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Mark Scheme (Results)

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Principal Learning

Engineering
EG208 Paper 01

Exploring Engineering Innovation, Enterprise and Technological Advancements

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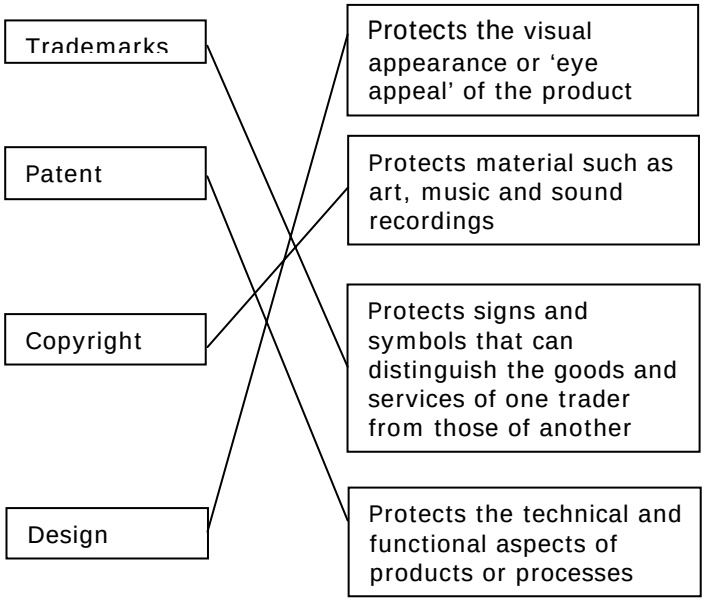
General Marking Guidance

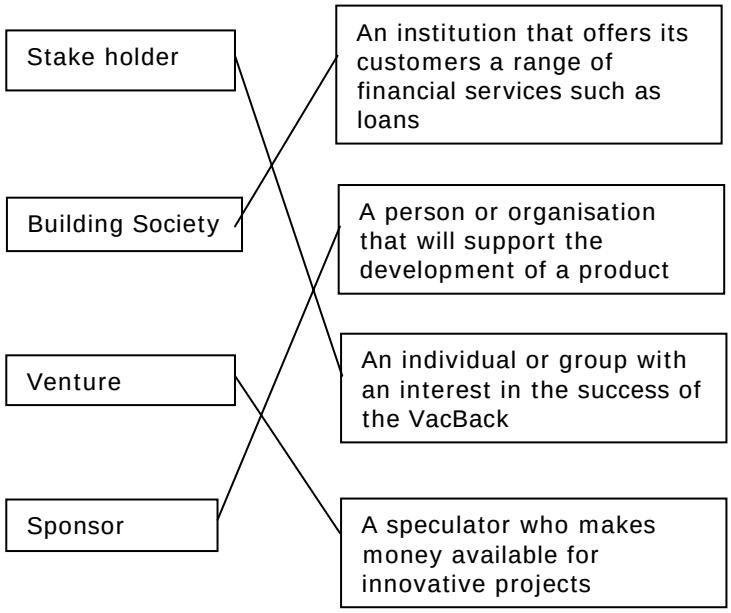
- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question Number	Answer	Mark
1 (a)	One mark for each correct line  No mark for any description linked to more than one type. (4 x1)	**(4)**

Question Number	Answer	Mark
1 (b)(i)	Copyright (1 x1)	**(1)**

Question Number	Answer	Mark
1 (b)(ii)	One mark for each correct answer (max 4) • Write it down (1) • Record it (1) • Post it to yourself (1) • Lodge it with a solicitor (1) • Lodge it with a bank (1) • Independent witness (1) • Register claim (1) Accept any reasonable statement Allow follow through for incorrect answer in (b)(i) (4 x1)	**(4)**

Question Number	Answer	Mark
1 (c)	One mark for each correct answer (max 3) • Stop the idea from being stolen (1) • Stop the idea from being copied (1) • Stop the idea being commercially exploited by others (1) • To legally protect the idea (1) • To be able to make money from the idea (1) • To franchise the idea (1) • Earn royalties (1) • Claim legal ownership (1) • Place on national database (1) • Prove she came up with the idea first (1) Accept any reasonable advantage (3 x 1)	**(3)**

Question Number	Answer	Mark
2 (a)	One mark for each correct line  No mark for any description linked to more than one type. (4 x1)	**(4)**

