*

(ii) Explain why driverless cars are more complex than ordinary robotic devices.

*Explain: [5 mks] - multiple inputs (sensors), complex data processing , etc. (5/3/1)*

**(15 marks)**

## 5.  Design & Manufacture

A student intends to manufacture a water wheel generator based on the design shown.



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

*3 steps [ 3 x 5 mks] (5/3/1)*
*- Sketches, Tools named, Process stated :*

*(Steps: Design / Drawing / CAD / Material processing / Construction technique)*

(ii)  Describe, with the aid of sketches, how the turning wheel could be supported with a suitable frame.   *Name any additional components required.*

*2 steps [ 2x 5 mks] (5/3/1)*
*- Support structure (frame) design, attachment/connections to wheel:*

(25 marks)

(b)  A motor, two different sized pulley wheels and a pulley belt are available.

(i)  Describe, with the aid of sketches, how the turning water wheel could be used to generate electric current.

*[2 x 5 mks] (5/3/1)*
*- Sketches : suitable pulley / gear system connected to water wheel, connection to shaft on motor*

(ii)  Describe, with the aid of a suitable circuit diagram, how the generator could power a number of LEDs.

*[5 mks] (5/3/1)*
*- Circuit diagram: correct connection between contacts on motor and LED (R)*

(iii)  Describe, with the aid of sketches, **two** other methods of generating electricity from environmentally friendly resources.
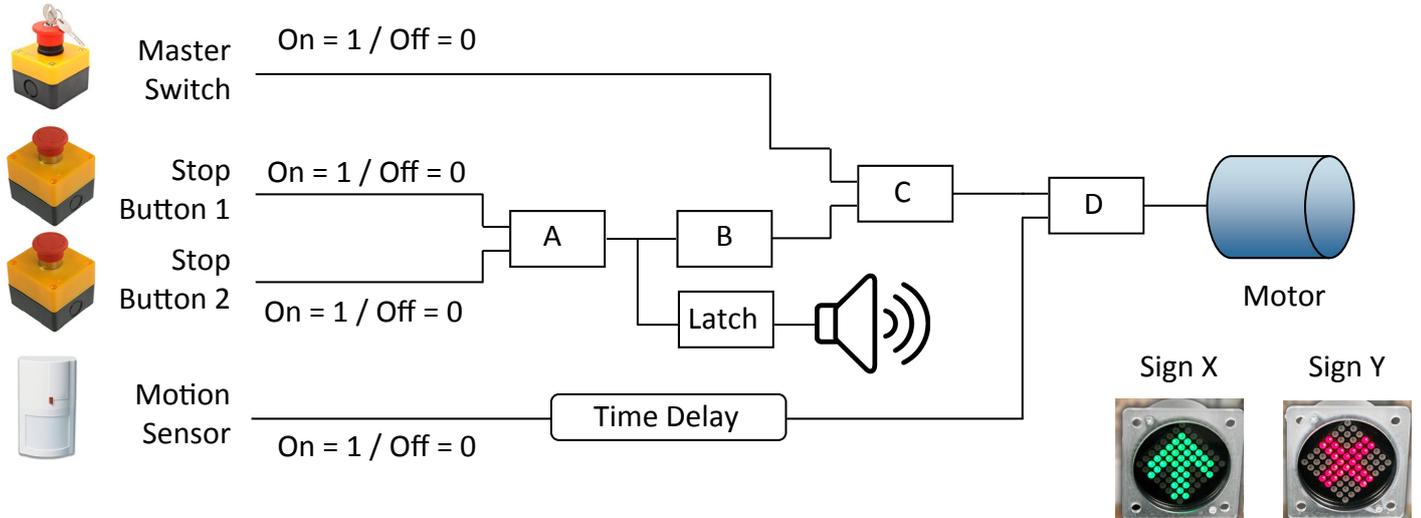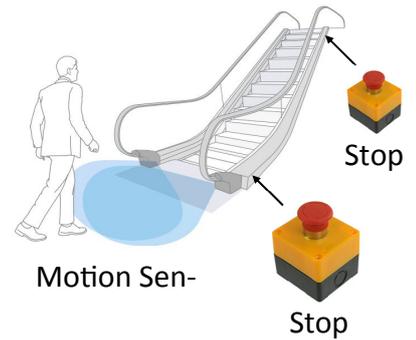
*[2 x 5 mks] (5/3/1)*
*- Sketches :  Wind generation, Water (Tidal, etc.), Solar,  etc.*

(25 marks)

## 6. Control Systems

(a) A system diagram, to control the operation of an escalator is shown. The system has the following features: *A master on/off switch, two emergency stop buttons and a motion sensor to detect people approaching the escalator. Once the motion sensor is activated, a time delay will keep the motor running to allow the person to reach the top of the escalator. The control system will stop the escalator if either of the stop buttons are pressed or if no one is approaching the escalator.*



Stop

Motion Sen-

Stop



Master Switch — On = 1 / Off = 0

Stop Button 1 — On = 1 / Off = 0

Stop Button 2 — On = 1 / Off = 0

Motion Sensor — On = 1 / Off = 0

A   B   C   D   Latch   Time Delay

Motor

Sign X    Sign Y

(i) Name the logic gates required at **A, B, C** and **D**.

