

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Certificate 2014

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, 2014

Technology

Higher Level

Wednesday, 18 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

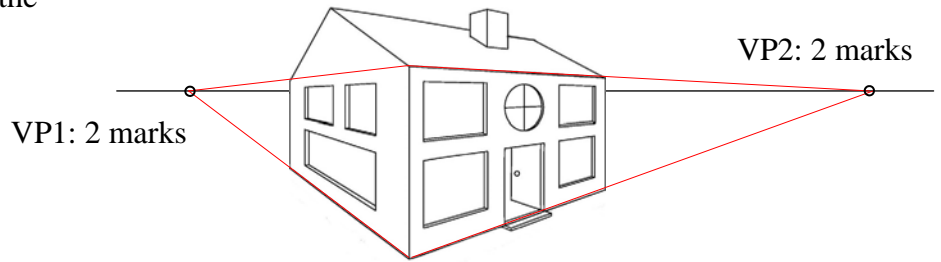
Examination Number

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. Indicate clearly the location of the **two** vanishing points for the perspective drawing shown.

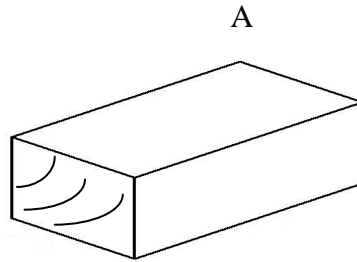


2. Use rendering techniques on the graphics shown to suggest that:

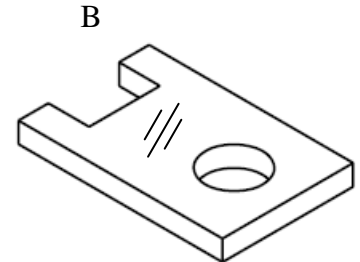
A is made of wood

and

B is made of acrylic.



Wood render: 2 marks



Acrylic render: 2 marks

3. State **two** advantages of tablet devices.

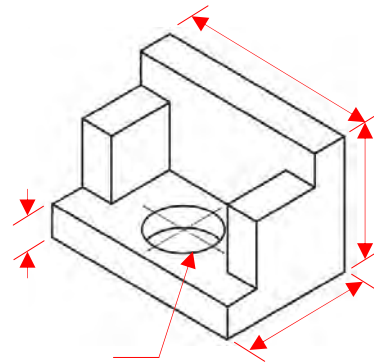


Answer: Any 2 valid advantages:
2 x 2 marks.

Size, weight, portability, store books (many), web access, take and process photographs/movies, etc.

4. Show clearly **two** important dimensions on the drawing given.

Any 2 valid dimensions:
2 x 2 marks.



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



(i)



(ii)

(i): 2 marks: Wear ear protection

(ii): 2 marks: Recycle

6. Indicate clearly if each of the timbers listed are hardwoods or softwoods.



Wood	Hardwood	Softwood
Beech	x	
Oak	x	
Scots Pine		x
Sycamore	x	

Each correct answer: 1 mark (max:4)

7. Designers commonly use cardboard to produce models of their ideas.



Answer: Any 2 valid advantages:
2 x 2 marks.

Low cost material, easily worked, easily altered, etc.

State **two** advantages of using cardboard to make the model shown.

8. Name **each** of the saws shown

and

name a suitable material for cutting with each saw.



X: 1 mark: Tenon saw.

Material: 1 mark: Wood

Y: 1 mark: Hacksaw

Material: 1 mark: Metal/Plastic

9. When drilling acrylic sheet, why is it important to:

(i) drill a pilot hole

and

(ii) place a piece of waste wood under the acrylic?

(i): 2 marks:

Prevent main drill bit slipping/
To minimise risk of acrylic cracking with larger drill use

(ii): 2 marks:

Prevent 'break-through' or equivalent statement.

10. Name a suitable material to make the body of the hair straightener shown

and

state **one** reason for using that material.



Hair straightener

Material: 2 marks:
Named insulator (Plastic)

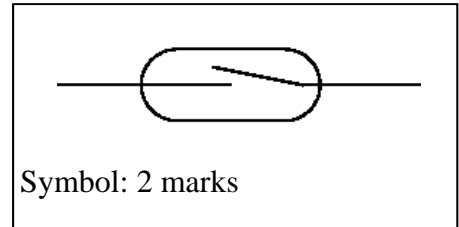
Reason: 2 marks:

Material must insulate user from heating element /
Electrical insulator

11. Sketch the electronic symbol for the switch shown

and

name the additional component required to operate this switch.

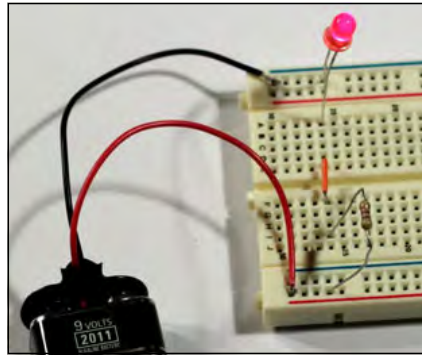


Symbol: 2 marks

Component: 2 marks: Magnet

12. When a working 9V battery is attached to the circuit shown, the LED does not light.

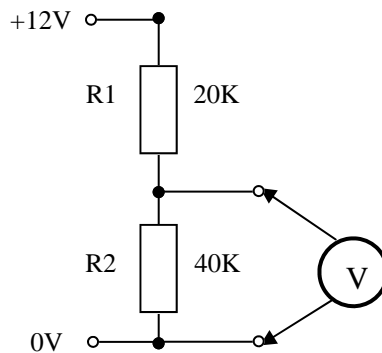
Suggest **two** reasons for this.



