



**Coimisiún na Scrúduithe Stáit
State Examinations Commission**

JUNIOR CERTIFICATE 2012

MARKING SCHEME

***MATERIALS AND TECHNOLOGY*
METALWORK**

ORDINARY LEVEL

MATERIALS AND TECHNOLOGY ***METALWORK***

ORDINARY LEVEL


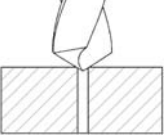
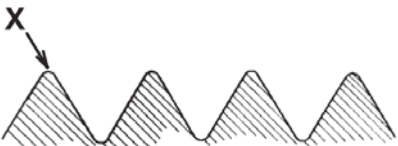
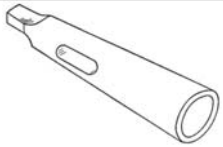
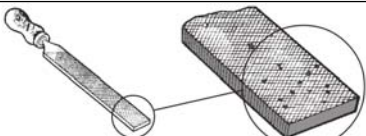
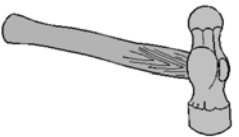
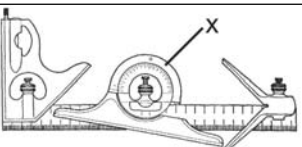
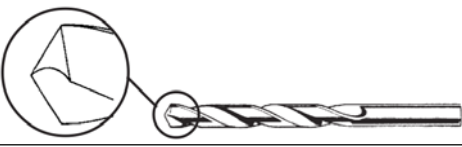

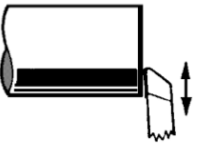
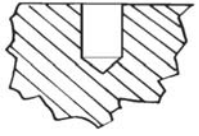
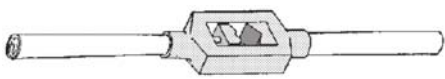
MARKING SCHEME **Written Examination and Project**

Note: For the written examination - Answer Question 1, Sections A and B and any three other questions.
The solutions presented are examples only.
All other valid solutions are acceptable and are marked accordingly.

Question 1.