Question Number	Answer	Mark
2 (b)	Accept any four of the following answers (max 4) • Find out who will buy the Vac Back (1) • Find out what customers will pay (1) • Find out what other products are available (1) • Find out what similar products will cost (1) • Find out where similar products are sold (1) • To determine how much demand there is for the product (1) • To establish if similar products are successful (1) • To find out what materials similar products are made from (1) • To determine what manufacturing techniques have been used with similar products (1) • To check how far can the product be distributed profitably (1) • To carry out trial testing with a group of customers (1) • Complete a customer questionnaire/survey (1) Example Market research is undertaken to determine who will purchase the product (1). This can be achieved through trial testing (1) or a questionnaire (1) with a group of customers. Market research offers the manufacturer a chance see what similar products are available (1) therefore providing an insight to the material (1) and manufacturing requirements (1) of the product. Accept any reasonable market research activity One or more low responses – one mark only. (4 x 1) (1 x 4)	**(4)**

Question Number	Answer	Mark
2 (c)	One mark for identifying, one mark for description x 2 (max 4) • Operational testing (1) – ensure that suction is being generated (1) • Electrical testing (1) – ensure that control switch is functioning (1) • Battery testing (1) – to check operational/charging time of Vac Back (1) • Durability/reliability testing (1) – continuous user trials (1) • Ergonomic testing (1) – through ease of control (1) • Legal compliance testing (1) – to ensure it meets required standards (1) • Materials testing (1) – parts fit for purpose (1) • Comparison testing (1) – comparing function/aesthetics of similar products (1) Accept any reasonable description of generic or pre-production tests. (1 x 2) (1 x 2)	**(4)**

Question Number	Answer	**Mark**
3 (a)	One mark for each appropriate physical property – up to 2 marks • Strong (1) • Lightweight (1) • Ductile (1) • Stiff/rigid (1) • Malleable (1) • Toughness (1) Do not accept 'corrosion resistant' or 'hardness' Accept any reasonable property (2 x 1)	**(2)**

Question Number	Answer	Mark
3 (b)	One mark for naming one of the appropriate metals below: • Aluminium (1) • Aluminium alloy (1) • Duralumin (1) • Low carbon steel (1) • Mild steel (1) • Steel (1) • Stainless steel (1) Do not accept any other 'steel' (1 x 1)	**(1)**

Question Number	Acceptable Answers	Mark
3 (c)	One mark for each correctly identified form  • Channel • U section • U shape • U Form • U • Channel Form  • Square bar • Square • Square Form  • Flat bar • Plate • Strip/Rectangle Form  • Angle • L section • 90^0 • 90^0Angle • Right angle Section • 90^0 Section • Angle Form (4x1)	**(4)**

Question Number	Answer	Mark
3 (d)	One mark for identifying, one mark for expansion (max 2) • A mixture of two or more metals (1) or a metal and other elements (1) to produce a metal with enhanced properties (1) (1 x 2)	**(2)**

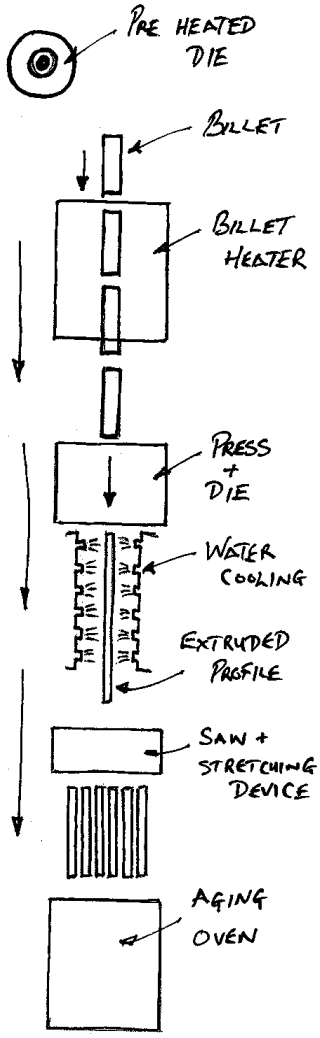
Question Number	Answer	Mark
3 (e)(i)	• A metal that contains iron (1) Do not accept 'a material that rusts/corrodes' (1 x 1)	**(1)**

Question Number	Answer	Mark
3(e)(ii)	• any type of steel • cast iron • grey iron • iron Any appropriate metal that contains iron (1 x 1)	**(1)**