Answer: Any two valid reasons:
2 x 2 marks.

Incorrect resistor used,
LED (legs) reversed,
Wired incorrectly, etc.

13. Calculate the voltage across resistor R2 in the circuit shown.

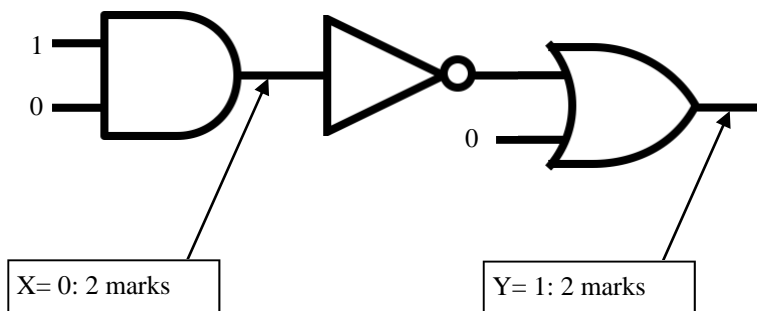


Voltage: 4 marks: 8 V

2 marks: *correct fraction:*
 $R2/(R1+R2) = 40/60 = 2/3$

2 marks: *fraction applied*
 $12V \times (2/3)$

14. Identify the logic states of the circuit at points X and Y.



X= 0: 2 marks

Y= 1: 2 marks

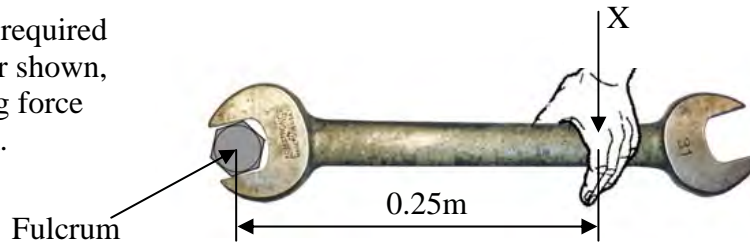
15. Electrical solder is an alloy. Name the **two** metals in electrical solder.



Answer: two valid metals:
2 x 2 marks

Lead (Pb), Tin (Sn)

16. Calculate the force required at X, on the spanner shown, to produce a turning force (moment) of 15Nm.



Force: 4 marks:
60N

2 marks:
 $M = F \times d$
 $15 = F \times 0.25$

2 marks:
 $F = 15/0.25 = 60$

17. State clearly, where on a bicycle it is important to:

(i) minimise friction

and

(ii) maximise friction.



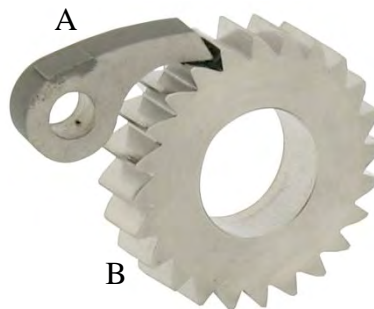
Minimise: Correctly identified
2 marks.
Axel, etc.

Maximise: Correctly identified
2 marks.
Seat, Handlebars, Pedals, Breaks, etc.

18. Name the parts of the gear system shown

and

state the function of part A.

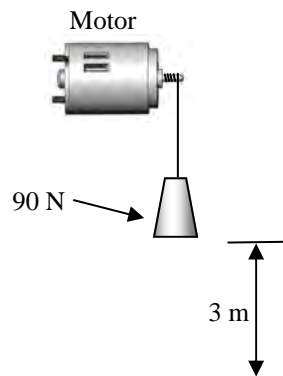


A: 1 mark: Pawl

B: 1 mark: Ratchet

Function of A: 2 marks:
Prevent slippage, prevent
ratchet rotating in reverse
direction.

19. Calculate the work done to lift the 90 N load by 3m in the system shown.



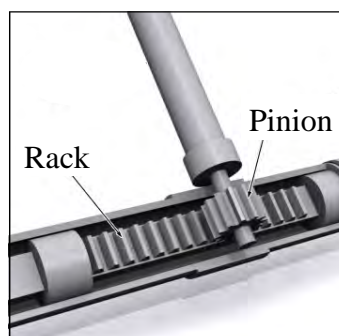
Work: 4 marks: 270 (Nm)

2 marks:
 $W = F \times d$

2 marks:
 $W = 90 \times 3 = 270$

20. The gears shown are used in a car steering system.

Name **two** other areas where this gear system is used.



Answer: Two other valid areas of
usage 2 x 2 marks.

Canal lock gates, Mountain railways,
Kitchen scales (mechanical), Bench
drill, etc.

21. Explain the term: 'biodegradable'

and

name **one** common biodegradable household material.



Biodegradable: 2 marks:
Material can be broken down quickly to natural elements in nature / biologically / by micro-organisms.