SECTION A - 20 MARKS
ANSWER ANY TEN QUESTIONS FROM THIS SECTION

40 Marks

| | | | | | | | | | | | |
|--|--|---|-------------------|--|------------------|---|--------------------|---|---------------|---|----------|
| <p>(a)</p>  | <p>This tool is a:</p> | <table border="1"> <tr><td>Chisel</td><td></td></tr> <tr><td>Soldering Iron</td><td>✓</td></tr> <tr><td>Centre Punch</td><td></td></tr> <tr><td>Drill Drift</td><td></td></tr> </table> | Chisel | | Soldering Iron | ✓ | Centre Punch | | Drill Drift | | <p>②</p> |
| Chisel | | | | | | | | | | | |
| Soldering Iron | ✓ | | | | | | | | | | |
| Centre Punch | | | | | | | | | | | |
| Drill Drift | | | | | | | | | | | |
| <p>(b)</p>  | <p>This drill bit is guided by a:</p> | <table border="1"> <tr><td>Clearance Hole</td><td></td></tr> <tr><td>Countersink Hole</td><td></td></tr> <tr><td>Pilot Hole</td><td>✓</td></tr> <tr><td>Punch Mark</td><td></td></tr> </table> | Clearance Hole | | Countersink Hole | | Pilot Hole | ✓ | Punch Mark | | <p>②</p> |
| Clearance Hole | | | | | | | | | | | |
| Countersink Hole | | | | | | | | | | | |
| Pilot Hole | ✓ | | | | | | | | | | |
| Punch Mark | | | | | | | | | | | |
| <p>(c)</p>  | <p>Part 'X' on a thread is called the:</p> | <table border="1"> <tr><td>Flank</td><td></td></tr> <tr><td>Pitch</td><td></td></tr> <tr><td>Crest</td><td>✓</td></tr> <tr><td>Lead</td><td></td></tr> </table> | Flank | | Pitch | | Crest | ✓ | Lead | | <p>②</p> |
| Flank | | | | | | | | | | | |
| Pitch | | | | | | | | | | | |
| Crest | ✓ | | | | | | | | | | |
| Lead | | | | | | | | | | | |
| <p>(d)</p>  | <p>This tool is used when:</p> | <table border="1"> <tr><td>Filing</td><td></td></tr> <tr><td>Drilling</td><td>✓</td></tr> <tr><td>Threading</td><td></td></tr> <tr><td>Riveting</td><td></td></tr> </table> | Filing | | Drilling | ✓ | Threading | | Riveting | | <p>②</p> |
| Filing | | | | | | | | | | | |
| Drilling | ✓ | | | | | | | | | | |
| Threading | | | | | | | | | | | |
| Riveting | | | | | | | | | | | |
| <p>(e)</p>  | <p>This file should be cleaned using a:</p> | <table border="1"> <tr><td>Dividers</td><td></td></tr> <tr><td>Double Cut</td><td></td></tr> <tr><td>File Card</td><td>✓</td></tr> <tr><td>Centre Punch</td><td></td></tr> </table> | Dividers | | Double Cut | | File Card | ✓ | Centre Punch | | <p>②</p> |
| Dividers | | | | | | | | | | | |
| Double Cut | | | | | | | | | | | |
| File Card | ✓ | | | | | | | | | | |
| Centre Punch | | | | | | | | | | | |
| <p>(f)</p>  | <p>This bench tool is a:</p> | <table border="1"> <tr><td>Cross Pein Hammer</td><td></td></tr> <tr><td>Ball Pein Hammer</td><td>✓</td></tr> <tr><td>Claw Hammer</td><td></td></tr> <tr><td>Mallet</td><td></td></tr> </table> | Cross Pein Hammer | | Ball Pein Hammer | ✓ | Claw Hammer | | Mallet | | <p>②</p> |
| Cross Pein Hammer | | | | | | | | | | | |
| Ball Pein Hammer | ✓ | | | | | | | | | | |
| Claw Hammer | | | | | | | | | | | |
| Mallet | | | | | | | | | | | |
| <p>(g)</p>  | <p>Part 'X' is called the:</p> | <table border="1"> <tr><td>Ruler</td><td></td></tr> <tr><td>Centre Square</td><td></td></tr> <tr><td>Bevel</td><td></td></tr> <tr><td>Protractor</td><td>✓</td></tr> </table> | Ruler | | Centre Square | | Bevel | | Protractor | ✓ | <p>②</p> |
| Ruler | | | | | | | | | | | |
| Centre Square | | | | | | | | | | | |
| Bevel | | | | | | | | | | | |
| Protractor | ✓ | | | | | | | | | | |
| <p>(h)</p>  | <p>The point angle of a standard twist drill is:</p> | <table border="1"> <tr><td>30°</td><td></td></tr> <tr><td>60°</td><td></td></tr> <tr><td>118°</td><td>✓</td></tr> <tr><td>210°</td><td></td></tr> </table> | 30° | | 60° | | 118° | ✓ | 210° | | <p>②</p> |
| 30° | | | | | | | | | | | |
| 60° | | | | | | | | | | | |
| 118° | ✓ | | | | | | | | | | |
| 210° | | | | | | | | | | | |
| <p>(i)</p>  | <p>This fastener is a:</p> | <table border="1"> <tr><td>Spring Washer</td><td></td></tr> <tr><td>Split Pin</td><td></td></tr> <tr><td>Grub Screw</td><td>✓</td></tr> <tr><td>Set Screw</td><td></td></tr> </table> | Spring Washer | | Split Pin | | Grub Screw | ✓ | Set Screw | | <p>②</p> |
| Spring Washer | | | | | | | | | | | |
| Split Pin | | | | | | | | | | | |
| Grub Screw | ✓ | | | | | | | | | | |
| Set Screw | | | | | | | | | | | |
| <p>(j)</p>  | <p>This technique is called:</p> | <table border="1"> <tr><td>Parallel Turning</td><td></td></tr> <tr><td>Knurling</td><td></td></tr> <tr><td>Taper Turning</td><td></td></tr> <tr><td>Facing</td><td>✓</td></tr> </table> | Parallel Turning | | Knurling | | Taper Turning | | Facing | ✓ | <p>②</p> |
| Parallel Turning | | | | | | | | | | | |
| Knurling | | | | | | | | | | | |
| Taper Turning | | | | | | | | | | | |
| Facing | ✓ | | | | | | | | | | |
| <p>(k)</p>  | <p>The depth of a hole is measured using a:</p> | <table border="1"> <tr><td>Micrometer</td><td></td></tr> <tr><td>Drill Gauge</td><td></td></tr> <tr><td>Depth Gauge</td><td>✓</td></tr> <tr><td>Surface Gauge</td><td></td></tr> </table> | Micrometer | | Drill Gauge | | Depth Gauge | ✓ | Surface Gauge | | <p>②</p> |
| Micrometer | | | | | | | | | | | |
| Drill Gauge | | | | | | | | | | | |
| Depth Gauge | ✓ | | | | | | | | | | |
| Surface Gauge | | | | | | | | | | | |
| <p>(l)</p>  | <p>This tool is a(n):</p> | <table border="1"> <tr><td>Open Spanner</td><td></td></tr> <tr><td>Tap Wrench</td><td>✓</td></tr> <tr><td>Adjustable Spanner</td><td></td></tr> <tr><td>Box Spanner</td><td></td></tr> </table> | Open Spanner | | Tap Wrench | ✓ | Adjustable Spanner | | Box Spanner | | <p>②</p> |
| Open Spanner | | | | | | | | | | | |
| Tap Wrench | ✓ | | | | | | | | | | |
| Adjustable Spanner | | | | | | | | | | | |
| Box Spanner | | | | | | | | | | | |