*[4 x 2 mks]  A: OR, B: NOT, C: AND, D: AND*

(ii) Draw a truth table for each of the logic gates at **A** and **D**.
*A: OR [ 4 x 2 mks]*                    *D: AND [ 4 x 2 mks]*

| Input X | Input Y | Output Z |
|---------|---------|----------|
| 1 | 1 | 1 |
| 1 | 0 | 1 |
| 0 | 1 | 1 |
| 0 | 0 | 0 |

| Input X | Input Y | Output Z |
|---------|---------|----------|
| 1 | 1 | 1 |
| 1 | 0 | 0 |
| 0 | 1 | 0 |
| 0 | 0 | 0 |

(iii) State the purpose of the 'Latch' in the system.

*Latch: [4 mks]  Keep alarm 'on' even if stop button released.*

(iv) Outline a modification to the system which will:
*turn on sign X only, when the system is operating correctly,*
*turn on sign Y only, when the escalator has been switched off or*
*when a stop button has been pressed.*

Sign X
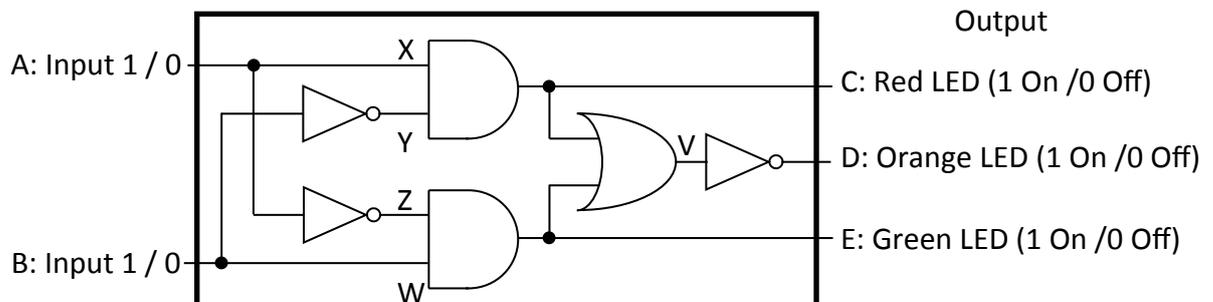


NOT

C    D    Motor
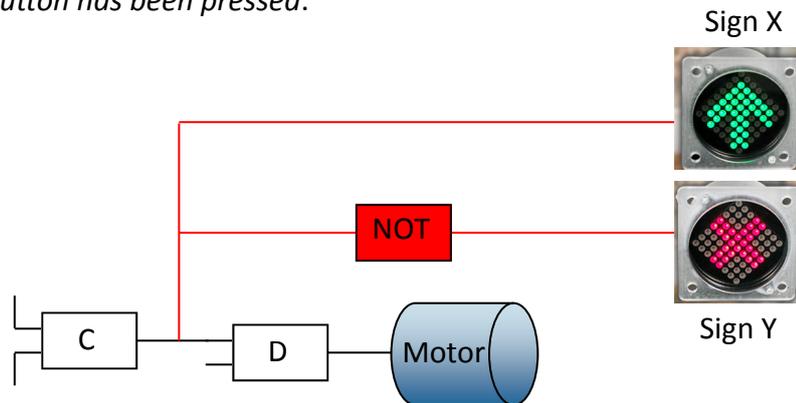
Sign Y

[3 mks] - Mod for '*turn on sign X only, when the system is operating correctly*'
O/P from gate C = 1 in normal operation, direct connection to sign X required.

[3 mks] - Modification for '*turn on sign Y only, when the escalator has been switched off or when a stop button has been pressed*'.
O/P from gate C = 0 under conditions specified, connection to sign Y via NOT gate is required.

(34 marks)

(b) Draw a truth table for the system below and hence state which LED will light if :
(i) the input value of A is greater than B (A > B),
(ii) the input values are the same (A = B).

Output

A: Input 1 / 0

X
Y
Z
W
V

C: Red LED (1 On /0 Off)

D: Orange LED (1 On /0 Off)

E: Green LED (1 On /0 Off)

B: Input 1 / 0

|  | Input | Input |  |  |  |  |  | Output | Output | Output |
|---|---|---|---|---|---|---|---|---|---|---|
|  | A | B | x | y | z | w | v | C (Red) | D (Orange) | E (Green) |
| A = B | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| A > B | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| A < B | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 |
| A = B | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 |

(i) [8 mks] A = B Orange LED will light    X/Y/Z/W/V/C/D/E