Material: 2 marks:
valid named material.
Certain packaging, (paper based, egg cartons, some plastics, etc.)

22. Name **two** properties of fabrics which make them suitable for use as sails on yachts.



Answer: Any two valid properties:
2 x 2 marks

Strength, flexibility, can be repaired, can be printed on, weight to size ratio, etc.

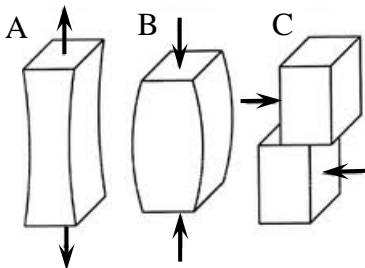
23. Explain the term 'smartphone' in relation to modern mobile phones.



Smartphone: 4 marks:

Phone with advanced capabilities / connectivity: Cameras/Video, Advanced processors, Internet/Wi-fi/Bluetooth, Apps, Data processing, Touchscreen, etc.

24. Name the forces operating at A, B and C.



A: Tension
B: Compression
C: Shear

1st correct: 2 marks
2nd correct: 1 mark
3rd correct: 1 mark

25. Name **two** applications of pneumatics.



Answer: Any two valid applications:
2 x 2 marks

Air brakes, Air compressors, Exercise machines, Pneumatic tools, Spray painting, Jackhammers, Nail guns, etc.

26. Identify **two** safety features on the drill shown.



Answer: Two valid safety features:
2 x 2 marks

Emergency stop button, drill guard, workpiece clamp.

27. Wind energy is a renewable form of energy.



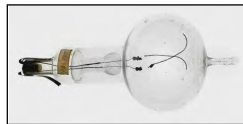
Name **two** other commercial renewable energies available in Ireland.

Answer: Two valid commercial renewable energies available in Ireland:
2 x 2 marks

Wave, Tidal, Hydro, Biofuels, Biomass, Geothermal, Solar.
Exclude: Wind, Nuclear.

28. Name the inventors of:

(i) the practical electric light bulb



(i): 2 marks: Thomas Edison (1879)

and

(ii) the first modern automobile.



(ii): 2 marks: Karl Benz (1886)

29. Name the structural feature which makes the tower-crane both strong and lightweight.



Answer: Correctly named feature:
4 marks.

Triangulation

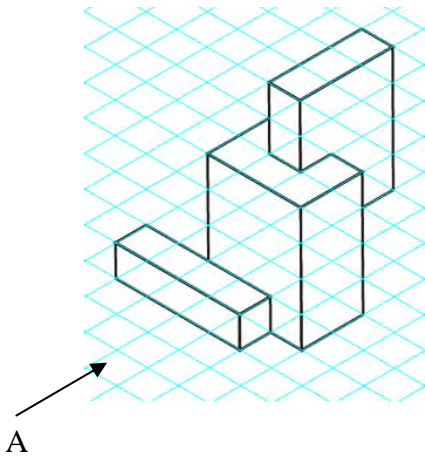
30. Why have 'USB sticks' (flash drives) replaced 'floppy disks' for portable data storage?



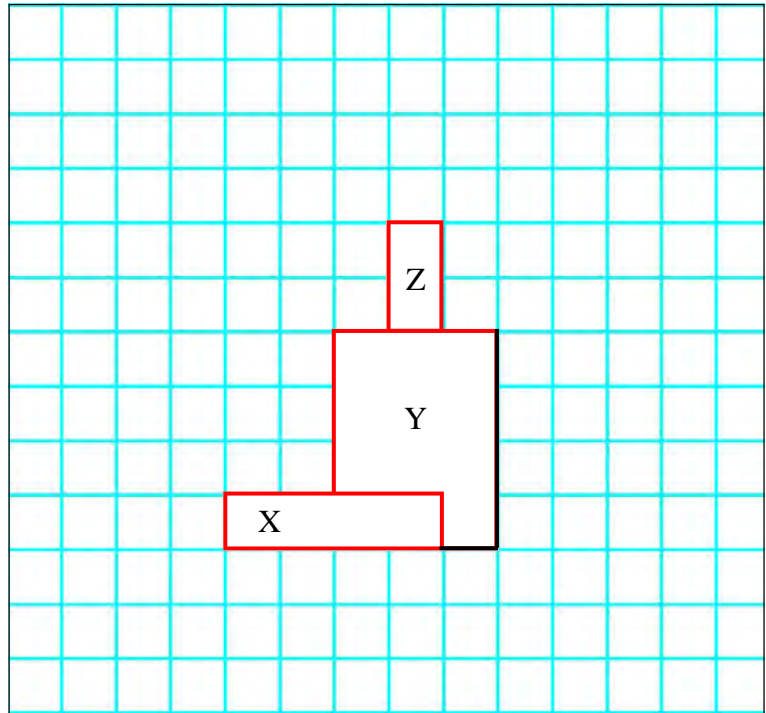
Answer: Correctly identified reason:
4 marks.

Storage capability of USB higher, Faster access with USB, Reliability, etc.