SECTION B - 20 MARKS
ANSWER ALL QUESTIONS FROM THIS SECTION

(m)

Name **any four** materials used in the manufacture of modern cars. **5**



| | |
|----|------------------|
| 1. | <i>Aluminium</i> |
| 2. | <i>Steel</i> |
| 3. | <i>Acrylic</i> |
| 4. | <i>Glass</i> |

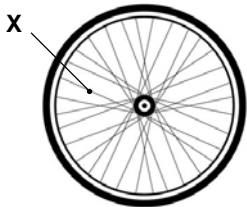
(n)

What is the function of a spark plug in a petrol engine? **6**



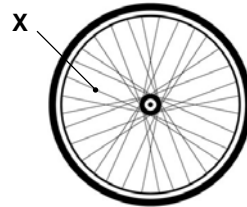
| |
|--|
| <i>To ignite the petrol and air mixture.</i> |
| |
| |
| |

(o) (i) Part 'X' is called a(n):



| | |
|-------|-------------------------------------|
| Hub | <input type="checkbox"/> |
| Spoke | <input checked="" type="checkbox"/> |
| Rim | <input type="checkbox"/> |
| Axle | <input type="checkbox"/> |

(ii) Part 'X' is normally in:



| | |
|-------------|-------------------------------------|
| Tension | <input checked="" type="checkbox"/> |
| Torsion | <input type="checkbox"/> |
| Compression | <input type="checkbox"/> |
| Shear | <input type="checkbox"/> |

(p) (i) Part 'Y' is called a:



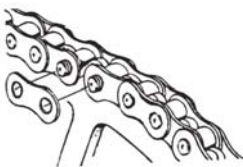
| | |
|----------------|-------------------------------------|
| Brake | <input type="checkbox"/> |
| Lever | <input type="checkbox"/> |
| Fork | <input type="checkbox"/> |
| Shock Absorber | <input checked="" type="checkbox"/> |

(ii) Why are bicycle chains lubricated? **3**



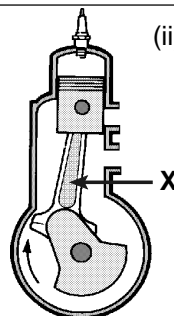
| |
|--|
| <i>To reduce friction and keep the links moving freely</i> |
| |
| |

(q) (i) The links of this chain are joined by:



| | |
|-----------|-------------------------------------|
| Soldering | <input type="checkbox"/> |
| Brazing | <input type="checkbox"/> |
| Riveting | <input checked="" type="checkbox"/> |
| Screwing | <input type="checkbox"/> |

(ii) Part 'X' is called the: **3**



| | |
|----------------|-------------------------------------|
| Valve | <input type="checkbox"/> |
| Connecting Rod | <input checked="" type="checkbox"/> |
| Piston | <input type="checkbox"/> |
| Crankshaft | <input type="checkbox"/> |

Question 2.

20 Marks

(a)

8

(i) Cooking foil is made from:

| | |
|-----------|---|
| Zinc | |
| Aluminium | ✓ |
| Steel | |

(v) The furnace used to produce steel is called a(n):

| | |
|----------------------|---|
| Blast Furnace | |
| Cupola Furnace | |
| Electric Arc Furnace | ✓ |

(ii) Aluminium is a(n):

| | |
|-------------------|---|
| Ferrous Metal | |
| Non-Ferrous Metal | ✓ |
| Alloy | |

(vi) Metal gates are usually made from:

| | |
|-------|---|
| Steel | ✓ |
| Lead | |
| Zinc | |

(iii) Steel is produced by combining iron with:

| | |
|--------|---|
| Lead | |
| Carbon | ✓ |
| Ore | |

(vii) Which one of these metals is the best conductor of heat?

| | |
|--------|---|
| Steel | |
| Lead | |
| Copper | ✓ |

(iv) Cast Iron is:

| | |
|-----------|---|
| Ductile | |
| Brittle | ✓ |
| Malleable | |

(viii) Which one of these metals is the hardest?

| | |
|-------------------|---|
| High Carbon Steel | ✓ |
| Aluminium | |
| Silver | |

(b) Complete the table:

