Design & Technology
(Product Design)

DTBase©

OCR A-Level

Metal Alloys (5.2a iv)

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
- For the multiple choice questions, circle your 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. Brass is often specified for architectural fittings rather than pure copper mainly because:

A Brass has a higher electrical conductivity than copper

B The addition of zinc improves strength and machinability while maintaining corrosion resistance

C Brass has a lower melting point, reducing manufacturing costs

Q2. Bronze is preferred over steel for certain bearing applications because bronze:

A Can be heat treated to achieve higher hardness than steel

B Has a significantly lower density than steel

C Exhibits good wear resistance and low friction when in contact with steel shafts

Q3. Tungsten is unsuitable for most structural products but ideal for heating elements because it:

A Retains strength at extremely high temperatures due to its high melting point

B Is highly ductile at room temperature

C Has excellent corrosion resistance in moist environments

Q4. Which statement best explains why alloys are generally used instead of pure metals in product design?

A Alloying allows designers to tailor mechanical and physical properties for specific applications

B Pure metals are rarely available in sufficient quantities

C All alloys are cheaper to produce than pure metals

Q5. Name the two metals that are alloyed to make brass. **(2 marks)**

Q6. Explain why tungsten carbide is an appropriate material for the manufacture of a centre lathe cutting tool. **(6 marks)**

Q7. Explain why metals are alloyed. **(2 marks)**

Answers

Q1. B
Q2. C
Q3. A
Q4. A

Q5.
The following two metals:

- Copper (1)
- Zinc (1)

Q6.
Indicative content

- The combination of tungsten and carbon produces a hard material which will allow the cutting tool to resist the wear associated with cutting a rotating material.
- Tungsten carbide can maintain a sharp tool edge for longer while producing a better-quality finish.
- Tungsten carbide is an extremely hard material so is suitable for use on a wide range of softer metals.
- Tungsten carbide has good corrosion resistance which enables it to be used with a range of lubricants and coolants.
- Tungsten carbide can be formed by sintering into an appropriate shape for the cutting tool tip.
- The porous nature of sintered product can assist cutting when using a lubricant.
- Tungsten carbide is dimensionally stable at high temperatures associated with friction involved with cutting and shaping materials. This list is not exhaustive.

Accept any other valid responses

Q7.
Indicative content:

- Where a mixture of at least 2 metals are combined to give enhanced properties
- To produce a tough corrosion resistant material eg stainless steel
- Titanium can be alloyed with other metals like aluminium and vanadium for increased strength, better corrosion resistance and easier workability

- Alloying metals can improve working properties and improve aesthetics

Possible reference to examples of use to enhance explanation:

- Stainless steel – cutlery to make hard wearing and corrosion resistant
- Brass – copper and zinc for brass musical instruments due to workability into different forms and profiles

Accept all other valid responses.