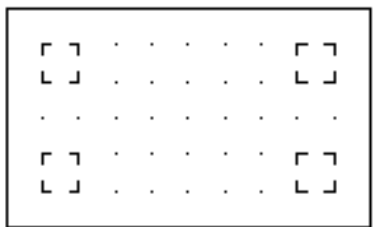
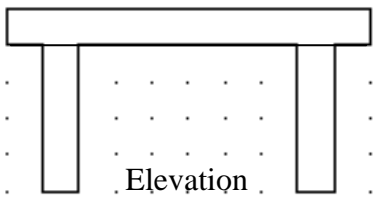
31. An isometric view of an object is shown.
On the grid below, complete the front elevation of the object when viewed in the direction of arrow A.



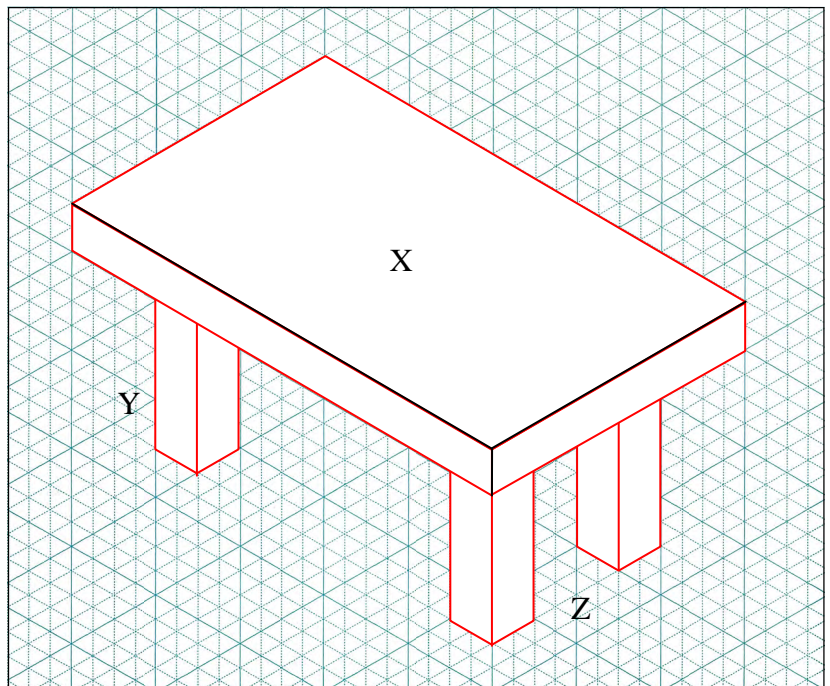
Part X: 2 marks (size: 4×1)
Part Y: 1 mark (size: 3×4)
Part Z: 1 mark (size: 1×2)



32. An orthographic projection of a table is shown below.
Complete the isometric sketch of the table on the grid provided.



Part X: 2 marks (table top)
Part Y: 1 mark (one leg)
Part Z: 1 mark (two legs)





Junior Certificate Examination, 2014

Technology

Higher Level

Wednesday, 18 June
Afternoon, 2:00 - 4:00

Section B and Section C

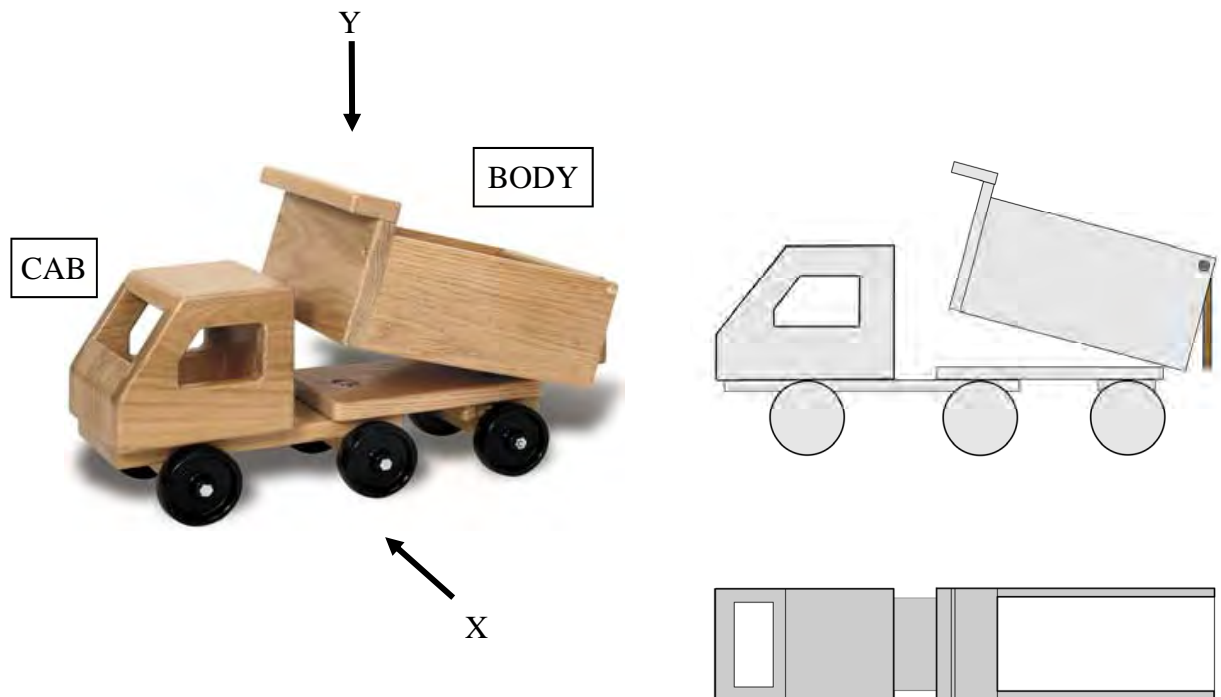
Section B - 50 marks

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.