6

| | | |
|--|-----|---|
| (i) Is copper a hard material? | Yes | |
| | No | ✓ |
| (ii) Is copper a malleable material? | Yes | ✓ |
| | No | |
| (iii) Is copper ore called bauxite? | Yes | |
| | No | ✓ |
| (iv) Is nylon a good conductor? | Yes | |
| | No | ✓ |
| (v) Is lime used in the production of steel? | Yes | ✓ |
| | No | |
| (vi) Is galvanised iron coated with zinc? | Yes | ✓ |
| | No | |

(c)

6

(i) After moulding thermosetting plastics soften when reheated:

| | |
|-----------|---|
| Always | |
| Never | ✓ |
| Sometimes | |

(iv) The main raw material for plastic is:

| | |
|----------|---|
| Gas | |
| Oil | ✓ |
| Iron Ore | |

(ii) Another name for glass reinforced polyester is:

| | |
|--------------------|---|
| Polyvinyl Chloride | |
| Fibre Glass | ✓ |
| Acrylic | |

(v) Disposable cups are usually made from:

| | |
|-------------|---|
| Nylon | |
| Polystyrene | ✓ |
| PVC | |

(iii) A strip heater is usually used to bend:

| | |
|----------|---|
| Acrylic | ✓ |
| Foam | |
| Bakelite | |

(vi) Which one of these is a Thermoplastic?

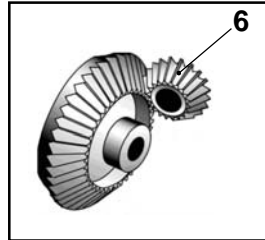
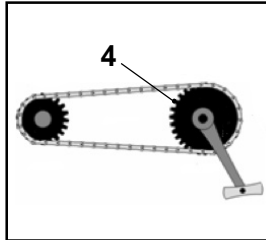
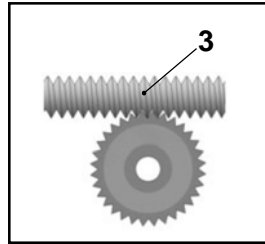
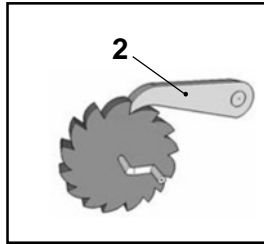
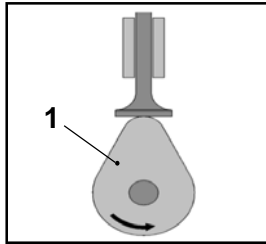
| | |
|-----------|---|
| Polyester | |
| Nylon | ✓ |
| Bakelite | |

Question 3.

20 Marks

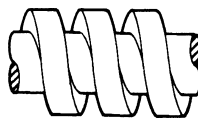
(a) (i) Match the number to the correct mechanism part.

6



| Mechanism Part | No. |
|----------------|-----|
| Bevel Gear | 6 |
| Sprocket Wheel | 4 |
| Pawl | 2 |
| Cam | 1 |
| Pulley | 5 |
| Worm Gear | 3 |

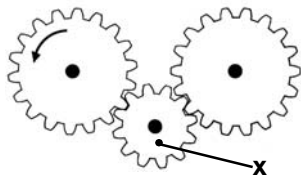
(ii) Name a machine that uses this thread:



Lathe

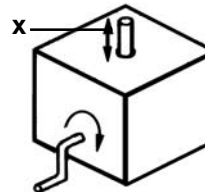
2

(b) (i) Gear 'X' is the:



| | |
|-------------|-------------------------------------|
| Driver Gear | <input type="checkbox"/> |
| Driven Gear | <input type="checkbox"/> |
| Idler Gear | <input checked="" type="checkbox"/> |

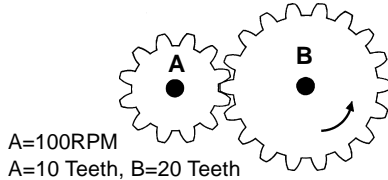
(iv) The motion at 'X' is:



| | |
|---------------|-------------------------------------|
| Linear | <input type="checkbox"/> |
| Oscillating | <input type="checkbox"/> |
| Reciprocating | <input checked="" type="checkbox"/> |

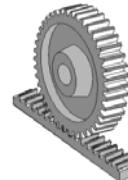
6

(ii) Gear 'B' rotates at:



| | |
|---------|-------------------------------------|
| 200 RPM | <input type="checkbox"/> |
| 100 RPM | <input type="checkbox"/> |
| 50 RPM | <input checked="" type="checkbox"/> |

(v) This mechanism is used in a:



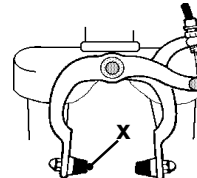
| | |
|--------------|-------------------------------------|
| Pillar Drill | <input checked="" type="checkbox"/> |
| Forge | <input type="checkbox"/> |
| Bench Shears | <input type="checkbox"/> |

(iii) This device is a:



| | |
|---------|-------------------------------------|
| Bearing | <input checked="" type="checkbox"/> |
| Shaft | <input type="checkbox"/> |
| Clutch | <input type="checkbox"/> |

(vi) The material used to make 'X' is called:



| | |
|-----------|-------------------------------------|
| Lead | <input type="checkbox"/> |
| Aluminium | <input type="checkbox"/> |
| Rubber | <input checked="" type="checkbox"/> |

(c) Complete the table by naming devices that use the following mechanisms. The first row has been completed for you, as an example.

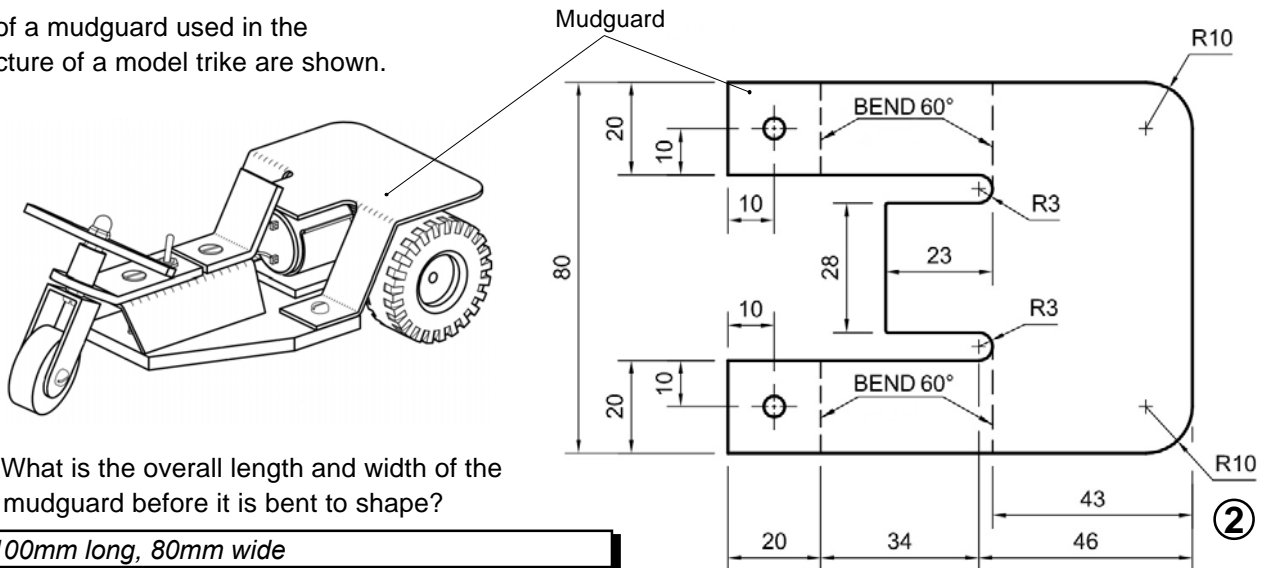
6

| Mechanism | Device |
|-----------|-----------------------------|
| Lever | <i>Nutcracker</i> |
| Chain | <i>Oil filter wrench</i> |
| Pulley | <i>Car water pump</i> |
| Cam | <i>Toys</i> |
| Gears | <i>Electric screwdriver</i> |
| Spring | <i>Door handles</i> |
| Linkage | <i>Windscreen wiper</i> |

Question 4.

20 Marks

Details of a mudguard used in the manufacture of a model trike are shown.



(i) What is the overall length and width of the mudguard before it is bent to shape?

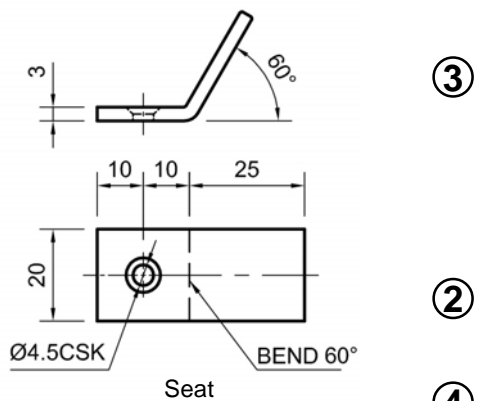
100mm long, 80mm wide

(ii) Describe the stages involved in bending the mudguard to shape.