Question Number	Answer	Mark
4 (a)	One mark for any of the answers below • Nickel Cadmium (NiCad) (1) • Nickel Metal Hydride (NiMH) (1) • Lithium Ion (Li-ion) (1) • Lithium Polymer (Li-Poly) (1) • Lithium (1) • Zinc (1) • Nickel (1) • Nickel-Zinc (NiZn) (1) (1 x 1)	**(1)**

Question Number	Answer	Mark
4 (b)	1 mark for identifying, 1 mark for explanation (max 4) • Need electricity to recharge battery (1) which is a cost burden (1) • Do not generate the same power (1) not as efficient at cleaning (1) • Do not last a long time (1) have to stop to recharge (1) • Continuous recharging (1) causes battery life to decrease (1) • Costs more to purchase than ordinary batteries (1) so product costs more to run (1) • Not easy to recycle (1) material not good for the environment (1) Accept any other appropriate response (2 x 2)	**(4)**

Question Number	Answer	Mark
5	One mark for each process description (max 8) • The die is loaded into a press (1) that has openings that will create the profile when the material is pushed through (1) • The die is pre heated in an oven (1) to prevent the material from sticking in the openings (1) • Next the material is brought to the press in the form of a billet (1) which is usually a solid cylindrical piece of material (1) • It is placed into a furnace and heated up to over 400C(1) which allows the billet to become soft but still maintain its shape (1) • The heated billet is now loaded into the press (1) where pressure is applied to crush the billet against the die (1) • As the pressure increases the soft but still solid formed billet has nowhere to go so it is forced through the openings in the die (1) and it comes out the other side as a fully formed profile (1) • The extrusion is then cooled as it comes from the die (1) either naturally or through air or water clenches (1) and transferred to a cooling table (1) • A stretching device is used (1) to correct any twisting in the profile (1) and a finished cut saw is then used (1) to cut the profile to the specified length (1) • Finally the profiles are loaded into a Treatment Oven (1) where they undergo a controlled heating process (1) to maximise the strength, hardness and elasticity (1) • Once the extrusion process is complete the die is removed from the press (1) it is cleaned, inspected and prepared for the next time it will be used (1) Do not accept extrusion with reference to CAD software	**(8)**

	EXTRUSION PROCESS  (1 x 8)	

Question Number		Indicative Content
6 (a)		Businesses need to think about their products during the manufacturing stages. This means that at the production planning stages, some consideration needs to have been made about the production techniques to be used as poor techniques can produce waste products. This waste may go into landfill sites releasing further greenhouse gases into our atmosphere. The need to recycle rejected products is essential to minimising waste disposal. Also many of the parts that are produced could be biodegradable so that when sent to landfill they will break up and not harm the environment. Standard components could also be used where applicable so that they can be reused on other products when the VacBack has completed its anticipated life cycle. Also businesses need to consider the importance of designing products with recycling in mind.
Level	Mark	Descriptor
	0	No reward-able material
1	**1-2**	Some acknowledgment that the issue of waste disposal should be considered during the manufacturing stages.
2	**3-4**	Some justification of waste disposal techniques, such as recycling and reusing, during the manufacturing and design stages.
3	**5-6**	There should be a full understanding and appreciation of how waste disposal techniques, such as recycling and reusing materials, should be considered during the whole manufacturing process, from design to sales.

Question Number		Indicative Content
6 (b)		Manufacturing businesses need to consider how machinery and equipment will be powered. Many of the processes involved with making the VacBack require electrical energy. This energy usually comes from non renewable sources such as coal, gas and oil, so the more energy that is used the more the resources are depleted. This type of energy production is costly in terms of production efficiency and carries a heavy carbon footprint. Heavy carbon footprints are bad for the environment. Manufacturers need to consider sustainable ways of producing energy such as wind or solar power. These are green forms of energy harnessing natural sources such as wind and sunlight. However these sources, at the moment, are not always cost effective. Do not accept responses relating to operation of the VacBack
Level	Mark	Descriptor
	0	No reward-able material
1	**1-2**	Some acknowledgment that energy efficiency should be considered during the manufacturing stages.
2	**3-4**	Some justification of energy efficiency and impact on the environment during the manufacturing stages should be presented and acknowledged.
3	**5-6**	There should be a full understanding and appreciation of why and how energy efficiency and the impact on the environment should be considered during the manufacturing stages of a project such as using renewable sources of energy to power machinery and equipment.

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