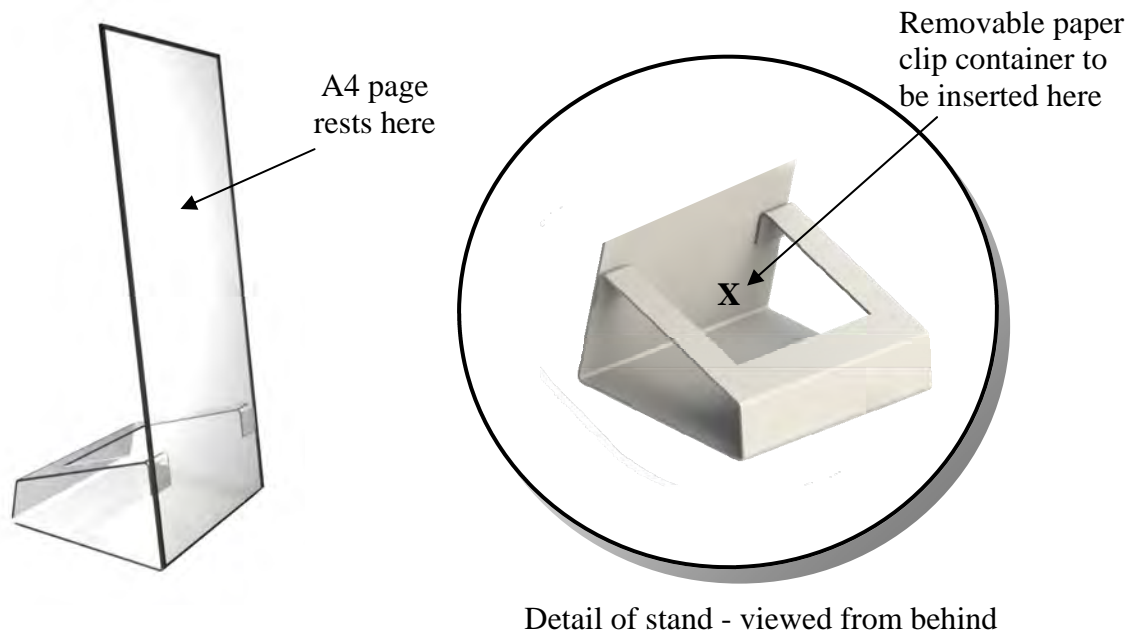
- 1 (a) The graphic shows a toy truck. The cab and body are made from 6 mm thick red deal. The wheels are made from black nylon.



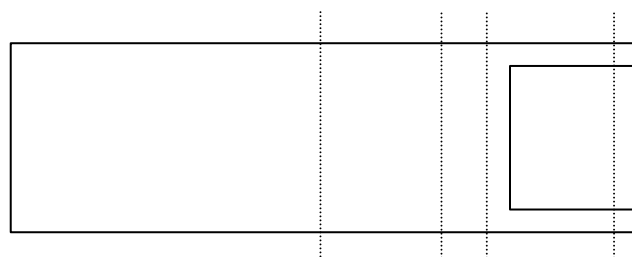
- (i) Make well-proportioned sketches of the following views:
1. An **elevation** in the direction of arrow **X**.
5 marks: Correct elevation: (2), Wheels, cab & body (3 x 1)
(The wheels should be shown as circles)
 2. A **plan** in the direction of arrow **Y**.
5 marks: Correct plan view: (2), Cab, (1), body (2)
- (10 marks)
- (ii)
1. Describe, using sketches, a suitable method of attaching the wheels.
5 marks: Sketch: (2), suitable method (3, 2, 1)
 2. Use neat labelled sketches to describe a suitable mechanical method of raising and lowering the body.
5 marks: Sketch: (2), suitable method (3, 2, 1)
- (10 marks)
- (iii) Outline **two** processes which might be used to manufacture and finish the wooden cab to a standard similar to that shown in the graphic.
First named process: sanding, varnish, wax, stain (1) & process outlined (2)
Second named process (1) & process outlined (1)
- (5 marks)