Align the 43mm bend line in the folding bars, hold in the vice and using a mallet bend each 20mm section separately to the correct angle.
For the 20mm bend lines hold each section separately in the folding bars and bend to shape.

(iii) What precautions should be taken when working with acrylic?

Use fibre clamps when holding in the vice.
Support when drilling.



(iv) What does 'Ø4.5CSK' refer to in this drawing?

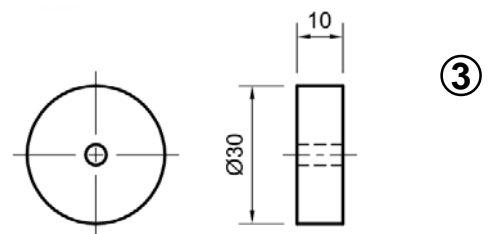
Drill hole using a 4.5mm drill bit & then countersink

(v) List four tools used in the manufacture of the seat.

1. File
2. Saw
3. Drilling machine
4. Strip heater

(vi) Describe the stages involved in making the nylon wheel shown.

Face off
Centre drill
Drill correct diameter
Part off



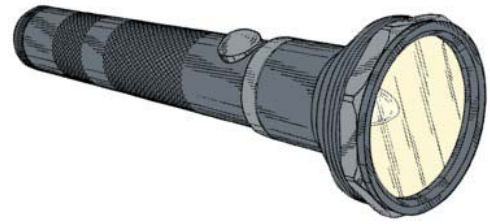
(vii) What safety precautions should you take when operating a lathe?

Wear eye protection
Ensure work is held securely
Do not handle swarf
Do not leave the chuck key in the chuck

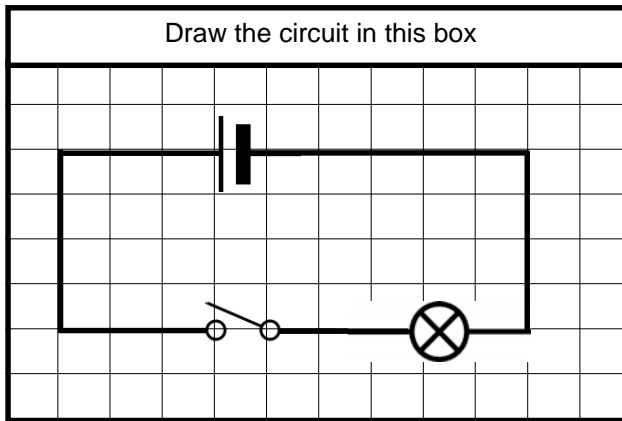
Question 5.

20 Marks

- (a)** (i) Using the symbols from the table below draw the circuit diagram for the torch.



4



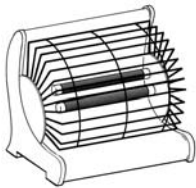
- (ii) What energy conversion takes place when a torch is switched on?

Electrical energy to light energy

5

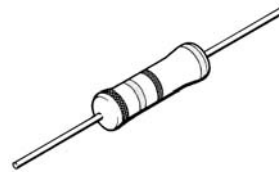
| Component | Symbol |
|-----------|--------|
| | |
| | |
| | |

- (b)** (i) Electrical power is measured in:



| | |
|-------|---|
| Ohms | |
| Watts | ✓ |
| Amps | |

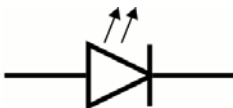
- (iv) This is a(n):



| | |
|----------|---|
| LED | |
| LDR | |
| Resistor | ✓ |

6

- (ii) This is the symbol for a(n):



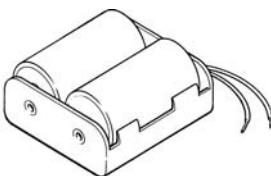
| | |
|--------|---|
| Motor | |
| LED | ✓ |
| Buzzer | |

- (v) A scanner is a(n):



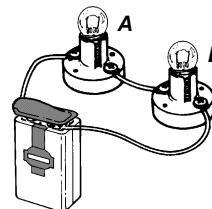
| | |
|----------------|---|
| Output Device | |
| Input Device | ✓ |
| Process Device | |

- (iii) Batteries convert chemical energy directly into:



| | |
|-------------------|---|
| Electrical energy | ✓ |
| Mechanical energy | |
| Kinetic energy | |

- (vi) When this circuit is connected:



| | |
|-------------------|---|
| Bulb A will light | |
| Bulb B will light | |
| Both will light | ✓ |

- (c)** Complete the table by matching the inventors listed to their achievement.

Inventors: Rudolf Diesel, John Dunlop, John P. Holland, James Watt.

