**Design & Technology**

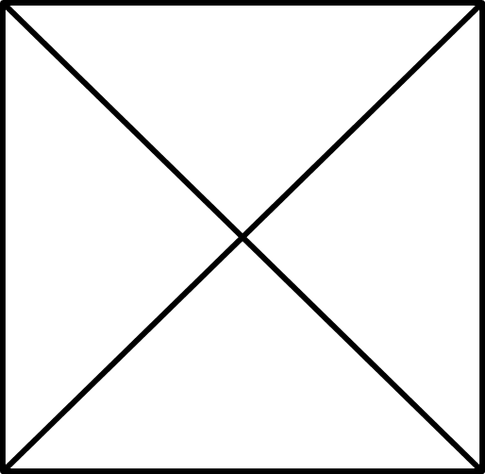
**A-Level**

**Metal Processes**

**Materials required for questions**

* Pencil
* Rubber
* Calculator

**Instructions**

* Use black ink or ball-point pen
* Try answer all questions
* Use the space provided to answer questions
* Calculators can be used if necessary
* Use a cross in the box to mark you answer

**Advice**

* Marks for each question are in brackets
* Read each question fully
* Try to answer every question
* Don’t spend too much time on one question

**Good luck!**

**Q1.** What is the name given to a sand-casting mould?

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**A** Cope and drag

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**B** Top and bottom

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**C** Wat and drag

**Q2.** Why is sand-casting used to make engine blocks?

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**A** Fast production rates

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**B** High quality surface finish

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**C** Complex shapes can be produced

**Q3.** What is an advantage of dies casting?

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**A** High production rates

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**B** Low setup costs

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**C** Short lead times

**Q4.** Why is pewter casting commonly used in schools?

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**A** It has a low melting point

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**B** Safe

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**C** Can be done on a largescale

**Q5.** What is milling typically used for?

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**A** Making holes

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**B** Cutting slots

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**C** Marking patterns

**Q6.** What machine would typically be used to make a cylindrical handle?

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**A** Stamping press

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**B** Drilling machine

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**C** Metal lathe

**Q7.** Why is a metal lathe used to make engine parts?

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**A** No seams on product

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**B** Can make complex designs

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**C** Can be used on a variety of metals

**Q8.** What is a limiting factor of the stamping process?

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**A** The metal thickness

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**B** The type of metal

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**C** The shape of the die

Q9. Die-casting is a common process used for making metal products.  
(a) Explain **one** property of zinc that makes it a suitable material for die-casting. (2 marks)

(b) Describe, using labelled sketches, the process of die-casting. (4 marks)

A picture containing road, bus

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(c) Explain **two** advantages of using die-casting over sand casting to manufacture

the body of the toy bus. (6 marks)

**Q10.** Casting is a common process used for making metal products such as brass paperweights.

(a) Explain **one** property of brass that makes it a suitable material for casting (2 marks)

(b) Describe, using labelled sketches, the process of investment casting from a foam pattern. (4 marks)

A picture containing helmet

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(c) Explain **two** reasons why this method of casting was chosen to produce a single

whale paperweight. (4 marks)

**Answers**

**Q1.** A

**Q2.** C

**Q3.** A

**Q4.** A

**Q5.** B

**Q6.** C

**Q7.** B

**Q8.** A

Q9a

* Zinc has good fluidity when molten (1), which means it will flow readily into the die (1).
* •  Zinc has a low melting point/changes quickly from solid to liquid (1), which results in less energy being used to melt it/which means you can use a range of materials for the die without melting it/can produce products more quickly (1).

Q9b.

* Die sprayed (1).
* •  Molten metal shot into closed die

(1).

* •  Die/casting cooled (1).
* •  Die is opened/casting removed (1).
* •  Reference in graphic or label form

to die being opened/closed/split (1).

Diagram

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Q9c.

* Using a permanent die is quicker than preparing a sand mould for each casting (1), which increases throughput/produce more in a given time (1) and means keeping up with high volume/commercial demand (1).
* •  The surface quality of the cast item is much better than sand casting (1), therefore no additional surface finishing/secondary processing such as milling/grinding is required (1) to produce a bus that is suitable for being handled/played with/to get a commercial quality finish (1).
* •  Die casting can create finer details/thinner sections (1) as a sand mould may collapse (1) when trying to cast a small-scale product like the bus (1).

Q10a.

* Brass has good fluidity when molten (1), which means it will flow readily into a mould (1).
* •  Brass has a relatively low melting point (1), therefore less energy is used to melt it (1).

Q10b.

* Place/bury foam pattern in sand (1).
* •  Molten metal poured into mould (1).
* •  Foam melts/vaporises (1).
* •  Allowed to cool until solidified (1).

A picture containing text, clock

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Q10c.

* Investment casting is fast (1) because you can produce your pattern/mould quickly (1).
* •  Investment casting can be cheap (1) as you need less specialist equipment/material (1).
* •  The whale’s relatively limited detail (1) can be easily created in the foam pattern (1).
* •  The whale has undercuts (1) which would not have been possible with some other methods of casting (1).