- OR -

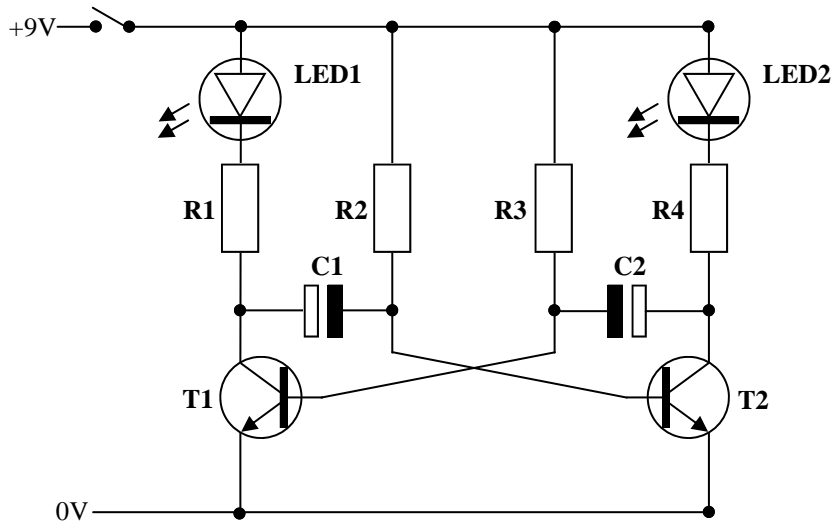
- 1 (b) The graphics show a student's unfinished design for a document (A4 page) stand. The stand is to be manufactured from a single sheet of 3 mm acrylic.



- (i) Make a well-proportioned sketch of a **development** of the stand. Indicate clearly on your sketch the position of all bend lines. Development: 5 panels (5 x 2) (10 marks)
- (ii) 1. Explain, using sketches, the steps required to manufacture the stand from the acrylic sheet. 5 marks: sketches (3) , steps (2) (Steps: Marking out, cutting, strip heater, finish) (10 marks)
2. Sketch a design for a removable paper clip container to fit in the space labelled X. 5 marks: Design sketch (3), removable feature (2)
- (iii) It was found during testing that A4 pages fell off the stand. Describe, using sketches, a design modification to solve this problem. 5 marks: Design modification sketch (3), modification described (2)



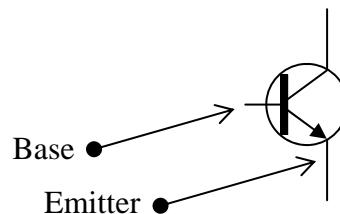
- 2 (a) The diagram shows the component layout for a flashing LED circuit.
(LED1 on, LED2 off, LED1 off, LED2 on)



- (i) LED1 has the following values: $V_f = 2V$ and $I_{max} = 0.02A$.
Calculate the required value of R1 in the circuit shown.
4 marks: R1: $(9V - 2V / 0.02A) = 350\Omega$
- (ii) The required value of resistor R2 is $47k\Omega$.
Use the resistor colour codes shown below to determine the colour bands of this resistor.
7 marks: R2: Yellow (2), Violet (2), Orange (3)
- (iii) Identify the components shown at C1 and C2.
3 marks (C1 & C2: Capacitors)
What unit is used to measure the value of C1 and C2?
3 marks (C1 & C2: unit: Farad)
What effect will increasing the value of these components have on the operation of the circuit?
3 marks (increasing C: increasing the time for 'on' and 'off')
- (iv) Copy the symbol for transistor T1 into your answer book and indicate clearly the position of the base and emitter.
5 marks : 1st correct (3), 2nd correct (2)

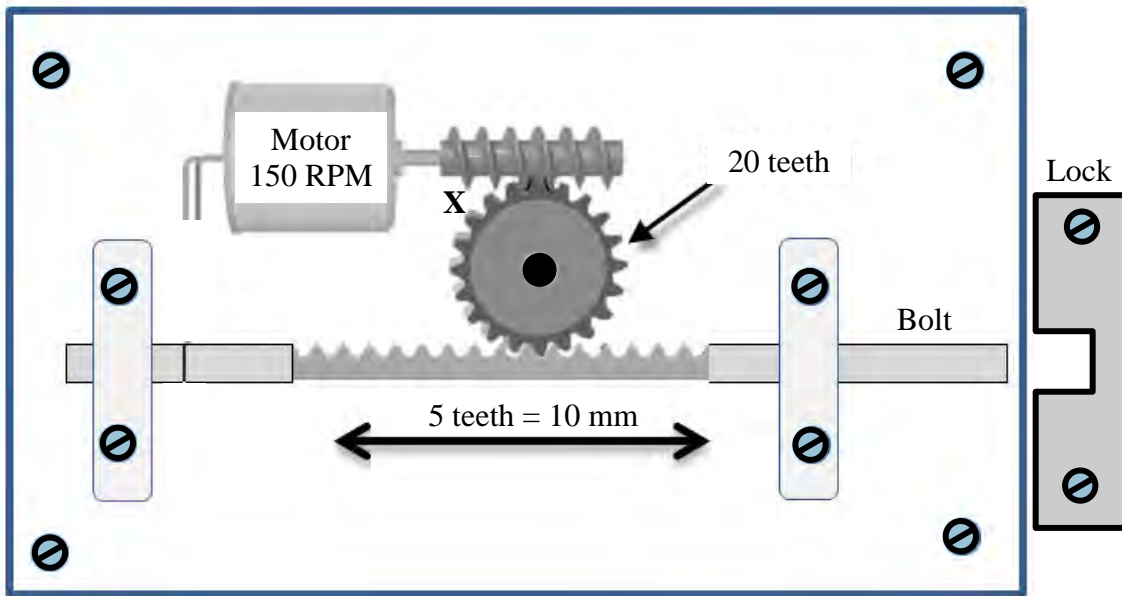
Resistor Colour Codes

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

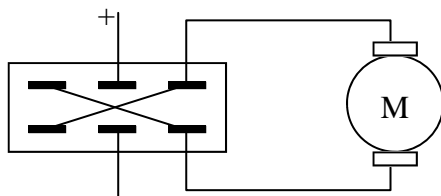
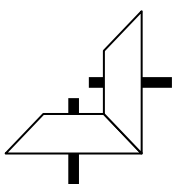


- OR -

2 (b) The sketch shows a mechanism to lock and unlock a door.