5

| Achievement | Inventors |
|-------------------|------------------------|
| 1. Steam Engine | <i>James Watt</i> |
| 2. Submarine | <i>John P. Holland</i> |
| 3. Pneumatic Tyre | <i>John Dunlop</i> |
| 4. Diesel Engine | <i>Rudolf Diesel</i> |

Question 6.

20 Marks

- (i) The design shows a mobile phone holder made from acrylic. Why is acrylic a good choice of material to make the holder?

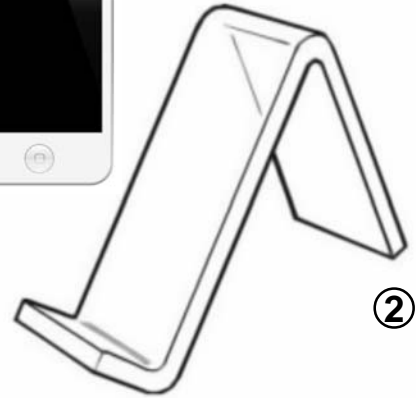
| |
|---------------------------------------|
| <i>Light</i> |
| <i>Easily shaped</i> |
| <i>Available in different colours</i> |



④

- (ii) State **any one** change that you would make to improve the given design of the mobile phone holder.

| |
|----------------------|
| <i>Side supports</i> |
| <i>Make it wider</i> |
| |



②

- (iii) Describe how you would polish the edges of the mobile phone holder.

| |
|--------------------------------|
| <i>Drawfile</i> |
| <i>Use wet & dry paper</i> |
| <i>hand or machine polish</i> |

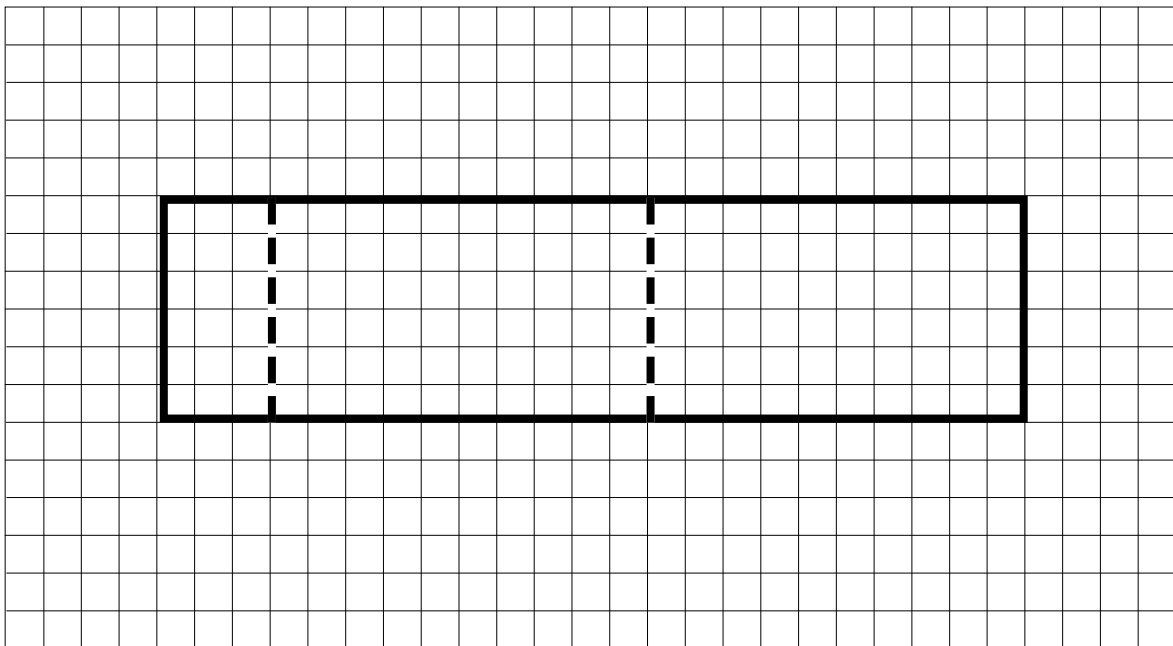
③

- (iv) How would you make sure that the mobile phone holder was not damaged during manufacture?

| |
|--|
| <i>Use fibre clamps when holding in a vice</i> |
| <i>Keep low in a vice when filing</i> |
| |

③

- (v) Draw, in the grid below, the acrylic strip before it was bent to form the mobile phone holder shown above. Show on your drawing the position of the bend lines.



⑤

- (vi) Briefly describe how you would bend the mobile phone holder to the required shape.

