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General Certificate of Secondary Education June 2010

Engineering (Single Award) 48501

Unit 1

Final

Mark Scheme

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1 (a) In the spaces below, correctly identify what each labelled part does.

1 mark for each of the following:

Hull – provides bouyancy / makes it float etc
Tiller – steering lever / arm / control etc
Crankshaft – converts linear motion to rotary motion / or physical explanation of action

(3 marks)

1 (b) For each part, suggest a different material that could be used and say why it is suitable.

Crankshaft material – rigid / strong / corrosion resistant such as stainless steel / hard brass / appropriate other (1 mark)

Suitable because – needs to withstand the stresses of being pedalled / it is in direct contact with water, possibly sea water / or similar (1 mark)

Tiller material – anything light / strong / resistant to corrosion such as aluminium / brass / composite polymer / timber or timber laminate (1 mark)

Suitable because – does not carry much stress as speeds are very slow / needs to be tough rather than strong / similar (1 mark)

Hull material – any resilient polymer or composite such as Polyethylene / polycarbonate / Polypropylene / ABS / GRP / or similar (1 mark)

Suitable because – needs to be waterproof / mouldable / rigid etc (1 mark)

(6 marks)

1 (c) Using notes and sketches, describe a method of driving a pedalo through the water.

Sketch showing systems such as:
Pedals
Paddle wheel / propeller / oscillating plate
Attachment system (3 marks)

Notes describing function (2 marks for clear and accurate notes, 1 mark for unclear or incomplete notes) (2 marks)

(5 marks)

1 (d) Add a method of steering the pedalo to this sketch and label the parts you have drawn.

Sketch showing the following (one marks for each up to a maximum of 3, plus two further marks for appropriate labels):

- Rudder shaft
- Shaft tube
- Rudder
- Tiller
- Or other appropriate functional system

(5 marks)

1 (e) Describe how these problems can be overcome.

Candidates should provide logical answers comprising of:

Simplistic phrasing and unrelated statements / one simple point made correctly (1 mark)
Simplistic phrasing and related statements / two simple points made correctly (2 marks)
Logically structured and correct answer covering most of the key points, containing some punctuation and grammatical inaccuracies (3 marks)
Technically correct answer covering all of the key points, written in mostly accurate and correct English (4 marks)

(4 marks)

2 (a) In the spaces below identify and explain two hazards for a pedalo created by its working conditions.

Hazards: candidates should select appropriate examples such as the following (one mark for each to a maximum of two) –

- Corrosion
- Collision
- Abrasion
- UV / weather attack

Explanations: covering at least two relevant points such as –

- Used in seawater, metal parts would corrode quickly
- Used by people in fun situations where anything could happen
- If launched over sand, damage from grit in moving parts
- Out in all weathers, polymers will eventually denature.

Up to 2 marks per answer, maximum of 4

(6 marks)

2 (b) For each hazard identified in 2 (a), suggest a way a pedalo designer may have tried to prevent it.

Suggestions fitting the selected hazard and covering at least two relevant points such as:

Designer has specified corrosion resistant materials for the metal components
Designer has specified the use of tough, resilient materials / a substantial rubbing strake / or buffer, to allow boats to collide without damage
Designer has specified the use of seals on bearings / planned for quick and easy maintenance and repair to bearing surfaces to limit/tackle the effects of abrasion.
Designer has specified the use of UV resistant polymers, which will lengthen the working life of the pedalo.

Two marks for a well explained point, one mark for an incomplete or only partially accurate point.

(4 marks)

3 (a)(i) Identify a process used to manufacture the hulls of this type of pedalo.

Forming processes such GRP or other resin bonding process / vacuum forming / injection moulding / rotational moulding / blow moulding

(1 mark)

3 (a)(ii) Describe a process used to manufacture the hulls of this type of pedalo.

Description of selected process, including:

Structure of mould (1 mark)
Input of polymer (2 marks)
Operational routine (2 marks)

(5 marks)

3 (b) Explain how the seats are attached to the pedalo.

Explanation in written and graphical form of a suitable method of attachment.

Mechanical solutions such as: nuts and bolts, self tapping screws, integrally moulded mountings, washers to spread load

Suitable industrial adhesive bonding solutions such as: resin bonding, self vulcanising bonding agent (such as 'Sikaflex'), high modulus silicon bonding agent.

2 marks for sketches and 2 marks for annotation.

(4 marks)

3 (c) Give an advantage of using a CNC machine to produce the vinyl stickers.

Any acceptable answer such as:

Logo designs can be modified easily
Easy to match logo production to pedalo production
Keeps the logo production 'in-house'.

(1 mark)

3 (d) Describe the process of creating a self-adhesive vinyl logo, from initial artwork to final cutting using a CNC machine.

Description of process such as: use of appropriate CAD package, conversion to file type recognisable to chosen cutter, importation of file to machine, cutting process used

1 mark per point made

(4 marks)

4 (a) Complete the side elevation on Figure 4 above, using the correct conventions.

Insert hidden detail (1 mark), insert centrelines (1 mark)

(2 marks)

4 (b) In the table below, create a Production Plan listing five major operations that need to be completed so that a bearing meets the specification.

Tools and Equipment	**Description of Task Carried Out**
B	F
H	D
C	J
I	A
E	G

1 mark for each *(10 marks)*

5 (a) Give two reasons why bronze is a suitable material for a pedalo crankshaft bearing.

Any two reasons from answers such as:

- Bronze used in relation with a harder metal such as steel is a tried and tested bearing combination
- Bronze is resistant to corrosion
- Bronze is easy to machine

(one mark per answer to a maximum of 2)

(2 marks)

5 (b) Name one piece of equipment for accurately checking the dimension of internal diameters.

Any acceptable answer such as: vernier calliper / internal calliper / internal micrometer

(1 mark)

5 (c) Give two health and safety hazards associated with machining metals and suggest suitable Personal Protective Equipment (PPE) for each.

Any two hazards such as:

Rotation hazards / sight hazards / nips, traps, crushes / dermatological hazards
(one mark for each to a maximum of 2)

Any two PPEs such as:

Hats or hairnets / safety glasses, goggles / safety guards, interlocks / barrier creams
(one mark for each to a maximum of 2)

(4 marks)

6 (a) In the spaces below identify and explain the changes in each of the following.

The size of the workforce – one mark for an answer such as 'has reduced dramatically'

Explanations such as:

- Labour intensive industry is no longer viable
- Automated production needs fewer operatives
- Although smaller, the workforce needs to be of a higher skill level

(one mark per point, to a maximum of 2)

Buying raw material – one mark for an answer such as:

Reduction of material quantities kept in stock, use of Just In Time ordering, use of automated stock control systems

Explanations such as:

- Stock materials now kept to a minimum to maintain production but prevent cash being wasted on stock that is not needed
- Improves cash flow figures
- Keeps the business viable
-

(one mark per point, to a maximum of 2)

(6 marks)

6 (b) Describe one positive and one negative effect on society arising from the use of modern technology.

Positive effects such as:

- Wide range of consumer goods
- Affordable prices

(1 mark maximum):

Negative effects such as:

- Possible unemployment through reduction in manpower
- Loss of working communities
- Loss of traditional skills

(1 mark maximum)

(2 marks)