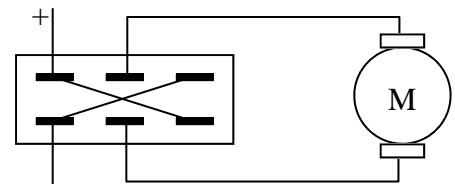


- (i) Name the mechanism shown at X.
 3 marks (X: Worm)
 State **one** advantage of using this mechanism in a lock.
 2 marks (no slip, slow return, compact, locking mechanism, etc.) (5 marks)
- (ii) The mechanism at X changes the direction of motion through 90°. Name and sketch another mechanism which also achieves this change.
 3 marks (named: bevel), 2 marks (sketch) (5 marks)
- (iii) Using the information given in the sketch, calculate the length of time for which the motor must run to move the bolt a distance of 30 mm.
 5 marks: 6 seconds.
 10mm = 5 teeth on rack, 30 mm = 15 teeth on rack,
 150 rotations of motor in 60 sec, 1 rotation in 60/150 sec,
 15 rotations in (15 x 60)/150 sec = 6 seconds (5 marks)
- (iv) The door can be locked and unlocked, using a circuit constructed from the following components: a battery, a DPDT switch and a motor.
 Indicate how these components should be wired to allow the door to lock and unlock.
 5 marks (2 marks: DPDT wired correctly, 2 marks: motor wired correctly, 1 mark: battery connected correctly) (5 marks)
- (v) Explain why limit switches should be used as part of the controlling circuit.
 5 marks (stop the motor to prevent motor damage / gear damage) (5 marks)



DPDT switch

OR



DPDT switch

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) Many 'end of life' microelectronic devices (e-waste) find their way to landfill.
- (i) Outline **two** reasons why many electronic devices have a 'short working life'.
2 x 5 marks: (new technologies, smaller size, no longer supported, repair not possible, made to break, upgrade not possible, etc.)
- (ii) Outline **two** reasons why sending these products to landfill is not good practice environmentally.
2 x 5 marks: (toxic materials, valuable metals, parts recycled, create employment, etc.)
(20 marks)

- (b) *'Internet users continue to spend more time on social media sites than any other type of site.'*



- (i) Explain what is meant by 'social media'.
8 marks : (User generated content facilitated by sites which allow users to create or exchange ideas, opinions, images, video, etc.)
- (ii) Outline **one** advantage of using these sites.
6 marks : (Share information, business advantage, News update, video upload, political movements, Allow users keep in contact, find people, etc.)
- (iii) Outline **one** disadvantage of using these sites.
6 marks: (Fraud, privacy, cyberbullying, uncensored, etc.)

(20 marks)

- (c) Services to customers of Intercity rail travel have improved through technological advances.

Outline, using **two** examples, new technologies now available to rail customers.

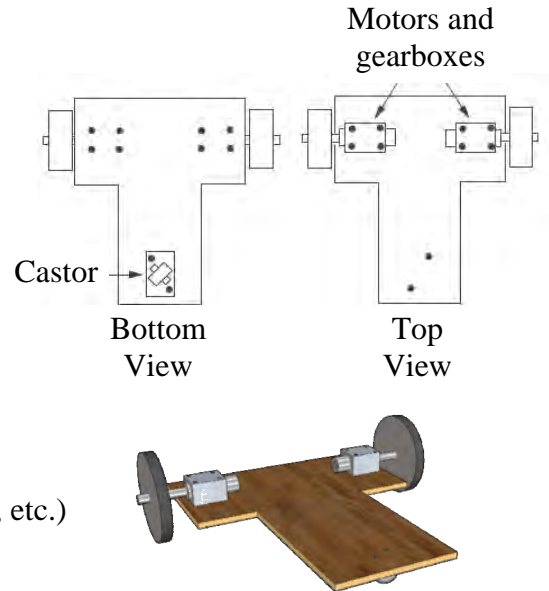
2 x 5 marks: (online booking, dedicated seating, updates on arrivals, dep (service), trains faster / more comfort, wi-fi, etc.)



(10 marks)

4. Control Systems & Technology and Society

The graphics show a base platform for an educational robot.