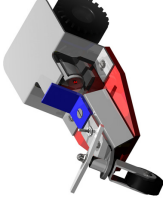
| |
|---|
| <i>Place the bend line over the heating element of the strip heater and heat to the correct temperature. Shape using a former or a jig.</i> |
| |

③



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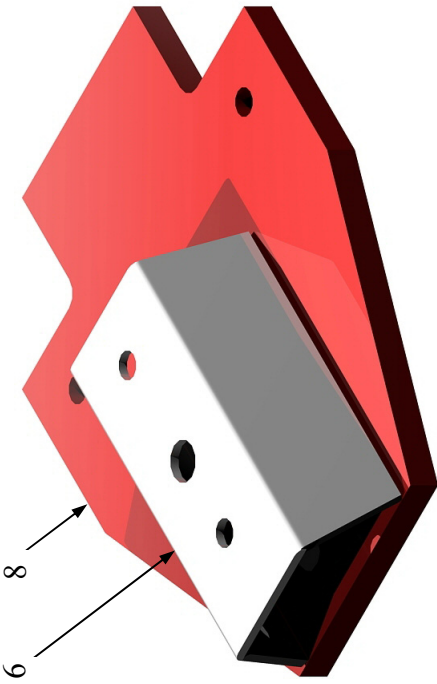
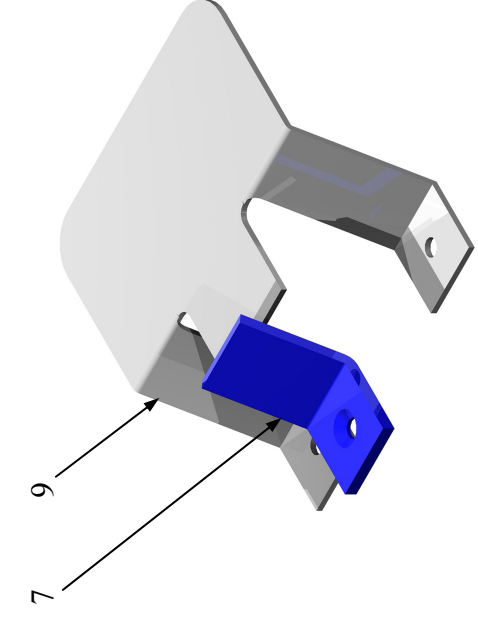


| Subjective Grading 1-5 | | 5 Excellent | 4 Very Good | 3 Good | 2 Poor | 1 Very Poor | Mark | Marks | |
|------------------------|--|---|-------------|--------|---|-------------|------|-------|----|
| Section | Part Number | Pictorial Sketch/Description | | | Concept | | Mark | Marks | |
| 1 | Complete Model (Not including Design Element) | Assembly | | | Subjective Grade 1-5 | | 5 | 20 | |
| | | Finish | | | Subjective Grade 1-5 | | 5 | | |
| | | Function | | | Mechanical Function: | | 5 | | |
| | | | | | Electrical Function: | | 5 | | |
| 2 | Design | Design, make and attach a Rear Carrier to hold the battery unit and a Front Mudguard for the model. | | | Design Rear Carrier: Subjective Grade 1 – 5 | | 5 | 20 | |
| | | | | | Make/Finish | | 3 | | |
| | | | | | Attach | | 2 | | |
| | | | | | Design Front Mudguard: Subjective Grade 1 – 5 | | 5 | | |
| | | | | | Make/Finish | | 3 | | |
| Attach | | 2 | | | | | | | |
| 3 | Parts 1, 2, 3, 4 & 5 | | | | Part 1 Front Fork | | 7 | 1 | 20 |
| | | | | | Drill & Shape | | 6 | | |
| | | | | | Part 2 Front Fork Support | | 5 | 1 | |
| | | | | | Drill, CSK, Shape & Bend | | 4 | | |
| | | | | | Part 3 Steering Column | | 2 | 2 | |
| | | | | | Drill & Length | | 2 | | |
| | | | | | Part 4 Handlebars | | 4 | 4 | |
| | | | | | Mark Out, Drill & Shape | | 4 | | |
| | | | | | Part 5 Front Wheel | | 2 | 2 | |
| | | | | | Drill & Width | | 2 | | |



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| | | | | | | | |
|---|-------------|--|--------------------------|----|--------------------------|----|----|
| 4 | Parts 6 & 8 |  | Part 6 Centre Support | 8 | Mark Out | 1 | 20 |
| | | | Part 8 Chassis | 12 | Drill, Shape & Bend | 7 | |
| 5 | Parts 7 & 9 |  | Part 7 Seat | 6 | Mark Out | 1 | 20 |
| | | | Part 9 Rear Mudguard | 14 | Drill, CSK, Shape & Bend | 5 | |
| | | | | | Mark Out | 2 | |
| | | | | | Drill, Shape & Bend | 12 | |

100 Marks (×3 =300 Total)