- (a) (i) Outline **two** reasons why the castor is required.
5 marks: 3, 2 (weight distribution, free turning)
- (ii) Explain why gear boxes are attached to the drive motors.
5 marks: (torque, speed reduction, etc.)
- (iii) Outline **two** reasons why some robots use tracks instead of wheels.
2 x 5 marks: (better traction, climb over obstacles, etc.)
- (iv) Explain how, using the two motors, the robot can move forward in a straight line and then turn left.
5 marks: forward (M1 & M2 operate together)
5 marks: turn (M1 stop & M2 on or M1 rev. & M2 fwd)
- (v) Outline how such a robot could detect and avoid an obstacle (e.g. a wall).
5 marks: sensor (detect obstacle switch etc.)
5 marks: avoid (reverse, turn, forward) (40 marks)

- (b) Robotic devices are commonly used in military operations and in space exploration. In **each** case, explain the advantages of using robotic devices for these operations.
5 marks: military (bomb disposal save lives, drones endurance, etc.)
5 marks: space (operate in hostile environment, operate 24/7, etc.) (10 marks)

5. Design and Manufacture

It is required to manufacture a lightweight show-jumping fence. The fence should be both free standing and height adjustable.

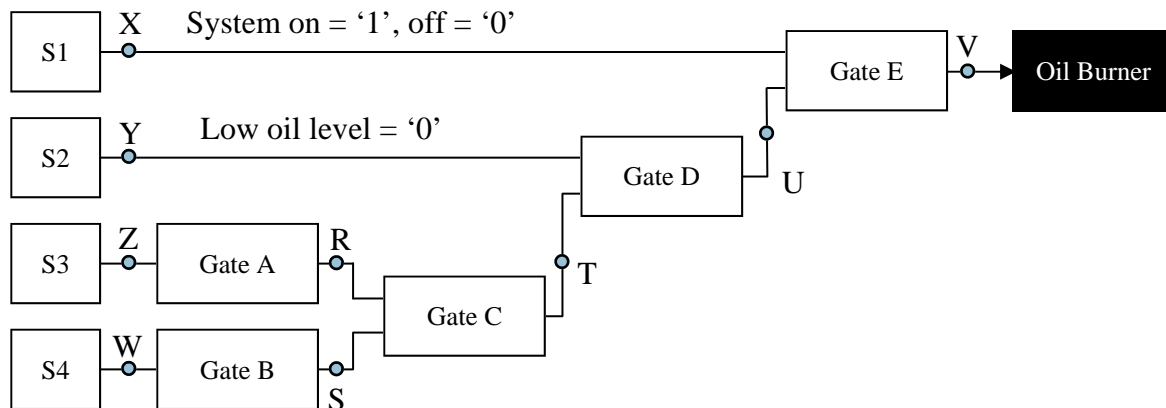


- (a) (i) Explain, giving **two** reasons, your choice of material to manufacture the fence.
2 x 5 marks: (reasons-manufacture cost, properties (lightweight etc.)
- (ii) Outline **two** safety features which should be included in the design of the fence.
2 x 5 marks: (collapse easily, no sharp edges, etc.)
- (iii) Describe, with the aid of sketches, a proposed structure for the side supports of the show jumping fence.
5 marks: structure sketched - quality of sketch
5 marks: valid structure
- (iv) Describe, with the aid of sketches, the features of your design which will allow the horizontal fence poles to fall if struck by a horse.
5 marks: feature sketched - quality of sketch
5 marks: valid feature (40 marks)

- (b) Outline, with the aid of labelled sketches, a suitable mechanism to allow one person easily adjust the height of the fence.
5 marks: mechanism sketched - quality of sketch
5 marks: valid mechanism (10 marks)

6. Control Systems

A system diagram for an oil-burning heating control unit is shown. The system contains: a system on/off switch (S1), a low oil-level sensor (S2), a low-temperature sensor (S3) and a high-temperature sensor (S4). S3 will output a '0' at a set low temperature and S4 will output a '1' at a set high temperature. The oil burner must operate if the temperature is between the values set by S3 and S4. A number of logic gates are identified as: A, B, C, D and E.



- (i) Name the logic gates required at A, C, D and E. (10 marks)
 10 marks: 3, 3, 2, 2 (A: NOT, C: OR, D: AND, E: AND)
- (ii) Draw truth tables for gates C and E. (10 marks)

Truth table for C: OR
 5 marks: table 1 mark, 4 x 1 o/p

R	S	T
1	1	1
0	1	1
1	0	1
0	0	0

Truth table for E: AND.
 5 marks: table 1 mark, 4 x 1 o/p

X	U	V
1	1	1
0	1	0
1	0	0
0	0	0

(iii) Copy the truth table below into your answer book.

For **each** of the situations described below, use the truth table to identify the logic states (1 / 0) at the points marked X, Y, Z, W, R, S, T, U and V.

	X	Y	Z	W	R	S	T	U	V
Situation 1	1	1	0	0	1	1	1	1	1
Situation 2	1	0	1	0	0	1	1	0	0

Situation 1: The system is turned on, there is sufficient oil in the tank, a low temperature is detected by S3 and a low temperature is detected by S4.

10 marks: first correct 2 marks, 8 x 1mark remaining 8 values correct

(10 marks)

Situation 2: The system is turned on, there is no oil in the tank, a high temperature is detected by S3 and a low temperature is detected by S4.

10 marks: first correct 2 marks, 8 x 1mark remaining 8 values correct

(10 marks)

(iv) A latched alarm is required to indicate that there is no oil in the tank. Explain how a latch alarm can be constructed from an 'OR' logic gate.

10 marks: (5 marks : OR gate correctly configured)

(5 marks: latch explained— when input goes high (1), output goes high and remains high (1) after input goes low(0))

(10 marks)

